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DOCTORAL THESIS

Title	**THE ADVENTURES OF FAMA & FRENCH IN EUROPE**
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Abstract

The main purpose of this dissertation is threefold. For one, we aim to shed further light on the general pricing ability of the Fama and French (1993) (FF) three-factor model (3FM) in Europe. For two, we mean to assess whether the FF factors are related to systematic risk and, thus, whether the 3FM is consistent with an intertemporal asset pricing explanation behind the size and book-to-market effects. For three, we endeavor to measure the extent to which European equity markets are integrated. This is motivated by the continuous institutional and economic alignment process in Europe.

The 3FM has become one of the most popular models of risk adjustment in the empirical asset pricing literature. However, to date most empirical work has been done for a few selected markets, especially the US. Hence, the 3FM demands more time and further empirical support before it may be accepted as a credible theory-based model to replace the CAPM. We use a fresh holdout sample with newly constructed FF factors for an extensive set of European countries, industries, and regions. Our findings imply that in each of our subsamples, the 3FM clearly dominates the CAPM, even if formal test statistics imply that neither model is free of mispricing. We also document that augmenting the 3FM by a momentum factor may only marginally help to explain European equity return behavior.

The enormous success of the 3FM has also triggered an extensive debate about the economic rationale of the FF factors. We purse this discussion by assessing via two different approaches whether size and book-to-market may be related to time varying investment opportunities. We first assume that changes in the investment opportunity set are summarized by changes in future macroeconomic growth rates.

Nevertheless, if we link our newly constructed FF factors to future GDP growth rates in the Eurozone, then we find that only size appears to contain some information on future macroeconomic growth. Yet, not even this finding for the size effect is, admittedly, very persistent across our sub-samples.

In a second step, we relate size and book-to-market to changes in European default and term spreads. These yield spreads are generally acknowledged for their ability to track investment opportunities. Our results suggest, however, that neither changes in the European default spread nor changes in the European term spread may proxy for the risk underlying our size and book-to-market factors. In fact, our empirical findings imply that augmenting the 3FM by changes in these yield spreads may notably help to price European equity portfolios at country, industry, and regional level. Hence, it appears that the variables may be considered complements rather than substitutes. This is contrary to US findings (see Hahn and Lee, 2006, Petkova, 2006).

Finally, we follow two related approaches to study the degree to which European stock markets are integrated. We first show that a pan-European version of the 3FM is able to explain a considerable proportion of domestic equity portfolio returns. For one, this entails that the model contains valuable information from pricing domestic equity. For two, it may imply that European stock markets are integrated (see Bekaert and Harvey, 1995, Roll and Ross, 1980). In a second and more generic step, we utilize a stochastic discount factor (SDF) framework to estimate and compare domestic pricing kernels across European markets. Our results convey that the amount of information shared by these kernels increases significantly over time, especially after the advent of the euro. This may serve as an indicator of an increasing European stock market integration.

Keywords: Asset pricing, Diversification, Europe, Fama & French Factors, Market Integration, Stochastic Discount Factor (SDF).

To my parents & sister.

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Barcelona, March 17, 2010

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Glossary

3FM Three-Factor Model - An asset pricing model proposed by Fama and French (1993) that exhibits as explanatory variables the market risk factor, a value factor, and a size factor.

4FM Four-Factor Model - An extension of the 3FM by momentum as a fourth factor (see Carhart, 1997).

ADF Augmented Dickey-Fuller.

ANOVA Analysis of Variance.

APM Alternative (Asset) Pricing Model.

APT Arbitrage Pricing Theory.

AR Autoregressive.

BAS Basic Industries.

BD Germany (BD ≡ Bundesrepublik Deutschland).

BG Belgium.

BLUE Best Linear Unbiased Estimator.

CAPM Capital Asset Pricing Model.

CCAPM Consumption Capital Asset Pricing Model.

cf. Abbreviation for the Latin word *confer*, meaning "consult" or "compare".

CGD Cyclical Consumer Goods.

CPER Center for Economic Policy Research.

CSER Cyclical Services.

CRSP Center for Research in Security Prices at the University of Chicago.

DEM Deutsche Mark.

d.f. Degrees of Freedom.

EC European Commission.

ECB European Central Bank.

ECSC European Coal and Steel Community.

EEC European Economic Community.

EGARCH Exponential Generalized Autoregressive Conditional Heteroscedasticity.

EMI European Monetary Institute.

EMS European Monetary System.

EMU European Economic and Monetary Union.

ERM Exchange Rate Mechanism.

EU European Union.

EURATOM European Atomic Energy Community.

EV Eigenvalue.

FF Fama and French.

FR/FRA France.

GARCH Generalized Autoregressive Conditional Heteroscedasticity.

GDP Gross Domestic Product.

GER Germany.

GL Grubel and Lloyd (1975) Index.

GLS Generalized Least Squares.

GMM Generalized Methods of Moments.

GN General Industries.

GRS Gibbons, Ross, and Shanken. Refers to the authors of a time series based asset pricing test (see Gibbons et al., 1989).

HAC Heteroscedastic and Autocorrelation Consistent.

HML High Minus Low. Portfolio that mimics the value risk factor.

IAPM International Asset Pricing Model.

ICAPM Intertemporal Capital Asset Pricing Model.

i.i.d. Independent and Identically Distributed.

IIT Intra-Industry Trade.

IT Italy.

ITECH Information Technology.

LM Lagrange Multiplier.

LR Likelihood Ratio.

LOP Law of One Price.

MAD Mean Absolute Deviation.

MIDAS Mixed Data Sampling.

MiFID Market in Financial Instruments Directive.

MMV Multifactor Minimum-Variance.

MRS Marginal Rate of Substitution.

MSCI Morgan Stanley Capital International.

NAFTA Northern American Free Trade Agreement.

NCGD Non-Cyclical Consumer Goods.

NCSER Non-Cyclical Services.

NL The Netherlands.

NW Norway.

OECD Organization for Economic Co-Operation and Development.

OLS Ordinary Least Squares.

PC Principal Component.

PCA Principal Component Analysis.

PPP Purchasing Power Parity.

RES Resources.

SDF Stochastic Discount Factor.

SMB Small Minus Big. Portfolio that mimics the size risk factor.

SML Security Market Line.

SP Spain.

TOLF Financials.

UK United Kingdom.

US United States.

UTL Utilities.

VAR Vector Autoregressive.

VIF Variance Inflation Factor.

WML Winners Minus Losers. Portfolio that mimics the momentum risk factor.

Chapter 1

Introduction

1.1 Statement of Problem

The three-factor model (3FM) of Fama and French (1993) has become one of the most successful models for risk adjustment in the empirical asset pricing literature. In numerous papers, Fama and French (1992, 1993, 1995, 1996a, 1997) (FF) document that their 3FM explains a large proportion of the cross-sectional variation in average returns to equity portfolios that are sorted by two firm characteristics: size and book-to-market. The three factors that comprise the 3FM are the excess return to the market portfolio, the return to a portfolio long in small stocks and short in big stocks, and the return to a portfolio long in high book-to-market stocks and short in low book-to-market stocks.

The ample success of the 3FM has ignited an extensive debate in the financial economics literature. For one, studies have raised the concern that FF's findings might be subject to survivorship bias (Kothari, Shanken, and Sloan, 1995) or data-snooping (Black, 1993, Lo and MacKinley, 1990, MacKinlay, 1995, Van Vliet and Post, 2004). For two, FF's proposition that small and high-book-to-market firms yield above average returns as compensation for higher systematic risk has triggered numerous responses by various academic scholars. The literature has undoubtedly made a remarkable progress in identifying the economic rationale and systematic risk behind the size and book-to-market factors (see Hahn and Lee, 2006, Petkova, 2006). Nevertheless, the question whether the 3FM may be considered a good candidate in context of Merton's (1973) Intertemporal Capital Asset Pricing Model (ICAPM) is still fairly disputed to date.

Most empirical work on the pricing ability of the FF factors has been done for the United States (US) and, to a considerably lesser extent, for other developed markets, such as Canada, Japan, and the United Kingdom (see Fama and French, 1993, 1996b, Griffin, 2002, Pham, 2007, Wang, 2005). Overall, there is little to no research that applies the 3FM in an exclusive European framework. Notable exceptions are the works of Malin and Veeraraghavan (2004) and Moerman (2005). Moreover, the debate about the economic rationale of the size and book-to-market effects has nearly been addressed solely for the US. In other words, to date the empirical findings for the FF factors may be considered somewhat biased towards a few selected markets, especially the US. This leaves the question on whether the propositions of FF may also hold in a global, European, or pure industry context.

Barber and Lyon (1997) and Campbell et al. (1997) state that the usefulness of multifactor models, such as the 3FM, is not fully known until sufficient data become available to provide robustness checks on the models' performances, using different countries, time periods, or true holdout samples. Bishop et al. (2001, p. 192) also notes that the "[3FM] needs more time and further empirical verification before it can be accepted as a credible theory-based model to replace the CAPM [of Lintner (1965), Sharpe (1964), and Treynor (1965)]."[1]

In this dissertation, we intend to follow up on these arguments. Our objective and interest is thereby twofold. We first aim to shed further light on the general pricing ability of the FF factors in Europe. We therefore use a fresh holdout sample of size and book-to-market factors and assess whether those factors are able to explain the return behavior of equity portfolios at European country, industry, and pan-European level. We then attempt to provide additional empirical findings to the ongoing debate about the link between the FF factors and systematic risk. We thence assess whether our new set of size and book-to-market factors may help to forecast financial investment opportunities across various European sub-samples.

Finally, motivated by the continuous institutional and economic alignment process in Europe, we endeavor to give a new twist to the FF factors by using them as means to measure the extent to which European equity markets are integrated.

[1] Adopted and re-quoted from Malin and Veeraraghavan (2004).

This is an important issue since economic theory and empirical findings suggest that the convergence and development of stock markets are likely to contribute to economic growth by removing frictions and barriers to exchange, and by allocating capital more efficiently (see Baele et al., 2004).

In order to address these issues, we start with constructing an exhaustive set of FF factors for numerous European countries, industries, and regions. We compile a new set of data for two reasons. First, our European focus does not allow us to use the original factors of FF. Second, we want to account for momentum, which has mainly been neglected by FF.[2] We then use our compiled factors intensively in two separate, yet complementary, empirical parts (Empirical Part A & B). Each of these parts comprises, in turn, two different methods. This is illustrated in Figure 1.1.

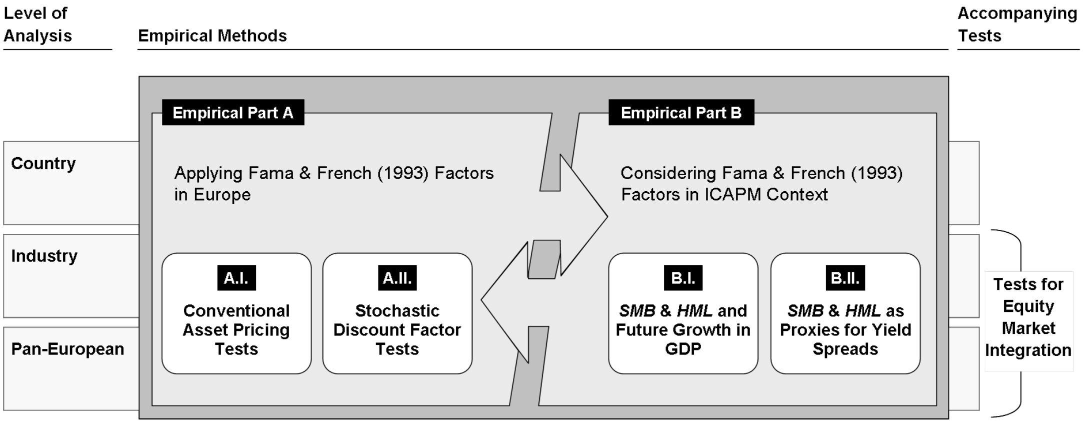
The first empirical block (Empirical Part A) aims to provide further insights on (i) the general pricing ability of the 3FM and (ii) the degree to which European equity markets are integrated. We start with conventional time-series and cross-sectional tests to assess the pricing ability of the 3FM at European country, industry, and regional level (Method A.I). In a subsequent step, we pursue this goodness-of-fit analysis by studying whether a pan-European 3FM may be used to explain country specific equity returns (Method A.II). If that is the case, then this may be considered an indicator of market integration. We complement this approach to integration by employing a more generic (though nevertheless related) stochastic discount factor (SDF) framework as means to estimate and compare domestic pricing kernels across European country borders.[3]

The second empirical line (Empirical Part B) focuses primarily on the economic link between the FF factors and systematic risk. We use a twofold approach that rests on a strand of literature that aims to explain the success of the 3FM based on time-varying investment opportunities and, hence, in context of Merton's (1973) ICAPM. In particular, we first assume that changes in the investment opportunity set are summarized by changes in future macroeconomic growth. We then assess whether size and book-to-market are related to future growth in GDP

[2] Note that our construction approach appears to assure that all of our risk factors are nearly orthogonal to each other.

[3] The SDF is also known, amongst others, as marginal rate of substitution (MRS), pricing kernel, or marginal utility growth.

Figure 1.1: Empirical Parts A & B in Context - *Own Draft*



(Method B.I). Thereafter, we study whether changes in yield spreads may serve as alternative risk factors for size and book-to-market (Method B.II).

In our attempt to conduct all of these tests not only at country but also at pan-European and industry level entails that we impose European stock markets to be integrated, at least to a certain extent. In fact, we presume that there are no frictions among European equity markets and that European equity investors face the same opportunity set, irrespective of their physical presence within Europe. Albeit this imposition may on the one hand appear as a restriction, it facilitates us on the other hand to test the null hypothesis of integrated European equity markets. In particular, we share the proposition of Bekaert and Harvey (1995) and Roll and Ross (1980) that the measurement of integration is conditioned on the identification of common risk. This implies in the strongest sense that "[...] [m]arkets are completely integrated if assets with the same risk have identical expected returns irrespective of the market [they are listed in]" (Bekaert and Harvey, 1995, p. 403). In a less strict manner, the above argument suggests that European stock markets may be considered integrated if there exist (a) common risk factors across European equity markets (regional level) and (b) risk factors that are able to explain in unison the variation in returns to cross-border industry portfolios (industry level).

Therefore, if we are able to show (i) that size and book-to-market are able to explain the variation of stock returns at pan-European and industry level or (ii) that the FF factors help to forecast changes in a common European investment opportunity set, then this may imply that European stock markets are to a certain degree integrated. Notwithstanding, if we fail to find any empirical support for the pricing ability of the FF factors at pan-European and industry level, then this does not necessarily imply that European stock markets are segmented. In fact, there could always be other pan-European risk factors that may price European equity portfolios across country borders.

1.2 Research Background

In the main, this study rests on two major streams of literature: (i) asset pricing, with a particular focus on the 3FM, and (ii) financial market integration, with a particular focus on equity markets. The following paragraphs depict a brief introduction into the main link between this project and those two strands of research. Yet, note that this section is merely meant to be indicative rather than exhaustive. A more thorough literature review is presented in Chapter 2.

1.2.1 Modern Asset Pricing & the Fama and French (1993) 3FM

Although the early beginning of asset pricing may most likely be traced back to Daniel Bernoulli, who published a paper on evolutions and economics under risk in the 18th century (see Stearns, 2000), the start of modern asset pricing history may presumably be dated back to Markowitz (1952).[4] In the 1950s, Markowitz developed the fundamental concepts of portfolio theory for which he assumes that investors select assets from the set of Pareto optimal risk-return combinations. Today, this set of mean return and risk combination is commonly referred to as the *efficient frontier* and forms the groundwork for the fundamental Capital Asset Pricing Model (CAPM) of Lintner (1965), Sharpe (1964), and Treynor (1965).

The CAPM is a single factor risk model that relates the return of a capital asset to the market return through a beta parameter, which measures the asset's

[4] A brief history of modern asset pricing literature is presented by Dimson and Mussavian (1999). More thorough presentations of modern asset pricing theory are presented by Adam et al. (2002), Campbell et al. (1997), and Cochrane (2005).

sensitivity to movements in the market portfolio. Albeit the CAPM is presumably still the most frequently and widely used asset pricing model, an increasing number of studies has claimed that the CAPM should be revisited in regard to its pricing capability.[5] Moreover, the CAPM has become subject to criticism because of its strong underlying assumptions.[6] Black (1972), for instance, proposes to revise the CAPM in a way that would allow for considering the borrowing constraints of agents.

Merton (1973) even suggests to extend the CAPM by state variables that help to forecast changes in the distribution of future returns or income, and, hence, an agent's marginal utility. The underlying idea of his Intertemporal Capital Asset Pricing Model (ICAPM) is that investors have to consider not only the risks to their wealth, but also the risks to the productivity of their wealth and, thus, the rate of return at which wealth can be reinvested. Merton (1973), thence, argues that investors are supposed to hedge not only shocks to wealth itself, but also shocks to any state variable that facilitates forecasting expected returns to wealth. This proposition has been fundamental and has spurred an extensive line of research with the aim to identify variables that qualify as risk factors in context of the ICAPM.

Ross (1976) chooses a different approach. He builds up on the law of one price and proposes a relative asset pricing model that is based on the absence of arbitrage. His Arbitrage Pricing Theory (APT) model considers a factor structure for the return generating process. Thus, contrary to the CAPM, the APT model does not restrict asset returns to be dependent on one single risk factor. Furthermore, the APT model accounts for the interrelationship among security returns

[5]The empirical challenges to the CAPM come from various documented irregularities in returns that are not captured by the market beta. Among those anomalies are past earnings announcement surprises (Ball and Barton, 1968), the earnings-to-price ratio (Basu, 1977, 1983), firm size (Banz, 1981, Fama and French, 1992), leverage (Bhandari, 1988), the book-to-market ratio (Fama and French, 1992, Lakonishok et al., 1994, Reinganum, 1988, Rosenberg et al., 1985), past returns (De Bondt and Thaler, 1985, Jegadeesh, 1990, Jegadeesh and Titman, 1993), and the cash flow-to-price ratio as well as sales growth (Lakonishok et al., 1994).

[6]The assumptions are: (1) all investors are risk averse and terminal wealth maximizers, (2) all investors have identical decision horizons and homogeneous expectations as regards investment opportunities, (3) all investors are able to choose among portfolios only on the basis of expected returns and their respective variances, (4) all transaction costs and taxes are zero, and (5) all assets are infinitely divisible.

and does not rely on the utility and distribution assumptions of the CAPM. The theoretical advantages and the empirical success of the APT model vis-à-vis the CAPM have eventually resulted in a strong support for the relative pricing method of Ross (1976).

Nevertheless, the APT model faces its own downsides. Black (1995), for example, remarks that the APT framework is based on data rather than on economic theory. In other words, there is no utility theory that states how factors should be priced and what the factors should be in the first place. This is also, amongst others, criticized by Dhrymes, Friend, and Gultekin (1984), who claim that even if past average returns may give a best estimate for a factor, this estimate is normally highly inaccurate. This has been confirmed by Connor and Korajczyk (1988), who use an asymptotic principal component technique to estimate pervasive factors for their APT model. They document that their APT provides a better description of the expected returns to assets than the CAPM. Yet, they also admit that some statistically reliable mispricing remains if assets are priced in an APT framework. A multivariate approach for the determination of suitable APT factors is also used by Brennan, Chordia, and Subrahmanyam (1998), Cho and Taylor (1987), Jones (2001), Pukthuanthong and Roll (2009), and Zhou (1999).

Given the methodological drawbacks in deriving accurate APT factors and the frequent lack of relation of those factors to systematic risk, further propositions for theoretical asset pricing models went back to the CAPM. For instance, Jagannathan and Wang (1996) develop a conditional CAPM which allows for a time varying behavior of the factor loading to an economy's aggregate wealth as proxied by the market risk premium. Their findings reveal that a conditional CAPM is better able to explain equity return behavior than the conventional CAPM proposed by Lintner (1965), Sharpe (1964), and Treynor (1965). Studies by Adrian and Franzoni (2009) and Ferson and Harvey (1991, 1999) also show that models with conditional risk parameters are on average better able to price assets than their unconditional counterparts.

Overall, the evolution of different theoretical asset pricing models has naturally resulted in many empirical applications of them. However, of all the empirical models proposed, the remarkable cross-sectional findings reported by FF has left a considerable footprint in the asset pricing literature. In fact, FF's 3FM has presumably become the benchmark model for risk adjustment in the empirical financial economics literature (see Cochrane, 2005, Hahn and Lee, 2006). As mentioned earlier (cf. Section 1.1), FF suggest that their 3FM explains a large proportion of the cross-sectional variation in average returns of portfolios that are sorted by book-to-market and size (i.e., a firm's market capitalization). The three factors that FF propose are (1) the risk premium of the market portfolio, (2) the return to a portfolio long in small stocks and short in big stocks (*SMB*, small minus big), and (3) the return to a portfolio long in high-book-to-market stocks and short in low-book-to-market stocks (*HML*, high minus low).

FF's propositions to consider market capitalization and the book-to-market ratio for explaining equity returns have been inspired by a variety of scholars. Empirical support for the size effect, which eventually resulted in FF's *SMB* factor, has been provided, amongst others, by Banz (1981), Dimson and Marsh (1989, 1999), Heston et al. (1999), Keim (1983), Reinganum (1983), and Schwert (1983). The importance of the book-to-market (or value) effect, which is captured by FF's *HML* factor, has been remarked, amongst others, by Reinganum (1988) and Lakonishok, Shleifer, and Vishny (1994). Nonetheless, the findings of other scholars imply that the empirical case for the importance of the book-to-market ratio may be somewhat weaker or subject to survivorship bias (Kothari, Shanken, and Sloan, 1995) and data-snooping (Black, 1993, Lo and MacKinley, 1990, MacKinlay, 1995, Van Vliet and Post, 2004).

Carhart (1997) suggests to expand the 3FM by a momentum factor to a four-factor model (4FM). He shows that momentum is able to explain equity return behavior that is not captured by size and book-to-market. Momentum makes a tiny autocorrelation of high-returns significant by forming portfolios of extreme winners and losers (*WML*, winner minus losers).[7] Yet, Cochrane (2005) counters the 4FM by stating that *WML* is more palatable as a performance attribution factor. In fact, he stresses that a 'momentum factor' works solely to 'explain' momentum portfolio returns. This is obviously ad hoc, conveying that momentum does actually not qualify as a risk factor per se.

[7] cf. also Jegadeesh and Titman (1993), who argue that past winner stocks outperform past loser stocks in the short run. International evidence for a momentum effect is also found by Rouwenhorst (1998).

All in all, the vast success of the 3FM and its predominant role in empirical finance has spurred a fair amount of academic debate over the economic link between the FF factors and systematic risk.[8] In fact, the question remains whether the 3FM may be considered a good candidate for Merton's (1973) ICAPM or whether the 3FM depicts merely an APT model. This is insofar important as Black (1995), Cochrane (2005), and even Fama (1998) himself remark that the ICAPM should not serve as a 'fishing license' for choosing factors that have high explanatory power but intrinsically lack the ability to forecast future investment opportunities.

Nevertheless, recent findings of Hahn and Lee (2006) and Petkova (2006) suggest that size and book-to-market proxy for changes in default and term spreads in the US, which implies that the FF factors may proxy for innovations in state variables that forecast future investment opportunities. This is further underlined by In and Kim (2007), who point out that the FF factors share in the long run a considerable proportion of variation with innovations of state variables in the US. This, in turn, entails that the FF factors may indeed qualify as risk factors in context of the ICAPM.[9]

However, Campbell et al. (1997) and Cochrane (1999) remark that the propositions of FF are actually very hard to rationalize. Besides, the majority of the tests on both the pricing ability and the economic rationale of the FF factors have primarily been conducted for the US. This holds especially for the link between size and book-to-market and systematic risk. Thus, the question remains whether the documented findings so far may also hold in a non-US setting, i.e., in a global, European, or pure industry framework. This may also be of interest under European equity market integration considerations.

[8] cf. for instance, Cooper et al. (2001), Fama and French (1996a), Ferson and Harvey (1999), Hahn and Lee (2006), Heaton and Lucas (2000), Hodrick and Zhang (2001), Lettau and Ludvigson (2001), Liew and Vassalou (2000), Perez-Quiros and Timmermann (2000), Petkova (2006), Vassalou (2003).

[9] There is another fair share of studies that provides a macroeconomic explanation for the FF factors based on time-varying investment opportunities, for instance, Cooper et al. (2001), Fama and French (1996a), Ferson and Harvey (1999), Heaton and Lucas (2000), Hodrick and Zhang (2001), Lettau and Ludvigson (2001), Liew and Vassalou (2000), Perez-Quiros and Timmermann (2000), and Vassalou (2003).

1.2.2 European Stock Market Integration

The advent of the European Economic and Monetary Union (EMU) and especially the launch of the euro have tremendously altered the European landscape over the last decades. On the institutional level, legal barriers have been removed and monetary policies have been harmonized. In consequence, European market participants face increasingly similar market conditions, rules, and opportunities when operating across country borders.[10] Yet, the degree to which the harmonization process has lead to real economic integration is still under debate. Numerous studies have approached the discussion from a macroeconomic angle by assessing whether macro variables have converged across countries over time.[11] The integration of financial markets and, more precisely, the integration of equity markets depicts, in turn, a more narrow view on integration.

Usually, the integration of European stock markets is seen as an outcome of an ongoing European institutional and economic convergence. However, one may alternatively consider the integration of equity markets an early indicator of (or a prerequisite for) a wider economic convergence process. This line of thought is the one we share in this study. The prognostic character of equity markets is due to the very nature of publicly listed stocks. As opposed to any other tradable good, stocks are fully standardized and are, hence, perfectly interchangeable across countries. This implies, amongst others, low information asymmetries and relatively low transaction costs across European country borders, especially when comparing stocks to less liquid, less transparent, and less standardized assets. The standardized nature of stocks is also reflected by the exact same rights that stocks certify to their owners. These rights depict fairly unique and inherent attributes and are irrespective of not only the physical presence of the stock holders but also the country the stocks are listed in.

[10] For a more detailed discussion about European integration and changes in the European regulation system, see Adjaoute and Danthine (2003), Baele, Ferrando, Hördahl, Krylova, and Monnet (2004), De Menil (1999), Guiso, Jappelli, Padula, and Pagano (2004).

[11] Among these variables are, for example, money supplies, inflation rates, short-term and long-term interest rates, gross domestic products (GDP) and indices of industrial productions, and national budget deficits as a ratio of GDP (see Bernard and Durlauf, 1995, Bredin and Fountas, 1998, Caporale and Pittis, 1993, Fountas and Wu, 1998, Hafer and Kutan, 1997, Haug et al., 2000, Holmes, 2000, 2002).

Eventually, gaining transparency on the integration of European equity markets is of considerable economic importance and interest. Economic theory and empirical findings suggest that the convergence and development of stock markets are likely to contribute to economic growth by removing frictions and barriers to exchange, and by allocating capital more efficiently (see Baele et al., 2004). Hence, understanding the dynamics of European stock market integration is not only of interest to European equity investors but also to European-policy makers and consumers alike.[12]

The first attempts to measure equity market integration focused on the evolution of correlation patterns across stock market indices (see Grubel, 1968, Grubel and Fadner, 1971, Levy and Sarnat, 1970, Solnik, 1974). The low correlation values documented by these studies suggest that global equity markets appeared to be segmented rather than integrated throughout the 1960s. Nonetheless, there is still academic disagreement today on whether low correlation patterns among indices are due to national diversity or the difference in the industrial composition of the indices in the individual countries. In addition, more recent studies began to remark that correlation per se does not serve as a good indicator of market integration. Adler and Dumas (1983), for instance, show that even two stocks that are listed on the same exchange do not move together for reasons other than a lack of integration. Beckers et al. (1992) and Pukthuanthong and Roll (2009) also find that the correlation between two country indices can be small even if these countries are perfectly integrated.

A more recent strand of integration literature has moved from measuring correlation patterns towards assessing the relative importance of country factors vis-à-vis more global factors for the pricing of equity. In this approach, the loss of the country factor is regarded an indicator of market integration. This mitigation is usually accompanied by a change in the investment decision process, with investors increasingly favoring a diversification across industries and regions to a diversification across countries. Traditionally, country specific environments, such a local monetary and fiscal policies, have been considered the main determinants of stock returns. This has been confirmed by a fair share of studies which document that country factors dominate industry factors in various developed

[12]Please refer to Section 1.6 for further details.

countries (see Beckers et al., 1996, Griffin and Karolyi, 1998, Grinold et al., 1989, Heston and Rouwenhorst, 1994, Lessard, 1974, Serra, 2000). Even in supposedly more integrated European markets, country factors still appear to play a dominant role (see Drummen and Zimmermann, 1992, Freiman, 1998, Heston et al., 1995, Rouwenhorst, 1999).

Yet, later research casts doubt about this issue with studies remarking the growing importance of industry factors relative to country effects for the explanation of equity returns in different international markets (see Baca et al., 2000, Campa and Fernandes, 2006, Cavaglia et al., 2000, Isakov and Sonney, 2004). This holds as well throughout Europe (see Flavin, 2004, Moerman, 2008) and implies an increasing global and European stock market integration. Further empirical support pro market integration is provided by Ferreira and Gama (2005), who show that industry volatility has been increasing relative to country volatility in the late 1990s.[13]

Albeit the analysis of the relative importance of country versus industry determinants provides fruitful insights on the general evolution of the integration of stock markets, the mere focus on these two factors may presumably be regarded as too narrow. In fact, merely contrasting country and industry factors does not allow for differentiating whether any potential equity market integration is due to regional or global influences. This is, however, of particular importance, especially in a European market context. Brooks and Del Negro (2002) argue that the increase in the industry effect is simply a temporary result of the global 'dot-com bubble'. They also suggest, in line with Soriano and Climent (2006), that the variation typically attributed to country effects may to a large extent be explained by regional effects in both developed and emerging countries.[14]

Moreover, simply focusing on country versus industry determinants fails to provide any information on the potential economic drivers of integration. Campa

[13]See also Soriano and Climent (2006) for a brief literature review on studies that deal with the issue of country vs. industry effects.

[14]Brooks and Del Negro (2002) propose to split the pure country effect into a 'region' effect and an 'within-region country' effect and find that region effects account for half the return variation typically attributed to country effects for both developed and emerging countries. Soriano and Climent (2006) contrast region (rather than country) effects with industry effects and present overall dominance of region effects over industry effects over the period January 1995 to December 2004.

and Fernandes (2006) aim to overcome this drawback. They regress pure country and industry effects on a set of economic variables to determine the sources of gains from international portfolio diversification. Their findings imply that the importance of country and industry effects is correlated with measures of economic shocks which, in turn, are the result of an enhanced global financial market integration.[15] Hardouvelis et al. (2006) go directly to the economic variables as a measure of integration. Their findings suggest that the relative importance of European wide risk factors for the pricing of indices and stocks increases with the probability of joining the EMU. This implies a shift from a country-specific pricing kernel to a common European discount factor.[16] The findings of León et al. (2007) indicate, however, that an apparent integration of European equity markets is not only a European but also a global market integration phenomenon.

Inspired by these findings, we decide to go one step further in this study. We disregard the country factor at all and focus solely on pan-European and industry-wide risk factors. If European equity markets are fully integrated, then European stock returns should only be driven by pan-European risk factors.[17] Alternatively, stocks within one industry should also be priced by industry-wide risk factors, regardless of the country they are listed and traded in. This is in line with Bekaert and Harvey (1995) and Roll and Ross (1980), who remark that the measurement of integration is conditioned on the identification of common risk factors. It is also in accordance with the concept of the law of one price.[18] For instance, Chen and Knez (1995, 1996) suggest that markets cannot be integrated if there are cross-market opportunities and if there are two assets, both from different markets, that have identical payoffs but differ in prices.

[15] The transmission of macroeconomic shocks as a means to integration has been studied in numerous papers. The most prevalent approach in the literature has been to study the effect of macroeconomic announcements and news from the US or other developed market economies on global financial markets (see Andersen et al., 2003, Canova, 2005, Ehrmann and Fratzscher, 2004, Miniane and Rogers, 2007, Wongswan, 2003).

[16] The battery of economic variables used by Hardouvelis et al. (2006) comprises monetary, currency, and business-cycle-variables. They also remark that the integration in Europe appears to be independent of a potential global market integration.

[17] In the extreme, a single global asset pricing model should apply in perfectly integrated markets (see Adler and Dumas, 1983, Agmon, 1972, Harvey, 1991, Solnik, 1974, Stulz, 1981).

[18] Cassel (1921) was among the first to remark that in an efficient market, assets with similar properties should have the same price.

Yet, the question remains: what are potential pan-European and industry-wide risk factors? A probable answer may be provided in form of the FF factors. The immense success of the 3FM to explain the variation of equity return behavior at country level (cf. Section 1.2.1) let size and book-to-market appear attractive as potential candidates for pan-European and industry-wide risk factors. This is particularly underpinned by more recent empirical findings that suggest that the FF factors are related to systematic risk and may, hence, help to forecast future investment opportunities.[19]

Triggered by these findings, we study the suitability of the FF factors as common, pan-European, risk factors, i.e., we use them to infer whether European equity markets are integrated. In particular, we construct pan-European and industry-specific FF factors and assess whether these factors are able to price equity at pan-European and industry level. If they do, then this may serve as an indicator of market integration. Admittedly, measuring European stock market integration in such a way depends heavily on the specification of the asset pricing model and, thus, on the correct identification of the relevant risk factors.

Therefore, if we fail to find any empirical support for the pricing ability of the FF factors at pan-European and industry level, then this does not necessarily imply that European stock markets are segmented. Instead, if European equity markets are indeed integrated, then there are at least one or more common risk factors - other than the FF factors - that may price assets in these markets. Nevertheless, to eventually overcome at least part of the drawbacks associated with our proposed approach to market integration, we also employ a slightly more generic, yet still related, stochastic discount factor (SDF) approach to market integration, which we will outline in more detail below.

1.3 Research Methods

This study comprises two empirical parts, each of which consists, in turn, of two different methods. Empirical Part A deals with (i) the pricing ability of the FF

[19] cf. for instance, Cooper et al. (2001), Fama and French (1996a), Ferson and Harvey (1999), Hahn and Lee (2006), Heaton and Lucas (2000), Hodrick and Zhang (2001), Lettau and Ludvigson (2001), Liew and Vassalou (2000), Perez-Quiros and Timmermann (2000), Petkova (2006), Vassalou (2003).

factors and (ii) the integration of European equity markets. The main objective of Empirical Part B is to test whether size and book-to-market may be linked to systematic risk and, thus, to assess whether the 3FM may be considered a good candidate for an intertemporal asset pricing model.

As our European focus does not allow us to borrow the size and book-to-market factors of FF, we follow Liew and Vassalou (2000) to build a new and extensive set of FF factors for 16 European countries, 3 European regions, and 11 industries over various time periods. We pursue the procedure of Liew and Vassalou (2000) rather than Fama and French (1992, 1993) due to data availability constraints and to account for momentum, which has mainly been neglected by FF. Our construction procedure appears also to assure near orthogonality among the risk factors. Overall, the compilation of the factors provides us as well with 27 portfolios per country, region, and industry, which we use as dependent variables throughout our analyses in Empirical Part A. To study whether the FF factors may be linked to systematic risk, we extend our sample of risk factors in Empirical Part B by macro variables, such as gross domestic product (GDP) figures and yield spreads.

1.3.1 Part A: Applying the FF Factors Across Europe

To assess the goodness-of-fit of the FF factors across Europe and to examine the integration of European equity markets, we utilize different means and samples, which we cluster into two parts: (a) conventional asset pricing tests and (b) a pan-European risk factor approach along with a stochastic discount factor (SDF) framework. These approaches are outlined in more detail in the following paragraphs.

1.3.1.1 Method A.I: Conventional Asset Pricing Tests

We start with assessing whether domestic versions of the Fama and French (1993) three-factor model (3FM) are able to explain the behavior of domestic equity portfolios in 16 European countries. Conditioned on our country findings, we shift our focus to the integration of European equity markets and study whether pan-European versions of the 3FM may price pan-European equity portfolios and whether industry versions of the 3FM may price industry portfolios. As previously noted, we suggest that if the FF factors are helpful to price equity at pan-European and industry level, then this may serve as an indicator of market integration. In other words, our testing approach at industry and pan-European level depicts a joint test of (a) the pricing ability of the risk factors and (b) market integration. It is not feasible to disentangle this joint hypothesis.

To contrast our findings for the 3FM with other popular asset pricing models, we enrich our analyses by the conventional Capital Asset Pricing Model (CAPM) (Lintner, 1965, Sharpe, 1964, Treynor, 1965) and the Carhart (1997) four-factor model (4FM), which extends the 3FM by a momentum factor.[20,21] To assess the pricing capability of our models, we regress per country, region, and industry our 27 portfolios on each of the pricing models under consideration. We then consider standard performance criteria, such as adjusted R^2 values and the mean absolute deviation (MAD) from zero of the regression intercepts (pricing errors) α.

We also employ formal finite valid F-tests based on comparative (i) time-series analysis (see Gibbons et al., 1989) and (ii) cross-sectional regressions (see Cochrane, 2005).[22] For the cross-sectional analyses, we use both ordinary least square (OLS) and generalized least square (GLS) regressions. Even if GLS regressions may provide more precise estimates than OLS regressions, the gained precision often results in a sacrifice of robustness.[23]

1.3.1.2 Method A.II: Pan-European Risk Factors

The second empirical part can be clustered along two dimensions. We first test whether a pan-European 3FM is able to explain the variation of domestic equity returns in selected European countries, i.e., we use pan-European factors to explain country specific returns. For each sample country considered, we regress

[20]Carhart (1997) shows that momentum is able to capture information that is neither explained by size nor book-to-market.

[21]We construct momentum in line with Liew and Vassalou (2000).

[22]Given our small sample size at hand, we only report finite valid F-tests, as opposed to asymptotically valid χ^2-statistics. The F-distribution is directly related to the χ^2-distribution as the F-distribution is a function of the ratio of two independent χ^2 variates that have been divided by their respective degrees of freedom.

[23]We use our estimated parameters from time-series regressions as regressors in our cross-sectional regressions to estimate the factor risk premia. This results in so-called errors-in-variables (EIV) problems, i.e., independent variables are observed with errors (see Cochrane, 2005, Fuller, 1987). We correct for this problem following Shanken (1992).

our 27 portfolios per market on a pan-European 3FM. We therefore consider two different time periods, one prior to the advent of the euro and one after. Our assumption is that the pricing ability of the pan-European 3FM increases in the euro area relative to the pre-euro era. This may serve again as an indicator of market integration. To assess the goodness-of-fit of the pan-European 3FM per market, we rely again on conventional performance criteria, i.e., the adjusted R^2 and the regression intercept (pricing error) α. We also use the formal finite valid time series test of Gibbons et al. (1989) to test the null hypothesis that per country: $a_j = 0 \ \forall j \ (j = 1, \ldots, 27)$.

We then shift our attention from the general pricing ability of a pan-European 3FM towards a slightly more generic stochastic discount factor (SDF) approach.[24] We thereby consider equity markets integrated, if all stocks in those markets are priced by the same SDF. Unlike in a traditional asset pricing context, we do not impose a common risk-free rate as the SDF. We rather extract domestic pricing kernels and assess whether these kernels are not significantly different across markets and whether the kernels have converged over time.

To empirically implement the SDF approach, we employ a pan-European covariance model to estimate pricing kernels in individual European countries. To obtain the kernels, we first run OLS time-series regressions without an intercept for each of our 27 portfolios in each of our sample countries. We then follow two different approaches. In the first approach, we use the obtained variance-covariance matrix of residuals as an input to derive the principal components in each individual market. We then take the strong assumption that the first principal component represents the SDF in each country.[25] In the second approach, we take the average across the 27 residual vectors in each country. We then presume that this obtained average corresponds to the SDF in this market.

1.3.2 Part B: The FF Factors and Systematic Risk

Ever since Merton's (1973) proposition of the ICAPM, scholars have recognized the need to extend the CAPM by sources of priced risk beyond market portfolio

[24] Given that economics is usually a non-experimental science, the discount factor is of stochastic (rather than deterministic) nature. This suggests that the discount factor is not known with certainty at time t.

[25] Please refer to Section 4.2.4.2 for a more detailed elaboration on this motivation.

movements to explain why average returns differ. FF suggest that size and book-to-market might proxy for these sources. They admit, however, that they have not yet identified the exact proxies behind *SMB* and *HML* (Fama and French, 1996a, p. 76). The two methods in this part of the dissertation aim to address this issue in a European context. We assess whether the FF factors may indeed be linked to systematic risk in Europe by building up on existing methods and present empirical findings that have been employed and derived for the US.

1.3.2.1 Method B.I: *SMB* & *HML* and Future Macroeconomic Growth

In order to study whether there exists a link between the FF factors and systematic risk, we first take the proposition that changes in the investment opportunity set are summarized by changes in future macroeconomic growth rates. Based on this assumption we relate our country, industry, and pan-European FF factors to future GDP growth rates in individual European countries and the Eurozone to see whether size and book-to-market contain information in regard to future macroeconomic growth and, thus, future investment opportunity sets.

Linking size and book-to-market to future growth in GDP rests on two main pillars. For one, we rely on a strand of literature that has provided empirical evidence that there exists a relation between equity market returns and real economic activities in individual countries.[26] For two, we pursue a branch of research that has aimed to provide macroeconomic explanations for the FF factors based on time-varying investment opportunities.[27] Concatenating these two lines of work begs the question, whether size and book-to-market may contain incremental information on future macroeconomic growth as well. This is not only interesting

[26] For instance, Aylward and Glen (2000), as well as Fischer and Merton (1984), document international evidence that aggregate market returns can be used as leading indicators of future economic growth. Barro (1990), Fama (1981, 1990), Geske and Roll (1983), and Schwert (1990) report that US stock returns are positively related to future macroeconomic growth in the United States. Mullins and Wadhwani (1989) find a similar relation pattern for Germany and the United Kingdom. These findings are corroborated by Wahlroos and Berglund (1986) and Wasserfallen (1989, 1990), who identify a positive relation between market returns and future real economic activity for a variety of European countries.

[27] cf. for instance, Cooper et al. (2001), Fama and French (1996a), Ferson and Harvey (1999), Heaton and Lucas (2000), Hodrick and Zhang (2001), Lettau and Ludvigson (2001), Liew and Vassalou (2000), Perez-Quiros and Timmermann (2000), and Vassalou (2003).

from an economic forecasting perspective, but also, as previously indicated, in an intertemporal asset pricing context.

We borrow the empirical method introduced by Liew and Vassalou (2000), yet employ it in an exclusive European framework.[28] In particular, for each of our sample countries, we link future macroeconomic growth in a respective market to the corresponding country specific market, size, book-to-market, and momentum factors. We first compute the returns of our risk factors during good, bad, and mid states of the business cycle. We then use a battery of least square regressions with future nominal growth rates in GDP as dependent variable and the market risk premium, size, book-to-market, as well as momentum, as explanatory variables.

In addition, we augment the methodology of Liew and Vassalou (2000) by testing not only the link of the three risk factors to future GDP growth at country level, but also at pan-European and industry level. The reason is twofold. First, there is a fair share of research that documents an increasing importance of industry factors relative to country factors for the pricing of equity.[29] Second, the use of industry specific portfolios may be considered highly important considering that some industries are more sensitive to business cycle movements than others (see Berman and Pfleeger, 1997, Gourio, 2006, Hornstein, 2000), even if, admittedly, past studies show that industry portfolios are difficult to price using the conventional CAPM or the 3FM (see Fama and French, 1997, Moerman, 2005, Van Vliet and Post, 2004).

1.3.2.2 Method B.II: *SMB* & *HML* as Proxies for Yield Spreads

In two recent studies, Hahn and Lee (2006) and Petkova (2006) show that book-to-market and size are significantly correlated with innovations in state variables that predict the excess market return and its variance in the US market. More specifically, they denote that book-to-market proxies for a term spread surprise

[28] Focusing on the time period 1978 to 1996 (with varying time frames per country), Liew and Vassalou (2000) show the book-to-market factor has significant correlation with future macroeconomic growth in France, Germany, Italy, the Netherlands, Switzerland, the UK, and the US. They also document that the factor loading for size is significantly related to future growth in GDP in Australia, Canada, France, Germany, Italy, the Netherlands, Switzerland, and the UK.

[29] cf. for instance, Baca et al. (2000), Campa and Fernandes (2006), Cavaglia et al. (2000), Flavin (2004), Isakov and Sonney (2004), Moerman (2008), Soriano and Climent (2006).

factor in returns, while size proxies for a default spread surprise factor. In and Kim (2007) also stress that the FF factors share a considerable proportion of variation with macroeconomic shocks in the long run. We build up on these findings and test whether they also hold in a European setting.

In particular, we borrow a variety of tests introduced by Hahn and Lee (2006) and use those to study whether our country, industry, and pan-European size and book-to-market factors are related to changes in European default and term spreads. Our interest lies in determining whether size and book-to-market may eventually become superfluous in the presence of risk factors related to changing credit market conditions and interest rate proxies. Our test may also be seen as an answer to Campbell (1996) who remarks that empirical applications of the ICAPM should not merely be related to macroeconomic variables (as we do in Method B.I) but to *shocks* in state variables that forecast future investment opportunities.[30]

1.4 Data

Our overall sample comprises monthly data covering the time-frame from January 1981 to April 2008. We choose a monthly frequency since it accounts for speed in arbitrage adjustments but mitigates any potential problems that are associated with microstructure issues such as bid-ask spreads. Besides, the use of monthly data allows us to neglect that there might be no simultaneous trading at a given day, as trading days may differ per country, e.g., due to local bank holidays

To conduct our analyses, we require firm specific data, market indices, a proxy for the risk-free rate, and exchange rates (to compare data across countries). We derive all those data from Datastream (cf. Section 3.2 for further details and

[30]Implementing empirical specifications of the ICAPM actually requires to estimate *innovations* in state variable proxies rather than mere changes in these variables. To do so, one may specify a time-series process for the spread of the state variables to estimate a type of vector autoregressive (VAR) model and use the residuals as innovations, as in Campbell (1996) and Petkova (2006). Yet, Hahn and Lee (2006, p. 250) remark that "[w]hile a failure to filter out expected movements in [yield] spreads may introduce an errors-in-variables problem, misspecification of the time-series process will also introduce errors in using estimated innovations". They further denote that their empirical findings for either of the two approaches do not differ significantly. We therefore decide to focus on changes in spreads only rather than 'real' innovations.

the precise codes). Each firm considered is thereby classified by country, region, and industry. We draw our sample for the 12 Eurozone countries as of January 2006, i.e., Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, and Spain.[31] These countries comprise our *Eurozone*. In addition, we extend our sample for robustness analyses by three further members of the European Union (EU), i.e., Denmark, Sweden, and the United Kingdom, plus two other European countries, i.e., Norway and Switzerland. The Eurozone countries plus Denmark, Sweden, and the United Kingdom comprise our *European Union* sample. Eventually, these EU countries plus Norway and Switzerland make up our common *European* market. Smaller countries are usually ignored for these kind of studies due to the small number of stocks available. For a classification along industries we rely on the industry definitions of the *Financial Times Actuaries*.

We then use those stocks to build per country, industry, and region 27 portfolios that are sorted by size, book-to-market, and momentum. These 27 portfolios are then, in turn, used to construct per sub-sample our FF factors, along with a factor that mimics momentum. We use a three-sequential sorting alike Liew and Vassalou (2000) rather than the more popular two-sequence sort of FF due to data availability constraints and to account for momentum, which FF neglect.[32] Our sorting procedure appears to assure near orthogonality among the risk factors. Besides, our European focus does not allow us to borrow the original FF factors available at the website of Kenneth R. French.[33]

For Method B.I, we extend our dataset by quarterly GDP growth rates for the time period from January 1990 to April 2008. These figures are obtained per country and for the Eurozone (i.e., the euro area of the 12 countries under consideration) from the Organization for Economic Co-Operation and Development (OECD) data warehouse. We adjust our monthly firm dataset to match the time

[31] We do not include the Eurozone countries Slovenia (since January 2007), Cyprus, Malta (both since January 2008), and Slovakia (since January 2009) in our analyses, simply due to (i) limitations of data availability and (ii) a potential lack of market integration.

[32] Note that our results may be said to be specific to the sorting order used. Yet, robustness tests of Liew and Vassalou (2000) imply that this sorting methodology is stable and that results are not conditioned on the sorting sequence employed.

[33] The website of Kenneth R. French can be found at: $http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html$, last accessed September 2009.

frame and frequency of the GDP growth rates. For Method B.II, we augment our dataset by monthly default and term spreads for the Eurozone for the time period May 1999 to October 2006. The default spread is defined as the difference between the yields to maturity on the all-maturities iBoxx BBB Corporate Bond Index for the Eurozone and the all-maturities FTSE Global Government Eurozone index. The term spread is defined as the difference between the yields to the 10-year and one-year Eurozone interest rate for constant maturities. The data have also been derived from Datastream.[34]

In regard to our interest in European equity market integration, the selection of the sample period depicts a dilemma. The shorter the time period, the higher the probability that a country (industry) might be underrepresented relative to other countries (industries) as less data become available. Consequently, the shorter the time period, the lower becomes the number of stocks per country (industry); in turn, the lower becomes the validity and reliability of the data set. On the other hand, as the first step of the EMU was just officially launched in 1990, implementing data way prior to this year may seem inappropriate under market integration considerations. Put differently, there exists a trade-off between the availability of data and the compliance with the null hypothesis of integrated markets.

1.5 Main Findings

Our findings for Method A.I imply that the 3FM explains notably more in the variation of equity returns than the CAPM at European country, industry, and regional level. Yet, complementing the 3FM by momentum as a fourth factor appears to only help marginally to better explain the behavior of equity returns. Notwithstanding, formal tests on the joint distribution of the pricing errors let us reject the validity of not only the CAPM but also the 3FM and 4FM as ‘good’ asset pricing models in the majority of cases.[35] However, at large our empirical

[34] I would like to thank Magdalena Lewandowska from the European Commission’s Economic and Financial Affairs for providing me with some preliminary data on yield and term spreads in Europe that have been used for economic research at the EU.

[35] Our fairly poor empirical findings for the CAPM may apparently solely due to bad proxies for the market portfolio as argued by Roll (1977).

findings for the 3FM and 4FM support FF's argument that size and book-to-market, as well as momentum (Carhart, 1997), are helpful to overcome some of the average-return anomalies of the CAPM.

Moreover, our observation that pan-European versions of the 3FM are able to explain a considerable proportion in the variation of pan European equity portfolios may serve as an indicator of European stock market integration in line with Bekaert and Harvey (1995) and Roll and Ross (1980). This is seconded by our findings that pan-European industry FF factors contain incremental information for the pricing of pan-European industry portfolios. The pricing ability of the industry FF factors may, in turn, also underpin past empirical findings which suggest that the importance of industry factors for the explanation of equity returns has notably increased.[36]

Our results for Method A.II underscore our findings of Method A.I. We find that a pan-European version of the 3FM is also able to explain a reasonable proportion in the variation of country specific equity returns. Nonetheless, formal test statistics suggest that a pan-European 3FM is not able to price country portfolios without pricing errors. Thus, a pan-European 3FM is not free of shortcomings, even if our findings across time reveal that the pricing model does a considerable better job in explaining equity return behavior after the advent of the euro than before. The increasing ability of pan-European factors to price country specific returns may be regarded an indicator of European stock market integration.

Our findings of this section also entail that the relation among SDF across European countries increases significantly over time. While we find modest correlations among domestic pricing kernels prior to the introduction of the euro, the information shared among those kernels intensifies sharply in the first decade of the 21st century. The exception to this phenomenon is the UK, which however does not belong to the Eurozone. Overall our empirical findings of this section support recent works that document a trend of an increasing integration of European stock markets (see Hardouvelis et al., 2006, Kim et al., 2006, León et al.,

[36] cf. Baca et al. (2000), Brooks and Catao (2000), Campa and Fernandes (2006), Cavaglia et al. (2000), Cavaglia and Moroz (2002), Diermeier and Solnik (2001), Ferreira and Gama (2005), Flavin (2004), Isakov and Sonney (2004), L'Her et al. (2002), Moerman (2008), Taing and Worthington (2005), Urias et al. (1998), Wang et al. (2003).

2007, Yang et al., 2003).

The results of Method B.I, in which we link future growth in GDP to our size, book-to-market and momentum factors, indicate at large that a risk-based explanation of the FF factors is at most plausible and likely for the size factor. FF and Liew and Vassalou (2000) suggest that size and book-to-market are state variables that help to predict future changes in investment opportunity sets in context of the ICAPM. We support this hypothesis, yet only with respect to size. The predicative abilities of book-to-market and momentum on future GDP growth in the Eurozone are considerably lower than the one for size. Moreover, from an equity market integration perspective, our industry and pan-Eurozone findings for size reveal that European equity markets may be somewhat integrated. This is due to the fact that returns to pan-Eurozone constructed size factors allow for a common prediction of economic growth in the euro area and, hence, future investment opportunities.

Finally, our findings for Method B.II suggest that changes in European term and default spreads do not appear to proxy for the risk underlying size and book-to-market. In fact, our empirical results imply that augmenting the 3FM by changes in European yield spreads may notably help to price equity portfolios across Europe. This indicates that the information conveyed by changes in the default spread and changes in the term spread complement rather than substitute the information contained in size and book-to-market. This is contrary to the empirical results of Hahn and Lee (2006) and Petkova (2006) for the US. It also leaves the question whether the 3FM eventually helps to forecast future investment opportunities and, thus, whether the 3FM qualifies as a candidate for Merton's (1973) ICAPM.

1.6 Contributions & Potential Implications

Our objective to provide further insights on (i) the pricing ability of the FF factors and their link to systematic risk and (ii) the degree of European stock market integration may potentially benefit European equity investors, policy-makers, and researchers in the field of international finance.

From an asset pricing perspective, the findings of this study may help to shed further light on whether FF's seminal 3FM may not only be considered the benchmark model for risk adjustment in the US but also in European markets. Moreover, our results may add further empirical support to the pricing ability of the FF factors at region and industry level. These areas have mainly been overlooked so far, even though a growing body of research implies an increasing importance of industry and region effects relative to country factors. For one, Brooks and Del Negro (2002) and Soriano and Climent (2006) note that the variation typically attributed to country effects may to a large extent be explained by regional effects in both developed and emerging countries. For two, a fair set of studies documents that industry factors have caught up, or even surpassed, country factors for the explanation of equity returns (see Baca et al., 2000, Campa and Fernandes, 2006, Cavaglia et al., 2000, Flavin, 2004, Isakov and Sonney, 2004, Moerman, 2008, Soriano and Climent, 2006).

Moreover, in relating size and book-to-market to systematic risk, this work may also be considered a further response to the criticism of Black (1995), Cochrane (2005), and Fama (1998), who remark that Merton's (1973) ICAPM should not serve as a 'fishing license' for choosing factors that have high explanatory power but intrinsically lack the ability to forecast future investment opportunities. In fact, with our study we may not only provide further details on whether the FF factors may proxy *at all* for innovations in state variables that help to forecast future investment opportunities in Europe, but also whether changes in default and term spreads may be the underlying factors of what constitutes the size and book-to-market effect in FF's 3FM. This has been shown for the US (see Hahn and Lee, 2006, Petkova, 2006), but whether this is also the case in Europe has not yet been addressed.

Additionally, it is also of particular interest from an international finance and asset pricing perspective to obtain further insights on the degree to which European stock markets are integrated. The general globalization has facilitated short-term interlinkages among financial markets and has reduced previous institutional constraints. Upon arrival of new information, it is easier, cheaper, and quicker for investors to participate in foreign stock markets today than it used to be even a few decades ago. However, the reduction of these frictions, and, thence, the creation of short-term linkages among financial markets, should play a minor role in explaining long-run integration patterns and stock returns.

Economic theory suggests that stock prices are the present value of expected future dividends. The amount of the latter is not only subject to managerial issues but also contingent on wider macroeconomic activities, such as changes in policies and treaties or shocks to affiliated markets. Thence, albeit stocks may temporarily deviate from their fundamentals in the short-run, they should in the long run be affected by any economic convergence of the EMU. This entails that in a European framework, a potential asset pricing model should not only comprise domestic aspects but also exhibit factors that contain proxies for innovations in pan-European state variables of real economic activities.

To address the issue of whether European stock markets are integrated should also be of considerable interest to European policy makers, including the European Central Bank (ECB) and the general Eurosystem. For instance, the empirical findings of past studies imply that the convergence and development of stock markets are likely to contribute to economic growth by removing frictions and barriers to exchange, and by allocating capital more efficiently (see Baele et al., 2004). The improved possibilities of investors to eliminate country-specific risk by investing abroad may also result in a considerable decrease in the cost of equity (see Hardouvelis et al., 2006, Koedijk and Van Dijk, 2004). On top, corporations may gain access to a much larger pool of funds and may not solely rely anymore on the supply of local financing. In general, a decrease in the cost of capital may be associated with an increase in the number of productive investments. This, in turn, may contribute to future economic growth.

At large, equity markets have been increasing in size over the last decades and the wealth effects on consumption have become more and more relevant.[37] Put differently, the increase of equity markets has brought about a tighter link between stock market fluctuations and fluctuations in real economic variables. This strengthened interrelation may also help households to better smooth their consumption relative to fluctuations in their income. It is, hence, important for European monetary policy-makers to understand the dynamics of European equity market integration, especially once individual countries start specializing in different sectors in line with the principle of comparative advantage.

[37] An increased possibility for international risk sharing may also reduce the sensitivity of local consumption to local economic shocks. This may contribute to less divergence in cyclical developments throughout Europe, especially throughout the Eurozone.

The cascade of the economic convergence among European countries and the interdependence of European stock markets implies also that any European-wide policy making may have an immediate impact on European stock markets. As equity markets serve as proxies for future economic growth, output, wealth, and, hence, consumption, European policy-makers should aim at achieving price stability across European stock markets.[38] Besides, contingent stock market reactions to possible changes in European policies may provide European policy-makers with immediate and fruitful feedback. This may help them to better understand that their efforts to obtain economic convergences and stability among European countries can be achieved and interpreted by the degree to which European stock markets are integrated.

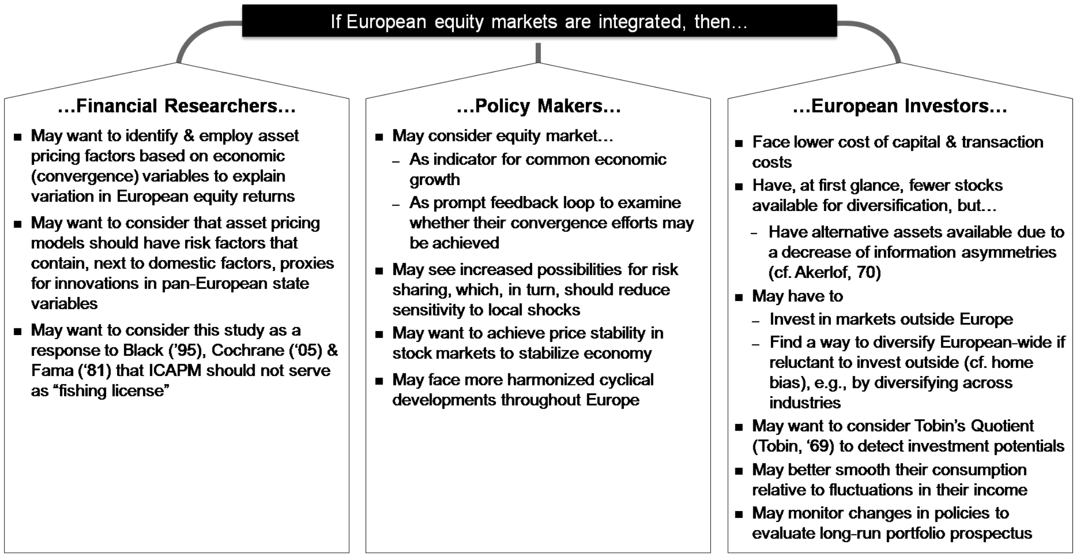
Finally, shedding further light on European stock market integration should be of interest and importance to equity investors. For instance, Hassan and Naka (1996) and Chen, Firth, and Meng Rui (2002) remark that the interdependence among equity markets implies that those markets share some stochastic trends. Hence, stocks traded in these markets are to a certain extent subject to the same market forces. Consequently, if stock markets are integrated, then fewer assets become available to investors to obtain long-run diversification gains. Thence, under diversification considerations investors need to either (i) select appropriate and unrelated stock markets outside Europe or (ii) find a way on how to diversify their portfolios European-wide if they are reluctant to invest outside Europe.[39]

Notwithstanding, intuitive interpretations that European equity markets may eventually become unattractive for diversification do not necessarily imply that this turns out to be true. For example, in case the importance of European country borders may diminish, industry barriers may not alter. Thus, a general switch from investments along European country lines towards investments along industry sectors may occur. Besides, investors may gain from lower information asymmetries (see Akerlof, 1970). They may, hence, better evaluate the prospects of

[38]For the interrelation of stock markets and real economic activities see also, among others, Aylward and Glen (2000), Barro (1990), Binswanger (2000a,b, 2004), Fama (1981, 1990), Fischer and Merton (1984), Geske and Roll (1983), Schwert (1990), Wahlroos and Berglund (1986), Wasserfallen (1989, 1990).

[39]This reluctance may be traced back to the so-called home-bias-puzzle (see Coval and Moskowitz, 1999, Gordon and Bovenberg, 1996, Lewis, 1995, Matsen, 2001, Tesar and Werner, 1995).

Figure 1.2: European Stock Market Integration: Potential Implications *- Own Draft*



their cross-border European investments, especially vis-à-vis investments in non-European markets. Investors may thereby rely on fundamental business analysis or plain value indicators, such as Tobin's Quotient (Tobin, 1969).[40] Eventually, an advanced stadium of integration among European stock markets implies that investors should monitor changes in EMU policies and the level of economic convergence among European countries when evaluating long-run prospectus of their portfolios.

Figure 1.2 summarizes the main implications of a potential equity market integration to selected target groups, i.e., to equity investors, European policy makers, and scholars in the area of financial economics.

1.7 Organization

The remainder of this dissertation is structured as follows: Chapter 2 provides a threefold literature review. The first part briefly portrays the evolution of modern asset pricing with a particular focus on the 3FM. Part two discusses the inception of the EMU and its impact on European equity markets. Part three

[40]Tobin's Quotient, or simply Tobin's Q, is defined as: market value / asset value.

reviews the most classical approaches to financial market integration. Chapter 3 comprises a detailed description of the data to be employed in our two different empirical sections. This is succeeded in Chapters 4 and 5 by a discussion of our empirical results for (i) testing the pricing ability of the FF factors in Europe and (ii) relating size and book-to-market to systematic risk. Chapter 6 concludes this study in providing a coherent summary of our findings.

Chapter 2

Literature Review

2.1 Introduction

This chapter covers three branches of literature. In the first part, we intend to provide a brief review about the evolution of the most prominent asset pricing models. As the literature on asset pricing models is vast, this review is by no means meant to be exhaustive but rather indicative. A brief history of modern asset pricing literature is also presented by Dimson and Mussavian (1999), while thorough presentations of modern asset pricing theory are given by Adam et al. (2002), Campbell et al. (1997), Cochrane (2005), and Marín and Rubio (2001).

We focus our main concern on the literature related to (i) the development and empirical application of the 3FM and (ii) the relation between size and book-to-market and systematic risk. However, our asset pricing review also shortly addresses various pricing models that have been developed to account for different degrees of market integration.

Part two of this chapter provides an overview about the development of the European Economic and Monetary Union (EMU) and its impact on Europe's financial markets. This discussion includes a brief history of the European Union (EU), the evolvement of the EMU, and the accompanied introduction of the euro. This is followed by a brief presentation of the most recent empirical findings which reveal the impact of the EMU on European financial - and in particular stock - market integration. In the third and final part of this chapter, we briefly review the most conventional approaches to measure financial market integration.

2.2 The Evolution of Modern Asset Pricing

The pricing of assets constitutes one of the major areas in financial economics. The history of asset pricing can be dated back to Daniel Bernoulli, who published a paper on evolutions and economics under risk in 1738 (see Stearns, 2000). Bernoulli's paper has profoundly influenced economic theory, portfolio theory, as well as operations research. Bernoulli denotes that risk may be minimized by spreading it across a set of independent events. This proposition led to the birth of the paramount economic concept of diversification. Nonetheless, the most significant contributions to the asset pricing literature occurred in the second half of the twentieth century.

In 1952, Markowitz developed the basic concepts of portfolio theory in which he presumes that investors select assets from the set of Pareto optimal risk-return combinations. In particular, the model of Markowitz (1952) assumes that investors are risk averse and that they care only about the mean and variance of their one-period investment return when choosing among different portfolios. Therefore, rational investors always choose *mean-variance-efficient* portfolios that either maximize their expected return for a given level of risk, as measured by the variance, or that minimize their risk (variance) for a given expected return. Today, this set of mean return and risk combination is commonly referred to as the *efficient frontier*.

Based on Markowitz's findings, Lintner (1965), Sharpe (1964), and Treynor (1965) developed the fundamental Capital Asset Pricing Model (CAPM). The CAPM turns the mean-variance model into a testable prediction of the link between risk and expected return by identifying a portfolio that must be efficient if asset prices are to clear the market. Lintner (1965) and Sharpe (1964) show that if all investors have homogeneous expectations and if they can lend and borrow at the risk-free rate, they see the same opportunity set that combines a risky portfolio with risk-free lending or borrowing. As all investors hold the same portfolio of risky assets, this portfolio has to be the value-weighted market portfolio of risky assets. This risky asset portfolio must further be on the minimum efficient frontier of the Markowitz (1952) model if the market is to clear.

Fama (1976) and Roll (1977), amongst others, also show that the expected return to assets which are uncorrelated to the market equal the risk-free rate. This implies that rational agents desire at least a compensation in form of the risk-free rate. Thus, if investors are willing to take on any sort of risk, they demand an extra compensation. Consequently, in equilibrium the expected return to any asset j equals the sum of the risk-free rate, R_f, and a risk premium. This risk premium equals the asset's sensitivity to movements in the market premium times the market premium, whereas the market risk premium is the expected return to the value-weighted market portfolio, $E(R_m)$, minus, the risk-free rate. This is the idea of the CAPM and can be summarized as:

$$E(R_j) = R_f + \beta_j \left[E\left(R_m\right) - R_f\right] \tag{2.1}$$

where the beta parameter, β_j is the measure of the asset's sensitivity to movements in the market premium.[1]

The CAPM is up to now perhaps the most widely used asset pricing model. Welch (2008) finds that about 75% of finance professors recommend to use the CAPM for estimating the cost of capital for capital budgeting purposes. Graham and Harvey (2001) conduct a survey on CFOs and report that 73.5% of the responding financial executives use the CAPM. Yet, an increasing number of studies has triggered criticism towards the unconditional version of this popular one factor model. These critiques address mainly two concerns: (i) the strong underlying assumptions of the CAPM and (ii) the models poor pricing capability.

In particular, the CAPM implies that (1) all investors are risk averse and terminal wealth maximizers, (2) all investors have identical decision horizons and homogeneous expectations in regard to investment opportunities, (3) all investors are able to choose among portfolios only on the basis of expected returns and their respective variances, (4) all transaction costs and taxes are zero, and (5) all assets are infinitely divisible. Black (1972) relaxes some of the assumptions in providing a modified version of the CAPM, which allows for considering the borrowing constraints of agents.

[1] In particular,

$$\beta_j = \frac{cov\left(R_j, R_m\right)}{\sigma^2\left(R_m\right)}$$

where $cov(R_j, R_{,m})$ is the covariance between the return to asset j and the return to the market premium m, and $\sigma^2(R_m)$ depicts the variance of the market premium.

The main empirical challenges to the CAPM come from various well documented irregularities (anomalies) in market returns that cannot be fully captured by the market beta. Most common among these anomalies are results that suggest that average stock returns are related to past earnings announcement surprises (Ball and Barton, 1968), the earnings-to-price ratio (Basu, 1977, 1983), firm size (Banz, 1981, Fama and French, 1992), leverage (Bhandari, 1988), the book-to-market ratio (Fama and French, 1992, Lakonishok et al., 1994, Reinganum, 1988, Rosenberg et al., 1985), past returns (De Bondt and Thaler, 1985, Jegadeesh, 1990, Jegadeesh and Titman, 1993), and the cash flow-to-price ratio as well as sales growth (Lakonishok et al., 1994). A fair share of subsequent studies has confirmed the presence of similar patterns using other datasets.

One step to overcome some of the theoretical weaknesses of the CAPM are presented by Merton (1973), who extends in his Intertemporal Capital Asset Pricing Model (ICAPM) the classical version of the CAPM by state variables that help to forecast expected return to future investment opportunities. The main idea behind the ICAPM is that investors have to consider not only the risks to their wealth, but also the risk to the productivity of their wealth. The latter is the rate of return at which wealth can be reinvested. Merton (1973), hence, suggests that investors are supposed to hedge not only shocks to wealth itself, but also shocks to any state variable that helps to predict changes in the distribution of future returns or income, and, hence, an agent's marginal utility.

Fama (1996) shows that a generalized portfolio-efficiency concept drives Merton's (1973) ICAPM. Thus, the usual representation of an ICAPM consists of the value-weighted market portfolio (as a proxy for general wealth) and other multifactor minimum variance (MMV) portfolios that mimic state variables of special hedging concerns to investors.[2] Merton's (1973) proposition has caused an extensive line of research with studies aiming to identify innovations in state variables that exhibit the ability to predict future investment opportunities. Keim and Stambaugh (1986) and Fama and French (1989), for instance, remark that default and term spreads qualify as state variables in context of the ICAPM, as they help to forecast aggregate stock market returns.

[2]MMV portfolios have the smallest possible return-variances, given their expected returns and sensitivities to the state-variables.

Another approach that aims to overcome the weaknesses of the CAPM finds its roots in Ross (1976), who suggests an Arbitrage Pricing Theory (APT) framework for the return generating process. As opposed to the CAPM, an APT model does not restrict asset returns to be solely dependent on one risk factor.[3] In fact, APT models rely on the interrelation of security returns and the absence of arbitrage and the law of one price, but not on the utility and distribution assumptions of the CAPM.[4] Thus, if we are able to price a set of factors and we may replicate the payoffs of assets with these factors, we may price these assets using the law of one price. This entails that APT models are not equilibrium asset pricing models like the CAPM but statistical models. The APT also only demands that there is at least one rational investor that mitigates arbitrage opportunities; it does not require that all agents are rational wealth optimizers.[5] This makes the APT a much more reasonable theory than the CAPM, which is also underpinned by a superior empirical success of APT models vis-à-vis the CAPM as documented in an extensive APT survey of Connor and Korajczyk (1995).

Notwithstanding, APT models face their own downsides. Black (1995) remarks that the APT framework is based on data rather than on economic theory. In other words, there is no utility theory that states how factors should be priced and what the factors should be in the first place. This is also, amongst others, criticized by Dhrymes et al. (1984), who claim that albeit past average returns may give a best estimate for a factor, this estimate is normally highly inaccurate. This is, for example, apparent in Connor and Korajczyk (1988), who use an asymptotic principal components technique to estimate pervasive factors for their APT model. They document that APT provides a better description of the expected returns to assets than the CAPM. Yet, they also state that some statistically reliable mispricing of assets by the APT remains. Other multivariate approaches for the determination of APT factors are, amongst others, given by Brennan et al. (1998), Cho and Taylor (1987), Jones (2001), and Zhou (1999).

[3] Unlike the ICAPM, which does not require the estimate of the variance/covariance matrix of factor returns, the APT does demand this matrix. In fact, the ICAPM does not even require that its factors are orthogonal to each other (see Cochrane, 2005).

[4] The absence of arbitrage in financial markets would imply that there is no security that has a negative price and a non-negative payoff.

[5] For the APT, we still need to assume that (1) all securities have finite expected values and variances, (2) some (not all) agents can form well diversified portfolios, (3) there are no taxes, and (4) there are no transaction costs.

Due to the methodological drawbacks associated with deriving useful APT factors and due to the often present lack of relation of these factors to systematic risk (given that the factors are mainly statistically derived rather than economically motivated), alternative theoretical asset pricing propositions referred back to the original CAPM. For instance, Jagannathan and Wang (1996) advocate a conditional CAPM that allows for time varying slope coefficients in line with changing market risk premia. Their findings imply that their conditional version of the CAPM is considerably better than the conventional CAPM for explaining the cross-section of equity returns.

Other studies by Ferson and Harvey (1991, 1999) also document that models with conditional risk parameters are better able to price assets than their unconditional counterparts. In a recent work, Adrian and Franzoni (2009) complement the conditional CAPM by introducing unobservable long-run changes in factor loadings, which they model through a Kalman filter. They find that their learning-augmented CAPM passes formal tests when pricing portfolios that are sorted by size and book-to-market.

2.2.1 The Fama and French (1993) 3FM

Triggered by (i) the empirical findings that challenge the CAPM (cf. Section 2.2) and (ii) the propositions of Merton (1973) and Ross (1976), empiricists and theorists have recognized the possibility that asset pricing theory requires sources of priced risk beyond movements in the market portfolio in order to explain why some average returns are higher than others. Fama and French (1992, 1993, 1995, 1996a, 1998) (FF) take an indirect and empirical approach to this issue.

FF relate size (i.e., a firm's market capitalization) and the book-to-market ratio to equity returns. They argue that these attributes proxy for firm risk sensitivities with respect to changes in the economic environment. For the most part, FF's asset pricing approach is associated with Ross's APT rather than with Merton's ICAPM, whose optimal implementation demands to specify the state variables that affect expected returns. Nonetheless, a more recent strand of literature has tried to link the success of the FF factors to systematic risk (cf. Section 2.2.1.1). FF argue themselves that even if size and book-to-market are not state variables per se, the higher average returns on small stocks and high book-to-market stocks represent unidentified state variables that produce priced covariances in returns not captured by the market beta.[6] FF eventually propose a three-factor model (3FM) for expected returns. The three factors are (1) the risk premium of the market portfolio, (2) the return to a portfolio long on small stocks and short on big stocks (*SMB*, small minus big), and (3) the return to a portfolio long in high-book-to-market stocks and short in low-book-to-market stocks (*HML*, high minus low). Today, the 3FM is one of the most popular multifactor models that dominate empirical research (Cochrane, 2005).

Carhart (1997) extends the 3FM by a momentum factor, i.e., the difference between the return to a portfolio of past winner stocks and the return to a portfolio of past loser stocks (*WML*, winner minus losers).[7] Yet, Cochrane (2005) suggests that a momentum factor is more palatable as a performance attribution factor. In fact, he stresses that a 'momentum factor' works solely to 'explain' momentum portfolio returns. This is obviously ad hoc and, thence, momentum does actually not qualify as a risk factor per se.

FF's propositions to consider size and the book-to-market ratio for explaining equity returns are inspired by numerous scholars. Rosenberg et al. (1985) were among the first to suggest that the *book-to-market ratio* of a firm's equity may serve as a prevailing predictor of returns across securities. Yet, these early findings have not actually received wide attention, given the fairly short sample period employed, spanning from 1973-1984. Nevertheless, subsequent studies of Chan et al. (1991), Lakonishok et al. (1994), and Reinganum (1988) provide further empirical support for a link between the cross-section of average returns and the book-to-market ratio. This link appears to be net of the market beta. This implies that either high book-to-market ratio stocks are relatively underpriced, or that the book-to-market ratio serves as a proxy for a risk factor that has a considerable impact on equilibrium expected returns. Lakonishok et al. (1994)

[6] To support their position, FF show that (i) the returns to small firms covary more with one another than with returns to large firms and (ii) the returns to high book-to-market (value) stocks covary more with one another than with returns to low book-to-market (growth) stocks.

[7] cf. also Jegadeesh (1990) and Jegadeesh and Titman (1993), who argue that past winner stocks outperform past loser stocks in the short run. Jegadeesh and Titman (1993) also indicate that momentum is stronger for firms that have had poor recent performance. The tendency of recent good performance to continue is weaker. International evidence for a momentum effect is also found by Rouwenhorst (1998).

remark that the book-to-market effect occurs because investors tend to overvalue stocks that performed well in the past.

The findings of other scholars, however, imply that the empirical case for the importance of the book-to-market ratio may be somewhat weaker or subject to survivorship bias (Kothari et al., 1995) and data-snooping (Black, 1993, Lo and MacKinley, 1990, MacKinlay, 1995, Van Vliet and Post, 2004). For instance, Kothari et al. (1995) remark that the data obtained from Compustat, the source of FF's data, is affected by a selection bias and provides indirect evidence. Using an alternative data source, i.e., the S&P 500 from 1947-1987, Kothari et al. (1995) find that the book-to-market effect is weakly related to average stock returns.

In response to the increased criticism on the book-to-market factor, Davis (1994) mirrors the study of Fama and French (1992). He uses a potentially survivorship-free database of book values for large US industrial firms over the sample period 1940-1963, a time window for which the Compustat coverage is (or used to be) nearly nonexistent and that did not overlap with the time period employed by Fama and French (1992, 1993). The findings of Davis (1994) generally confirm those of Fama and French (1992), albeit the magnitude of the return dispersion for the book-to-market effect is somewhat smaller.[8] Studies by Barber and Lyon (1997) and Chan et al. (1995) further indicate that data-snooping and selection biases do not explain the size and book-to-market patterns in returns.[9]

The empirical findings of Banz (1981) and Schwert (1983) suggest evidence for the presence of a *size effect* in several markets. Banz (1981), for example, finds that average annual returns are consistently higher for small firm portfolios relative to big firm portfolios. He argues that even if returns are adjusted for risk using the CAPM, there is still a considerable premium for smaller-sized portfolios. The findings documented by Banz (1981) and Schwert (1983) triggered a wave

[8]The difference is presumably due to the fact that the Davis (1994) database primarily comprises large firms.

[9]For instance, Barber and Lyon (1997) note that empirical results caused by data mining should not carry over to other independent samples. As Fama and French (1992) do not include financial firms in their sample, Barber and Lyon (1997) use a set of financial firms for the period 1973 to 1994 and find a significant book-to-market effect among these firms. Chan et al. (1995), on the other hand, examine the period 1968-1991 and find that when firms of (i) the Center for Research in Security Prices (CRSP) database at the University of Chicago and (ii) Compustat are properly matched, there are not sufficient firms missing from Compustat to have a significant impact on the Fama and French (1992, 1993) results.

of studies that examined and mainly corroborated the existence of a small firm effect (see Dimson and Marsh, 1989, 1999, Heston et al., 1999).

However, other authors remark that the small-firm effect occurs mainly in January.[10] Daniel and Titman (1997), for instance, separate the returns to size and book-to-market portfolios into (i) January and (ii) non-January months. They find that the size effect is almost exclusively a January phenomenon and that the book-to-market effect occurs chiefly in January for bigger firms. For the largest quintile of their sample, high book-to-market stocks exhibit a 3% January premium over the returns to low book-to-market stocks. But for those stocks, the difference between the high and low book-to-market portfolio returns has been negative in the other 11 months. This argument that the January effect explains multifactor model results is yet rejected by Malin and Veeraraghavan (2004).

Daniel and Titman (1997) also note that the return premia on small capitalization and high book-to-market stocks does not arise because of the co-movements of these stocks with pervasive factors. They therefore suggest that it is the firm characteristics and not the covariance structure of returns that explain the cross-sectional variation in stock returns. They call their alternative hypothesis of the 3FM the characteristic based model.[11] Yet, Pastor and Stambaugh (2000) eventually remark that there is virtually no difference between the 3FM and the covariance model of Daniel and Titman (1997). In fact, Pastor and Stambaugh (2000) find that both models lead to similar portfolio choices with the investment universe constructed to exploit differences between the two models.[12]

The explanatory power of a size (*SMB*) and value (*HML*) effect were recently confirmed for the US in an independent study by Wang (2005). Yet, Griffin (2002) reports that the FF factors are country specific for the US, the UK, Canada, and Japan. Malin and Veeraraghavan (2004) apply domestic versions of the 3FM in France, Germany, and the UK over the time period 1992 to 2001. They find empirical support for a small firm effect in France and Germany but a big firm effect in the UK. Moreover, they do not find any evidence for a value effect

[10] cf. Daniel and Titman (1997), Davis (1994), Keim (1983), Reinganum (1983).

[11] Daniel and Titman (1997) argue that expected asset returns are directly linked to their characteristics, such as behavioral biases or liquidity, which have nothing in common with the covariance structure of returns.

[12] Pastor and Stambaugh (2000) study the portfolio choices of an investor seeking a mean-efficient portfolio in comparing different asset pricing models.

but for a growth effect instead.[13] This is contrary to FF, Haugen (1999), and Lakonishok et al. (1994), but in line with Otten and Bams (2002), who study European mutual fund performance.

Moerman (2005) conflates the findings of the European stock market integration literature and the preeminent status of the 3FM. He suggests that in the EMU (i) the 3FM is superior to the conventional CAPM to explain equity return behavior and (ii) industry factors have become more important relative to country factors for the pricing of assets. Albeit he fails to provide formal test statistics, he eventually notes that both a domestic 3FM and industry 3FM clearly outperform a common euro area 3FM. He remarks, however, that the explanatory power of the common euro area 3FM increases over time. This may be regarded an indicator of an increasing European equity market integration.

2.2.1.1 *SMB* & *HML* and Systematic Risk

The success of the 3FM and its predominant role in empirical finance has triggered a fair amount of debate in the literature over the economic rationale of the FF factors. Up to date, the question remains whether the 3FM may be regarded a suitable candidate for Merton's (1973) ICAPM or whether it falls into Ross's (1976) APT framework. Black (1995), Cochrane (2005), and even Fama (1981) remark that the ICAPM should not serve as a 'fishing license' for choosing factors with high explanatory power but that intrinsically lack the ability to forecast future investment opportunities. Fama and French (1996a, p. 76) admit themselves that they have not yet identified the state variables of special hedging concern to investors behind *SMB* and *HML* that lead to their seminal 3FM.

A starting point to find a link between the FF factors and systematic risk may be seen in the neo-classical Solow growth model (also known as the exogenous growth model), which describes the relation between macroeconomic variables and firm characteristics (see Solow, 1956). In particular, the Solow model predicts firm convergence towards an optimal size and depicts the sensitivity of

[13]Investment managers classify stocks with high ratios of book-to-market, earnings-to-price, or cash flow-to-price as value stocks. Fama and French (1992, 1996a, 1998), Haugen (1999), and Lakonishok et al. (1994) show that for US stocks there exists a strong value premium in average returns as stocks that have high values in the aforementioned ratios have higher average returns than 'growth stocks', i.e., stocks with low values in these ratios. Fama and French (1995) and Lakonishok et al. (1994) find that the value premium is related to relative financial distress.

optimal size to technological growth. Thus, if agents have the objective to maximize profits, then an economy that is comprised of homogeneous firms follows an equilibrium growth path, i.e., there exists an optimal firm size per firm and per economic state. Consequently, within this context, changes in the economic environment may be considered useful in explaining changes in size and, perhaps also, book-to-market. For instance, Maksimovic and Phillips (2002) develop and test a model which explains how firms allocate their resources with changes in the business cycle and how they respond to industry shocks. Their findings document that the growth, and thus the size, of a firm is related to neo-classical theory. This is in line with the findings of Lucas (1978).

Further macroeconomic explanations behind the success of the 3FM is based on time-varying investment opportunities.[14] In this context, size (*SMB*) and boot-to-market (*HML*) proxy for state variables that depict time variation in the investment opportunity set. Clearly, to hold as risk factors in context of the ICAPM, *SMB* and *HML* need to proxy for aggregate, systematic (rather than idiosyncratic) risk, as only collective economic events to which all investors are subject (e.g., financial crises or economic troughs) can lead to a risk premium.

Perez-Quiros and Timmermann (2000), for instance, suggest that the returns to small firms are more volatile during economic troughs, given investors' increased sensitivity to risk. This is in accordance with Heaton and Lucas (2000), who see the average stockholder as the holder of a small, privately held company. For this reason, investors' wealth is rather sensitive to economic recessions or events that may cause financial distress. Thence, they demand a substantial premium for holding small or value (high book-to-market) stocks. Notwithstanding, agents are not entirely reluctant to hold big and growth (low book-to-market) stocks either because of diversification considerations.

Fama and French (1996a) remark that the market value of a typical value firm has been driven down due to a variety of bad news, bringing the firm down to near financial distress. In turn, however, stocks bought on the edge of liquidation have strived more often than not. These comebacks usually result in above average returns. Lettau and Ludvigson (2001) add to the discussion by noting that *HML*

[14] cf. Cooper et al. (2001), Fama and French (1996a), Ferson and Harvey (1999), Heaton and Lucas (2000), Hodrick and Zhang (2001), Lettau and Ludvigson (2001), Liew and Vassalou (2000), Perez-Quiros and Timmermann (2000), Petkova (2006), Vassalou (2003).

is sensitive to bad news in bad times. They therefore propose a CAPM that considers a time-varying beta for *HML*. This beta is conditional on both the market return and consumption. In two other studies, Ferson and Harvey (1999), as well as Vassalou (2003), provide empirical evidence that an incorporation of macroeconomic risk reduces the information content of the book-to-market effect. Yet, Cooper et al. (2001) remark that macroeconomic variables combined with the FF factors enhance the predictability of expected returns. They eventually conclude that time variation in *HML* and *SMB* is linked to variations in aggregate, macroeconomic, non-diversifiable risk.

Hodrick and Zhang (2001) compare the 3FM to a number of asset pricing models that employ macroeconomic variables. Using the distance measure proposed by Hansen and Jagannathan (1997) they fail to find that any of the models is superior to the others. In yet another work, Liew and Vassalou (2000) link value and small firm returns to macroeconomic events. They document that *HML* and *SMB* help to forecast future rates of economic growth in various countries as proxied for by domestic GDP growth rates.[15] They, thence, suggest that the FF factors may be considered state variables in context of Merton's (1973) ICAPM, since they help to predict future changes in investment opportunities.

In two recent studies on US data, Hahn and Lee (2006) and Petkova (2006) find that *HML* and *SMB* are significantly correlated with innovations in state variables that predict the excess market return and its variance. More specifically, they denote that *HML* proxies for a term spread surprise factor in returns, while *SMB* proxies for a default spread surprise factor. In and Kim (2007) also point out that the FF factors share a considerable proportion of variation with shocks to state variables in the long run.

2.2.2 International Asset Pricing

Based on different degrees of market integration, academics and practitioners have developed various models to price assets. One strand of literature thereby assumes that world markets are fully integrated. This includes, amongst others,

[15]Focusing on the time period 1978 to 1996, the bivariate regression results of Liew and Vassalou (2000) reveal that *HML* has a statistically significant coefficient in France, Germany, Italy, the Netherlands, Switzerland, the UK, and the US. The factor loading of *SMB* is significant in Australia, Canada, France, Germany, Italy, the Netherlands, Switzerland, and the UK.

works of a world CAPM (Agmon, 1972, 1973, Fama and French, 1998, Ferson and Harvey, 1993, Harvey, 1991), a world CAPM with exchange-rate risk (Dumas, 1994, Dumas and Solnik, 1995), a world consumption based model (Wheatley, 1988), world APT models (Cho et al., 1986, Griffin and Karolyi, 1998, Grinold et al., 1989, Korajczyk and Viallet, 1989, Roll, 1992, Rouwenhorst, 1999, Solnik, 1983), and latent factor models (Bekaert and Hodrick, 1992, Campbell and Hamao, 1992, Harvey et al., 2002). The rejection of these models is usually considered a rejection of the underlying asset pricing model, market inefficiency, or the rejection of the null hypothesis of integrated capital markets. It is infeasible to disentangle this joint test.[16]

For instance, Agmon (1972) applies the CAPM in a multinational context over the time period from 1961 to 1966. He shows that despite apparent barriers in multi-national equity markets, there exists a considerable relationship among the equity markets of Germany, Japan, the UK, and the US. Put differently, share prices in the equity markets in these four countries behave as if there exists one multinational equity market. Yet, in a follow-up study one year later, Agmon (1973) finds empirical evidence that, even though share price movements in the equity markets of the UK, Germany, and Japan are related to price changes in the US market index, there are still some small country specific residual factors. These factors are independent of each other but affect domestic share-price fluctuations. Koedijk and Van Dijk (2004), however, provide empirical evidence that global risk factors, despite an increasing financial globalization, are not essentially important for practical cost of capital calculations. They therefore anticipate that the domestic CAPM will not become obsolete in the near future.[17]

Another line of research does not impose perfect market integration, but considers a hybrid market structure that accounts for both integration and segmenta-

[16]Put differently, applying asset pricing models across country borders can be considered from two angles: (a) Test for the asset pricing ability of a model given integration (i.e., asset pricing | integration) or (b) test for integration given the asset pricing ability of a model (i.e., integration | asset pricing).

[17]In detail, Koedijk and Van Dijk (2004) analyze 3,300 stock from nine industrialized countries over the period 1980-1999. They show that an international CAPM yields a cost of equity capital estimate that is significantly different from that of the domestic CAPM in only 4 to 5 percent. They, thence, advocate that for the vast majority of companies in their sample, the domestic market factor is an adequate benchmark against which to measure an individual company's exposure to both global market and currency risk factors.

tion. Stulz (1995) presents a survey of different asset pricing models that contain several global risk factors for pricing assets in (supposedly) segmented markets. For example, Adler and Dumas (1983) advocate an International Asset Pricing Model (IAPM) that makes allowances for cross-border investments. Assuming that financial markets are neither fully integrated nor fully segmented, Bodnar et al. (2003) suggest the implementation of a hybrid multifactor model that recognizes multidimensional risk. They propose that pricing models should include both a global and domestic risk factor. This is in line with Chan et al. (1992), who develop a two-factor model that comprises a domestic and foreign index. They find that this model performs better than an international version of the CAPM with just a single global market factor over the time period January 1978 to December 1989. They, hence, argue that markets are gobally integrated.[18]

Errunza and Losq (1985) and Errunza et al. (1992) also propose mild segmentation models that neither assume fully segmented nor integrated markets. Yet, the problem with these models lies in the fact that the degree of segmentation is fixed over time. In other words, the models fail to account for an increasing market integration along time. In another study, Solnik (1974) presents some empirical evidence of an international pricing of risk by studying eight major European markets and the US over the time period from March 1966 to April 1971. He suggests that an international market structure of price behavior exists, i.e., securities are priced according to their exposure to international systematic risk. Nonetheless, he concludes that stock prices are still strongly affected by domestic factors. The importance of international risk is also supported by Lessard (1974), who argues that the pre-dominant position of US securities in the world portfolio asks for a multi-factor market pricing model. This model should include a factor that minimizes the impact of national risk attributes.

Eun and Shim (1989) also confirm a substantial amount of multi-lateral interaction and the predominant role of the US stock market. They argue that innovation in the US are rapidly transmitted to other markets, whereas no single foreign market can significantly explain movements in the US market. This is

[18] Chan et al. (1992) note that since the mid-1970s the market value of US assets has become a smaller fraction of world wealth, indicating that the risk premium to US assets may be determined by world capital markets rather than the US capital market alone.

in line with De Santis and Gerard (1997), who denote that holding an internationally diversified portfolio provides little protection against severe US market declines. They, yet, also remark that long-term gains from international diversification remain economically attractive. Their findings are based on a conditional CAPM for the world's eight largest equity markets and a parsimonious generalized autoregressive conditional heteroscedasticity (GARCH) parameterization.

In a recent work, Hardouvelis et al. (2006) study whether European stock returns are driven by European-wide monetary, currency, and business cycle variables. Their findings suggest that the relative importance of European-wide factors increases with the probability of joining the European Economic and Monetary Union (EMU). This implies a shift from a country-specific to a common European pricing kernel, which, in turn, indicates an increased equity market integration in Europe. Interestingly, Hardouvelis et al. (2006) remark that the integration in Europe appears to be independent of a potential global market integration.[19] This is contrary to the findings of León, Nave, and Rubio (2007), who also note that European stock markets have become more integrated ever since the advent of the euro. Nevertheless, they show that this integration is not solely European-specific but also a global market integration phenomenon (cf. Section 2.3.3, page 53).

2.3 The European Economic & Monetary Union and European Stock Market Integration

2.3.1 A Brief History of the European Union

In 1946, the then prime minister of the United Kingdom, Sir Winston Churchill, called for the "United States of Europe". Even though his call has not been entirely accomplished, Europe has come a long way from the vast devastations of the Second World War to its economical and political structure today.[20] In fact, over the last 60 years several treaties were signed with the primary intention to

[19] Hardouvelis et al. (2006) suggest that due to increased opportunities for risk sharing, the risk premium, and, hence, the cost of capital, typically decreases when markets are more integrated. They estimate this decrease to be between 0.3 and 0.5 percent in the EMU.

[20] *Today* in the context of this chapter refers to the turn of the year 2009/2010.

preserve war and to pursue peace.[21] Most of these treaties signed up to today have been dealing with economic integration. This is due to the signatories' believe that wars and political conflicts of any kind are less likely to occur if their respective countries share common economic interests.

The root of the European Union can be traced back to 1949, when the first pan-European organization was established in form of the Council of Europe. Based on a speech by the then French Foreign Minister Robert Schuman on May 9, 1950, first voices arouse to integrate the coal and steel industries in Europe.[22] De facto, in 1951, Belgium, France, Italy, Luxembourg, the Netherlands, and West Germany signed the Treaty of Paris to set up the European Coal and Steel Community (ECSC). The Treaty of Paris gave rise to the first European institutions, such as the High Authority (today the European Commission) and the Common Assembly (today the European Parliament). Giving the tremendous success of the ECSC, the same six countries decided to further integrate other sectors of their economies. Hence, the Treaty of Paris was followed by the adoption of the Treaty of Rome in 1957. At the core of the latter treaty was the foundation of the European Atomic Energy Community (EURATOM) and the European Economic Community (EEC).

Ten years later, in 1967, the three established European communities (i.e., ECSC, EEC, and EURATOM) merged into the European Community (EC). From this date onwards, one European Commission, one Council of Ministers, and a European Parliament came into operation with the objective to pursue higher economic integration by removing trade barriers and by creating a single market. Subsequently, the Single European Act was signed in 1986. Six years later in 1992, and after the fall of the Berlin Wall and the reunification of Germany, the then twelve member states declared to speak with a common voice, which resulted in the approval of the Treaty of Maastricht (also referred to as the Treaty of the European Union).[23] The European Community was renamed into the European Union (EU) with the primary goal of securing peace and creating a monetary federation in form of the European Economic and Monetary Union (EMU). The

[21] cf. http://europa.eu/abc/history/index_en.htm (EU, 2008), last visited January, 2009.

[22] Coal and steel are considered the two main elements required to create weapons of war.

[23] At that time, the twelve member states consisted of: Belgium, Denmark (joined 1973), France, Germany, Greece (joined 1981), Ireland (joined 1973), Italy, Luxembourg, the Netherlands, Portugal (joined 1986), Spain (joined 1986), and the United Kingdom (joined 1973).

treaty also established an intergovernmental mechanism to direct common defense and foreign policies. The convention also contained the issuance of directives that dealt with labor and social policies (see Abdelal and Haddad, 2003).

The EU has eventually become a customs union with its key objectives being (i) the cutback of discrepancies among the various regions and (ii) the minimization of the backwardness of the less favored areas. Since the signing of the fundamental Treaty of Maastricht, further treaties, such as the Treaty of Amsterdam (1997), the Treaty of Nice (2001), and the Treaty of Lisbon (2007), have been signed to lay down plans to reform EU institutions, to enhance transparency as well as efficiency, to dedicate more resources on employment and the rights of citizens, and to give Europe a stronger voice in the world.[24] Besides, in October 2004, the then 25 EU member states signed a treaty in establishing a European Constitution.[25]

Nonetheless, the shift of power from the country level to the EU created also some objections. Recent polls in the Netherlands and France (May 2005), as well as an objection of Ireland (June 2008) to vote for a European Constitution, created a period of reflection towards the common European objectives. Even if the Irish revised their opinion under public pressure and voted pro a European Constitution in October 2009, there still exists skepticism among some about the path the EU is taking. Yet, the final pro-EU vote of the Irish paved the way for an even tighter Europe and let the European Constitution become effective with the treaty of Lisbon on 1 December 2009 with the aim to facilitate democratic decision-making and management. The existence of the Lisbon Treaty has also resulted in the creation of two permanent posts in form of the President of the European Council and a European Foreign Minister. As of December 2009, these posts are held by the Belgian prime minister Herman Van Rompuy and the British Labour politician Catherine Margaret Ashton. Since January 2009, the EU comprises 27 member states.[26]

[24]The five main institutions of the EU are: (i) the European Parliament, (ii) the Council of the European Union, (iii) the European Commission and - to a lesser extent - (iv) the Court of Justice and (v) the Court of Auditors, each of which has different tasks and obligations.

[25]The then 25 member states consisted of: Austria, Belgium, Czech Republic, Cyprus, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Poland, Portugal, Slovenia, Slovakia, Spain, Sweden, and the UK.

[26]Bulgaria and Romania joined in 2007. Croatia, the former Yugoslav Republic of Macedonia

2.3.2 The Inception of the European Economic and Monetary Union & the Advent of the Euro

The previous paragraphs have shown that the European landscape has changed noticeably over the last decades. However, the official launch of the EMU in 1990 and the advent of the euro in 1999 may presumably be considered the culminations of the lengthy political and economic process. In fact, the monetary reforms in Europe date back to March 1979, when the European Monetary System (EMS) was created by the then current EEC states to foster monetary stabilization. The EMS adopted a European Exchange Rate Mechanism (ERM) with the intention to link the members' currencies with the objective to prevent large exchange rate fluctuations. Yet, the ERM did not prove to be successful at that time. The speculations on the pound sterling and the accompanied exchange rate crises in 1992/1993 represent perhaps the peak of the monetary problems that the members of the EMU were still facing.[27]

In an effort to address the financial difficulties of the 1980s, the European Council confirmed in 1988 the objective of the proceeding realization of the EMU. The Council mandated a committee chaired by Jacques Delors, the then President of the European Commission, to examine and propose concrete stages leading to the EMU. A compiled report proposed that the European Economic and Monetary Union should be accomplished in three discrete and subsequent steps, which are also illustrated in Figure 2.1. In particular,

- *Stage 1 (as of July 1, 1990)* - Complete freedom of capital transactions, complete cooperation among central banks, and improve economic convergence;

- *Stage 2 (as of January 1, 1994)* - Converge the member states' economic policies and establish the European Monetary Institute (EMI) and the European Central Bank (ECB);

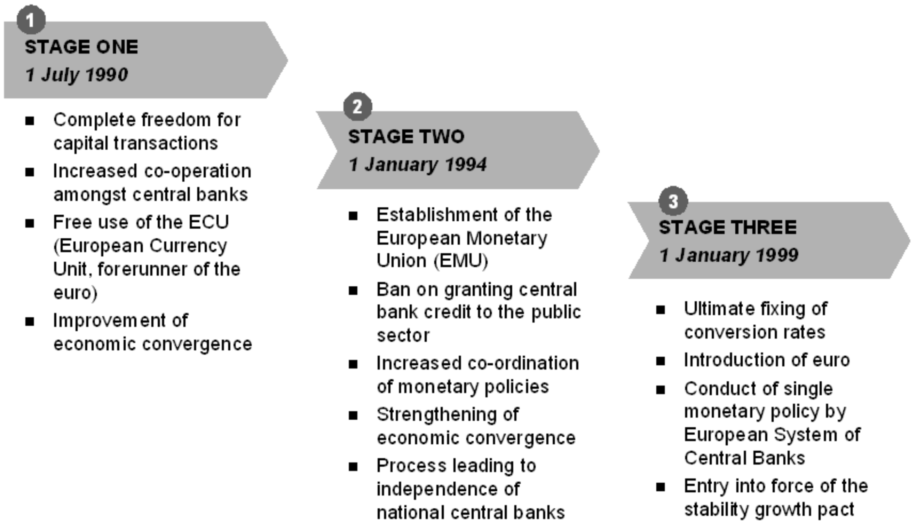
- *Stage 3 (as of January 1, 1999)* - Irrevocable fix exchange rates and introduce the euro.[28]

and Turkey remain potential candidates for the future.

[27]Please refer to Buiter et al. (2001) for more details on this crises.

[28]For a more detailed description, please refer to the website of the European Central

Figure 2.1: 3 Stages of the EMU - *Source: European Central Bank (ECB), http://www.ecb.int/ecb/history/emu/html/index.en.html, Frankfurt am Main, Germany, (see ECB, 2008); Own Draft*



To establish the institutional structure desired for stage 2 and stage 3 of the EMU, the Treaty of Maastricht (signed in 1992) contained an explicit passage on economic and monetary policies. In particular, the Treaty of Maastricht specified a progressive adjustment process to a union with member states converging in monetary and fiscal policies to a pre-specified level. Besides, in order to ensure harmonization among the EMU member states and also among potential future candidates, four convergence criteria with respect to interest rates, inflation, exchange rates, and budget deficits were established. The criteria mandate that inflation, budget deficits, and interest rates are to be lowered, while exchange rate fluctuations are to be stabilized.

In June 1997, the European Council adopted the Stability and Growth Pact to assure that the members of the EMU maintain desirable budget deficits.[29] The Stability and Growth Pact basically denotes that participating states that run a budget deficit should be penalized in a way that fiscal policies of all member states may remain as harmonized as if they had not entered the EMU. Some

Bank (ECB) and its depiction of the European Economic and Monetary Union (EMU), cf. http://www.ecb.int/ecb/history/emu/html/index.en.html (ECB, 2008).

[29]For more details, cf. http://europa.eu/scadplus/leg/en/lvb/l25014.htm (EU, 2006).

countries such as France, Germany, Italy, and especially Portugal and Greece have already breached the desirable budget deficits and, thus, obtained issued warnings of excessive deficits.[30] However, given the strict regulations of the pact, some economists have yet claimed that the Stability and Growth Pact should be subject to revision (see Annet, Decressin, and Deppler, 2005, Bofinger, 2003, Buti, Eijffinger, and Franco, 2003, Chang, 2006).

In order to obtain the aim of a common currency area, further resolutions have thereafter been adopted by the European Council. These resolutions, often in form of informal meetings among the respective ministers of EMU countries, have triggered further actions to pave the way for the euro by harmonizing policies other than monetary and fiscal ones. Eventually, in 1998, those countries meeting the convergence criteria of the Stability and Growth Pact and those willing to participate in the third stage of the EMU, fixed their bilateral foreign exchange rates against the Deutsche Mark (DEM).[31] On January 1, 1999, the same countries finally adopted the euro as a common currency. Three years later, the euro banknotes and coins were ultimately introduced as legal currency. For most of the participating countries, the old domestic currency ceased to be legal tender on February 28, 2002.[32] As of January 2009, 16 out of the 27 EU member states have adopted the euro as their sole legal tender.[33] Figure 2.2 provides an overview of the EU countries and their currency status, i.e., whether the country (i) is a member of the Eurozone, (ii) has its currency pegged to the euro, or (iii) has its currency freely floating.[34]

[30]The ongoing global economic crises, triggered by the sub-prime crises in the United States in 2007, has caused European governments to compile stimulus packages of hundreds of billion euros to hamper the economic downturn. The enormous government spending may most likely result in further breaches of the budget deficit levels by several European countries.

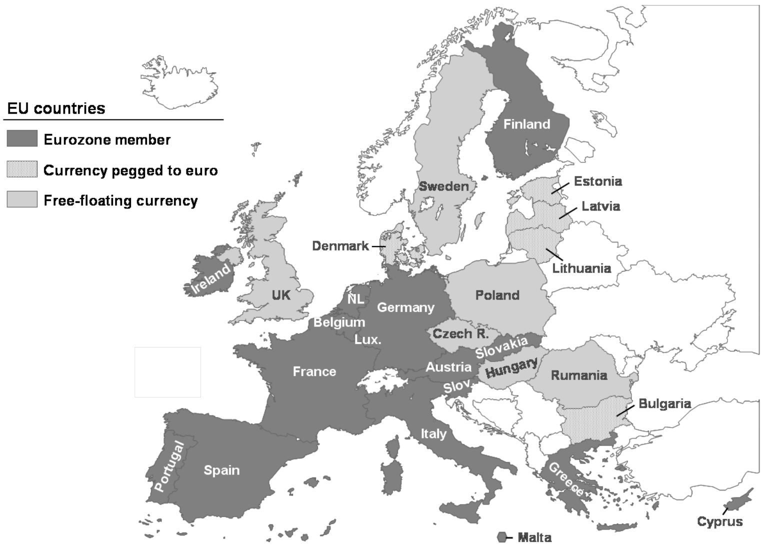
[31]Initially, eleven countries met the criteria, i.e., Austria, Belgium, Finland, France, Germany, Ireland, Italy, Luxembourg, the Netherlands, Portugal, and Spain. Greece did not fulfill the criteria on January 1, 1999; yet, it joined the Eurozone two years later.

[32]For the original eleven member states (plus Greece), June 30, 2002 was the last day for changing the old domestic currency to euro at any bank. Thereafter, the obsolete domestic currencies may only be exchanged at national central banks and some specially designated financial institutions.

[33]As of January 2009, the 16 Eurozone members are: Austria, Belgium, Cyprus, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Malta, Netherlands, Portugal, Slovakia, Slovenia, and Spain.

[34]cf. Adjaoute and Danthine (2003), Baele et al. (2004), Eijffinger and Lemmen (1995), Guiso et al. (2004), and Hardouvelis et al. (2006) for more detailed discussions on regulatory changes.

Figure 2.2: EU Countries & Their Currency Status - *Source: The Economist, 'A Special Report on the Euro Area - Holding Together', June 11, 2009*



2.3.3 EMU Impact on Stock Market Integration

The creation of the EMU and the advent of the euro have triggered an unremitting effort in harmonizing monetary and fiscal policy rules, as well as aligning legal considerations among the Eurozone countries. Although the 16 member states of the euro area (as of January 2009) still possess the sovereignty of their fiscal policies, monetary decisions have been centralized and are now decided upon by the European Central Bank (ECB) with seat in Frankfurt am Main, Germany. However, unlike the Federal Reserve Bank in the US, which focuses simultaneously on reducing inflation and on pushing employment as well as growth, the ECB primarily aims for hampering inflation. The narrow focus of the ECB may eventually impede the efficacy of monetary decisions and demand fiscal policies as primarily drivers to stimulate economic growth in the euro area.

The institutional development has initiated an extensive line of research on both an economic integration and the interdependence of financial, and especially stock, markets. For instance, the effects of the continuous alignment process on an *economic* integration of EMU member states is examined in a variety of studies in measuring the convergence of various economic variables across affiliated

European countries. In studying the approximation of variables such as money supplies, inflation rates, short-term and long-term interest rates, GDP and indices of industrial productions, as well as national budget deficits as a ratio of GDP, most of these studies provide strong empirical support for an economic integration among European countries, especially those associated with the EMU.[35] Moreover, Danthine et al. (2000) suggest that the economic convergence has provoked a surge in international investments and cross-border trading in the EMU. This is due to a reduction of implicit and explicit transaction costs as well as in an increased standardization and transparency of prices. Eventually, European investors may have become stimulated to hold non-domestic European assets that used to be too costly and risky prior to the arrival of the euro.

Another strand of literature studies the effects of an economic convergence among EMU members on the integration of European *stock markets*.[36] Positive effects of an economic integration on the convergence of European stock markets are documented by a fair share of studies.[37] Atteberry and Swanson (1997) and Chen et al. (2002), for one, stress the importance of economic factors, such as significant trade among countries and economic policies, as drivers for a strong interdependence and long-run linkages of international stock markets. Additionally, Prati and Schinasi (1997) suggest that the introduction of the euro might work as a catalyst for further harmonization among European equity markets in terms of legislation, regulation, and settlement procedures and systems. This, however, also implies that stock exchanges may face more competitive pressures, potentially leading to mergers of exchanges or at least strategical partnerships.[38] In the long run, trading should increase as investors benefit from lower transaction costs, increased liquidity and transparency. This is underpinned by Hardouvelis et al.

[35]cf. Bernard and Durlauf (1995), Bredin and Fountas (1998), Caporale and Pittis (1993), Fountas and Wu (1998), Hafer and Kutan (1997), Haug et al. (2000), Holmes (2000, 2002).

[36]Note, however, that economic integration does not necessarily represent a prerequisite for stock market integration (cf. Section 1.2.2).

[37]cf. Abbot and Chow (1993), Atteberry and Swanson (1997), Baele (2005), Baele et al. (2004), Chen et al. (2002), Guiso et al. (2004), Hardouvelis et al. (2006), Kim et al. (2006), Levine (1997), Melitz and Zumer (1999), Morana and Beltratti (2002), Prati and Schinasi (1997), Savaa et al. (2009), Serletis and King (1997), Worthington et al. (2003).

[38]cf. the creation of Euronext N.V. in September 2000 as a pan-European stock exchange based in Paris, France, with subsidiaries in Belgium, France, the Netherlands, Luxembourg, Portugal, and the United Kingdom.

(2006), who denote that the advent of the euro in 1999 has been accompanied by a period of regulatory harmonization.

Hardouvelis et al. (2006) also measure the importance of EU-wide risk relative to country-specific risk over the time period 1992 to June 1998 through a conditional asset pricing model which allows for a time-varying degree of integration. Their findings suggest that integration has substantially increased over time, especially since 1995. Further empirical support for an increasing integration of European equity markets over time is presented by León et al. (2007), who study prices of covariance risk via a mixed data sampling (MIDAS) method. In particular, they test, amongst others, the null hypotheses that (i) the price of covariance risk is equal across countries and that (ii) the price of country-idiosyncratic risk is zero for their sample indices. They reject the nulls when focusing on the time period January 1988 to December 1998 (i.e., prior to the advent of the euro), but fail to reject the nulls for the period January 1999 to December 2004.

Kim et al. (2006) assess European stock market integration via a bivariate exponential generalized autoregressive conditional heteroscedasticity (EGARCH) framework with time varying conditional correlations. Their results also indicate that the inception of the EMU has led to a significant increase of integration among European equity markets over the time period 1999-2003. Similar inferences are presented by Baele (2005), who studies volatility spillover effects across European countries. He reports that common European shocks explain merely about 8% of local variance during the first half of the 1980s. Yet, this proportion increases to 23% by the end of the 1990s.

Bley (2009) applies a multivariate cointegration approach on a European sample from 1998 to 2006. He finds that integration within euro markets rapidly increased between 2001 and 2003, but then decreased substantially from 2004 to 2006. In another study, Yang et al. (2003) also examine the impact on the EMU on long-run integration structures among eleven European countries. Using generalized impulse response analysis and generalized forecast error variance decomposition, their results depict that albeit there has been some integration among the member states of the Eurozone prior to the inception of the EMU, the long-run linkages have generally been strengthened after the establishment of the EMU. However, they further show that while larger EMU stock markets (i.e., Germany, France, and Italy) have become more integrated with each other ever since the launch of the EMU, the three smallest markets in their sample (i.e., Austria, Belgium, and Ireland) have become more isolated.

Furthermore, Baele et al. (2007) and Danthine et al. (2000) note that with the evolution of the EMU, the importance of the so-called home bias has been decreasing, indicating that European capital markets have become more integrated in the course of time. Home bias denotes the riddle that the share of foreign assets is lower than optimal portfolio theory would suggest. This might be due to information asymmetries across markets (Coval and Moskowitz, 1999, Gordon and Bovenberg, 1996, Matsen, 2001), the presence of transaction costs (Lewis, 1995), lack of regulations (Glassman and Riddick, 2001, Tesar and Werner, 1995), or the fact that investors exhibit bounded rationality and may thus also behave overly optimistic towards domestic assets vis-à-vis foreign investments.

With the enlargement of the European Union on May 1, 2004 towards the east, a new strand of literature has started to study the financial market integration process of the newly admitted countries, which are in transition to full membership of the EMU. Of these, Hungary, Poland and the Czech Republic have the largest GDP and equity markets and, therefore, form the focal point of these studies. While there is evidence that the business cycles of these countries has synchronized with the Eurozone, the evidence on financial integration is mixed.[39] For instance, Baltzer et al. (2008) and Égert and Kočenda (2007) argue for relatively low integration in equity markets, while Cappiello et al. (2006) and Chelley-Steeley (2005) document increasingly strong co-movements.

Baele et al. (2004) state that there are in general three main benefits of financial integration: (i) better risk sharing and diversification, (ii) improved capital allocation, and (iii) higher economic growth. The increased integration may create better risk sharing, given the increase of available financial instruments and the possibilities of cross-border asset ownerships. This may result in a smoothing of economic shocks and, thus, of risk (see Melitz and Zumer, 1999). Besides, Baele et al. (2004) argue that enhanced capital allocation due to financial integration arises from the elimination of barriers to trade. Investors can thus allocate their funds in a way that allows them to generate the highest productivity and, eventually, return. Baele et al. (2004) also suggest that financial integration provides better access to investment opportunities in other regions so that financial

[39] cf. Fidrmuc and Korhonen (2006) for a comprehensive survey on business cycle integration.

development will eventually increase. This is supported by Levine (1997), who also stresses that there exists a strong positive link between the well functioning of financial systems and long-term economic growth.

Nonetheless, despite the apparent benefits of market interdependence and the increasing convergence process of European equity markets, there is another set of studies which provides weaker support for stock market integration. For example, Adjaoute et al. (2000) and Danthine et al. (2000) remark that cross-border transaction costs were estimated to be still around ten to twenty times more than domestic ones at the end of the 1990s. The presence of these frictions does not provide a strong claim of fully integrated financial markets, especially considering that other barriers like varying accounting and reporting standards, or tax regulations are still present, impeding cross-border transactions and investments.

Notwithstanding, any present frictions across European equity markets may further diminish with the introduction of the Markets in Financial Instruments Directive (MiFID), which came into effect on November 1, 2007. The MiFID is a European directive that aims for creating an integrated structure for a pan-European market (including the current 27 member states of the EU plus Iceland, Norway, and Liechtenstein) for investment services. In particular, it seeks to make cross-border trading in securities in Europe simpler for investors as well as for financial institutions. Besides, the directive also seeks to promote competition between trading venues by recognizing new types of exchanges and by creating a common best execution regime. Unlike previous directives, which strove for a minimum harmonization and a mutual recognition principle, the MiFID aims at a maximum convergence and puts more emphasis on a home state supervision.[40]

2.4 Measuring Market Integration

When talking about the integration of markets, one may broadly identify three different dimension of integration: (1) institutional integration, (2) economic integration, and (3) financial integration.

[40] For more details on MiFID, please refer to: http://ec.europa.eu/internal_market/securities/isd/index_en.htm (EU, 2007)

2.4.1 Institutional and Economic Integration

Institutional integration covers the political and regulatory harmonization of different markets. As discussed in Section 2.3, this is, for instance, reflected in the alignment process among the members of the European Union (EU) and, especially, the European Economic and Monetary Union (EMU). Economic integration of markets refers to the abolition of trade barriers and, thus, the promotion of free inter-country trade agreements among countries. According to Balassa (1961) and Machlup (1977), an economic integration usually precedes institutional integration as the free cross-border movements of economic factors demand a political union in the long run.[41] This is, for example, the case in the EMU. The Northern American Free Trade Agreement (NAFTA), on the other hand, has not yet, if it will ever, resulted in a politically integrated market.

2.4.1.1 Measuring Economic Integration

Two potential ways to measure economic integration are to test for either (a) the correlation of consumption growth or (b) the purchasing power parity (PPP) across countries.

2.4.1.1.1 Consumption Model Approach

One conventional approach to test for market integration is through measuring the correlation of consumption growth across countries. Consumption pricing models give the expected return to any asset as a function of risk, whereby risk is given by the covariance between an asset's return and marginal utility of aggregate consumption (see Breeden, 1979, Grossman and Shiller, 1981, Lucas, 1978).[42] Although consumption based models enjoy considerable popularity in the area of economics, they have rarely been used in finance for the study of international

[41]Balassa (1961) categorizes the degree of economic integration along six stages: (1) Preferential trading area; (2) Free trade area; (3) Customs union; (4) Common market; (5) Economic and monetary union; (6) Complete economic integration.

[42]The CAPM and consumption capital asset pricing model (CCAPM) approach are similar to the extent that both methodologies imply a security market line (SML), yet with a different measure of risk. While the CAPM expresses risk as the covariance of an asset with the market portfolio, the CCAPM considers instead the covariance of an asset with consumption growth. Besides, both models test simultaneously the joint hypothesis of model validity and market integration. It is not feasible to break up the joint hypothesis.

financial integration. This is primarily due to the fact that basic empirical consumption models do not appear to be able to explain financial data, despite of the models' strong economic rationale.

In particular, Mehra and Prescott (1985) remark that the equity premium is too high to be in alignment with observed consumption behavior unless investors are extremely risk averse. This riddle is commonly referred to as the *equity premium puzzle*. Further evidence and explanations for this puzzle have been found, amongst others, by Benartzi and Thaler (1995), Kocherlakota (1996), and Mehra (2003). Besides, Campbell (1996, 2003), Grauer and Hakansson (1987), as well as Zimmermann, Drobetz, and Oertmann (2003), show that the equity puzzle is even more prevailing in an international setting, given the difficulty in measuring consumption across countries.

Moreover, the theoretical convention of treating the stock market as a valid proxy for total consumption or the aggregate wealth of an economy appears more plausible in highly capitalized countries. For instance, Campbell (1999) documents that in highly capitalized countries, such as the UK and Switzerland, the Morgan Stanley Capital International (MSCI) index accounted for about 80% of GDP in 1993, whereas in Germany and Italy it accounted for less than 20% of GDP in the same year.[43] In addition, stock ownership tends to be much more concentrated in countries with low capitalization, making it harder to employ the Consumption Capital Asset Pricing Model (CCAPM) across different countries.

2.4.1.1.2 Purchasing Power Parity Approach

Another common way to test for economic market integration concerns testing whether PPP holds across country borders. PPP theory is based on the law of one price. Cassel (1921) was the first to suggest that in an efficient market identical goods should only have one price and that the long-term nominal exchange rate of two currencies should equalize their purchasing power. This implies that the real exchange rate converges to a constant level over time. Most commonly, PPP is tested in examining unit roots in real exchange rates. PPP is said to hold in

[43] Campbell (1999) also shows that in the quarterly MSCI data for 1993, the Japanese MSCI index was only 65% of the US MSCI index, the UK MSCI index was worth only 30% of the US index, and the German and French MSCI indices were worth only 11% of the US index, all other countries' indices were even worth less than 10% of the US benchmark.

the long run, if the unit root may be rejected in favor of level stationary. The presence of a unit root would indicate a temporary deviation from a long-run equilibrium.[44]

Employing various international sample data sets, the results of Abuaf and Jorion (1990), Alesina and Perotti (1998), Froot and Rogoff (1991), Koedijk, Tims, and Van Dijk (2004), Lopez and Papell (2007), and Nessen (1996) reveal a common consensus that PPP does not appear to hold in the short run. Moreover, most studies denote that the deviation from PPP are quite persistent and robust in the long term, i.e., the mean reversion process is slower than theoretically suggested. The academic literature provides different explanations for this behavior. For instance, Nessen (1996) addresses differences in tastes and preferences among the citizens of her sample countries, namely Germany, Japan, the United Kingdom, and the United States. Alesina and Perotti (1998) and Froot and Rogoff (1991) make government spending shocks accountable for long-run PPP deviations. Other studies by Dutton and Strauss (1997), Engel and Rogers (1996), and Fleissign and Strauss (2000) mention the inclusion of non-traded goods, while transaction costs are suggested as a cause by Dumas (1992), Sercu, Uppal, and Van Hulle (1995), and Rogoff (1996).

Notwithstanding, albeit the findings of past studies document that PPP diverges internationally, more recent empirical results suggest that the economic convergence process among EMU member states has resulted in long-run PPP in the Eurozone. In fact, using a panel data method, Lopez and Papell (2007) find that PPP holds in the Eurozone and that the process of PPP convergence can be traced back as far as the financial crisis of 1992/1993.[45] Koedijk, Tims, and Van Dijk (2004) also conclude that the process of economic integration in Europe has accelerated convergence towards PPP within the euro area. However, while they reject the unit root hypothesis for some countries of their panel, they also remark that there is still some weak evidence for PPP in some other nations.

[44] A stochastic process is called to be stationary if the probability distribution at a fixed time or position is the same for all times or positions. This implies that the mean and variance do not change over time or position.

[45] In 1992/1993, many European currencies collapsed after unrelenting speculative attacks on their narrow exchange bands. For more details on the financial crisis of 1992/1993, please refer to Buiter et al. (2001).

Even if the PPP approach represents perhaps the most prevalent way to test for the law of one price, it is not free of shortcomings. The main drawback of the PPP methodology is given by the fact that the analyses and the drawn conclusions rest entirely on the choice of indices considered. In most of the cases, analysts refer to the local consumer or wholesale indices provided by national statistical agencies for their examinations. These indices are, nonetheless, not entirely comparable, as the index composition and relative weights of goods and services contained in those indices differ per country. Thus, in order to be able to test the hypotheses of the law of one price, researchers instantaneously impose homogeneity on indices across their sample countries.

Additionally, it is not only the composition of these indices per se that differs. It may also be the case that the base years of the baskets of goods and services are not necessarily in alignment. This implies implicitly that the PPP is supposed to hold on top prior to the base year (Latif and Kazemi, 2006). Although the problem of deviating base years may be mitigated using the change in price levels rather than absolute values, the imposed existence of the homogeneity of both indices and agents' preferences across countries still reflect rather strong assumptions of the PPP model.

2.4.2 Financial Market Integration

Next to institutional and economic integration, the interdependence of financial markets constitutes the third main dimension of integration. Most commonly, the interlink of financial - and especially stock - markets is seen as an outcome of an ongoing institutional and economic convergence. In this line of thought, long-run stock market integration is primarily driven by the following factors: (i) the formation of a common currency area that strengthens the relation amongst respective domestic economic variables, (ii) the existence of a predominant financial center within a pan-domestic area, facilitating cash-flows across the region, yet (iii) a deregulated financial structure that allows investors to diversify their portfolios internationally, (iv) a common technological trend, (v) similarities in income patterns, including PPP considerations, and (vi) the existence of considerable international trade in general, and in capital goods in particular, triggering strong economic ties and the harmonization of marginal products and capital.

Arshanapalli et al. (1995) and Lee and Jeon (1995), for instance, suggest that the international integration of stock markets in the long-run is driven by institutional convergence and the deregulations and improvements of communication technologies that facilitate easy access to non-domestic markets. Atteberry and Swanson (1997) and Chen et al. (2002), on the other hand, denote the significance of economic factors, such as considerable trade among countries and economic policies, as drivers for a strong interdependence and long-run linkages of international stock markets.

However, as already mentioned in Section 1.2.2, one may alternatively consider the integration of equity markets an early indicator of (or a prerequisite for) a wider economic convergence process. The anticipating character of equity markets is due to the very nature of publicly listed stocks. As opposed to any other tradable good, stocks are fully standardized and are, thus, perfectly interchangeable across countries. This implies, among others, low information asymmetries and relatively low transaction costs across country borders, especially when comparing stocks to less liquid, less transparent, and less standardized assets. The standardized nature of stocks is also reflected by the exact same rights that stocks certify to their owners. These rights depict fairly unique and inherent attributes and are irrespective of the physical presence of the stock holders and the country the stocks are listed in.

2.4.2.1 Measuring Stock Market Integration

To measure the degree of stock market integration, past studies have chosen different angles and approaches. Although the existing literature on this subject is immense, the majority of studies can probably be clustered along two main lines: (i) the investigation of correlation and cointegration patterns and (ii) the identification of common risk factors.

2.4.2.1.1 Correlation / Cointegration Approach

The degree of stock market integration and the factors that drive the covariation of stock returns across different countries and industries have attracted the interest of academics and practitioners since the late 1960s. Correlation-based approaches to market integration suggest that a low correlation between indices provides evidence for segmented markets, while a high co-movement supports market integration.

Grubel (1968), Grubel and Fadner (1971), Levy and Sarnat (1970), and Solnik (1974) are the first to verify low correlations between index returns among different countries. They remark that the benefits of international diversification offset the numerous costs associated with international trading.[46] Yet, it is not apparent where the benefits from diversification exactly stem from. For instance, Roll (1992) remarks that the industrial composition notably explains cross-sectional differences in volatility, as well as correlation patterns, of country index returns. Others propose that returns of assets are influenced by business cycles, man-made or natural catastrophes, general government decisions as well as monetary and fiscal policies whose effects are limited to or preliminary felt in the economies of the respective countries (see Benderly and Zwick, 1985, Canova and De Nicolo, 1995, Park and Ratti, 2000).

Later studies find empirical evidence of short-run interrelations (in terms of correlation patterns) among stock indices of different countries, especially during and after the stock market crash in the United States in 1987.[47] The convergence has allowed investors to participate in foreign markets upon arrival of new information in a cheap and fast way without any major institutional constraints. Nevertheless, in this context of international convergence, some scholars point out that the US stock market still serves as the leading financial market of the world (see Koch and Koch, 1991). This may primarily be attributed to the US's dominant political and economic role in the world, even though China and the European Union have strengthened their positions in the global market venue. The global financial (and then also economic) crisis that started in 2007 and that became more transparent in the autumn of 2008 may further underpin this thought.[48]

[46] These costs include higher direct trading expenses, regulatory and cultural diversities, as well as exchange rate and political risk.

[47] cf. Bertero and Mayer (1990), Eun and Shim (1989), King et al. (1994), King and Wadhwani (1990), Park and Fatemi (1993), Ratner (1992).

[48] The financial crisis of 2007-2009 and most likely beyond, began in July 2007 due to a loss of investors' confidence in the value of securitized mortgages in the United States. This loss of confidence triggered a global liquidity crisis in the inter-bank market that prompted a substantial injection of capital into financial markets by the US Federal Reserve and the European Central Bank. The financial crisis also resulted in an harsh global economic downturn

Notwithstanding, the United States still represent the major source of relevant news and information that affect other markets around the world. For instance, Canova (2005) finds that US monetary shocks produce significant variations in Latin America. Other research focuses on the impact of US news on exchange rates and asset prices in other markets (Andersen et al., 2003, Ehrmann and Fratzscher, 2004, Miniane and Rogers, 2007). For example, Ehrmann and Fratzscher (2004) analyze the effects of US monetary policy on stock markets. They find that, on average, a tightening of 50 basis points reduces returns by about 3%. Wongswan (2003) also documents that equity volatility and trading volume in emerging markets can in the short run be associated with macroeconomic announcements in developed economies.

The identification of short-term integration through macroeconomic shocks and correlation patterns might be of interest from a market and trading facilitation perspective. Yet, true integration among stock markets should be driven by long-term fundamental patterns and eventually the law of one price and the presence of common risk factors. In other words, the interdependence of stock markets is supposed to be the result of some underlying factors that provide indirect links among stock prices in various countries (see Bachman, Choi, Jeon, and Jopecky, 1996, Cheung and Lai, 1999, Cho, Eun, and Senbet, 1986, Ripley, 1973).

Besides, it is possible for asset prices to move together while violating the law of one price. Adler and Dumas (1983), for instance, remark that even two stocks that are listed on the same exchange do not move together for reasons other than lack of integration. Additionally, correlation-based approaches assume that in the presence of low correlations among different regions, investors may easily move to a higher mean-variance frontier simply by investing abroad in order to diversify their portfolios. Hence, taking low correlations as evidence of market segmentation along with benefits of diversification ignores the fact that low co-movements do not allow an investor to obtain the same mean portfolio without taking on additional risk by diversifying geographically.

with a severe impact, amongst others, on the automobile industry, with companies such as General Motors and Chrysler, perhaps even Ford, finding themselves close to filing bankruptcy (as of December 2008).

Alike, Beckers et al. (1992) remark that low correlations among different stock markets may be perfectly consistent with complete market integration as the evolution of the correlation between two indices could be caused either by the industry or the country factors of each index return. Also, Pukthuanthong and Roll (2009) advocate that a simple correlation between two stock markets is likely to be a weak indicator of integration. They suggest that if multiple factors drive returns, two markets can be perfectly integrated and yet still be imperfectly correlated. Put differently, perfect integration between two countries implies that the same common international factors explain 100% of the index returns in these countries. However, if the country indices differ in their sensitivities to these factors, then they do not exhibit perfect correlation.

Moreover, integration analyses of Engle and Granger (1987), Johansen (1988, 1994), and Johansen and Juselius (1990) provide relatively conflicting findings on the long-run interdependence and integration of various national stock markets when examining cointegration vectors.[49] Besides, a weakness of cointegration methods is that a focus on comparative statistics does not account for the time variation in equity risk premia (see Bekaert and Harvey, 1995), which may yield confusing and partial results.

2.4.2.1.2 Common Risk Factor Approach

The fact that correlation patterns fail to account for the law of one price (see Adler and Dumas, 1983, Beckers et al., 1992) and that two markets can be perfectly integrated and yet still be imperfectly correlated (see Pukthuanthong and Roll, 2009), has triggered a strand of integration research that has moved from identifying correlation patterns among indices returns (cf. Section 2.4.2.1.1) to the identification of common risk factors across markets. This move has also been motivated by the perception that a change in the investment decision process -

[49] Johansen (1988, 1994), and Johansen and Juselius (1990) examine the long-run integration of stock markets through an equilibrium relationship that precludes the variables in the model to diverge from one another in the long run. Unlike the cointegration methodology employed by Engle and Granger (1987), the Johansen techniques allows for using multiple cointegration vectors. The latter would, for instance, allow to facilitate a comparison of the level of integration between the EMU and countries outside the EMU.

from a diversification across countries towards a diversification across industries - may be regarded an indicator of market integration.[50]

As pointed out in Section 2.2.2, numerous studies have approached financial market integration in an asset pricing framework by studying the extent to which domestic returns may be explained by global rather than country factors (see De Santis and Gerard, 1997, Errunza et al., 1992, Eun and Resnick, 2001, Ferson and Harvey, 1993, Harvey et al., 2002, Stulz, 1995). Traditionally, country specific environments have been considered the main determinants of stock returns. Therefore, a rise in the proportion of global factors is associated with an increasing level of market integration. In consequence, a single global asset pricing model should apply in perfectly integrated markets (see Adler and Dumas, 1983, Agmon, 1972, Harvey, 1991, Solnik, 1974, Stulz, 1981). Albeit this may seem intuitively apparent to many, the reliance on some parametric asset pricing model is fairly restrictive. In fact, when the underlying pricing model is empirically called into question, so is the respective notion of market integration (see Chen and Knez, 1996).

A more recent strand of literature has left the strong restrictions of an asset pricing approach to market integration behind by moving towards a plain covariance-factor structure for the return generating process. For the most part, studies have thereby focused on the relative importance of country and industry factors in international portfolio returns.[51] If the proportion of the country factor diminishes vis-à-vis the proportion of the industry factor, markets are regarded more integrated.

In the 1970s, Grubel and Fadner (1971) and Lessard (1974) started to consider the importance of differences in industrial composition for explaining the variations in global stock returns. While Grubel and Fadner (1971) denote that there exists a difference in correlation among intra- and inter-country pairs of indus-

[50]The underlying rationale behind these tests for integration is comprised of the perception that a rational investor would only include a country specific risk factor in his pricing system if markets are segmented and not if markets are integrated (see Baele, 2005).

[51]cf. Baca et al. (2000), Beckers et al. (1996), Cavaglia et al. (2000), Drummen and Zimmermann (1992), Ferreira and Gama (2005), Freiman (1998), Griffin and Karolyi (1998), Grinold et al. (1989), Heston and Rouwenhorst (1994), Heston et al. (1995), Isakov and Sonney (2004), Lessard (1974), Rouwenhorst (1999), Serra (2000). See also Soriano and Climent (2006) for a brief literature review on studies that deal with the issue of country vs. industry effects.

tries, Lessard (1974) concludes that national effects dominate industrial effects. Triggered by these findings, the relevance of industry and country factors in the determination of asset returns have become subject to a considerable amount of academic research.

Most of these studies regard the change in the investment decision process from a diversification across countries towards a diversification across industries an indicator or market integration. This is usually reflected by an increase in the importance of the industry factor vis-à-vis the country factor for the explanation of equity returns. In order to measure the relative importance of these factors, most studies employ the popular dummy variable approach proposed by Heston and Rouwenhorst (1994). This method assumes that the return to an asset j at time t depends on a common factor that is universally shared by all assets, an industry factor, and a country factor, i.e.,

$$R_{j,t} = \alpha_t + \beta_{i,t} + \gamma_{k,t} + \varepsilon_{j,t} \tag{2.2}$$

where α_t is the common factor at time t, β_i is the industry effect for industry i, γ_k is the country effect for country k, and ε_j is the idiosyncratic disturbance. In context of Equation (2.2), equity markets are considered fully integrated when the country component γ_k is insignificant. In turn, equity markets are said to be fully segmented when the common factor α and the industry effect β_i are not significant.

The time-varying parameters in equation (2.2) are usually estimated by running for each period t a cross-sectional regression of the returns to each available asset j on a set of K-1 country and I-1 industry dummies:[52]

$$R_j = \alpha_j + \beta_1 I_1 + \beta_2 I_2 + \ldots + \beta_{I-1} I_{I-1} + \gamma_1 C_1 + \gamma_2 C_2 + \ldots + \gamma_{K-1} C_{K-1} + \varepsilon_j \tag{2.3}$$

where I and C are the industry and country dummies and $I_1 = 1$ if asset j belongs to industry 1 (zero otherwise) and $C_1 = 1$ if asset j belongs to country 1

[52]Using dummies for all K countries and I industries may cause identification problems, as each asset j belongs to one industry and one country. To allow identification, the model is usually estimated with K-1 countries and I-1 industries via an appropriate transformation relative to a global benchmark portfolio (see Campa and Fernandes, 2006).

(zero otherwise).[53]

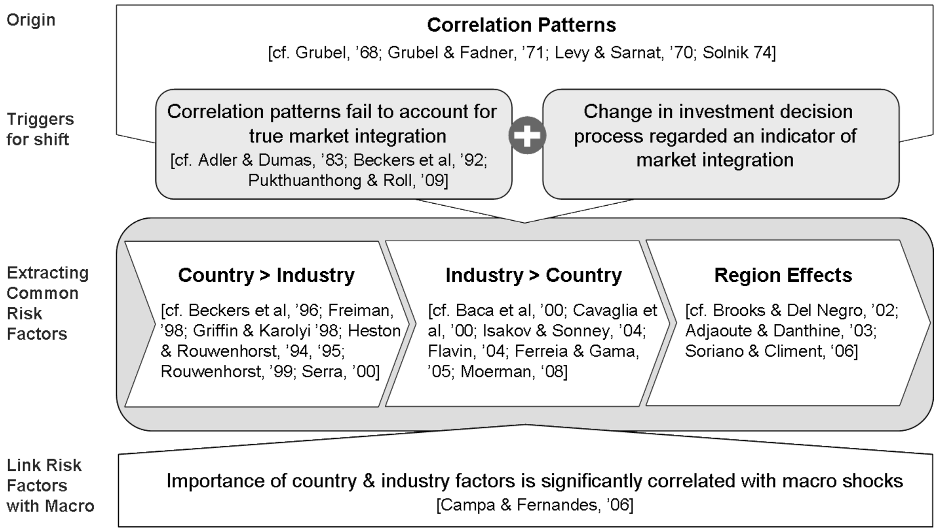
In following this (or a partly derived) dummy approach, earlier studies document that country factors dominate industry factors in various developed countries (see Beckers et al., 1996, Griffin and Karolyi, 1998, Heston and Rouwenhorst, 1994, Serra, 2000). Even in a more integrated market as the European Union, country factors still appear to play the dominant role (see Freiman, 1998, Heston et al., 1995, Rouwenhorst, 1999). Yet, later studies remark the growing importance of industry factors relative to country effects for the explanation of equity returns in different international markets (see Baca et al., 2000, Campa and Fernandes, 2006, Cavaglia et al., 2000, Isakov and Sonney, 2004) and throughout Europe (see Flavin, 2004), implying an increasing equity market integration.[54]

A major advantage of the Heston and Rouwenhorst (1994) method lies in the fact that it yields much information about the dynamics of the integration process over time. However, it fails to account for the drivers of economic integration. Campa and Fernandes (2006) aims to overcome this drawback. They first replicate the Heston and Rouwenhorst (1994) method for a sample of 48 countries and 39 industries and find that country effects have remained fairly stable over the time period 1973 to 2004 while industry factors have significantly increased during the last decade and then dropped again since 2000. Campa and Fernandes (2006) then regress the pure country and industry effects on a set of economic variables to determine the sources of gains from international portfolio diversification. They document that the importance of country and industry effects is correlated with measures of economic shocks which, in turn, are the result of an enhanced global financial market integration.

[53]Note that the regressors matrix in Equation (2.3) is singular. Most studies solve for singularity by imposing the net effects of countries and industries to be zero. This, moreover, allows for interpreting α as the return to the general market factor. Hence, γ_k (β_i) can be considered the excess return of country k (industry i), free of incremental industry (country) effects. It is the return that country k (industry i) would have if its industrial (country) structure was the same as that of the universal market.

[54]Next to these studies, there exist other papers that employ other means to test for the relative importance of country versus industry factors. For instance, Ferreira and Gama (2005) use a volatility composition method and find that industry volatility has been increasing vis-à-vis country volatility in the late 1990s. Moerman (2008) analyses the euro area using a mean-variance analysis. He finds that diversification over industries yields more efficient portfolios than diversification over countries. See also Soriano and Climent (2006) for a brief literature review on studies that deal with the issue of country vs. industry effects.

Figure 2.3: From Correlation Patterns to Common Risk Factors - *Own Draft*

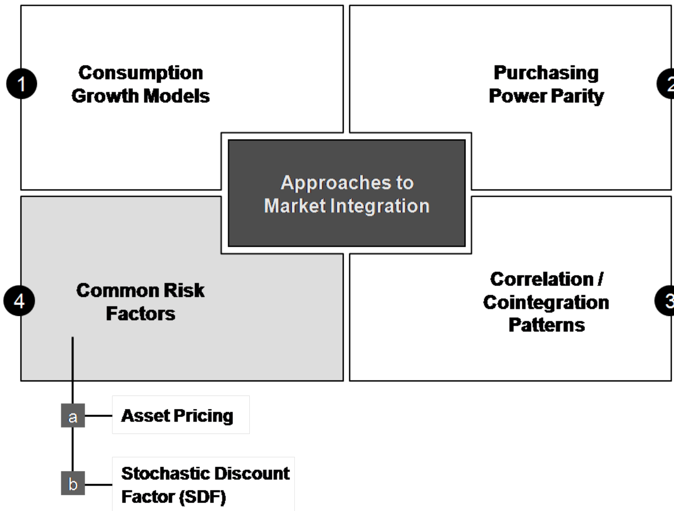


More recent studies find, however, that the country effect appears to basically resemble a region rather than a true domestic effect (Brooks and Del Negro, 2002, Soriano and Climent, 2006) and that the industry effect may be considered a temporary (as opposed to permanent) result of the 'dot-com bubble' (Brooks and Del Negro, 2002). In more detail, Brooks and Del Negro (2002) propose to split the pure country effect in the Heston and Rouwenhorst (1994) model into a 'region' effect and an 'within-region country' effect.[55] They find that region effects account for half the return variation typically attributed to country effects for both developed and emerging countries.

Soriano and Climent (2006) also contrast region - rather than country - effects with industry effects and present overall dominance of region effects over industry effects over the period January 1995 to December 2004. Soriano and Climent (2006) further analyze volatility transmission patterns within an industry across regions to assess to what extent the same international links found in aggregate stock market indices are present at the industry level. They find that

[55] The 'region effect' is supposed to capture common variation in the Heston and Rouwenhorst (1994) country effects within regions. The 'within-region country' effect is estimated as the divergence of country effects from the relevant region effect and, thus, intends to measure within-region return heterogeneity.

Figure 2.4: Conventional Approaches to Market Integration - *Own Draft*



the importance of spillovers depends on the respective industry being analyzed. On the whole, their findings suggest that a diversification across regions provides a greater reduction in risk than a diversification across industries. Figure 2.3 briefly summarizes the development in the literature from the identification of correlation patterns towards the identification of country vs. industry risk factors.

2.4.3 The Meaning of Integration in Context of this Study

In this study, we take the premise that in financially integrated markets assets are subject to the same market forces and should accordingly be priced by the same risk factors. This is in line with Bekaert and Harvey (1995) and Roll and Ross (1980), who suggest that the measurement of integration is conditioned on the identification of risk. Thus, two financial markets are integrated when risk in these markets is entirely shared and identically priced. This idea is reflected in the common risk factors approach, which is therefore highlighted relative to all presented integration methods in Figure 2.4.

The common risk factor approach itself can further be broken down into two sub-approaches, which are conceptually equivalent, but differ in terms of measurement and operationalization: (a) an asset pricing approach and (b) a SDF approach to market integration. These two means are part of our study and are

Figure 2.5: Overview of Consumption Growth Model, PPP & Correlation / Cointegration Approaches - *Own Draft*

	❶ Consumption Growth Models	❷ Purchasing Power Parity (PPP)	❸ Correlation / Cointegration Patterns
Description	▪ Consumption Capital Asset Pricing Model (CCAPM) ▪ Measuring covariance of marginal aggregate consumption & consumption return on asset	▪ Law of one price ▪ Examination of unit roots in real FX rates – PPP holds in long run, if unit root is rejected in favor of level stationary	▪ Markets integrated, if subject to similar economic shocks – High correlation → integrated – Low correlation → segmented
Studies (sample)	▪ Mehra & Prescott (1985); Grauer & Hakansson (1987); Benartzi &Thales (1995); Kocherlakota (1996); Mehra, (2003); Zimmermann et al. (2003)	▪ Alesina & Perotti (1998); Dumas (1992); Fleissign & Strauss (2000); Froot & Rogoff (1991); Koedijk et al, (2004); Nessen (1996); Lopez & Papell (2007)	▪ Levy & Samat (1970); Grubel & Fadner (1971); Eun & Shim (1989); Bertero & Mayer (1990); King & Wadwani (1990); King et al (1994); Ratner (1992); Park & Fatemi (1993)
Drawbacks	▪ Not able to explain financial market data (cf. equity premium puzzle)	▪ Conditioned on indices employed ▪ Imposes homogeneity on indices & agents' preferences	▪ Merely short run integration ▪ Asset prices may correlate while violating law of one price (Adler & Dumas, '83; Beckers et al, '92; Pukthuanthong & Ross, '09)

later empirically utilized in our Empirical Part A, i.e., in Methods A.I & A.II.

Our choice for the two selected methods is supported by the methodological problems and limitations of the other integration approaches, i.e., the (i) consumption model, (ii) PPP, and (iii) correlation/cointegration approaches. Figure 2.5 briefly summarizes again the drawbacks of these means to integration, which we have discussed more thoroughly in the previous sections. Albeit a common risk factor approach to market integration is not entirely free of drawbacks either, especially as the results are highly conditioned on the risk factors employed, its application appears to be justifiable under our main objective, i.e., to provide further insights on the general pricing ability of the 3FM. Again, as previously noted (cf. Section 2.2.2), applying the 3FM in a pan-European context depicts a joint test for (a) asset pricing and (b) market integration. It is infeasible to disentangle this test.

Nonetheless, it is worth mentioning from the outset that a limited pricing ability of the 3FM in a pan-European context does not necessarily imply that European stock markets are segmented. Truly, there could always be other risk factors to which European stock markets are commonly exposed. Therefore, our means to measure market integration via an asset pricing model (Method A.I & Method A.II) is, admittedly, purely conditioned on the risk factors employed and, thus, evidently restricted.

Notwithstanding, we aim to circumvent part of the restrictions that an asset pricing approach to market integration imposes. We therefore employ a slightly more generic stochastic discount factor (SDF) approach to market integration (Method A.II). This approach is insofar more generic, since we do not impose as in an asset pricing context a common risk-free rate as the SDF and do not test whether the pricing errors are jointly equal to zero across a set of portfolios. We rather use a covariance model to estimate domestic pricing kernels and then assess whether these kernels are not significantly different across markets.

Chapter 3

Data Description

3.1 Introduction

We employ, with minor variations, the same data set in all of our four methods (Method A.I/A.II & Methods B.I/B.II). As such, we consider it reasonable to discuss our sample more thoroughly and already at this stage, i.e., prior to the detailed introduction of our four methods employed.[1] We begin with a description of our (i) sample period, sample classification, and data sources. We then shift our attention to (ii) the construction and description of our risk factors, i.e., size, book-to-market (value), and momentum factors. We also conduct (iii) multicollinearity analyses to determine to what extent our aforementioned risk factors are orthogonal to each other. Note that we use MATLAB for all steps in the data analysis process.

3.2 Sample Period and Data Sources

Our total sample includes monthly European data ranging in total from January 1981 to April 2008. We choose a monthly frequency since it accounts for speed in arbitrage adjustments but mitigates any potential problems that are associated with microstructure issues such as bid-ask spreads. Besides, the use of monthly

[1]For Method B.I, we extend this data set by quarterly GDP growth rates for the time period from January 1990 to April 2008. For Method B.II we augment our data set by monthly default and term spreads for the Eurozone for the time period May 1999 to October 2006. More details on these data are provided in Sections 5.1.2 and 5.2.2, respectively.

data allows us to neglect that there might be no simultaneous trading for a given day, as trading days may differ per country, e.g., due to local bank holidays.

For our analyses, we require firm specific data, market indices, a proxy for the risk-free rate, and exchange rates (to compare data across countries). We derive all of our firm specific data, such as beginning of month stock prices, market capitalization, and book-to-market ratios from Datastream's Market Constitution List (*LTOTMK*).[2] All equity prices are adjusted for stock splits and dividends. Country specific market indices are also drawn from Datastream's *TOTMK* indices.[3] We also include the DJ EuroStoxx 50 index in our analyses, whenever we refer to pan-European and industry indices.[4] We use Datastream's *DJES50I* code to obtain the time-series of the DJ EuroStoxx 50. The return to a one-month ecu-market deposit serves as our risk-free return and is derived from Datastream's *GSECU1M* code.[5] For firms in the Eurozone, prices are given in euros. Prior to January 1999, prices are given in ecu, which is in accordance with Datastream computations. For non-members of the EMU, we compute prices and returns based on the countries' respective exchange rate with either (i) the ecu prior to 1999 or (ii) the euro as of 1999.[6]

Each stock considered is classified by country, region, and industry. We draw our sample for the 12 Eurozone countries as of January 2006, i.e., Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, and Spain.[7] These countries comprise our *Eurozone*. In addition, we extend our sample for robustness analyses by three further members of the

[2]For the market capitalization, we use Datastream's data-type *MV*. For the book-to-market ratio we use the inverse of the price-to-book value *BP*. Book value refers thereby to the latest book value shown on the balance sheet.

[3]Unfortunately, those lists do not prevent a survivorship bias in our sample.

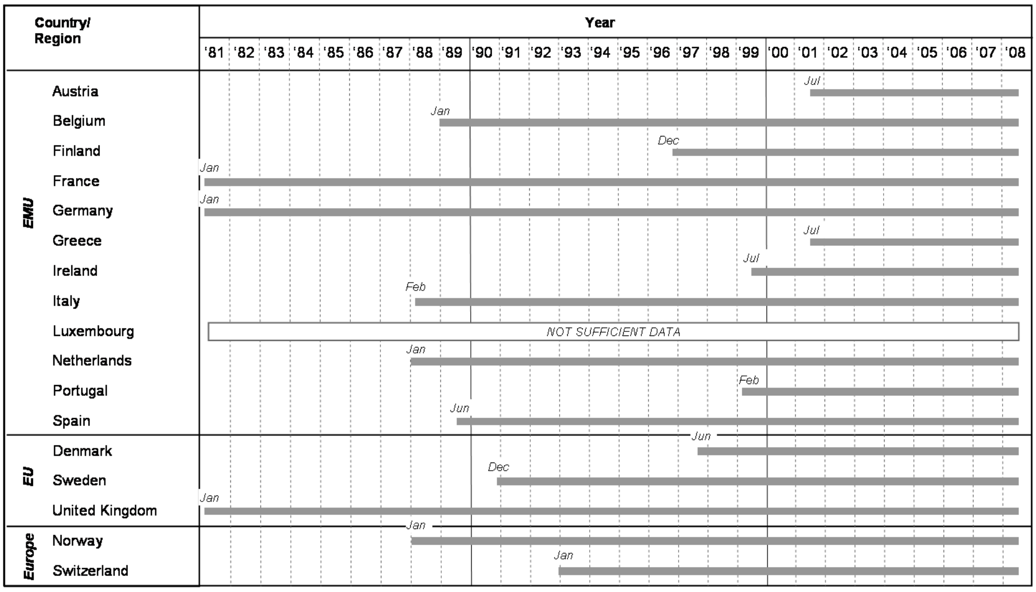
[4]Apparently, we would prefer industry specific market indices, but we lack data availability constraints. Yet, as our industry analyses are across country borders, we consider the DJ EuroStoxx index to be a more suitable benchmark than any country specific index.

[5]Prior to February 1995, we us the one months money market middle rated quoted in Frankfurt (code: *BDMNY1M*) as the one-month ecu-rate is not available any earlier.

[6]We use again Datastream. In particular, we employ the following codes: *DANEECU* (Denmark), *NORGECU* (Norway), *SWEDECU* (Sweden), *SWISECU* (Switzerland), and *STERECU* (UK).

[7]We do not include the other current (as of January 2009) Eurozone states Slovenia (member since January 2007), Cyprus, Malta (both members since January 2008), and Slovakia (member since January 2009) in our analyses, simply due to limitations of data availability and a potential lack of market integration.

Figure 3.1: Sample Period per Country/Region - *Source: Datastream*



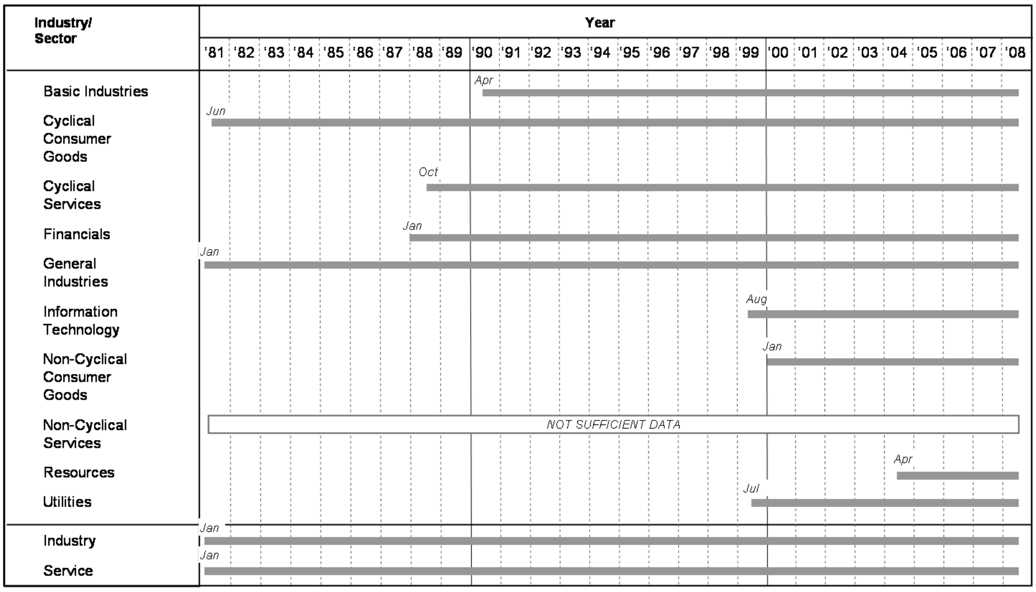
European Union (EU), i.e., Denmark, Sweden, and the United Kingdom (UK), plus two other European countries, i.e., Norway and Switzerland. The Eurozone countries plus Denmark, Sweden, and the UK comprise our *European Union* sample. Eventually, these EU countries plus Norway and Switzerland make up our common *European* market. Smaller countries are usually ignored for these kind of studies due to the short number of stocks available.

Overall, the availability of data and the number of firms differ considerably per country. Figure 3.1 illustrates the time windows for which data are available. Moreover, the number of stocks may vary from year to year due to new stock issues, mergers, takeovers, and bankruptcies, or simply due to a lack or increase of data availability.[8]

We also classify the firms in our sample along ten different industries as defined by the *Financial Times Actuaries*. These industries include: *basic industries (BAS), cyclical consumer goods (CGD), cyclical services (CSER), financials (TOLF), general industries (GN), information technology (ITECH), non-cyclical consumer goods (NCGD), non-cyclical services (NCSR), resources (RES)*, and *utilities (UTL)*. A more detailed description of the industry classification can be

[8]In general, the amount of data available per stock certainly reflects a disadvantage of using European data as opposed to US data.

Figure 3.2: Sample Period per Industry - *Source: Datastream*



found in Table A.1 on page 259 in Appendix A.[9] Besides, for further analytical purposes, we group the industries *cyclical services*, *non-cyclical services*, and *financials* under the common umbrella *services*. The remaining industries are clustered under *industries*. Again, the availability of data and the number of firms differ per industry/service. This is depicted in Figure 3.2.

Table 3.1 provides a joint overview of the average number of stocks per country and industry. 'Average' refers thereby to the mean number of stocks available per country/industry for the *entire* sample period (i.e., January 1981 to April 2008). A more detailed distribution of the exact number of stocks per year and country/industry can be found in Tables A.2-A.5 on pages 260-263 in Appendix A. Note that the total number of stocks depicted in the last column of Table 3.1 differs from the average number of stocks in the bottom of Tables A.2-A.5 in the Appendix. Table 3.1 depicts the average across the total sample period (i.e., January 1981 to April 2008), while Tables A.2-A.5 portray the average for the *actual* period considered per country/industry, which may differ from the total sample period. This holds especially for smaller countries (e.g., Austria, Belgium, and Ireland) and selected industries (e.g., *resources* and *utilities*).[10]

[9] For even more details, please refer to http://www.ftse.com, last accessed February 2009.

[10] Yet, all stocks across all countries are considered for our pan-European analysis for the entire sample period.

Table 3.1: Number of Stocks per Country, Region, and Industry - Average Jan. 1981 to Apr. 2008

This table reports the average number of stocks available per country/industry for the entire sample period, i.e., from January 1981 to April 2008. The countries are clustered along three dimensions. The first group comprises those countries that belong to the Eurozone. The second cluster represents countries of the European Union that do not belong to the Eurozone. The last cluster contains European countries that neither belong to the Eurozone nor the European Union. Note that the total averages stated per country and industry might differ from the ones stated in Tables A.2 to A.5 in Appendix A (see pages 260-263). This is due to the varying sample periods per country/industry that we consider for the individual country/industry analysis (cf. Figure 3.1 & 3.2 on pages 73 & 74).

BAS = *basic industries*; CGD = *cyclical consumer goods*; CSER = *cyclical services*; TOLF = *financials*; GN = *general industries*; ITECH = *information technology*; NCGD = *non-cycical consumer goods*; NCSR = *non-cycical services*; RES = *resources*; UTL = *utilities.*

	BAS	CGD	CSER	TOLF	GN	ITECH	NCGD	NCSR	RES	UTL	Total	Industry	Service	Total
Austria	2	2	1	8	6	0	0	0	1	1	22	13	9	22
Belgium	5	6	3	14	8	1	5	1	1	1	45	27	18	45
Finland	6	3	6	3	12	2	2	0	0	0	35	25	9	35
France	4	21	21	30	27	10	10	2	5	6	136	83	54	136
Germany	12	23	11	33	34	5	9	1	2	8	136	92	45	136
Greece	2	5	2	12	7	0	1	1	1	1	32	17	15	32
Ireland	2	6	3	5	6	1	1	0	2	0	26	18	8	26
Italy	2	10	6	29	19	2	1	1	2	4	77	41	36	77
Luxembourg	2	6	3	14	1	0	0	0	1	3	30	13	18	30
Netherlands	4	8	11	18	27	8	2	0	2	0	79	50	29	79
Portugal	5	2	6	5	10	1	1	1	0	1	33	21	13	33
Spain	6	10	4	21	16	3	2	1	2	6	71	46	25	71
Denmark	0	6	0	10	9	0	6	0	0	1	32	22	10	32
Sweden	4	4	4	14	14	2	2	1	0	0	44	25	18	44
United Kingdom	12	27	55	119	82	11	8	4	10	4	332	155	178	332
Norway	2	2	1	3	8	1	0	0	5	2	23	19	3	23
Switzerland	6	7	5	24	18	3	10	1	1	5	79	48	30	79
Eurozone	45	95	72	176	161	32	33	8	17	29	668	412	256	668
European Union	61	132	130	318	265	45	48	12	28	34	1073	613	461	1073
Europe	68	142	139	349	297	50	57	13	33	42	1188	687	501	1188

As countries like Germany and France, which are the largest economies in the Eurozone, have the highest proportion of stocks in our data sample (neglecting the UK), one could perhaps argue that some industries, such as *non-cyclical consumer goods* and *basic industries*, are to some extent country specific, since they only comprise a few stocks of smaller countries, such as Greece or Ireland. Consequently, the interpretation of the empirical results needs to take into consideration whether some industries might be biased towards one specific country. If this is the case, then the industry factor may actually turn out to be a country factor. Notwithstanding, given the empirical findings that suggest an increasing importance of industry factors versus country factors in Europe (cf. Section 2.4.2.1.2), we consider it not only appropriate but also necessary to cluster our firms along both dimensions, i.e., country and industry.

All in all, based on the previous discussion on the degree of market integration in the euro area, the selection of the sample period depicts somehow a dilemma. The shorter the time period, the lower is the *overall* number of stocks available per country (industry). This may, in turn, lead to a lower validity and reliability of the data set. On the other hand, the longer the time period, the higher becomes the probability that a country (industry) might be fairly underrepresented relative to other countries (industries). The further we go back in time, the less data become available for smaller economies, such as Austria and Belgium. Besides, as the first step of the EMU was just officially launched in 1990, implementing data way prior to this date may seem inappropriate under market integration considerations. In other words, there exists a trade-off between the availability of data and the compliance with the null hypothesis of integrated markets.

3.3 Portfolio Construction and Risk Factors

The implementation of our four empirical methods (Method A.I & A.II and Method B.I & B.II) demands ex ante the construction of FF and momentum factors for each of our sample countries, regions, and industries. We need to construct the risk factors ourselves, since our European focus does not allow us to borrow the original FF factors available at the website of Kenneth R. French.[11]

[11]The website of Kenneth R. French can be found at:
$http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html$, last accessed

Besides, we use a three-sequential sorting alike Liew and Vassalou (2000) rather than the more popular two-sequence sort of FF due to data availability constraints and to account for momentum, which FF neglect.[12] Moreover, as we will discuss later (cf. Section 3.4.2), our sorting procedure assures that the risk factors are nearly orthogonal to each other, implying that each of them captures different information.

To build the risk factors for each country, region, and industry, we conduct per sub-sample the following steps. We first rank all stocks by their book-to-market ratio for each month in year *t*-1. We then classify the ranked stocks into three different portfolios: portfolio 1 contains the stocks with the highest book-to-market ratios; portfolio 2 comprises the stocks with the medium book-to-market ratios; and portfolio 3 consists of the stocks with the lowest book-to-market ratios. Thereafter, we take each of these three portfolios, one at a time, and re-sort all stocks according to their market capitalization (i.e., small, medium, and big market capitalization). Thereby, three portfolios within each book-to-market portfolio are created. This leads to nine portfolios.

In a next step, each of those nine portfolios is again divided into three sub-portfolios, based on the momenta of the inherent stocks (i.e., winner stocks, mid-field stocks, and loser stocks). The momentum of a stock is computed by deriving the mean of the stock's past year's returns. We exclude, however, the most recent month.[13] Besides, for reasons of continuity, we only consider stocks for which we are able to derive the market capitalization of at least twelve months in a row. We eventually classify as winners the top third of the stocks per sub-sample with the highest last year's average return. Correspondingly, losers comprise the bottom third per sub-sample. The midfield stocks are the remaining (middle) third of the sub-sample. At last, we obtain per country, industry, and region 27 portfolios,

September 2009.

[12]Note that our results may be said to be specific to the sorting order used. Yet, robustness tests of Liew and Vassalou (2000) imply that this sorting methodology is stable and that results are not conditioned on the sorting sequence employed. Hence, we are comfortable in following our three-sequential sort.

[13]Liew and Vassalou (2000) suggest to exclude the most recent month in order to eliminate problems that are associated with microstructure issues such as the bid-ask spread. Carhart (1997) also excludes the last month for the construction of the momentum (*WML*) factor in his four-factor model (4FM).

Table 3.2: Portfolio Construction Procedure

This table shows the portfolio construction procedure in line with Liew and Vassalou (2000).

Book-to-Market	**Market Capitalization**	**Momentum**	**Portfolio**
High	Small	Losers	P1
		Medium	P2
		Winners	P3
	Medium	Losers	P4
		Medium	P5
		Winners	P6
	Big	Losers	P7
		Medium	P8
		Winners	P9
Medium	Small	Losers	P10
		Medium	P11
		Winners	P12
	Medium	Losers	P13
		Medium	P14
		Winners	P15
	Big	Losers	P16
		Medium	P17
		Winners	P18
Low	Small	Losers	P19
		Medium	P20
		Winners	P21
	Medium	Losers	P22
		Medium	P23
		Winners	P24
	Big	Losers	P25
		Medium	P26
		Winners	P27

which we number from *P1* to *P27*.[14] Table 3.2 provides an overview of the three sequential portfolio construction procedure. Note also that our sorting method assures that each stock can only be in one of the 27 portfolios at a time.

[14]Since we create 27 portfolios, the number of securities has to be at least 27. If one country/industry has more than 27 stocks, then we first divide the total number of stocks in this country/industry by 3. The greatest feasible divisor is then included in the extreme portfolios, i.e., high/low (for book-to-market), small/big (for size), and winner/loser (for momentum). The remaining stocks are sorted in the respective middle portfolio. For instance, in our sample, the total number of stocks for Spain is 119. After having ranked these stocks by their book-to-market ratio, we divide 119 by 3 and obtain 39.6666. We, thus, put the 39 stocks with the highest book-to-market ratio into the first portfolio that will, hence, include all *value* stocks. The lowest ranked 39 assets are put into the portfolio with the assets comprising the lowest book-to-market ratio. The remaining 41 [= 119 - 39 - 39] stocks are then put in the middle portfolio. We follow the same logic for the remaining rebalancing steps.

The return to these 27 portfolios represent the ingredients for the return to our three risk factors, i.e., *HML*, *SMB*, and *WML* for each of our sample countries, industries, and regions. In particular, for each sub-sample, we compute the factor returns by adding and subtracting the returns to the individual portfolios as follows:

$$HML = 1/9 \times \begin{bmatrix} (P1 - P19) + (P2 - P20) + (P3 - P21) + (P4 - P22) + (P5 - P23) \\ +(P6 - P24) + (P7 - P25) + (P8 - P26) + (P9 - P27) \end{bmatrix}$$

$$SMB = 1/9 \times \begin{bmatrix} (P1 - P7) + (P2 - P8) + (P3 - P9) + (P10 - P16) + (P11 - P17) \\ +(P12 - P18) + (P19 - P25) + (P20 - P26) + (P21 - P27) \end{bmatrix}$$

$$WML = 1/9 \times \begin{bmatrix} (P3 - P1) + (P6 - P4) + (P9 - P7) + (P12 - P10) + (P15 - P13) \\ +(P18 - P16) + (P21 - P19) + (P24 - P22) + (P27 - P25) \end{bmatrix}$$

In summary, *HML* describes the return to a portfolio that is long on high book-to-market firms and short on low book-to-market firms. By simultaneously controlling for *SMB* and *WML*, *HML* becomes size and momentum neutral. Accordingly, *SMB* and *WML* are corrected for a book-to-market and momentum, or size effect, respectively.[15] The individual risk factor returns are derived for annually rebalanced frequencies for equally weighted portfolios per country, per region, i.e., for the Eurozone, the EU, and Europe as whole, and per industry.[16,17] For the latter, we compile the risk factors per industry across our Eurozone countries, per industry across our EU countries, and per industry across all our European countries. Table 3.3 provides an overview about our portfolios and risk factors per country, region, and industry.

[15] Note that this approach allows us, therefore, to eliminate any potential problems of multicollinearity among the risk factors. Please refer to Section 3.4.2 for more details.

[16] We use equally weighted rather than value weighted portfolios as suggested by Lakonishok, Shleifer, and Vishny (1994) (LSV). Fama and French (1996b) also document that the 3FM does a better job in explaining LSV equally weighted portfolios when compared to value weighted portfolios.

[17] We also use higher turnover frequencies, i.e., quarterly and semi-annually. Please refer to Section 3.4.1 for details.

Table 3.3: Returns and Risk Factors per Sub-Sample

This table presents an overview about our portfolios and our constructed risk-factors per country, region, and industry.

	Country $\forall C$ $(C = 1, \ldots, 16)$	Region $\forall R$ $(R = 1, \ldots, 3)$	Industry† $\forall I$ $(I = 1, \ldots, 11)$
Portfolio Return $\forall j$ $(j = 1, \ldots, 27)$	$R^C_{j,t}$	$R^R_{j,t}$	$R^I_{j,t}$
Book-to-Market (Value) Factor	HML^C_t	HML^R_t	HML^I_t
Size Factor	SMB^C_t	SMB^R_t	SMB^I_t
Momentum Factor	WML^C_t	WML^R_t	WML^I_t
Market Factor‡	MRF^C_t	MRF^R_t	MRF^I_t

† Note that we construct industry factors across (i) the Eurozone, (ii) the EU, and (iii) Europe as a whole.
‡ Note that MRF^C_t refers to the return of the local $TOTMK$ index in excess of the ecu-rate; MRF^R_t & MRF^I_t refer to the return of the DJ Euro Stoxx 50 in excess of the ecu-rate.

3.4 Descriptive Characteristics of Risk Factors

While the previous section has focused on the compilation of the risk factors, we now shift our focus to their basic descriptive characteristics per country, industry, and region.[18] Prior to employing the factors in our set of empirical tests in Chapters 4 and 5, we would like to have an idea about their distribution, their means and median returns, their standard deviations, and whether they follow a stationary process, i.e., whether they exhibit unit roots or not.

First of all, we are interested in whether our risk factors show a Gaussian-normal behavior.[19] Albeit we may conduct our regression analyses with our variables being non-normally distributed, we need to be aware that the explanation of non-normal data requires further effort to be interpreted correctly. For instance, is the non-normality caused by unique events that are not likely to be repeated? In this case, the data need to be corrected. Yet, it may be that extreme values in a data set provide either the most useful information about values of some of the

[18] As previously mentioned, we distinguish for robustness consideration among three different regions: the Eurozone, the EU, and Europe as a whole (cf. Section 3.2).

[19] The findings of past studies suggest that financial data usually exhibit non-normal behavior (see Cochrane, 2005). Thus, we expect to find the same for our data sample at hand.

coefficients or the most realistic guide to the magnitudes of error terms. As such, a closer examination of the data is required. We test for normality by taking a look at the third and fourth central moments (i.e., skewness and kurtosis) of the variables and by employing also the Jarque-Bera test statistic (Jarque and Bera, 1980, 1981) as a goodness-of-fit measure.[20]

Next to normality, we are interested in whether our variables exhibit unit roots. Specifically, in order to obtain meaningful results from our regression analyses, we want our variables to be level stationary, i.e., they should not exhibit any unit roots. We test for the presence of unit roots using the Augmented Dickey-Fuller (ADF) test statistic (see Dickey and Fuller, 1979, Said and Dickey, 1984), given a constant and setting the lag p equal to 1.[21]

Finally, we are interested in the mean and median returns of the individual variables along with the corresponding standard deviations. The reason is twofold. First, positive mean/median returns for *HML*, *SMB*, and *WML* indicate that these trading strategies result in abnormal return patterns and may, thus,

[20] The Jarque-Bera test is a goodness-of-fit measure of deviations from normality. It is based on the sample skewness and kurtosis. The test statistic is denoted as

$$JB \equiv \chi^2 - statistic = \frac{N-k}{6}\left(S^2 + \frac{(K-3)^2}{4}\right) \text{ d.f. } = 2,$$

where N is the number of observations, k represents the number of estimated coefficients, S is the sample skewness, and K is the sample kurtosis. The null hypothesis is a joint hypothesis of $S = 0$ and $K = 3$, since samples from a normal distribution have an expected skewness of 0 and an expected kurtosis of 3.

[21] The ADF-test constructs a parametric correction for higher-order correlation assuming that a variable y follows an autoregressive process AR(p) with p lagged difference terms of the dependent variable y on the right hand side of the test regression,

$$\Delta y_t = \alpha + \beta t + \gamma y_{t-1} + \delta_1 \Delta y_{t-1} + \cdots + \delta p \Delta y_{t-p} + \epsilon_t$$

where α is a constant (here: $\alpha \neq 0$), β the coefficient on a time trend (here: $\beta = 0$) and p the lag order of the AR process (here: $p = 1$). The unit root test is then carried out under the null hypothesis $\gamma = 0$ against the alternative hypothesis of $\gamma < 0$ and evaluated using the test statistic

$$DF \equiv T - ratio = \frac{\hat{\gamma}}{SE(\hat{\gamma})}$$

where $\hat{\gamma}$ is the estimate of γ and $SE(\hat{\gamma})$ is the standard error of the coefficient. If the test statistic is smaller than the critical value for the Dickey-Fuller test, then the null hypothesis of $\gamma = 0$ is rejected, implying that no unit roots are present.

contain incremental information. This would make them attractive as risk factors in pricing models, as suggested by FF and Carhart (1997). Second, from an investor's point of view and, thence, from a risk-return perspective, the first and second moments of the variables provide an indication on whether *HML*, *SMB*, and *WML* may be considered valuable investment-strategies, e.g., by ranking stocks based on their Sharpe ratios (see Sharpe, 1966, 1994).[22] Yet, the attractiveness of these strategies is, of course, conditioned on the risk utility of individual agents, and the presence of transaction costs.

Tables 3.4 to 3.7 report the summary statistics for our risk factors *MRF*, *HML*, *SMB*, and *WML* at country, regional, and industry level. The statistics are based on annually rebalanced and equality weighted portfolios and consider all data available per sub-sample. Note that, hence, the time periods and the number of observations might differ per country, region, and industry (cf. Section 3.2). We present accompanying return histograms and time plots of returns for all factors per country, region, and industry in Figures A.1 to A.10 on pages 264 to 284 in Appendix A.

When looking at the second-last column of Tables 3.4 to 3.7, and, thus, the Jarque-Bera (JB) test statistics, it becomes apparent that most of the variables are not normally distributed. In most of the cases, we reject the null hypothesis of normally distributed data at a 1% significance level. This non-normal return behavior of the risk factors is further underpinned by the return histograms and time plots presented in Figures A.1 to A.10 in Appendix A. Our results of non-normal behavior are, thence, in line with past empirical findings (see Cochrane, 2005). Further indications for non-normal return distributions of the risk factors may be provided by simply looking at our documented results for the third and fourth central moments, i.e., skewness and kurtosis, of the respective variables. Most risk factors show a positive skewness, with exceptions primarily found for *WML*, which appears to be mainly negatively skewed for all countries and industries. In addition, even though most variables only possess somewhat of an excess kurtosis, quite a few show a kurtosis of 20 or even higher (the highest being 56 for *WML* for Portugal).

[22] The Sharpe ratio, S, is defined as: $S = (R_j - R_f)/\sigma_j$, where R_j is the return to an asset j, R_f is the risk-free rate, and σ_j is the standard deviation to the return of asset j.

Table 3.4: Summary Statistics per Country & Region

This table reports the annualized summary statistics for all risk factors considered per country and region, i.e., the Eurozone, European Union and Europe as a whole. The countries are clustered along three dimensions. The first group comprises those countries that belong to the Eurozone. The second cluster represents countries of the European Union that do not belong to the Eurozone. The last cluster contains European countries that neither belong to the Eurozone nor the European Union. The results are based on annually rebalanced HML, SMB, and WML portfolios using monthly observations. MRF denotes the market risk factor. HML is the return on a portfolio that is long on high book-to-market stocks and short on low book-to-market securities, holding size and momentum characteristics of the portfolio constant. SMB is the return on a portfolio that is long on small capitalization stocks and short on big capitalization securities, holding book-to-market and momentum characteristics of the portfolio constant. WML is the return on a portfolio that is long on the best performing stocks of the past year ('winners') and short on the worst performing securities of the previous year ('losers') holding book-to-market and size characteristics of the portfolio constant. *, **, *** used for the Jarque-Bera (JB) test and for the Augmented Dickey Fuller (ADF) test denote, respectively, significance at the 10%, 5%, and 1% significance level.

	Mean (%)	Median (%)	Std. (%)	Skweness	Kurtosis	Jarque-Bera	ADF
Austria							
MRF	17.63	12.81	21.27	0.133	1.909	4.60	-0.843
HML	6.24	2.11	23.72	1.117	5.186	30.540***	-1.492
SMB	11.74	8.67	22.06	0.471	2.413	4.300	-2.039
WML	5.95	4.93	14.66	1.259	7.754	90.922***	-3.129**
Belgium							
MRF	4.62	3.69	20.10	0.082	2.179	7.038**	-2.598*
HML	6.22	7.66	12.56	-0.397	3.692	10.195***	-4.774***
SMB	8.77	5.55	16.63	0.937	3.873	40.166***	-3.044**
WML	6.36	2.83	12.53	0.718	2.961	19.658***	-4.981***
Finland							
MRF	22.75	20.68	48.24	0.819	4.097	20.961***	-2.061
HML	19.33	11.22	47.39	4.171	22.461	2459.876***	-4.911***
SMB	25.04	11.35	51.99	3.444	17.606	1429.548***	-4.535***
WML	1.43	1.64	13.89	-2.909	23.167	2415.403***	-5.687***
France							
MRF	8.05	9.04	24.92	0.106	2.529	3.799	-3.690***
HML	11.18	5.67	25.54	2.384	10.792	1113.155***	-3.406**
SMB	9.63	9.27	20.06	0.086	4.448	27.721***	-4.140***
WML	3.77	2.75	13.38	0.470	8.754	451.823***	-7.313***
Germany							
MRF	5.67	6.54	22.39	-0.024	2.458	4.232	-3.531***
HML	9.42	7.09	15.15	1.529	7.433	386.109***	-4.898***
SMB	11.23	7.02	20.54	1.821	7.685	469.184***	-3.105**
WML	4.56	4.16	10.89	0.521	3.851	23.815***	-5.698***
Greece							
MRF	4.80	11.35	26.15	-0.250	1.963	4.789*	-2.327
HML	10.96	6.45	22.56	0.457	2.644	3.313	-2.494
SMB	17.71	4.02	32.90	0.590	2.198	7.003**	-1.769
WML	1.10	1.19	18.79	0.095	3.523	0.760	-2.853*
Ireland							
MRF	3.15	6.68	18.38	-0.458	2.087	7.535**	-1.962
HML	22.75	13.35	30.45	1.658	5.963	82.291***	-2.257
SMB	9.56	5.47	33.09	1.042	3.949	21.797***	-2.933**
WML	-2.50	-1.23	25.10	-0.852	5.950	47.557***	-4.375***
Italy							
MRF	3.06	3.72	25.10	0.711	4.231	34.542***	-3.054*
HML	4.81	3.40	14.63	0.182	3.909	9.071**	-4.364***
SMB	6.39	5.72	16.80	-0.102	3.961	9.099**	-4.183***
WML	3.73	4.31	12.78	-0.439	8.104	263.512***	-5.670***
Netherlands							
MRF	5.46	5.89	20.44	-0.013	3.098	0.060	-2.885**
HML	4.18	1.16	16.85	0.768	4.227	37.950***	-3.718***
SMB	7.04	5.28	17.95	0.679	3.639	22.195***	-3.533***
WML	3.40	3.37	14.13	-0.555	5.834	90.911***	-4.715***
Portugal							
MRF	1.19	4.12	20.85	-0.108	1.757	7.653**	-2.127
HML	20.49	8.04	43.46	3.863	22.823	1992.846***	-3.514***
SMB	8.70	-0.63	46.01	3.538	19.492	1417.106***	-3.331**
WML	-1.69	-0.38	31.71	-6.241	56.086	13121.839***	-5.344***
Spain							
MRF	7.32	8.07	24.04	0.421	2.889	6.770**	-2.970**
HML	8.38	8.04	18.17	0.288	3.950	10.960***	-4.712***
SMB	10.05	1.58	27.02	0.883	3.717	33.412***	-2.976**
WML	0.93	3.13	17.46	-0.650	4.959	50.234***	-5.039***
Denmark							
MRF	12.01	13.12	23.56	-0.113	2.079	5.189*	-2.472
HML	16.28	16.30	21.93	1.189	6.703	100.144***	-3.923***

Continued on next page

Table 3.4 – continued from previous page

	Mean (%)	Median (%)	Std. (%)	Skweness	Kurtosis	Jarque-Bera	ADF
SMB	18.87	10.33	26.58	0.882	2.964	16.517***	-2.565
WML	-1.87	-0.72	16.50	-0.564	3.604	8.379**	-5.485***
Sweden							
MRF	11.05	12.74	32.20	0.365	3.215	4.850*	-2.858*
HML	10.07	5.52	33.55	3.505	17.822	2280.098***	-3.081**
SMB	8.87	8.66	22.52	-0.221	3.985	9.447***	-3.113**
WML	-3.01	-0.25	21.66	-2.411	12.083	895.450***	-3.876***
United Kingdom							
MRF	5.75	7.90	15.17	-0.364	3.015	7.113**	-4.368***
HML	5.87	5.42	9.96	0.505	4.750	53.772***	-4.196***
SMB	9.99	7.88	13.81	1.577	7.668	422.548***	-4.032***
WML	2.01	2.34	9.41	-0.588	3.994	31.301***	-5.335***
Norway							
MRF	12.03	10.35	29.16	0.253	2.281	8.063**	-3.200**
HML	6.36	4.00	19.82	1.220	6.050	150.665***	-4.294***
SMB	2.68	2.97	18.95	0.007	4.402	18.883***	-4.243***
WML	3.91	2.34	18.07	-0.284	4.947	39.997***	-4.900***
Switzerland							
MRF	9.33	10.27	20.59	-0.105	2.629	1.546	-2.260
HML	11.69	13.13	32.12	0.037	4.158	9.485***	-2.425
SMB	15.10	10.25	27.51	1.403	5.916	121.041***	-2.744*
WML	-2.34	2.92	22.90	-2.637	12.856	928.466***	-3.620***
Eurozone							
MRF	5.61	7.46	21.74	-0.207	2.485	4.635*	-3.083**
HML	6.92	6.15	8.38	0.553	3.444	14.030***	-5.206***
SMB	11.96	11.47	12.85	0.630	4.325	32.871***	-3.119**
WML	4.07	4.42	9.65	-1.638	9.114	478.562***	-5.694***
European Union							
MRF	5.61	7.46	21.74	-0.207	2.485	4.635*	-3.083**
HML	5.47	4.16	8.12	1.078	4.505	68.548***	-3.870***
SMB	10.59	9.62	11.44	1.250	5.759	137.488***	-2.946**
WML	2.62	3.39	9.02	-1.556	8.618	410.080***	-4.653***
Europe							
MRF	5.61	7.46	21.74	-0.207	2.485	4.635*	-3.083**
HML	5.48	3.80	8.33	1.099	4.385	67.002***	-4.049***
SMB	10.64	9.62	11.61	1.189	5.579	121.999***	-2.874**
WML	2.76	3.89	8.80	-1.477	7.598	296.794***	-4.902

Intuitively, it appears that the variables for smaller European economies, such as Portugal and Sweden, possess higher kurtosis. This might imply that the returns in smaller countries are more sensitive to unanticipated events - and thus infrequent extreme deviations - such as the 'dot-com bubble', than the returns in bigger European economies, e.g., Germany and the United Kingdom.[23] This is supported by high kurtosis values for the *information technology* sector and coinciding positive return fluctuations during the late 1990s and early 2000.[24] Yet, a high kurtosis cannot necessarily be generalized across small countries, as we find rather low kurtosis values for Greece, Ireland, and Belgium, indicating that the variables of these countries show rather modestly-sized deviations.

In general, the tests for normality imply that one may want to employ data

[23] Alternatively, the short number of stocks for small countries relatively to bigger countries may serve as an explanation.

[24] The high return fluctuations of the *information technology* sector around this period are particularly apparent in Figures A.5 and A.6 on pages 272 and 274 in Appendix A.

Table 3.5: Summary Statistics per Industry (Eurozone)

This table reports the annualized summary statistics for all risk factors considered per industry across the Eurozone. The results are based on annually rebalanced HML, SMB, and WML portfolios using monthly observations. MRF denotes the return to the market risk factor. HML is the return on a portfolio that is long on high book-to-market stocks and short on low book-to-market securities, holding size and momentum characteristics of the portfolio constant. SMB is the return on a portfolio that is long on small capitalization stocks and short on big capitalization securities, holding book-to-market and momentum characteristics of the portfolio constant. WML is the return on a portfolio that is long on the best performing stocks of the past year ('winners') and short on the worst performing securities of the previous year ('losers') holding book-to-market and size characteristics of the portfolio constant. *, **, *** used for the Jarque-Bera (JB) test and for the Augmented Dickey Fuller (ADF) test denote, respectively, significance at the at the 10%, 5%, and 1% significance level.

BAS = *basic industries*; CGD = *cyclical consumer goods*; CSER = *cyclical services*; TOLF = *financials*; GN = *general industries*; ITECH = *information technology*; NCGD = *non-cycical consumer goods*; RES = *resources*; UTL = *utilities.*

	Mean (%)	Median (%)	Std. (%)	Skweness	Kurtosis	Jarque-Bera	ADF
BAS							
MRF	5.87	6.57	21.83	-0.181	2.578	2.952	-2.656*
HML	13.13	6.79	22.92	1.230	4.469	72.031***	-3.726***
SMB	4.10	-1.47	26.50	1.003	4.416	52.699***	-3.346**
WML	0.78	2.47	18.80	-1.453	7.689	266.914***	-5.500***
CGD							
MRF	5.61	7.46	21.74	-0.207	2.485	4.635*	-3.083**
HML	5.97	3.98	13.72	0.635	3.580	19.256***	-3.551***
SMB	5.17	4.59	14.85	-0.171	3.049	1.180	-3.218**
WML	6.70	6.18	9.09	0.070	3.776	5.835*	-5.648***
CSER							
MRF	6.85	8.59	21.32	-0.289	2.684	4.329	-2.856*
HML	9.77	7.07	18.36	0.952	3.497	36.988***	-4.296***
SMB	9.47	9.10	14.38	0.341	4.090	15.346***	-5.119***
WML	3.81	2.98	12.57	0.188	4.428	20.200***	-6.435***
TOLF							
MRF	5.76	7.68	21.65	-0.211	2.506	4.462	-3.166**
HML	8.38	6.27	12.15	1.055	5.662	113.821***	-5.370***
SMB	10.24	8.45	16.55	0.824	5.005	66.237***	-3.482***
WML	5.45	5.27	13.62	-0.618	6.554	139.346***	-6.728***
GN							
MRF	5.61	7.46	21.74	-0.207	2.485	4.635*	-3.083**
HML	10.68	9.23	19.31	0.092	45.231	17815.965***	-7.718***
SMB	16.84	13.44	26.68	4.604	31.685	9066.340***	-4.726***
WML	0.79	4.26	24.17	-5.661	43.153	17391.675***	-5.396***
ITECH							
MRF	2.26	6.44	23.71	-0.303	2.135	5.102*	-1.711
HML	32.57	8.39	76.39	3.604	17.301	1064.316***	-3.266**
SMB	19.77	14.63	52.63	3.294	18.453	1170.646***	-5.785***
WML	-15.12	-6.23	38.50	-2.916	14.940	731.698***	-3.756***
NCGD							
MRF	0.62	6.12	23.06	-0.292	2.143	4.707*	-2.071
HML	9.75	9.73	34.08	1.507	11.897	345.537***	-4.406***
SMB	24.72	18.49	35.29	1.242	7.978	120.427***	-3.802***
WML	1.72	3.41	26.91	-0.482	4.714	14.530***	-4.783***
RES							
MRF	10.02	10.20	8.95	-0.774	3.999	5.896*	-0.941
HML	27.02	13.12	42.60	1.152	3.446	10.151***	-3.354**
SMB	64.46	55.23	42.80	1.003	3.974	8.865**	-3.023**
WML	11.72	8.36	44.53	-0.167	3.419	0.365	-1.877
UTL							
MRF	2.27	6.41	23.59	-0.305	2.156	5.012*	-1.886
HML	3.80	2.08	13.21	0.301	2.716	2.038	-2.277
SMB	9.64	9.57	15.27	0.091	2.268	2.771	-1.472
WML	0.13	0.19	8.65	-0.098	2.511	1.424	-5.753***
Industry							
MRF	5.61	7.46	21.74	-0.207	2.485	4.635*	-3.083**
HML	7.02	6.39	10.43	0.848	5.678	99.281***	-5.433***
SMB	12.49	12.76	15.75	1.330	8.726	396.136***	-3.088
WML	3.20	4.57	13.34	-2.783	16.633	2163.063***	-4.994***
Service							
MRF	5.61	7.46	21.74	-0.207	2.485	4.635*	-3.083
HML	7.22	7.44	10.86	1.148	6.322	161.621***	-4.946***
SMB	10.02	9.91	13.06	0.513	4.365	28.531***	-4.279***
WML	5.03	5.06	11.17	-0.308	4.944	40.671***	-5.934***

only after the end of the 'dot-com' bubble. This, however, would considerably limit our already small sample data.[25] Alternatively, one might include a dummy variable approach in the empirical part of this study in order to correct for the specific event of the 'dot-com' bubble. Nonetheless, the current financial and economic crisis of 2008/2009 might also indicate that extreme deviations in equity markets may become the norm rather than the exception in the near and medium-term future. This would suggest that the data should not necessarily be corrected for any impacts of the 'dot-com' bubble. In fact, the stock behavior of the late 1990s and early 2000s may mirror fairly well unforeseeable extreme future market deviations.

In regard to stationarity, the Augmented Dickey-Fuller (ADF) test statistic in the last columns of Tables 3.4 to 3.7 imply that the joint probability distribution of most variables does not change significantly when shifted across time. In fact, we only find unit roots and, thus, non-stationary processes in a small number of cases. The most noteworthy cases are Austria, Greece, Ireland, Denmark, Switzerland and the *resources* and *utilities* sectors.[26] Altogether, we are confident in obtaining meaningful regression estimates with our factors at hand. This holds especially, given that our analyses focuses on returns rather than prices.[27]

Moreover, our findings support at large the existence of a value, size, and momentum effect at country, industry, and regional level. In particular, in regard to *HML*, we find that high book-to-market stocks appear to outperform low book-to-market stocks as indicated by the mean and median values portrayed in the second and third columns of Tables 3.4 to 3.7. Moreover, the returns to *HML* are, on average, considerably higher than the returns to the market factor, i.e., $HML > MRF$. This holds for all countries, the Eurozone, the EU, and Europe as a whole, as well as for all industries across all three regions. Besides, given the varying sample periods per country, region and industry, our findings appear

[25]Besides, limiting our sample size further would make our later tests for European stock market integration nearly obsolete, since we expect integration to start only throughout the late 1990s (cf. Section 2.3).

[26]There is also some weaker statistical support for the presence of unit roots for some factors in case of Finland, Portugal, Europe, Switzerland, and the *non-cyclical consumer goods* sector, as well as, *aggregated industries*.

[27]Our returns represent already the first differential of prices. Using the differential is considered the standard way to eliminate the presence of unit roots.

Table 3.6: Summary Statistics per Industry (European Union)

This table reports the annualized summary statistics for all risk factors considered per industry across the European Union. The results are based on annually rebalanced HML, SMB, and WML portfolios using monthly observations. MRF denotes the return to the market risk factor. HML is the return on a portfolio that is long on high book-to-market stocks and short on low book-to-market securities, holding size and momentum characteristics of the portfolio constant. SMB is the return on a portfolio that is long on small capitalization stocks and short on big capitalization securities, holding book-to-market and momentum characteristics of the portfolio constant. WML is the return on a portfolio that is long on the best performing stocks of the past year ('winners') and short on the worst performing securities of the previous year ('losers') holding book-to-market and size characteristics of the portfolio constant. *, **, *** used for the Jarque-Bera (JB) test and for the Augmented Dickey Fuller (ADF) test denote, respectively, significance at the at the 10%, 5%, and 1% significance level.

BAS = *basic industries*; CGD = *cyclical consumer goods*; CSER = *cyclical services*; TOLF = *financials*; GN = *general industries*; ITECH = *information technology*; NCGD = *non-cycical consumer goods*; RES = *resources*; UTL = *utilities*.

	Mean (%)	Median (%)	Std. (%)	Skweness	Kurtosis	Jarque-Bera	ADF
BAS							
MRF	5.87	6.57	21.83	-0.181	2.578	2.952	-2.656*
HML	13.29	8.55	20.84	1.123	3.837	50.576***	-3.455***
SMB	2.57	-0.73	23.65	0.513	3.583	12.060***	-3.031**
WML	0.83	1.94	16.03	-0.637	4.979	48.029***	-5.184***
CGD							
MRF	5.61	7.46	21.74	-0.207	2.485	4.635*	-3.083**
HML	7.63	5.84	12.12	1.259	5.664	133.280***	-3.565***
SMB	5.43	4.91	13.36	0.126	2.601	2.436	-2.839*
WML	4.73	4.46	8.25	0.049	3.571	3.081	-5.149***
CSER							
MRF	6.85	8.59	21.32	-0.289	2.684	4.329	-2.856*
HML	6.53	4.95	14.13	0.145	2.506	3.402	-4.399***
SMB	12.17	12.50	14.69	0.882	5.678	97.399***	-3.466***
WML	2.89	4.35	12.27	-0.436	3.601	10.477***	-5.786***
TOLF							
MRF	5.76	7.68	21.65	-0.211	2.506	4.462	-3.166**
HML	8.26	7.91	12.22	0.689	5.650	87.666***	-4.584***
SMB	8.51	6.85	11.53	0.937	4.856	68.502***	-3.457***
WML	2.15	3.68	10.43	-0.678	4.162	31.244***	-5.840***
GN							
MRF	5.61	7.46	21.74	-0.207	2.485	4.635*	-3.083**
HML	10.70	8.90	13.68	1.524	9.065	458.143***	-4.863***
SMB	13.55	12.55	17.81	4.321	31.243	8713.320***	-4.125***
WML	2.69	4.35	17.65	-5.455	44.461	18366.416***	-6.679***
ITECH							
MRF	2.26	6.44	23.71	-0.303	2.135	5.102*	-1.711
HML	19.98	4.92	39.99	2.520	10.660	347.876***	-3.367**
SMB	22.36	16.87	33.43	4.015	26.139	2492.298***	-4.796***
WML	-6.91	-3.99	29.86	-0.255	11.425	292.888***	-4.713***
NCGD							
MRF	0.62	6.12	23.06	-0.292	2.143	4.707*	-2.071
HML	12.94	11.43	24.38	1.772	15.148	628.883***	-4.921***
SMB	18.91	18.33	26.07	1.894	12.127	382.892***	-4.657***
WML	1.22	0.87	22.94	-0.397	5.292	22.232***	-4.529***
RES							
MRF	10.02	10.20	8.95	-0.774	3.999	5.896*	-0.941
HML	23.96	18.95	37.64	0.450	2.453	2.360	-2.795*
SMB	64.48	52.38	48.11	1.178	3.833	11.327***	-3.545***
WML	11.41	16.66	29.70	-0.387	3.576	1.489	-1.843
UTL							
MRF	2.27	6.41	23.59	-0.305	2.156	5.012*	-1.886
HML	1.92	0.10	13.15	0.427	3.206	3.195	-2.735*
SMB	11.93	12.46	16.33	-0.086	2.259	2.813	-2.176
WML	-0.56	-1.44	10.10	0.057	3.947	3.382	-4.762***
Industry							
MRF	5.61	7.46	21.74	-0.207	2.485	4.635*	-3.083**
HML	7.39	5.75	10.15	0.683	3.238	19.204***	-3.949***
SMB	11.11	10.91	13.26	1.228	7.279	241.485***	-2.881*
WML	3.04	3.88	11.25	-2.694	16.585	2130.449***	-4.796***
Service							
MRF	5.61	7.46	21.74	-0.207	2.485	4.635*	-3.083**
HML	6.19	5.33	9.76	0.991	5.511	101.233***	-4.092***
SMB	9.33	8.26	10.89	1.193	6.292	163.882***	-3.758***
WML	2.01	3.25	9.45	-0.516	3.435	12.362***	-5.742***

Table 3.7: Summary Statistics per Industry (Europe Total)

This table reports the annualized summary statistics for all risk factors considered per industry across Europe. The results are based on annually rebalanced HML, SMB, and WML portfolios using monthly observations. MRF denotes the return to the market risk factor. HML is the return on a portfolio that is long on high book-to-market stocks and short on low book-to-market securities, holding size and momentum characteristics of the portfolio constant. SMB is the return on a portfolio that is long on small capitalization stocks and short on big capitalization securities, holding book-to-market and momentum characteristics of the portfolio constant. WML is the return on a portfolio that is long on the best performing stocks of the past year ('winners') and short on the worst performing securities of the previous year ('losers') holding book-to-market and size characteristics of the portfolio constant. *, **, *** used for the Jarque-Bera (JB) test and for the Augmented Dickey Fuller (ADF) test denote, respectively, significance at the at the 10%, 5%, and 1% significance level.

BAS = *basic industries*; CGD = *cyclical consumer goods*; CSER = *cyclical services*; TOLF = *financials*; GN = *general industries*; ITECH = *information technology*; NCGD = *non-cycical consumer goods*; RES = *resources*; UTL = *utilities.*

	Mean (%)	Median (%)	Std. (%)	Skweness	Kurtosis	Jarque-Bera	ADF
BAS							
MRF	5.87	6.57	21.83	-0.181	2.578	2.952	-2.656*
HML	12.66	6.97	20.10	1.193	3.919	57.572***	-3.413**
SMB	4.17	0.57	20.53	0.546	3.384	11.701***	-3.265**
WML	0.42	3.29	17.16	-1.254	6.442	158.842***	-5.080***
CGD							
MRF	5.61	7.46	21.74	-0.207	2.485	4.635*	-3.083*
HML	7.80	5.93	11.57	1.194	5.503	118.643***	-3.540***
SMB	6.03	5.42	13.63	0.019	2.605	1.774	-3.174**
WML	4.82	5.13	8.69	-0.040	3.033	0.066	-4.620***
CSER							
MRF	6.85	8.59	21.32	-0.289	2.684	4.329	-2.856*
HML	5.33	4.76	13.69	0.186	2.540	3.586	-3.985***
SMB	12.46	12.89	14.59	0.878	5.828	104.935***	-3.264**
WML	3.20	3.97	11.62	-0.097	3.080	0.391	-5.108***
TOLF							
MRF	5.76	7.68	21.65	-0.211	2.506	4.462	-3.166**
HML	8.18	6.82	12.13	0.861	5.673	99.468***	-4.798***
SMB	9.35	7.83	11.96	0.887	4.700	59.409***	-3.431**
WML	2.23	3.22	10.01	-0.474	3.608	12.390***	-5.842***
GN							
MRF	5.61	7.46	21.74	-0.207	2.485	4.635*	-3.083**
HML	8.98	7.55	13.36	-0.590	19.582	2755.559***	-5.501***
SMB	12.60	11.80	16.23	3.993	29.097	7438.871***	-4.091***
WML	3.00	4.56	17.13	-4.967	37.701	13016.558***	-5.513***
ITECH							
MRF	2.26	6.44	23.71	-0.303	2.135	5.102*	-1.711
HML	14.98	6.15	28.84	2.397	12.186	444.068***	-3.309**
SMB	26.93	18.54	41.05	3.546	19.290	1310.066***	-3.866***
WML	-7.89	-4.73	29.34	-0.047	9.274	161.100***	-5.315***
NCGD							
MRF	0.62	6.12	23.06	-0.292	2.143	4.707*	-2.071
HML	11.25	10.38	25.79	0.983	11.680	309.680***	-3.788***
SMB	22.63	20.15	26.58	2.059	11.463	347.395***	-4.096***
WML	0.45	1.93	20.77	-0.643	4.870	19.574***	-4.004***
RES							
MRF	10.02	10.20	8.95	-0.774	3.999	5.896*	-0.941
HML	25.30	18.65	30.94	0.644	2.585	3.656	-2.343
SMB	49.38	41.86	29.58	0.663	3.016	3.328	-3.252***
WML	18.82	22.98	17.93	-0.634	3.138	3.019	-2.009
UTL							
MRF	2.27	6.41	23.59	-0.305	2.156	5.012*	-1.886
HML	3.20	1.01	13.32	0.279	2.956	1.365	-2.722*
SMB	15.91	16.46	17.77	0.041	2.214	3.026	-1.836
WML	2.04	1.36	9.86	-0.047	3.638	1.454	-4.207***
Industry							
MRF	5.61	7.46	21.74	-0.207	2.485	4.635*	-3.083**
HML	6.97	5.87	10.05	0.573	3.125	13.286***	-3.879***
SMB	10.69	11.02	13.11	1.022	5.943	127.094***	-2.744*
WML	3.10	4.46	10.71	-2.443	13.544	1346.387***	-4.540***
Service							
MRF	5.61	7.46	21.74	-0.207	2.485	4.635*	-3.083**
HML	6.22	5.04	9.76	1.193	5.598	123.343***	-4.068***
SMB	9.99	8.63	11.15	1.069	5.592	111.758***	-3.574***
WML	2.20	3.18	9.25	-0.435	3.078	7.628**	-5.490***

to be irrespective of time. Our values range between a median return of 1.16% for the Netherlands and 16.30% for Denmark for the country and pan-European factors (i.e., the Eurozone, the EU, and Europe as a whole) and between 2.08% for the the *utilities* and 13.12% for the *resource* sector when considering industries across the Eurozone.[28] As a whole, our findings are line with those of FF and Liew and Vassalou (2000), who remark that a value premium is pervasive. We yet challenge the findings of Malin and Veeraraghavan (2004) and Otten and Bams (2002), who document a growth effect rather than a value effect in selected European countries, such as France, Germany, and the UK.[29] One explanation for our discrepancy with the findings of Malin and Veeraraghavan (2004) and Otten and Bams (2002) might be found in varying sample periods. While our sample period covers the time frame 1981 to 2008, Otten and Bams (2002) focus exclusively on the period from 1991 to 1998, and, thus, ex-ante the 'dot-com bubble', while the sample of Malin and Veeraraghavan (2004) runs from 1992 to 2001.

Concerning *SMB*, our results suggest that mean and median returns are consistently higher to small firm portfolios than to big firm portfolios, except for Portugal and *basic industries*, where we find small negative median (though positive mean) returns for *SMB*.[30] Altogether, our findings support the existence of a small size premium in most European countries and industries. This is in accordance with Malin and Veeraraghavan (2004) and Otten and Bams (2002), who report a small size premium in France and Germany.[31]

Our findings for a size effect are also in line with FF, Banz (1981), and Liew and Vassalou (2000). The third column of Table 3.4 reveals that the median returns for *SMB* vary between -0.63% for Portugal (yet, mean return of 8.70%)

[28]For industries across the EU, the median returns vary between 0.10% for the *utilities* and 18.95% for the *resource* sector. The corresponding values across the entire European market are 1.01% for the *utilities* and 18.65% the *resource* sector.

[29]While a 'value effect' denotes that stocks with a high book-to-market ratio outperform stocks with a low book-to-market ratio, the 'growth effect' describes the opposite, i.e., stocks with a low book-to-market ratio provide higher yields than stocks with a low book-to-market ratio.

[30]The negative median returns for *SMB* in case of *basic industries* only refers to industries across the Eurozone and the EU. In case of the entire European market, this value is slightly positive, i.e., 0.57%.

[31]However, contrary to our results, Malin and Veeraraghavan (2004) and Otten and Bams (2002) document a big firm effect in the UK.

and 11.35% for Finland (the mean return is here even 25.04%). The range is even higher for the indutries. For instance, the third column of Table 3.5 reflects median returns between -1.47% for *basic industries* and 55.23% for the *resource* sector across the Eurozone, albeit our findings for *resources* should be treated with extreme caution, given both a small number of stocks and a very short sample period, covering only the time window April 2004 to April 2008 (cf. Section 3.2). The findings for industries across the EU and the entire European market are consistent.

Regarding *WML*, and thus the profitability of a momentum strategy, our results for median and mean returns depicted in column 3 and 4 of Tables 3.4 to 3.7 imply that past winner stocks usually outperform past loser stocks in the short run for (i) nearly all countries, except Ireland, Portugal, Denmark, and Sweden, (ii) all industries (except the *information technologies* sector), and (iii) across the Eurozone, the EU, and Europe as a whole. This is in line with the findings of Jegadeesh and Titman (1993), Liew and Vassalou (2000), and Rouwenhorst (1998). The highest *WML* median return that we find for a country is merely 4.93% for Austria, a value which is only about half as big as the country's *SMB* return of 8.67%.

The difference becomes even higher when we consider industries. Here, we find the highest *WML* median return for the *resource* sector with a value of 8.36%. Albeit this seems to be a notable gain above an average market return, it looks rather small when compared to the previously mentioned *SMB* median return of 55.23% for the same sector.[32] Moreover, from an investor's perspective it is worthy to note that the standard deviations for *WML* tend to be smaller than those of *HML* and *SMB* (cf. column 4 of Tables 3.4 to 3.7). This implies that investing in a *WML* investment strategy is on average accompanied by less total risk vis-à-vis a tactical asset allocation into *HML* and *SMB* portfolios.

Overall, the apparent existence of a value, size, and momentum effect at country, industry, and regional level might be of interest to investors who look for profitable investment strategies in Europe. Specifically, our findings per region indicate that an investor may (i) hold a diversified portfolio in line with modern

[32] Again, given the small amount of data available for the *resource* sector, the results should be treated with caution, cf. Table 3.1 on page 75 and Tables A.3 to A.5 on pages 261 to 263 in Appendix A.

portfolio theory (see Markowitz, 1952) and yet (ii) surpass the market by following an investment strategy driven by a value, size, or momentum effect. By investing in a pan-European portfolio, an investor may not put all his eggs in one basket, i.e, one country or industry, but may still take advantage of any present market anomalies, neglecting, of course, any potential transaction costs.[33]

3.4.1 Rebalancing Portfolios at Higher Frequencies

Our analyses focus primarily on annually (as opposed to monthly, quarterly and semi-annually) rebalanced portfolios to be in line with the existing literature. In addition, we choose to concentrate on annually rebalanced portfolios because we face data constrains. In particular, the book-to-market value that we obtain per month through Datastream always refers to the latest book value shown on the balance sheet, i.e., for the majority of European stocks usually a value as of December 31. Thence, it appears more coherent to consider primarily annual rebalanced portfolios. For intra-annual rebalancing frequencies the *HML* factor is inconsistent because it is always based on the book-to-market value at the end of the previous fiscal year.

Furthermore, and more important in light of our empirical tests that concern the link between the FF factors and systematic risk (cf. Chapter 5), empirical evidence has shown that the degree of correlation between real stock returns and production growth rates increases with an extension of the time period for which growth rates and returns are computed (see Fama, 1981). Therefore, when linking *GDP* growth to the returns to the risk factors *HML*, *SMB*, and *WML*, as we will do in Section 5.1, an annual rebalancing may be considered more powerful.

Notwithstanding, despite our primary focus on annually rebalanced portfolios, a few quick notes on higher turnover frequencies appear to be worth noting. The summary statistics for quarterly and semi-annually rebalancing frequencies can be found in Appendix A.[34] In particular, Tables A.6 and A.7 on pages 287 and

[33]Under practical aspects one needs to consider the impact of transaction costs. These may decrease the attractiveness of the investment strategies, simply because the rebalancing of a portfolio is not for free.

[34]Even though we use monthly data, we refrained from rebalancing our portfolios on a monthly basis, simply due to practical considerations and the increasing importance and impact of transaction costs, which we neglect to consider in this study.

289 depict the summary statistics per country and region. The corresponding findings per industry are presented in Tables A.8 to A.13 on pages 291 to 296.

First, albeit the summary statistics for a quarterly and a semi-annual rebalancing reveal in general (with a few exceptions, such as *WML* for Ireland or Sweden) a somewhat consistent view on the risk factors as regards magnitude and tendency, it appears that the variables become *slightly* less stationary as turnover frequency decreases. Put differently, we fail to reject the null hypothesis for the presence of unit roots more often in case of a semi-annual or annual portfolio rebalancing than we do for a quarterly portfolio turnover. Nevertheless, given that most of our variables show level stationarity when considering the Augmented Dickey-Fuller (ADF) test statistic, given a constant and setting the lag p equal to 1, we are confident in obtaining meaningful regression estimates in using an annual frequency. Besides, the longer the time horizon, the lower usually tend to be the deviations from the mean.

Second, generally one might expect quarterly rebalanced portfolios to show a somewhat superior performance because a more frequent turnover implies the use of more recent data and, thus, the incorporation of fresh information. Therefore, when portfolios are rebalanced more frequently, the perishable incremental information content of the risk factors *HML*, *SMB*, and *WML* may be grasped more effectively. For instance, Haugen (1999) suggests that while the book-to-market ratio serves as an extremely good performance predictor of future return for well diversified portfolios, the prospects of stocks alter and assets may change from expensive to cheap and back.

Albeit our findings convey that the rebalancing period does not alter very much the returns to *HML* and *SMB*, the returns to *WML* appear to be more sensitive to the rebalancing frequency. The more often the portfolios are rebalanced, the higher become (on average) their mean and median returns. In other words, returns to *WML* decrease considerably as the turnover interval increases. This may be expected, given the transitory character of a momentum strategy. Yet, any potential financial gains associated with a higher turnover may eventually offset by higher transaction costs.[35]

[35] The frequent turnover and rebalancing of the portfolios causes transaction costs that we do not consider in this study. These transaction costs, in turn, consume some of the returns gained. This holds especially for the not very persistent momentum strategy, which results in higher

3.4.2 Multicollinearity Among Risk Factors

Prior to utilizing our risk factors (i.e., *MRF*, *HML*, *SMB*, and *WML*) in our empirical sections to follow (cf. Chapters 4 & 5), a few words on any potential information overlap among them are worth mentioning. In particular, it is worthy to stress whether the risk factors are independent of each other, i.e., whether the information contained in one factor is unassociated to the information contained in the other factors. Statistically speaking, we need to test whether there is some approximate linear relationship, or multicollinearity, among our risk factors. This is a serious practical concern as nearly linear relationships among financial variables are rather common.[36]

Even though the presence of multicollinearity does not affect the consistency of ordinary least squares (OLS) estimates of the regression coefficients, the estimates become extremely imprecise and unreliable. Besides, distinguishing the individual impacts of the independent variables on the dependent variables becomes practically infeasible. The statistical consequence is presented in inflated OLS standard errors for the factor loadings of the regression. This, in turn, implies that t-tests on the coefficients have little power.[37] Yet, multicollinearity may be a problem even if the classic symptom of insignificant t-statistics along with a highly significant F-test, which measures how well the regression equation explains the variation in the dependent variable, cannot be observed.[38] Nonetheless, even though severe multicollinearity leads to unreasonable coefficient estimates, large standard errors, and consequently bad interpretation/inference, multicollinearity is, on the other hand, the basis for conducting multiple regressions. In fact, if

profits if the portfolio is turned over more frequently. In general, *HML* and *SMB* strategies are cheaper to implement than *WML* strategies, because they generate lower transaction costs based on their persistence.

[36] If there exists a perfect linear relationship among independent variables, then this is commonly referred to as perfect collinearity. In this case, it becomes mechanically infeasible to estimate regressions. In practice, however, we are more concerned with multicollinearity, which occurs when two or more independent variables are highly, though not perfectly, correlated with each other. In fact, multicollinearity is often a matter of degree rather than of absence or presence (see Greene, 2008, Kmenta, 1986).

[37] Note that the t-statistic is defined as $\frac{\hat{\beta}_i-\beta_i}{s_{\hat{\beta}_i}}$, where β_i is the hypothesized value of the coefficient, $\hat{\beta}_i$ is the regression estimate of β_i, and $s_{\hat{\beta}_i}$ is the standard error of $\hat{\beta}_i$.

[38] Please refer to Greene (2008) for further details.

there is no relation among the independent variables, then multiple regression is unnecessary.[39]

In practice, the use of a Variance Inflation Factor (VIF) has proven adequate in detecting severity in multicollinearity, even though it is occasionally suggested that pairwise correlation among independent variables may be used to identify whether the information in one explanatory variable is net of that of another. Yet, high pairwise correlation is neither a sufficient nor even a necessary criteria for multicollinearity. Likewise, a low pairwise correlation does not imply that multicollinearity is not a problem. Even if pairs of independent variables have low correlation, there could be linear combinations of the independent variables that are very highly correlated. As such, the only case in which correlation between independent variables may be a reasonable indicator of multicollinearity occurs through regression analyses, which lies at the heart of the VIF.

In particular, the VIF is an index which measures how much the variance of a coefficient is increased due to collinearity. For illustrative purposes, let us consider the following time-series regression with one dependent variable Y and K independent variables X_i $(i = 1, \ldots, K)$:

$$Y_t = \alpha + \sum_{i=1}^{K} \beta_i X_{i,t} + \epsilon_t \tag{3.1}$$

where α is the regression intercept, and β_i are the factor loadings $\forall i$ $(i = 1, \ldots, K)$. One could then compute K different VIFs, one for each X_i by running an OLS regression that represents X_i as a function of all other explanatory variables of Equation (3.1). In case $i = 1$, this regression would be of the form:

$$X_{1,t} = \theta_0 + \theta_2 X_{2,t} + \theta_3 X_{3,t} + \ldots + \theta_K X_{K,t} + \epsilon_{1,t} \tag{3.2}$$

where θ_0 is a constant and θ_i are the factor loadings $\forall\ i$ $(i = 2, \ldots, K)$. The VIF index for each estimated factor loading, $\hat{\beta}_i$, of Equation (3.1) may then be computed as follows:[40]

$$VIF\left(\hat{\beta}_i\right) = \frac{1}{1 - R_i^2} \tag{3.3}$$

[39] Put differently, the only reason to conduct multiple regression is to determine the effect of one independent variable on the dependent variable, net of any other variable. Eventually, there is a thin line between multicollinearity being a problem or a necessity in multiple regressions.

[40] Please refer to Wooldridge (2000) for proof.

where R_i^2 is the coefficient of determination of the OLS regression depicted in Equation (3.2). The square root of the variance inflation factor describes how much larger the standard error is compared to what it would be if that variable was uncorrelated with the other independent variables. As a common rule of thumb, a $VIF(\hat{\beta}_i) > 10$ is said to imply high multicollinearity (see Kutner et al., 2003). Table 3.8 depicts the VIFs for our four risk factors, i.e., *MRF, HML, SMB*, and *WML* per country and region.[41] Table 3.9 reports the VIFs for industries aggregated across, respectively, the Eurozone, the EU, and Europe as a whole. The tables reported consider the total number of periods available per country and industry and are based on annually rebalanced portfolios as ingredients for the risk factors *HML*, *SMB*, and *WML*.

All VIFs reported are below the critical threshold of 10. Most VIFs are close to one or at least below or around two. For Finland, the numbers reported for *HML* and *SMB* are around 4.5.[42] A potential dependency between these risk factors may be explained by their strong positive co-movement during the 'dot-com' bubble in the late 1990s and the early 2000s. The Finnish economy is especially known for its high-tech IT businesses, which have been affected considerably during this period. The return histograms for Finland depicted in Figure A.1 on page 264 in Appendix A, as well as the corresponding return time plots presented in Figure A.2 on page 267, underpin these thoughts.

In addition, reasonably high VIF values for *HML*, and to a lesser extent for *SMB*, for the *information technology* sector, further support the explanation for a 'dot-com' bubble effect. Again, the corresponding histogram of returns in Figure A.5 on page 272 and the return plot in Figure A.6 on page 274 underline this thought even more. Interestingly, the corresponding VIFs for the *information technology* sector are way lower when considering industries across the EU and Europe as a whole rather than industries across the Eurozone. This may be due to the inclusion of the UK, which does not only comprise the biggest number of stocks in our sample but also represents a fairly diversified market. The latter may serve as a reason for a lower impact of the 'dot-com' bubble effect.

[41] In Equations (3.1) and (3.2), let $X_1 = MRF$, $X_2 = HML$, $X_3 = SMB$, and $X_4 = WML$.

[42] To get a better understanding of the VIF tables, this refers to the regressions in which *HML* and *SMB* serve as dependent variables in Equation (3.2).

Table 3.8: Variance Inflation Factor (VIF) per Country & Region

This table reports the variance inflation factor (VIF) for all risk factors per country and the total European market, i.e., the Eurozone, European Union, and Europe as a whole. The VIF is defined as:

$$VIF\left(\hat{\beta}_i\right) = 1/\left(1 - R_i^2\right)$$

It is estimated by regressing each of the variables on the remaining three using all observations available per country. The countries are clustered along three dimensions. The first group comprises those countries that belong to the Eurozone. The second cluster represents countries of the European Union that do not belong to the Eurozone. The last cluster contains European countries that neither belong to the Eurozone nor the European Union. The results are based on annually rebalanced HML, SMB, and WML portfolios using monthly observations. MRF denotes the market risk factor. HML is the return on a portfolio that is long on high book-to-market stocks and short on low book-to-market securities, holding size and momentum characteristics of the portfolio constant. SMB is the return on a portfolio that is long on small capitalization stocks and short on big capitalization securities, holding book-to-market and momentum characteristics of the portfolio constant. WML is the return on a portfolio that is long on the best performing stocks of the past year ('winners') and short on the worst performing securities of the previous year ('losers') holding book-to-market and size characteristics of the portfolio constant.

	Dependent Variable			
	MRF	**HML**	**SMB**	**WML**
Austria	1.559	1.490	1.239	1.705
Belgium	1.381	1.216	1.288	1.615
Finland	1.456	4.264	4.877	1.010
France	1.244	1.152	1.192	1.268
Germany	1.368	1.646	1.379	1.128
Greece	1.304	2.322	2.074	1.073
Ireland	1.280	1.322	1.410	1.366
Italy	1.361	1.368	1.048	1.062
Luxembourg*	-	-	-	-
Netherlands	1.120	1.272	1.098	1.255
Portugal	1.276	3.665	4.201	1.783
Spain	1.780	1.057	1.740	1.368
Denmark	1.311	1.091	1.464	1.255
Sweden	1.220	3.456	1.087	3.089
United Kingdom	1.138	1.055	1.236	1.191
Norway	1.646	1.825	1.360	1.395
Switzerland	1.235	1.251	1.950	1.970
Eurozone	1.186	1.041	1.243	1.100
European Union	1.172	1.148	1.296	1.212
Europe	1.196	1.160	1.311	1.239

* Not sufficient data available

Next to Finland, we only find some somewhat higher VIF figures for Sweden (i.e., *HML*=3.456 & *WML*=3.089) and Portugal (i.e., *HML*=3.665 & *SMB*=4.201), around the same time period. Again, one explanation might be the 'dot-com' bubble, even though Portugal is clearly not as sensitive to IT movements as Finland or Sweden. Nevertheless, as a whole, we may conclude that there is no clear support for the existence of multicollinearity among our risk factors. In other

Table 3.9: Variance Inflation Factor (VIF) per Industry

This table reports the variance inflation factor (VIF) for all risk factors per industry across the Eurozone, the European Union, and Europe as a whole. The VIF is defined as:

$$VIF\left(\hat{\beta}_i\right) = 1/\left(1 - R_i^2\right)$$

It is estimated by regressing each of the variables on the remaining three using all observations available per industry. The results are based on annually rebalanced HML, SMB, and WML portfolios using monthly observations. MRF denotes the market risk factor. HML is the return on a portfolio that is long on high book-to-market stocks and short on low book-to-market securities, holding size and momentum characteristics of the portfolio constant. SMB is the return on a portfolio that is long on small capitalization stocks and short on big capitalization securities, holding book-to-market and momentum characteristics of the portfolio constant. WML is the return on a portfolio that is long on the best performing stocks of the past year ('winners') and short on the worst performing securities of the previous year ('losers') holding book-to-market and size characteristics of the portfolio constant.

	Dependent Variable			
	MRF	**HML**	**SMB**	**WML**
Eurozone				
Basic Industries	1.103	1.223	1.416	1.251
Cyclical Consumer Goods	1.260	1.135	1.057	1.117
Cyclical Services	1.178	1.236	1.023	1.082
Financials	1.069	1.212	1.109	1.103
General Industries	1.194	1.100	2.299	2.166
Information Technology	1.271	5.252	2.898	2.782
Non-Cyclical Consumer Goods	1.430	1.111	1.320	1.056
Non-Cyclical Services*	-	-	-	-
Resources	1.106	1.073	1.472	1.454
Utilities	1.046	1.472	1.478	1.048
Industry (aggregate)	1.374	1.018	1.744	1.344
Service (aggregate)	1.057	1.354	1.130	1.276
European Union				
Basic Industries	1.153	1.322	1.187	1.259
Cyclical Consumer Goods	1.193	1.155	1.078	1.192
Cyclical Services	1.180	1.172	1.198	1.118
Financials	1.068	1.328	1.090	1.351
General Industries	1.219	1.069	1.862	1.677
Information Technology	1.481	1.633	2.244	1.172
Non-Cyclical Consumer Goods	1.618	1.489	1.422	1.135
Non-Cyclical Services*	-	-	-	-
Resources	1.315	1.371	1.179	1.167
Utilities	1.141	1.800	1.744	1.072
Industry (aggregate)	1.344	1.029	1.694	1.327
Service (aggregate)	1.059	1.445	1.196	1.316
Europe (total)				
Basic Industries	1.191	1.488	1.369	1.320
Cyclical Consumer Goods	1.212	1.214	1.047	1.246
Cyclical Services	1.167	1.183	1.265	1.104
Financials	1.089	1.323	1.109	1.368
General Industries	1.153	1.046	1.992	1.823
Information Technology	1.835	1.738	2.836	1.067
Non-Cyclical Consumer Goods	1.564	1.456	1.520	1.405
Non-Cyclical Services*	-	-	-	-
Resources	1.190	1.266	1.237	1.036
Utilities	1.595	1.789	1.469	1.254
Industry (aggregate)	1.364	1.032	1.631	1.272
Service (aggregate)	1.087	1.421	1.161	1.345

* Not sufficient data available

words, our portfolio construction procedure described in Section 3.2 appears to be proper, given that each risk factor seems to contain information net of the others. Furthermore, the apparent unrelated information content of the risk factors allows us to use them without any major concerns side by side in our empirical tests that follow in the following chapters.

Chapter 4

Empirical Part A: Applying the FF Factors Across Europe

This chapter follows a twofold interest. For one, we aim to provide fresh insights on the general asset pricing ability of the 3FM by using a new and extensive European holdout sample. For two, we intend to shed further light on the integration of European equity markets.

In Section 4.1, we first apply the 3FM at European country level, i.e., we use the domestic FF factors compiled in Chapter 3 and study whether those factors are able to explain domestic equity returns. To assess the overall goodness-of-fit of the 3FM per country, we use conventional measures based on regression analyses. We focus our attention on (i) the coefficient of determination, the adjusted R^2, and (ii) the regression intercepts (pricing errors), α.[1] We rely on standard tests based on both time-series and cross-sectional analyses to test the null hypothesis that $\alpha_j = 0 \ \forall j$. To contrast our findings for the 3FM with other popular asset pricing models, we enrich our assessment by the classical CAPM and the Carhart (1997) four-factor model (4FM), which extends the 3FM by a momentum effect.

In a second step, we move from the country to the regional level. We use our pan-European FF factors of Chapter 3 and assess whether they are able to explain the return to pan-European equity portfolios, i.e., portfolios that are constructed across the Eurozone, the European Union, and Europe as a whole. As previously argued, applying the 3FM in a pan-European context depicts a

[1]For a good fit of the model, we want the adjusted R^2 values to be close to one and the intercepts to be zero across all priced portfolios j in one country.

joint and inseparable test of (a) the pricing ability of the FF factors and (b) market integration. In particular, if we are able to show that size and book-to-market are able to price stocks at pan-European level, then the FF factors may serve as pan-European risk factors. This, in turn, may entail that European stock markets are integrated.

In a third step, we shift our analyses from the regional level to the industry level, i.e., we assess whether pan-European industry FF factors are may be used to price pan-European industry portfolios. Our motivation for the industry analysis is twofold. First, our pan-European risk factors (and, hence, our findings) at regional level might be biased towards bigger European economies, given data availability constraints for smaller countries. Put differently, the portfolios that we use to construct our pan-European FF factors in Chapter 3 comprise more stocks of e.g., France, Germany, and the UK than Austria, Belgium, and Sweden.[2] Second, past empirical findings have shown that the importance of industry factors for the pricing of equity has considerably increased (cf. Section 2.4.2.1.2).

In the second empirical part of this chapter, i.e., Section 4.2, we pursue both the goodness-of-fit analyses of the 3FM and the assessment of European stock market integration. In detail, we first study whether a pan-European version of the 3FM is able to price equity in individual European countries prior to the advent of the euro and after. This analysis may allow us to test the evolution of European stock market integration. Besides, we may obtain further empirical findings on the pricing ability of the 3FM.

We complement this traditional asset pricing approach to integration by a somewhat more generic, though still related, stochastic discount factor (SDF) framework. We use this concept to model and compare domestic pricing kernels across European country borders. We suggest that in case the kernels are not significantly different across markets, European stock markets may be considered integrated.

[2] Clearly, taking an industry rather than regional perspective does not allow us to eliminate the bias towards bigger economies. Yet, it enables us to minimize the impact.

4.1 Method A.I: Conventional Asset Pricing Tests

4.1.1 Introduction

As mentioned earlier (cf. Section 2.4), Fama and French (1992, 1993, 1995, 1996a) (FF) suggest that a large proportion of the cross-sectional variation in average US equity returns can be explained by the market factor as well as firm size and book-to-market characteristics. This has been confirmed more recently by Wang (2005). Fama and French (1998) also remark that size and book-to-market should be of interest to non-US investors. They document a value premium in 12 of 13 major markets and show that small stocks outperform large stocks in 11 out of 16 countries in the time period 1975 to 1995.[3] These findings imply that the market beta alone may not be sufficient to entirely grasp the variation in equity returns, neither in the US nor in other markets.

Notwithstanding, Fama and French (1998) do not present domestic versions of their 3FM for each of their sample markets (i.e., one 3FM for France, one 3FM for Germany, one 3FM for Italy, etc.). Hence, they fail to tender goodness-of-fit measures for their 3FM in these countries. In consequence, their study does not truly render any empirical support for the pricing ability of the 3FM in markets other than the US, even if the international support for the presence of size and value effects may indicate that these effects contain incremental information for equity pricing.

Griffin (2002), on the other hand, remarks that the FF factors are country specific for the US, the UK, Canada, and Japan. Pham (2007) finds some empirical support for the pricing ability of the FF factors in Japan.[4] Yet, at large there is little to no research on the pricing ability of the 3FM that exclusively focuses on European markets or industries. Some notable exceptions are the works of Malin and Veeraraghavan (2004) and Moerman (2005), who study the pricing ability of the the FF factors in a selective set of European countries.

[3]'Value premium' indicates that stocks with a high book-to-market ratio ('value stocks') outperform stocks with a low book-to-market ratio ('growth stocks').

[4]Pham (2007) creates simple benchmarks for FF factors in Japan by using four commercially available Daiwa style indices [(1) Daiwa Small Value Index (DSVI), (2) Daiwa Small Growth Index (DSGI), (3) Daiwa Large Value Index (DLVI), and (4) Daiwa Large Growth Index]. He suggests that his construction of the risk factors is similar to the nature of the original Fama and French (1993) constructs.

Malin and Veeraraghavan (2004), for instance, apply the 3FM in France, Germany, and the UK over the time period 1992 to 2001. They find that the FF factors help to explain the variation of returns by 53% in the UK, 69% in France, and 82% in Germany. They also document empirical support for a small firm effect in France and Germany, and a big firm effect in the UK. Yet, contrary to FF, Haugen (1999), and Lakonishok et al. (1994), they do not report any evidence on a value effect in their sample countries, but rather document a growth effect in line with Otten and Bams (2002), who study European mutual fund performance.

Moerman (2005) also tests the information content of the FF factors in a European context using country and industry specific versions of the 3FM, along with a common euro area 3FM. His sample comprises 11 Eurozone countries and 10 selected industries over the period 1991 to 2002. He finds that country and industry specific versions of the 3FM are more suitable than a common euro area 3FM to explain the time-variation of equity returns in his sample countries and industries.[5]

Albeit Malin and Veeraraghavan (2004) and Moerman (2005) provide new and fruitful insights on the pricing ability of the 3FM, they both fail, alike Fama and French (1998), to conduct any formal tests on the joint distribution of the pricing errors. They also do not render any cross-sectional evidence. Thus, the findings of Malin and Veeraraghavan (2004) and Moerman (2005) do not inevitably allow for making valid inferences on the true validity and goodness-of-fit of the 3FM in a European context. Moreover, neither of these two studies contrasts the 3FM with any other other pricing model, such as the CAPM of Lintner (1965), Sharpe (1964), and Treynor (1965) or the four-factor model (4FM) of Carhart (1997), which extends the 3FM by a momentum effect. Thence, the question remains whether the 3FM dominates any other asset pricing model in European markets.

Barber and Lyon (1997), Campbell et al. (1997), and Malin and Veeraraghavan (2004) remark that the usefulness of multifactor models, such as the 3FM, is not fully known until sufficient data become available to provide robustness checks on the models' performances, using different countries, time periods, or

[5] He remarks, however, that the explanatory power of the common euro area 3FM increases over time. This may be regarded an indicator of an increasing European equity market integration.

true holdout samples.[6] Bishop et al. (2001, p. 192) also notes that the "[3FM] needs more time and further empirical verification before it can be accepted as a credible theory-based model to replace the CAPM."[7]

In the course of this section, we intend to follow up on these arguments by shedding further light on the general pricing ability of the FF factors in Europe. In particular, we assess whether the 3FM is able to explain the return behavior of equity portfolios at European country, industry, and pan-European level, i.e., we relate (i) domestic returns to domestic factors, (ii) industry returns to industry factors, and (iii) regional returns to regional factors. Applying the FF factors on industry portfolios is not necessarily new (see Fama and French, 1997, Moerman, 2005, Pham, 2007).[8] Yet, our attempt to construct the FF factors *across* country borders and imposing them as common, pan-European, risk factors presents a novelty.

We also advance the past literature by contrasting the 3FM with the CAPM and 4FM in using formal test procedures as presented by Cochrane (2005) and Gibbons et al. (1989). Besides, in comparison to the studies of Malin and Veeraraghavan (2004) and Moerman (2005), we use longer time periods, a bigger set of countries and also industries and various regions (i.e., the Eurozone, the EU, and Europe). We also use a different procedure to create our risk factors, which we cannot borrow from FF, given our European focus (cf. Section 3.3).

In detail, to construct our FF factors, we follow up on Liew and Vassalou (2000) to build true country, industry, and regional size and book-to-market factors using a bottom-up approach, i.e., country by country, industry by industry, and region by region. Moerman (2005), on the other hand, employs a top-down approach in line with Griffin (2002), in which he builds his pan-European and industry factors as the weighted averages of all domestic risk factors under consideration. We believe our approach to be more stringent given that we do not merge, add, or multiply factors at country level to obtain the risk factors at other

[6] Please refer also to Section 2.2.1 for details.

[7] Adopted and re-quoted from Malin and Veeraraghavan (2004).

[8] For instance, Fama and French (1997) show that in the US, estimates of the cost of equity for industries are imprecise. They report that standard errors of more than 3.0% per year are typical for both the CAPM and the 3FM. They suggest that these large standard errors are the result of (i) uncertainty about true factor risk premia and (ii) imprecise estimates of the loadings of industries on the risk factors.

levels. Moreover, contrary to Moerman (2005) and FF, our risk factor construction procedure accounts for momentum. Our procedure also appears to assures near orthogonality among our risk factors.

Eventually, our attempt to apply the 3FM at regional and industry level depicts a joint test of (a) the validity of the FF factors for international asset valuation purposes and (b) market integration. It is not feasible to disentangle this joint hypothesis.[9] Thus, if the FF factors are able to explain equity return behavior at industry and regional level, then this may suggest that size and book-to-market may serve as common risk factors in European equity markets. This, in turn, may imply that European stock markets are integrated (see Bekaert and Harvey, 1995, Roll and Ross, 1980).[10]

Traditionally, country specific environments, such a local monetary and fiscal policies, have been considered the main determinants of stock returns. Therefore, numerous studies suggest that a rise in the explanatory power of global factors is associated with an increasing level of market integration.[11] The shrinkage of the country factor is also often accompanied by a change in the investment decision process, with investors increasingly favoring a diversification across industries to a diversification across countries. While earlier studies document that country factors still appear to play a dominant role in Europe (see Drummen and Zimmermann, 1992, Freiman, 1998, Heston et al., 1995, Rouwenhorst, 1999), more recent studies remark the growing importance of industry factors relative to country effects for the explanation of equity returns in this region (see Flavin, 2004, Moerman, 2008).[12]

Figure 4.1 summarizes the idea of using an asset pricing model, such as the 3FM, as a means to test whether equity markets are integrated. Nonetheless, it

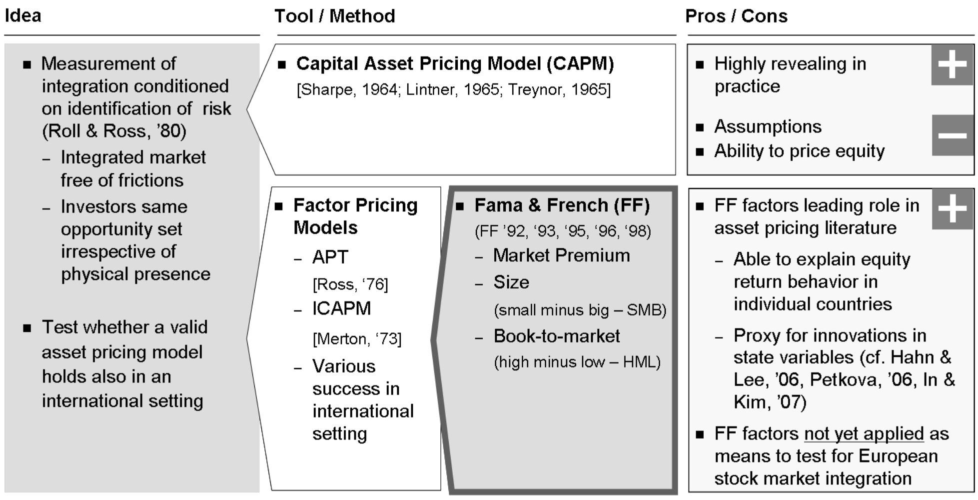
[9]We impose *intra*-industry integration and eventually try to reject this imposition.

[10]cf. also Section 2.4.2.1.2 for further details on this argument.

[11]cf. for instance, De Santis and Gerard (1997), Errunza et al. (1992), Eun and Resnick (2001), Ferson and Harvey (1993), Hardouvelis et al. (2006), Harvey et al. (2002), León et al. (2007), and Stulz (1995).

[12]Further earlier international support for a dominance of country factors vis-à-vis industry factors is given by, amongst others, Beckers et al. (1996), Griffin and Karolyi (1998), Grinold et al. (1989), Heston and Rouwenhorst (1994), Lessard (1974), and Serra (2000). More recent international evidence of the increasing importance of industry factors is presented by Baca et al. (2000), Campa and Fernandes (2006), Cavaglia et al. (2000), Ferreira and Gama (2005), and Isakov and Sonney (2004). See also Soriano and Climent (2006) for a brief literature review on studies that deal with the issue of country vs. industry effects.

Figure 4.1: Fama and French (1993) Approach to Market Integration - *Own Draft*



needs to be clearly stated from the outset that a limited pricing ability of the 3FM in a pan-European context does not necessarily imply that European stock markets are segmented. In fact, there could always be risk factors other than the FF factors to which European stock markets are commonly exposed. Thence, our means to measure market integration via the 3FM is purely conditioned on the FF factors employed and, thus, evidently restricted.

The following sections are organized as follows. Section 4.1.2 presents the models and the goodness-of-fit measures to be employed. Section 4.1.3 depicts our empirical findings for testing whether the FF factors are able to price equity portfolios in individual European countries (Section 4.1.3.1), region (Section 4.1.3.2), and industry (Section 4.1.3.3). Section 4.1.4 concludes this empirical part.

4.1.2 Models & Goodness-of-Fit Measures

4.1.2.1 The Fama and French (1993) Three-Factor Model

The Fama and French (1993) three-factor model (3FM) aims at explaining the excess return to a capital asset through the returns to three different factors, i.e., (1) the risk premium of the market portfolio, (2) the return to a portfolio that is long on small stocks and short on big stocks (*SMB*, small minus big), and (3) the return to a portfolio that is long in high-book-to-market stocks and short in low-book-to-market stocks (*HML*, high minus low). More formally,

$$E(R_{j,t}) - R_{f,t} = \beta_j[E(R_{m,t}) - R_{f,t}] + \gamma_j HML_t + \phi_j SMB_t \tag{4.1}$$

where $E(R_j)$ and $E(R_m)$ are, respectively, the expected return to an asset j and to the market portfolio m at time t. R_f denotes the risk-free rate and $[E(R_m) - R_f]$ depicts the expected growth premium of the market portfolio. *HML* and *SMB* proxy for a value and size effect, respectively. The construction of *HML* and *SMB* was outlined in more detail in Section 3.3.[13] β, γ, and ϕ represents the factor loadings. If we now define the market excess return, $[R_m - R_f]$, as *MRF* (i.e., the market risk factor), then Equation (4.1) can be rewritten as

$$E(R_{j,t}) - R_{f,t} = \beta_j MRF_t + \gamma_j HML_t + \phi_j SMB_t \tag{4.2}$$

and shall hereafter serve as our 3FM.

4.1.2.2 CAPM & Carhart (1997) Four-Factor Model

To contrast our findings for the 3FM with other popular asset pricing models, we enrich our study by the classical CAPM (Lintner, 1965, Sharpe, 1964, Treynor, 1965) and the Carhart (1997) four-factor model (4FM).[14] Our motivation to use the CAPM and 4FM is manifold.

First of all, the CAPM is the first, most famous, and perhaps the most widely used model in asset pricing today. Thus, its use has a strong practical relevance, even though the model has been criticized considerably for its underlying assumptions and its lack of explanatory power (cf. Section 2.2). Moreover, as denoted in Section 2.2.2, the CAPM has been employed previously for financial market

[13] Note that we construct and use our own country and industry specific, as well as pan-European, *HML* and *SMB* factors. Put differently, we do not use the commonly employed FF factors available at the website of Kenneth R. French at *http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html*, last accessed September 2009. The latter are only US specific and, hence, their application in a European context would presuppose a global integration of equity markets. Besides, our preliminary findings of regressing European country and industry portfolios on US specific *HML* and *SMB* factors reveal very low coefficients of determination. This suggests, not surprisingly, that the original US factors of FF are not suitable to price European equity.

[14] This is surely an advancement to the Moerman (2005) study.

integration purposes (see Agmon, 1972, 1973, Chan et al., 1992, De Santis and Gerard, 1997, Lessard, 1974, Solnik, 1974), yet not within a purely European stock market context. We aim to fill this void. We reach the CAPM by imposing the loadings γ, and ϕ in Equation (4.2) to be zero, which implies that the only source of priced risk is the one of the market portfolios. This can be formally expressed as:

$$E(R_{j,t}) - R_{f,t} = \beta_j MRF_t. \tag{4.3}$$

Carhart (1997), on the other hand, shows that momentum is able to capture information that is neither explained by size nor book-to-market.[15] He extends the 3FM and, thus, Equation (4.2) by an additional momentum factor that captures the return to a portfolio that is long in past winner stocks and short in past loser stocks (*WML*, winners minus losers).[16] In particular, Carhart (1997) notes that the excess return to an asset can be expressed as follows:

$$E(R_{j,t}) - R_{f,t} = \beta_j MRF_t + \gamma_j HML_t + \phi_j SMB_t + \eta_j WML_t. \tag{4.4}$$

It is worthy to note that Cochrane (2005) counters the 4FM by stating that *WML* is more palatable as a performance attribution factor. In fact, he stresses that a 'momentum factor' works solely to 'explain' momentum portfolio returns. This is obviously ad hoc, conveying that momentum does actually not qualify as a risk factor per se.

4.1.2.3 Goodness-of-Fit and Hypothesis Testing

To test the asset pricing ability of the 3FM, CAPM, and 4FM, we start with conventional OLS time-series regressions. This provides us with stochastic processes of Equations (4.2), (4.3), and (4.4) of the form:

$$R_{j,t} - R_{f,t} = [\text{Model}] + \varepsilon_{j,t} \tag{4.5}$$

[15] Gonsell and Nejadmalayeri (2008) try to add economic meaning to momentum. They document that the return to momentum is significantly related to shocks in producers' inflation, unemployment, and consumer confidence. They also show that durable goods' consumption, unemployment, economic outlook, productivity, and business activities are pertinent determinants of momentum factor's volatility.

[16] To construct *WML*, we follow Liew and Vassalou (2000) rather than Carhart (1997). Please refer to Section 3.3 for details.

$$\text{where 'Model'} := \begin{cases} \text{(i) CAPM:} & \alpha_j + \beta_j MRF_t \\ \text{(ii) 3FM:} & \alpha_j + \beta_j MRF_t + \gamma_j HML_t + \phi_j SMB_t \\ \text{(iii) 4FM:} & \alpha_j + \beta_j MRF_t + \gamma_j HML_t + \phi_j SMB_t + \eta_j WML_t \end{cases}$$

and α_j is the regression intercept (pricing error), also referred to as Jensen's alpha (Jensen, 1968). ε_j depicts an idiosyncratic disturbance that is assumed to follow a white noise process.[17] Equation (4.5) highlights that the CAPM is nested in both the 3FM and 4FM and that the 4FM is a mere extension of the 3FM by a momentum factor, i.e., *WML*.

In line with standard literature, we use two standard criteria to evaluate the performance of the different asset pricing models depicted in Equation (4.5): the adjusted R^2 and the intercept α.[18] In general, the higher the coefficient of determination, the stronger the explanatory power, i.e., pricing capability, of the model. Thus, we would like to get adjusted R^2 values as close to one as feasible.[19] However, Gauer (2006) argues that lower benchmark values, such as 0.2 or 0.3, if not even lower, are often considered reasonable in social science.

Besides, under the null hypothesis that a given asset pricing model holds, the regression intercepts should be zero. We are, thus, first of all interested in whether the α in Equation (4.5) deviates considerably from zero.[20] If they do not, then this may indicate that the respective pricing model exhibits reasonable

[17] A variable is said to be white noise if it has zero mean, constant variance, and all of its autocovariances are zero.

[18] We choose the adjusted R^2 rather than the plain R^2, since the adjusted coefficient corrects for the degrees of freedom of the sum of squares when adding more regressors. Thus, unlike the plain R^2, which simply increases with adding new variables, the adjusted R^2 allows us to compare multiple regression models with different numbers of regressors.

[19] Note that the adjusted R^2 may actually turn out to be negative. An adjusted R^2 considers that an explanatory variable, which is completely unrelated to a dependent variable, might have some relationship to the latter just by luck. In this case, the adjusted R^2 reduces the R^2 by how much fit would probably happen just by chance. If this reduction is bigger than the actually calculated R^2, then this results in a negative adjusted R^2.

[20] Note that past studies have commonly focused on the mean absolute regression intercept rather than the mean absolute deviation from zero of the regression intercept. We believe, however, the deviation from zero to be a better measure of fit, because for a good asset pricing model to hold, the regression intercepts should be zero. Hence, it is less about the deviation of the regression intercept from its own mean but rather about the mean absolute deviation of the intercepts from zero.

pricing ability for this respective portfolio. Yet, this does not suffice. The overall fit of an asset pricing model is not merely determined by the fact that an asset pricing model produces zero pricing errors for at least one portfolio at a time [i.e., in Equation (4.5) $\alpha_j = 0$ $(j = 1, \ldots, N)$], but only if all pricing errors are *jointly* equal to zero for all portfolios in a given sub-sample. In other words, we are interested in the joint distribution of α estimates from N separate time-series regressions running side by side. This requires us to test the null hypothesis, H_0, that in Equation (4.5) $\alpha_j = 0\ \forall j$ $(j = 1, \ldots, N)$. A failure to reject the null hypothesis would serve as an empirical support for the goodness-of-fit of the asset pricing model used. Formally testing this hypothesis, rather than just relying on the adjusted coefficient of determination or the mean absolute deviation (MAD) of the pricing errors resembles an advancement to the studies of Malin and Veeraraghavan (2004) and Moerman (2005), who fail to provide this formal test.

We eventually test the H_0 of joint zero pricing errors using finite valid time-series tests and cross-sectional analyses. In regard to the time-series, we employ the Gibbons, Ross, and Shanken (1989) (GRS) test statistic, which follows approximately an F-distribution, i.e.,

$$\frac{T-N-K}{N}\left[1+E_T\left(f\right)'\hat{\Omega}^{-1}E_T\left(f\right)\right]^{-1}\hat{\alpha}\hat{\Sigma}^{-1}\hat{\alpha}\approx F,\ \text{d.f. } N, T-N-K$$

where T is the number of periods, N is the number of assets, K is the number of factors in Equation (4.5).[21] $E_T\left(f\right)$ is a row vector of the sample means of the risk factors, $\hat{\alpha}$ is the vector of the regression intercept estimates, $\hat{\Sigma}$ represents the residual variance-covariance matrix, i.e., the sample estimate of $E\left(\varepsilon_t\varepsilon_t'\right)$, and

$$\hat{\Omega}=\frac{1}{T}\sum_{t=1}^{T}\left[f_t-E_T\left(f\right)\right]\left[f_t-E_T\left(f\right)\right]'$$

is the variance-covariance matrix of factors in Equation (4.5).[22] Gibbons et al.

[21] Note that in practice, the F-test demands that N is less than T-K. In this case $\hat{\Sigma}$ is full rank.

[22] Note that in case of the CAPM, Equation boils down to:

$$\frac{T-N-1}{N}\left[1+\left(\frac{E_T\left(f\right)}{\hat{\sigma}\left(f\right)}\right)^2\right]^{-1}\hat{\alpha}\hat{\Sigma}^{-1}\hat{\alpha}\approx F,\ \text{d.f. } N, T-N-1$$

where $E_T\left(f\right)$ is the sample mean of the risk factor MRF over T periods, $\hat{\sigma}\left(f\right)$ denotes the corresponding sample standard deviation.

(1989) and Cochrane (2005) remark that this test may be interpreted as a test whether all intercepts α_j $(j = 1, \ldots, N)$ are jointly equal to zero $\forall j$, but also whether a risk factor is ex-ante mean-variance efficient, i.e., whether it lies on the mean-variance frontier using population moments that have been adjusted for sampling error.

An alternative way to test asset pricing models is via cross-sectional regressions. The underlying idea in this approach roots in the central economic question why average returns vary across assets. Clearly, the more risk an investor is willing to bear, the higher should be his expected return, i.e., there is a positive relationship between risk and return. This in turn implies that expected returns to an asset j should be high if that asset has high betas (as a measure of systematic risk) or large risk exposure to factors that possess high risk premia.

To test this, we may take our factor loadings of the previously described time-series regression and then estimate the factor risk premia λ from a cross-sectional regression of the average returns to the factor loadings, i.e.,

$$E_T\left(R_j\right) = \widehat{\beta}_j{}' \lambda + e_j,\ j{=}1{,}\ldots,\ N \tag{4.6}$$

where R_j is the excess return to any asset j and $\widehat{\beta}_j$ denotes the vector of factor loadings for asset j obtained from time-series regressions. Here, however, the $\widehat{\beta}$s serve as explanatory variables in the regression, while λ takes the role of the regression coefficients. The cross-sectional regression residuals e_j represent the pricing errors.

In this cross-sectional setting we may then use the following finite valid test statistics to test the null hypothesis that all pricing errors are jointly zero:

$$\frac{Q\left(T-N+K-1\right)}{\left(N-K\right)\left(T-K\right)} \approx F,\ \text{d.f. } N-K,\, T-N+K-1.$$

where $Q = T\hat{e}\hat{\Sigma}^{-1}\hat{e}$. As the residuals in the cross-sectional regression presented in Equation (4.6) are usually correlated with each other, we do not only use OLS but also GLS cross-sectional regressions. We eventually employ both approaches, since even if GLS regressions may provide more precise estimates than OLS ones, this often comes at some sort of sacrifice of robustness.[23] Besides, using standard

[23]In a simple environment the choice between OLS and GLS cross-sectional regressions is not very important. Nonetheless, in more complex environment the choice is not trivial. Roll

OLS/GLS formulas to cross-sectional regressions presumes that $\widehat{\beta}$s are fixed. Yet, our $\widehat{\beta}$s are not fixed but estimated through time series regressions. This demands an adjustment of standard errors (see Cochrane, 2005, Shanken, 1992), which we consider for our test results. We provide more details about the formal time-series and cross-sectional tests in Section B.1 in Appendix B.

Finally, to interpret our unconditional factor loadings in Equation (4.5), i.e., our OLS estimates $\widehat{\beta}$, $\widehat{\gamma}$, $\widehat{\phi}$, and $\widehat{\eta}$, along with the corresponding test statistics correctly, we assume that the Gauss-Markov assumptions hold about the error term ε and the explanatory variables, i.e., the risk factors *MRF*, *HML*, *SMB*, and *WML*. We further correct any problems of serial-correlation and heteroscedasticity using the Newey and West (1987) estimator up to three lags. We provide more details about the Gauss-Markov assumptions and serial correlation among the error terms in Section B.2 in Appendix B.

4.1.3 Empirical Implementation

To empirically implement Equations (4.2) [3FM], (4.3) [CAPM], and (4.4) [4FM], we use as dependent variables our 27 sorted portfolios and risk factors constructed for each individual country, industry, and region (cf. Section 3.3).[24] We use our 27 portfolios rather than individual stocks due to complexity considerations and because of standard reasons mentioned in the finance literature. Cochrane (2005)

and Ross (1994) show that there can be a range of different results, solely conditioned on the econometric method used. They argue that using GLS instead of OLS always results in positive cross-sectional relations between betas and expected returns. This holds irrespective of the efficiency of the proxy as long as the return to the proxy is greater than the return to the minimum variance portfolio. Kandel and Stambaugh (1995) document that the use of GLS produces higher R^2 values, since the proxy is closer to the efficient frontier. GLS may therefore mitigate the extreme sensitivity of cross-sectional results. Amihud et al. (1993), for instance, replicate the Fama and French (1992) tests using GLS. They remark that, contrary to Fama and French (1992), the market beta has a significant impact on expected returns. Unfortunately, the true parameters are not known with GLS. Thence, the true variance-covariance matrix of returns is also not known. Thus, unless other efficiency tests are carried out, the results of GLS are by themselves of little relevance.

[24]Put differently, for each country, industry, and European market (i.e., the Eurozone, the EU, and Europe as a whole), we run 27 individual regressions for each of the three asset pricing models introduced, i.e., a total of 81 regressions per country, per industry, and region. For instance, in case of Austria, we run 27 regressions for the CAPM, 27 regressions for the 3FM, and 27 regressions for the Carhart (1997) model. We then do the same for Belgium, Finland, France, Germany, *basic industries*, *cyclical consumer goods*, etc.

denotes that portfolio betas are measured with less error than individual stock betas because of a lower residual variance. Besides, portfolio returns vary less over time, since leverage, size, and business risk alter less frequently for an equity portfolio than a single stock. Portfolio variances are also smaller than those of individual securities, which allows for a more precise estimate of the covariance relationship. Finally, informed finance investors tend to use portfolios rather than single stocks, if for no reason other than diversification.

The following paragraphs provide our estimation and test results per subsample. We start by outlining the results for each individual country and each of our European regions, i.e., the Eurozone, the EU, and Europe as a whole. This is followed by a presentation of the findings for our industry regressions. Note again that our findings per country serve as a prerequisite for our region and industry analyses. Specifically, our country analyses allow us to test whether country specific market, size, book-to-market, and momentum factors may price domestic equity returns in individual markets. If that is the case, testing whether these risk factors are also able to explain the variation of equity returns in an international setting (i.e., whether pan-European FF factors may price pan-European portfolios and whether industry FF factors may price industry portfolios), may be considered a means to test for stock market integration. Thus, if our pricing models are able to price equity at industry and pan-European level, then this suggests that returns to European stocks may be explained by common risk factors. This, in turn, serves as an indicator of European stock market integration.

4.1.3.1 Results per Country

Tables 4.1 and 4.2 on pages 113 and 116 present a summary of our country findings for regressing per country our 27 portfolios on the three different domestic asset pricing models, i.e., (i) the CAPM, (ii) the 3FM, and (iii) the 4FM. While Table 4.1 depicts the mean absolute deviation from zero of the regression intercept, av. $|\alpha|$, and the average adjusted R^2 (in %), Table 4.2 provides the formal F-statistics obtained from time-series and cross-sectional regressions to test the null hypothesis that all regression intercepts (pricing errors) are jointly zero. The regressions consider annually rebalanced portfolios and the full data available

Table 4.1: Regression Results for $|\alpha|$ & Adjusted R^2 per Country & Region

This table presents the two performance measures, i.e., average $|\alpha|$ and average adjusted R^2 (in %), from regressing all 27 sorted portfolios of the countries considered, as well as the total European market, i.e., the Eurozone, European Union (EU), and Europe, on (i) the Capital Asset Pricing Model, (ii) the Fama and French (1993) model (3FM), and (iii) the Carhart (1997) model (4FM). The regressions consider annually rebalanced portfolios and the full data available per country and for the European markets under consideration. The countries are clustered along three dimensions. The first group comprises those countries that belong to the Eurozone. The second cluster represents countries of the European Union that do not belong to the Eurozone. The last cluster contains European countries that neither belong to the Eurozone nor the European Union. Next to the two performance measures presented per model and country/European market, the table denotes the sample period, the corresponding number of periods, i.e., months, and the average (Ø) number of stocks available per country.

Country/	CAPM		3FM		4FM		Period			Ø No.
Region	Av. $\|\alpha\|$	Av. $\bar{R}^2$	Av. $\|\alpha\|$	Av. $\bar{R}^2$	Av. $\|\alpha\|$	Av. $\bar{R}^2$	Start	End	No.	Stocks
Austria	0.086	25.026	0.046	42.419	0.051	45.920	07/01	04/08	83	40
Belgium	0.064	30.882	0.042	43.344	0.040	46.221	01/89	04/08	232	54
Finland	0.133	6.338	0.157	16.356	0.158	20.057	12/96	04/08	137	43
France	0.080	40.854	0.046	55.288	0.043	57.968	01/81	04/08	328	136
Germany	0.068	42.744	0.030	58.296	0.024	61.271	01/81	04/08	328	136
Greece	0.100	49.978	0.060	65.600	0.062	70.218	07/01	04/08	83	46
Ireland	0.169	15.952	0.076	29.624	0.073	34.059	07/99	04/08	106	39
Italy	0.048	52.115	0.034	61.420	0.032	65.046	02/88	04/08	243	96
Netherlands	0.053	38.246	0.026	54.989	0.023	58.679	01/88	04/08	244	91
Portugal	0.119	32.065	0.093	42.475	0.087	46.508	02/99	04/08	111	45
Spain	0.069	46.308	0.052	56.446	0.051	60.087	06/89	04/08	227	79
Denmark	0.115	22.066	0.062	38.104	0.071	40.305	06/97	04/08	131	44
Sweden	0.079	31.119	0.039	50.171	0.038	53.362	12/90	04/08	209	54
UK	0.063	43.081	0.027	59.507	0.018	63.868	01/81	04/08	328	332
Norway	0.046	33.502	0.035	44.716	0.029	48.613	01/88	04/08	244	28
Switzerland	0.087	27.730	0.067	43.444	0.060	46.391	01/93	04/08	184	119
Eurozone*	0.081	52.088	0.039	64.468	0.050	69.708	01/81	04/08	328	668
EU*	0.078	53.704	0.037	66.519	0.024	70.131	01/81	04/08	328	1073
Europe*	0.078	55.679	0.036	69.453	0.025	73.056	01/81	04/08	328	1188

* The Eurozone, the EU, and Europe contain as well an average of 30 stocks available for Luxembourg.

per country.[25] Detailed results for the time-series regressions of each of the 27 portfolios per country are provided in Tables B.1 to B.32 in Appendix B.

At large, our results imply that the ability of the models to explain equity return behavior in European countries increases from the CAPM via the 3FM to the 4FM. Albeit our findings for the 3FM and 4FM are fairly close, it appears that both multifactor models clearly dominate the CAPM. The apparent dominance of the multifactor models, especially of the 3FM vis-à-vis the CAPM, is in line with the majority of past empirical findings (see Carhart, 1997, Fama and French, 1992, 1993, 1996a, Wang, 2005). Yet, admittedly, our formal tests statistics let

[25] Please refer to Section 3 for data availability.

us reject the null hypothesis of all regression intercepts being jointly equal to zero for the majority of models and countries. Nonetheless, if we take a more liberal view on the formal test statistics, in accordance with Fama and French (1993, 1996a,b), then our findings entail that the FF factors and momentum contain valuable information for the pricing of equity at country level. In other words, the FF factors and momentum appear to qualify as risk factors at country level.[26] Hence, unless there are more suitable factors, size, book-to-market, and momentum should not be omitted when explaining equity return behavior in European countries. This, in turn, makes it attractive to employ size, book-to-market and momentum in a pan-European context to use them as means to test for the integration of European equity markets. A thought we will further pursue in the sections to follow (cf. Sections 4.1.3.2 & 4.1.3.3).

In more detail, an analysis of the average R^2 values exhibited in Table 4.1 provides us with an indication to what extent each of our three models is able to explain the variation of equity returns in each country. We find that the average adjusted R^2 values increase from the CAPM via the 3FM to the 4FM. This implies that once we add more factors to our models and simultaneously account for degrees of freedom, the proportion of variation explained increases more than would be expected by pure chance. With the exception of Finland, Ireland, and Denmark, all average adjusted R^2 values are above 40%, i.e., in 13 out of 16 cases, for the 3FM and 4FM. For half of the countries, the average adjusted R^2 values climb even above 50%. This entails that both pricing models appear to explain a considerable amount of variation in equity returns in European countries. Yet, the same cannot necessarily be said about the CAPM. Here, we only have 6 out of 16 countries for which the average adjusted R^2 is bigger than 40%.

As a whole, the adjusted R^2 figures vary between 6.338% for the CAPM in Finland and 70.218% for the 4FM in case of Greece. The fairly low coefficients of determination for Finland (3FM: 16.356%; 4FM: 20.057%) do not necessarily come as a surprise, given a high industry concentration of Finnish stocks in the *general industries sector* (cf. Table 3.1), on the one hand, and the fairly short sample period ranging from December 1996 to April 2008, on the other hand.

[26]Note again that Cochrane (2005) remarks that momentum is actually a 'performance attribute rather than a real risk factor, especially in context of Merton's (1973) CAPM.

The descriptive characteristics of the Finnish risk factors might also serve as an explanation for the low pricing capability (cf. Section 3.4).[27]

In contrasting our country findings with those available for the 3FM of Malin and Veeraraghavan (2004) and Moerman (2005), it is worthy to mention that our adjusted R^2 values are on average notably lower, especially for Germany. Particularly, our average adjusted R^2 for the 3FM in Germany equals about 58% considering the time period January 1981 to April 2008. Moerman (2005) finds average adjusted R^2 values for Germany of more than 70% focusing on a time frame 1992 to 2001. The corresponding coefficient of determination found by Malin and Veeraraghavan (2004) equals around 82% using roughly the same sample period as Moerman (2005). The deviations in the findings may be due to varying sample sizes and, especially, due to differences in the construction of the FF factors (cf. Section 3).

The findings for the mean absolute deviation of the regression intercepts from zero, i.e., av. $|\alpha|$, basically underpin our results for the adjusted R^2 values per country. We find considerably lower average $|\alpha|$ values for the multiple factor models vis-à-vis the CAPM. Yet, we cannot necessarily generalize that the regression intercepts are always lower for the 4FM when compared to the 3FM. In particular, the average regression intercepts tend in general to be smaller for the 4FM, yet they appear to be higher relative to the 3FM in Austria, Finland, and Denmark.

Altogether, the mean absolute deviations of the regression intercept $|\alpha|$ seem to be higher and the adjusted R^2 coefficients appear to be lower for smaller economies, such as Austria, Ireland, Denmark, Portugal, and Sweden, than for bigger ones, namely, France, Germany, Italy, and the United Kingdom. However, the apparent lower pricing ability of the factors models in smaller economies may be due to the lower number of stocks available in these markets.[28] For one, this may impede the reliability of the construction of our risk factors. For two, it may

[27] Especially the non-normality of the risk factors, as primarily expressed through an extremely high kurtosis and a positive skewness triggered chiefly through the ‘dot-com’ bubble, might not allow them to explain the variation of returns in the 27 Finnish portfolio. Running regressions for Finland with data after the ‘dot-com’ bubble may presumable provide a different solution. Yet, potential inferences might be limited, given the small size of the then left sample.

[28] cf. Table 3.1 on page 75 in Chapter 3 and Tables A.2 to A.5 on pages 260 to 263 in Appendix A.

Table 4.2: Formal Test Statistics: $\hat{\alpha}_j = 0 \; \forall j$ per Country & Region

This table presents the goodness-of-fit statistics for the null hypothesis that all estimated pricing errors $\hat{\alpha}_j$ are jointly zero when regressing all 27 sorted portfolios side-by-side on (i) the Capital Asset Pricing Model (CAPM), (ii) the Fama and French (1993) model, and (iii) the Carhart (1997) model. The regressions consider annually rebalanced portfolios and the full data available per country and for the European markets under consideration. Columns two and three show the Gibbons et al. (1989) F-statistics and its p-values for time series regressions. Columns four and five show the F-statistics and p-values for ordinary least squares (OLS) cross-sectional regressions. The last two columns depict the same statistics for generalized least squares (GLS) cross-sectional regressions. The statistics for cross-sectional regressions consider adjusted standard errors in line with Shanken (1992). All statistics are corrected for heteroscedasticity and autocorrelation, up to three lags, using the Newey and West (1987) estimator.

Country/Region	Time-Series		Cross-Section OLS		Cross-Section GLS	
	F-stat.	p-value	F-stat.	p-value	F-stat.	p-value
Panel A: Capital Asset Pricing Model						
Austria	7.600	0.000	7.673	0.000	7.477	0.000
Belgium	2.422	0.000	2.670	0.000	2.669	0.000
Finland	5.594	0.000	7.172	0.000	7.130	0.000
France	1.311	0.144	1.518	0.052	1.509	0.054
Germany	1.831	0.008	1.938	0.004	1.900	0.006
Greece	8.396	0.000	7.755	0.000	7.716	0.000
Ireland	5.775	0.000	6.329	0.000	6.221	0.000
Italy	2.519	0.000	2.633	0.000	2.629	0.000
Netherlands	1.061	0.389	1.120	0.319	1.113	0.326
Portugal	4.723	0.000	4.604	0.000	4.547	0.000
Spain	1.968	0.005	2.046	0.003	2.034	0.003
Denmark	7.364	0.000	7.096	0.000	6.801	0.000
Sweden	1.812	0.012	2.119	0.002	2.098	0.002
United Kingdom	4.197	0.000	4.999	0.000	4.987	0.000
Norway	1.251	0.192	1.500	0.061	1.494	0.062
Switzerland	5.405	0.000	6.452	0.000	6.439	0.000
Eurozone†	5.339	0.000	5.658	0.000	5.657	0.000
European Union†	5.623	0.000	5.936	0.000	5.936	0.000
Europe†	6.487	0.000	6.937	0.000	6.937	0.000
Panel B: Fama and French (1993) Model						
Austria	5.875	0.000	8.450	0.000	4.409	0.000
Belgium	1.426	0.089	2.854	0.000	2.211	0.001
Finland	5.181	0.000	7.920	0.000	4.755	0.000
France	0.872	0.652	1.468	0.067	1.102	0.336
Germany	1.210	0.222	1.842	0.008	1.379	0.104
Greece	6.328	0.000	8.557	0.000	7.186	0.000
Ireland	3.676	0.000	6.832	0.000	4.782	0.000
Italy	1.891	0.007	2.803	0.000	2.504	0.000
Netherlands	0.866	0.660	1.164	0.272	1.000	0.471
Portugal	3.323	0.000	5.049	0.000	4.453	0.000
Spain	1.581	0.041	2.279	0.001	1.861	0.009
Denmark	4.219	0.000	8.015	0.000	5.089	0.000
Sweden	1.437	0.086	2.221	0.001	1.840	0.010
United Kingdom	2.495	0.000	5.117	0.000	3.629	0.000
Norway	1.066	0.383	1.608	0.035	1.411	0.094
Switzerland	4.533	0.000	7.066	0.000	4.616	0.000
Eurozone†	2.109	0.002	5.849	0.000	2.898	0.000
European Union†	2.670	0.000	6.236	0.000	3.785	0.000
Europe†	3.129	0.000	7.342	0.000	4.410	0.000
Panel C: Carhart (1997) Model						
Austria	5.575	0.000	8.914	0.000	4.664	0.000
Belgium	1.121	0.319	2.848	0.000	2.004	0.004
Finland	5.106	0.000	8.333	0.000	4.697	0.000
France	0.747	0.817	1.471	0.066	1.050	0.400
Germany	1.059	0.389	1.812	0.010	1.157	0.274
Greece	6.073	0.000	9.045	0.000	7.599	0.000
Ireland	3.534	0.000	7.178	0.000	4.914	0.000
Italy	1.824	0.010	2.931	0.000	2.629	0.000
Netherlands	0.777	0.779	1.172	0.264	0.957	0.531
Portugal	3.264	0.000	5.273	0.000	4.369	0.000
Spain	1.486	0.067	2.351	0.000	1.907	0.007
Denmark	4.073	0.000	8.431	0.000	5.209	0.000
Sweden	1.366	0.120	2.315	0.001	1.903	0.007
United Kingdom	2.115	0.001	5.186	0.000	2.843	0.000
Norway	0.958	0.528	1.648	0.028	1.381	0.108
Switzerland	3.974	0.000	7.386	0.000	4.874	0.000
Eurozone†	1.592	0.038	6.047	0.000	2.147	0.001
European Union†	1.999	0.004	6.371	0.000	2.485	0.000
Europe†	2.283	0.001	7.503	0.000	2.995	0.000

† The Eurozone, the EU, and Europe contain as well an average of 30 stocks available for Luxembourg.

suggest that the portfolios that serve as our dependent variables comprise only very few stocks and are, hence, not really diversified.

The formal tests-statistics obtained from time-series and cross-sectional regressions depicted in Table 4.2 provide further evidence in regard to the intercepts α. If we shift our view to the 3FM and 4FM, then we admittedly reject the null hypothesis of the regression intercepts being jointly zero for the majority, i.e., for 9 out of 16, countries. For the CAPM, we even reject the null hypothesis for all but three countries. The exceptions are France, the Netherlands, and Norway.

Yet, despite the vast rejections, our findings are fairly in line with those of Fama and French (1996a, 1998). In fact, Fama and French (1996a, p. 74) state that even if all GRS F-tests fail "[...] the CAPM is dominated by the three-factor model. The average absolute pricing errors (intercepts) of the CAPM are large [...], and they are three to five times those of the three-factor model." Thus, if we are willing to consider the relative magnitude of the F-statistics as our benchmark, i.e., the lower the F-statistics, the better the pricing model, then our findings depicted in Panels A to C of Table 4.2 imply that the multiple factor models do on average notably better than the CAPM.[29] This holds especially for our GRS time-series and GLS cross-sectional tests.

4.1.3.2 Results per Region

The last three rows in Tables 4.1 and 4.2 on pages 113 and 116 depict, next to the country findings, the goodness-of-fit measures for our pan-European regressions. The regressions consider again annually rebalanced portfolios and the full data available per region, i.e., from January 1981 to April 2008. Detailed results for the time-series regressions of the 27 pan-European portfolios per region on the corresponding regional factors are to be found in Tables B.33 to B.38 in Appendix B.

[29] Rejecting the pricing ability of the CAPM is not uncommon and has been shown in earlier studies (see Banz, 1981, Basu, 1977, 1983, Bhandari, 1988, De Bondt and Thaler, 1985, Fama and French, 1992, Jegadeesh and Titman, 1993, Lakonishok et al., 1994, Rosenberg et al., 1985, Stattman, 1980), even though Roll (1977) suggests that the CAPM has never actually been tested and probably will never be, given that the market portfolio at the core of the CAPM is theoretically and empirically elusive. In fact the market portfolio should principally include not just traded financial assets, but also consumer durables, real estate, and human capital.

Overall, the figures per region are fairly much in line with our findings per country. It appears that the pan-European FF factors, along with momentum, contain a considerable portion of information on the equity return behavior of pan-European portfolios, even though our formal test statistics let us reject the multifactor models in most of the cases. Nonetheless, our findings convey that size, book-to-market, and momentum contain incremental information above the market factor. This suggest that they may serve, to a certain degree, as pan-European risk factors that price equity *collectively* across the Eurozone, the EU, and Europe. Following Bekaert and Harvey (1995) and Roll and Ross (1980) and our definition of market integration, this may indicate an interdependence among European equity markets.

The regression intercepts for all three models and across all three regions are on average smaller than the av. $|\alpha|$ values that we find per country. This holds especially for the 3FM and 4FM, which exhibit considerably lower regression intercepts than the CAPM. This implies, in line with our country results, that the 3FM and 4FM are more suitable than the classical CAPM to price equity in the Eurozone, the EU, and Europe. Moreover, the F-statistics denoted in Table 4.2 are on average lower for the 3FM and 4FM, implying on average lower absolute pricing errors (regression intercepts). This holds particularly for the GRS time-series tests and the GLS cross-sectional F-statistics. Nonetheless, with the exception of the GRS test for the 4FM in the Eurozone, we reject the null hypothesis that all α values are jointly equal to zero at the 1% significance level for all models and regions. Yet, the fairly high coefficients of determination (varying from 52.088% for the CAPM in the Eurozone and 73.056% for the 4FM in total Europe) suggest that all three models are able to explain a considerable proportion of the variation in equity returns throughout Europe. This may indicate the existence of common, pan-European, risk factors and may suggest that European stock markets are to a certain extent integrated.

Yet, there are two remarks worth mentioning. First, the on average higher explanatory power of the models at region vis-à-vis country level may be due to the fact that portfolios restricted to individual countries are less diversified. Thus, their returns exhibit large idiosyncratic components (see Fama and French, 1998, Harvey, 1991). In consequence, asset pricing tests on country portfolios are noisier than tests on global portfolios. Moreover, the number of stocks per portfolio at regional level is considerably bigger than at country level, especially when compared to smaller European countries. Hence, our FF factors compiled for the regional level are most likely more reliable and robust than our FF factors constructed for each of our sample countries (cf. Chapter 3).

Second, it is worthy to note that the results for the Eurozone, the EU, and Europe might be somewhat biased towards bigger European economies, given that prior to the late 1980s data are only available for these countries (cf. Table 3.1; page 75).[30] Thence, when interpreting the results for pan-European regressions, the compilation of the portfolios should be taken into consideration. Besides, the better goodness-of-fit measures for the EU and Europe relative to the Eurozone might be explained by the big influence of the UK data (being the biggest in our dataset). In order to account for a potential country bias, we proceed our discussion with our findings for common risk factors across pan-European industries.

4.1.3.3 Results per Industry

Tables 4.3 to 4.6 present our estimation and test results for regressing our 27 portfolios per industry on the corresponding industry-specific CAPM, the 3FM, and the 4FM. For robustness considerations, we aggregate industries across, respectively, (i) the Eurozone, (iii) the EU, and (iii) Europe as a whole. While Table 4.3 depicts the mean absolute deviation from zero of the regression intercept, av. $|\alpha|$, and the average adjusted R^2 (in %) per industry, Tables 4.4 to 4.6 portrays the formal F-statistics for testing the null hypothesis: $\alpha_j = 0\ \forall j$ ($j = 1, \ldots, 27$). The regressions consider annually rebalanced portfolios, the full data available per industry, and industry specific risk factors.[31] Detailed results for the time-series regressions per industry aggregated across the Eurozone are provided in Tables B.39 to B.40 in Appendix B.[32]

[30] Please note that in order to account for different time periods and thus also events, we divide our sample into different sub-periods in Section 4.2.

[31] Please refer again to Section 3 for data availability. Note also that due to data availability constraints the market risk factor corresponds in all cases to the DJ EuroStoxx 50 index. Yet, the size, book-to-market, and momentum factors are industry specific.

[32] Given space constraints, we do not report the individual regression results for the 27 portfolios per industry aggregated across the EU and Europe as a whole. Overall, they are fairly in line with our findings for industries aggregated across the Eurozone.

Table 4.3: Regression Results for $|\alpha|$ & Adjusted R^2 per Industry

This table presents the two performance measures, i.e., average $|\alpha|$ and average adjusted R^2 (in %), from regressing all 27 sorted portfolios of the industries considered on (i) the Capital Asset Pricing Model, (ii) the Fama and French (1993) model (3FM), and (iii) the Carhart (1997) model (4FM). The regressions consider annually rebalanced portfolios and the full data available per industry under consideration. Results are depicted for industries aggregated across the Eurozone (Panel A), the European Union (Panel B), and Europe as a whole (Panel C). Next to the two performance measures presented per model and industry, the table denotes the sample period, the corresponding number of periods, i.e., months, and the average (Ø) number of stocks available per industry.

BAS = *basic industries*; CGD = *cyclical consumer goods*; CSER = *cyclical services*; TOLF = *financials*; GN = *general industries*; ITECH = *information technology*; NCGD = *non-cycical consumer goods*; RES = *resources*; UTL = *utilities.*

Sector	CAPM		3FM		4FM		Period			Ø No.
	Av. $\|\alpha\|$	Av. $\bar{R}^2$	Av. $\|\alpha\|$	Av. $\bar{R}^2$	Av. $\|\alpha\|$	Av. $\bar{R}^2$	Start	End	No.	Stocks
Panel A: Eurozone										
BAS	0.062	15.842	0.033	28.714	0.034	34.920	04/90	04/08	201	59
CGD	0.061	28.633	0.043	42.652	0.029	45.742	01/83	04/08	249	95
CSER	0.067	36.204	0.045	45.191	0.035	48.714	10/88	04/08	235	88
TOLF	0.072	32.701	0.053	43.579	0.030	48.756	01/88	04/08	244	217
GN	0.105	32.552	0.103	40.779	0.068	46.122	01/81	04/08	328	161
ITECH	0.183	39.683	0.100	55.667	0.105	58.643	08/99	04/08	105	58
NCGD	0.229	16.786	0.222	25.730	0.227	31.656	01/00	04/08	110	57
RES	0.368	11.775	0.248	23.629	0.202	32.220	04/04	04/08	48	34
UTL	0.112	13.730	0.087	28.694	0.087	30.967	07/99	04/08	106	47
Industry	0.087	44.544	0.049	55.769	0.039	62.278	01/81	04/08	328	412
Service*	0.067	46.058	0.046	56.515	0.029	61.497	01/81	04/08	328	256
Panel B: European Union										
BAS	0.067	16.571	0.045	35.282	0.052	39.784	04/90	04/08	201	78
CGD	0.064	27.138	0.036	40.207	0.025	43.062	06/81	04/08	268	132
CSER	0.064	37.736	0.036	47.635	0.027	51.287	10/88	04/08	235	154
TOLF	0.062	45.928	0.048	54.890	0.034	59.072	01/88	04/08	244	379
GN	0.090	38.125	0.070	52.406	0.049	56.988	01/81	04/08	328	265
ITECH	0.218	45.617	0.138	61.059	0.140	65.346	08/99	04/08	105	82
NCGD	0.226	26.309	0.207	33.821	0.216	41.714	01/00	04/08	110	82
RES	0.335	8.824	0.260	22.417	0.205	29.102	04/04	04/08	48	54
UTL	0.111	15.030	0.099	25.111	0.100	28.249	07/99	04/08	106	56
Industry	0.086	45.493	0.046	62.240	0.038	66.715	01/81	04/08	328	613
Service**	0.064	51.638	0.045	60.690	0.028	64.775	01/81	04/08	328	461
Panel C: Europe (total)										
BAS	0.069	19.348	0.042	37.437	0.048	42.360	04/90	04/08	201	87
CGD	0.067	29.112	0.038	42.595	0.029	45.604	06/81	04/08	268	142
CSER	0.068	37.878	0.045	47.832	0.037	51.381	10/88	04/08	235	165
TOLF	0.065	46.688	0.047	56.568	0.034	60.607	01/88	04/08	244	416
GN	0.087	40.736	0.065	52.528	0.037	56.647	01/81	04/08	328	297
ITECH	0.207	45.795	0.123	61.113	0.107	65.906	08/99	04/08	105	90
NCGD	0.237	34.870	0.214	43.792	0.216	47.698	01/00	04/08	110	98
RES	0.293	10.521	0.159	32.381	0.152	38.107	04/04	04/08	48	68
UTL	0.123	19.050	0.088	30.393	0.088	33.135	07/99	04/08	106	65
Industry	0.085	49.232	0.042	65.875	0.037	70.198	01/81	04/08	328	687
Service***	0.067	53.045	0.044	63.059	0.027	66.929	01/81	04/08	328	501

* Service (Eurozone) contains an average of 8 stocks available for *non-cyclical services* (NCSER).
** Service (European Union) contains an average of 12 stocks available for *non-cyclical services* (NCSER).
*** Service (Europe) contains an average of 13 stocks available for *non-cyclical services* (NCSER).

The tables reveal that the pricing capabilities of the models vary considerably across different industries, yet not so much across European regions. Our results primarily suggest that industry specific FF and momentum factors help notably to explain the variations of equity returns at European industry level, except for *resource* and *utility*. Again, the average adjusted R^2 values increase from the CAPM via the 3FM to the 4FM. This connotes that, once we account for degrees of freedom, additional industry specific risk factors add some marginal explanation to the proportion of return variation in the 27 industry portfolios. In particular, if we merely look at industries across the Eurozone, then the adjusted R^2 figures vary between 11.775% for the CAPM in the *resource* sector and 58.643% for the 4FM in the *information technology* sector (neglecting *aggregated industry*). The tendency is the same when we look at industries across the EU and Europe as a whole.

Moreover, for industries aggregated across the Eurozone, we only find average adjusted $R^2 > 50\%$ for the *information technology* sector (3FM: 55.667%; 4FM: 58.643%), *aggregated industries* (3FM: 55.769%; 4FM: 62.278%), and *aggregated services* (3FM: 56.515%; 4FM: 61.497%). The coefficients of determination are, however, slightly higher at EU and general European level. In particular, we do not only find $R^2 \geq 50\%$ for the *information technology* sector, *aggregated industries*, and *aggregated services*, but also for *cyclical services*, *financials*, and *general industries*. The increase in explanatory power may yet be due to the inclusion of the UK and, thus, the large number of added stocks.

A potential explanation for the low pricing capability of the risk models in some sectors, such as the *resources* and the *utility* sector, may be due to the small number of stocks available (cf. Chapter 3) and be traced back to the fact that these sectors are still subject to a fair share of national regulations. National policies may significantly influence equity returns on a local level and, thus, impede European stock market integration. As for all the other industries/services, our results suggest that not even the European market factor, as mimicked by the DJ EuroStoxx 50 index, but especially the FF factors and momentum are able to explain a considerable amount of variations in equity returns. This holds especially if we consider adjusted R^2 values of e.g., 20% to 30%, values which are not uncommon in social science (see Gauer, 2006).

Table 4.4: Formal Test Statistics: $\hat{\alpha}_j = 0 \ \forall j$ per Industry (Eurozone)

This table presents the goodness-of-fit statistics for the null hypothesis that all estimated pricing errors $\hat{\alpha}_j$ are jointly zero when regressing all 27 sorted portfolios side-by-side on (i) the Capital Asset Pricing Model (CAPM), (ii) the Fama and French (1993) model, and (iii) the Carhart (1997) model. The regressions consider annually rebalanced portfolios and the full data available per industry. Columns two and three show the Gibbons et al. (1989) F-statistics and its p-values for time series regressions. Columns four and five show the F-statistics and p-values for ordinary least squares (OLS) cross-sectional regressions. The last two columns depict the same statistics for generalized least squares (GLS) cross-sectional regressions. The statistics for cross-sectional regressions consider adjusted standard errors in line with Shanken (1992). All statistics are corrected for heteroscedasticity and autocorrelation, up to three lags, using the Newey and West (1987) estimator.

Country/Region	Time-Series		Cross-Section OLS		Cross-Section GLS	
	F-stat.	p-value	F-stat.	p-value	F-stat.	p-value
Panel A: Capital Asset Pricing Model						
Basic Industries	1.930	0.006	2.081	0.002	1.857	0.009
Cyclcal Consumer Goods	2.187	0.001	2.237	0.001	1.975	0.004
Cyclical Services	2.242	0.001	2.594	0.000	2.238	0.001
Financials	3.010	0.000	2.948	0.000	2.444	0.000
General Industries	3.241	0.000	3.421	0.000	2.562	0.000
Information Technology	0.738	0.810	0.797	0.742	0.642	0.901
Non-Cyclical Consumer Goods	1.963	0.013	2.153	0.005	1.258	0.220
Resources	5.907	0.000	4.157	0.000	2.648	0.014
Utilities	6.316	0.000	5.273	0.000	2.800	0.000
Industry (aggregated)	4.638	0.000	4.981	0.000	4.005	0.000
Service (aggregated)	3.305	0.000	3.638	0.000	3.192	0.000
Panel B: Fama and French (1993) Model						
Basic Industries	1.437	0.085	2.271	0.001	1.908	0.007
Cyclcal Consumer Goods	1.697	0.021	2.442	0.000	2.061	0.002
Cyclical Services	1.374	0.113	2.648	0.000	1.946	0.005
Financials	1.792	0.012	3.185	0.000	2.084	0.002
General Industries	1.790	0.013	3.656	0.000	2.845	0.000
Information Technology	0.589	0.938	0.853	0.670	0.731	0.818
Non-Cyclical Consumer Goods	1.126	0.338	2.323	0.003	1.396	0.135
Resources	2.900	0.011	6.078	0.000	3.731	0.003
Utilities	3.044	0.000	5.826	0.000	3.177	0.000
Industry (aggregated)	2.219	0.001	5.225	0.000	3.763	0.000
Service (aggregated)	1.743	0.016	3.829	0.000	2.059	0.002
Panel C: Carhart (1997) Model						
Basic Industries	1.376	0.113	2.381	0.000	1.999	0.004
Cyclcal Consumer Goods	1.015	0.450	2.395	0.000	1.557	0.045
Cyclical Services	1.186	0.250	2.697	0.000	1.792	0.013
Financials	1.458	0.075	3.242	0.000	2.008	0.003
General Industries	1.468	0.071	3.747	0.000	2.816	0.000
Information Technology	0.573	0.947	0.909	0.597	0.741	0.807
Non-Cyclical Consumer Goods	1.090	0.376	2.449	0.002	1.467	0.103
Resources	2.022	0.067	7.076	0.000	3.479	0.005
Utilities	3.002	0.000	6.130	0.000	3.369	0.000
Industry (aggregated)	1.594	0.037	5.396	0.000	1.881	0.007
Service (aggregated)	1.270	0.178	3.750	0.000	1.839	0.009

Table 4.5: Formal Test Statistics: $\hat{\alpha}_j = 0 \; \forall j$ per Industry (EU)

This table presents the goodness-of-fit statistics for the null hypothesis that all estimated pricing errors $\hat{\alpha}_j$ are jointly zero when regressing all 27 sorted portfolios side-by-side on (i) the Capital Asset Pricing Model (CAPM), (ii) the Fama and French (1993) model, and (iii) the Carhart (1997) model. The regressions consider annually rebalanced portfolios and the full data available per industry. Columns two and three show the Gibbons et al. (1989) F-statistics and its p-values for time series regressions. Columns four and five show the F-statistics and p-values for ordinary least squares (OLS) cross-sectional regressions. The last two columns depict the same statistics for generalized least squares (GLS) cross-sectional regressions. The statistics for cross-sectional regressions consider adjusted standard errors in line with Shanken (1992). All statistics are corrected for heteroscedasticity and autocorrelation, up to three lags, using the Newey and West (1987) estimator.

Country/Region	Time-Series		Cross-Section OLS		Cross-Section GLS	
	F-stat.	p-value	F-stat.	p-value	F-stat.	p-value
Panel A: Capital Asset Pricing Model						
Basic Industries	2.316	0.001	2.470	0.000	2.420	0.000
Cyclcal Consumer Goods	2.702	0.000	2.726	0.000	2.682	0.000
Cyclical Services	3.241	0.000	3.737	0.000	3.736	0.000
Financials	5.233	0.000	4.723	0.000	4.560	0.000
General Industries	4.162	0.000	4.365	0.000	4.352	0.000
Information Technology	0.757	0.789	0.802	0.735	0.795	0.745
Non-Cyclical Consumer Goods	1.740	0.033	1.280	0.203	1.278	0.205
Resources	1.847	0.080	2.579	0.016	2.472	0.020
Utilities	2.607	0.001	2.225	0.003	2.202	0.004
Industry (aggregated)	4.942	0.000	5.423	0.000	5.421	0.000
Service (aggregated)	5.852	0.000	5.636	0.000	5.589	0.000
Panel B: Fama and French (1993) Model						
Basic Industries	1.657	0.028	2.751	0.000	2.386	0.000
Cyclcal Consumer Goods	1.804	0.012	2.964	0.000	2.330	0.000
Cyclical Services	1.926	0.006	3.881	0.000	2.474	0.000
Financials	2.828	0.000	5.064	0.000	3.638	0.000
General Industries	1.802	0.012	4.602	0.000	3.633	0.000
Information Technology	0.439	0.991	0.873	0.645	0.705	0.844
Non-Cyclical Consumer Goods	0.952	0.541	1.371	0.148	0.819	0.713
Resources	1.099	0.426	3.093	0.008	1.068	0.451
Utilities	1.097	0.366	2.356	0.002	1.251	0.223
Industry (aggregated)	2.296	0.001	5.648	0.000	4.070	0.000
Service (aggregated)	3.199	0.000	5.989	0.000	3.722	0.000
Panel C: Carhart (1997) Model						
Basic Industries	1.513	0.059	2.885	0.000	2.506	0.000
Cyclcal Consumer Goods	1.175	0.261	2.977	0.000	1.778	0.014
Cyclical Services	1.714	0.020	4.011	0.000	2.270	0.001
Financials	2.140	0.002	5.196	0.000	3.193	0.000
General Industries	1.279	0.171	4.600	0.000	2.840	0.000
Information Technology	0.353	0.998	0.910	0.596	0.735	0.813
Non-Cyclical Consumer Goods	0.904	0.604	1.449	0.111	0.864	0.655
Resources	0.899	0.609	3.325	0.006	0.984	0.528
Utilities	1.081	0.384	2.504	0.001	1.266	0.212
Industry (aggregated)	1.617	0.033	5.776	0.000	1.849	0.009
Service (aggregated)	2.599	0.000	6.176	0.000	3.402	0.000

Table 4.6: Formal Test Statistics: $\hat{\alpha}_j = 0\ \forall j$ per Industry (Europe)

This table presents the goodness-of-fit statistics for the null hypothesis that all estimated pricing errors $\hat{\alpha}^j$ are jointly zero when regressing all 27 sorted portfolios side-by-side on (i) the Capital Asset Pricing Model (CAPM), (ii) the Fama and French (1993) model, and (iii) the Carhart (1997) model. The regressions consider annually rebalanced portfolios and the full data available per industry. Columns two and three show the Gibbons et al. (1989) F-statistics and its p-values for time series regressions. Columns four and five show the F-statistics and p-values for ordinary least squares (OLS) cross-sectional regressions. The last two columns depict the same statistics for generalized least squares (GLS) cross-sectional regressions. The statistics for cross-sectional regressions consider adjusted standard errors in line with Shanken (1992). All statistics are corrected for heteroscedasticity and autocorrelation, up to three lags, using the Newey and West (1987) estimator.

Country/Region	Time-Series		Cross-Section OLS		Cross-Section GLS	
	F-stat.	p-value	F-stat.	p-value	F-stat.	p-value
Panel A: Capital Asset Pricing Model						
Basic Industries	2.241	0.001	2.194	0.001	2.108	0.002
Cyclcal Consumer Goods	4.192	0.000	4.286	0.000	4.231	0.000
Cyclical Services	3.028	0.000	3.473	0.000	3.473	0.000
Financials	5.274	0.000	5.050	0.000	4.955	0.000
General Industries	5.063	0.000	5.549	0.000	5.548	0.000
Information Technology	1.252	0.222	1.339	0.162	1.330	0.168
Non-Cyclical Consumer Goods	1.791	0.027	1.058	0.411	1.058	0.412
Resources	5.696	0.000	10.211	0.000	9.647	0.000
Utilities	3.693	0.000	2.847	0.000	2.828	0.000
Industry (aggregated)	5.322	0.000	5.906	0.000	5.902	0.000
Service (aggregated)	5.227	0.000	5.151	0.000	5.126	0.000
Panel B: Fama and French (1993) Model						
Basic Industries	1.620	0.034	2.531	0.000	2.158	0.002
Cyclcal Consumer Goods	2.653	0.000	4.660	0.000	3.559	0.000
Cyclical Services	1.789	0.013	3.605	0.000	2.456	0.000
Financials	2.743	0.000	5.398	0.000	3.602	0.000
General Industries	2.255	0.001	5.859	0.000	4.659	0.000
Information Technology	0.737	0.811	1.446	0.109	1.182	0.281
Non-Cyclical Consumer Goods	0.818	0.714	1.142	0.322	0.685	0.862
Resources	2.720	0.015	11.948	0.000	3.418	0.004
Utilities	1.384	0.137	3.018	0.000	1.616	0.054
Industry (aggregated)	2.544	0.000	6.168	0.000	4.398	0.000
Service (aggregated)	2.713	0.000	5.433	0.000	3.175	0.000
Panel C: Carhart (1997) Model						
Basic Industries	1.480	0.070	2.654	0.000	2.228	0.001
Cyclcal Consumer Goods	1.774	0.014	4.748	0.000	2.885	0.000
Cyclical Services	1.571	0.043	3.711	0.000	2.248	0.001
Financials	2.025	0.003	5.532	0.000	3.203	0.000
General Industries	1.569	0.043	5.789	0.000	2.877	0.000
Information Technology	0.635	0.906	1.496	0.090	1.177	0.286
Non-Cyclical Consumer Goods	0.797	0.740	1.203	0.266	0.722	0.825
Resources	1.872	0.090	12.658	0.000	2.760	0.016
Utilities	1.262	0.215	3.013	0.000	1.107	0.356
Industry (aggregated)	1.825	0.010	6.301	0.000	2.185	0.001
Service (aggregated)	2.144	0.001	5.567	0.000	2.889	0.000

Further empirical support for the pricing ability of the 3FM and 4FM (and, to a considerably lesser extent, for the CAPM) at pan-European industry level are provided by the MAD of the regression intercepts α (cf. Table 4.3) and the corresponding formal F-statistics (cf. Tables 4.4 to 4.6). The F-statistics are on average smaller for the 3FM and 4FM than for the CAPM, implying on average lower pricing errors for the multifactor models. This holds especially for the F-statistics for the time-series and GLS cross-sectional regressions. While we reject the null hypothesis that all α values are jointly equal to zero for nearly all industries (across all regions) under the CAPM (except: the *information technology* sector), we fail to reject the null for numerous industries under the 3FM and the 4FM. The differences between the CAPM and the 3FM/4FM are most apparent for the *cyclical services*, *general industries*, *non-cyclical consumer goods*, *resources*, and *aggregated service* sector.

Thus, the loadings to industry specific FF factors appear to capture a considerable amount of information in European industry portfolios. This information may not be grasped by the market (as proxied for by the DJ EuroStoxx 50 index) beta alone. Since the FF factors are compiled across country borders, it seems that size and book-to-market may serve as common *intra*-industry risk factors - at least to a certain degree. As previously argued, the presence of these risk factors, in turn, may be regarded an indicator of European stock market integration. Besides, our observation that industry factors appear to contain considerable information on industry return behavior in various industries implies an increasing importance of industry factors for the explanation of equity returns. This is in line with a variety of other studies.[33]

4.1.3.4 Synopsis of Results Across Sub-Samples

To put our findings per country, industry, and region in a general context, we summarize in Table 4.7 our main results portrayed in Tables 4.1 to 4.6. The figures presented in Table 4.7 indicate that the 3FM explains considerably more in the variation of equity returns than the CAPM, irrespective of whether we

[33] cf. Baca et al. (2000), Brooks and Catao (2000), Campa and Fernandes (2006), Cavaglia et al. (2000), Cavaglia and Moroz (2002), Diermeier and Solnik (2001), Ferreira and Gama (2005), Flavin (2004), Isakov and Sonney (2004), L'Her et al. (2002), Moerman (2005, 2008), Taing and Worthington (2005), Wang et al. (2003).

Table 4.7: Summary of Conventional Asset Pricing Tests - All Sub-Samples

This table provides a summary of our findings portrayed in Tables 4.1 through 4.6. The first column shows the individual risk models employed, i.e, the CAPM, the 3FM, and 4FM. Panel A, B, and S depict per sub-sample how often each of our risk models show adjusted R^2 values of $\geq 50\%$, $\geq 40\%$, and $\geq 30\%$, respectively. Panel D shows how often we fail to reject our null hypothesis H_0: $\alpha_j = 0 \; \forall \; j \; (j = 1, \ldots, 27)$ for each of our sub-samples, i.e., per country, region, and industry. The depicted numbers refer to the finite valid Gibbons, Ross, and Shanken (1989) (GRS) test statistic at the 5% significance level. The first of the two columns per sub-sample shows the absolute number of counts, while the second column portrays the relative frequency in %. For instance, in case of the CAPM, we fail to reject the H_0 in 3 out of 16 cases at country level. This corresponds to approximately 19% of the cases. For each Panel: the higher the number of counts and the relative frequency, the better is the respective pricing model to explain average equity return behavior in each of the sub-samples considered.

Model	Country		Region		Industry					
					Eurozone		EU		Europe	
	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%
Panel A: # of average adjusted $R^2 \geq 50\%$										
CAPM	1/16	[6]	3/3	[100]	0/11	[0]	1/11	[9]	1/11	[9]
3FM	8/16	[50]	3/3	[100]	3/11	[27]	5/11	[45]	5/11	[45]
4FM	8/16	[50]	3/3	[100]	3/11	[27]	6/11	[55]	6/11	[55]
Panel B: # of average adjusted $R^2 \geq 40\%$										
CAPM	5/16	[31]	3/3	[100]	2/11	[18]	4/11	[36]	5/11	[45]
3FM	13/16	[81]	3/3	[100]	7/11	[64]	7/11	[64]	7/11	[64]
4FM	14/16	[88]	3/3	[100]	7/11	[64]	8/11	[73]	9/11	[82]
Panel C: # of average adjusted $R^2 \geq 30\%$										
CAPM	11/16	[69]	3/3	[100]	6/11	[55]	6/11	[55]	7/11	[64]
3FM	14/16	[88]	3/3	[100]	7/11	[64]	9/11	[82]	11/11	[100]
4FM	15/16	[94]	3/3	[100]	11/11	[100]	9/11	[82]	11/11	[100]
Panel D: # of failures to reject H_0: $\alpha_j = 0 \; \forall \; j \; (j = 1, \ldots, 27)$ - finite GRS-tests at 5% sign. level										
CAPM	3/16	[19]	0/3	[0]	1/11	[9]	2/11	[18]	1/11	[9]
3FM	7/16	[44]	0/3	[0]	4/11	[36]	4/11	[36]	3/11	[27]
4FM	7/16	[44]	0/3	[0]	4/11	[36]	4/11	[36]	5/11	[45]

focus on the country, regional, or industry level. Besides, complementing the FF factors by momentum appears to only help marginally for the explanation of equity return behavior, given that the adjusted R^2 values for the 4FM are not notably bigger than for the 3FM (cf. Panel A, B, and C).

In general, we find the highest coefficients of determination at regional level, regardless of whether we focus on the Eurozone, the EU, or Europe as a whole. This is insofar interesting as the ability of the pricing models to explain a considerable proportion in the variation of equity returns at pan-European level (Eurozone, EU, and Europe) may be regarded an indicator of market integration. However, albeit all pricing models exhibit considerable explanatory power for most of our sub-sample, our formal GRS F-test let us reject the models in most of the cases at country, industry, and regional level (cf. Panel D).[34] The rejection of the 3FM is, however, in line with Fama and French (1996a), who note that the 3FM dominates the CAPM, even if formal GRS F-tests fail.[35]

4.1.4 Conclusion

The primary aim of this section has been to shed further light on the general pricing ability of the FF factors and European stock market integration. We have therefore employed a new and extensive European holdout sample, covering the time period January 1981 to April 2008, to assess whether the 3FM is able to price European stocks at country, industry, and pan-European level.[36] In contrast to many other empirical works, we have also used an alternative approach to construct our risk factors at country, industry, and regional level. This approach is borrowed from Liew and Vassalou (2000) and follows a three-sequential sorting (as opposed to FF's two-sequential sort) to account simultaneously for not only size and book-to-market, but also momentum. Besides, our approach to construct the risk factors appears to assure near orthogonality among the risk factors.

To further advance the current literature, we have also contrasted the 3FM with the CAPM and 4FM in all of our sub-samples. We have therefore relied on standard performance criteria of the asset pricing literature. For one, we have assessed the average adjusted R^2 as a measure to study the explanatory power of the 3FM vis-à-vis the CAPM and 4FM. For two, we have utilized formal test-statistics based on time-series and cross-sectional regressions to test whether any of our models is able to produce pricing errors which are jointly equal to zero.

Our findings suggest that the 3FM explains notably more in the variation of equity returns than the CAPM in all European countries. Besides, complementing the 3FM by momentum as a fourth factor appears to only help marginally to better explain the behavior of domestic equity returns. Yet, formal tests on the joint distribution of the pricing errors let us reject the validity of not only the

[34]In fact, the rejections of our H_0: $\alpha_j = 0 \; \forall j \; (j = 1, \ldots, 27)$, is even higher when considering our formal test statistics based on cross-sectional regressions.

[35]Fama and French (1996a) remark that the average absolute pricing errors of the CAPM are considerably larger than those for the 3FM, making the 3FM the superior pricing model.

[36]Please note that the specific time frame might vary per country (industry) due to data availability constraints, see Table 3.1 on page 75.

CAPM but also the 3FM and 4FM as 'good asset' pricing models in the majority of cases.[37] Yet, at large our empirical findings for the 3FM and 4FM support the arguments of Fama and French (1992, 1993, 1995, 1996a,b) that size and book-to-market, as well as momentum (Carhart, 1997), are helpful to overcome some of the average-return anomalies of the CAPM.

However, in comparison to the studies of Malin and Veeraraghavan (2004) and Moerman (2005), which also assess the pricing ability of the 3FM in selective European markets and in a less exhaustive manner, our coefficients of determination for the 3FM are on average lower across overlapping sample countries. This holds especially for Germany.[38] Any deviations may yet be due to different sample periods employed and the different approaches chosen to construct the local FF factors. Besides, unlike Malin and Veeraraghavan (2004) and Moerman (2005), we account for momentum in our analyses, not only as additional risk factor but also for the construction of the risk factors.

Our results also convey that all models are better able to price equity in bigger European economies than in smaller countries. The ability of the models to explain the variation of equity returns is considerably lower in Austria, Finland, Greece, Ireland, Portugal, and Denmark when compared to Germany, France, and the UK. This might, yet, be explained by the bigger impact of the 'dot-com' bubble on the average equity returns in smaller European countries. It may also be referred back to the lower number of stocks available in these markets.[39]

At industry level, our findings also reveal that the 3FM, the 4FM and, to a lesser extent, the CAPM, are able to explain a considerable proportion in the

[37] It is, of course, possible that our relatively poorer empirical findings for the CAPM are due to bad proxies for the market portfolio, i.e., while the true market portfolio is mean-variance efficient, our market proxies might not (see Roll, 1977). In fact, having a true market portfolio would wash away any average return anomalies, such as our size and book-to-market factors, and reveal that the market beta is sufficient to explain equity return behavior. Yet, this is purely theoretical and probably elusive.

[38] In particular, our average adjusted R^2 for the 3FM in Germany equals about 58% considering the time period January 1981 to April 2008. Moerman (2005) finds average adjusted R^2 values for Germany of more than 70% focusing on a time frame 1992 to 2001. The corresponding coefficient of determination found by Malin and Veeraraghavan (2004) equals around 82% using roughly the same sample period as Moerman (2005).

[39] For one, a small number of stocks may impede the reliability of the construction of our risk factors. For two, it may suggest that the portfolios that serve as our dependent variables comprise only very few stocks and are, hence, not really diversified.

variation of equity portfolios at industry level. Yet, formal tests statistic imply that none of our employed models is free of mispricing at industry level either. Nonetheless, our industry findings underpin at large recent empirical results which suggest that the importance of industry factors for the pricing of equity has increased over time.[40] Our results are irrespective of whether the industry portfolios are compiled across the Eurozone, the EU, or Europe as a whole. We have only failed to find considerable empirical support for the *resource* and *utilities* sectors. This might, yet, be due to the relatively diverse and strict national regulations in these industries, implying that local influences seem to impede pan-European shocks and spillovers.

In addition, the fact that the models contain incremental information for the pricing of industry portfolios indicates that stocks which belong to the same industry are priced by common means, irrespective of the country that those stocks are listed in. In detail, it appears that the market factor, size, book-to-market, and momentum may act as common risk factors that explain *intra*-industry returns. We have suggested that this may serve as an indicator of market integration in line with the proposition of Bekaert and Harvey (1995) and Roll and Ross (1980). Yet, admittedly, our formal rejections of the pricing models at industry level leave room for further research to address whether there might be common factors other than market, size, book-to-market, and momentum that may explain the behavior of industry returns across Europe.

Notwithstanding, our findings at regional level provide further empirical support for the existence of common risk factors. We have shown that the FF factors, along with momentum, contain also a considerable portion of information on the equity return behavior of pan-European portfolios, even if we have also formally rejected the models in most of the cases. Yet, overall the reasonable ability of the models to price pan-European and industry portfolios may convey that European stock markets are to a certain extent integrated. This is in line with Hardouvelis et al. (2006), Kim et al. (2006), León et al. (2007), and Yang et al. (2003).

[40]see Baca et al. (2000), Brooks and Catao (2000), Campa and Fernandes (2006), Cavaglia et al. (2000), Cavaglia and Moroz (2002), Diermeier and Solnik (2001), Ferreira and Gama (2005), Flavin (2004), Isakov and Sonney (2004), L'Her et al. (2002), Moerman (2008), Taing and Worthington (2005), Urias et al. (1998), Wang et al. (2003).

4. EMPIRICAL PART A: APPLYING THE FF FACTORS ACROSS EUROPE

Under considerations of modern portfolio theory (see Markowitz, 1952), the significance of integrated European stock markets is twofold. First, European equity investors should invest in non-European assets to enhance their mean-variance frontier. Second, if holders of European equity portfolios are reluctant to invest outside Europe, they need to find means to diversify European-wide. This may, for instance, be achieved by diversifying across selected industries rather than across European countries. Nevertheless, an integration of stock markets conveys also that European investors may better evaluate the prospects of investments in non-domestic European countries, given lower information asymmetries and fewer transaction costs across markets.

4.2 Method A.II: Pan-European Risk Factors

4.2.1 Introduction

The previous section has provided some empirical support for the pricing ability of the 3FM and the 4FM and, to a lesser degree, the CAPM in Europe. Our findings indicate that the market factor, size, book-to-market, and momentum contain valuable information for the pricing of equity at European country, industry, and regional level, even if formal test statistics imply that none of the aforementioned models depicts a 'good' asset pricing model (i.e., none of the models is free of mispricing). We have further argued, in line with Bekaert and Harvey (1995) and Roll and Ross (1980), that the apparent existence of common risk factors at industry and pan-European level may be regarded as an indicator of European stock market integration.[41]

In this section, we pursue our studies on both the general pricing ability of the 3FM and European stock market integration. In particular, we intend to assess to what extent the returns to individual country portfolios may be explained by pan-European risk factors.[42] Our motivation to relate domestic returns to pan-European factors stems from numerous studies that have already tried to explain the behavior of country-specific returns through global risk factors (see De Santis and Gerard, 1997, Errunza et al., 1992, Eun and Resnick, 2001, Ferson and Harvey, 1993, Harvey et al., 2002, Stulz, 1995).[43] Moreover, linking country returns to pan-European risk factors may allow us to test again the integration of European equity markets. In other words, our attempt to explain domestic portfolio behavior by pan-European factors depicts again a joint (and inseparable) test of (i) the pricing ability of the risk factors and (ii) market integration.

If our pan-European factors explain domestic equity returns, then the implication is twofold. For one, the factors may be considered suitable factors in an asset pricing context. For two, European stock markets may be regarded integrated. Traditionally, country specific environments have been considered the

[41] As previously noted, this implies that potentially integrated markets are free of any frictions and that investors face the same opportunity set regardless of their physical presence.

[42] Note that we have so far only related (i) domestic returns to domestic factors, (ii) industry returns to industry factors, and (iii) regional returns to regional factors.

[43] Please refer also to Section 2.2.2.

main determinants of stock returns. Therefore, a rise in the explanatory power of global factors may be associated with a stronger integration. In the extreme, a single global asset pricing model should apply in perfectly integrated markets (see Agmon, 1972, Harvey, 1991, Solnik, 1974, Stulz, 1981).

Further, by focusing our analysis on different time periods, i.e., one period prior to the launch of the euro and one after, we may also make some potential inferences on the *evolution* of European stock market integration. In fact, we expect that the degree of integration is higher for the the euro era than for the pre-euro era. This is simply motivated by an increasing harmonization of monetary and fiscal policies among the euro area member states throughout the last decades (cf. Section 2.3.2) and past empirical findings (see Hardouvelis et al., 2006, Kim et al., 2006, León et al., 2007, Moerman, 2005, Yang et al., 2003).

Nonetheless, a failure of our pan-European factors to explain country specific return behavior does not imply that European stock markets are segmented. In fact, our means to measure integration is insofar limited, as we impose the factors. Truly, there could always be other risk factors to which European stock markets are commonly exposed. Hence, our means to measure market integration is purely conditioned on the pricing ability of the pan-European FF factors and, thus, evidently restricted.

To relief at least partly some of the restrictions that a traditional asset pricing approach to market integration imposes, we utilize in a subsequent step a slightly more generic stochastic discount factor (SDF) framework.[44] This means is insofar more generic as we do not impose a common risk-free rate as the SDF as in a traditional asset pricing context. We rather use a covariance model to estimate domestic pricing kernels, which we then compare across European country borders. If the information contained in those kernels do not differ considerably across markets, then this may be regarded an indicator of market integration.

The following sections are structured as follows. We first outline our motivation of applying a pan-European version of the 3FM on country specific portfolios as a means to both asset pricing and market integration. This is followed by a brief methodological and data description along with our empirical findings. We then shift our view to our slightly broader SDF approach to market integration.

[44] The SDF is also widely referred to as the intertemporal marginal rate of substitution, pricing kernel, the growth of marginal utility, or zero-beta return.

This comprises a brief method description along with a discussion of our empirical findings. The final part of this section comprises some concluding remarks.

4.2.2 The Motivation for a Pan-European 3FM

Up to now, we have only studied (i) whether domestic portfolio returns may be explained by domestic factors, (ii) whether industry factors help to explain industry portfolio return behavior, and (iii) whether pan-European factors may be used to price pan-European portfolios.[45] Our findings have revealed higher adjusted R^2 values at regional level than at country level (cf. Section 4.1). This suggests that pan-European factors exhibit value information for the pricing of equity at regional level.[46] Our past findings leave, hence, also room to study whether pan-European factors may price domestic equity portfolios.

The link between our domestic returns and our regional factors depicts a new holdout sample, which may allow us to provide further empirical results on the general pricing ability of the FF factors. This is insofar of interest as there is still considerable academic debate about the usefulness of multifactor models. Indeed, numerous studies argue that further robustness checks are needed to determine whether the 3FM may be accepted as a credible theory-based model to replace the CAPM (see Barber and Lyon, 1997, Bishop et al., 2001, Campbell et al., 1997). This is mainly due to the claim that FF's findings might be subject to survivorship bias (Kothari et al., 1995) or data-snooping (Black, 1993, Lo and MacKinley, 1990, MacKinlay, 1995, Van Vliet and Post, 2004).[47]

Moreover, our motivation to link country returns to pan-European risk factors rests on an earlier introduced strand of literature that applies popular pricing models in an international pricing setting (cf. Sections 2.2.1 & 2.2.2). For instance, Agmon (1972) tests the CAPM in a multinational context and finds a considerable relationship among the equity markets of Germany, Japan, the UK,

[45]These pan-European portfolios are: a pan-Eurozone, pan-EU, and pan-European (total) portfolio, cf. Section 3.

[46]In particular, we have shown that pan-European versions of the CAPM, 3FM, and 4FM are able to explain on average around 55%, 69%, and 73%, resepctively, of the variation in returns to pan-European equity portfolios, even if we, admittedly, reject the hypothesis that the true intercepts for these models are all zero using formal Gibbons, Ross, and Shanken (1989) (GRS) and cross-sectional F-tests.

[47]Please refer to Sections 1.1 and 4.1.1 for further details.

and the US over the time period from 1961 to 1966. Bruner et al. (2008), Fama and French (1998), Harvey (1991), and Solnik (1974) also provide some empirical support for an international version of the CAPM as a model to explain the returns to the market portfolios of countries.[48]

Moerman (2005) goes on step further. He constructs a European-wide version of the 3FM and reports that the relative performance of this 3FM has been increasing vis-à-vis domestic versions of the 3FM over time.[49] In another study, Heston et al. (1999) document the existence of an international size effect in twelve European markets.[50] On the other hand, Capaul et al. (1993), Fama and French (1998), and Liew and Vassalou (2000) report pervasive evidence for an international value effect. By employing a pan-European 3FM, we may eventually capture the presence of both an international size and value effect, i.e., we may test whether pan-European FF factors may price any type of equity portfolio in Europe [i.e., at regional level (cf. Section 4.1) and country level (this section)].

Furthermore, our attempt to test whether average equity returns in individual European countries are consistent with pan-European pricing models builds up on Fama and French (1998). They suggest that there is a considerable advantage of regressing country portfolios (as opposed to international portfolios) on international risk factors. As country portfolios are small fractions of international portfolios, there is no reason to believe that one induces a linear relation between average returns and risk loadings in the way the book-to-market (*HML*) and size (*SMB*) factors are constructed (cf. Section 3.3).[51] Hence, regressing country port-

[48]Koedijk and Van Dijk (2004), however, analyze nine industrialized countries over the period 1980-1999. They show that an international CAPM yields a cost of equity capital estimate that is not significantly different from that of domestic versions of the CAPM. This assertion is supported by the empirical findings of Mirsha and O'Brien (2001), Koedijk et al. (2002) and Harris et al. (2003). A recent study by Bruner et al. (2008) shows, however, that the choice of market portfolio is more important for emerging stock markets than for developed ones. Their results suggest that the average absolute difference in local versus global CAPM expected returns is 5.6% - versus 3.6% for developed markets. Fama and French (1998) also argue that an international CAPM does a poor job in explaining equity return behavior in various individual markets.

[49]Moerman (2005), yet, does not contrast the 3FM to any other pricing model and does not render any formal tests on the pricing errors.

[50]Heston et al. (1999) also find that equally-weighted stock portfolios tend to have higher average returns than value-weighted portfolios.

[51]Note, however, that asset pricing tests on country portfolios tend to be noisier than tests on more global portfolios, given that country portfolios are less diversified and exhibit therefore

folios on pan-European FF factors may provide less restrictive and new insights on the general pricing ability of the 3FM.

Finally, the existence of any potential idiosyncratic components inherent in country portfolios may leave plenty of room for our pan-European 3FM to fail.[52] This, however, does not necessarily need to be the case. International asset pricing implies that expected asset returns are determined by their covariances with the global (here: European) market return and the returns to global (European) multifactor minimum-variance (MVV) portfolios needed to grasp the effects of priced state variables in Merton's (1973) ICAPM framework.[53] Yet, covariances with these global (European) returns may merely be due to the variances and covariances of asset returns *within* countries, i.e., covariances between the returns to assets of different markets are zero (see Fama and French, 1998). Therefore, even if the global factors are international in nature, they allow for capturing domestic variances and covariances of assets within one market.

4.2.3 Empirical Implementation of the Pan-European 3FM

Our objective of this section is to test whether a pan-European version of the 3FM is able to explain the variation of country portfolios. As previously argued (cf. Section 4.2.1), if this is the case, then this may be considered both empirical support for the general pricing ability of the 3FM and an indicator of market integration. Moreover, if the pricing ability of the model improves over time, then this may indicate a progressing level of integration. We therefore decide to focus on three sample periods, one period prior to the launch of the euro, one after, and one spanning both eras.

more idiosyncratic risk (see Harvey, 1991).

[52]Besides, the findings of past studies imply that a full description of expected stock returns throughout Europe would likely demand pricing models with several dimensions of risk. For instance, Dumas and Solnik (1995) document that exchange rate risks are priced in equity returns around the world. Studies by Cho et al. (1986) and Korajczyk and Viallet (1989) convey that APT factors (determined through factor analysis) are important in international stock returns. Other studies show that the loadings of country portfolios on international risk factors are time-varying (Ferson and Harvey, 1993).

[53]We provide more details on the relation between the FF factors and systematic risk in an ICAPM context in Chapter 5.

4.2.3.1 Model

As outlined in Section 4.1.2, the Fama and French (1993) three-factor model (3FM) aims to explain the excess return to an asset via three factors: (1) the risk premium of the market risk factor (*MRF*), (2) the return to a portfolio that is long on small stocks and short on big stocks (*SMB*, small minus big), and (3) the return to a portfolio that is long in high-book-to-market stocks and short in low-book-to-market stocks (*HML*, high minus low). This can be written in a stochastic process as:

$$R_{j,t}^{C} - R_{f,t}^{R} = \alpha_j^C + \beta_j^C MRF_t^R + \gamma_j^C HML_t^R + \phi_j^C SMB_t^R + \varepsilon_{j,t}^C \qquad (4.7)$$

where R_j^C is the return to a portfolio j in country C, R_f^R denotes the European risk-free (one-month ecu) rate. α is the regression intercept. β, γ, and ϕ are slope coefficients. ε depicts an idiosyncratic disturbance.

Note that *MRF*, *SMB*, and *HML* represent pan-European rather than country-specific risk factors. In particular, they depict our pan-*Eurozone* factors described in Chapter 3. This is in contrast to Equation (4.2) [page 106], which only relates factors and portfolios of the same level, i.e., country portfolios with country factors, industry portfolios with industry factors, and pan-European portfolios with pan-European factors.

4.2.3.2 Data

We draw on the same dataset as the one described in Section 3. We consider a total sample period from January 1990 to April 2008. We further subdivide this period into two sub-periods to measure not only the degree of integration across markets but also over time. As the third and last stage of the EMU occurred just in January 1999 with the introduction of the euro, we split our total sample into (i) sub-period I from January 1990 to April 1998 (pre-euro era) and (ii) sub-period II from January 2000 to April 2008 (euro era). We leave a few months in-between those sub-periods to avoid any short-term transition effects that might be related to the immediate launch of the euro in 1999.

Note that our focus on an overarching sample period from January 1990 to April 2008 implies that we do not have sufficient data available for all of our

Table 4.8: Countries Considered per Sample Period

This table presents an overview of the three sample periods considered for the SDF approach to measuring market integration in the Eurozone. The first sub-periods spans from January 1990 to April 1998. The second sub-period covers the time frame January 2000 to April 2008. The last period covers the entire time frame from January 1990 to April 2008. The countries are clustered along three dimensions. The first group comprises those countries that belong to the Eurozone. The second cluster represents countries of the European Union that do not belong to the Eurozone. The last cluster contains European countries that neither belong to the Eurozone nor the European Union.

Sub-Period I	Sub-Period II	Total Period
January 1990 - April 1998	January 2000 - April 2008	January 1990 - April 2008
$\vdash$	Belgium	$\dashv$
$\vdash$	France	$\dashv$
$\vdash$	Germany	$\dashv$
$\vdash$	Italy	$\dashv$
$\vdash$	Netherlands	$\dashv$
$\vdash$	Spain	$\dashv$
$\vdash$	United Kingdom	$\dashv$
$\vdash$	Norway	$\dashv$

Not considered due to a lack of data: Austria, Finland, Greece, Ireland, Luxembourg, Portugal (all Eurozone), Denmark, Sweden (both EU), and Switzerland (Europe).

countries considered in Chapter 3.[54] Nevertheless, going back to January 1990 allows us to include at least a considerable number of countries, which are depicted in Table 4.8. Next to Belgium, France, Germany, Italy, the Netherlands, and Spain as representative countries for the Eurozone, we consider for robustness consideration the UK as a sample country for the EU, and Norway as a sample European country that neither belongs to the Eurozone nor the EU.[55]

4.2.3.3 Goodness-of-Fit & Hypothesis Testing

To test the overall goodness-of-fit of the model depicted in Equation (4.7), we first run 27 ($j = 1, \dots, 27$) OLS time-series regressions per country C. We then study across all portfolios j, the adjusted R^2 values and the regression intercepts (pricing errors), α. For a good asset pricing model to hold, we want the adjusted

[54] Note that we eventually disregard Austria, Finland, Greece, Ireland, Luxembourg, Portugal (all Eurozone), Denmark, Sweden (both EU), and Switzerland (Europe).

[55] Note that we also disregard some data from our total sample (cf. Section 3.2) for Belgium, France, Germany, Italy, the Netherlands, Spain, the UK, and Norway. For those countries we have actually data available prior to January 1990. We employ the full data set, however, for our asset pricing approach to market integration - see Section 4.1.

R^2 values to be high and the regression intercepts α_j to be jointly zero across all portfolios j. To formally test the null hypothesis (H_0) that all regression intercepts are jointly equal to zero, we employ the Gibbons, Ross, and Shanken (1989) (GRS) time series test, which follows approximately an F-distribution, i.e.,

$$\frac{T-N-K}{N}\left[1+E_T\left(f\right)'\hat{\Omega}^{-1}E_T\left(f\right)\right]^{-1}\hat{\alpha}\hat{\Sigma}^{-1}\hat{\alpha}\approx F,\ \text{d.f. } N, T-N-K \quad (4.8)$$

where T is the number of periods, N is the number of assets, K is the number of factors. $E_T\left(f\right)$ is a row vector of the sample means of the risk factors, $\hat{\alpha}$ is the vector of the regression intercept estimates, $\hat{\Sigma}$ represents the residual variance-covariance matrix, i.e., the sample estimate of $E\left(\varepsilon_t\varepsilon_t'\right)$, and

$$\hat{\Omega}=\frac{1}{T}\sum_{t=1}^{T}\left[f_t-E_T\left(f\right)\right]\left[f_t-E_T\left(f\right)\right]'$$

is the variance-covariance matrix of factors in Equation (4.7).[56]

4.2.3.4 Findings per Country

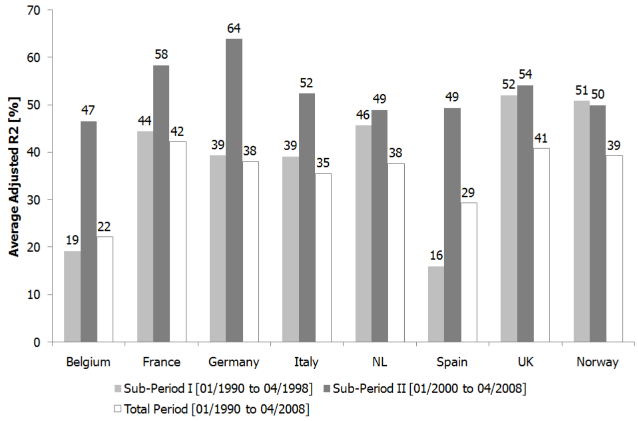
Figure 4.2 shows the evolution of our goodness-of-fit statistics for running 27 ($j=1,\ldots,27$) time-series regressions of Equation (4.7) per country C (C=Belgium, ..., Norway). Subfigure 4.2a visualizes the evolution of the average adjusted R^2 values, while Subfigures 4.2b and 4.2c depict the evolution of the average absolute αs and the GRS F-test statistics, respectively. For all subfigures, the light gray bars present the statistics for sub-period I (01/1990 to 04/1998 - *pre-euro era*), the dark gray bars reveal our findings for sub-period II (01/2000 to 04/2008 - *euro era*), while the white bars indicate our results for the entire sample period (01/1990 to 04/2008). A detailed overview about the findings are presented in Table C.1 (page 368) in Appendix C.

Our results are easily summarized. Overall, our findings entail that the pan-European FF factors are better able to explain the variation of country specific equity returns in the euro era than in the pre-euro era. However, when considering the GRS F-statistics, we admittedly reject the null hypothesis that all

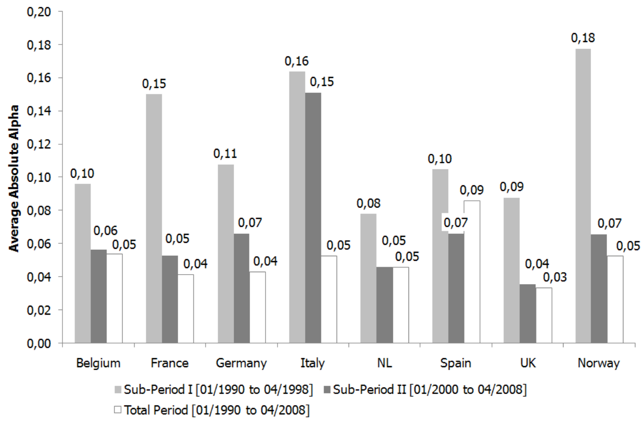
[56] Please refer to Section 4.1.2.3 (page 107) and Section B.1 (page 297) in Appendix B for further details.

Figure 4.2: Time-Series: Evolution of Goodness-of-Fit Statistics per Country - *Own Draft*

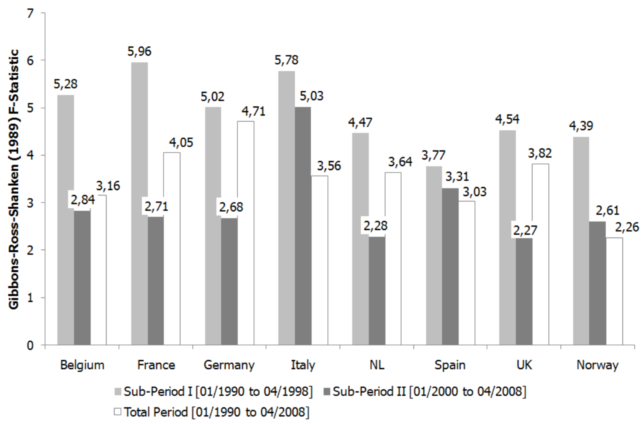
(a) Average Adjusted R^2 Values



(b) Average $|\alpha|$ Values



(c) Gibbons, Ross, and Shanken (1989) F-Statistics



regression intercepts are jointly equal to zero in all cases and irrespective of the sub-period. Nevertheless, the F-statistics decrease considerably from sub-period I to sub-period II, implying a better fit of the pan-European 3FM in the individual countries over time and, hence, and increasing level of market integration. Moreover, all adjusted R^2 values, except for Norway, increase from sub-period I to sub-period II, while all average $|\alpha|$ values decrease.

In more detail, Subfigure 4.2a reveals the biggest jumps for the average adjusted R^2 values in Belgium (from 19% to 47%), Germany (from 39% to 64%), and Spain (from 16% to 33%). On the other hand, we fail to find any significant increase in the coefficient of determination for the UK (from 52% to 54%). For Norway, we even report a small decrease in the average adjusted R^2 values (from 51% to 50%). Interestingly, neither the UK nor Norway are part of the Eurozone and, hence, seem to be less affected by the introduction and impact of the euro.

Subfigure 4.2b tells a nearly similar story. We find diminishing average $|\alpha|$ values in all of our sample countries. The biggest declines are to be found in France (from 0.15 to 0.05) and Norway (from 0.18 to 0.07). The lower regression intercepts for sub-period II convey a better fit of the pan-European 3FM in the euro era than for the time period before. However, the F-statistics portrayed in Subfigure 4.2c and the corresponding p-values depicted in Panel C of Table C.1 in Appendix C (page 368) let us formally reject the null hypothesis of $\alpha_j = 0$ $\forall j$ (j=1, ..., 27) in each individual country C (C=Belgium, ..., Norway). This entails that despite of some apparent pricing ability, the pan-European 3FM is not free of shortcomings when it comes to the return behavior of country portfolios.

In contrast to our findings in Section 4.1.3.1, in which we have assessed the link between domestic portfolio returns and domestic factors, our results depicted in Figure 4.2 reveal, on average, a worse fit of the pan-European 3FM vis-à-vis the domestic versions of the 3FM for the pricing of domestic returns. This holds, in most of the cases, even if we consider the findings for the pan-European 3FM for the period after the launch of the euro.[57] At large, our adjusted R^2 values reported for all sub-periods in Subfigure 4.2a are, on average, smaller than those we report in Tables 4.1 & 4.2 (pages 113 & 116) for the pure domestic relation. This holds especially for Germany, Italy, the Netherlands, Spain, and the UK. Yet,

[57]The exception are Belgium, France, and Norway.

overall, our results are, admittedly, barely comparable across these two sections, given the difference in the time-series considered.

Notwithstanding, our findings of this section imply overall that the pan-European FF factors entail some, yet not necessarily sufficient, information to price European equity portfolios across country borders. However, our observation that domestic stocks have become more exposed to common pan-European risk factors over time, especially in the euro era, may imply that European stock markets may have become more integrated (see Bekaert and Harvey, 1995, Roll and Ross, 1980). However, the fact that we formally reject the pricing ability of the pan-European 3FM implies that our findings are not very robust. Nonetheless, given that we impose common risk factors, namely the pan-European FF factors, entails that our means to integration is solely conditioned on these factors. In other words, there could still be other universal factors that price domestic equity in individual countries.

One way to circumvent part of the restrictions of the asset pricing approach to market integration is not to impose a common risk-free rate across markets. In fact, in the paragraphs to follow we propose a stochastic factor discount (SDF) framework as a means to estimate and compare domestic pricing kernels across markets. We suggest that in case those kernels do not differ notably across markets, those markets may be considered integrated. Admittedly, we pursue the asset pricing literature to market integration (cf. Section 2.4.2.1.2) insofar as we also rely on a covariance factor model as means to derive our kernel estimates. Yet, again, we refrain from imposing the risk-free rate to be common across markets. This makes our SDF approach a little bit more generic than an asset pricing approach to market integration.

4.2.4 Stochastic Discount Factor Test

By definition, an admissible SDF is a random variable that is common to all assets in a market, i.e., all assets in a market are subject to the same SDF.[58] Cochrane

[58] Campbell et al. (1997), Cochrane (2005) and Marín and Rubio (2001) provide a detailed overview about the SDF framework. A critique to the SDF method is provided by Kan and Zhou (1999), who argue that the SDF method suffers from two problems when returns follow a linear factor model. For one, risk premia estimates are not reliable. For two, specification tests under the SDF method exhibit very low power in detecting misspecified models.

(2005) provides detailed proof that the existence of an SDF implies the law of one price (LOP) - and vice versa.[59] Hence, one way to approach market integration is by assessing whether assets of different markets are subject to the same SDF and, hence, the LOP (see Chen and Knez, 1995, 1996, Flood and Rose, 2004, 2005a,b). If that is the case, then those markets may be considered integrated, given that assets of different markets are priced by common factors (see Bekaert and Harvey, 1995, Roll and Ross, 1980).

We pursue this line of thought in this section. Our objective is to estimate implied SDF in our sample countries depicted in Table 4.8 (page 137) and to compare those estimates across country borders and time. Following the argument above, we consider our sample countries integrated, if the information contained in our SDF estimates are not considerably different across country borders. Moreover, we suggest that in case we find stronger relations among the SDF in sub-period II than in sub-period I (cf. Section 4.2.3.2), European equity markets have converged over time.[60]

4.2.4.1 Model

Our method used to model implied SDF for each of our sample countries finds its origin in the general pricing formula. In detail, we consider equity markets integrated if all stocks in those markets satisfy the pricing condition:

$$\begin{aligned} P_{j,t} &= E_t(M_{t+1}X_{j,t+1}) \\ M_{t+1} &= f(\text{data, parameters}) \end{aligned} \tag{4.9}$$

where $P_{j,t}$ is the price of an asset j at time t, $E_t(\cdot)$ is the expectations operator, which is conditional on information at time t; $X_{j,t+1}$ is the payoff to be received at time *t+1* by owners of asset j; and M_{t+1} is the SDF for a payoff accruing at time *t+1*.[61] Cochrane (2005) shows that Equation (4.9) can be transformed into

[59] Cochrane (2005) also shows that the correlation between the random components of the SDF and any asset specific payoff generate asset-specific risk corrections.

[60] Clearly, if our dataset used is derived from a group of assets that violate the LOP, any pricing theory, irrespective of its merits, is doomed to fail.

[61] In particular, the stochastic discount factor M is defined as:

$$M_{t+1} \equiv \beta \left[\frac{u'(c_{t+1})}{u'(c_t)} \right] = \beta \left(\frac{c_{t+1}}{c_t} \right)^{-\gamma}$$

a return beta-representation, such as:[62]

$$R_{j,t} = \delta_t + \sum_{n=1}^{N} \beta_j^n f_t^n + \varepsilon_{j,t} \tag{4.10}$$

where R_j is the return to an equity portfolio j; f^n is the set of N factors; β_j^n are asset specific factor loadings; ε_j depicts an idiosyncratic disturbance; δ_t *is a zero-beta return and represents the SDF*.[63] Hence, δ_t is the parameter of focal interest to us. Equation (4.10) implies that δ_t: (i) accounts for all the variance that is unexplained by $\sum_{n=1}^{N} \beta_j^n f_t^n$; (ii) is a time-varying vector; and (iii) has a loading of 1.

To implement Equation (4.10), we need to decide which factors to use for f^n. These factors may either be derived statically or be chosen on economic grounds. We chose to utilize again our pan-European FF factors.[64] Our motivation is twofold. For one, they appear to explain a considerable proportion of equity return behavior across European markets (cf. Sections 4.1 & 4.2.3). For two, they seem to exhibit a link to systematic risk (cf. Section 2.2.1.1).[65] Hence, substituting f^n by our pan-European FF factors in Equation (4.10) leads to:

$$R_{j,t} = \delta_t + \beta_j MRF_t^R + \gamma_j HML_t^R + \phi_j SMB_t^R + \varepsilon_{j,t}. \tag{4.11}$$

The fact that we impose the pan-European FF factors as our f^n depicts clearly a restriction to our SDF method in line with an asset pricing context. In fact, all of our subsequent findings are conditioned on the factors employed. Moreover, it is worth noting that the well-functioning of Equation (4.11) is important, since a misspecified model might lead to inconsistent δ_t estimates.[66]

Yet, there is a considerable difference between our SDF framework and the asset pricing means to integration. In detail, in the asset pricing literature it is

where $u'(c_t)$ denotes the marginal utility of consumption c at time t, β represents the subjective discount factor, which captures the impatience of an agent, and γ denotes the relative risk aversion coefficient. For a more detailed description, please refer to Cochrane (2005).

[62] Please refer also to Section C.2 in Appendix C for a detailed description on how to get from the general pricing formula depicted in Equation (4.9) to the return-beta representation shown in Equation (4.10).

[63] To be more precise, δ_t depicts the inverse of the SDF, i.e., $\delta_t \equiv 1/\text{SDF}_t$.

[64] Note again that we employ once more our pan-*Eurozone* factors described in Chapter 3.

[65] Chapter 5 contains further discussions and findings on the economic rationale of the FF factors.

[66] Please refer to Section C.2.2 in Appendix C for details.

common practice to assess whether $\delta_t = R_{f,t}\ \forall j$ (where: $R_f \doteq$ 'gross risk-free rate').[67] If this is the case, then the covariance model in Equation (4.11) may be considered a 'good' asset pricing model. Notwithstanding, we explicitly do not demand that $\delta_t = R_{f,t}\ \forall j$.[68] Instead we estimate δ_t for each of our sample countries and compare those estimates across markets. Moreover, unlike in an asset pricing framework, we only use the factor loadings to our pan-European risk factors *MRF*, *HML*, and *SMB* to clear the way to get δ_t, i.e., we are not necessarily interested in the specific loadings per se.[69]

4.2.4.1.1 Estimating δ_t

Equation (4.11) implies that we cannot estimate our time-varying δ_t with the help of a plain OLS regression. A potential solution to this problem might be a non-parametric estimation or the use of a Kalman filter (see Kalman, 1960).[70,71] Yet, using a Kalman filter implies that we have to impose a structure on δ_t. This would, however, depict a further restriction to our model. Moreover, we are not necessarily interested in the value of δ_t per se, but rather whether stocks

[67] To be more precise, it is usually tested whether the regression intercept is equal to zero, assuming that the left hand-side of Equation (4.10) considers an excess return $(R_{j,t} - R_{f,t})$ rather than a regular return $(R_{j,t})$ - cf. Section 4.1.2.3 and Section B.1 in Appendix B.

[68] In detail, alike Flood and Rose (2004, 2005a,b), we do not assume that the bond market is integrated with other asset markets. When applied to a bond without nominal risk (e.g., a basic zero-coupon bond that pays one monetary unit independently of the state of nature at the end of time *t+1*), Equation (4.9) implies:

$$1 = E_t(M_{t+1}R_{f,t+1}) \qquad \text{or} \qquad \delta_t \equiv 1/E_t(M_{t+1}) = R_{f,t+1}$$

where $R_{f,t+1}$ is the one period nominal gross risk-free rate known today, and M_{t+1} is again the nominal SDF. Traditionally, inside domestic finance and economics, it is assumed that the SDF that prices bonds is the same for all bonds and identical to that pricing all other securities (see Flood and Rose, 2004, 2005a,b).

[69] Using the 3FM as means to clear the way to obtain the SDF is in accordance with Flood and Rose (2004, 2005a,b), who use the 3FM as means to derive discount factors in the US.

[70] The Kalman filter is a set of mathematical equations that provides an efficient computational means to estimate the state of a process, in a way that minimizes the mean of the squared error. The filter is very useful in several aspects: it supports estimations of past, present, and even future states, and it can do so even when the precise nature of the modeled system is unknown.

[71] Adrian and Franzoni (2009), for example, use a Kalman filter to model conditional betas for their conditional version of the CAPM.

in different markets are subject to the same δ_t. We, hence, choose for a less conventional approach to derive δ_t.

In particular, we decide to regress the return to each portfolio j ($j = 1, \ldots, 27$) in each of our sample countries C on our pan-European FF factors by constraining the regression intercepts to be zero, i.e.,

$$\begin{aligned} R_{j,t} &= \widehat{\beta}_j MRF_t + \widehat{\gamma}_j HML_t + \widehat{\phi}_j SMB_t + \overbrace{\widehat{\mu_{j,t}}}^{\widehat{\delta_t+\varepsilon_{j,t}}} \\ \widehat{\mu_{j,t}} &= R_{j,t} - \left[\widehat{\beta}_j MRF_t + \widehat{\gamma}_j HML_t + \widehat{\phi}_j SMB_t\right] \\ \widehat{\delta_t + \varepsilon_{j,t}} &= R_{j,t} - \left[\widehat{\beta}_j MRF_t + \widehat{\gamma}_j HML_t + \widehat{\phi}_j SMB_t\right] \end{aligned} \tag{4.12}$$

Disregarding the regression intercept implies that everything left unexplained in Equation (4.12) (i.e., everything which is not grasped by the factor loadings, $\widehat{\beta}_j$, $\widehat{\gamma}_j$, and $\widehat{\phi}_j$) is captured by the residual term estimate $\widehat{\mu_{j,t}}$, whereby $\widehat{\mu_{j,t}} = \widehat{\varepsilon_{j,t} + \delta_t}$. In other words, our residual estimate $\widehat{\mu_{j,t}}$ depicts a joint estimate of (i) an idiosyncratic disturbance, $\varepsilon_{j,t}$, and (ii) a component which is common to all assets j, δ_t.

As we are merely interested in δ_t rather than $\widehat{\mu_{j,t}}$, we need to disentangle $\widehat{\delta_t}$ from $\widehat{\mu_{j,t}}$ $\forall j$ in Equation (4.12). By assumption, $E(\varepsilon_{j,t}) = 0$ $\forall j$. Therefore, $E(\mu_{j,t}) = E(\delta_t) + E(\varepsilon_{j,t}) = E(\delta_t) + 0 = E(\delta_t)$. On this premise, we consider two different approaches. First, we use principal component analysis (PCA) to extract those components in $\widehat{\mu_{j,t}}$ that are common to all portfolios j in a country C.[72] We then take the strong assumption that in each country C the first principal component represents $\widehat{\delta_t}$. Second, we take the average of $\widehat{\mu_{j,t}}$ across all 27 residual vectors per market. We then presume that this obtained average corresponds to $\widehat{\delta_t}$ in each market C. Both approaches are described in more detail below.

Eventually, either of the two methods provides us with one $\widehat{\delta_t}$ for each country C.[73] We may then use those estimates for a cross-country comparison. We suggest that if δ_t contains the same information $\forall C$, then this may be regarded an indicator of stock market integration. Explicitly, if $\delta_t^{C_1} = \delta_t^{C_2} = \delta_t$, the equity markets of country C_1 and country C_2 may be considered integrated. Once again,

[72] We use MATLAB's *princomp* function.

[73] In particular, either approach provides us for each of our two sub-periods with eight $\widehat{\delta_t}$ vectors (i.e., one $\widehat{\delta_t^{BG}}$ for Belgium, one $\widehat{\delta_t^{FR}}$ for France, ..., one $\widehat{\delta_t^{NW}}$ for Norway).

we expect that with the introduction of the euro, the characteristics of δ_t have converged $\forall C$ over time. Hence, we expect a stronger relation among δ_t $\forall C$ in our sub-period II than in our sub-period I.

Finally, next to deriving one $\widehat{\delta_t}$ per country C, we also intend to derive one $\widehat{\delta_t}$ across *all* country portfolios by estimating Equation (4.12) jointly $\forall j$ and $\forall C$. In particular, for the Eurozone we start with running a joint estimate of 27 × 6 regressions [i.e., 27 portfolios × 6 Eurozone countries (Belgium, France, Germany, Italy, Netherlands, and Spain)]. We then use the obtained 162 (=6×27) residuals to derive one $\widehat{\delta_t}$ via the two approaches described above (i.e., via PCA and by taking the average across residuals). Accordingly, we also derive one $\widehat{\delta_t}$ for the EU and one $\widehat{\delta_t}$ for Europe.[74] We use those regional $\widehat{\delta_t}$ to assess to what extent country specific SDF have been converged towards a pan-European SDF over time. As our pan-European FF factors in Equations (4.11) & (4.12) are again of a pan-*Eurozone* nature (cf. Section 4.2.3), we will focus our subsequent discussion primarily on the Eurozone as our benchmark region.[75]

4.2.4.2 Approach A: Principal Component Analysis

Our first means to obtain $\widehat{\delta_t}$ from $\widehat{\mu_{j,t}}$ for each country C (and henceforth also region R) is through principal component analysis (PCA). PCA depicts a mathematical approach that allows for transforming a number of variables into a smaller set of variables that are called principal components ('factors'). The first component captures as much of the variability in the data as possible, while each succeeding factor grasps as much of the remaining variability as attainable.[76] PCA thereby assumes that the extracted components are exact linear to each other and, hence, uncorrelated.[77] Additionally, given our way to derive $\widehat{\mu_{j,t}}$, we

[74] In detail, for the EU we run 27 × 7 joint regressions (all Eurozone countries plus the EU), while we run 27 × 8 joint regressions for Europe (all EU countries plus Norway).

[75] Note that we do not expect any significant differences across the regions, given that we 'only' add (i) the UK to our Eurozone pool to get our EU sample region and (ii) Norway to our EU pool to get our European sample area. Hence, the marginal impact of the UK and, especially, Norway is rather low.

[76] Usually, a few eigenvalues are approximately as large as the largest eigenvalue, and all the others are at least an order of magnitude smaller.

[77] PCA also assumes that the communality of each item sums to 1 over all components, implying that each item has zero unique variance.

may also reasonably assume that any extracted principal components are also orthogonal to our pan-European *MRF*, *HML*, and *SMB* factors.

In each country C, we use the variance-covariance matrix of $\widehat{\mu_{j,t}}$ to compute eigenvectors (weightings), which we sort from the largest to smallest eigenvalue.[78] This gives us per country C the components in order of significance. It is reasonable to assume that the large eigenvectors correspond to those components that dominate our residuals $\widehat{\mu_{j,t}}$. The smaller eigenvectors, in turn, might be expected to carry the noise components, i.e, $\widehat{\varepsilon_{j,t}}$.

We now take the strong assumption that the first principal component (PC) corresponds to the SDF estimate per country C, i.e., $\widehat{\delta_t}$. Apparently, disregarding other components entails that we forfeit some information. Yet, if the eigenvalues are small, we do not lose much. Moreover, the orthogonality of the components does not allow us to sum one or more components to consider them as one factor. Our decision to focus only on the first component, i.e., the factor that explains the most, is also motivated by the widely used Guttman-Kaiser criterion (see Guttman, 1954, Kaiser, 1960). This criterion suggests to retain only factors with eigenvalues greater than 1. Therefore, unless a factor extracts at least as much as the equivalent of one of our estimated residuals [i.e., $\widehat{\mu_{j,t}}$ for each portfolio j ($j = 1, \ldots, 27$)], it is worth to drop it. This, is the case for most of the components (cf. Figure C.3 on page 380 in Appendix C).

4.2.4.2.1 % of Variance Explained by Principal Component

Table 4.9 depicts the cumulative percentage of variance explained by our sorted eigenvalues per region and country for both sub-period I [01/1990 to 04/1998 - *pre-euro era*] and sub-period II [01/2000 to 04/2008 - *euro era*].[79] The first block (i.e., columns 2-4) portrays the percentage of variance explained by the biggest eigenvalue alone. The second block (i.e., columns 5-7) contains the cumulative percentage of variance explained by the two biggest eigenvalues. The last

[78] Eigenvectors are the weight used to calculate principal component scores, while eigenvalues are the standardized variances that are associated with particular components. Note that the sum of eigenvalues cannot exceed the number of our portfolios j (thus, 27), since in each country each portfolio contributes 1 to the sum of variances.

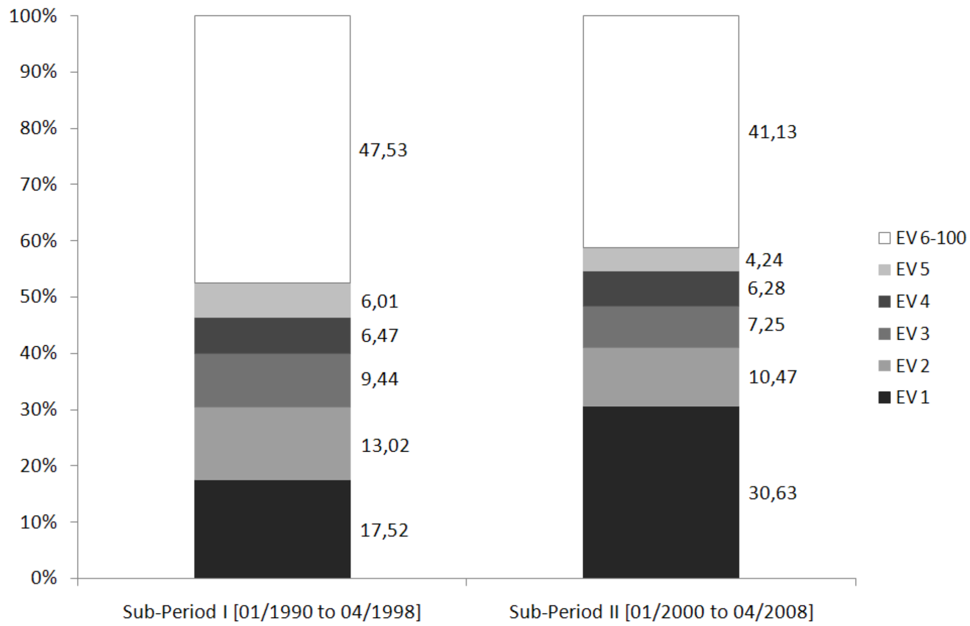
[79] Figure C.1 on page 373 in Appendix C portrays a more detailed overview about the percentage variability explained by the biggest principal components in each country and region.

Table 4.9: Cumulative Percentage of Variance Explained by Sorted Eigenvalues: Regions/Countries

This table reports per region/country and sub-period (a) the percentage of variance explained by the biggest eigenvalue (columns 2 & 3), (b) the cumulative percentage of variance explained by the 2 biggest eigenvalues (columns 5 & 6), and the cumulative percentage of variance explained by the 10 biggest eigenvalues (columns 8 & 9). Columns 4, 7, and 10 depict the difference (Δ) between sub-period II and sub-period I for these values. The first cluster comprises our 3 sample regions: Europe, the EU, and the Eurozone. The second cluster depicts countries that belong to the Eurozone. The third cluster depicts the United Kingdom, which belongs to the EU but not the Eurozone. The last cluster contains Norway, which belongs neither to the Eurozone nor the EU.

Region/ Country	% of Variance Explained by Biggest Eigenvalue			Cumulative % of Variance Explained by 2 Biggest Eigenvalues			Cumulative % of Variance Explained by 10 Biggest Eigenvalues		
	Sub-Period I	Sub-Period II	ΔPII-PI	Sub-Period I	Sub-Period II	ΔPII-PI	Sub-Period I	Sub-Period II	ΔPII-PI
Europe	14.44	29.14	14.70	26.10	39.30	13.20	62.64	72.56	9.92
EU	17.09	31.03	13.95	30.30	41.16	10.87	67.64	74.34	6.70
Eurozone	17.52	30.63	13.11	30.54	41.10	10.56	68.76	74.68	5.92
Belgium	26.27	42.93	16.66	42.92	57.61	14.70	86.33	90.85	4.51
France	22.09	48.44	26.35	34.50	68.40	33.90	81.92	94.01	12.09
Germany	34.84	58.76	23.91	48.44	71.01	22.58	89.20	94.77	5.57
Italy	46.05	30.81	-15.25	59.70	51.70	-8.00	88.61	92.66	4.05
Netherlands	31.54	29.49	-2.05	43.02	43.69	0.68	85.46	86.18	0.71
Spain	29.20	40.86	11.67	46.67	63.85	17.18	92.54	94.46	1.92
United Kingdom	46.45	49.18	2.74	59.85	63.20	3.35	91.17	93.30	2.13
Norway	17.28	25.58	8.30	31.79	46.16	14.37	85.28	88.86	3.58

Figure 4.3: Cumulative % of Variance Explained by Sorted Eigenvalues: Eurozone - *Own Draft*



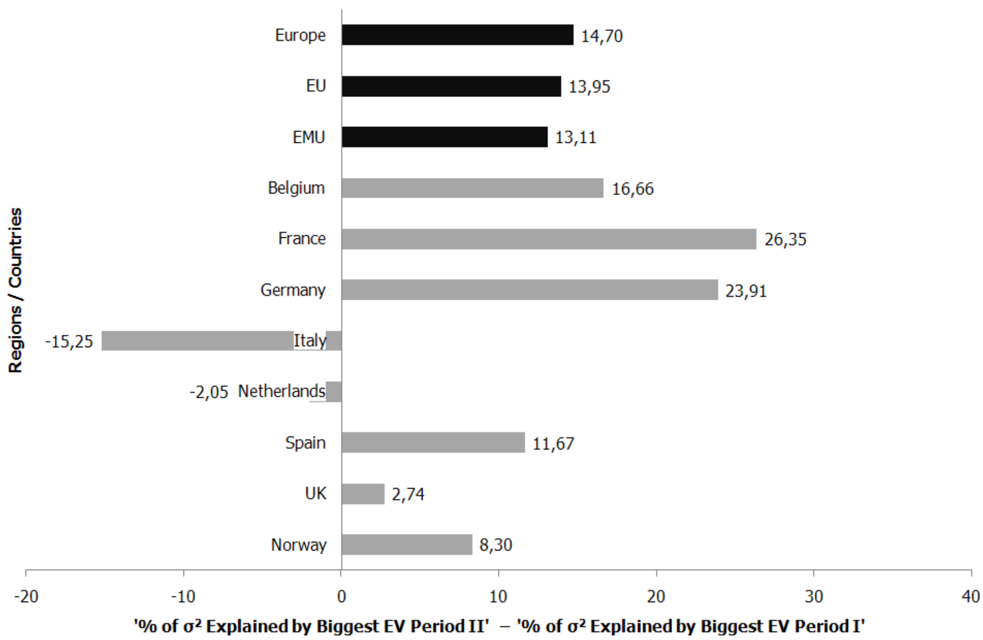
block (i.e., columns 8-10) portrays the corresponding findings for the 10 biggest eigenvalues.

The figures in the first block in Table 4.9 reveal that the first principal component explains only 17.52% of the variance in $\widehat{\mu_{j,t}}$ in the Eurozone in sub-period I. Albeit this passes the 10% threshold of the Guttman-Kaiser criterion, it is apparent that the first principal component alone does a poor job in explaining the variation in $\widehat{\mu_{j,t}}$. This entails that there does not appear to be a dominat factor that may be associated with a potential $\delta_t^{Eurozone}$. Hence, there does not seem to be a common SDF across the markets of the Eurozone.

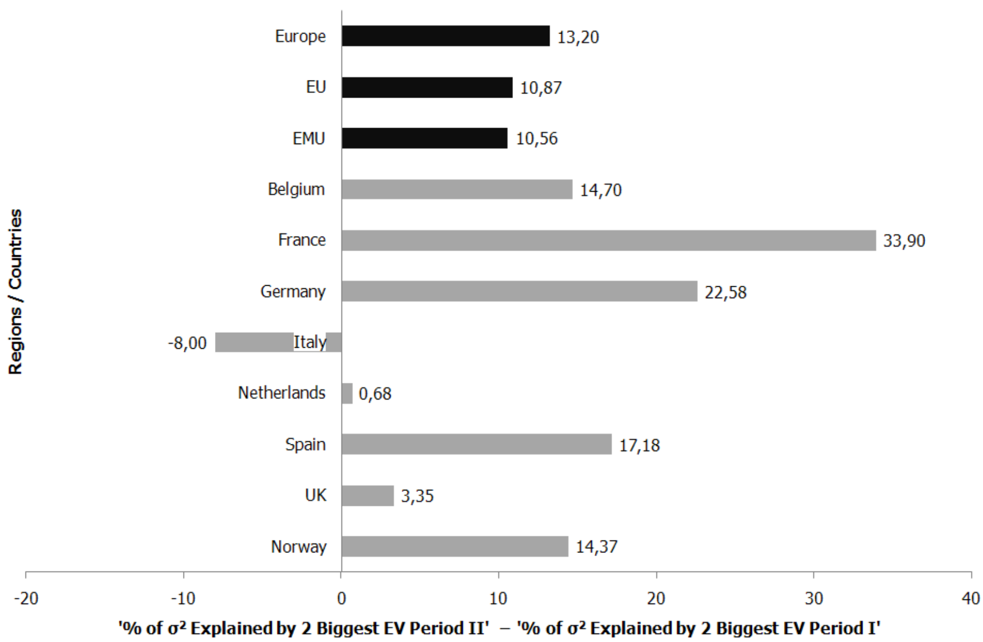
However, once we move our focus from sub-period I to sub-period II, we find a considerable increase in the amount of variance explained by the first component in the Eurozone. In fact, the percentage of variance explained nearly doubles from 17.52% in sub-period I to 30.63% in sub-period II. This is clearly indicated by column 4 in Table 4.9 and further underpinned by Figure 4.3, which portrays in more detail how the variance explained by the biggest eigenvalue jumps in the Eurozone from about 17.52% in sub-period I to 30.63% in sub-period

Figure 4.4: Δ Between Cumulative % of Variance Explained by Sorted Eigenvalues of Sub-Period II & Sub Period I: Regions/Countries - *Own Draft*

(a) Only Biggest Eigenvalue



(b) Two Biggest Eigenvalues



II.[80] Admittedly, the 30.63% of variance explained by the first component in the Eurozone is still fairly small. Notwithstanding, the sharp increase in proportion explained from sub-period I to sub-period II may indicate the rising presence of a more dominat factor, i.e., the existence of a common European SDF.

If we shift our view from the Eurozone to our sample countries, then we find a similar pattern. Figure 4.4 visualizes per country the differences in the cumulative percentage of variance explained by (i) the biggest eigenvalue alone and (ii) the two biggest eigenvalues between sub-period II and sub-period I.[81] Subfigure 4.4a clearly reveals that the amount of variance explained by the first principal component is considerably bigger in sub-period II than the one explained by the first component in sub-period I. This holds for all countries, except Italy and the Netherlands. Overall, we find the biggest jumps for Germany (from 34.85% to 58.76%) and France (from 22.09% to 48.44%).

As a whole, it is worthy to note that the variation explained by the first principal component in sub-period I is always higher for the countries than the Eurozone (except Norway). This may, however, simply be due to the fact that stocks in one country were already subject to a common component prior to the introduction of the euro. This common component, however, did not yet exist at regional level before the euro was launched.

4.2.4.2.2 Correlation Among Principal Components

To assess whether the first principal components are correlated across borders, we draw the correlation matrix among those components across all of our sample countries and regions. The results are depicted in Table 4.10. Panel A depicts the correlation coefficients for sub-period I [01/1990 to 04/1998 - *pre-euro era*] while Panel B portrays the corresponding figures for sub-period II [01/2000 to 04/2008 - *euro era*]. Panel C shows the difference between (i) the correlation coefficients of sub-period II and (ii) the correlation coefficients of sub-period I.

[80] A similar scenario is presented for the EU and Europe in Figure C.2 (page 377) in Appendix C.

[81] In particular, Subfigure 4.4a visualizes column 4 (ΔPII-PI - cumulative % of variance explained by the biggest eigenvalue) of Table 4.9, while Subfigure 4.4b portrays column 7 (ΔPII-PI - cumulative % of variance explained by the 2 biggest eigenvalues) of the same table.

Table 4.10: Correlation Among 1. Principal Components Across Markets

This table depicts the correlation coefficients among the first principal components across our sample regions and countries. Panel A shows the values for sub-period I [01/1990 to 04/1998], Panel B for sub-period II [01/2000 to 04/2008], and Panel C the difference between (i) the correlation coefficients of sub-period II and (ii) the correlation coefficients of sub-period I.

EU=European Union; EMU=Eurozone; BG=Belgium; FR=France; BD=Germany; IT=Italy; NL=Netherlands; SP=Spain; UK=United Kingdom; NW=Norway.

Panel A: Correlation Coefficients Sub-Period I [01/1990 to 04/1998]: ρ_I

	Europe	EU	EMU	BG	FR	BD	IT	NL	SP	UK	NW
Europe	1										
EU	1	1									
Eurozone	0.96	0.98	1								
Belgium	-0.46	-0.43	-0.38	1							
France	0.52	0.50	0.42	-0.57	1						
Germany	0.12	0.14	0.27	-0.02	0.08	1					
Italy	0.85	0.85	0.78	-0.24	0.42	-0.02	1				
Netherlands	0.29	0.26	0.10	-0.39	0.59	-0.28	0.43	1			
Spain	0.81	0.84	0.92	-0.23	0.21	0.34	0.52	-0.19	1		
UK	0.58	0.55	0.39	-0.28	0.45	-0.25	0.57	0.42	0.17	1	
Norway	-0.28	-0.22	-0.20	0.44	-0.29	-0.04	-0.12	-0.14	-0.12	-0.16	1

Panel B: Correlation Coefficients Sub-Period II [01/2000 to 04/2008]: ρ_{II}

	Europe	EU	EMU	BG	FR	BD	IT	NL	SP	UK	NW
Europe	1										
EU	1	1									
Eurozone	1	1	1								
Belgium	0.89	0.90	0.91	1							
France	0.57	0.60	0.61	0.53	1						
Germany	0.90	0.89	0.89	0.73	0.36	1					
Italy	0.43	0.43	0.43	0.36	0.25	0.28	1				
Netherlands	0.90	0.90	0.89	0.79	0.44	0.79	0.40	1			
Spain	0.86	0.88	0.88	0.79	0.62	0.64	0.31	0.77	1		
UK	-0.87	-0.86	-0.84	-0.71	-0.31	-0.80	-0.37	-0.80	-0.70	1	
Norway	0.78	0.75	0.74	0.62	0.26	0.73	0.36	0.70	0.57	-0.78	1

Panel C: Difference Between ρ_{II} & ρ_I

	Europe	EU	EMU	BG	FR	BD	IT	NL	SP	UK	NW
Europe	0										
EU	0	0									
Eurozone	0.03	0.02	0								
Belgium	1.35	1.34	1.29	0							
France	0.04	0.09	0.19	1.10	0						
Germany	0.78	0.75	0.62	0.75	0.28	0					
Italy	-0.41	-0.42	-0.35	0.61	-0.17	0.30	0				
Netherlands	0.62	0.64	0.79	1.18	-0.14	1.07	-0.02	0			
Spain	0.05	0.04	-0.04	1.02	0.40	0.30	-0.20	0.96	0		
UK	-1.45	-1.41	-1.23	-0.43	-0.77	-0.55	-0.94	-1.22	-0.87	0	
Norway	1.07	0.97	0.94	0.18	0.55	0.77	0.48	0.83	0.69	-0.62	0

The figures depicted in Panel C of Table 4.10 clearly reveal that the correlation coefficients among the first principal components across countries increase considerably from sub-period I to sub-period II. This holds especially for Belgium and Germany and, to a lesser extent, for France, the Netherlands, Spain, and Norway. For the UK and Italy, the correlation coefficients decrease in the majority of cases. Thus, the correlation figures depicted support at large our hypothesis that the driving factor behind the increase in the variation explained by the first component from sub-period I to sub-period II might be similar across countries, except for the UK and Italy. Overall, it appears that in sub-period II the information content in the first principal component in one European country can be strongly associated with the information contained in the first principal component in another European country, expect for the UK and Italy.

Besides, in the majority of cases the correlation coefficients between the first component of any country and the first component of the Eurozone increase notably from sub-period I to sub-period II. This entails clearly a convergence of the components over time. The UK depicts once more a clear exception. Yet, the fact that the correlation coefficient between the UK and the Eurozone turns from 0.39 in sub-period I to -0.84 in sub-period II may imply that the UK has not been affected to the same extent as the Eurozone countries by the introduction of the euro. In fact, it appears as if the UK has become more isolated from other European countries over time. An apparent explanation might be the fact that the UK does not belong to the Eurozone. Hence, there exists still some exchange rate risk between the UK and the member countries of the Eurozone.

Thence, under the premises that (i) Equation (4.11) is well specified and that (ii) the first principal component in each country C serves as a valid proxy for δ_t in that respective market, our findings entail that European stocks may have become subject to a common SDF along time. This, in turn, may also imply that European stock markets have become more integrated over time, especially after the advent of the euro. This is in line with the findings of Hardouvelis et al. (2006), Kim et al. (2006), León et al. (2007), and Yang et al. (2003).[82]

[82]Given the figures presented in Table 4.10, it also appears that there is no significant difference among the first principal components across our sample regions. This is irrespective of the sub-period considered. All correlation coefficients are > 0.95 and statistically significant at the 1% signifiacne level. The similarity across the regions is not too surprising, given only the marginal difference across the regions (cf. Footnote 75).

Moreover, an increase in market integration is further underpinned by taking a portfolio rather than country perspective. In detail, rather than deriving principal components for each country, we also extract principal components for each of our 27 portfolios, i.e., considering the residuals of each portfolio j across country borders.[83] As a whole, our results support our cross-country findings. With the exception of only a very few cases, the proportion of variation explained by the first component increases significantly from sub-period I to sub-period II. For reasons mentioned above, this may again be regarded as an indicator of market integration, given that the components derived per portfolio j are of a pan-European nature.

4.2.4.2.3 What Is Behind the First Principal Component?

One question that remains to be addressed is: what is behind the first principal component? As we omit the risk-free rate for our analysis, i.e., we do not consider it in Equation (4.12), we suspect that the European risk-free rate may be associated with the first principal component that we derive for the Eurozone. Albeit this does not necessarily have to be the case for sub-period I, given that the euro was not yet introduced as the sole legal tender, it may be a proper guess for sub-period II.

4.2.4.2.3.1 Region

The figures portrayed in Table 4.11 reveal, however, that in sub-period I it is the second principal component of the Eurozone rather than the first that may be related to the European risk-free rate, if at all. This is reflected by higher and significant correlation coefficients between the European risk-free (one-month ecu) rate and the second component ($\rho = 0.426$) vis-à-vis the corresponding figure for the first component ($\rho = 0.227$) of the Eurozone.

Yet, if we move from sub-period I to sub-period II, the correlation coefficient between the European risk-free rate and the first principal component increases

[83] Particularly, we use Equation (4.12) to estimate $\mu_{j,t}$ for each portfolio j ($j = 1, \ldots, 27$) $\forall C$. We then construct the variance-covariance matrix of the residuals for each portfolio j across all countries C, and use this matrix to compile our eigenvectors and eigenvalues, and eventually our principal components for each portfolio j. The findings are depicted in Table C.3 (page 379) and Figures C.3 & C.4 (pages 380 & 389) in Appendix C.

Table 4.11: Correlation Between Principal Components & European R_f: Regions

This table reports per region and sub-period the correlation between either the first or second principal component (PC) and the inverse of the European gross risk-free rate, i.e., the European discount rate.

	Sub-Period I		Sub-Period II	
	1. Principal Component	2. Principal Component	1. Principal Component	2. Principal Component
Panel A: Eurozone				
% of Variance Explained by PC	17.521	13.023	30.629	10.474
Correlation(PC; $\frac{1}{(1+r_f)}$)	0.227	0.426	0.341	0.302
p-value	0.023	0.000	0.001	0.002
Panel B: European Union				
% of Variance Explained by PC	17.085	13.210	31.031	10.129
Correlation(PC; $\frac{1}{(1+r_f)}$)	0.140	-0.465	0.336	-0.294
p-value	0.166	0.000	0.001	0.003
Panel C: Europe				
% of Variance Explained by PC	14.438	11.662	29.141	10.159
Correlation(PC; $\frac{1}{(1+r_f)}$)	0.115	-0.487	0.332	-0.312
p-value	0.253	0.001	0.000	0.002

and becomes even statistically significant. The absolute magnitude of the correlation coefficient (PC_1: $\rho = 0.341$) also surpasses the one for the second component (PC_2: $\rho = 0.302$). However, neither coefficient value truly supports the hypothesis that either principal component may be associated with the European risk-free rate, at least not considering our short term proxy, i.e., the one-month ecu rate.

Hence, any other factor, such as the presence of a common currency (i.e., the loss of exchange rate risk) or the alignment of fiscal and monetary policies, might be the drivers behind the increase in (i) the magnitude of the correlation coefficient and (ii) the absolute proportion of variance explained by the first principal component in sub-period II. Nonetheless, irrespective of what might be driving the increase of the proportion of variance explained from one period to another, the mere presence of a rise alone may imply that European stock markets may have become more integrated over time.

Note that the correlation for the second principal component is negative for the EU (Panel B) and Europe (Panel C). This may be explained by the fact that the euro may neither be found in the UK nor in Norway. Besides, as noted earlier, our pan-European factors are in fact pan-*Eurozone* and, hence, disregard the returns to stocks from the UK and Norway (cf. Chapter 3 & Section 4.2.3.1).[84]

4.2.4.2.3.2 Country

At country level, we have fortunately more variables at hand to assess what might be underlying the first principal component in each country for each sub-period. Figure 4.12 depicts the correlation coefficients between the first principal component in each country with (i) the European risk-free rate, (ii) the domestic risk-free rate, (iii) the domestic *MRF*, (iv) the domestic *HML*, and (v) the domestic *SMB*.[85]

In many countries, we find more than one significant correlation coefficient in each sub-period. This holds especially for sub-period II. Yet, if we were always to take the coefficient with the biggest absolute magnitude, then it appears that in the majority of cases the first principal component is related to the domestic *SMB* factor. We also find some significant coefficients for the domestic market factor (*MRF*) and the domestic risk-free rate, but these findings are less persistent than for the *SMB* effect.

The dominance of *SMB* vis-à-vis *MRF* might be explained by the nature of the factors. For one, numerous studies find that local and global indices yield identical market betas (see Harris et al., 2003, Koedijk et al., 2002, Koedijk and Van Dijk, 2004, Mirsha and O'Brien, 2001). Thus, the information contained in a domestic *MRF* may already be captured by the European *MRF* depicted in Equations (4.11) & (4.12). For two, as pointed out earlier, the domestic *SMB* factor contains valuable information for the explanation of equity returns in individual markets (cf. Sections 2.2.1 & 4.1). This entails that a local size factor should not be disregarded as it may be contain incremental information (net of the market

[84]Table 4.10 also shows that in sub-period I, the first principal component of Norway is negatively correlated to the majority of first principal components in other markets. The same holds for the UK in sub-period II.

[85]The domestic risk-free rate refers to the return to a long-term (10 year) government bond. In particular, we use Datastream country benchmark bonds with the end-codes: *BRYLD*. Apparently, we would prefer to have benchmark risk-free rates with the same term, but we unfortunately face data availability constraints. Moreover, there is a debate among both academics and practitioners on whether to use short- or long-term risk free rates for cost of equity computations (see Damodaran, 2008). Hence, there is surely room for discussion on whether the use of a short-term rate is to be preferred to a long-term rate, or vice-versa.

Table 4.12: Correlation Between 1. Principal Components & Selective Variables: Countries

This table reports the correlation coefficients and corresponding p-values between the first principal component and selective variables. Column 1 depicts the country, column 2 the sub-period, column 3 the percentage of variance explained by the first principal component (relative to all other components extracted), column 5 the inverse of the European risk-free rate, column 6 the inverse of the country specific risk-free rate, column 7 the country specific market factor (*MRF*), column 8 the country specific book-to-market (*HML*) factor, and column 9 the country specific size (*SMB*) factor.

				Variables				
Country	Sub-	% of Variance		Euro	Country			
	Period	Explained		$\frac{1}{(1+r_f)}$	$\frac{1}{(1+r_f)}$	*MRF*	*HML*	*SMB*
Belgium	I	26.27	Correlation	0.090	-0.008	0.030	-0.006	0.459
			p-Value	0.375	0.937	0.769	0.956	0.000
	II	42.93	Correlation	0.330	0.582	0.726	-0.262	0.411
			p-Value	0.001	0.000	0.000	0.009	0.000
France	I	22.09	Correlation	-0.008	-0.011	-0.078	-0.274	-0.441
			p-Value	0.940	0.911	0.442	0.006	0.000
	II	48.44	Correlation	0.067	0.412	-0.004	0.723	0.733
			p-Value	0.508	0.000	0.968	0.000	0.000
Germany	I	34.84	Correlation	0.528	0.499	0.041	-0.111	-0.117
			p-Value	0.000	0.000	0.685	0.274	0.245
	II	58.76	Correlation	0.354	0.524	-0.004	0.491	0.712
			p-Value	0.000	0.000	0.971	0.000	0.000
Italy	I	46.05	Correlation	0.060	0.281	0.525	0.566	-0.192
			p-Value	0.553	0.005	0.000	0.000	0.055
	II	30.81	Correlation	0.085	0.083	0.117	0.188	-0.033
			p-Value	0.400	0.410	0.247	0.061	0.742
Netherlands	I	31.54	Correlation	-0.292	-0.118	-0.102	0.022	-0.434
			p-Value	0.003	0.242	0.312	0.827	0.000
	II	29.49	Correlation	0.476	0.616	0.174	0.368	0.500
			p-Value	0.000	0.000	0.084	0.000	0.000
Spain	I	29.20	Correlation	0.293	0.261	0.228	-0.221	0.622
			p-Value	0.003	0.009	0.022	0.027	0.000
	II	40.86	Correlation	0.268	0.520	0.356	0.398	0.388
			p-Value	0.007	0.000	0.000	0.000	0.000
United Kingdom	I	46.45	Correlation	-0.117	-0.103	-0.098	0.007	-0.421
			p-Value	0.247	0.309	0.330	0.944	0.000
	II	49.18	Correlation	-0.225	-0.148	-0.343	0.299	0.243
			p-Value	0.025	0.141	0.000	0.002	0.015
Norway	I	17.28	Correlation	0.086	0.011	-0.007	0.646	-0.034
			p-Value	0.395	0.916	0.948	0.000	0.738
	II	25.58	Correlation	0.089	0.203	0.258	0.345	-0.506
			p-Value	0.377	0.043	0.009	0.000	0.000

factor) on systematic risk embedded in a particular country (cf. Section 2.2.1.1 & Chapter 5).

Interestingly, if we correlate the second principal component of each country C with the variables described above in any of our sub-periods, then we find that most of the components show the strongest relation with the other FF factor, i.e., *HML*. The explanation for this may be analogous to the one we provide for *SMB*. The findings for the second principal components are portrayed in Table C.2 (page 378) in Appendix C.

4.2.4.3 Approach B: Average Across Residuals

In the final part of this section, we briefly conduct a different approach to extract stochastic discount factors per country C (and henceforth also region R). For each market, we use the average of our residuals in Equation (4.12), i.e, $\mu_{j,t}$ $\forall j$ ($j = 1, \ldots 27$), to generate δ_t. By assumption, the expectation of $\varepsilon_{j,t}$ across our 27 residuals equals 0, i.e., $E(\varepsilon_{j,t}) = 0$. Based on this, we construct for each country C a new average portfolio, AP_{27}, whose return equals δ_t. In detail, for each market we assume that

$$AP_{27} = \frac{1}{27} \times \sum_{j=1}^{27} \mu_{j,t} = \frac{1}{27} \times \sum_{j=1}^{27} (\delta_t + \varepsilon_{j,t}) = \delta_t + \underbrace{\sum_{j=1}^{27} \frac{\varepsilon_{j,t}}{27}}_{=0} = \delta_t.$$

Table 4.13 depicts the expectations of δ_t per country. The table also reveals the correlation between δ_t of each country C with the European risk-free rate. In general, the expectation of δ_t increases from sub-period I to sub-period II, except for the Netherlands and the UK. Yet, this alone is of no considerable value. More interestingly is our observation that neither in sub-period I nor in sub-period II a significant relation between δ_t and the European risk-free rate appears to exist. We find that there is no correlation coefficient > 0.50, even if the parameters increase slightly from sub-period I to sub-period II. The same holds for the Eurozone (and the EU and Europe), whose findings are depicted in Table 4.13 as well.

Nonetheless, irrespective of whether δ_t may serve as proxy for the European risk-free rate, the more absorbing questions are perhaps (i) whether our δ_t vectors

Table 4.13: δ_t Expectations per Country & Region - AP_{27}

This table depicts per country C and region R the expectation of δ_t for sub-period I [01/1990 to 04/1998] and sub-period II [01/2000 to 04/2008]. It also portrays in the correlation between δ_t and the European discount rate.

EU=European Union; EMU=Eurozone; BG=Belgium; FR=France; BD=Germany; IT=Italy; NL=Netherlands; SP=Spain; UK=United Kingdom; NW=Norway.

	Europe	EU	EMU	BG	FR	BD	IT	NL	SP	UK	NW
Panel A: Sub-period II											
$E(\delta_t)$	0.015	0.014	0.009	0.019	0.012	0.003	-0.048	0.041	0.026	0.044	0.020
$\rho(\delta_t; \frac{1}{(1+R_f)})$	0.166	0.166	0.142	0.061	-0.062	-0.482	0.062	0.230	0.340	0.099	0.066
Panel B: Sub-period II											
$E(\delta_t)$	0.029	0.027	0.028	0.021	0.038	0.026	0.040	0.014	0.028	0.025	0.040
$\rho(\delta_t; \frac{1}{(1+R_f)})$	0.203	0.235	0.234	0.421	-0.017	0.261	-0.186	0.409	0.237	0.213	-0.054

are related across markets and (ii) whether the δ_t vectors of individual markets have converged over time. Table 4.14 shows the correlation coefficients among δ_t for all of our sample countries and regions. Panel A depicts once more the correlation coefficients for sub-period I [01/1990 to 04/1998 - *pre-euro era*] while Panel B exhibits the corresponding figures for sub-period II [01/2000 to 04/2008 - *euro era*]. Panel C illustrates the difference between (i) the correlation coefficients of sub-period II and (ii) the correlation coefficients of sub-period I.

At large, it appears that the relation among δ_t across markets increases considerably over time. This holds for all countries and also for the Eurozone (and the EU, and Europe). With the exception of Italy, all countries depict correlation coefficients > 0.75 with the Eurozone in sub-period II, while none of these coefficients is > 0.68 in sub-period I.[86] Even the UK and Norway, albeit not part of the Eurozone, show high correlation values with the Eurozone and other European countries. We find the biggest increases for Germany (Sub-period I: $\rho^{Eurozone} = 0.21$; Sub-period II: $\rho^{Eurozone} = 0.86$), which may suggest that Europe's biggest economy has become more central to other European countries ever since the introduction of the euro. Overall, our findings entail that all δ_t vectors share a big proportion of information across all of our sample countries. This holds especially for sub-period II.

[86] The value for Italy is still 0.64 in sub-period II.

Table 4.14: Correlation Among AP_{27} Portfolios

This table depicts the correlation coefficients among the AP_{27} across our sample regions and countries. Panel A shows the values for sub-period I [01/1990 to 04/1998], Panel B for sub-period II [01/2000 to 04/2008], and Panel C the difference between (i) the correlation coefficients of sub-period II and (ii) the correlation coefficients of sub-period I.

EU=European Union; EMU=Eurozone; BG=Belgium; FR=France; BD=Germany; IT=Italy; NL=Netherlands; SP=Spain; UK=United Kingdom; NW=Norway.

Panel A: Correlation Coefficients Sub-Period I [01/1990 to 04/1998]: ρ_I

	Europe	EU	EMU	BG	FR	BD	IT	NL	SP	UK	NW
Europe	1										
EU	0.98	1									
Eurozone	0.89	0.95	1								
BG	0.46	0.49	0.40	1							
FR	0.53	0.51	0.41	0.58	1						
BD	0.09	0.11	0.21	0.14	0.20	1					
IT	0.11	0.20	0.40	-0.22	-0.37	0.08	1				
NL	0.71	0.70	0.61	0.41	0.57	-0.11	-0.37	1			
SP	0.67	0.68	0.68	-0.11	-0.03	-0.33	0.27	0.52	1		
UK	0.42	0.32	0.00	0.33	0.37	-0.27	-0.56	0.39	0.12	1	
NW	0.50	0.32	0.13	0.06	0.29	-0.05	-0.31	0.31	0.24	0.60	1

Panel B: Correlation Coefficients Sub-Period II [01/2000 to 04/2008]: ρ_{II}

	Europe	EU	EMU	BG	FR	BD	IT	NL	SP	UK	NW
Europe	1										
EU	1	1									
Eurozone	0.99	1	1								
BG	0.90	0.91	0.92	1							
FR	0.90	0.89	0.90	0.72	1						
BD	0.87	0.87	0.86	0.83	0.64	1					
IT	0.66	0.64	0.64	0.41	0.78	0.30	1				
NL	0.90	0.90	0.90	0.85	0.76	0.81	0.49	1			
SP	0.86	0.88	0.89	0.82	0.78	0.71	0.48	0.73	1		
UK	0.91	0.90	0.87	0.77	0.78	0.82	0.55	0.80	0.70	1	
NW	0.84	0.80	0.78	0.64	0.79	0.70	0.68	0.68	0.55	0.81	1

Panel C: Difference Between ρ_{II} & ρ_I

	Europe	EU	EMU	BG	FR	BD	IT	NL	SP	UK	NW
Europe	0										
EU	0.02	0									
Eurozone	0.10	0.05	0								
BG	0.44	0.42	0.51	0							
FR	0.37	0.38	0.48	0.15	0						
BD	0.78	0.76	0.66	0.69	0.44	0					
IT	0.54	0.44	0.24	0.62	1.14	0.22	0				
NL	0.19	0.20	0.30	0.44	0.19	0.92	0.86	0			
SP	0.19	0.20	0.22	0.93	0.81	1.04	0.21	0.21	0		
UK	0.49	0.58	0.87	0.45	0.42	1.09	1.11	0.41	0.58	0	
NW	0.34	0.48	0.65	0.58	0.50	0.76	0.99	0.37	0.30	0.21	0

Finally, Figure C.5 on page 390 in Appendix C provides further support for the converging trend of δ_t $\forall C$ over time. In particular, Figure C.5 depicts for each country C the deviation of δ_t^C from δ_t^{EMU} of the Eurozone.[87] As a whole, it appears that the deviation of δ_t^C from δ_t^{EMU} is smaller $\forall C$ in sub-period II than in sub-period I. This holds especially for Belgium, France, Italy, the Netherlands, and the UK. The diminishing difference may already serve as an indicator of a progressing European stock market integration. Yet, most of the subfigures also reveal that the majority of δ_t^C converges towards δ_t^{EMU} as the end of sub-period II is approaching. This may further indicate that European stock markets have become more integrated over time. In sum, our results support our previous findings for the principal component analysis. They are, hence, also in line with those of other studies that document an increase in European stock market integration over time (see Hardouvelis et al., 2006, Kim et al., 2006, León et al., 2007, Yang et al., 2003).

4.2.5 Conclusion

This section has aimed to provide further insights on (i) the general pricing ability of the 3FM and (ii) the degree to which European equity markets are integrated. In a first step, we have applied an asset pricing approach in which we have attempted to price country portfolios through a pan-European version of the 3FM. This approach depicts a joint (and inseparable) test for asset pricing and market integration. In particular, it involves testing whether all pricing errors are jointly equal to zero, either in one market at a time or across country borders.

At large, our findings suggest that pan-European FF factors are better able to price country portfolios in the euro era than in the pre-euro era. This is in line with Moerman (2005). We have found considerably increases in adjusted R^2 coefficients and significant decreases in $|\alpha|$ values. Nevertheless, we have formally rejected the null hypothesis of zero pricing errors for all of our sub-samples. This entails that a pan-European 3FM is not free of shortcomings when it comes to the pricing of domestic equity portfolios. However, the apparent better fit of the

[87] As we are primarily interested in assessing whether the δ_t^C of any market C differs significantly from δ_t^{EMU} at any point in time, we have set δ_t^{EMU} equal to 1. Hence, all subfigures in Figure C.5 depict merely the deviations of δ_t^C of each country C from δ_t^{EMU} rather than the value and volatility of either δ_t^C $\forall C$ or δ_t^{EMU}.

pan-European 3FM over time may imply that European stocks have more and more become subject to common risk factors. This, in turn, entails that European stock markets have become more integrated over time (see Bekaert and Harvey, 1995, Roll and Ross, 1980).

In a second step, we have left some of the strong restrictions of an asset pricing approach to market integration behind by utilizing a slightly more generic stochastic discount factor (SDF) framework. In particular, unlike in an asset pricing context, we have not imposed a common risk-free rate as the SDF and have not tested whether the pricing errors are jointly equal to zero across a set of portfolios. In fact, we have rather estimated and compared domestic pricing kernels across European country borders.

Our findings entail that the relation among the SDF across European countries increases significantly over time. While we find modest correlations among the SDF prior to the introduction of the euro, the information shared among the discount factors intensifies sharply in the first decade of the 21st century. The exception to this phenomenon is the UK, which, however also does not belong to the Eurozone. Yet, our results also imply that the underlying factor that drives this increase is not necessarily the European risk-free rate, which has been commonly exposed to the Eurozone countries with the advent of the euro. This leaves surely room for further research. Nevertheless, our empirical results of this section support at large the findings of other recent studies that document as well a trend of an increasing integration of European stock markets (see Hardouvelis et al., 2006, Kim et al., 2006, León et al., 2007, Yang et al., 2003).

Further research may use other approaches to model the SDF, e.g., by using non-parametric tests or a Kalman filter. Besides, future work may use means other than correlation to measure the extent to which SDF are equal across countries. For instance, one may employ a Wald-test, ANOVA, or the mean absolute difference (MAD) to compare the first moments of our SDF estimates. To account for the differences in the second moments, one may adopt the external risk sharing index proposed by Brandt et al. (2006). This may provide further robustness to our findings.

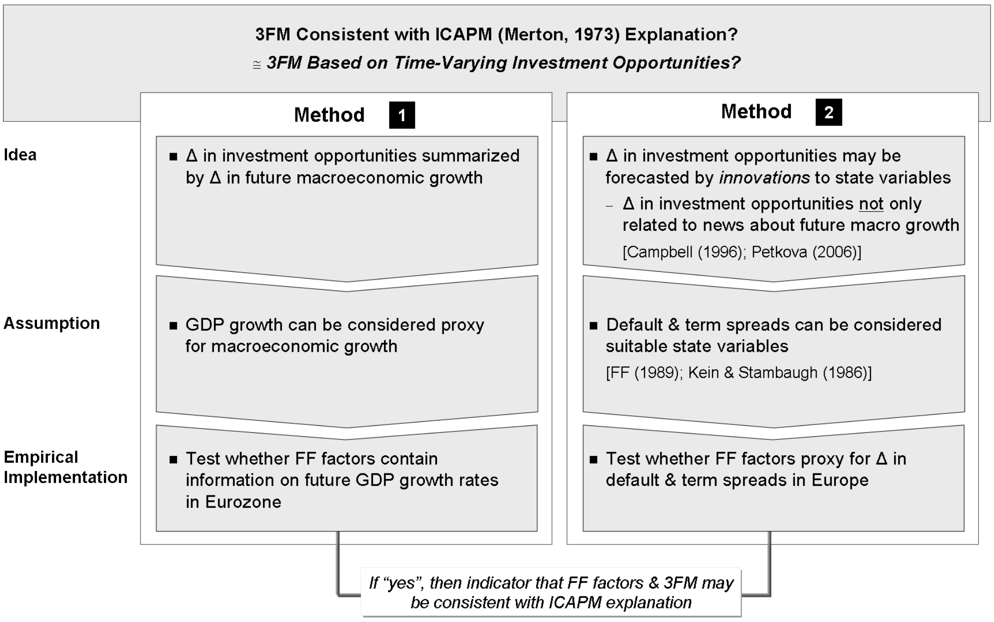
Chapter 5

Empirical Part B: FF Factors and Systematic Risk

FF suggest that size (*SMB*) and book-to-market (*HML*) proxy for common sources of variance in returns that are not fully captured by the market beta. Yet, the success of the 3FM to absorb most of the anomalies plaguing the CAPM has triggered a lively debate in the financial economics literature over the economic rationale of the FF factors (cf. Section 2.2.1.1). Per se, *SMB* and *HML* merely depict returns to portfolios. These portfolios, however, inherently lack clear economic links to systematic risk. As such, numerous studies argue that FF's proposition to consider size and book-to-market risk factors is not easy to rationalize (see Campbell et al., 1997, Cochrane, 1999). This holds especially in context of Merton's (1973) Intertemporal Capital Asset Pricing Model (ICAPM).

Merton (1973) advocates to extent the classical CAPM by state variables that help in forecasting investment opportunities. The main idea of the ICAPM is that investors have to consider not only the risks to their wealth, but also the risk to the productivity of their wealth, i.e., the rate of return at which wealth can be reinvested. Merton (1973), hence, denotes that investors are supposed to hedge not only shocks to wealth itself, but also shocks to any state variable which helps to forecast expected return to wealth. Fama and French (1993) remark that *SMB* and *HML* might serve as proxies for these state variables. Yet, they also admit that they have not yet identified the state variables behind *SMB* and *HML* that lead to their seminal 3FM (Fama and French, 1996a, p. 76).

Figure 5.1: 2 Approaches to Test 3FM in ICAPM Context - *Own Draft*



In this chapter, we intend to advance the discussion about the economic interpretation of the FF factors. We use a twofold approach and pursue thereby a strand of literature that aims to explain the success of the 3FM based on time-varying investment opportunities in context of Merton's (1973) ICAPM.[1] This twofold approach is briefly illustrated in Figure 5.1. We first assume (Section 5.1) that changes in investment opportunities are summarized by changes in future macroeconomic growth rates. Based on this assumption, we assess whether the FF factors contain information on GDP growth rates in the Eurozone.

In a second step (Section 5.2), we disregard our GDP growth rates and consider instead default and term spreads as potential state variables that may help in forecasting investment opportunities.[2] We then test whether the FF factors may proxy for shocks to these yield spreads in Europe. Our motivation for this approach stems from Campbell (1996) and Petkova (2006), who commend that empirical implementations of the ICAPM demand factors that are related to *in-*

[1] Campbell (1996) notes that proxies for state variables of time-varying investment opportunities should be chosen on their ability to explain the cross-section of asset returns and their ability to forecast market returns.

[2] Both yield spreads are known to forecast aggregate stock market returns (see Fama and French, 1989, Keim and Stambaugh, 1986) and, hence, investment opportunities.

novations in state variables that help to forecast future investment opportunities. They, thus, propose to go directly to the state variables as financial investment opportunities are not exclusively related to news about future macroeconomic growth.

Albeit our primary objective is to examine the economic rationale of the FF factors, we also intend to provide further insights about European stock market integration. We suggest that if size and book-to-market may help to forecast pan-European investment opportunities, then this may indicate that European equity markets are integrated (cf. Section 2.4.2.1.2).

5.1 Method B.I: *SMB* & *HML* and Future Macroeconomic Growth

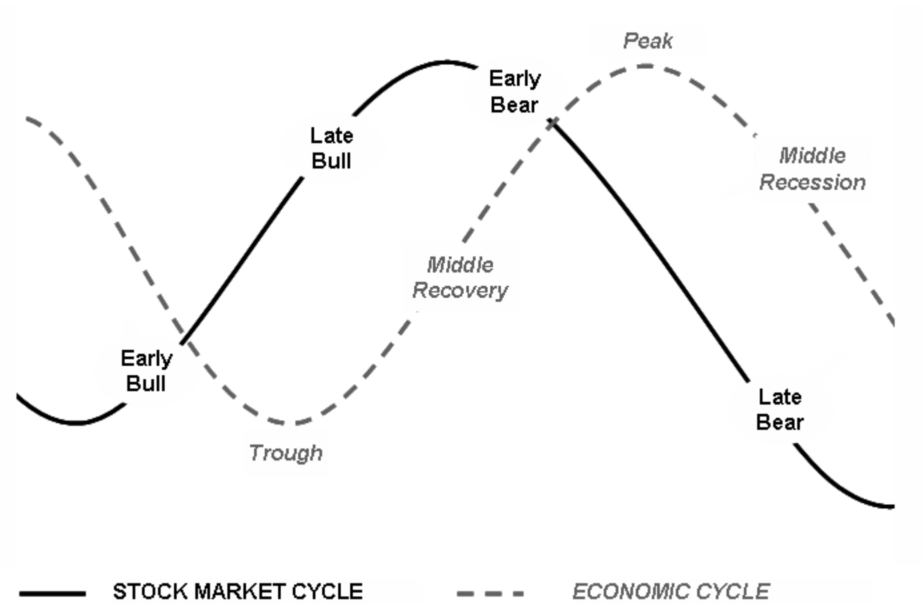
5.1.1 Introduction

The purpose of this section is to assess whether the FF factors may serve as proxies for state variables of time-varying investment opportunities. To approach this objective, we presuppose that changes in investment opportunities are summarized by changes in future macroeconomic growth. Based on this assumption, we study whether size and book-to-market help to forecast future growth in GDP across the Eurozone. If that is the case, then this may imply that size and book-to-market may serve as proxies for state variables of real economic activities. This, in turn, would provide some support for an economic link between the FF factors and systematic risk. Nonetheless, it is worthy to note from the outset that our focal point of interest lies merely in studying *whether* the FF factors may serve as proxies for any state variables. We, thus, do not yet intend to identify the precise nature of any potential state variables behind size and book-to-market and leave this for Section 5.2.

In order to link the FF factors with macroeconomic growth, we first of all follow a branch of literature that examines the relation between stock market returns and real economic activity.[3] Present empirical findings predominately

[3]cf. Aylward and Glen (2000), Barro (1990), Binswanger (2000a,b, 2004), Fama (1981, 1990), Fischer and Merton (1984), Geske and Roll (1983), Mullins and Wadhwani (1989), Schwert (1990), Wasserfallen (1989, 1990).

Figure 5.2: Stock Cycle Leading Economic Cycle - *Own Draft*



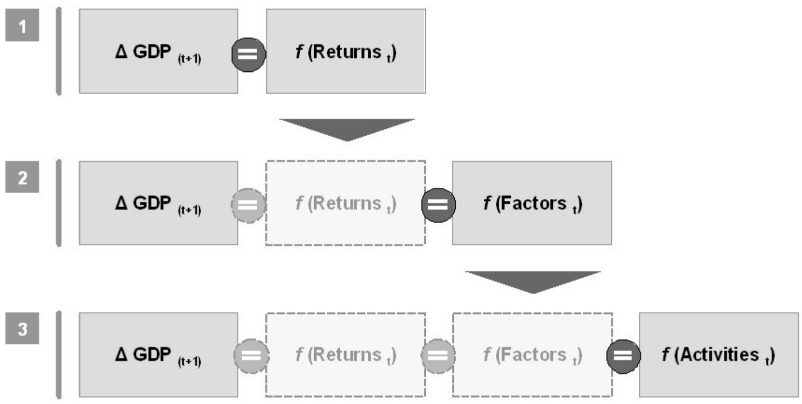
suggest that there exists a positive relationship between lagged stock market returns and real economic activity. This entails that stock market cycles tend to precede economic cycles. This is conceptually depicted in Figure 5.2.

For example, Barro (1990), Fama (1981, 1990), Geske and Roll (1983), and Schwert (1990) report that U.S. stock returns are positively related to an increase in future macroeconomic growth rates. Mullins and Wadhwani (1989) find a similar relation pattern for Germany and the United Kingdom. These findings are in line with Wahlroos and Berglund (1986) and Wasserfallen (1989, 1990), who identify a positive relation between stock market returns and future real economic activity for a variety of European countries. Further international evidence is provided by, amongst others, Aylward and Glen (2000), Binswanger (2000a,b, 2004), and Fischer and Merton (1984).

If lagged aggregate stock market returns serve as a prevailing indicator of macroeconomic growth, then this triggers the question whether other prominent risk factors may serve as such indicators as well, especially if these factors convey information on current economic activities.[4] This is illustrated in Figure 5.3.

[4]In the paradigm of the neo-classical Solow growth model (also known as the exogenous growth model) (see Solow, 1956), current economic activities condition future macroeconomic

Figure 5.3: GDP Growth, Equity Returns, Factors & Economic Activities - *Own Draft*



To the extent that the FF factors explain equity return behavior (cf. Section 2.2.1), we are interested in assessing whether size and book-to-market may contain incremental information on future macroeconomic growth as well. It is generally acknowledged that accounting ratios are supposed to convey growth expectations (see Cooper et al., 2008, Lakonishok et al., 1994, Schwert, 2003). In particular, they represent scaled prices with respect to the future.

A variety of studies has already aimed to link the 3FM to macroeconomic variables and business cycle variables in order to assess whether size and book-to-market are based on time-varying investment opportunities.[5] Heaton and Lucas (2000), as well as Perez-Quiros and Timmermann (2000), for instance, argue that

growth. In particular, the Solow model predicts firm convergence towards an optimal size and depicts the sensitivity of this desired size to technological growth. Hence, if agents have the objective to maximize profits, which would be reflected in an optimal firm size, then an economy that is comprised of homogeneous firms follows an equilibrium growth path, i.e., per firm and economic state there exists an optimal firm size. For instance, Lucas (1978) and Maksimovic and Phillips (2002) develop and test models that reveal how firms allocate their resources with changes in the business cycle and how they respond to industry shocks. Their findings imply that the growth, and therefore the size, of a firm is related to neo-classical theory. These results entail that risk factors that proxy for current economic affairs should contain information in regard to future macroeconomic growth as well.

[5]cf. Cooper et al. (2001), Fama and French (1996a), Ferson and Harvey (1999), Heaton and Lucas (2000), Hodrick and Zhang (2001), Lettau and Ludvigson (2001), Liew and Vassalou (2000), Perez-Quiros and Timmermann (2000), Vassalou (2003).

small firms tend to be more volatile during economic troughs due to investors' increased sensitivity to risk. Lettau and Ludvigson (2001), on the other hand, suggest that book-to-market is sensitive to bad news in bad times. This is in line with Fama and French (1996a), who remark that not seldom the market capitalization of a typical value firm is driven down severely by bad news, bringing the firm down to near financial distress.[6] However, they also denote that stocks bought on the edge of liquidation have strived more often than not. These comebacks usually result in above average returns.

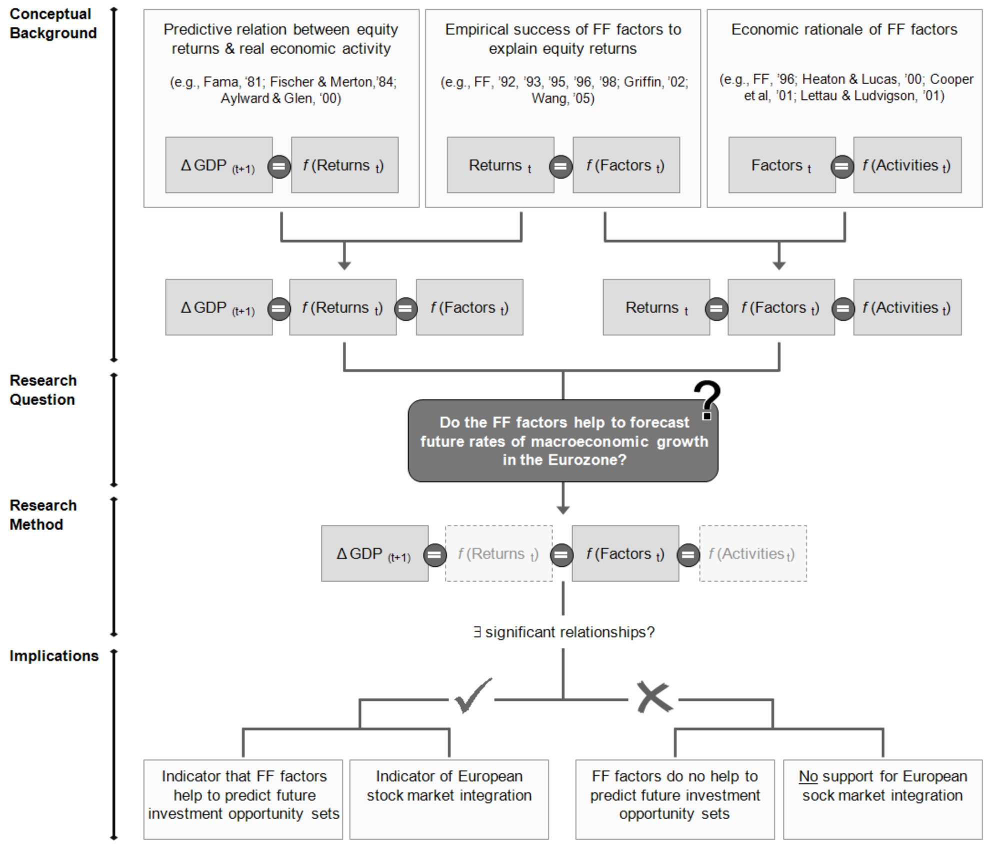
Ferson and Harvey (1999), as well as Vassalou (2003), provide empirical support that an incorporation of macroeconomic variables reduces the information content of the book-to-market effect. Yet, Cooper et al. (2001) remark that macroeconomic variables combined with the FF factors allow for an enhanced predictability of expected returns. They trace this back to the premise that time variation in size and book-to-market is linked to variations in aggregate, macroeconomic, non-diversifiable risk. In yet another study, Liew and Vassalou (2000) document that *HML* and *SMB* help to forecast future GDP growth rates in various countries.[7] They eventually conclude that the FF factors are consistent with an ICAPM explanation to asset pricing.

In line with Liew and Vassalou (2000), we test whether the FF factors help to forecast future GDP growth in individual European countries and the Eurozone as a whole. This may be seen as a further response to the criticism of Black (1995), Cochrane (2005), and Fama (1998), who remark that the ICAPM should not serve as a 'fishing license' for choosing factors that have high explanatory power but intrinsically lack the ability to forecast future investment opportunities. In addition, we suggest that in case the FF factors contain information on common macroeconomic growth in the Eurozone, then this may serves as an indicator of European stock market integration, given that future changes in European

[6]'Value' firms are considered companies that have high book-to-market ratios; on the other hand, 'growth' firms are companies with low book-to-market ratios.

[7]For instance, focusing on the time period 1978 to 1996 (with varying time frames per country) and using bivariate regressions that include the market factor and either *HML* or *SMB* at a time, Liew and Vassalou (2000) find that *HML* has a statistically significant coefficient in France, Germany, Italy, the Netherlands, Switzerland, the United Kingdom, and the United States. The factor loading of *SMB* is significant in Australia, Canada, France, Germany, Italy, the Netherlands, Switzerland, and the United Kingdom.

Figure 5.4: FF Factors & GDP Growth - *Own Draft*



investment opportunity sets may be explained by common pan-European factors.[8] This puts the methodology proposed by Liew and Vassalou (2000) in a new context. Figure 5.4 provides a brief illustration of this thought and approach.

We extend this view and augment our analysis by European industries. This is important for a variety of reasons. For one, recent empirical findings suggest that industry characteristics have become more important relative to country factors in explaining equity returns throughout Europe.[9] The rationale behind

[8]This argument presupposes that the FF factors are attributes that contain incremental information for pricing assets in the Eurozone - see also Section 4 for the general pricing ability of the 3FM in a European setting.

[9]cf. Baca et al. (2000), Brooks and Catao (2000), Campa and Fernandes (2006), Cavaglia et al. (2000), Cavaglia and Moroz (2002), Diermeier and Solnik (2001), Ferreira and Gama

the increasing importance of industry factors relative to country attributes may lie within the progression of the European Economic and Monetary Union (EMU) and especially the advent of the euro in 1999 and has been thoroughly discussed in Section 2.3.

For two, it is likely that stocks that belong to different industries differ in their book-to-market ratios, size, and momentum characteristics. Put differently, by going e.g., long on high book-to-market stocks and short on low book-to-market firms, a *HML* portfolio may contain significantly more stocks of one specific industry than of another. This entails that the returns to *HML* and *SMB* may be biased towards individual industries. Thence, it appears reasonable to classify stocks not only per country but also by industry, even if studies of Fama and French (1997), Moerman (2005), and Van Vliet and Post (2004) imply that industry portfolios are difficult to price using the conventional CAPM or the 3FM.[10]

For three, Berman and Pfleeger (1997), Gourio (2006), and Hornstein (2000) argue that some industries are more sensitive to business cycle swings than others. While some industries are very vulnerable to economic movements, others are relatively immune to them. Especially for industries classified as cyclical (e.g., *automobiles and parts*, *household goods and textiles*, *general retailers*, *leisure and hotels*, and *transport*), the degree and timing of these fluctuations vary widely. On the other hand, industries that experience only modest gains during expansionary periods (e.g., *personal care and household products*, *health*, *tobacco*, and *food and drug retailers*) may also suffer only mildly during contractions.[11] Thence, GDP growth depends not only on aggregate but also specific industry output, given that some industries have higher correlations with real economic output and development than others.

For four, the GDP growth for the Eurozone is significantly driven by the macroeconomic growth in Germany and France, the two biggest economies in

(2005), Flavin (2004), Isakov and Sonney (2004), L'Her et al. (2002), Moerman (2008), Taing and Worthington (2005), Urias et al. (1998), Wang et al. (2003).

[10]In an earlier draft of this paper, Liew and Vassalou (1999) classify their stocks into different industry groups, in order to test whether in all three portfolios (i.e., *HML*, *SMB*, and *WML*) one specific industry seems to be fairly represented in one market as reflected by the number of stocks included in each portfolio. They argue that it is unlikely that the returns to the *HML*, *SMB*, and *WML* portfolios are due to industry characteristics.

[11]cf. Table A.1 (page 259 in Appendix A for an overview of our industry classification.

this region. In other words, the relative proportions of Germany's and France's GDP in the common Eurozone GDP is considerably bigger than the proportion of Luxembourg's or Belgium's GDP. Hence, if the economies of Germany and France are booming, then this has presumably a higher impact on GDP growth in the Eurozone than as if the economies of Luxembourg and Belgian are doing markedly well. Therefore, if we solely considered a pan-Eurozone model, then our findings would presumably be biased towards Germany and France. Relating future GDP growth in the Eurozone to individual industries may presumably allow to reduce, though not eliminate, this problem.[12]

Finally, although our main focus lies on *HML* and *SMB*, we also consider in line with Liew and Vassalou (2000) momentum, i.e., *WML*, as an alternative factor.[13]Carhart (1997) shows that momentum is able to capture information that is neither explained by size nor book-to-market. Although, Cochrane (2005) suggests that momentum is a 'performance attribute' rather than a real risk factor in context of Merton's ICAPM, Gonsell and Nejadmalayeri (2008) try to add economic meaning to momentum. They document that the return to momentum is significantly related to shocks in producers' inflation, unemployment, and consumer confidence. They also show that durable goods' consumption, unemployment, economic outlook, productivity, and business activities are pertinent determinants of momentum factor's volatility.

The rest of this section is structured as follows. We first provide an overview of our data to be employed. We then briefly summarize the relation between our risk factors and different states of the macroeconomy. In the last two steps, we present our methods and results for assessing whether the FF factors, and momentum, contain information on future macroeconomic growth in the Eurozone, i.e., at country, industry, and region level.

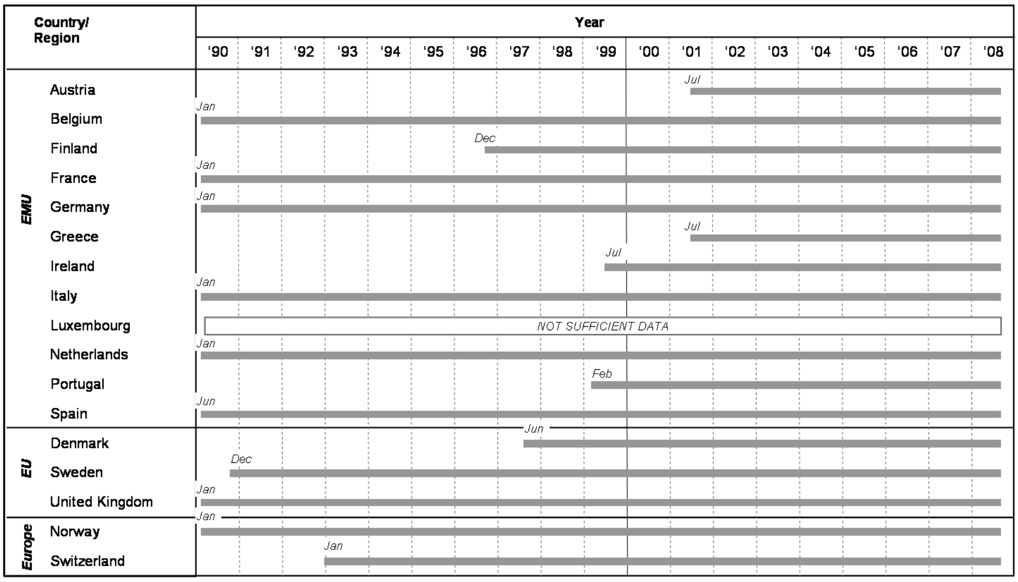
5.1.2 Macroeconomic Data & Descriptives

To conduct our analyses, we rely on our monthly FF and momentum factors introduced in Section 3 and use as measure for macroeconomic growth nomi-

[12]Note that some industries in our sample are also biased towards individual countries. Table 5.1 on page 174 portrays the distribution of our sample data per country and industry.

[13]Momentum makes a tiny autocorrelation of high-returns significant by forming portfolios of extreme winners and losers.

Figure 5.5: Adjusted Sample Period per Country/Region - *Source: Datastream, OECD*



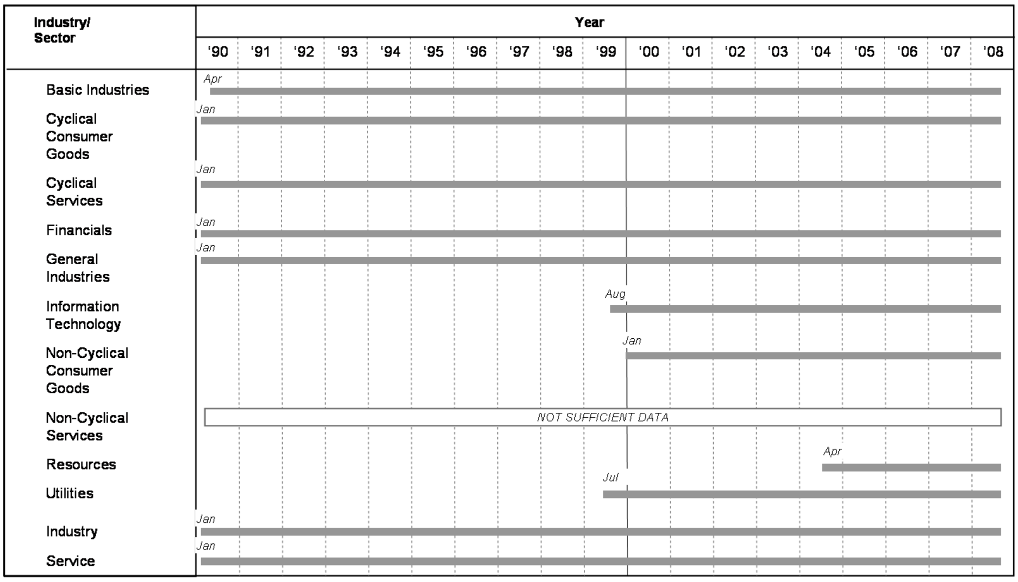
nal Gross Domestic Product (GDP) growth figures from the Organization for Economic Co-Operation and Development (OECD) data warehouse. The GDP growth rates are derived per quarter, per semi-annum, and per annum for the time period January 1990 to April 2008 per country and for the Eurozone (i.e., the common euro area of the 12 countries under consideration).[14]

In order to match the time frame and frequency of the GDP growth rates and our monthly FF and momentum factors, we make corresponding adjustments to our risk factors.[15] If our overall firm data sample of Section 3.2 does not comprise data for one country or industry as of January 1990, we focus our analyses on the time frame for which data are actually available. The reduced dataset per country and industry are depicted in Figures 5.5 and 5.6, respectively. Table 5.1

[14]We only consider the euro area of the 12 EMU (Eurozone) member states as of January 2006, i.e., Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, and Spain. We do not include the EMU member states Cyprus, Malta (both as of January 2008), and Slovenia (as of January 2007) in our analyses, simply due to limitations of data availability and a potential lack of market integration.

[15]Note again that we thereby disregard once more some data from our total sample (cf. Section 3.2) for the countries: Belgium, France, Germany, Italy, the Netherlands, Spain, the United Kingdom, and Norway as well as for the industries: *cyclical consumer goods, cyclical services, financials, general industries, industry (aggregated)*, and *service (aggregated)*.

Figure 5.6: Adjusted Sample Period per Industry - *Source: Datastream, OECD*



provides an adjusted version of the joint distribution of the average number of stocks per country and industry.[16]

Prior to concatenating the risk factors with future GDP growth, we briefly study the characteristics of the different GDP growth rates per country and the common Eurozone. First of all, we are interested in the general mean and median GDP growth rates to determine any potential differences in the macroeconomic growth rates of individual European countries. Then, as for the risk factors, we also want our dependent variables to be level stationary to obtain interpretable and meaningful results. To test for unit roots, we once more employ the Augmented Dickey-Fuller (ADF) test statistic (see Dickey and Fuller, 1979, Said and Dickey, 1984), given a constant and setting the lag p equal to 1. Next to level stationarity, we are also interested in whether our variables show a Gaussian-normal behavior. We test for normality by taking a look at the third and fourth central moments (i.e., skewness and kurtosis) of the GDP growth rates and by employing the Jarque-Bera test statistic (Jarque and Bera, 1980, 1981) as a goodness-of-fit measure. Table 5.2 presents the summary statistics for nominal GDP growth

[16] A more detailed overview of the number of stocks per country and industry can be found in Tables D.3 and D.4 in Appendix D (pages 396-397).

Table 5.1: Number of Stocks per Country, Region, and Industry - Average Jan. 1990 to Apr. 2008

This table reports the average number of stocks available per country/industry for the period from January 1990 to April 2008. The countries are clustered along three dimensions. The first group comprises those countries that belong to the Eurozone. The second cluster represents countries of the European Union that do not belong to the Eurozone. The last cluster contains European countries that neither belong to the Eurozone nor the European Union. Note that the total averages stated per country and industry might differ from the ones stated in Tables D.3 to D.4 in Appendix D. This is due to the varying sample periods per country/industry that we consider for the individual country/industry analysis (cf. Figure 5.5 and 5.6).

BAS = *basic industries*; CGD = *cyclical consumer goods*; CSER = *cyclical services*; TOLF = *financials*; GN = *general industries*; ITECH = *information technology*; NCGD = *non-cycical consumer goods*; NCSR = *non-cycical services*; RES = *resources*; UTL = *utilities.*

	BAS	CGD	CSER	TOLF	GN	ITECH	NCGD	NCSR	RES	UTL	Total	Industry	Service	Total
Austria	3	2	1	11	8	0	0	0	1	2	30	17	13	30
Belgium	5	8	4	18	9	2	6	1	1	2	55	32	23	55
Finland	7	3	6	3	13	2	2	0	0	1	37	27	10	37
France	4	27	27	40	36	13	14	3	6	8	178	108	70	178
Germany	13	28	14	41	41	7	11	1	3	9	169	113	57	169
Greece	2	5	2	12	7	0	1	1	1	1	32	17	15	32
Ireland	2	8	4	6	7	2	2	0	3	0	32	22	10	32
Italy	3	13	8	36	24	3	2	2	2	5	98	53	45	98
Luxembourg	2	6	3	13	1	0	0	0	1	3	27	11	16	27
Netherlands	5	9	13	21	31	10	3	0	2	0	93	59	34	93
Portugal	5	3	6	5	10	1	1	1	0	2	34	21	13	34
Spain	7	12	4	22	18	3	3	1	2	7	79	52	28	79
Denmark	0	7	0	13	11	0	7	0	1	1	39	26	13	39
Sweden	4	4	5	16	17	2	2	1	0	0	53	30	22	53
United Kingdom	14	30	64	140	92	14	10	5	12	6	388	180	208	388
Norway	2	2	1	3	10	1	0	0	7	2	29	24	4	29
Switzerland	7	9	6	30	22	4	11	1	1	6	97	60	37	97
Eurozone	58	124	93	228	205	42	44	11	22	37	865	532	332	865
European Union	76	164	162	397	326	59	63	17	36	45	1344	769	575	1344
Europe	85	177	172	436	363	66	74	17	43	54	1486	860	625	1486

rates per county and the Eurozone. Corresponding histograms and time plots of growth rates are depicted, respectively, in Figures D.1 and D.2 in Appendix D (pages 398-401).

The statistics presented in the fifth to seventh column of Table 5.2 reveal that most of the GDP growth rates tend to be normally distributed.[17] When considering the Jarque-Bera test statistic, we only reject the null hypothesis that our GDP growth rates are normally distributed for all frequencies (i.e., for quarterly, semi-annually, and annually growth rates) for France, Germany, and the United Kingdom. Interestingly, these three countries represent the three biggest economies in Europe. For Spain, we find non-normal patterns for the quarterly and semi-annual growth rates, which leads us to reject the null hypothesis of normality at the 1% significance level. There are also some minor deviations from normality in case of Finland, Italy, Norway, and the Eurozone. Yet, neither the kurtosis nor the skewness figures presented here show as high extremes as earlier (Section 3.4) found for the market risk factors, *HML*, *SMB*, and *WML*. Most likely the use of a longer time period would prove to result in more normal patterns.

Next to showing a mainly normal behavior, most of the GDP growth rates also appear to be level stationary, i.e., they do not exhibit any unit roots. The Augmented Dickey-Fuller (ADF) test statistic depicted in the last column of Table 5.2 let us reject the null hypothesis of level stationarity only in Austria, and in some more noteworthy cases, in Finland, Ireland, and Portugal.[18] For all other countries, GDP growth rates, especially quarterly rates, appear to follow a stationary process. Hence, with a few exceptions, our GDP growth rates seem to be suitable to apply them in linear regression analyses.

[17] Tables D.1 and D.2 in Appendix D (pages 393-395) depict the summary statistics for the risk factors, i.e., *MRF*, *HML*, *SMB*, and *WML*, over the time period January 1990 to April 2008 per country and industry (Eurozone). We again consider annually rebalanced portfolios as ingredients for the risk factors. As the statistics do not differ extremely from those presented in Section 3.4, we focus our discussion on the descriptives of the GDP growth rates. In addition, multicollinearity analyses among the risk factors has also shown that there is no linear relation among them. This is again based on a variance inflation factor (VIF) approach with the critical benchmark set to 10 (see Wooldridge, 2000). The results are not presented here, given space constraints and the fact that they are analogous to our previous findings.

[18] In fact, we reject the null hypothesis of level stationarity in at least one case for all countries but Germany and the Eurozone. Yet, in most of the cases, level stationarity seems to be present.

Table 5.2: GDP Growth Rate Descriptives per Country & Eurozone

This table reports annualized descriptive statistics for the nominal GDP growth per country and the Eurozone. The countries are clustered along three dimensions. The first group comprises those countries that belong to the Eurozone. The second cluster represents countries of the European Union that do not belong to the Eurozone. The last cluster contains European countries that neither belong to the Eurozone nor the European Union. For each country, we report in the first row the annualized quarterly GDP growth rate, in the second row the annualized semi-annually growth rate, and in the third row the annual growth rate. *, **, *** used for the Jarque-Bera (JB) test and for the Augmented Dickey Fuller (ADF) test denote, respectively, significance at the 10%, 5%, and 1% significance level.

	Mean (%)	Median (%)	Std. (%)	Skweness	Kurtosis	Jarque-Bera	ADF
Austria							
Quarter	4.02%	4.35%	0.79%	-0.103	1.717	2.201	-2.344
Semi-Annual	3.93%	4.13%	1.11%	-0.170	1.744	2.199	-1.906
Annual	3.83%	4.05%	1.39%	-0.034	1.419	3.093	-1.744
Belgium							
Quarter	3.93%	4.52%	1.13%	-0.703	3.200	3.889	-3.739***
Semi-Annual	3.94%	4.50%	1.20%	-0.414	2.260	2.726	-4.287***
Annual	3.95%	4.26%	1.37%	-0.292	2.008	2.893	-3.489**
Finland							
Quarter	5.52%	5.88%	1.71%	-0.952	4.256	8.273**	-2.885*
Semi-Annual	5.51%	5.38%	2.00%	-0.328	2.564	1.293	-3.203**
Annual	5.47%	5.68%	2.46%	0.063	2.157	1.648	-2.359
France							
Quarter	5.39%	4.69%	1.73%	1.233	5.025	43.433***	-3.653***
Semi-Annual	5.43%	4.63%	2.35%	1.323	5.076	48.307***	-3.774***
Annual	5.51%	4.45%	3.31%	1.336	4.648	42.201***	-2.793**
Germany							
Quarter	3.00%	2.90%	1.40%	1.010	5.497	26.104***	-5.711***
Semi-Annual	2.96%	2.58%	1.46%	0.907	5.715	26.439***	-5.981***
Annual	2.91%	2.48%	1.66%	1.158	4.223	16.821***	-3.948***
Greece							
Quarter	7.64%	7.61%	1.13%	0.967	5.343	7.303**	-3.921***
Semi-Annual	7.69%	7.78%	0.94%	0.398	2.721	0.836	-3.784***
Annual	7.71%	7.77%	0.78%	-0.182	2.198	1.111	-1.899
Ireland							
Quarter	8.55%	8.44%	5.14%	0.090	2.164	1.323	-3.310**
Semi-Annual	9.21%	9.59%	4.07%	0.161	4.232	1.448	-2.611*
Annual	9.88%	9.07%	4.39%	0.808	3.602	3.479	-2.427
Italy							
Quarter	5.40%	5.22%	1.65%	0.137	2.378	1.749	-3.459**
Semi-Annual	5.46%	4.56%	2.02%	0.505	2.337	4.888*	-3.576***
Annual	5.57%	4.66%	2.73%	0.723	2.241	8.692**	-2.669*
Netherlands							
Quarter	5.07%	4.99%	1.21%	0.312	3.272	1.370	-4.266***
Semi-Annual	5.05%	5.12%	1.32%	0.165	2.450	1.590	-3.739**
Annual	5.07%	5.14%	1.62%	0.145	2.605	0.974	-2.397
Portugal							
Quarter	4.65%	4.81%	1.47%	0.011	1.972	1.894	-2.878*
Semi-Annual	4.63%	4.66%	1.27%	-0.210	3.443	0.326	-2.895*
Annual	4.75%	4.56%	1.59%	0.144	2.406	0.886	-1.677
Spain							
Quarter	7.29%	7.62%	1.24%	-0.139	13.555	213.862***	-6.223***
Semi-Annual	7.31%	7.45%	1.05%	0.416	7.995	46.951**	-6.388***
Annual	7.37%	7.39%	0.89%	-0.539	3.226	2.196	-2.492
Denmark							
Quarter	4.15%	4.37%	2.43%	0.379	3.044	0.954	-5.549***
Semi-Annual	4.23%	4.04%	1.99%	0.224	2.073	2.163	-4.492***
Annual	4.23%	4.08%	1.85%	-0.217	2.242	1.611	-2.678*
Sweden							
Quarter	4.94%	5.45%	1.49%	-1.032	4.484	14.310***	-4.182***
Semi-Annual	4.92%	5.27%	1.46%	-0.267	2.894	0.755	-3.973***
Annual	4.91%	4.63%	1.69%	-0.105	3.229	0.128	-2.643*
United Kingdom							
Quarter	6.78%	6.43%	1.49%	0.558	3.462	6.171**	-4.654***
Semi-Annual	6.81%	6.43%	1.69%	0.661	3.155	7.692**	-4.062***
Annual	6.88%	6.19%	2.18%	0.698	2.490	9.913***	-2.184
Norway							
Quarter	6.88%	5.54%	4.70%	0.252	3.232	0.890	-5.156***
Semi-Annual	6.85%	6.42%	4.53%	0.571	3.737	5.572*	-4.792***
Annual	6.83%	6.46%	5.13%	0.706	4.026	9.254***	-3.110**
Switzerland							
Quarter	2.60%	2.54%	1.28%	0.250	3.433	0.850	-4.017***
Semi-Annual	2.56%	2.63%	1.48%	0.520	3.517	2.977	-4.317***
Annual	2.47%	2.13%	1.66%	0.351	1.991	4.055	-2.875*
Eurozone							
Quarter	5.17%	4.96%	1.11%	0.160	3.008	0.443	-4.197***
Semi-Annual	5.21%	4.88%	1.40%	0.433	3.527	4.073	-4.227***
Annual	5.26%	5.03%	1.87%	0.497	3.404	4.662*	-3.673***

Finally, among all countries under consideration, Germany shows, next to Switzerland, the lowest average nominal GDP growth with about 3% per annum. While, the low average GDP growth of Germany may be traced back to the country's economic burden of reunification, the low average numbers for Switzerland reflect the country's slow growth throught the 1990s. Especially the recession of the 1990s was more pronounced in Switzerland than in the OECD average (see Giorno et al., 2007). Other countries, such as Greece (∼7.7% p.a.), Ireland (between ∼9.5% p.a.), and Spain (∼7.3% p.a.), show, on the other hand, fairly high nominal growth rates. This reflects the economic booms in these states over the last decade, partly thanks to the successful local implementation of European policies and transfer payments.[19]

5.1.3 Relation Between Risk Factors & Macroeconomy

To link the returns of *HML*, *SMB*, and *WML* to the macroeconomy, we follow a twofold approach. We first associate next year's annual growth in GDP with past year's annual return to *HML*, *SMB*, and *WML* to identify whether the returns to our factors are positively or negatively related to future real economic growth (cf. Section 5.1.3.1). We then employ formal regression analyses to assess whether future growth in GDP may be explained by the current return to the FF factors and momentum (cf. Section 5.1.3.2).

5.1.3.1 Factor Returns at Different States of the Economy

In order to test for the sign dependency between our factor returns and future growth in the macroeconomy, we associate next year's annual growth in GDP with past year's annual return to *HML*, *SMB*, and *WML*.[20] This is in line with Liew and Vassalou (2000). In particular, given quarterly GDP observations, we construct a matrix of the form

[19]To obtain a more precise perspective, the nominal growth figures should be adjusted for inflation to obtain real GDP growth numbers.

[20]Please note that we employ annually rebalanced portfolios to obtain our risk factors (cf. Section 3.3 for details).

Quarter t	:	$\Delta GDP_{t,t+4}$	$HML_{t-4,t}$	$SMB_{t-4,t}$	$WML_{t-4,t}$
Quarter $t-1$	:	$\Delta GDP_{t-1,t+3}$	$HML_{t-5,t-1}$	$SMB_{t-5,t-1}$	$WML_{t-5,t-1}$
Quarter $t-2$	:	$\Delta GDP_{t-2,t+2}$	$HML_{t-6,t-2}$	$SMB_{t-6,t-2}$	$WML_{t-6,t-2}$
Quarter $t-3$	:	$\Delta GDP_{t-3,t+1}$	$HML_{t-7,t-3}$	$SMB_{t-7,t-3}$	...
Quarter $t-4$	:	$\Delta GDP_{t-4,t}$	$HML_{t-8,t-4}$	...	...
Quarter $t-5$	:	$\Delta GDP_{t-5,t-1}$	...	...	...
Quarter $t-6$	:	...	...	...	...
⋮					

where ΔGDP denotes the growth in GDP. We then sort this matrix by ΔGDP from the highest to lowest and define as 'good states' of the economy those states that exhibit the highest 33.33% future GDP growth rate per country and the Eurozone. 'Bad states' are those states that exhibit the lowest 33.33% future GDP growth. The remaining third is classified as 'mid state'.[21] A positive relation would exist, if high returns to *HML*, *SMB*, and *WML* are associated with good future states of the economy. This would suggest that high book-to-market, small capitalization, and past winner stocks are more likely to prosper than low book-to-market, big capitalization, and past loser stocks when high growth periods in the economy are anticipated.

The findings per country and the Eurozone are portrayed in Table 5.3. The presented Δ depicts the difference between the 'good states' and the 'bad states' of the respective economies. T-values are computed for this difference.[22] The figures reveal some noteworthy insights. First, the bottom line of the table indicates that the returns to *HML*, *SMB*, and *WML* appear to be positively related to future growth in the macroeconomy of the Eurozone. High factor returns precede periods of high GDP growth and low factor returns are associated with small future growth in GDP. The difference in returns between good and bad states of the economy is positive for all factor returns, but only significant for *SMB*.

The noticed positive relation between *SMB* and future GDP growth appears plausible as investors prefer holding stocks whose returns are relatively high when they realize that the economy is weak. They thus hold big capitalization stocks

[21]In this respect our study differs from the one of Liew and Vassalou (2000) as the latter do not include a medium state and classify 'good' ('bad') states as those that exhibit the highest (lowest) 25% of future GDP growth.

[22]The T-statistic is computed by dividing the difference between the returns on the 'good states' and 'bad states' by the quotient of the standard deviation of the returns over the square root of the number of observations. More formally: $[R_{GS} - R_{BS}]/[\sigma/\sqrt{n}]$.

Table 5.3: Performance of Risk Factors at Different States of the Economy per Country

The results are based on annually rebalanced HML, SMB, and WML portfolios using quarterly observations. HML is the annual return on a portfolio that is long on high book-to-market stocks and short on low book-to-market securities, holding size and momentum characteristics of the portfolio constant. SMB is the annual return on a portfolio that is long on small capitalization stocks and short on big capitalization securities, holding book-to-market and momentum characteristics of the portfolio constant. WML is the annual return on a portfolio that is long on the best performinbg stocks of the past year ('winners') and short on the worst performing securities of the previous year ('losers') holding book-to-market and size characteristics of the portfolio constant. The GDP growth rate is calculated as the continuously compounded rate in a country's Gross Domestic Product, which is seasonally adjusted. We define as 'good states' of the economy those states that exhibit the highest 33.33% future GDP growth rate in the individual countries/the Eurozone. 'Bad states' are those states that exhibit the lowest 33.33% future GDP growth. The remaining third is classified as 'mid state'. The presented Δ depicts the difference between the 'good states' and the 'bad states' of the respective economies. T-values are computed for this difference.

Country	Past year return on factor sorted by future GDP growth														
	HML					SMB					WML				
	Good State (%)	Mid State (%)	Bad State (%)	Δ Go./Bad (%)	T-value	Good State (%)	Mid State (%)	Bad State (%)	Δ Go./Bad (%)	T-value	Good State (%)	Mid State (%)	Bad State (%)	Δ Go./Bad (%)	T-value
Austria	19.89	19.90	2.34	17.55	3.54	9.90	21.39	5.02	4.88	1.09	4.48	5.86	1.38	3.10	1.21
Belgium	1.39	10.03	5.35	-3.95	-2.20	15.23	4.71	5.74	9.49	4.79	14.21	2.86	-1.00	15.21	7.13
Finland	20.52	38.88	21.98	-1.46	-0.15	32.46	46.19	11.92	20.54	2.04	0.94	2.01	-5.92	6.86	4.26
France	6.21	5.77	5.47	0.74	0.45	10.90	9.46	5.57	5.32	2.81	3.77	1.82	3.80	-0.03	-0.03
Germany	1.56	6.67	18.09	-16.53	-7.37	5.75	6.35	19.00	-13.25	-4.27	2.85	6.44	5.36	-2.51	-2.30
Greece	4.63	15.19	-6.60	11.24	2.27	4.45	2.25	-14.08	18.53	5.20	-6.01	-6.78	6.78	-12.79	-3.06
Ireland	8.95	46.15	29.95	-21.00	-3.05	7.45	23.69	-10.74	18.19	2.60	-8.59	-10.06	-1.83	-6.76	-1.12
Italy	7.55	-3.72	9.29	-1.74	-1.09	8.93	7.32	0.85	8.07	4.19	1.86	3.81	3.58	-1.73	-1.32
Netherlands	1.71	4.23	9.88	-8.17	-4.12	9.35	11.00	-1.13	10.48	4.97	3.39	6.29	-1.23	4.62	2.99
Portugal	22.55	15.79	6.13	16.41	2.67	19.04	13.84	-2.25	21.29	2.95	-10.21	-5.25	-1.28	-8.94	-3.33
Spain	9.69	15.32	8.72	0.97	0.38	13.52	10.96	17.04	-3.52	-0.86	-1.91	4.14	-9.75	7.84	2.62
Denmark	10.42	7.83	29.40	-18.98	-5.79	22.87	22.31	6.17	16.69	3.80	-1.52	2.20	0.22	-1.74	-0.60
Sweden	25.69	7.59	6.30	19.40	3.51	3.47	10.33	12.07	-8.60	-2.76	-12.63	4.12	-4.76	-7.88	-2.57
UK	6.52	6.43	3.50	3.03	2.64	5.89	7.58	14.62	-8.73	-4.67	3.49	3.83	-3.25	6.74	5.46
Norway	9.84	7.33	-0.71	10.55	4.75	6.26	0.32	2.56	3.70	1.64	0.38	3.10	6.04	-5.67	-2.59
Switzerland	17.73	24.93	3.51	14.23	3.19	13.85	19.24	6.09	7.75	1.98	3.70	-12.25	-2.07	5.77	1.92
Eurozone	6.81	7.17	6.36	0.45	0.45	19.37	9.48	3.20	16.17	10.94	3.73	5.16	2.73	0.99	0.92

with promising growth opportunities and low debt ratios (Liew and Vassalou, 2000). Heaton and Lucas (2000) and Perez-Quiros and Timmermann (2000) also suggest that returns to small firms are more volatile during economic recessions than peaks. This is due to the increased sensitivity of investors towards risk. In other words, small firms appear to be extremely sensitive to economic swings, e.g., due to liquidity constraints and a lack of diversification.

Second, our findings for *SMB* are underpinned when shifting our view from the regional to the country level. The findings in Table 5.3 convey that there also exists a positive relation between *SMB* and future growth in GDP at country level. The difference in factor returns between good and bad states of the economy is positive in 12 out of 16 countries. In 10 cases the difference in returns is statistically significant. On the other hand, our results for *HML* and *WML* are considerably weaker and less consistent across countries. We find that *HML* produces a positive difference in only 9 countries, of which 7 are significant, while *WML* shows a positive difference in only 7 countries, of which 6 are significant.

Interestingly, for Germany we find a negative difference for all factor returns between good and bad states of the economy. A potential explanation may be the burden of reunification that Germany's economy has to face. While Western Germany's stock market has not necessarily been negatively affected with the fall of the Berlin Wall, Germany's overall economic growth flattened considerably ever since the reunification. In fact, the fall of the Berlin Wall increased Germany's population by a quarter, its territory by two-fifths, but its economy only by a tenth. Thus, while Germany's publicly listed stocks, especially the big and established firms of the West may have prospered from reunification, given an enhanced access to customers and wider market opportunities and exports, Germany's overall economic growth slowed down due to the poor economic conditions of former Eastern Germany.[23]

Further empirical findings for the relation between the risk factors and the state of the macroeconomy is presented in Table 5.4, which depicts the link of our industry factors and future GDP growth in the Eurozone. As outlined in Section 5.1.1, we account for different industries to capture (i) the relative importance of industry factors vis-à-vis country factors for the explanation of equity returns, (ii)

[23] A potential approach to account for this may be the implementation of a dummy approach that separates the sample into a pre- and post-reunification period.

Table 5.4: Performance of Risk Factors at Different States of the Economy per Industry

The results are based on annually rebalanced HML, SMB, and WML portfolios using quarterly observations. HML is the annual return on a portfolio that is long on high book-to-market stocks and short on low book-to-market securities, holding size and momentum characteristics of the portfolio constant. SMB is the annual return on a portfolio that is long on small capitalization stocks and short on big capitalization securities, holding book-to-market and momentum characteristics of the portfolio constant. WML is the annual return on a portfolio that is long on the best performinbg stocks of the past year ('winners') and short on the worst performing securities of the previous year ('losers') holding book-to-market and size characteristics of the portfolio constant. The GDP growth rate is calculated as the continuously compounded rate in the Eurozone's Gross Domestic Product, which is seasonally adjusted. We define as 'good states' of the economy those states that exhibit the highest 33.33% future GDP growth rate in the individual industries. 'Bad states' are those states that exhibit the lowest 33.33% future GDP growth. The remaining third is classified as 'mid state'. The presented Δ depicts the difference between the 'good states' and the 'bad states' of the respective economies. T-values are computed for this difference.

BAS = *basic industries*; CGD = *cyclical consumer goods*; CSER = *cyclical services*; TOLF = *financials*; GN = *general industries*; ITECH = *information technology*; NCGD = *non-cycical consumer goods*; RES = *resources*; UTL = *utilities.*

Industry	Past year return on factor sorted by future GDP growth														
	HML					SMB					WML				
	Good State (%)	Mid State (%)	Bad State (%)	Δ Go./Bad (%)	T-value	Good State (%)	Mid State (%)	Bad State (%)	Δ Go./Bad (%)	T-value	Good State (%)	Mid State (%)	Bad State (%)	Δ Go./Bad (%)	T-value
BAS	19.86	7.44	5.55	14.31	6.18	-2.48	5.30	-1.06	-1.42	-0.54	-1.31	2.54	-3.06	1.75	0.99
CGD	7.46	7.73	8.02	-0.56	-0.37	10.81	6.69	-3.08	13.89	7.90	4.17	6.12	1.69	2.48	2.43
CSER	5.88	7.08	6.02	-0.14	-0.08	14.59	14.54	10.57	4.03	2.16	6.47	-1.04	0.61	5.86	3.82
TOLF	10.24	8.87	7.49	2.75	1.82	14.21	6.86	2.59	11.63	8.25	-2.31	5.32	3.12	-5.43	-4.13
GN	15.93	9.59	5.22	10.71	7.05	22.46	8.70	7.91	14.55	7.02	-0.92	4.72	1.35	-2.27	-1.09
ITECH	25.88	33.99	15.80	10.08	1.22	22.50	21.71	3.59	18.91	4.25	-7.94	-13.92	-7.40	-0.54	-0.12
NCGD	-2.00	20.44	23.56	-25.57	-6.94	29.27	4.18	6.42	22.84	4.20	9.88	1.04	6.39	3.49	0.69
RES	38.66	25.34	61.08	-22.42	-1.37	35.75	59.27	158.38	-122.63	-5.51	24.65	36.70	-21.53	46.18	2.65
UTL	-3.61	3.80	8.82	-12.43	-4.87	21.66	9.00	10.57	11.09	3.50	-3.53	2.08	5.39	-8.92	-4.16
Industry	7.98	6.53	5.18	2.80	2.32	15.98	10.42	3.40	12.58	7.90	3.01	3.59	2.41	0.59	0.49
Service	8.70	6.61	3.56	5.14	4.36	14.14	8.33	3.56	10.59	7.80	-0.91	3.76	2.12	-3.04	-2.63

the diverse book-to-market, size, and momentum characteristics of stocks from different industries, (iii) the degree to which individual industries are sensitive to the general business cycle, and (iv) the fact that common GDP growth in the Eurozone is significantly influenced by the macroeconomic growth in Germany and France.

Overall, we find a robust positive and significant relation between *SMB* and future growth in real economic activities for 9 out of 11 industries. As for our country results, we do not find a clear pattern for the relation between *HML* and *WML* and future growth in GDP. In particular, we observe that the difference between good and bad states of the economy and both *HML* and *WML* returns is positive in only 6 out of 11 industries. In several cases, the difference is statistically significant. Hence, little can be inferred from these results in regard to the relation between future growth in GDP and either *HML* or *WML*.

A potential explanation for the unclear pattern for *WML* may be found in Cochrane (2005) and Haugen (1999). For one, Cochrane (2005) remarks that momentum is ad hoc rather than fundamental. It it, thus, merely a characteristic and does not really qualify as a risk factors per se. For two, Haugen (1999) argues that the market is not seldom wrong. He notes that the price of shares often becomes inflated on the basis of very recent developments rather than true fundamental values and real economic activities. The market therefore develops a false belief that a few or negative events cause a run that will persist for long periods into the future.

All in all, any incremental information on future real economic activities contained in the returns to *SMB* - and if any to *HML* and *WML* - are largely independent of the information content of the market factor. The results from our multicollinearity analysis presented in Section 3.4.2 show also that there does not exist a linear relation between the returns to the individual risk factors and the market risk premium. Thence, the relation between the risk factors and future economic growth is unlikely to be induced by the leading relation between the market factor and real future economic activities as suggested in a variety of past studies.[24] This hypothesis is confirmed by the results of the following section.

[24] cf. Aylward and Glen (2000), Barro (1990), Binswanger (2000a,b, 2004), Fama (1981, 1990), Fischer and Merton (1984), Geske and Roll (1983), Liew and Vassalou (2000), Mullins and Wadhwani (1989), Schwert (1990), Wahlroos and Berglund (1986), Wasserfallen (1989, 1990).

5.1.3.2 Regression Analyses

In this section, we assess to what extent future growth in GDP can be explained by the current return to our risk factors. In particular, analogous to Liew and Vassalou (2000), we use quarterly data and run a set of univariate and multifactor regressions. We begin by testing the total information content of each individual risk factor on future growth in real activities. This univariate regression is of the form

$$\Delta GDP_{j,(t,t+4)} = \alpha_j + \theta_j^i f_{j,(t-4,t)}^i + \varepsilon_{j,(t,t+4)} \tag{5.1}$$

where ΔGDP is the growth rate in GDP for each country j (j=Austria,..., Switzerland) and the Eurozone, respectively, one period hence, α_j represents the regression intercept, f_j^i is the return to each risk factor i (i=*MRF*, *SMB*, *HML*, *WML*), θ_j^i depicts the corresponding factor loadings, and ε_j denotes an idiosyncratic disturbance. The four quarter (i.e., one year) time lag between ΔGDP and f_j^i is required in order to test for the prediction of future real activity growth based on current risk factor returns.

We then shift our view to bivariate and multifactor regressions to study the *incremental* information content of *HML*, *SMB*, and *WML* vis-à-vis the excess return to the market (*MRF*). If any added factor comes along with a significant non-zero factor loading and an increased adjusted R^2 (accounted for degrees of freedom), then this factor exhibits information on the future state of the macroeconomy that cannot be fully explained by the market factor itself. This, in turn, entails that this factor contains significant information on the future investment opportunity set. Put differently, significant factor loadings allow us for identifying those variables that may potentially be considered proxies for state variables in context of Merton's (1973) ICAPM.

The bivariate regressions that we estimate to assess the incremental information content of *HML*, *SMB*, and *WML* relative to the information contained in *MRF* are given by

$$\Delta GDP_{j,(t,t+4)} = \alpha_j + \beta_j MRF_{(t-4,t)} + \theta_j^i f_{j,(t-4,t)}^i + \varepsilon_{j,(t,t+4)} \quad \forall i;\ i \neq MRF \tag{5.2}$$

where β_j depicts the slope coefficient to the market factor *MRF* and θ_j^i the loading to each risk factor i (i=*HML*, *SMB*, or *WML*). We then consider two multiple regressions that include either the market factor together with the FF factors [Equation (5.3)] or the market factor together with the FF factors and momentum [Equation (5.4)]. These regressions are of the form

$$\Delta GDP_{j,(t,t+4)} = \alpha_j + \sum_{i=1}^{3} \theta_j^i f_{j,(t-4,t)}^i + \varepsilon_{j,(t,t+4)} \quad \forall i;\ i \neq WML, \tag{5.3}$$

$$\Delta GDP_{j,(t,t+4)} = \alpha_j + \sum_{i=1}^{4} \theta_j^i f_{j,(t-4,t)}^i + \varepsilon_{j,(t,t+4)} \quad \forall i \tag{5.4}$$

and may allow us to assess which risk factor contains the most significant information on future macroeconomic growth in present of all other factors. Finally, note that GDP growth rates are observed at quarterly frequencies. Thus, successive annual growth rates have three overlapping quarters. This causes autocorrelation among the residuals of Equations (5.1) to (5.4). We correct for the presence of autocorrelation and heteroscedasticity of the error terms, using the Newey and West (1987) estimator, setting the lags equal to three.

5.1.3.2.1 Findings

Our findings for our system of regression models are summarized in Tables 5.5, 5.6, and 5.7 for our analyses at Eurozone, country, and industry level, respectively. We begin to discuss our results for the Eurozone, followed by our country and industry findings.

The factor loadings depicted in Table 5.5 for our Eurozone analysis highlight that of all factors employed, *SMB* appears to have the most significant information on future macroeconomic growth in the Eurozone. Our results seem to be robust as we always find statistically significant loadings to *SMB* irrespective of the four regression models employed. Our findings for *SMB* also underpin our results of the previous section and those of Liew and Vassalou (2000). Moreover, the economic significance of *SMB* appears to be bigger than those of the other factors, given the absolute magnitude of the laodings. On top, all models including the *SMB* show the highest adjusted R^2 values (between 21.02% & 23.6%).

Surprisingly, we do not find any significant coefficients to *MRF*, which actually implies that the market factor does not convey any information on future

Table 5.5: Relation Between Risk Factors & GDP Growth - **Eurozone**

This table presents an overview of the factor loadings and adjusted R^2 values for regressing GDP growth in the Eurozone on past four-quarters factor returns. In the regression notation, ΔGDP depicts the seasonly adjusted compounded GDP growth rate of the Eurozone. f^i is the return to each risk factor i (i=*MRF*, *HML*, *SMB*, and *WML*). *MRF* is the market risk premium in the Eurozone. The risk free rate is given by the one-month ecu deposit quoted in London. *HML* is the annual return on a portfolio long on high book-to-market stocks and short on low book-to-market securities, holding size and momentum characteristics of the portfolio constant. *SMB* is the annual return on a portfolio long on small capitalization stocks and short on big capitalization securities, holding book-to-market and momentum characteristics of the portfolio constant. *WML* is the annual return on a portfolio that is long on the best performing stocks of the past year ('winners') and short on the worst performing securities of the previous year ('losers') holding book-to-market and size characteristics of the portfolio constant. The adjusted R^2 is corrected for degrees of freedom. *, **, and *** are used as indicators of statistical significance at, respectively, the 10%, 5%, and 1% significance level.

Panel A: $\Delta GDP_{(t,t+4)} = \alpha + \theta^i f^i_{(t-4,t)} + \varepsilon_{(t,t+4)} \quad \forall i;\ i = (MRF,\ HML,\ SMB,\ WML)$

MRF	*HML*	*SMB*	*WML*	Adj. R^2
0.009				0.04
	0.005			-1.35
		0.063***		22.02
			0.006	-1.30

Panel B: $\Delta GDP_{(t,t+4)} = \alpha + \beta MRF_{(t-4,t)} + \theta^i f^i_{(t-4,t)} + \varepsilon_{(t,t+4)} \quad \forall i;\ i = (HML,\ SMB,\ WML)$

MRF	*HML*	*SMB*	*WML*	Adj. R^2
0.009	0.007			-1.27
-0.003		0.065***		21.02
0.009			0.005	-1.34

Panel C: $\Delta GDP_{(t,t+4)} = \alpha + \beta MRF_{(t-4,t)} + \gamma HML_{(t-4,t)} + \phi SMB_{(t-4,t)} + \varepsilon_{(t,t+4)}$

MRF	*HML*	*SMB*	*WML*	Adj. R^2
-0.003	0.008	0.065***		23.39

Panel D: $\Delta GDP_{(t,t+4)} = \alpha + \beta MRF_{(t-4,t)} + \gamma HML_{(t-4,t)} + \phi SMB_{(t-4,t)} + \eta WML_{(t-4,t)} + \varepsilon_{(t,t+4)}$

MRF	*HML*	*SMB*	*WML*	Adj. R^2
-0.006	0.015	0.076***	0.042*	23.60

growth in GDP, at least not on an aggregate Eurozone level. Hence, our findings are not necessarily in line with those of other studies, who find that aggregated market and stock returns may be used as leading indicator of future macroeconomic growth in individual countries.[25] The figures portrayed in Table 5.5 also convey that neither *HML* nor *WML* contain significant information on future GDP growth in the Eurozone.

Our findings for our country analysis summarized in Table 5.6 (and in more

[25] cf. Aylward and Glen (2000), Barro (1990), Binswanger (2000a,b, 2004), Fama (1981, 1990), Fischer and Merton (1984), Geske and Roll (1983), Mullins and Wadhwani (1989), Schwert (1990), Wahlroos and Berglund (1986), and Wasserfallen (1989, 1990).

detail depicted in Tables D.7 to D.10 in Appendix D) appear as a whole to be less robust than those for the Eurozone. Albeit the presented figures in in Table 5.6 suggest that *SMB* is primarily positively related to future GDP growth in our 16 European sample countries, we only find significant loadings (indicated by the numbers in [ ]) to *SMB* in a very few cases. It is, however, interesting to observe that the countries for which we find the most persistent positive relations between *SMB* and future macroeconomic growth (e.g., Greece and Portugal) are not the same as the countries for which we find the most significant relations between future GDP and *MRF* (e.g., Austria, Finland, and the Netherlands) - see Tables D.7 to D.10 (pages 408 ff.) in Appendix D for details. This may imply that whenever the market factor does not contain information on the growth of future real activities, then there might be a chance that the return to *SMB* may provide such information. However, overall, neither the findings for *SMB* and *MRF* are very persistent across all countries. The results for the other factors are even less pronounced. In particular, we fail to find any clear pattern for a negative or positive relation between either *HML* or *WML* and future macroeconomic growth across our sample countries. Especially, *WML* appears to contain little, if any, information about future economic growth. The non-existence of a clear pattern for *HML*, on the other hand, may to some extent be country-specific. This may appear plausible, as our countries examined differ in terms of their size, average market capitalization, and accounting standard.

Table 5.7 draws a similar high-level image of the relation between factor returns and future macroeconomic growth when looking at the industry level. A more detailed overview of the individual regression results per industry are provided in Tables D.11 to D.14 in Appendix D. Note again that we consider the growth in GDP of the Eurozone as our reference point for future macroeconomic growth (as opposed to individual industry GDP figures). As a whole, we find again that *SMB* is primarily positively related to future macroeconomic growth, especially when referring to our findings for the univariate and bivariate models (cf. Panel A & B in Table 5.7) introduced by Equations (5.1) & (5.2). This is in particularly supported by 'relatively' high coefficients of determinations, especially in comparison to the other risk factors. Yet, on the other hand, we fail to find any robust empirical support for a relation between either *HML* or *WML*

Table 5.6: Relation Between Risk Factors & GDP Growth - **Country**

This table presents an overview of the sum of positive and negative loadings to each individual factor across all countries for regressing the GDP growth in 16 European countries on past four-quarters country factor returns. In the regression notation, ΔGDP depicts the seasonly adjusted compounded GDP growth rate in each country. f^i is the return to each risk factor i (i=*MRF*, *HML*, *SMB*, and *WML*). *MRF* is the market risk premium in each country. The risk free rate is given by the one-month ecu deposit quoted in London. *HML* is the annual return on a portfolio long on high book-to-market stocks and short on low book-to-market securities, holding size and momentum characteristics of the portfolio constant. *SMB* is the annual return on a portfolio long on small capitalization stocks and short on big capitalization securities, holding book-to-market and momentum characteristics of the portfolio constant. *WML* is the annual return on a portfolio that is long on the best performing stocks of the past year ('winners') and short on the worst performing securities of the previous year ('losers') holding book-to-market and size characteristics of the portfolio constant. The numbers in [ ] imply how many of the loadings are statistically significant at the 10% significance level the least. The depicted average adjusted R^2 values are corrected for degrees of freedom.

Panel A: $\Delta GDP_{(t,t+4)} = \alpha + \theta^i f^i_{(t-4,t)} + \varepsilon_{(t,t+4)} \quad \forall i;\ i = (MRF,\ HML,\ SMB,\ WML)$

	MRF		*HML*		*SMB*		*WML*		Av. Adj. R^2
	+	-	+	-	+	-	+	-	
	10	6							7.64
	[3]	[-]							
			10	6					2.76
			[3]	[1]					
# of +/- coefficients									
[ ] thereof significant†					13	3			2.84
					[3]	[1]			
							7	9	2.27
							[2]	[2]	

Panel B: $\Delta GDP_{(t,t+4)} = \alpha + \beta MRF_{(t-4,t)} + \theta^i f^i_{(t-4,t)} + \varepsilon_{(t,t+4)} \quad \forall i;\ i = (HML,\ SMB,\ WML)$

	MRF		*HML*		*SMB*		*WML*		Av. Adj. R^2
	+	-	+	-	+	-	+	-	
	10	6	9	7					11.25
	[3]	[-]	[3]	[3]					
# of +/- coefficients	9	7			12	4			11.13
[ ] thereof significant†	[3]	[1]			[4]	[2]			
	11	5					4	12	9.58
	[3]	[-]					[2]	[4]	

Panel C: $\Delta GDP_{(t,t+4)} = \alpha + \beta MRF_{(t-4,t)} + \gamma HML_{(t-4,t)} + \phi SMB_{(t-4,t)} + \varepsilon_{(t,t+4)}$

	MRF		*HML*		*SMB*		*WML*		Av. Adj. R^2
	+	-	+	-	+	-	+	-	
# of +/- coefficients	10	6	9	7	12	4			6.64
[ ] thereof significant†	[3]	[1]	[3]	[4]	[2]	[-]			

Panel D: $\Delta GDP_{(t,t+4)} = \alpha + \beta MRF_{(t-4,t)} + \gamma HML_{(t-4,t)} + \phi SMB_{(t-4,t)} + \eta WML_{(t-4,t)} + \varepsilon_{(t,t+4)}$

	MRF		*HML*		*SMB*		*WML*		Av. Adj. R^2
	+	-	+	-	+	-	+	-	
# of +/- coefficients	11	5	9	7	12	4	8	8	7.28
[ ] thereof significant†	[3]	[1]	[2]	[4]	[2]	[-]	[2]	[-]	

† at the 10% significance level.

cf. Tables D.7 to D.10 in Appendix D for detailed regression results.

Table 5.7: Relation Between Risk Factors & GDP Growth - **Industry**

This table presents an overview of the sum of positive and negative loadings to each individual factor across all countries for regressing the GDP growth of the Eurozone on past four-quarters industry factor returns. In the regression notation, ΔGDP depicts the seasonly adjusted compounded GDP growth rate of the Eurozone. f^i is the return to each risk factor i (i=*MRF*, *HML*, *SMB*, and *WML*). *MRF* is the market risk premium in the Eurozone. The risk free rate is given by the one-month ecu deposit quoted in London. *HML* is the annual return on a portfolio long on high book-to-market stocks and short on low book-to-market securities, holding size and momentum characteristics of the portfolio constant. *SMB* is the annual return on a portfolio long on small capitalization stocks and short on big capitalization securities, holding book-to-market and momentum characteristics of the portfolio constant. *WML* is the annual return on a portfolio that is long on the best performing stocks of the past year ('winners') and short on the worst performing securities of the previous year ('losers') holding book-to-market and size characteristics of the portfolio constant. The numbers in [ ] imply how many of the loadings are statistically significant at the 10% significance level the least. The depicted average adjusted R^2 values are corrected for degrees of freedom.

Panel A: $\Delta GDP_{(t,t+4)} = \alpha + \theta^i f^i_{(t-4,t)} + \varepsilon_{(t,t+4)} \quad \forall i;\ i = (MRF,\ HML,\ SMB,\ WML)$

	MRF		*HML*		*SMB*		*WML*		Av. Adj. R^2
	+	-	+	-	+	-	+	-	
	10	1							9.36
	[5]	[-]							
			7	4					2.82
			[1]	[2]					
# of +/- coefficients									
[ ] thereof significant†					10	1			12.01
					[6]	[1]			
							6	5	1.49
							[1]	[1]	

Panel B: $\Delta GDP_{(t,t+4)} = \alpha + \beta MRF_{(t-4,t)} + \theta^i f^i_{(t-4,t)} + \varepsilon_{(t,t+4)} \quad \forall i;\ i = (HML,\ SMB,\ WML)$

	MRF		*HML*		*SMB*		*WML*		Av. Adj. R^2
	+	-	+	-	+	-	+	-	
	10	1	6	5					8.84
	[5]	[-]	[1]	[2]					
# of +/- coefficients	9	2			7	4			21.89
[ ] thereof significant†	[5]	[1]			[3]	[2]			
	11	-					6	5	10.20
	[4]	[-]					[2]	[1]	

Panel C: $\Delta GDP_{(t,t+4)} = \alpha + \beta MRF_{(t-4,t)} + \gamma HML_{(t-4,t)} + \phi SMB_{(t-4,t)} + \varepsilon_{(t,t+4)}$

	MRF		*HML*		*SMB*		*WML*		Av. Adj. R^2
	+	-	+	-	+	-	+	-	
# of +/- coefficients	8	3	5	6	5	6			22.95
[ ] thereof significant†	[4]	[1]	[1]	[-]	[4]	[1]			

Panel D: $\Delta GDP_{(t,t+4)} = \alpha + \beta MRF_{(t-4,t)} + \gamma HML_{(t-4,t)} + \phi SMB_{(t-4,t)} + \eta WML_{(t-4,t)} + \varepsilon_{(t,t+4)}$

	MRF		*HML*		*SMB*		*WML*		Av. Adj. R^2
	+	-	+	-	+	-	+	-	
# of +/- coefficients	8	3	6	5	6	5	8	3	23.77
[ ] thereof significant†	[4]	[-]	[1]	[-]	[4]	[1]	[1]	[1]	

† at the 10% significance level.

cf. Tables D.11 to D.14 in Appendix D for detailed regression results.

and future growth in GDP. In other words, both factors appear to contain little, if any information on future macroeconomic growth. Moreover, the lack of statistical significant factor loadings to *HML* and *WML* does not let us to infer that either of the two factors is industry specific. However, the market factor, as proxied for by the DJ EuroStoxx 50 index for all industries, exhibits a predominately positive relation to future macroeconomic growth, albeit not necessarily statistical significant in the majority of cases. This is contrary to our country and Eurozone results but very much in line with the majority of empirical findings in the literature.[26]

Altogether, we have shown, in line with Liew and Vassalou (2000) that *SMB* contains some significant information on future growth in the economy. The information of *SMB* on the future state of the economy appears, moreover, to be net of the information contained in the market factor *MRF*. Our results are especially robust for the Eurozone as a common region. This is insofar interesting as it not only shows that *SMB* contains valuable information on the future investment opportunity set, but also on an investment opportunity set that is aggregated across markets. This may, for one, imply that *SMB* may serve as a state variable in context of Merton's (1973) ICAPM as suggested by FF and Liew and Vassalou (2000). Yet, it may also entail, for two, that European equity markets are somehow integrated. This hypothesis is further, albeit admittedly not very strongly, supported by our industry specific findings for *SMB*, given that our industry factors in place are aggregated across country borders.

5.1.3.2.2 Sensitivity Analyses

In order to test to what extent our findings are sensitive to the time lag between future GDP growth and past factor returns, we replicated the study, using a two year, i.e., eight quarter, rather than a one year, i.e., four quarter, time lag. The results are depicted in Tables D.5 to D.22 in Appendix D (pages 406-423).

Our findings for *SMB* and *WML* are to a large extent analogous to the ones we find for a four quarter lag. Yet, for *HML* we find that the factor returns are predominantly negatively related to future growth in GDP (overall in 18 out of 28 cases, across countries, industries, and the Eurozone). In general, as opposed

[26] cf. Footnote 25 on page 185.

to the four quarter lagged regressions, the findings are less robust, and the factors appear to contain slightly less information on future macroeconomic growth activities. This may indicate that either factor returns are not very persistent or, more likely, that equity markets cannot anticipate future events over a very long time horizon. In other words, given our findings, it appears more likely that equity markets are able to anticipate real economic activity one rather than two years ahead. Under equity market integration considerations, however, the presence of same sign tendencies of the factor loadings for different time lags may support our null hypothesis of integrated market. This, however, only holds admittedly on a small scale and only when considering our pan-Eurozone and industry findings for *SMB*.

5.1.4 Conclusion

The primary aim of this section has been to study whether the FF factors, along with momentum, may serve as proxies for state variables of time-varying investment opportunities. We have assumed that changes in investment opportunities are summarized by changes in future macroeconomic growth. Based on this assumption, we have assessed whether *SMB*, *HML*, and *WML* may help to forecast future growth in GDP in various European countries and across the Eurozone. If this is the case, then this may imply that the aforementioned factors may serve as proxies for state variables of real economic activities. This, in turn, would provide some support for an economic link between the FF factors and momentum and systematic risk.

Apart from Liew and Vassalou (2000) little to no research has been done that provides evidence of a relation between the aforementioned factors and intuitive economic growth, this holds especially for the European market and for an analysis across industries. Our focus on Europe is motivated by equity market integration considerations. In particular, we suggest that the potential existence of pan-European risk factors serves as an indicator of European stock market integration. This holds especially under the consideration that these factors are pan-European and that they proxy for state variables that contain information on future changes in European-wide investment opportunities (as proxied for by future GDP growth in the Eurozone).

Moreover, unlike Liew and Vassalou (2000), we account for different industries to capture (i) the relative importance of industry factors vis-à-vis country factors for the explanation of equity returns, (ii) diverse book-to-market, size, and momentum characteristics of stocks from different industries, (iii) the degree to which individual industries are sensitive to the general business cycle, and (iv) the fact that common GDP growth in the Eurozone is significantly influenced by the macroeconomic growth in Germany and France. Besides, a significant relation between pan-European industry factors and future GDP growth in the Eurozone may also indicate that European stock markets are to a certain degree integrated.

Using data for 16 countries and 11 different industries across the Eurozone over a sample period from January 1990 to April 2008, our results reveal that the market factor may serve as a leading indicator for future real economic activities in various countries and industries. This is in line with the results of a variety of other studies.[27] However, the empricial support is not very strong and the information contained in the market factor is to some extent country- and industry-specific. This may appear plausible, given that the markets examined differ in terms of their size, average market capitalization, and, to some extent, also still their accounting standards - despite any harmonization efforts.

In addition, we document that *SMB* contains information with respect to future growth in GDP across the Eurozone. This holds in particular at region level and for numerous countries and industries. The information content is net of any information contained in the market factor. As expected the relation is primarily positive, indicating that small capitalization firms are better able to prosper than big capitalization stocks whenever strong economic growth is expected. This is in accordance with Liew and Vassalou (2000) and Perez-Quiros and Timmermann (2000).

The ability of either *HML* or *WML* to forecast future GDP growth in the Eurozone is considerably lower than the one for *SMB*. Our findings suggest that *HML* is rather positively than negatively related to future real economic activities. Yet, our results are, admittedly, not very robust and hardly statistically

[27] cf. Aylward and Glen (2000), Barro (1990), Binswanger (2000a,b, 2004), Fama (1981, 1990), Fischer and Merton (1984), Geske and Roll (1983), Liew and Vassalou (2000), Mullins and Wadhwani (1989), Schwert (1990), Wahlroos and Berglund (1986), Wasserfallen (1989, 1990).

and economically significant. For *WML*, our findings reveal no clear and robust pattern for the relation between the factor returns and future growth in GDP. It appears that *WML* is either country- or industry-specific or that *WML* contains very little, if any, information on future macroeconomic growth. This is, yet, not too surprising given Cochrane's (2005) remark that momentum qualifies as a 'performance attribute' rather than as a risk factor per se.

At large, the results of this section indicate that a risk-based explanation is at most plausible and likely for *SMB*. FF and Liew and Vassalou (2000) suggest that *SMB* and *HML* are state variables that help to predict future changes in investment opportunity sets in context of the ICAPM. Our findings support this hypothesis, yet only with respect to *SMB*. Moreover, from an equity market integration perspective, our industry and pan-Eurozone findings for *SMB* reveal that European equity markets may be somewhat integrated. This is due to the fact that returns to pan-Eurozone constructed *SMB* factors allow for a common prediction of economic growth in the euro area and, hence, future investment opportunities.

5.2 Method B.II: *SMB* & *HML* as Proxies for Yield Spreads

5.2.1 Introduction

In line with our assessments in Section 5.1, the paragraphs to follow intend to shed further light on the economic rationale of the FF factors. We link *SMB* and *HML* to changes in the European default spread and the European term spread to assess whether the FF factors proxy for risks associated with European business cycle fluctuations. We choose default and terms spreads, since these variables are generally acknowledged for their ability to track investment opportunities and to help forecasting aggregate bond and equity market returns (see Fama and French, 1989, Keim and Stambaugh, 1986). These yield spreads have also been associated with the systematic risks underlying the FF factors in the US (Hahn and Lee, 2006, Petkova, 2006). Yet, empirical findings for any potential link between the FF factors and European default and term spreads are still absent.

Default and term spreads have long been regarded as proxies for the state of business conditions, particularly as measures of credit market conditions and the stance of monetary policies.[28] For instance, variations in default spreads have frequently been used as proxies for time-varying risk premia (see Jagannathan and Wang, 1996), while the term spread is one of the most widely used proxies for the market's expectations about future interest rates (see Brennan et al., 2004).[29] Fama and French (1989) also denotes that (i) variations in the default spread are related to long-term business cycle movements whereas (ii) variations in the term spread capture short-term business cycles.

These past empirical findings suggest that shocks to default and term spreads may capture revisions in market expectations in regard to future macroeconomic conditions and investment opportunities. Hence, the default spread and term

[28]cf. for instance, Brennan et al. (2004), Gertler et al. (1991), Jagannathan and Wang (1996), and Kashyap et al. (1994).

[29]Brennan et al. (2004) argue that the term spread is likely to grasp the hedging concerns to investors triggered by variations in interest rates. They use an ICAPM model in which the relevant state variables are the stochastic real interest rate and the Sharpe ratio. Their model has some success at explaining the book-to-market and size effects in the US. Merton (1973) also notes that stochastic interest rates are a good example for inconsistencies in constant investment opportunities.

spread are also considered good candidates for state variables in an intertemporal asset pricing framework (see Hahn and Lee, 2006, Petkova, 2006).[30] The seemingly strong economic meaning of the default spread and the term spread, along with their apparent suitably for state variables in Merton's (1973) ICAPM context, begs thus the question whether these yield spreads may serve as alternative risk factors for size (*SMB*) and book-to-market (*HML*), given the characteristics of these factors.

On the one hand, *SMB* is the return to a portfolio long on small stocks and short on big stocks. Small firms tend to be young and poorly collateralized, with limited access to external financial markets (Gertler and Gilchrist, 1994). Moreover, small firms appear to be more vulnerable to variations of credit market conditions over the business cycle than bigger companies (Perez-Quiros and Timmermann, 2000). Thus, a decrease in the default spread, which is usually considered a market signal of improving credit market conditions, may presumably be associated with higher returns to *SMB*. We hence want to assess whether a change in the default spread conveys the same information as *SMB*.

On the other hand, *HML* is the return to a portfolio long on high book-to-market stocks and short on low book-to-market stocks. In general, high book-to-market firms tend to exhibit higher financial leverage and more cash flow constraints than low book-to-market firms (Fama and French, 1992, 1995). This implies that high book-to-market firms are also more sensitive to increasing interest rates than low book-to-market firms.[31] Growing interest rates, in turn, are usually associated with a decrease in the term spread (see Fama and French, 1989, Hahn and Lee, 2006).[32] Ergo, a decrease in the term spread might be reflected

[30] Campbell (1996) also remarks that proxies for state variables of time-varying investment opportunities ought to be selected by their ability (i) to forecast market returns and (ii) to explain the cross-sectional behavior of asset returns.

[31] Fama and French (1992) remark that the book-to-market ratio is the difference between market leverage and book leverage. Market leverage is thereby defined as the ratio of book value of assets to market value of equity. Book leverage refers to the ratio of book value of assets to book value of equity. They, thus, suggest that *HML* captures an indirect leverage effect to the extent that firms with high book-to-market ratios exhibit a large amount of market imposed leverage.

[32] In particular, the findings of Fama and French (1989) and Hahn and Lee (2006) entail that (i) the term spread exhibits a strong tendency of being high around business cycle troughs and low near peaks and that (ii) the term spread and one-year Treasury yield move in opposite directions in the US market. This conveys that a decrease in the term spread may be associated

in a lower return to *HML*. We therefore want to study whether a change in the term spread contains similar information as *HML*.

In sum, we may expect that changes in the default spread and the term spread may serve as good proxies for capturing the cross-sectional pattern of stock returns in size and book-to-market. This has, in fact, been empirically confirmed for the US by Hahn and Lee (2006) and Petkova (2006) but not yet been tested across Europe. We aim to fill this gap in the following sections. To do so, we borrow part of the Hahn and Lee (2006) method and transfer it into a European context, including analyses at country, industry, and pan-European level.[33]

We begin our discussion by describing our data sample employed. We then shift our focus to the link between (i) *SMB* and *HML* and (ii) changes in the default and term spreads. In a first step, we merely derive the correlation coefficients among the variables. We then regress size and book-to-market on the market factor, changes in the European default spread, and changes in the European term spread. This allows us to assess whether changes in the yield spreads contain any systematic risk in the FF factors not captured by the market beta. Yet, it eventually appears at large, contrary to our expectation, that changes in the yield spreads do not capture the systematic differences in average returns along size and book-to-market.

Given the difference in information content among the variables, we run in a second step a set of time-series and cross-sectional regressions to study whether a three-factor model comprised of the market factor and changes in the default spread and term spread may dominate the 3FM in explaining equity return behavior at European region, industry, and country level. Our findings suggest, however, that the ability of the 3FM to price European equity is superior to that of the alternative model. This holds despite the apparent stronger rationale of the latter model vis-à-vis the 3FM.

Finally, albeit our main objective is to examine whether *SMB* and *HML* may be associated with business cycle fluctuations, we also intend to provide some

with rising interest rates.

[33]Please note that in this section we only focus on industries aggregated across the Eurozone (rather than those aggregated across the EU or Europe as a whole - cf. Section 3).

further details on European stock market integration. In case size and book-to-market convey the same information as pan-European yield spreads, then we may infer that *SMB* and *HML* contain information in regard to future pan-European investment opportunities. This, in turn, may then imply that (i) European stock markets are to a certain degree integrated and that (ii) the 3FM may be consistent with an ICAPM explanation.[34] As it turns out, we find no notable empirical support for market integration.

5.2.2 Data Adjustments

In order to assess whether *HML* and *SMB* may serve as proxies for yield spreads, we augment our database (cf. Section 3) by a time-series of monthly default and term spreads for the Eurozone for the period May 1999 to October 2006. In consequence, our overall sample period becomes shorter, even if we have longer time-series for our risk factors at hand (cf. Section 3.2). It needs to be stated at the outset that the short sample period depicts a limitation to this study. For one, the short sample period does not leave a lot of room for big business cycle fluctuations. For two, the time period is characterized by low term and default spreads. However, given that the euro was just officially launched on January 1, 1999, commonly imposed interest rates in Europe have only been existing as of this date.[35] Nonetheless, our short sample period at hand limits the strengths and generalization of our results. Hence, our findings should be treated as a first attempt to link *HML* and *SMB* and yield spreads throughout Europe.

[34]Empirical specifications of the ICAPM actually demand to estimate *innovations* in state variable proxies rather than mere changes in these variables. To do so, one may specify a time-series process for the spreads of the state variables to estimate a type of vector autoregressive (VAR) model and use the residuals as innovations, as in Campbell (1996) and Petkova (2006). Yet, Hahn and Lee (2006, p.250) remark that "[w]hile a failure to filter out expected movements in [yield] spreads may introduce an errors-in-variables problem, misspecification of the time-series process will also introduce errors in using estimated innovations". They further denote that their empirical findings for either of the two approaches do not differ significantly. We therefore decide to focus on changes in spreads only rather than 'real' innovations.

[35]Note that we disregard the *resources* sector for this analysis, given data availability constraints. As indicated in Table 3.2 on page 74 in Section 3.2 we only have data for *resources* available as of April 2004. Hence, focusing just on the time period April 2004 to October 2006 appears too limited to us.

Table 5.8: Correlation Coefficients - Macro Variables

This table reports the correlation coefficients among our sample macro variables, i.e., the 1-year euro interest rate, the default spread, the EuroCoin indicator (as proxy for the business cycle), and the term spread. The coefficients are derived considering monthly data and the time period May 1999 to October 2006.

	1-Year Interest Rate	Default Spread	EuroCoin Indicator	Term Spread
1-Year Interest Rate	1	-0.52	0.29	-0.67
Default Spread		1	-0.37	-0.03
EuroCoin Indicator			1	-0.26
Term Spread				1

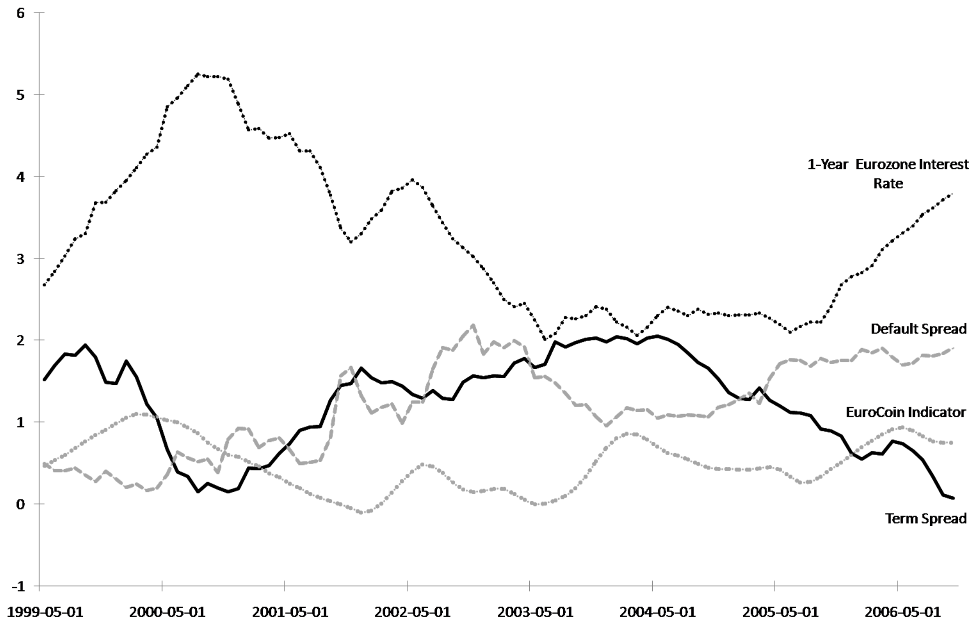
We define the default spread, *def*, as the difference between the yield to maturity on the all-maturities iBoxx BBB Corporate Bond Index for the Eurozone and the all-maturities FTSE Global Government Eurozone index.[36] We define the term spread, *term*, as the difference between the 10-year and one-year Eurozone interest rate for constant maturities. All data have been derived from Datastream. Next to the yield data, we also draw from the Centre of Economic Policy Research (CEPR) a time series of the EuroCoin indicator over the same sample period. The EuroCoin indicator serves as a measure for the euro area business cycle.[37]

Table 5.8 depicts the correlation coefficients among the term spread, the default spread, the one-year Eurozone interest rate, and the EuroCoin indicator for our sample period May 1999 to October 2006. Figure 5.7 plots the time-variation of these respective variables over the same time period. The presented figures reveal that there exists a negative relation between the term spread and the business cycle in Europe. This is alike Fama and French (1989) and Hahn and Lee (2006) for the US. Figure 5.7 visualizes that the term spread appears to be low near business cycle peaks and high near business cycle troughs. This negative

[36]Hahn and Lee (2006) remark that using the yield spread between Moody's Baa-rated and Moody's Aaa corporate bond portfolio does not alter their main findings when analysing the relation between the FF factors and the yield spreads in the US market over the time period July 1963 to June 2001. Petkova (2006) also employs the yields of long-term corporate Baa bonds for the same market and time period.

[37]EuroCoin is a real-time indicator of the euro area business cycle. It is computed each month by the Bank of Italy, i.e., Banca d'Italia, based on a large set of statistics (such as industrial production, surveys, stock market and financial data, demand indicators). For further technical details on EuroCoin, please refer to Altissimo et al. (2007).

Figure 5.7: Default Spread, Term Spread & Business Cycle - *Source: Datastream & Centre of Economic Policy Research (CEPR)*



relation is underpinned by a correlation coefficient, ρ, of -0.26 between the term spread and the EuroCoin indicator, as indicated in Table 5.8.

Furthermore, there seems to be a negative link between the default spread and the business cycle (ρ = -0.37). This does not come too much as a surprise, considering that interest rates tend to be lower during economic recessions, which leaves more room to add default risk premia to the government interest rate. Contrary, at business cycle peaks, interest rates tend to be higher and company defaults to be lower, which may result in lower default spreads (see Brennan et al., 2004).

Figure 5.7 and Table 5.8 also highlight that the term spread and the one-year Eurozone interest rate move in opposite direction. This is again analogous to the findings of Hahn and Lee (2006) for the US. The negative relation between the two variables is also reflected in a negative correlation coefficient of -0.67. This implies that increases in the term spread are associated with declining interest rates, which is in line with Fama and French (1989) and Hahn and Lee (2006).

Finally, the default spread and term spread appear to be fairly unrelated from a statistical point of view (ρ = -0.03), albeit Figure 5.7 may suggest that the yield spreads move in opposite directions as of May 2003. This result is also consistent with Fama and French (1989), who argue that the default spread and term spread capture distinct aspects of variation in the business cycle. We now turn our focus on linking size and book-to-market to the respective yield spreads in a manner similar to Hahn and Lee (2006).

5.2.3 Method & Empirical Tests

In the paragraphs that follow, we intend to assess to what extent changes in the default spread and the term spread convey the same information as size and book-to-market. In addition, given the apparent strong economic rationale of the default spread and the term spread, especially vis-à-vis the FF factors, we study also whether changes in these yield spreads help to explain equity return behavior in Europe. In particular, we test whether an alternative three-factor model comprised of the market risk premium, a default factor and a term factor exhibits the same pricing ability as the 3FM across Europe. This is motivated by Ferson and Harvey (1999), who remark that it is important to verify the pricing abilities of models that are proposed as alternatives to the 3FM.

Note that we focus our discussion primarily on the regional level, given that our default factor and our term factor are of a pan-European rather than country or even industry specific nature (cf. Section 5.2.2). Nonetheless, for robustness considerations, we also conduct empirical tests at country and industry level using our pan-European yield spreads.[38] We briefly discuss these findings in Section 5.2.4.

5.2.3.1 Relation Between FF Factors & Yield Spreads

In a first step, we merely derive the correlation coefficients among (i) pan-European FF factors and (ii) our European default factor and term factor, where the default factor is defined as: $\Delta def_t \equiv def_t - def_{t-1}$ and the term factor is defined as: $\Delta term_t \equiv term_t - term_{t-1}$.[39] The correlation coefficients are de-

[38]Preferably, we would like to have country and industry specific yield spreads. Yet, we face data availability constraints.

[39]Note that in an ICAPM context we would prefer to work with *innovations* in state variable proxies rather than mere changes in these variables. Yet, Hahn and Lee (2006) note that a misspecification of a time-series process may introduce errors in using estimated innovations.

Table 5.9: Correlation Coefficients - FF Factors & Yield Spreads - Region

This table reports the correlation coefficients among the FF factors and Δdef and $\Delta term$. The coefficients are derived considering monthly data and the time period May 1999 to October 2006. Panel A shows the coefficients for our Eurozone factors, while Panel B and Panel C depict the coefficients for our EU and European factors, respectively. Note that Δdef and $\Delta term$ always correspond to the same Eurozone factors. In particular: $\Delta def_t \equiv def_t - def_{t-1}$, and $\Delta term_t \equiv term_t - term_{t-1}$ where def_t and $term_t$ are the default spread and term spread at time T. The default spread is defined as the spread between yield to maturity on the all-maturities iBoxx BBB Corporate Bond Index for the Eurozone and the all-maturities FTSE Global Government Eurozone index. The term spread is defined as the difference between the 10-year and one-year Eurozone interest rate for constant maturities.

Panel A: Eurozone

	Δdef	$\Delta term$	MRF	HML	SMB
Δdef	1	-0.19	-0.03	-0.06	-0.03
$\Delta term$		1	-0.40	0.23	-0.39
MRF			1	-0.21	0.76
HML				1	-0.06
SMB					1

Panel B: EU

	Δdef	$\Delta term$	MRF	HML	SMB
Δdef	1	-0.19	-0.03	-0.06	-0.02
$\Delta term$		1	-0.40	0.23	-0.39
MRF			1	-0.16	0.76
HML				1	0.17
SMB					1

Panel C: Europe

	Δdef	$\Delta term$	MRF	HML	SMB
Δdef	1	-0.19	-0.03	-0.07	0.00
$\Delta term$		1	-0.40	0.18	-0.40
MRF			1	-0.15	0.78
HML				1	0.21
SMB					1

picted in Table 5.9. As expected, we find a positive correlation between *HML* and $\Delta term$ across all three regions, varying between 0.18 for Europe and 0.23 for the Eurozone and the EU. Moreover, the correlation between *HML* and Δdef is insignificantly low with ρ varying between -0.07 (Europe) and -0.06 (Eurozone and EU). These apparent relations are fairly in line with those found by Hahn and Lee (2006) and Petkova (2006) for the US.

Nonetheless, a failure to filter out expected movements in [yield] spreads may also introduce an errors-in-variables problem. Besides, Hahn and Lee (2006) do not find any significant differences in results when working with either innovations or mere changes.

However, contrary to our expectations, we fail to find a significant negative correlation between *SMB* and Δdef. In fact, the correlation coefficients between these variables are either 0 (Europe) or fairly close to 0 (Eurozone and EU). This suggests that the information content of Δdef is entirely unrelated to the information contained in *SMB*. Our results do also dissent from the findings of Hahn and Lee (2006) and Petkova (2006).[40] Nevertheless, the figures depicted in Table 5.9 convey, surprisingly, that there exists a negative and significant correlation between *SMB* and $\Delta term$, with the ρ coefficients varying between -0.39 (Eurozone and EU) and -0.40 (Europe). As a decrease in $\Delta term$ basically conveys an increase in interest rates (see Fama and French, 1989, Hahn and Lee, 2006), our preliminarily findings may convey that small firms suffer less than big firms from a raise in interest rates. This may be due to the fact that smaller firms are less levered than bigger firms as their access to financial markets is limited. Overall, it appears that the correlation between *SMB* and $\Delta term$ is even stronger, albeit inverse, than the correlation between *HML* and $\Delta term$, i.e., $|\rho_{SMB;\Delta term}| > |\rho_{HML;\Delta term}|$. On the other hand, Δdef does not seem to exhibit similar information as either *SMB* or *HML*.

Given these findings, we assess in a second step whether our European term factor - and for completeness also our European default factor - contains any systematic risks in *SMB* and *HML* that are not captured by the market beta.[41] In particular, we study the relation between (i) $\Delta term$ and Δdef and (ii) *SMB* and *HML* in presence of the market factor in a simple time-regression framework, i.e.,

$$SMB_t = \alpha_1 + \beta_1 MRF_t + \gamma_1 \Delta def_t + \phi_1 \Delta term_t + \varepsilon_{1,t} \quad (5.5)$$

$$HML_t = \alpha_2 + \beta_2 MRF_t + \gamma_2 \Delta def_t + \phi_2 \Delta term_t + \varepsilon_{2,t} \quad (5.6)$$

where *MRF* depicts the market risk factor, i.e., market risk premium, α is the regression intercept and ε is an idiosyncratic disturbance. The time-invariant

[40] Note that Hahn and Lee (2006) define the default spread as $\Delta def_t \equiv -(def_t - def_{t-1})$ and not, as we do, as $\Delta def_t \equiv def_t - def_{t-1}$. Thus, they expect a positive relation between their *SMB* and Δdef variables, while we expect a negative relation for our *SMB* and Δdef variables.

[41] Merton (1973) notes that in an intertemporal framework, state variables risks that arise from time variation in investment opportunities are part of systematic risk which is not captured by the market beta. Ergo, market portfolio returns ought not to be omitted when determining potential proxies for state variable risks (see Hahn and Lee, 2006).

factor loadings are given by β, γ, and ϕ.

Table 5.10 reports the coefficient estimates and the corresponding t-statistics (in parentheses) for regressions (5.5) and (5.6) at pan-European level. At large, it appears that *HML* covaries positively, though insignificantly, with $\Delta term$, even in presence of the market factor. Besides, *HML* does not seem to have a significant relation with Δdef. These relations are in line with our previous findings for the correlation patterns. Yet, albeit the sign of the relations are in accordance with our null hypothesis, the lack of statistical significance does not necessarily allow us to underpin the findings of Hahn and Lee (2006) and Petkova (2006). In other words, the figures depicted in Table 5.10 do not clearly support the argument that $\Delta term$ conveys the same information as *HML*.

For *SMB*, we again fail to find any significant negative relation to Δdef. Thus, even if the sign tendency is in accordance with our null hypothesis that size and the change in the default spread are inversely related, the lack of statistical support entails that *SMB* and -Δdef do not convey similar information. Again, this is contrary to the findings of Hahn and Lee (2006) and Petkova (2006). Nonetheless, as for the correlation patterns, we find some empirical support for a negative relation between *SMB* and $\Delta term$ at pan-European and, especially, Eurozone level. As previously suggested, a significant negative relation between *SMB* and $\Delta term$ may be explained by the fact that small firms exhibit less debt than bigger firms. As such, they are less sensitive to increases in interest rates.[42]

Taken together, our results indicate that if at all, only $\Delta term$ might contain some business cycle risk components related to the FF factors. Yet, our results are not robust enough to support at large the view that changes in the European term spread convey any significant information contained in pan-European size or even book-to-market factors. It also appears that Δdef does not capture any clear pattern of variation in *HML* and *SMB* either, albeit we expected a negative relation between size and changes in the default spread.

Eventually, given the apparent differences in information embedded in the (i) FF factors and (ii) changes in yield spreads begs the question whether an alternative asset pricing model comprised of the market factor and the yield factors may outperform the conventional 3FM in pricing pan-European portfolios.

[42] Note again that a decrease in $\Delta term$ basically conveys an increase in interest rates (Fama and French, 1989, Hahn and Lee, 2006).

Table 5.10: *SMB* & HML Factor Regressions - Region

The numbers reported are coefficient estimates of the regressions with the associated t-statistics in parentheses. The t-statistics are computed using Newey-West heteroscedastic-robust standard errors with three lags. The R^2 are adjusted for the number of degrees of freedom. MRF denotes the return to the DJ Euro Stoxx index in excess to the one-month ecu-markt deposit. SMB is the return on a portfolio that is long on small capitalization stocks and short on big capitalization securities, holding book-to-market and momentum characteristics of the portfolio constant. HML is the return on a portfolio that is long on high book-to-market stocks and short on low book-to-market securities, holding size and momentum characteristics of the portfolio constant. The default and term spread factors are defined as follows: $\Delta def_t \equiv def_t - def_{t-1}$, and $\Delta term_t \equiv term_t - term_{t-1}$ where def_t and $term_t$ are the default spread and term spread at time T. The default spread is defined as the spread between yield to maturity on the all-maturities iBoxx BBB Corporate Bond Index for the Eurozone and the all-maturities FTSE Global Government Eurozone index. The term spread is defined as the spread between the 10- and one-year Eurozone government bond for constant maturities. The sample period is May 1999 to October 2006 and the results are based on monthly data.

Region	Dependent Variable	Independent Variables				
		Constant	MRF	Δdef	Δterm	Adj. R^2
Panel A: Eurozone						
	SMB	0.158	0.426	-0.237	-1.464	0.594
		(9.152)	(5.552)	(-0.571)	(-1.871)	
		0.158	0.453	-0.066		0.584
		(9.063)	(5.914)	(-0.152)		
		0.157	0.428		-1.365	0.593
		(9.225)	(5.567)		(-1.777)	
	HML	0.088	-0.051	-0.167	1.348	0.070
		(6.018)	(-0.783)	(-0.422)	(1.083)	
		0.087	-0.076	-0.324		0.047
		(6.080)	(-1.366)	(-0.804)		
		0.087	-0.049		1.417	0.069
		(5.986)	(-0.756)		(1.125)	
Panel B: EU						
	SMB	0.162	0.403	-0.191	-1.412	0.586
		(9.613)	(5.273)	(-0.454)	(-1.538)	
		0.162	0.429	-0.026		0.576
		(9.525)	(5.665)	(-0.058)		
		0.161	0.405		-1.332	0.585
		(9.695)	(5.267)		(-1.481)	
	HML	0.080	-0.023	-0.093	1.191	0.057
		(6.946)	(-0.422)	(-0.312)	(1.210)	
		0.079	-0.044	-0.232		0.028
		(6.893)	(-0.899)	(-0.733)		
		0.079	-0.022		1.229	0.057
		(6.996)	(-0.400)		(1.228)	
Panel C: Europe						
	SMB	0.164	0.421	-0.019	-1.290	0.624
		(10.243)	(5.807)	(-0.047)	(-1.344)	
		0.165	0.444	0.132		0.615
		(10.134)	(6.142)	(0.322)		
		0.164	0.421		-1.282	0.624
		(10.454)	(5.814)		(-1.351)	
	HML	0.078	-0.031	-0.186	0.901	0.043
		(6.080)	(-0.494)	(-0.543)	(0.845)	
		0.078	-0.047	-0.291		0.028
		(6.107)	(-0.822)	(-0.851)		
		0.078	-0.029		0.979	0.040
		(6.068)	(-0.461)		(0.931)	

This holds especially under the consideration that this alternative three-factor model exhibits factors that are clearly linked to systematic risks, i.e., factors that appear to capture time variation in investment opportunities.

5.2.3.2 Time-Series Analysis: 3FM & Alternative Model

Given our findings above, this section merely intends to contrast the pricing ability of the 3FM with that of an alternative asset pricing model, which extends the conventional CAPM by two additional pricing factors: a change in the default spread (Δdef) and a change in the term spread ($\Delta term$). In particular, we estimate factor loadings for our 27 portfolios (per Eurozone, EU, and Europe) described in Section 3.3 by the following two time-series regressions:

$$R_{j,t} = \alpha_j + \beta_j^{MRF} MRF_t + \beta_j^{SMB} SMB_t + \beta_j^{HML} HML_t + \varepsilon_{j,t} \tag{5.7}$$

$$R_{j,t} = a_j + b_j^{MRF} MRF_t + b_j^{def} \Delta def_t + b_j^{term} \Delta term_t + e_{j,t} \tag{5.8}$$

where $R_{j,t}$ is the excess return to a portfolio j ($j = 1, \ldots, 27$) at time t. Note that Equation (5.7) is exactly the same as Equation (4.2) introduced in Section 4.1.2, page 106.[43] As our sample period for the default and term spreads runs only from May 1999 to October 2006, we replicate the FF regressions of Section 4.1 for this exact same sample period in order to make the time frames, and thus the test results, consistent and comparable.

Table 5.11 reports per region the mean absolute deviation (MAD) of the regression intercepts, α, and the adjusted coefficient of determinations, R^2, of the time-series regressions specified in Equations (5.7) and (5.8).[44] The depicted statistics reveal a few remarkable insights. First of all, the regression results for the 3FM are fairly consistent with our findings depicted for the 3FM per region in Section 4.1.3.[45] Minor potential deviations may merely be traced back to the different sample periods employed (May 1999 to October 2006 vs. January 1981 to April 2008, cf. Section 3.2 for details).

Second, the 3FM provides higher adjusted R^2 values vis-à-vis the alternative asset pricing model in all three regions. This suggests that the 3FM appears to be superior to the alternative model for the pricing of equity in Europe. Put differently, size and book-to-market seem to be better able to explain the time-variation of equity returns than changes in European default and term spreads.

[43] The only difference is that Equation (4.2) still depicts the return to the risk free asset, R_f, which has already been subtracted from the R_j in Equation (5.7).

[44] Given the vast number of regressions, i.e., 2 × 27 × 3 (2 asset pricing models, 27 equity portfolios, and 3 regions), we refrain from showing all factor loadings in detail but rather focus on the general average explanatory power of both asset pricing models.

[45] cf. Tables 4.1 on page 113.

Table 5.11: 3FM vs. Alternative Model: $|\alpha|$ & Adjusted R^2 - Region

This table reports the time-series regression results for the following two regression specifications:

Fama-French 3FM: $R_{j,t} = \alpha_j + \beta_j^{MRF} MRF_t + \beta_j^{SMB} SMB_t + \beta_j^{HML} HML_t + \varepsilon_{j,t}$
Alternative Model: $R_{j,t} = a_j + b_j^{MRF} MRF_t + b_j^{def} \Delta def_t + b_j^{term} \Delta term_t + e_{j,t}$

R_j is the monthly return on the 27 portfolios per region depicted in Table 3.2 in excess of the one-month ecu rate. MRF denotes the return to the DJ Euro Stoxx 50 index in excess to the one-month ecu-markt deposit. SMB is the return on a portfolio that is long on small capitalization stocks and short on big capitalization securities, holding book-to-market and momentum characteristics of the portfolio constant. HML is the return on a portfolio that is long on high book-to-market stocks and short on low book-to-market securities, holding size and momentum characteristics of the portfolio constant. The default and term spread factors are defined as follows: $\Delta def_t \equiv def_t - def_{t-1}$, and $\Delta term_t \equiv term_t - term_{t-1}$ where def_t and $term_t$ are the default spread and term spread at time T. The default spread is defined as the spread between yield to maturity on the all-maturities iBoxx BBB Corporate Bond Index for the Eurozone and the all-maturities FTSE Global Government Eurozone index. The term spread is defined as the spread between the 10- and one-year Eurozone government bond for constant maturities. The sample period is May 1999 to October 2006. Av. $|\alpha|$ denotes the mean absolute deviation from 0 of the regression intercepts. The R^2s of the regressions are adjusted R^2 from the regression of the average portfolio returns and a constant and the respective factors.

	Fama-French 3FM		Alternative Model	
	Av. $\lvert\alpha\rvert$	Adj. R^2 (%)	Av. $\lvert\alpha\rvert$	Adj. R^2 (%)
Eurozone	0.070	56.23	0.144	48.01
EU	0.091	57.87	0.147	52.70
Europe	0.105	62.83	0.148	55.59

Our findings may also entail that *SMB* and *HML* contain different - and, in fact, more - information on European equity returns than Δdef and $\Delta term$. Notwithstanding, as *SMB* and *HML* are constructed from the returns to the portfolios sorted on the same attributes as our 27 portfolios, one may expect that *SMB* and *HML* will outperform other regressors with nearly similar information in a time-series framework.

Third, note that the regression intercepts, α, are considerably higher for the alternative model than for the 3FM. In general, the closer the absolute value of α to zero, the lower the pricing error of the asset pricing model. However, as our factor proxies Δdef and $\Delta term$ are not portfolio excess returns, their sample means do not correspond to estimated risk premia.[46] Hence, the intercepts of the time-series regressions for the alternative model [cf. Equation (5.8)] do not correspond to the pricing error of the model for a given portfolio j. In consequence, the usual tests of the null hypothesis of the regression intercepts

[46] Note that *SMB* and *HML* are insofar excess returns as they depict the differences in returns between (i) short and big firms and (ii) high book-to-market and low book-to-market firms, respectively.

being jointly zero, such as the finite F-test of Gibbons et al. (1989), are not strictly applicable.[47] We, thus, turn our focus on cross-sectional analyses to make a better inference on whether the alternative model is able to outperform the 3FM in Europe or not.

5.2.3.3 Fama and MacBeth (1973) Cross-Sectional Estimation: 3FM & Alternative Model

The previous section has been indicative about the average pricing abilities of the 3FM and the alternative pricing model. Nevertheless, our findings so far have not yet addressed the matter on whether the 3FM may better price the cross-section of European equity than the alternative three-factor model or vice-versa. However, addressing this issue is not to be neglected. The content of the expected return-beta representation of asset pricing models is that the cross-sectional variation of average returns arises from the cross-sectional variation in the factor loadings.

In order to test for the cross-sectional pricing ability of the factor models, we employ the two-pass cross-sectional regression approach proposed by Fama and MacBeth (1973).[48] In particular, we build up on the parameter estimates that we obtain from the time-series regressions specified in Equations (5.7) and (5.8) and use them in the following two regressions:

$$R_t = \gamma_1 + \gamma_{MRF1}\hat{\beta}^{MRF} + \gamma_{SMB}\hat{\beta}^{SMB} + \gamma_{HML}\hat{\beta}^{HML} + \varepsilon_t \quad (5.9)$$

$$R_t = \gamma_2 + \gamma_{MRF2}\hat{b}^{MRF} + \gamma_{def}\hat{b}^{def} + \gamma_{term}\hat{b}^{term} + e_t \quad (5.10)$$

where R_t is the cross-section of the excess monthly return to our 27 portfolios. The independent variables in Equation (5.9) are a constant, γ_1, and the cross-section of $\hat{\beta}^{MRF}$, $\hat{\beta}^{SMB}$, and $\hat{\beta}^{HML}$, which are the estimated slope coefficients from a time-series regression of R_j on a constant, *MRF*, *SMB*, and *HML* for each portfolio j ($j = 1, \ldots, 27$) [cf. Equation (5.7)]. Likewise, the independent

[47] Please refer to Section 4.1.2.3 and Cochrane (2005) for an elaborated explanation.

[48] Alternatively one may use a generalized method of moments (GMM) estimation of a stochastic discount factor (SDF) representation of a given linear factor model. However, even if the GMM approach imposes less stringent statistical assumptions than the traditional Fama and MacBeth (1973) approach, the small sample properties of GMM may be a concern for the reliability of the estimates. Hence, we only compute and report the estimation results from the Fama and MacBeth (1973) regressions.

variables in Equation (5.10) are a constant, γ_2, and the cross-section of $\hat{b}^{MRF}$, $\hat{b}^{def}$, and $\hat{b}^{term}$, which are the estimated slope coefficients from a time-series regression of R_j on a constant, *MRF*, Δdef, and $\Delta term$ for each portfolio j ($j = 1, \ldots, 27$) [cf. Equation (5.8)].

Table 5.12 reports the results from the Fama and MacBeth (1973) regressions for the 3FM and alternative asset pricing model for the Eurozone, the EU, and Europe as a whole. The shown T-statistics are computed using Shanken's (1992) adjusted standard errors, which correct for the bias introduced by the sampling errors estimated betas. The R^2s of the regressions are adjusted R^2 from the regression of the average portfolio returns on a constant and the estimated betas. The F-statistics and the associated p-value (in parentheses) report cross-sectional regression tests of the linear expected return-beta relation according to Shanken (1985).[49]

As for the time-series, it appears that the 3FM outperforms the alternative asset pricing model (APM) in all three regions when merely looking at the adjusted R^2 values. However, the dominance diminishes once we move from the Eurozone (3FM: R^2=65.32% vs. APM: R^2=52.94%) via the EU (3FM: R^2=60.03% vs. APM: R^2=53.49%) to Europe as a whole (3FM: R^2=60.23% vs. APM: R^2=57.75%). Moreover, we find that all slope coefficients on $\hat{\beta}^{SMB}$ and $\hat{\beta}^{HML}$ are statistically significant in case of the 3FM. On the other hand, Table 5.12 reveals that only one of the loadings on $\hat{b}^{def}$ (Europe) and two loadings on $\hat{b}^{term}$ (EU and Europe) are statistically significant. These findings make a stronger case for the 3FM vis-à-vis the alternative pricing model. They also imply that *SMB* and *HML* exhibit more incremental information about the cross-sectional variation of pan-European equity returns than $\Delta term$ and, especially, Δdef.

Yet, if we shift our view to the F-statistics and our null hypothesis of the pricing errors being jointly equal to zero, then it appears that the alternative model dominates, albeit not considerably, the 3FM. Admittedly, we reject the null hypothesis in all cases but for the alternative pricing model in Europe ($F = 1.635$; $p = 0.058$). Nonetheless, if we consider the magnitude of the F-statistics as a reference to show how strongly the empirical data supports the model, i.e., the

[49] To avoid the problem of a potentially large Type I error that may occur by relying on an asymptotic theory when the sample size is small, we employ Shanken's (1985) F-test as an alternative to the asymptotic valid χ^2 test.

Table 5.12: Fama-MacBeth: 3FM & Alternative Model - Region

This table reports the regression coefficients and the associated t-statistics from the Fama-MacBeth (1973) regressions for the sample period May 1999 to October 2006. The dependent variable, R_t, is the cross section of the monthly return on the 27 portfolios per region depicted in Table 3.2 in excess of the one-month ecu rate. In Panel A, the independent variables are a constant and the cross-section of $\hat{\beta}^{MRF}$, $\hat{\beta}^{SMB}$, and $\hat{\beta}^{HML}$, which are the estimated factor loadings from a time-series regression on R_j on a constant, MRF, SMB, and HML for each portfolio j ($j = 1, \ldots, 27$). MRF denotes the return to the DJ Euro Stoxx 50 index in excess to the one-month ecu-markt deposit. SMB is the return on a portfolio that is long on small capitalization stocks and short on big capitalization securities, holding book-to-market and momentum characteristics of the portfolio constant. HML is the return on a portfolio that is long on high book-to-market stocks and short on low book-to-market securities, holding size and momentum characteristics of the portfolio constant. In Panel B, the independent variables are a constant and the cross-section of $\hat{b}^{MRF}$, $\hat{b}^{def}$, and $\hat{b}^{term}$, which are the estimated factor loadings from a time-series regression of R_j on a constant, MRF, Δdef, and $\Delta term$ for each portfolio j ($j = 1, \ldots, 27$). The default and term spread factors are defined as follows: $\Delta def_t \equiv def_t - def_{t-1}$, and $\Delta term_t \equiv term_t - term_{t-1}$ where def_t and $term_t$ are the default spread and term spread at time T. The default spread is defined as the spread between yield to maturity on the all-maturities iBoxx BBB Corporate Bond Index for the Eurozone and the all-maturities FTSE Global Government Eurozone index. The term spread is defined as the spread between the 10- and one-year Eurozone government bond for constant maturities. The T-statistics are computed using Shanken's (1992) adjusted standard errors. The R^2s of the regressions are adjusted R^2 from the regression of the average portfolio returns and a constant and the estimated betas. The F-statistics and the associated p-value (in parentheses) report Shanken's (1985) cross-sectional regression test of the linear expected return-beta relation.

Panel A: Fama and French (1993) 3FM

		$R_t = \gamma_1 + \gamma_{MRF1}\hat{\beta}^{MRF} + \gamma_{SMB}\hat{\beta}^{SMB} + \gamma_{HML}\hat{\beta}^{HML} + \varepsilon_t$					
		γ_1	γ_{MRF1}	γ_{SMB}	γ_{HML}	R^2 (%)	F-Test
Eurozone	Coefficient	0.029	0.131	0.123	0.038	65.32	6.783
	T-Statistic	1.046	2.210	9.096	2.957		(0.000)
EU	Coefficient	0.046	0.119	0.126	0.037	60.03	4.857
	T-Statistic	1.006	1.460	10.631	3.536		(0.000)
Europe	Coefficient	0.044	0.129	0.130	0.030	60.23	4.063
	T-Statistic	0.839	1.616	9.233	2.471		(0.000)

Panel B: Alternative Three-Factor Model

		$R_t = \gamma_2 + \gamma_{MRF2}\hat{b}^{MRF} + \gamma_{def}\hat{b}^{def} + \gamma_{term}\hat{b}^{term} + e_t$					
		γ_2	γ_{MRF2}	γ_{def}	γ_{term}	R^2 (%)	F-Test
Eurozone	Coefficient	-0.005	0.212	-0.014	-0.011	52.94	4.856
	T-Statistic	-0.266	3.027	-0.592	-1.527		(0.000)
EU	Coefficient	-0.001	0.210	-0.011	-0.016	53.49	2.706
	T-Statistic	-0.049	3.034	-0.617	-3.675		(0.000)
Europe	Coefficient	-0.011	0.210	-0.020	-0.018	57.75	1.635
	T-Statistic	-0.494	4.005	-1.796	-3.625		(0.058)

lower the statistics, the greater the support, then the alternative model surpasses the 3FM.

At large, our findings for the Fama and MacBeth (1973) regressions suggest that at the margin the 3FM does a slightly better job than the alternative pricing model. Yet, it does not appear that either model clearly dominates the other. Put differently, both models do nearly equally well in explaining the cross-section of European equity returns, despite the existence of some minor empirical support in favor of the 3FM. However, we have learned in Section 5.2.3.1 that the FF factors and the changes in the yield spreads do not necessarily convey the same information. This leaves the question whether augmenting the 3FM by Δdef and $\Delta term$ (or the alternative model by *SMB* and *HML*) may considerably enhance the model's ability to explain European equity behavior.

5.2.3.4 Augmented Pricing Models

Following up on our discussion above, we asses in a final step, whether augmenting our pan-European versions of the 3FM by Δdef and $\Delta term$ results in a better explanation of the cross-sectional variation in our 27 portfolio returns.[50] We therefore start to construct the portions of Δdef and $\Delta term$ orthogonal to *SMB* and *HML* as the respective sums of the estimated intercepts and the monthly series of residuals from the following time-series regressions:

$$\Delta def_t = \alpha_1 + \gamma_1 SMB_t + \phi_1 HML_t + \varepsilon_{1,t} \quad (5.11)$$

$$\Delta term_t = \alpha_2 + \gamma_2 SMB_t + \phi_2 HML_t + \varepsilon_{2,t} \quad (5.12)$$

We denote these two new variables $\Delta def^{\perp}$ and $\Delta term^{\perp}$.[51] We then run again Fama and MacBeth (1973) regressions using the estimated betas from time-series regressions of our 27 portfolios and the five factors: MRF, SMB, HML, $\Delta def^{\perp}$, and $\Delta term^{\perp}$.

An alternative approach that leads exactly to the same explanatory power (i.e., coefficient of determination), yet different factor loadings, is to augment our alternative asset pricing model by orthogonalized *SMB* and *HML* factors. Thus, to double-check our results, we construct the portions of *SMB* and *HML* orthogonal to Δdef and $\Delta term$. The portion of *SMB* orthogonal to Δdef and $\Delta term$, i.e., $SMB^{\perp}$, is therefore computed as the intercept plus the monthly series of residuals from the following time-series regression:

$$SMB_t = a_1 + \mu_1 \Delta def_t + \nu_1 \Delta term_t + e_{1,t}. \quad (5.13)$$

We analogously define the portion of *HML* orthogonal to Δdef and $\Delta term$, i.e., $HML^{\perp}$, with the help of the following time-series regression:

$$HML_t = a_2 + \mu_2 \Delta def_t + \nu_2 \Delta term_t + e_{2,t} \quad (5.14)$$

[50] The design of the test is similar to the one of Ferguson and Shockley (2003) and, as all previous tests in this section, the one of Hahn and Lee (2006).

[51] In detail: $\Delta def_t^{\perp} = \alpha_1 + \varepsilon_{1,t}$ and $\Delta term_t^{\perp} = \alpha_2 + \varepsilon_{2,t}$.

We then run once more Fama and MacBeth (1973) regressions. Yet, this time we use our 27 portfolios per region with the five corresponding factors: MRF, $SMB^{\perp}$, $HML^{\perp}$, Δdef, and $\Delta term$.[52]

Table 5.13 reports the regression results for the augmented versions of the 3FM and the alternative asset pricing model per region. All in all, the findings suggest that pooling all variables in one model allows for a considerably enhanced explanation of the cross-sectional variation in equity returns, both in regard to the conventional 3FM and necessarily also for our alternative three factor asset pricing model. The augmented 3FM depicted in Panel A of Table 5.13 and the augmented alternative asset pricing model shown in Panel B in the same table clearly reveal a considerable improvement in performance.[53] Thus, pooling (i) *SMB* and *HML* and (ii) Δdef and $\Delta term$ in a common pricing model allows for an enhanced ability to price pan-European equity.

In detail, augmenting the 3FM by orthogonalized Δdef and $\Delta term$ increases the general explanatory power of the model in each region, i.e., the Eurozone, the EU, and Europe as a whole, by a substantial degree. For instance, Panel A of Table 5.13 shows that in case of the Eurozone the adjusted R^2 increases from 65.32% for the simple 3FM to 84.42% for the augmented 3FM. Moreover, in all three cases the loadings for $\hat{\beta}^{SMB}$ and $\hat{\beta}^{HML}$ remain statistically significant. Even more, the slope coefficients for $\hat{\beta}^{term\perp}$ are significant for all thee regions, entailing that the term spread adds in fact incremental - as opposed to redundant - information to the pricing model.

The empirical support for the default spread is slightly weaker, because we only find a significant factor loading for $\hat{\beta}^{def\perp}$ in case of total Europe. However, Panel B of Table 5.13 depicts that once we add orthogonalized *SMB* and *HML* to the alternative asset pricing model, the factor loadings on $\hat{\beta}^{SMB\perp}$ are not statistically significant at all, while those of $\hat{\beta}^{HML\perp}$ are in all three cases. This implies once more that $\hat{\beta}^{term\perp}$ and $\hat{\beta}^{def\perp}$ do not fully, if at all, capture the cross-sectional explanatory power of *HML*.

[52] In detail: $SMB_t^{\perp} = a_1 + e_{1,t}$ and $\Delta HML_t^{\perp} = a_2 + e_{2,t}$.

[53] These findings also indicate once more that Δdef and $\Delta term$ do not convey the same information as *SMB* and *HML*. This, in turn, implies once more that changes in the default spread and the term spread do not proxy for the potential risk underlying size and book-to-market in Europe.

Table 5.13: Fama-MacBeth: Augmented Models - Region

This table reports the regression coefficients and the associated t-statistics from the Fama-MacBeth (1973) regressions for the sample period May 1999 to October 2006. The dependent variable, R_t, is the cross section of the monthly return on the 27 portfolios per region depicted in Table 3.2 in excess of the one-month ecu rate. In Panel A, the independent variables are a constant and the cross-section of $\hat{\beta}^{MRF}$, $\hat{\beta}^{SMB}$, $\hat{\beta}^{HML}$, $\hat{\beta}^{def\perp}$, and $\hat{\beta}^{term\perp}$, which are the estimated factor loadings from a time-series regression on R_j on a constant, MRF, SMB, HML, $\Delta def\perp$, and $\Delta term\perp$ for each portfolio j. MRF denotes the return to the DJ Euro Stoxx 50 index in excess to the one-month ecu-markt deposit. SMB is the return on a portfolio that is long on small capitalization stocks and short on big capitalization securities, holding book-to-market and momentum characteristics of the portfolio constant. HML is the return on a portfolio that is long on high book-to-market stocks and short on low book-to-market securities, holding size and momentum characteristics of the portfolio constant. $\Delta def\perp$ is the sum of the intercept and residual from regressing Δdef on a constant, SMB, and HML. $\Delta term\perp$ is the sum of the intercept and residual from regressing $\Delta term$ on a constant, SMB, and HML. The default and term spread factors are defined as follows: $\Delta def_t \equiv def_t - def_{t-1}$, and $\Delta term_t \equiv term_t - term_{t-1}$ where def_t and $term_t$ are the default spread and term spread at time T. The default spread is defined as the spread between yield to maturity on the all-maturities iBoxx BBB Corporate Bond Index for the Eurozone and the all-maturities FTSE Global Government Eurozone index. The term spread is defined as the spread between the 10- and one-year Eurozone government bond for constant maturities. In Panel B, the independent variables are a constant and the cross-section of $\hat{\beta}^{MRF}$, $\hat{\beta}^{SMB\perp}$, $\hat{\beta}^{HML\perp}$, $\hat{\beta}^{def}$, and $\hat{\beta}^{term}$, which are the estimated factor loadings from a time-series regression of R_j on a constant, MRF, $SMB\perp$, $HML\perp$, Δdef, and $\Delta term$ for each portfolio j. $SMB\perp$ is the sum of the intercept and residual from regressing SMB on a constant, Δdef, and $\Delta term$. $HML\perp$ is the sum of the intercept and residual from regressing HML on a constant, Δdef, and $\Delta term$. The T-statistics are computed using Shanken's (1992) adjusted standard errors. The R^2s of the regressions are adjusted R^2 from the regression of the average portfolio returns and a constant and the estimated betas. The F-statistics and the associated p-value (in parentheses) report Shanken's (1985) cross-sectional regression test of the linear expected return-beta relation.

Panel A: Fama and French (1993) 3FM with Marginal Contribution of SMB and HML Factors

$$R_t = \gamma_0 + \gamma_{MRF}\hat{\beta}^{MRF} + \gamma_{SMB}\hat{\beta}^{SMB} + \gamma_{HML}\hat{\beta}^{HML} + \gamma_{def\perp}\hat{\beta}^{def\perp} + \gamma_{term\perp}\hat{\beta}^{term\perp} + \varepsilon_t$$

		γ_0	γ_{MRF}	γ_{SMB}	γ_{HML}	$\gamma_{def\perp}$	$\gamma_{term\perp}$	R^2 (%)	F-Test
Eurozone	Coefficient	0.016	0.091	0.168	0.049	-0.015	-0.021	84.42	2.002
	T-Statistic	0.810	2.363	15.104	6.280	-1.138	-8.178		(0.014)
EU	Coefficient	0.034	0.108	0.154	0.038	-0.016	-0.021	75.52	2.277
	T-Statistic	0.753	1.485	15.490	4.493	-1.300	-5.364		(0.005)
Europe	Coefficient	0.015	0.125	0.153	0.040	-0.018	-0.025	76.79	2.230
	T-Statistic	0.375	2.102	14.179	4.309	-2.063	-5.275		(0.006)

Panel B: Alternative Model with Marginal Contribution of SMB and HML Factors

$$R_t = \gamma_0 + \gamma_{MRF}\hat{\beta}^{MRF} + \gamma_{SMB\perp}\hat{\beta}^{SMB\perp} + \gamma_{HML\perp}\hat{\beta}^{HML\perp} + \gamma_{def}\hat{\beta}^{def} + \gamma_{term}\hat{\beta}^{term} + \varepsilon_t$$

		γ_0	γ_{MRF}	$\gamma_{SMB\perp}$	$\gamma_{HML\perp}$	γ_{def}	γ_{term}	R^2 (%)	F-Test
Eurozone	Coefficient	0.016	0.091	0.021	0.093	-0.017	-0.025	84.42	2.002
	T-Statistic	0.810	2.363	1.159	8.187	-1.241	-9.208		(0.014)
EU	Coefficient	0.034	0.108	0.017	0.071	-0.017	-0.024	75.52	2.277
	T-Statistic	0.753	1.485	0.772	6.302	-1.376	-6.188		(0.005)
Europe	Coefficient	0.015	0.125	-0.006	0.071	-0.019	-0.029	76.79	2.230
	T-Statistic	0.375	2.102	-0.261	5.599	-2.123	-5.988		(0.006)

5.2.4 Empirical Findings per Industry & Country

After having assessed to what extent Δdef and $\Delta term$ may capture variation in *SMB* and *HML* at regional level, we now shift our view to the industry and country level. We therefore impose European market integration and test whether our European Δdef and $\Delta term$ factors may be linked to our industry and country specific FF factors introduced in Section 3. The integration of European markets implies that business cycles across European countries are shared, i.e., there exists a common European business cycle. This, in turn, entails that market expectations about credit market conditions and future interest rates should not differ across country borders.

Our motivation to impose market integration is twofold. For one, we have only information on pan-European default and term spreads at hand (cf. Section 5.2.2). In other words, we lack information on preferred country and industry specific yield spreads. For two, assessing whether Δdef and $\Delta term$ may convey similar information as our industry and country specific FF factors may serve as a robustness check (albeit, admittedly, limited), for our previous derived results at regional level. Nonetheless, it needs to be clearly stated at the outset that our imposition of a common business cycle across European country borders is of a very strong nature.[54] Hence, our industry, and especially country findings should be treated with caution and should only be considered as a supportive complement to our actual results at regional level.

5.2.4.1 Industry Findings

We begin again with the study of the relation between the FF factors and changes in the yield spreads in presence of the market factor.[55] We then compare per industry the 3FM to the alternative pricing model using both time-series and cross-sectional analysis. In a final step, we augment per industry the 3FM by Δdef and $\Delta term$ to assess whether this amplified model exhibits a considerable superior pricing ability relative to the 3FM.

All in all, our industry findings underpin our results at regional level, suggesting that Δdef and $\Delta term$ do not appear to proxy for the risk underlying *SMB* and *HML*. They, yet, act as good complements for pricing European equity at industry level. In other words, the combination of (i) size and book-to-market with (ii) changes in the European default spread and term spread leads to a considerable improvement for the explanation of the cross-sectional variation in

[54]For instance, Hallett and Richter (2006) remark that even if some Eurozone countries have some business cycles in common, they may still diverge at other frequencies. Moreover, countries may vary in the components and characteristics that make up their output cycles and may also differ in their position around the output cycle at each point in time (Hallett and Richter, 2008).

[55]We refrain from showing all the correlation coefficients since we are primarily interested in testing whether our term factor and default factor contain any systematic risks in *SMB* and *HML* that are not captured by the market beta (cf. Footnote 41, page 201).

Table 5.14: Summary of Relations: FF Factors & Δ in Yields - Industry

This table summarizes the results presented in Table E.2. In particular, it depicts the relationships between SMB and HML, on the one hand, and Δdef and $\Delta term$, on the other hand, at an aggregated industry level. Per SMB and HML, the first row depicts the number of positive (+), negative (-), and inconsistent (0) relations between the aforementioned factors and Δdef and $\Delta term$. The second row shows (in parentheses) how many of these relations are statistically significant at the 10% significance level. SMB is the return on a portfolio that is long on small capitalization stocks and short on big capitalization securities, holding book-to-market and momentum characteristics of the portfolio constant. HML is the return on a portfolio that is long on high book-to-market stocks and short on low book-to-market securities, holding size and momentum characteristics of the portfolio constant. The default and term spread factors are defined as follows: $\Delta def_t \equiv def_t - def_{t-1}$, and $\Delta term_t \equiv term_t - term_{t-1}$ where def_t and $term_t$ are the default spread and term spread at time T. The default spread is defined as the spread between yield to maturity on the all-maturities iBoxx BBB Corporate Bond Index for the Eurozone and the all-maturities FTSE Global Government Eurozone index. The term spread is defined as the difference between the 10-year and one-year Eurozone interest rate for constant maturities. The sample period is May 1999 to October 2006 and the results are based on monthly data.

	Δdef			$\Delta term$		
	+	-	0	+	-	0
SMB	6	5	-	2	9	-
significant	(3)	(3)	-	-	(3)	-
HML	9	2	-	7	4	-
significant	(1)	-	-	-	-	-

equity returns. This suggests that the information contained in these variables is complementary rather than redundant.

5.2.4.1.1 Relation Between FF Factors & Yield Spreads

Table 5.14 summarizes the number of positive (+), negative (-), and inconsistent (0) relations between our industry specific *SMB* and *HML* factors (cf. Section 3) and our European Δdef and $\Delta term$ factors.[56] The figures presented in $(\cdot)$ also imply how many of these relations are statistically significant at the 10% significance level. All results are based on applying Equations (5.5) and (5.6) [page 201] in each of our sample industries. A more detailed overview about the findings per industry are depicted in Table E.2 in Appendix E.

In line with our findings above, we find that the relation between *HML* and $\Delta term$ is mainly positive (7 out of 11 cases). Admittedly, the empirical support

[56] *Inconsistent (0)* in this regard means that we cannot identify a clear pattern of a positive or negative relationship between *SMB* / *HML* and Δdef / $\Delta term$, because the sign of relation depends on whether Δdef and $\Delta term$ serve simultaneously as regressors or not (cf. Table E.2 on page 429 in Appendix E).

is weak as none of the relations between *HML* and $\Delta term$ is statistically significant. Thence, it appears that $\Delta term$ does not contain clear business cycle risk components to *HML*. This may yet be explained by the fact that the business cycles of different industries do not overlap.[57] Nonetheless, as for our regional analysis, yet contrary to our expectations outlined in Section 5.2.1, we find a weak and negative relation between *SMB* and $\Delta term$. Admittedly, this relation is not very robust and only significant in a few cases (i.e., *cyclical services*, *information technologies*, and *general services*; cf. Table E.2 in Appendix E).

Moreover, in accordance with our previous results at regional level, it appears as if there is no clear link between Δdef and either *SMB* or *HML*. This holds especially for the relation between Δdef and *SMB*. We find that for about half the industries the relation is positive (6 out of 11 cases), while for the remaining five industries the relation is negative. Finally, it seems that *HML* is mainly positively related to Δdef. Yet, the lack of significant statistical support suggests that Δdef contains in fact different information than *HML*. Furthermore, the fairly low adjusted R^2 values depicted in Table E.2 in Appendix E underpin further that Δdef and $\Delta term$ do not necessarily capture the variation in *SMB* and *HML* related to the business cycle.

5.2.4.1.2 Time-Series Analysis

Given the apparent difference in information between (i) size and book-to-market and (ii) changes in the term spread and, especially, default spread at industry level, this section intends to contrast the pricing ability of an industry specific 3FM with that of our alternative asset pricing model. Our findings for a time-series analysis based on Equations (5.7) and (5.8) on page 204 are depicted in Table 5.15.

As for our previous analyses, it appears that the 3FM dominates the alternative asset pricing model. For all industries, the 3FM exhibits higher adjusted R^2 values vis-à-vis the alternative pricing model. This entails that the 3FM is better able to explain the time-variation in equity return behavior at industry

[57] Note again that *HML* is industry specific, while $\Delta term$ is a European factor.

Table 5.15: 3FM vs. Alternative Model: $|\alpha|$ & Adjusted R^2 - Industry

This table reports the time-series regression results for the following two regression specifications:

Fama-French 3FM: $R_{j,t} = \alpha_j + \beta_j^{MRF} MRF_t + \beta_j^{SMB} SMB_t + \beta_j^{HML} HML_t + \varepsilon_{j,t}$
Alternative Model: $R_{j,t} = a_j + b_j^{MRF} MRF_t + b_j^{def} \Delta def_t + b_j^{term} \Delta term_t + e_{j,t}$

R_j is the monthly return on the 27 portfolios per region depicted in Table 3.2 in excess of the one-month ecu rate. MRF denotes the return to the DJ Euro Stoxx 50 index in excess to the one-month ecu-markt deposit. SMB is the return on a portfolio that is long on small capitalization stocks and short on big capitalization securities, holding book-to-market and momentum characteristics of the portfolio constant. HML is the return on a portfolio that is long on high book-to-market stocks and short on low book-to-market securities, holding size and momentum characteristics of the portfolio constant. The default and term spread factors are defined as follows: $\Delta def_t \equiv def_t - def_{t-1}$, and $\Delta term_t \equiv term_t - term_{t-1}$ where def_t and $term_t$ are the default spread and term spread at time T. The default spread is defined as the spread between yield to maturity on the all-maturities iBoxx BBB Corporate Bond Index for the Eurozone and the all-maturities FTSE Global Government Eurozone index. The term spread is defined as the spread between the 10- and one-year Eurozone government bond for constant maturities. The sample period is May 1999 to October 2006. Av. $|\alpha|$ denotes the mean absolute deviation from 0 of the regression intercepts. The R^2s of the regressions are adjusted R^2 from the regression of the average portfolio returns and a constant and the respective factors.

BAS = *basic industries*; CGD = *cyclical consumer goods*; CSER = *cyclical services*; TOLF = *financials*; GN = *general industries*; ITECH = *information technology*; NCGD = *non-cycical consumer goods*; RES = *resources*; UTL = *utilities*.

	Fama-French 3FM		Alternative Model	
	Av. $\lvert\alpha\rvert$	Adj. R^2 (%)	Av. $\lvert\alpha\rvert$	Adj. R^2 (%)
BAS	0.047	33.06	0.113	14.33
CGD	0.114	24.85	0.111	18.50
CSER	0.040	47.54	0.091	40.25
TOLF	0.122	43.65	0.137	29.90
GN	0.135	46.85	0.179	35.44
ITECH	0.078	56.52	0.221	42.35
NCGD	0.216	26.43	0.262	20.46
RES	0.257	28.30	0.605	15.65
UTL	0.055	27.92	0.115	14.43
Industry	0.102	51.14	0.159	42.08
Service	0.060	54.43	0.121	45.47

level.[58] Along the lines of our previous discussion, and our primary interest in cross-sectional patterns, we now shift our focus on a comparison of these two pricing model considering the Fama and MacBeth (1973) step-wise procedure.

5.2.4.1.3 Fama and MacBeth (1973) Cross-Sectional Estimation: 3FM & Alternative Model

Our findings of employing Equations (5.9) and (5.10) [page 206] at industry level are depicted in Tables 5.16 and 5.17, respectively. At large our results are in

[58]Note once more that the presented average α values do not reflect estimated risk premia for the alternative asset pricing model. This is due to the fact that our factor proxies Δdef and $\Delta term$ are not portfolio excess returns (cf. Section 5.2.3.2).

Table 5.16: Fama-MacBeth: 3FM - Industry

This table reports the regression coefficients and the associated t-statistics from the Fama-MacBeth (1973) regressions for the sample period May 1999 to October 2006. The dependent variable, R_t, is the cross section of the monthly return on the 27 portfolios per country depicted in Table 3.2 in excess of the one-month ecu rate. The independent variables are a constant and the cross-section of $\hat{\beta}^{MRF}$, $\hat{\beta}^{SMB}$, and $\hat{\beta}^{HML}$, which are the estimated factor loadings from a time-series regression on R_j on a constant, MRF, SMB, and HML for each portfolio j ($j = 1, \ldots, 27$). MRF denotes the return to the DJ Euro Stoxx 50 index in excess to the one-month ecu-markt deposit. SMB is the return on a portfolio that is long on small capitalization stocks and short on big capitalization securities, holding book-to-market and momentum characteristics of the portfolio constant. HML is the return on a portfolio that is long on high book-to-market stocks and short on low book-to-market securities, holding size and momentum characteristics of the portfolio constant. The T-statistics are computed using Shanken's (1992) adjusted standard errors. The R^2s of the regressions are adjusted R^2 from the regression of the average portfolio returns and a constant and the estimated betas. The F-statistics and the associated p-value (in parentheses) report Shanken's (1985) cross-sectional regression test of the linear expected return-beta relation.

BAS = *basic industries*; CGD = *cyclical consumer goods*; CSER = *cyclical services*; TOLF = *financials*; GN = *general industries*; ITECH = *information technology*; NCGD = *non-cyclical consumer goods*; UTL = *utilities*.

		$R_t = \gamma_1 + \gamma_{MRF1}\hat{b}^{MRF} + \gamma_{SMB}\hat{b}^{SMB} + \gamma_{HML}\hat{b}^{HML} + e_t$					
		γ_1	γ_{MRF1}	γ_{SMB}	γ_{HML}	R^2 (%)	F-Test
BAS	Coefficient	0.039	0.078	0.013	0.137	57.93	2.119
	T-Statistic	1.768	2.064	0.462	5.522		(0.010)
CGD	Coefficient	0.056	0.145	0.126	-0.037	62.81	2.316
	T-Statistic	4.084	3.721	8.812	-2.097		(0.003)
CSER	Coefficient	-0.005	0.112	0.045	0.010	16.44	2.119
	T-Statistic	-0.166	2.892	2.233	0.242		(0.008)
TOLF	Coefficient	0.017	0.217	0.137	0.059	70.85	3.273
	T-Statistic	0.589	4.981	7.257	2.455		(0.000)
GN	Coefficient	0.024	0.184	0.144	0.044	84.82	3.312
	T-Statistic	0.698	3.264	11.282	3.814		(0.000)
ITECH	Coefficient	-0.011	0.082	0.121	0.352	88.67	0.941
	T-Statistic	-0.188	2.306	6.669	20.242		(0.549)
NCGD	Coefficient	0.181	0.073	0.183	-0.067	49.13	1.600
	T-Statistic	3.783	2.090	8.921	-5.455		(0.074)
UTL	Coefficient	0.062	0.060	0.080	0.012	28.14	5.329
	T-Statistic	1.937	0.990	2.804	0.229		(0.000)
Industry	Coefficient	0.028	0.175	0.129	0.021	71.84	3.871
	T-Statistic	0.771	2.413	8.977	2.196		(0.000)
Service	Coefficient	-0.019	0.199	0.129	0.010	54.43	3.234
	T-Statistic	-0.581	3.526	5.596	0.415		(0.000)

accordance with our results per region. The F-statistics shown in the last column of the tables are nearly similar for the 3FM and alternative model across all industries. The biggest exceptions are to be found for *general industries* and *aggregated services*, where the F-statistics are considerably lower, though still not statistically insignificant, for the 3FM in comparison to the alternative model. On the other hand, the relative magnitude of the pricing errors appears to be significantly closer to zero for the alternative model in case of the *information technology* sector.

Table 5.17: Fama-MacBeth: Alternative Model - Industry

This table reports the regression coefficients and the associated t-statistics from the Fama-MacBeth (1973) regressions for the sample period May 1999 to October 2006. The dependent variable, R_t, is the cross section of the monthly return on the 27 portfolios per industry depicted in Table 3.2 in excess of the one-month ecu rate. The independent variables are a constant and the cross-section of $\hat{b}^{MRF}$, $\hat{b}^{def}$, and $\hat{b}^{term}$, which are the estimated factor loadings from a time-series regression of R_j on a constant, MRF, Δdef, and $\Delta term$ for each portfolio j ($j = 1, \ldots, 27$). MRF denotes the return to the DJ Euro Stoxx 50 index in excess to the one-month ecu-markt deposit. The default and term spread factors are defined as follows: $\Delta def_t \equiv def_t - def_{t-1}$, and $\Delta term_t \equiv term_t - term_{t-1}$ where def_t and $term_t$ are the default spread and term spread at time T. The default spread is defined as the spread between yield to maturity on the all-maturities iBoxx BBB Corporate Bond Index for the Eurozone and the all-maturities FTSE Global Government Eurozone index. The term spread is defined as the spread between the 10- and one-year Eurozone government bond for constant maturities. The T-statistics are computed using Shanken's (1992) adjusted standard errors. The R^2s of the regressions are adjusted R^2 from the regression of the average portfolio returns and a constant and the estimated betas. The F-statistics and the associated p-value (in parentheses) report Shanken's (1985) cross-sectional regression test of the linear expected return-beta relation.

BAS = *basic industries*; CGD = *cyclical consumer goods*; CSER = *cyclical services*; TOLF = *financials*; GN = *general industries*; ITECH = *information technology*; NCGD = *non-cyclical consumer goods*; UTL = *utilities*.

		$R_t = \gamma_2 + \gamma_{MRF2}\hat{\beta}^{MRF} + \gamma_{def}\hat{\beta}^{def} + \gamma_{term}\hat{\beta}^{term} + e_t$					
		γ_2	γ_{MRF2}	γ_{def}	γ_{term}	R^2 (%)	F-Test
BAS	Coefficient	0.026	0.150	-0.010	-0.009	23.81	2.124
	T-Statistic	0.768	1.738	-0.984	-1.838		(0.010)
CGD	Coefficient	0.016	0.238	-0.007	-0.010	49.76	2.017
	T-Statistic	1.003	6.223	-0.644	-1.561		(0.012)
CSER	Coefficient	-0.017	0.129	-0.011	-0.009	27.55	2.236
	T-Statistic	-0.752	3.281	-1.033	-2.982		(0.005)
TOLF	Coefficient	-0.026	0.306	-0.012	-0.004	60.98	3.443
	T-Statistic	-0.876	3.911	-0.713	-0.317		(0.000)
GN	Coefficient	-0.007	0.248	0.015	-0.003	85.45	2.091
	T-Statistic	-0.598	13.159	3.223	-1.580		(0.009)
ITECH	Coefficient	-0.128	0.181	0.005	-0.004	84.18	1.565
	T-Statistic	-2.514	7.355	1.356	-4.360		(0.083)
NCGD	Coefficient	0.149	0.123	-0.001	-0.003	24.00	1.618
	T-Statistic	3.415	3.539	-0.068	-0.971		(0.069)
UTL	Coefficient	0.035	0.215	-0.002	0.004	15.85	5.439
	T-Statistic	0.915	3.122	-0.210	1.248		(0.000)
Industry	Coefficient	0.011	0.209	-0.006	-0.005	65.66	3.907
	T-Statistic	0.581	3.308	-0.322	-1.133		(0.000)
Service	Coefficient	-0.050	0.267	-0.020	-0.008	42.82	2.519
	T-Statistic	-1.226	2.758	-1.426	-0.924		(0.001)

Nonetheless, the adjusted R^2 values depicted in the second last column suggest that the 3FM appears to dominate the alternative model for most industries, i.e., in 7 out of 11 cases. The alternative model seems to perform better, despite still poor, for the *cyclical services* sector only (3FM: R^2=16.44% vs. APM: R^2=27.55%). In three cases (*general industries*, *information technologies*, and *resources*), there does not appear to be much of a difference between the models' abilities to price European industry portfolios.

Furthermore, the T-statistics for the factor loadings depicted in Tables 5.16 and 5.17 convey that the information content of *SMB* and *HML* in regard to European industry portfolios is more relevant than the one of Δdef and $\Delta term$.

In detail, we find that the factor loadings for $\hat{\beta}^{SMB}$ are statistically significant in 9 out of 11 cases and those for $\hat{\beta}^{HML}$ in 7 out of 11 cases. For $\hat{b}^{def}$ and $\hat{b}^{term}$ the numbers are remarkably lower, i.e., 1 out of 11 for $\hat{b}^{def}$ and 3 out of 11 for $\hat{b}^{term}$. Again, as noted earlier, the cross-sectional slope coefficients for the 3FM appear to be more economically significant than those for the alternative model, given their relative magnitudes.

5.2.4.1.4 Augmented Pricing Models

Finally, Table 5.18 and Table E.3 in Appendix E (page 432) report the results from the Fama and MacBeth (1973) regressions for the augmented versions of the 3FM and the alternative asset pricing model per industry, respectively (cf. Section 5.2.3.4). Again, our results are very much in line with our findings per region. Adding (i) orthogonalized Δdef and $\Delta term$ to the 3FM or (ii) orthogonalized *SMB* and *HML* to the alternative asset pricing model does improve the performance of the models to a noteworthy extent.

For instance, Table 5.18 reports considerably increased adjusted R^2 values for the augmented 3FM vis-à-vis its stripped version. This holds especially for the *cyclical consumer goods*, *utilities*, *general industry*, and *general service* sectors. Besides, Table 5.18 depicts a fair share of significant factor loadings on $\hat{\beta}^{def\perp}$ and $\hat{\beta}^{term\perp}$ in the augmented 3FM, suggesting that the combination of the factors results in an enhanced explanatory power. Interestingly, the majority of the slope coefficients on $\hat{\beta}^{def}$ and $\hat{\beta}^{term}$ are not significant in case of the simple alternative asset pricing model (cf. Table 5.17; page 217). This once more indicates that the FF factors and the yield spreads appear to contain different rather than redundant information. Eventually, as for the countries, Δdef and $\Delta term$ do not resemble good proxies for the potential risk underlying *SMB* and *HML* across European industries.[59]

[59] Table E.3 in Appendix E (page 432) also shows significantly increased coefficients of determination for the augmented alternative asset pricing model relative to the plain version of the model. The depicted parameters also convey that most of the slope coefficients on $\hat{\beta}^{SMB\perp}$ and $\hat{\beta}^{HML\perp}$ in the augmented asset pricing model are statistically significant. This implies that including these factors adds incremental information to the explanation of equity return behavior at industry level. Put differently, a noticeable proportion of the information that is not captured by $\hat{\beta}^{def}$ and $\hat{\beta}^{term}$ appears to be grasped by $\hat{\beta}^{SMB\perp}$ and $\hat{\beta}^{HML\perp}$.

Table 5.18: Fama-MacBeth: Augmented 3FM - Industry

This table reports the regression coefficients and the associated t-statistics from the Fama-MacBeth (1973) regressions for the sample period May 1999 to October 2006. The dependent variable, R_t, is the cross section of the monthly return on the 27 portfolios per industry depicted in Table 3.2 in excess of the one-month ecu rate. The independent variables are a constant and the cross-section of $\hat{\beta}^{MRF}$, $\hat{\beta}^{SMB}$, $\hat{\beta}^{HML}$, $\hat{\beta}^{def\perp}$, and $\hat{\beta}^{term\perp}$, which are the estimated factor loadings from a time-series regression on R_j on a constant, MRF, SMB, HML, $\Delta def\perp$, and $\Delta term\perp$ for each portfolio j. MRF denotes the return to the DJ Euro Stoxx 50 index in excess to the one-month ecu-markt deposit. SMB is the return on a portfolio that is long on small capitalization stocks and short on big capitalization securities, holding book-to-market and momentum characteristics of the portfolio constant. HML is the return on a portfolio that is long on high book-to-market stocks and short on low book-to-market securities, holding size and momentum characteristics of the portfolio constant. $\Delta def\perp$ is the sum of the intercept and residual from regressing Δdef on a constant, SMB, and HML. $\Delta term\perp$ is the sum of the intercept and residual from regressing $\Delta term$ on a constant, SMB, and HML. The default and term spread factors are defined as follows: $\Delta def_t \equiv def_t - def_{t-1}$, and $\Delta term_t \equiv term_t - term_{t-1}$ where def_t and $term_t$ are the default spread and term spread at time T. The default spread is defined as the spread between yield to maturity on the all-maturities iBoxx BBB Corporate Bond Index for the Eurozone and the all-maturities FTSE Global Government Eurozone index. The term spread is defined as the spread between the 10- and one-year Eurozone government bond for constant maturities. The T-statistics are computed using Shanken's (1992) adjusted standard errors. The R^2s of the regressions are adjusted R^2 from the regression of the average portfolio returns and a constant and the estimated betas. The F-statistics and the associated p-value (in parentheses) report Shanken's (1985) cross-sectional regression test of the linear expected return-beta relation.

BAS = *basic industries*; CGD = *cyclical consumer goods*; CSER = *cyclical services*; TOLF = *financials*; GN = *general industries*; ITECH = *information technology*; NCGD = *non-cyclical consumer goods*; UTL = *utilities*.

$$R_t = \gamma_0 + \gamma_{MRF}\hat{\beta}^{MRF} + \gamma_{SMB}\hat{\beta}^{SMB} + \gamma_{HML}\hat{\beta}^{HML} + \gamma_{def\perp}\hat{\beta}^{def\perp} + \gamma_{term\perp}\hat{\beta}^{term\perp} + \varepsilon_t$$

		γ_0	γ_{MRF}	γ_{SMB}	γ_{HML}	$\gamma_{def\perp}$	$\gamma_{term\perp}$	R^2 (%)	F-Test
BAS	Coefficient	0.044	0.078	0.015	0.139	0.005	0.002	54.57	2.120
	T-Statistic	1.624	2.017	0.617	5.701	0.371	0.347		(0.010)
CGD	Coefficient	0.060	0.151	0.125	-0.041	0.011	-0.004	61.25	2.431
	T-Statistic	3.232	3.122	7.804	-2.117	0.708	-0.984		(0.003)
CSER	Coefficient	-0.045	0.130	0.060	0.024	-0.022	-0.004	32.77	2.693
	T-Statistic	-1.274	2.765	3.066	0.642	-4.199	-1.265		(0.000)
TOLF	Coefficient	0.057	0.161	0.147	0.035	-0.018	0.008	80.97	1.935
	T-Statistic	2.743	4.854	10.851	3.326	-2.461	1.084		(0.018)
GN	Coefficient	0.014	0.187	0.146	0.046	0.001	-0.010	87.40	1.775
	T-Statistic	0.507	3.805	19.279	10.743	0.085	-3.268		(0.038)
ITECH	Coefficient	0.001	0.070	0.130	0.355	0.001	0.002	88.18	1.154
	T-Statistic	0.020	1.687	7.024	19.146	0.293	0.517		(0.320)
NCGD	Coefficient	0.194	0.085	0.184	-0.060	-0.013	-0.007	53.00	1.668
	T-Statistic	4.211	2.847	10.223	-4.809	-2.173	-3.098		(0.062)
UTL	Coefficient	0.046	0.071	0.083	0.019	0.023	0.004	36.34	5.862
	T-Statistic	1.302	1.217	3.956	0.463	1.823	1.690		(0.000)
Industry	Coefficient	0.043	0.089	0.166	0.049	-0.005	-0.019	85.42	2.351
	T-Statistic	1.739	2.005	21.130	6.720	-0.388	-9.441		(0.003)
Service	Coefficient	-0.010	0.156	0.136	0.005	-0.024	0.013	74.03	2.039
	T-Statistic	-0.345	3.725	6.791	0.314	-3.769	2.604		(0.012)

5.2.4.2 Country Findings

This final section assesses to what extent Δdef and $\Delta term$ may serve as good proxies for the potential risk underlying *SMB* and *HML* across European countries. We therefore pursue our standard procedure. We start once more with the relation between the FF factors and changes in the yield spreads in presence of the market factor. We then contrast the pricing ability of the 3FM to that of the alternative pricing model using both time-series and cross-sectional analysis.

Finally, we augment per country the 3FM by Δdef and $\Delta term$ to assess the pricing ability of this amplified model vis-à-vis the 3FM.[60]

At large, all of our findings at country level are very much in line with our results at regional and industry level and, thus, not necessarily with those of Hahn and Lee (2006) and Petkova (2006) for the US. In particular, it appears that there is some marginal information overlap between $\Delta term$ and both *SMB* and *HML*, though not at a very robust and significant level. On the other hand, Δdef does not seem to capture any clear pattern of variation in either of the FF factors across all countries.

Overall, it appears that Δdef and $\Delta term$ do not serve as good proxies for the potential risk underlying *SMB* and *HML* across European countries. As for our findings at region and industry level, it appears that (i) size and book-to-market and (ii) changes in the European default spread and term spread serve as good complements to each other. Thus, augmenting the conventional 3FM by the changes in yield spreads may allow for a notable increase in the ability to explain the cross-section of equity returns at industry level.

5.2.4.2.1 Relation Between FF Factors & Yield Spreads

Alike for the industries, Table 5.19 summarizes across countries the high level relations between (i) our country specific *SMB* and *HML* factors (cf. Section 3) and (ii) our European Δdef and $\Delta term$ factors. All results are based on applying Equations (5.5) and (5.6) [page 201] in each of our sample countries. A more detailed overview of our results per country are presented in Table E.1 in Appendix E.

As for our previous results, we find that *HML* appears to primarily exhibit a positive - and in half of these cases also a significant - relation to $\Delta term$. Moreover, the figures in Table 5.19 also suggest that there exists a negative relation between *SMB* and $\Delta term$. This relation, however, does not appear to be of any robust significance. Finally, it seems again as if there is no clear link between Δdef and either *SMB* or *HML*. Put differently, Δdef appears to contain different information than either of the FF factors or any potential information overlap

[60] Again, we refrain from showing correlation coefficients for reasons outlined above (cf. Sections 5.2.3.1 and 5.2.4.1.

Table 5.19: Summary of Relations: FF Factors & Δ in Yields - Country

This table summarizes the results presented in Table E.1. In particular, it depicts the relationships between SMB and HML, on the one hand, and Δdef and $\Delta term$, on the other hand, at an aggregated country level. Per SMB and HML, the first row depicts the number of positive (+), negative (-), and inconsistent (0) relations between the aforementioned factors and Δdef and $\Delta term$. The second row shows (in parentheses) how many of these relations are statistically significant at the 10% significance level. SMB is the return on a portfolio that is long on small capitalization stocks and short on big capitalization securities, holding book-to-market and momentum characteristics of the portfolio constant. HML is the return on a portfolio that is long on high book-to-market stocks and short on low book-to-market securities, holding size and momentum characteristics of the portfolio constant. The default and term spread factors are defined as follows: $\Delta def_t \equiv def_t - def_{t-1}$, and $\Delta term_t \equiv term_t - term_{t-1}$ where def_t and $term_t$ are the default spread and term spread at time T. The default spread is defined as the spread between yield to maturity on the all-maturities iBoxx BBB Corporate Bond Index for the Eurozone and the all-maturities FTSE Global Government Eurozone index. The term spread is defined as the difference between the 10-year and one-year Eurozone interest rate for constant maturities. The sample period is May 1999 to October 2006 and the results are based on monthly data.

	Δdef			$\Delta term$		
	+	-	0	+	-	0
SMB	9	5	2	4	12	-
significant	(3)	-	-	-	(3)	-
HML	5	9	2	12	3	1
significant	(2)	(2)	-	(6)	-	-

among Δdef and either size or book-to-market is country specific (for instance, regarding *SMB* in Finland, Italy, or Switzerland cf. Table E.1 in Appendix E).[61]

5.2.4.2.2 Time-Series Analysis

Given again a mismatch of the information patterns contained in (i) the FF factors and (ii) the changes in yield spreads, we assess whether the 3FM or the alternative asset pricing model is more useful to price European equity at country level. The results for our time-series regressions [cf. Equations (5.7) and (5.8) on page 204] are reported in Table 5.20.

The reported adjusted R^2 values suggest once more that the 3FM appears to be superior to the alternative asset pricing model to explain the time-variation in European equity return behavior. In particular for each of our sample countries,

[61] The lack of empirical support for a strong overlap of information content between (i) country specific FF factors and (ii) our European yield factors may be merely due to a lack of European market integration. As noted in Section 5.2.4, considering changes in common European yield spreads as proxies for country specific market expectations about credit market conditions and future interest rates presupposes that there exists a common European business cycle. This, however, is rather unlikely (see Hallett and Richter, 2006, 2008).

Table 5.20: 3FM vs. Alternative Model: $|\alpha|$ & Adjusted R^2 - Country

This table reports the time-series regression results for the following two regression specifications:

Fama-French 3FM: $R_{j,t} = \alpha_j + \beta_j^{MRF} MRF_t + \beta_j^{SMB} SMB_t + \beta_j^{HML} HML_t + \varepsilon_{j,t}$
Alternative Model: $R_{j,t} = a_j + b_j^{MRF} MRF_t + b_j^{def} \Delta def_t + b_j^{term} \Delta term_t + e_{j,t}$

R_j is the monthly return on the 27 portfolios per country depicted in Table 3.2 in excess of the one-month ecu rate. MRF denotes the return to the local TOTMK indices in excess to the one-month ecu-markt deposit. SMB is the return on a portfolio that is long on small capitalization stocks and short on big capitalization securities, holding book-to-market and momentum characteristics of the portfolio constant. HML is the return on a portfolio that is long on high book-to-market stocks and short on low book-to-market securities, holding size and momentum characteristics of the portfolio constant. The default and term spread factors are defined as follows: $\Delta def_t \equiv def_t - def_{t-1}$, and $\Delta term_t \equiv term_t - term_{t-1}$ where def_t and $term_t$ are the default spread and term spread at time T. The default spread is defined as the spread between yield to maturity on the all-maturities iBoxx BBB Corporate Bond Index for the Eurozone and the all-maturities FTSE Global Government Eurozone index. The term spread is defined as the spread between the 10- and one-year Eurozone government bond for constant maturities. The sample period is May 1999 to October 2006. Av. $|\alpha|$ denotes the mean absolute deviation from 0 of the regression intercepts. The R^2s of the regressions are adjusted R^2 from the regression of the average portfolio returns and a constant and the respective factors.

	Fama-French 3FM		Alternative Model	
	Av. $\lvert\alpha\rvert$	Adj. R^2 (%)	Av. $\lvert\alpha\rvert$	Adj. R^2 (%)
Austria	0.004	45.51	0.042	30.62
Belgium	0.050	48.28	0.058	42.74
Finland	0.076	19.15	0.157	11.46
France	0.076	51.40	0.143	38.05
Germany	0.019	61.57	0.161	41.75
Greece	0.005	70.28	0.047	54.89
Ireland	0.070	27.79	0.190	15.93
Italy	0.041	50.02	0.102	41.70
Netherlands	0.045	56.16	0.101	43.26
Portugal	0.043	44.24	0.087	34.05
Spain	0.044	48.45	0.123	32.50
Denmark	0.014	39.78	0.152	28.31
Sweden	0.010	40.62	0.144	19.39
United Kingdom	0.083	63.64	0.148	54.81
Norway	0.041	60.60	0.051	47.97
Switzerland	0.055	51.58	0.146	36.44

the adjusted R^2 values for the 3FM are higher than those for the alternative asset pricing model. This holds especially for Austria, Germany, Greece, Spain, and Sweden where the difference between the coefficients of determination is about 15% or more.[62] Nevertheless, our time-series findings are only indicative. As previously noted, the content of expected return-beta representation of asset pricing models implies that the cross-sectional variation of average returns comes from the cross-sectional variation in the factor loadings. We thus shift our view

[62]Note again that the depicted average α values do not correspond to estimated risk premia in case of the alternative asset pricing model, because our factor proxies Δdef and $\Delta term$ are not portfolio excess returns (cf. Section 5.2.3.2).

to Fama and MacBeth (1973) analyses below.

5.2.4.2.3 Fama and MacBeth (1973) Cross-Sectional Estimation: 3FM & Alternative Model

Tables 5.21 and 5.22 report per country the results from Fama and MacBeth (1973) regressions for the 3FM [cf. Equation (5.9); page 206] and alternative asset pricing model [cf. Equation (5.10); page 206]. Once more, the cross-sectional results are fairly much in line with our previous findings and our time-series analysis. On average, the pricing ability of the 3FM appears to be slightly superior to the alternative pricing model. The reported F-statistics in the last column of each table imply no considerable differences between the models, even though we reject the null hypothesis of zero pricing errors more often in case of the 3FM (in 11 out of 16 cases) than for the alternative asset pricing model (in 9 out of 16 cases).[63] However, if we consider the relative magnitude of the F-statistics as our benchmark, i.e., the lower the F-statistics, the better the pricing model, then there is no apparent differences among the models across all countries. The contrast between the two models is strongest in cases of Belgium, Greece, the Netherlands, Denmark, and Switzerland.

The depicted adjusted R^2 values provides us with a similar picture. The 3FM appears to clearly dominate the alternative model for half of the countries (8/16), especially for Austria, France, Ireland, Italy, Spain, and Sweden. The alternative model does, however, a better job in explaining the cross-sectional variation of equity returns in 5 out of 16 cases, i.e., in Belgium, Greece, Portugal, Norway, and Switzerland. In case of the remaining three countries, Finland, Germany, and Denmark, both pricing models appear to perform equally well.

Notwithstanding, the T-statistics for the slope coefficients depicted in Tables 5.21 and 5.22 suggest that the information content of *SMB* and *HML* on average equity returns in European countries is higher than the one of Δdef and $\Delta term$. In particular, we find that the factor loadings for $\hat{\beta}^{SMB}$ are statistically significant in 15 out of 16 cases and those for $\hat{\beta}^{HML}$ in 12 out of 16 cases. For $\hat{b}^{def}$ and $\hat{b}^{term}$ the numbers are considerably lower, i.e., in 7 and 10 out of 16 cases, respectively. Moreover, the cross-sectional slope coefficients for the 3FM appear to be more

[63] This refers to a 1% significane level.

Table 5.21: Fama-MacBeth: 3FM - Country

This table reports the regression coefficients and the associated t-statistics from the Fama-MacBeth (1973) regressions for the sample period May 1999 to October 2006. The dependent variable, R_t, is the cross section of the monthly return on the 27 portfolios per country depicted in Table 3.2 in excess of the one-month ecu rate. The independent variables are a constant and the cross-section of $\hat{\beta}^{MRF}$, $\hat{\beta}^{SMB}$, and $\hat{\beta}^{HML}$, which are the estimated factor loadings from a time-series regression on R_j on a constant, MRF, SMB, and HML for each portfolio j $(j = 1, \ldots, 27)$. MRF denotes the return to the local TOTMK indices in excess to the one-month ecu-markt deposit. SMB is the return on a portfolio that is long on small capitalization stocks and short on big capitalization securities, holding book-to-market and momentum characteristics of the portfolio constant. HML is the return on a portfolio that is long on high book-to-market stocks and short on low book-to-market securities, holding size and momentum characteristics of the portfolio constant. The T-statistics are computed using Shanken's (1992) adjusted standard errors. The R^2s of the regressions are adjusted R^2 from the regression of the average portfolio returns and a constant and the estimated betas. The F-statistics and the associated p-value (in parentheses) report Shanken's (1985) cross-sectional regression test of the linear expected return-beta relation.

$$R_t = \gamma_1 + \gamma_{MRF1}\hat{b}^{MRF} + \gamma_{SMB}\hat{b}^{SMB} + \gamma_{HML}\hat{b}^{HML} + e_t$$

		γ_1	γ_{MRF1}	γ_{SMB}	γ_{HML}	R^2 (%)	F-Test
Austria	Coefficient	0.039	0.169	0.093	0.092	50.41	4.852
	T-Statistic	1.263	3.502	4.683	5.705		(0.000)
Belgium	Coefficient	-0.034	0.130	0.039	0.038	48.26	2.581
	T-Statistic	-1.800	7.112	3.124	5.172		(0.001)
Finland	Coefficient	0.143	-0.063	0.222	0.179	88.08	5.465
	T-Statistic	6.073	-0.596	10.900	12.675		(0.000)
France	Coefficient	0.116	0.032	0.110	0.034	59.24	2.182
	T-Statistic	2.797	0.630	5.878	2.294		(0.008)
Germany	Coefficient	-0.076	0.195	0.236	0.122	83.96	2.086
	T-Statistic	-1.747	2.211	9.528	4.650		(0.009)
Greece	Coefficient	-0.150	0.207	0.104	0.060	52.74	6.861
	T-Statistic	-2.500	3.638	5.578	3.076		(0.000)
Ireland	Coefficient	0.117	0.024	0.098	0.186	55.66	5.095
	T-Statistic	3.273	0.416	2.815	6.790		(0.000)
Italy	Coefficient	0.047	0.023	0.111	0.004	77.55	1.371
	T-Statistic	2.069	0.891	10.460	0.426		(0.155)
Netherlands	Coefficient	0.073	-0.034	0.099	0.009	48.47	2.043
	T-Statistic	2.064	-0.966	4.331	0.408		(0.011)
Portugal	Coefficient	-0.032	0.058	0.184	0.155	70.12	2.003
	T-Statistic	-0.608	0.792	5.361	4.762		(0.016)
Spain	Coefficient	0.049	0.067	0.080	0.160	83.90	0.943
	T-Statistic	1.780	2.124	4.990	16.724		(0.554)
Denmark	Coefficient	0.055	0.129	0.134	0.117	55.21	4.828
	T-Statistic	1.096	3.266	4.416	5.568		(0.000)
Sweden	Coefficient	0.018	0.083	0.195	0.029	40.65	2.612
	T-Statistic	0.497	0.925	15.869	2.010		(0.001)
United Kingdom	Coefficient	0.048	0.051	0.137	0.025	65.45	3.400
	T-Statistic	0.975	1.047	7.863	1.620		(0.000)
Norway	Coefficient	-0.022	0.187	0.004	0.033	40.15	1.486
	T-Statistic	-0.566	4.514	0.169	1.593		(0.108)
Switzerland	Coefficient	0.038	0.075	0.130	0.011	34.88	7.231
	T-Statistic	0.696	1.047	4.346	0.314		(0.000)

Table 5.22: Fama-MacBeth: Alternative Model - Country

This table reports the regression coefficients and the associated t-statistics from the Fama-MacBeth (1973) regressions for the sample period May 1999 to October 2006. The dependent variable, R_t, is the cross section of the monthly return on the 27 portfolios per country depicted in Table 3.2 in excess of the one-month ecu rate. The independent variables are a constant and the cross-section of $\hat{b}^{MRF}$, $\hat{b}^{def}$, and $\hat{b}^{term}$, which are the estimated factor loadings from a time-series regression of R_j on a constant, MRF, Δdef, and $\Delta term$ for each portfolio j $(j = 1, \ldots, 27)$. MRF denotes the return to the local TOTMK indices in excess to the one-month ecu-markt deposit. The default and term spread factors are defined as follows: $\Delta def_t \equiv def_t - def_{t-1}$, and $\Delta term_t \equiv term_t - term_{t-1}$ where def_t and $term_t$ are the default spread and term spread at time T. The default spread is defined as the spread between yield to maturity on the all-maturities iBoxx BBB Corporate Bond Index for the Eurozone and the all-maturities FTSE Global Government Eurozone index. The term spread is defined as the spread between the 10- and one-year Eurozone government bond for constant maturities. The T-statistics are computed using Shanken's (1992) adjusted standard errors. The R^2s of the regressions are adjusted R^2 from the regression of the average portfolio returns and a constant and the estimated betas. The F-statistics and the associated p-value (in parentheses) report Shanken's (1985) cross-sectional regression test of the linear expected return-beta relation.

		$R_t = \gamma_2 + \gamma_{MRF2}\hat{\beta}^{MRF} + \gamma_{def}\hat{\beta}^{def} + \gamma_{term}\hat{\beta}^{term} + e_t$					
		γ_2	γ_{MRF2}	γ_{def}	γ_{term}	R^2 (%)	F-Test
Austria	Coefficient	0.073	0.160	-0.020	0.003	41.62	5.917
	T-Statistic	1.982	3.201	-4.578	0.536		(0.000)
Belgium	Coefficient	0.024	0.085	0.017	0.009	51.81	1.232
	T-Statistic	0.593	2.056	2.339	1.773		(0.247)
Finland	Coefficient	0.091	0.062	0.011	-0.009	87.91	5.383
	T-Statistic	2.701	0.703	1.117	-2.693		(0.000)
France	Coefficient	0.162	0.027	-0.009	-0.012	55.53	2.970
	T-Statistic	3.453	0.485	-0.260	-1.256		(0.000)
Germany	Coefficient	-0.085	0.263	-0.051	-0.004	82.86	2.895
	T-Statistic	-3.005	5.700	-4.639	-1.194		(0.000)
Greece	Coefficient	-0.140	0.205	-0.016	-0.004	59.09	4.118
	T-Statistic	-3.176	5.594	-3.157	-1.485		(0.000)
Ireland	Coefficient	0.079	0.135	0.015	-0.001	32.74	5.017
	T-Statistic	1.863	3.193	2.811	-0.133		(0.000)
Italy	Coefficient	-0.005	0.134	0.003	-0.001	46.97	1.481
	T-Statistic	-0.176	3.777	1.611	-0.168		(0.104)
Netherlands	Coefficient	0.080	0.007	-0.009	-0.010	41.57	1.213
	T-Statistic	1.684	0.170	-1.355	-2.492		(0.263)
Portugal	Coefficient	-0.061	0.072	0.009	-0.009	84.85	1.992
	T-Statistic	-1.480	1.530	16.744	-18.928		(0.016)
Spain	Coefficient	0.001	0.235	-0.016	0.011	49.39	1.036
	T-Statistic	0.027	2.962	-0.813	1.677		(0.437)
Denmark	Coefficient	0.004	0.182	0.006	0.010	53.40	2.784
	T-Statistic	0.077	7.779	1.046	2.139		(0.000)
Sweden	Coefficient	0.087	0.272	0.020	-0.012	22.59	2.631
	T-Statistic	1.329	2.124	0.806	-3.430		(0.001)
United Kingdom	Coefficient	-0.049	0.182	-0.043	-0.009	58.91	3.586
	T-Statistic	-1.690	7.297	-2.528	-3.194		(0.000)
Norway	Coefficient	-0.036	0.199	-0.005	-0.010	52.20	2.042
	T-Statistic	-1.371	6.594	-1.285	-4.620		(0.013)
Switzerland	Coefficient	-0.009	0.111	0.004	-0.011	46.07	4.730
	T-Statistic	-0.220	3.232	0.385	-1.889		(0.000)

economically significant, given their relative magnitude vis-à-vis the loadings for the alternative model.[64]

All in all, for those countries for which we find significant factor loadings for either model, pooling together all regressors may allow for a notably enhanced ability to explain the cross-section of European equity returns. On the other hand, it may still occur that some loadings may loose their significance once we pool all factors into one regression. This may imply that the information contained in one variable is already captured by another. We pursue this line of thought in the following section.

5.2.4.2.4 Augmented Pricing Models

As for our industry analysis, we report in Table 5.23 and Table E.4 in Appendix E (page 433) the results from the Fama and MacBeth (1973) regressions for the augmented versions of the 3FM and the alternative asset pricing model per country (cf. Section 5.2.3.4). All in all, the findings suggest that pooling all variables in one regression allows again for an enhanced explanation of the cross-sectional variation in equity returns. In fact, the adjusted R^2 values increase in 11 out of 16 cases and remain stable in the remaining five countries.

Besides, augmenting the 3FM with orthogonalized Δdef and $\Delta term$ factors does not alter considerably the slope coefficients on $\hat{\beta}^{SMB}$ and $\hat{\beta}^{HML\perp}$. Moreover, the loadings on $\hat{\beta}^{\Delta def}$ and $\hat{\beta}^{\Delta term}$ are statistically significant for both variables in 7 out of 16 cases. This implies further that the information contained in (i) Δdef and $\Delta term$ is complimentary rather than redundant to the information contained in *SMB* and *HML*.

5.2.5 Conclusion

The main purpose of this section has been to assess whether changes in the default spread (Δdef) and changes in the term spread ($\Delta term$) may capture the

[64] The different degrees of information content also imply that *SMB* and *HML* do not appear to serve as proxies for Δdef and $\Delta term$ across all European countries. Yet, they may still do in those countries where we find significant factor loadings for both models or, alternatively, no significant slope coefficients for either model. The latter case of insignificant loadings is not inconsistent with our null hypothesis that Δdef and $\Delta term$ are good proxies for the risk underlying *SMB* and *HML*. If the FF factors are not able to capture the cross-sectional variation in average equity returns, then Δdef and $\Delta term$ should not do so either.

Table 5.23: Fama-MacBeth: Augmented 3FM - Country

This table reports the regression coefficients and the associated t-statistics from the Fama-MacBeth (1973) regressions for the sample period May 1999 to October 2006. The dependent variable, R_t, is the cross section of the monthly return on the 27 portfolios per country depicted in Table 3.2 in excess of the one-month ecu rate. The independent variables are a constant and the cross-section of $\hat{\beta}^{MRF}$, $\hat{\beta}^{SMB}$, $\hat{\beta}^{HML}$, $\hat{\beta}^{def\perp}$, and $\hat{\beta}^{term\perp}$, which are the estimated factor loadings from a time-series regression on R_j on a constant, MRF, SMB, HML, $\Delta def\perp$, and $\Delta term\perp$ for each portfolio j. MRF denotes the return to the local TOTMK indices in excess to the one-month ecu-markt deposit. SMB is the return on a portfolio that is long on small capitalization stocks and short on big capitalization securities, holding book-to-market and momentum characteristics of the portfolio constant. HML is the return on a portfolio that is long on high book-to-market stocks and short on low book-to-market securities, holding size and momentum characteristics of the portfolio constant. $\Delta def\perp$ is the sum of the intercept and residual from regressing Δdef on a constant, SMB, and HML. $\Delta term\perp$ is the sum of the intercept and residual from regressing $\Delta term$ on a constant, SMB, and HML. The default and term spread factors are defined as follows: $\Delta def_t \equiv def_t - def_{t-1}$, and $\Delta term_t \equiv term_t - term_{t-1}$ where def_t and $term_t$ are the default spread and term spread at time T. The default spread is defined as the spread between yield to maturity on the all-maturities iBoxx BBB Corporate Bond Index for the Eurozone and the all-maturities FTSE Global Government Eurozone index. The term spread is defined as the spread between the 10- and one-year Eurozone government bond for constant maturities. The T-statistics are computed using Shanken's (1992) adjusted standard errors. The R^2s of the regressions are adjusted R^2 from the regression of the average portfolio returns and a constant and the estimated betas. The F-statistics and the associated p-value (in parentheses) report Shanken's (1985) cross-sectional regression test of the linear expected return-beta relation.

$$R_t = \gamma_0 + \gamma_{MRF}\hat{\beta}^{MRF} + \gamma_{SMB}\hat{\beta}^{SMB} + \gamma_{HML}\hat{\beta}^{HML} + \gamma_{def\perp}\hat{\beta}^{def\perp} + \gamma_{term\perp}\hat{\beta}^{term\perp} + \varepsilon_t$$

		γ_0	γ_{MRF}	γ_{SMB}	γ_{HML}	$\gamma_{def\perp}$	$\gamma_{term\perp}$	R^2 (%)	F-Test
Austria	Coefficient	0.035	0.178	0.102	0.089	-0.017	-0.005	52.80	4.154
	T-Statistic	0.767	2.680	5.144	3.517	-2.574	-0.557		(0.000)
Belgium	Coefficient	0.013	0.104	0.019	0.045	0.027	0.006	59.93	1.466
	T-Statistic	0.305	2.841	1.575	3.948	2.854	0.949		(0.113)
Finland	Coefficient	0.137	-0.055	0.221	0.179	0.002	0.000	87.90	6.525
	T-Statistic	2.411	-0.402	8.637	9.585	0.136	-0.047		(0.000)
France	Coefficient	0.120	-0.004	0.136	0.032	0.052	0.008	68.65	1.816
	T-Statistic	4.855	-0.115	8.182	1.691	4.108	0.877		(0.033)
Germany	Coefficient	-0.078	0.219	0.221	0.153	-0.026	-0.015	89.72	1.060
	T-Statistic	-2.561	4.601	11.891	7.452	-1.499	-4.246		(0.415)
Greece	Coefficient	-0.135	0.197	0.095	0.066	-0.016	-0.004	56.13	3.664
	T-Statistic	-2.976	4.294	5.665	2.569	-2.292	-1.700		(0.000)
Ireland	Coefficient	0.104	0.029	0.109	0.181	0.015	-0.004	64.89	6.027
	T-Statistic	4.304	0.725	2.863	5.443	3.626	-1.468		(0.000)
Italy	Coefficient	0.039	0.024	0.126	0.002	-0.001	0.006	82.53	1.554
	T-Statistic	1.704	0.911	13.521	0.279	-0.698	4.410		(0.080)
Netherlands	Coefficient	0.064	-0.032	0.107	0.010	-0.007	0.002	49.08	1.940
	T-Statistic	1.680	-0.821	5.167	0.518	-0.853	0.287		(0.017)
Portugal	Coefficient	0.020	-0.022	0.148	0.215	0.012	-0.002	90.55	1.950
	T-Statistic	1.000	-0.840	16.868	16.391	9.810	-1.039		(0.019)
Spain	Coefficient	0.048	0.099	0.067	0.169	-0.016	0.007	85.28	2.048
	T-Statistic	1.677	2.784	3.759	20.797	-1.380	2.037		(0.011)
Denmark	Coefficient	0.008	0.121	0.153	0.126	0.010	0.011	61.05	2.578
	T-Statistic	0.162	3.528	5.008	10.241	1.517	3.549		(0.002)
Sweden	Coefficient	0.017	0.079	0.201	0.024	0.005	0.003	76.53	1.479
	T-Statistic	0.587	0.772	12.153	1.906	0.801	0.253		(0.106)
United Kingdom	Coefficient	0.042	0.062	0.150	0.017	-0.036	-0.003	71.18	3.054
	T-Statistic	0.991	1.477	9.639	1.233	-3.739	-0.919		(0.000)
Norway	Coefficient	-0.019	0.182	0.010	0.054	-0.006	-0.015	51.87	1.998
	T-Statistic	-0.747	6.338	0.524	2.590	-1.397	-3.874		(0.014)
Switzerland	Coefficient	0.053	-0.008	0.159	0.036	0.005	-0.019	63.54	2.132
	T-Statistic	1.449	-0.149	9.206	1.395	0.746	-2.923		(0.008)

systematic risk proxied by FF's size (*SMB*) and book-to-market (*HML*) factors. As commonly used proxies for the market's expectation about credit market conditions and future interest rates, changes in the default and term spreads may economically interpretable as state variable proxies. Thus, in case *SMB* and *HML* may be related to changes in the aforementioned changes in yield spreads, then this may be considered as further empirical support for a risk-based interpretation of the size and book-to-market effects. Although this has been shown for the US (see Hahn and Lee, 2006, Petkova, 2006), there are not yet any empirical findings about the relation between the FF factors and changes in default and term spreads for Europe.[65] We have aimed to fill this void.

All in all our findings do not provide any robust empirical support for our hypothesis that changes in European yield spreads contain the same set of information as the FF factors throughout Europe. This is contrary to the empirical results of Hahn and Lee (2006) and Petkova (2006) for the US. Nonetheless, our findings may support Fama and French (1993), who find that the average premium on a default spread is too small to explain much variation in portfolios sorted by size and book-to-market.[66]

We also find that the ability of the 3FM to price European equity is superior to that of an alternative asset pricing model comprised of the market factor, $\Delta term$, and Δdef. This holds in spite of the apparent stronger rationale of the alternative asset pricing model vis-à-vis the 3FM and at European country, industry, and pan-European level. These findings suggest not only that *SMB* and *HML* exhibit different but also more relevant information than $\Delta term$ and Δdef for the pricing of European equity.[67] Yet, our evidence from time-series analyses

[65] Hahn and Lee (2006) and Petkova (2006) show that size is negatively related to changes in the default spread and that book-to-market is positively linked to changes in the term spread.

[66] In particular, Fama and French (1993) examine the pricing impact of bond market factors on their 25 portfolios (cf. the website of Kenneth R. French at $http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html$, last accessed September 2009, for the 25 portfolios). They define these factors as the difference between the return to a portfolios of high grade corporate bonds and the return to long term (20 years) government bonds. It is worthy to note, however, that Fama and French (1993) do not include the market factor when assessing the explanatory power of their bond market factors. Yet, omitting the market factor represents a misspecification of the ICAPM as state variable risks are part of systematic risks not captured by the market beta.

[67] One might expect that *SMB* and *HML* may outperform other regressors with supposedly similar information, given that size and book-to-market are related to they way the dependent

and cross-sectional regressions also imply that augmenting the 3FM by Δdef and $\Delta term$ may notably help to price European equity portfolios. This suggests that information conveyed by changes in the default spread and changes in the term spread serve as a complement to the returns to *SMB* and *HML*. Thus, it appears that Δdef and $\Delta term$ are not able to capture the systematic risk proxied for by FF's size and book-to-market factors. This, in turn, leaves the question whether the 3FM qualifies as a candidate for the ICAPM.

One of the reasons why we fail to find empirical support for the link between the variables may be the potential lack of integration among European equity markets. Our sample period has only comprised the time frame from May 1999 to October 2006 and has, thus, only covered a time window in which the euro has been serving as the sole legal tender in all Eurozone countries. For these countries, the monetary policy has been centralized in the European Central Bank (ECB). This has let to common interest rates across Eurozone countries. Notwithstanding, despite being commonly imposed, true term and default spreads may still differ among the euro area member states.

In fact, to consider changes in common European yield spreads as proxies for market's expectations about credit market conditions and future interest rates appears only plausible if business cycles across European countries are shared, i.e., if there exists a common European business cycle. Hallett and Richter (2006), however, remark that even if some Eurozone countries have some business cycles in common, they may still diverge at other frequencies. Moreover, countries may vary in the components and characteristics that make up their output cycles and may also differ in their position around the output cycle at each point in time (Hallett and Richter, 2008). This should not yet be the case when looking at one industry at a time.

variables i.e., the portfolios to be priced, are formed. However, the FF factors do not become superfluous in the presence of Δdef and $\Delta term$ for explaining the cross-section of average equity returns across our sample of European countries, industries, and regions.

Chapter 6

Summary & Closing Remarks

The main objective of this study has been threefold. For one, we have aimed to shed further light on the general pricing ability of the Fama and French (1993) (FF) three-factor model (3FM) in Europe. For two, we have meant to assess whether the FF factors are related to systematic risk and, thus, whether the 3FM is consistent with an intertemporal asset pricing explanation behind the size and book-to-market effects. For three, we have endeavored to measure the extent to which European equity markets are integrated.

In order to address these concerns, we have used a new holdout sample comprising an extensive set of newly constructed size and book-to-market factors for 16 European countries, 3 regions, and 11 industries. To construct our risk factors, we have followed Liew and Vassalou (2000) as our European focus has not allowed us to borrow the original size and book-to-market factors of FF. An advantage of our construction approach is that it accounts for momentum, which has mainly been neglected by FF. Besides, our multicollinearity analysis has implied near orthogonality among our constructed risk factors.

Once we had the risk factors constructed, we have started out to study their descriptive characteristics to assess whether there exist at all value, size, and even momentum effects across Europe. Our findings reveal that this is indeed the case, not only for the majority of our sample countries, but also for our different industries and even across the Eurozone, the EU, and Europe as a whole. In particular, we have found that *HML* portfolios, which are long on high book-to-market stocks and short on low book-to-market stocks, yield above average market returns in all of our sub-samples. This is in line with FF and Liew and

Vassalou (2000), who remark that a value premium is pervasive. Besides, our results suggest that a book-to-market factor is particularly sensitive to bad news in bad times. This goes in line with Lettau and Ludvigson (2001).

Second, we have documented that mean and median returns are consistently higher to small firm portfolios than to big firm portfolios. This holds for the biggest part of our sample countries, industries, and regions. Our findings for the apparent presence of a size premium are in accordance with those of FF, Banz (1981), and Liew and Vassalou (2000), but contrary to those of Otten and Bams (2002).[1]

Third, with a few exceptions, we have also reported that past winner stocks tend to outperform past loser stocks in the short run. This empirical support for a momentum effect underscores the findings of Carhart (1997) and Jegadeesh and Titman (1993). Nonetheless, our results imply that this anomaly is very sensitive to the rebalancing frequency chosen to construct the portfolios that serve as proxies for the momentum effect; the higher the frequency, the stronger the momentum effect. Put differently, our findings reveal that past winner stocks are able to outperform past loser stocks most notably in the short run. This success diminishes as time elapses.

Based on these findings and the noticed presence of a size, value, and momentum effect across Europe, we have turned our focus to our primary objectives, i.e., (i) to study the general pricing ability and economic rationale of the FF factors in Europe and (ii) to provide further insights on the degree to which European equity markets are integrated. We have therefore made an intensive use of our constructed FF factors in two different, yet closely related, empirical parts. In Empirical Part A, we have applied our FF factors across different European subsamples to assess the pricing ability of our constructed size and book-to-market factors and to determine to what extent European equity markets are integrated. In Empirical Part B, we have linked our FF factors to systematic risk to study the economic rationale behind size and book-to-market. Our findings are summarized in Figure 6.1.

[1]Otten and Bams (2002) document that big stocks outperform small stocks in major European markets. One explanation for the discrepancy in the findings might be varying sample periods, i.e., Otten and Bams (2002) focus exclusively on the period 1991 to 1998 and, thus, ex-ante the 'dot-com' bubble.

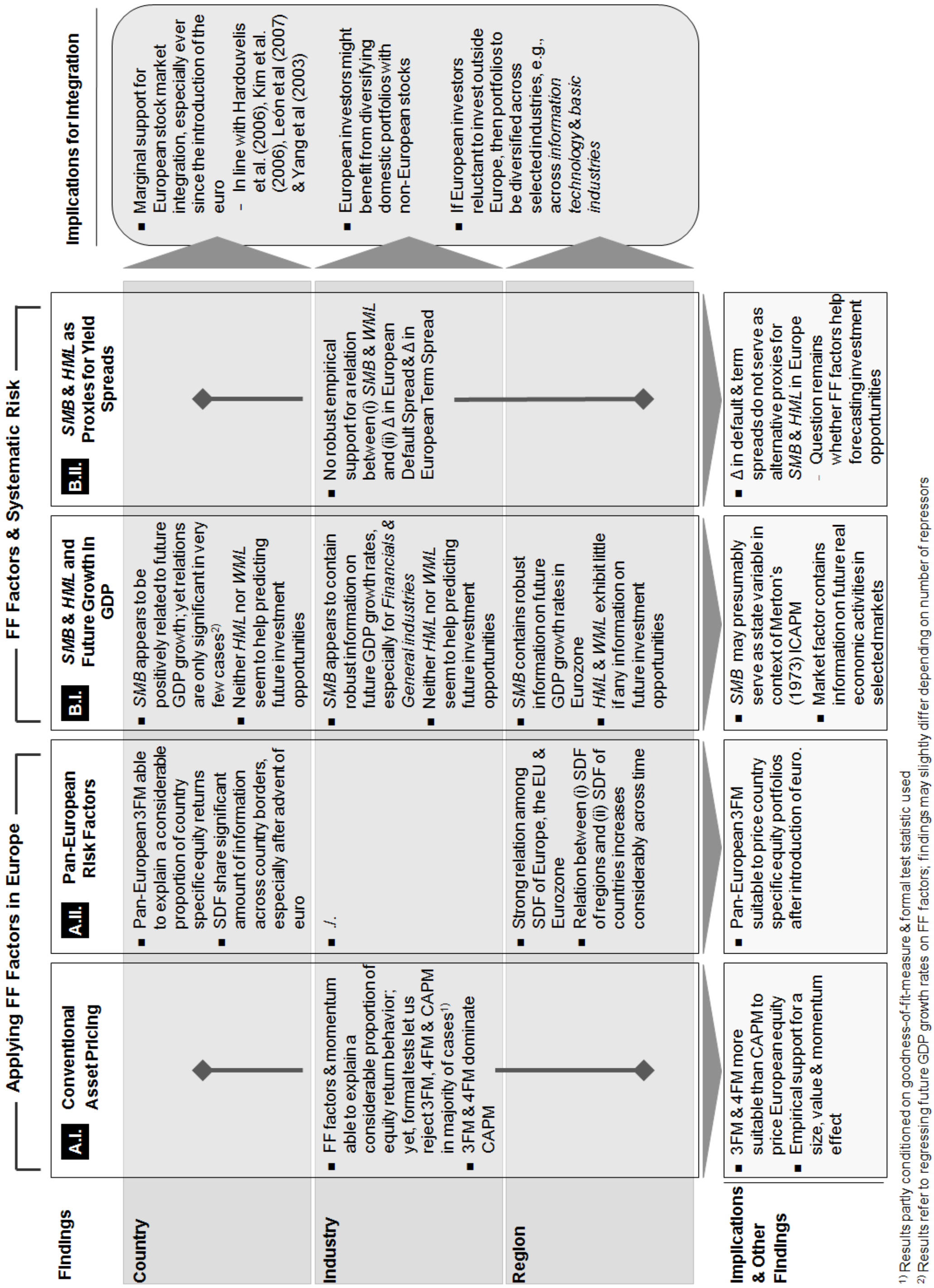


Figure 6.1: Overview of General Findings - *Own Draft*

In a first step (Empirical Part A.I), we have used conventional time-series and cross-sectional tests to assess the pricing ability of our FF factors at European country, industry, and regional level. We have therefore formed country, industry, and regional specific versions of the CAPM, 3FM, and Carhart (1997) four-factor model (4FM), which merely extends the 3FM by momentum. Our findings imply that the 3FM explains notably more in the variation of equity returns than the CAPM for all of our sub-samples employed. Yet, complementing the 3FM by momentum appears to only marginally help to explain the behavior of equity returns. Nevertheless, formal tests on the joint distribution of the errors let us reject the validity of not only the CAPM, but also the 3FM and 4FM as 'good' asset pricing models in the majority of cases. However, at large our empirical findings for the 3FM and 4FM support FF's argument that size and book-to-market, as well as momentum (Carhart, 1997), are helpful to overcome some of the average-return anomalies of the CAPM.

Our findings also reveal that all models are better able to explain the behavior of equity returns in bigger European economies than in smaller countries. The ability of the models to explain the variation of equity returns is considerably lower in Austria, Finland, Greece, Ireland, Portugal, and Denmark when compared to Germany, France, and the United Kingdom. This might yet be explained by differences in sample sizes and a presumably bigger impact of the 'dot-com' bubble on the average equity returns in smaller European countries.

Eventually, the reasonable ability of the 3FM and 4FM to price pan-European and industry portfolios conveys that European stock markets are to a certain extent integrated. This line of thought follows up on the idea of Bekaert and Harvey (1995) and Roll and Ross (1980) that the measurement of integration is conditioned on the identification of common risk. This implies that in integrated markets assets are subject to the same risk and should, thence, be priced by common risk factors. Besides, our findings also underpin past empirical findings that the importance of industry factors has increased relative to country factors for the explanation of European equity returns.[2]

[2]cf. Baca et al. (2000), Brooks and Catao (2000), Campa and Fernandes (2006), Cavaglia et al. (2000), Cavaglia and Moroz (2002), Diermeier and Solnik (2001), Ferreira and Gama (2005), Flavin (2004), Isakov and Sonney (2004), L'Her et al. (2002), Moerman (2008), Taing and Worthington (2005), Urias et al. (1998), Wang et al. (2003).

In a second step (Empirical Part A.II), we have pursued our goodness-of-fit analyses of the 3FM and the assessment of European stock market integration. We have thereby studied whether pan-European market, size, and book-to-market factors may be used to explain country specific equity returns. Our results support at large our previous findings for the country level. We have documented that a pan-European version of the 3FM is also able to explain country specific returns, even though formal test statistics reveal some mispricing when regressing domestic equity returns on a pan-European 3FM. Thus, a pan-European version of the 3FM is not free of shortcomings, even if our findings across time reveal that the pricing model does a considerable better job in explaining equity return behavior after the introduction of the euro than before. The increasing ability of pan-European factors to price country specific returns may once more be regarded an indicator of European stock market integration.

We have complemented this approach to market integration by employing a stochastic discount factor (SDF) framework, which has allowed us to estimate and compare domestic pricing kernels across European country borders. Our findings entail that the relation among SDF across European countries have significantly increased over time. While we find modest correlations among the SDF prior to the introduction of the euro, the information shared among the pricing kernels intensifies sharply in the first decade of the 21st century. The exception to this phenomenon is the UK, which, however also does not belong to the Eurozone. Overall our empirical findings support recent works that document an increasing trend of integration among European stock markets (see Hardouvelis et al., 2006, Kim et al., 2006, León et al., 2007, Yang et al., 2003).

In a third step (Empirical Part B.I), we have shifted our interest from the general pricing ability of the 3FM towards the ongoing debate about the link between the FF factors and systematic risk. We have therefore assessed whether size and book-to-market may help to forecast financial investment opportunities in Europe. In particular, we have related size and book-to-market to future growth in GDP, presupposing that changes in the investment opportunity set are summarized by changes in future macroeconomic growth. However, our results indicate at large that a risk-based explanation of the FF factors is at most plausible and likely for a size effect. The predictive abilities of a book-to-market and also momentum effect on future GDP growth in the Eurozone are considerably lower than for the size factor. As a whole, we may only support the hypothesis of FF and Liew and Vassalou (2000) that the FF factors may serve as state variables in Merton's (1973) ICAPM context for the size factor alone.

As a side-effect of this empirical part, we have yet shown that the market factor may serve as a leading indicator for future real economic activities in various countries and industries. This underpins the argumentation of a variety of past studies.[3] Yet, the empirical support is, admittedly, not very robust as the information contained in the market factor seems to some extent to be country- and industry-specific. On the other hand, the matter that our findings differ per country/industry may appear plausible, given that the markets examined differ in terms of their size, average market capitalization, and sometimes still in their accounting standards.

In a fourth and final step (Empirical Part B.II), we have studied whether changes in European default and term spreads may serve as alternative risk factors for size and book-to-market. Our findings imply at large that this is not the case. In fact, our empirical results entail that augmenting the 3FM by changes in European yield spreads may notably help to price European equity portfolios. This suggests that the information conveyed by changes in the default spread and changes in the term spread complement rather than substitute the information contained in *SMB* and *HML*. This is contrary to the empirical results of Hahn and Lee (2006) and Petkova (2006) for the US. It also leaves the question whether the 3FM eventually helps to forecast future investment opportunities and, thus, whether the 3FM qualifies as a candidate for Merton's (1973) ICAPM.

Overall, our findings may suggest an increasing interdependence among European stock markets through integration relations. This may allow for contributing capital more effectively across European country borders and second economic growth by removing frictions and barriers to exchange. Besides, the increased possibility for international risk sharing may reduce the sensitivity of local consumption to local economic shocks. Eventually, as equity markets serve as proxies for future economic growth, output, wealth, and, thus, consumption, European

[3] cf. Aylward and Glen (2000), Barro (1990), Binswanger (2000a,b, 2004), Fama (1981, 1990), Fischer and Merton (1984), Geske and Roll (1983), Liew and Vassalou (2000), Mullins and Wadhwani (1989), Schwert (1990), Wahlroos and Berglund (1986), Wasserfallen (1989, 1990).

policy-makers should aim at achieving price stability across European stock markets.[4]

Furthermore, our results indicate, though do not prove, that the interrelation among European equity markets, and especially those of the Eurozone, may primarily be attributed to the economic and political convergence of the EMU rather than any myopic aspects. Thence, in a European context, a potential asset pricing model should preferably exhibit a stochastic discount factor that contains proxies for innovations in pan-European state variables of real economic activities. Nevertheless, it still appears as if domestic factors should not be omitted entirely. Therefore a hybrid asset pricing model, comprising both domestic and global/European factors, may prove to be a suitable solution for explaining European equity return behavior. Yet, further empirical support, perhaps in line with Bodnar et al. (2003) and Chan et al. (1992), is needed to underpin this thought.

Our observation that European stocks seem to share some stochastic trends and to be subject to some common market forces may also entail that investors might have fewer assets available to obtain long-run diversification gains. Hence, to diversify their portfolios, investors need to either (i) select appropriate and unrelated stock markets outside Europe, or (ii) find a way on how to diversify their portfolios European-wide in case they are reluctant to invest outside European boundaries.[5]

One way to let investors overcome the intuitive interpretation that European equity markets have become unattractive is by letting them diversify their portfolios across industries rather than countries. Even though the importance of European country borders, especially across the Eurozone, have diminished, it appears as if industry barriers have nearly remained unchanged. Thus, a general switch from investments along country lines towards investments along industry sectors may occur, e.g., investors may diversify their portfolios by investing simultaneously in stocks in the *information technology* and *basic industries* sectors.

[4]For the interrelation of stock markets and real economic activities see also, among others, Aylward and Glen (2000), Barro (1990), Binswanger (2000a,b, 2004), Fama (1981, 1990), Fischer and Merton (1984), Geske and Roll (1983), Schwert (1990), Wahlroos and Berglund (1986), Wasserfallen (1989, 1990).

[5]This reluctance might be traced back to the so-called home-bias-puzzle (see Coval and Moskowitz, 1999, Gordon and Bovenberg, 1996, Lewis, 1995, Matsen, 2001, Tesar and Werner, 1995).

This may allow them to enhance their mean-variance frontier in line with modern portfolio theory (see Markowitz, 1952) without investing in stocks out of Europe.

Besides, rather than seeking investment opportunities outside Europe, investors may actually gain when just investing across European markets. For instance, they may better evaluate the prospects of their investments due to lower information asymmetries in European relative to non-European markets. Moreover, not only implicit but also explicit transaction costs can be assumed to be lower for intra-European investments vis-à-vis outer European transactions, especially outside the Eurozone. This holds if for no reason other than saving the costs associated with changing one currency for another.

Furthermore, integration does not only entail that risk is shared but also that some previously existing risk exposures might have been offset by positive spillover effects of other markets. This suggests that the systematic risk embedded in one particular market might have mitigated. In particular, investors may benefit from the fact that a fair share of European markets have become subject to the same political, economic and other exogenous trends, not only for the bad, but also for the good. For example, a Spanish investor whose portfolio has only comprised the Spanish market portfolio over the last thirty years is subject to lower systematic risk today than twenty or thirty years ago. Put differently, ceteris paribus and without any market interactions, this Spanish investor has a higher mean-variance frontier today than he used to have two or three decades ago.

Hence, investors that invest in European stock markets, especially those of the Eurozone, should not only monitor domestic trends but also changes in EMU policies and the level of economic convergence among EMU member states. This may help them to better evaluate the long-run prospectus of their stock portfolios. By doing so, they may also bear in mind that small capitalization stocks are better able to prosper than big capitalization stocks whenever strong economic growth is expected, as our findings and those of Liew and Vassalou (2000) and Perez-Quiros and Timmermann (2000) suggest. Yet, any potential yield advantages associated with a size effect may be consumed by transaction costs encountered to re-balance a portfolio. Nonetheless, future studies are needed to not only second this thought further, but also to advance our general knowledge on the integration of European stock markets.

Further research may also address the concern of using linear regression models to test the relation between the FF factors and either (i) the return to equity portfolios or (ii) future investment opportunities. For example, using panel data for 25 countries, Henry, Olekalns, and Thong (2004) argue that there is strong evidence to suggest that a linear regression model would be inaccurate and would probably provide misleading inference by relating stock market returns to economic output. They remark that different states of the economy produce asymmetric output patterns, i.e., marginal output growth recovers more strongly after a recession than marginal output declines after a boom. In particular, they denote that stock returns are most useful in predicting economic output when an economy is in a recession. Though, Henry et al. (2004) do not employ the same explanatory variables as used in this study, running a switching regression approach that accounts for different states of the economy may provide further insights into the information content of the FF factors, along with momentum, in regard to future investment opportunities.

As we do not find any robust relation between (i) size and book-to-market and (ii) changes in the default and term spreads in Europe, it might also be interesting to assess in more detail why our results differ from those of Hahn and Lee (2006) and Petkova (2006) for the US. For example, to ascertain more about the link between the FF factors, momentum, and systematic risk, one could relate *HML*, *SMB*, and *WML* to other explanatory variables that may contain information on future investment opportunities. Liew and Vassalou (2000), for instance, suggest to use the excess return to a market portfolio, a dividend yield, short-term interest rates, term spreads (i.e., the ten year government yield minus the yield on a treasury bill or the call money rate), and the industrial production as indicators for the business cycle. They show that there exists some overlap in the information content of *HML*, *SMB* and the proposed business cycle variables. This leaves surely room for further research that may aim to explain the success of the 3FM based on time-varying investment opportunities in context of Merton's (1973) ICAPM.

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Appendix

Appendix A

Sample Data Descriptives

A.1 Industry Classification & Distribution of Stocks

Table A.1: Industry Classification

This table reports the classification of industries according to the Financial Times Actuaries.

Basic Industries (BAS)	**Information Technology (ITECH)**
Chemicals	Information tech hardware
Construction and building materials	Software and computer services
Forestry and paper	**Non-cyclical Consumer Goods (NCGD)**
Steel and other metals	Beverages
Cyclical Consumer Goods (CGD)	Food producers and processors
Automobiles and parts	Health
Household goods and textiles	Personal care and household products
Cyclical Services (CSER)	Pharmaceuticals and biotechnology
General retailers	Tobacco
Leisure and hotels	**Non-cyclical Services (NCSR)**
Media and entertainment	Food and drug retailers
Support services	Telecommunication services
Transport	**Resources (RES)**
Financials (TOLF)	Mining
Banks	Oil and gas
Insurance	**Utilities (UTL)**
Life insurance / assurance	Electricity
Investment companies	Gas distribution
Real estate	Water
Specialty and other finance	
General Industries (GN)	
Aerospace and defense	
Diversified industrials	
Electronic and electrical equipment	
Engineering and machinery	

Table A.2: Number of Stocks per Year - Country & Region

This table reports the number of stocks available per country in a given year. The average number of stocks reported is computed solely on the numbers highlighted in bold, starting with a marked *. These stocks represent those used for the country regressions. The limitation of the time period is due to the necessity to have a limited amount of stocks available for the construction of the HML, SMB, and WML risk factors. For instance, in case of Austria, we run country regressions merely for the time period July 2001 to April 2008. The remaining stocks of the period January 1981 to June 2001 are, however, not neglected, since they are used for pan-European (across the Eurozone, the European Union, and Europe as a whole) portfolios and are considered also for industry regressions.

	Austria	Belgium	Finland	France	Germany	Greece	Ireland	Italy	Luxembourg	Netherlands	Portugal	Spain	Denmark	Sweden	United Kingdom	Norway	Switzerland	Eurozone	European Union[a]	Europe[b]
1981	4	16		*40	*39		11	23		41			15		*187	6	37	*174	*376	*419
1982	4	17		42	40		12	23		41			15		191	7	37	179	385	429
1983	4	17		43	63		12	23		43			16	15	196	8	38	205	432	478
1984	4	18		44	63		12	23		43			17	15	203	10	40	207	442	492
1985	4	18		47	66		13	24		45			17	18	210	10	41	217	462	513
1986	5	19		48	71		13	25		49			19	18	218	12	43	230	485	540
1987	8	32		50	75		15	49		54		5	19	20	231	14	55	288	558	627
1988	10	32	1	58	76		17	51		59		31	19	20	246	14	63	335	620	697
1989	12	*34	14	72	112	15	20	*57		*60	15	32	25	28	257	15	71	443	753	839
1990	13	35	19	115	116	15	24	58		64	17	*52	26	34	269	15	76	528	857	948
1991	13	35	23	124	123	16	24	62		65	18	55	28	*35	280	16	84	558	901	1001
1992	16	35	25	127	126	18	25	63	4	68	18	58	32	36	290	16	86	583	941	1043
1993	19	35	26	128	128	18	25	63	25	71	22	62	33	37	296	19	*86	622	988	1093
1994	19	35	29	131	129	18	25	64	25	73	22	64	33	38	308	19	89	634	1013	1121
1995	21	37	32	145	131	23	27	65	26	76	24	65	33	41	326	20	92	672	1072	1184
1996	24	37	*33	149	136	25	27	72	26	79	28	65	34	44	340	20	97	701	1119	1236
1997	25	41	36	155	144	26	27	75	27	82	28	68	38	49	362	21	98	734	1183	1302
1998	28	45	38	162	149	28	29	79	30	90	32	76	*38	52	382	*28	105	786	1258	1391
1999	28	53	41	180	160	31	31	86	32	97	38	79	40	54	389	29	112	856	1339	1480
2000	32	63	43	191	177	34	*34	97	32	105	*40	83	41	57	398	29	118	931	1427	1574
2001	*34	64	44	202	195	38	36	111	35	106	43	86	44	60	415	29	127	994	1513	1669
2002	35	66	44	207	198	*43	36	121	35	106	43	90	44	62	422	32	131	1024	1552	1715
2003	36	68	44	212	200	44	36	127	36	106	43	92	44	65	438	34	134	1044	1591	1759
2004	40	71	44	212	202	46	36	131	36	109	44	93	44	65	448	34	135	1064	1621	1790
2005	40	73	44	219	205	46	37	137	36	109	45	95	44	65	468	38	138	1086	1663	1839
2006	42	79	47	228	215	47	39	143	37	112	46	96	45	65	488	44	143	1131	1729	1916
2007	46	82	49	239	232	49	45	154	37	120	47	105	49	70	513	50	148	1205	1837	2035
2008	50	90	49	248	249	50	50	159	38	128	50	119	50	70	535	50	150	1280	1935	2135
Average	40	54	43	136	136	46	39	96	-	91	45	79	44	54	332	28	119	668	1073	1188

[a] Includes Eurozone countries plus Denmark, Sweden, and United Kingdom
[b] Includes European Union countries plus Norway and Switzerland

Table A.3: Number of Stocks per Year - Industry (Eurozone)

This table reports the number of stocks available per industry (Eurozone) in a given year. The average number of stocks reported is computed solely on the numbers highlighted in bold, starting with a marked *. These stocks represent those used for the industry regressions. The limitation of the time period is due to the necessity to have a limited amount of stocks available for the construction of the HML, SMB, and WML risk factors. For instance, in case of *basic industries*, we run industry regressions merely for the time period April 1991 to April 2008. The remaining stocks of the period January 1981 to March 1990 are, however, not neglected, since they are used for pan-Eurozone portfolios.

BAS = *basic industries*; CGD = *cyclical consumer goods*; CSER = *cyclical services*; TOLF = *financials*; GN = *general industries*; ITECH = *information technology*; NCGD = *non-cycical consumer goods*; NCSR = *non-cycical services*; RES = *resources*; UTL = *utilities.*

	BAS	CGD	CSER	TOLF	GN	ITECH	NCGD	NCSR	RES	UTL	Total	Industry	Service	Total
1981	14	22	20	39	***50**	8	8	2	3	8	***174**	***113**	***61**	***174**
1982	14	24	21	41	**50**	8	8	2	3	8	**179**	**115**	**64**	**179**
1983	15	*** 28**	23	51	**56**	8	9	2	3	10	**205**	**129**	**76**	**205**
1984	16	**28**	23	51	**56**	9	9	2	3	10	**207**	**131**	**76**	**207**
1985	16	**29**	23	55	**57**	10	9	2	5	11	**217**	**137**	**80**	**217**
1986	19	**31**	26	58	**59**	10	9	2	5	11	**230**	**144**	**86**	**230**
1987	19	**42**	29	81	**74**	11	11	2	7	12	**288**	**176**	**112**	**288**
1988	24	**47**	***33**	***91**	**86**	11	12	3	10	18	**335**	**208**	**127**	**335**
1989	35	**65**	**46**	**123**	**110**	14	15	3	11	21	**443**	**271**	**172**	**443**
1990	41	**81**	**53**	**145**	**126**	22	22	4	12	22	**528**	**326**	**202**	**528**
1991	***42**	**83**	**58**	**155**	**135**	22	24	4	12	23	**558**	**341**	**217**	**558**
1992	**44**	**88**	**58**	**166**	**139**	22	26	4	12	24	**583**	**355**	**228**	**583**
1993	**45**	**95**	**62**	**177**	**147**	23	28	4	14	27	**622**	**379**	**243**	**622**
1994	**46**	**97**	**63**	**178**	**150**	24	31	4	14	27	**634**	**389**	**245**	**634**
1995	**49**	**101**	**67**	**188**	**163**	24	32	4	15	29	**672**	**413**	**259**	**672**
1996	**54**	**105**	**67**	**193**	**171**	26	34	5	17	29	**701**	**436**	**265**	**701**
1997	**55**	**109**	**74**	**200**	**178**	28	36	7	17	30	**734**	**453**	**281**	**734**
1998	**57**	**120**	**84**	**208**	**189**	31	38	8	19	32	**786**	**486**	**300**	**786**
1999	**61**	**133**	**92**	**223**	**202**	***36**	43	10	21	***35**	**856**	**531**	**325**	**856**
2000	**62**	**139**	**99**	**240**	**224**	**46**	***47**	12	23	**39**	**931**	**580**	**351**	**931**
2001	**62**	**143**	**110**	**254**	**237**	**54**	**53**	15	24	**42**	**994**	**615**	**379**	**994**
2002	**63**	**145**	**115**	**262**	**242**	**57**	**54**	15	26	**45**	**1024**	**632**	**392**	**1024**
2003	**64**	**146**	**116**	**268**	**245**	**59**	**56**	16	27	**47**	**1044**	**644**	**400**	**1044**
2004	**65**	**147**	**118**	**274**	**249**	**62**	**56**	17	***28**	**48**	**1064**	**655**	**409**	**1064**
2005	**66**	**149**	**123**	**279**	**252**	**64**	**57**	18	**28**	**50**	**1086**	**666**	**420**	**1086**
2006	**68**	**153**	**130**	**290**	**264**	**64**	**60**	19	**33**	**50**	**1131**	**692**	**439**	**1131**
2007	**74**	**156**	**138**	**309**	**282**	**69**	**63**	20	**41**	**53**	**1205**	**738**	**467**	**1205**
2008	**77**	**159**	**148**	**327**	**306**	**72**	**71**	20	**42**	**58**	**1280**	**785**	**495**	**1280**
Average	59	95	88	217	161	58	57	-	34	47	668	412	256	668

Table A.4: Number of Stocks per Year - Industry (EU)

This table reports the number of stocks available per industry (European Union) in a given year. The average number of stocks reported is computed solely on the numbers highlighted in bold, starting with a marked *. These stocks represent those used for the industry regressions. The limitation of the time period is due to the necessity to have a limited amount of stocks available for the construction of the HML, SMB, and WML risk factors. For instance, in case of *basic industries*, we run industry regressions merely for the time period April 1991 to April 2008. The remaining stocks of the period January 1981 to March 1990 are, however, not neglected, since they are used for pan-European Union portfolios.

BAS = *basic industries*; CGD = *cyclical consumer goods*; CSER = *cyclical services*; TOLF = *financials*; GN = *general industries*; ITECH = *information technology*; NCGD = *non-cycical consumer goods*; NCSR = *non-cycical services*; RES = *resources*; UTL = *utilities.*

	BAS	CGD	CSER	TOLF	GN	ITECH	NCGD	NCSR	RES	UTL	Total	Industry	Service	Total
1981	21	***45**	50	110	***109**	10	14	2	7	8	***376**	***214**	***162**	***376**
1982	21	**47**	51	113	**111**	10	14	3	7	8	**385**	**218**	**167**	**385**
1983	24	**54**	56	128	**122**	12	16	3	7	10	**432**	**245**	**187**	**432**
1984	25	**54**	57	131	**123**	14	17	3	8	10	**442**	**251**	**191**	**442**
1985	26	**57**	59	138	**125**	15	17	4	10	11	**462**	**261**	**201**	**462**
1986	29	**61**	64	145	**129**	15	17	4	10	11	**485**	**272**	**213**	**485**
1987	29	**73**	71	171	**150**	16	20	4	12	12	**558**	**312**	**246**	**558**
1988	34	**78**	***77**	***188**	**166**	17	21	5	16	18	**620**	**350**	**270**	**620**
1989	46	**97**	**91**	**229**	**201**	21	24	6	17	21	**753**	**427**	**326**	**753**
1990	54	**113**	**99**	**255**	**227**	29	31	7	20	22	**857**	**496**	**361**	**857**
1991	***55**	**116**	**105**	**271**	**237**	30	34	7	20	26	**901**	**518**	**383**	**901**
1992	**58**	**121**	**106**	**291**	**243**	30	36	7	20	29	**941**	**537**	**404**	**941**
1993	**59**	**128**	**111**	**306**	**253**	31	38	7	22	33	**988**	**564**	**424**	**988**
1994	**61**	**131**	**115**	**311**	**258**	32	43	7	22	33	**1013**	**580**	**433**	**1013**
1995	**64**	**137**	**122**	**333**	**273**	33	45	7	23	35	**1072**	**610**	**462**	**1072**
1996	**69**	**142**	**126**	**344**	**281**	36	50	8	28	35	**1119**	**641**	**478**	**1119**
1997	**71**	**150**	**137**	**359**	**296**	40	54	11	28	37	**1183**	**676**	**507**	**1183**
1998	**75**	**161**	**152**	**376**	**309**	45	56	13	31	40	**1258**	**717**	**541**	**1258**
1999	**79**	**175**	**161**	**395**	**324**	***52**	61	15	34	***43**	**1339**	**768**	**571**	**1339**
2000	**82**	**182**	**169**	**416**	**347**	**63**	***66**	19	36	**47**	**1427**	**823**	**604**	**1427**
2001	**82**	**186**	**184**	**436**	**361**	**77**	**76**	23	38	**50**	**1513**	**870**	**643**	**1513**
2002	**83**	**188**	**191**	**448**	**368**	**80**	**77**	23	41	**53**	**1552**	**890**	**662**	**1552**
2003	**85**	**191**	**195**	**460**	**374**	**83**	**80**	24	44	**55**	**1591**	**912**	**679**	**1591**
2004	**86**	**192**	**201**	**469**	**379**	**87**	**80**	25	***45**	**57**	**1621**	**926**	**695**	**1621**
2005	**89**	**195**	**208**	**481**	**385**	**91**	**83**	26	**46**	**59**	**1663**	**948**	**715**	**1663**
2006	**93**	**199**	**218**	**499**	**400**	**92**	**87**	28	**53**	**60**	**1729**	**984**	**745**	**1729**
2007	**100**	**205**	**230**	**533**	**425**	**97**	**92**	29	**62**	**64**	**1837**	**1045**	**792**	**1837**
2008	**108**	**208**	**243**	**560**	**451**	**102**	**100**	29	**65**	**69**	**1935**	**1103**	**832**	**1935**
Average	78	132	154	379	265	82	82	-	54	56	1073	613	461	1073

Table A.5: Number of Stocks per Year - Industry (Europe)

This table reports the number of stocks available per industry (Europe total) in a given year. The average number of stocks reported is computed solely on the numbers highlighted in bold, starting with a marked *. These stocks represent those used for the industry regressions. The limitation of the time period is due to the necessity to have a limited amount of stocks available for the construction of the HML, SMB, and WML risk factors. For instance, in case of *basic industries*, we run industry regressions merely for the time period April 1991 to April 2008. The remaining stocks of the period January 1981 to March 1990 are, however, not neglected, since they are used for pan-Europe portfolios.

BAS = *basic industries*; CGD = *cyclical consumer goods*; CSER = *cyclical services*; TOLF = *financials*; GN = *general industries*; ITECH = *information technology*; NCGD = *non-cycical consumer goods*; NCSR = *non-cycical services*; RES = *resources*; UTL = *utilities.*

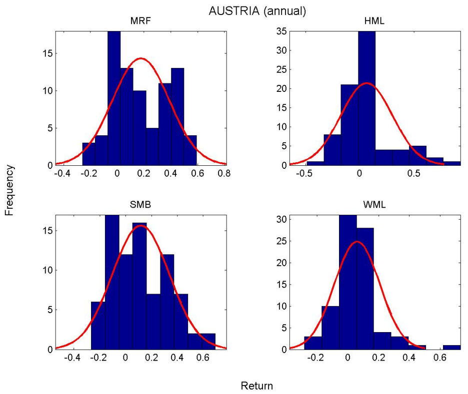
	BAS	CGD	CSER	TOLF	GN	ITECH	NCGD	NCSR	RES	UTL	Total	Industry	Service	Total
1981	23	__*48__	53	122	__*124__	10	17	2	7	13	__*419__	__*242__	__*177__	__*419__
1982	23	**50**	54	125	**127**	10	17	3	7	13	**429**	**247**	**182**	**429**
1983	26	**57**	59	141	**138**	12	19	3	8	15	**478**	**275**	**203**	**478**
1984	27	**57**	60	147	**139**	15	20	3	9	15	**492**	**282**	**210**	**492**
1985	28	**60**	62	154	**141**	17	20	4	11	16	**513**	**293**	**220**	**513**
1986	31	**64**	67	161	**149**	17	20	4	11	16	**540**	**308**	**232**	**540**
1987	32	**79**	75	188	**176**	19	23	4	13	18	**627**	**360**	**267**	**627**
1988	37	**84**	__*83__	__*209__	**193**	20	25	5	17	24	**697**	**400**	**297**	**697**
1989	50	**105**	**98**	**252**	**229**	25	28	6	18	28	**839**	**483**	**356**	**839**
1990	58	**121**	**106**	**282**	**255**	33	36	7	21	29	**948**	**553**	**395**	**948**
1991	__*60__	**125**	**113**	**300**	**266**	35	40	7	21	34	**1001**	**581**	**420**	**1001**
1992	**63**	**130**	**114**	**321**	**273**	35	42	7	21	37	**1043**	**601**	**442**	**1043**
1993	**64**	**137**	**120**	**337**	**283**	36	44	7	24	41	**1093**	**629**	**464**	**1093**
1994	**66**	**141**	**125**	**342**	**288**	37	50	7	24	41	**1121**	**647**	**474**	**1121**
1995	**69**	**147**	**132**	**365**	**305**	38	53	7	25	43	**1184**	**680**	**504**	**1184**
1996	**75**	**152**	**136**	**377**	**315**	41	58	8	30	44	**1236**	**715**	**521**	**1236**
1997	**77**	**160**	**147**	**392**	**331**	46	62	11	30	46	**1302**	**752**	**550**	**1302**
1998	**83**	**173**	**162**	**411**	**346**	51	64	13	39	49	**1391**	**805**	**586**	**1391**
1999	**87**	**189**	**171**	**432**	**362**	__*58__	71	16	42	__*52__	**1480**	**861**	**619**	**1480**
2000	**90**	**196**	**180**	**455**	**386**	**69**	__*78__	20	44	**56**	**1574**	**919**	**655**	**1574**
2001	**92**	**200**	**196**	**480**	**400**	**83**	**89**	24	46	**59**	**1669**	**969**	**700**	**1669**
2002	**94**	**202**	**203**	**494**	**408**	**87**	**90**	25	50	**62**	**1715**	**993**	**722**	**1715**
2003	**97**	**206**	**207**	**506**	**414**	**90**	**95**	26	54	**64**	**1759**	**1020**	**739**	**1759**
2004	**98**	**207**	**213**	**515**	**419**	**94**	**95**	27	__*55__	**67**	**1790**	**1035**	**755**	**1790**
2005	**102**	**210**	**220**	**527**	**427**	**99**	**100**	28	**57**	**69**	**1839**	**1064**	**775**	**1839**
2006	**106**	**216**	**230**	**547**	**445**	**100**	**105**	30	**67**	**70**	**1916**	**1109**	**807**	**1916**
2007	**113**	**223**	**243**	**583**	**472**	**105**	**110**	31	**80**	**75**	**2035**	**1178**	**857**	**2035**
2008	**121**	**226**	**256**	**612**	**498**	**110**	**118**	31	**83**	**80**	**2135**	**1236**	**899**	**2135**
Average	87	142	165	416	297	90	98	-	68	65	1188	687	501	1188

A.2 Histograms & Time Series Plots

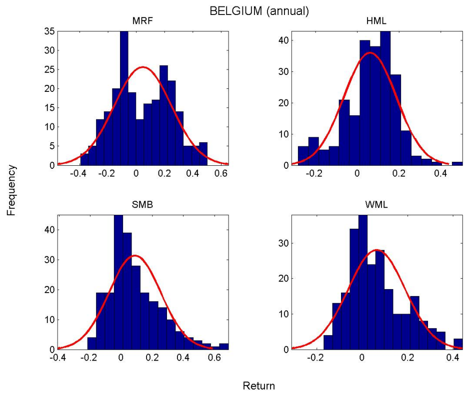
A.2.1 Figures per Country

Figure A.1: Return Histograms per Country [*Note: Histograms consider annually rebalanced portfolios. Sample periods might differ per country due to data availability constraints (see Figure 3.1 on page 73.)*]

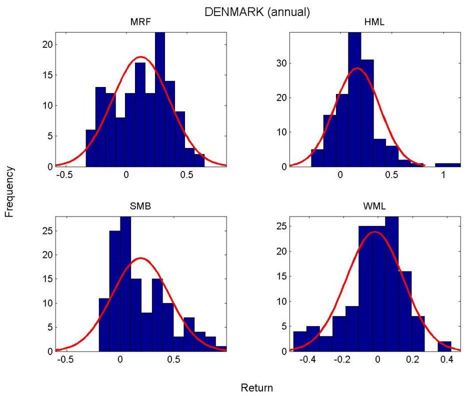
(a) Austria



(b) Belgium



(c) Denmark



(d) Finland

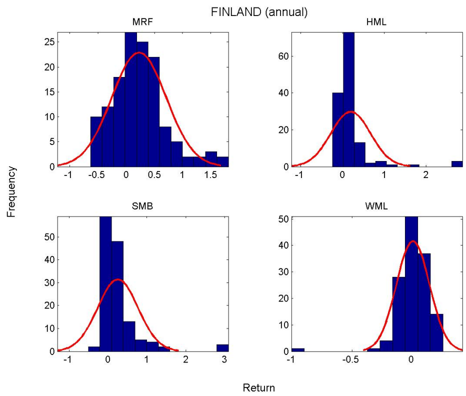
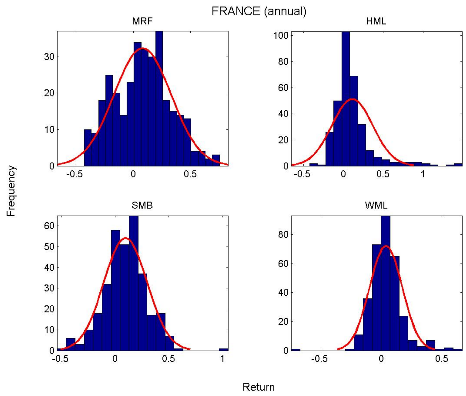
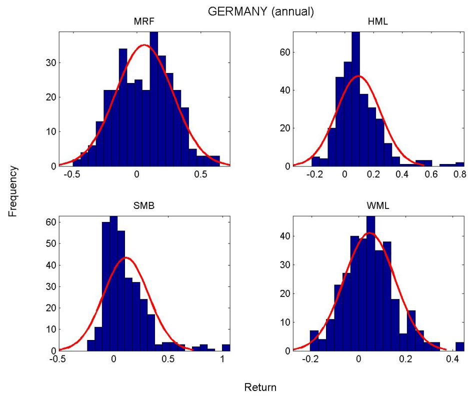


Figure A.1 cont'd: Return Histograms per Country

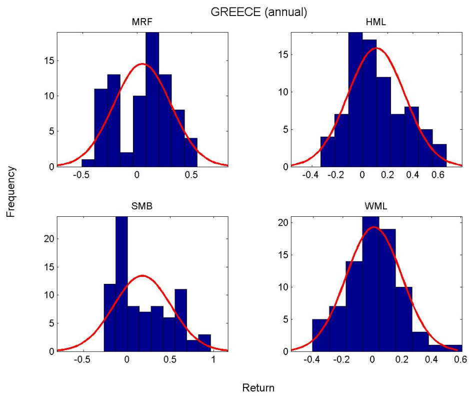
(e) France



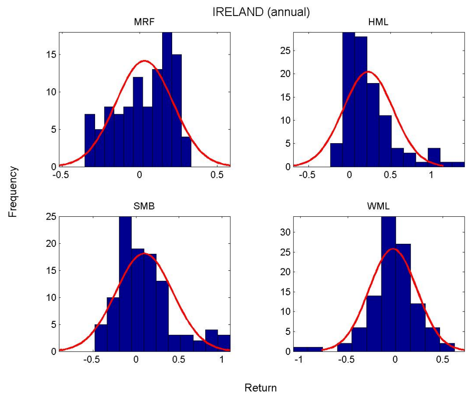
(f) Germany



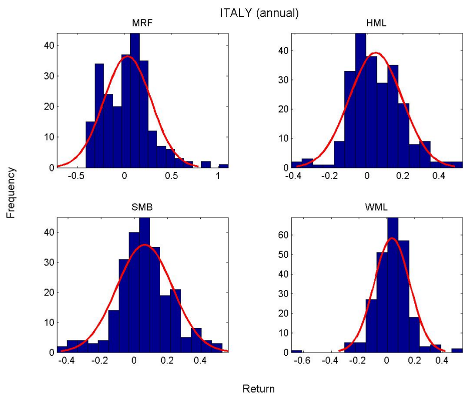
(g) Greece



(h) Ireland



(i) Italy



(j) The Netherlands

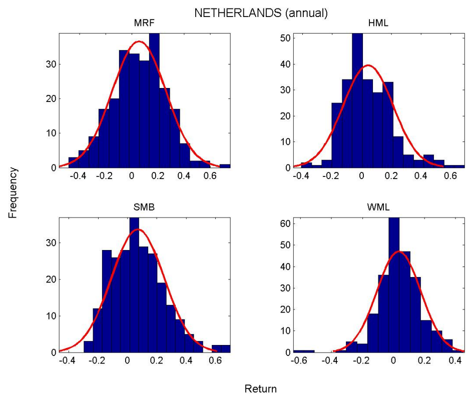
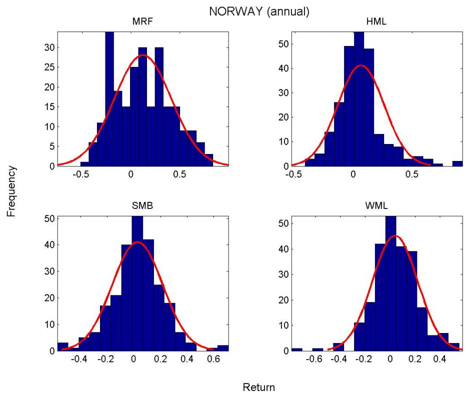
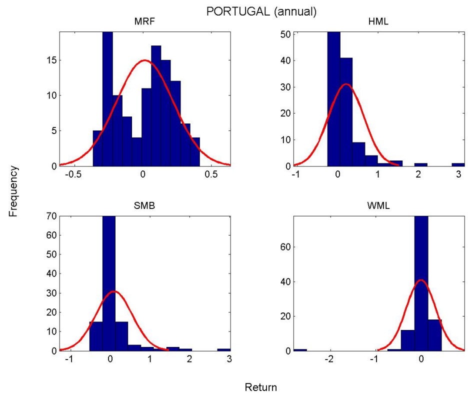


Figure A.1 cont'd: Return Histograms per Country

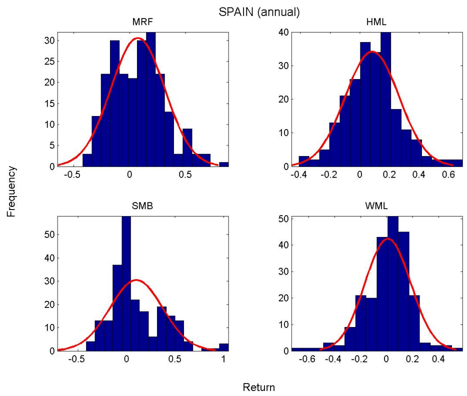
(k) Norway



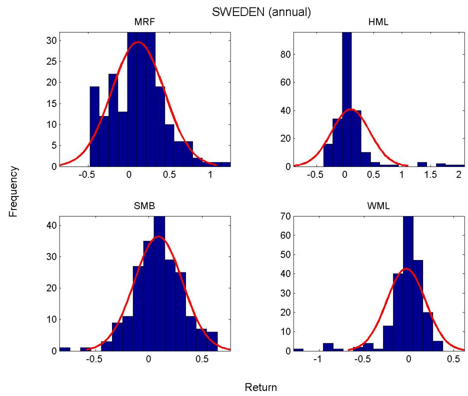
(l) Portugal



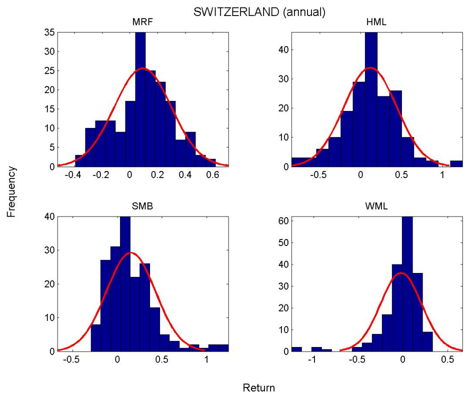
(m) Spain



(n) Sweden



(o) Switzerland



(p) United Kingdom

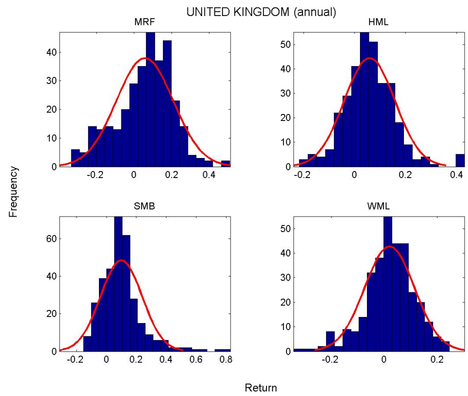
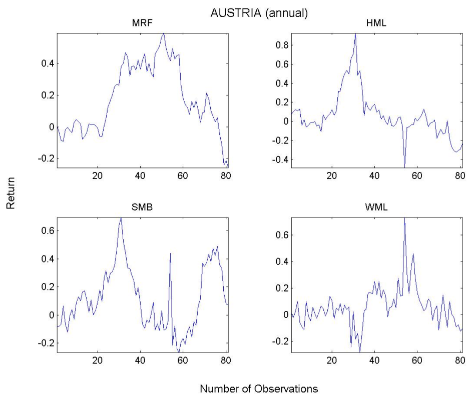
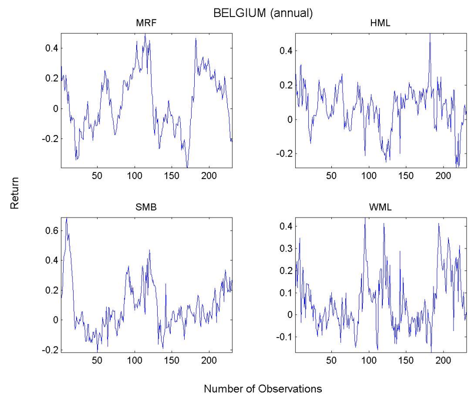


Figure A.2: Return Time Plots per Country [*Note: Time plots consider annually rebalanced portfolios. Sample periods might differ per country due to data availability constraints (see Figure 3.1 on page 73.)*]

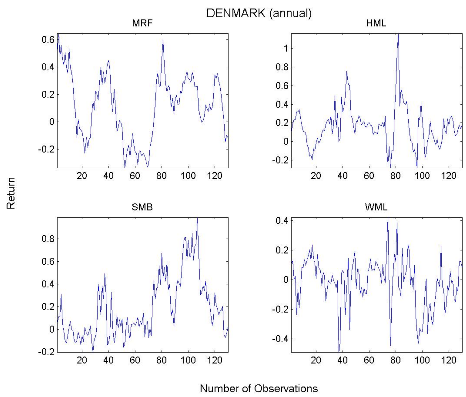
(a) Austria



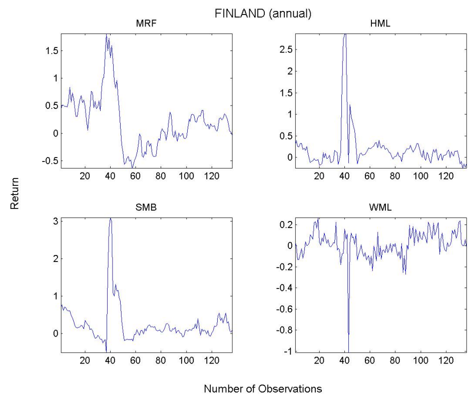
(b) Belgium



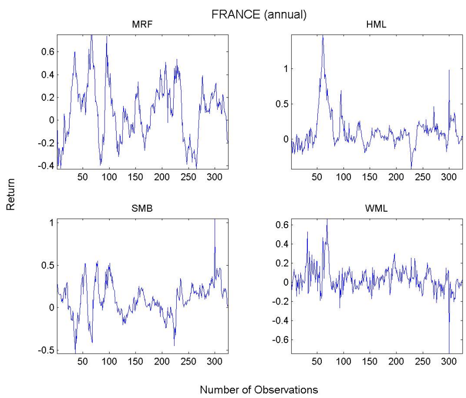
(c) Denmark



(d) Finland



(e) France



(f) Germany

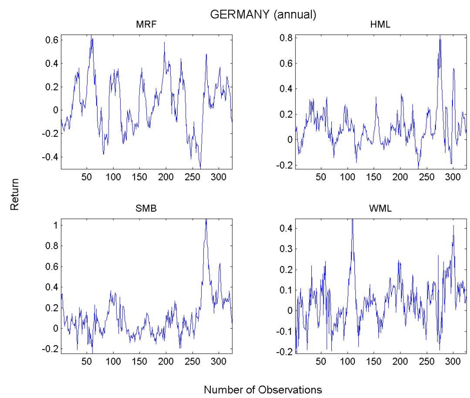
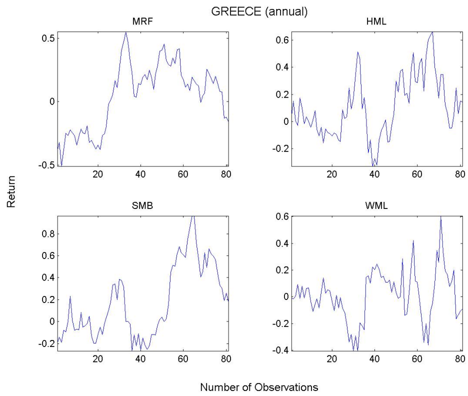
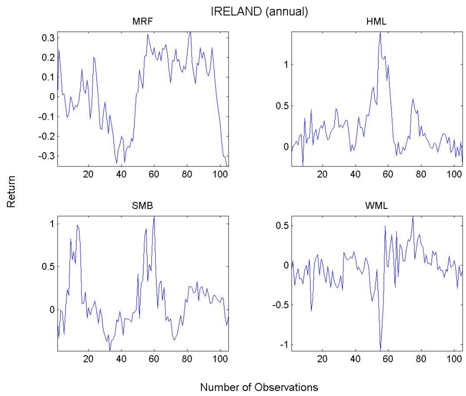


Figure A.2 cont'd: Return Time Plots per Country

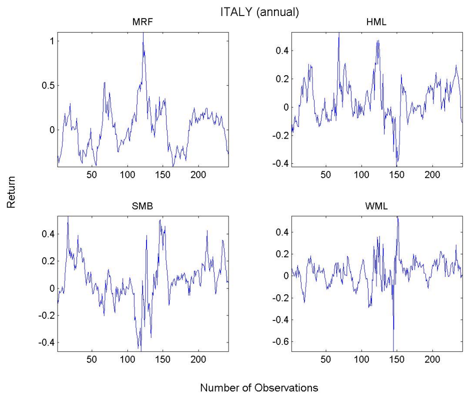
(g) Greece



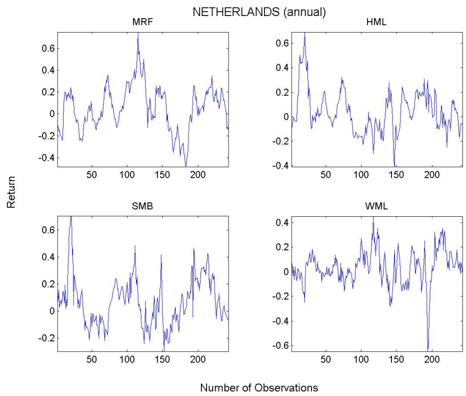
(h) Ireland



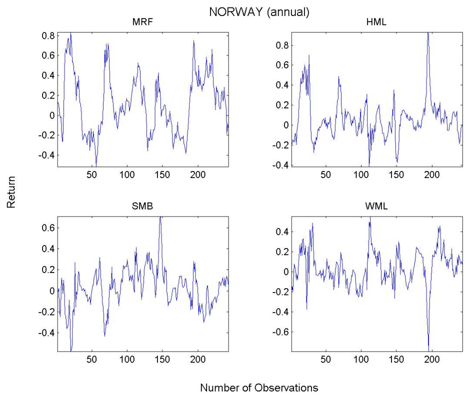
(i) Italy



(j) The Netherlands



(k) Norway



(l) Portugal

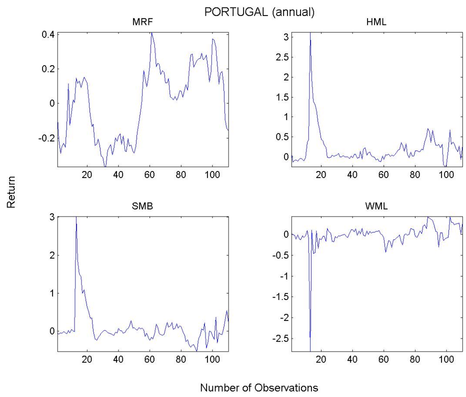
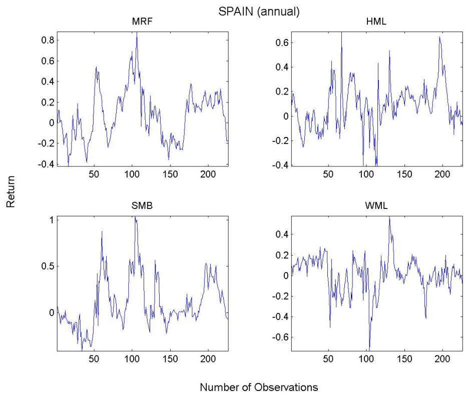
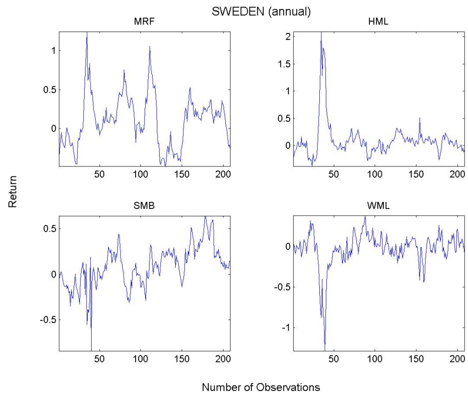


Figure A.2 cont'd: Return Time Plots per Country

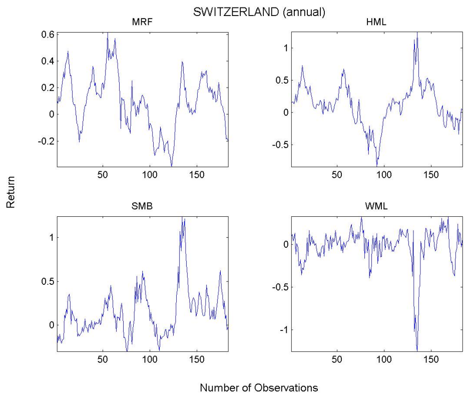
(m) Spain



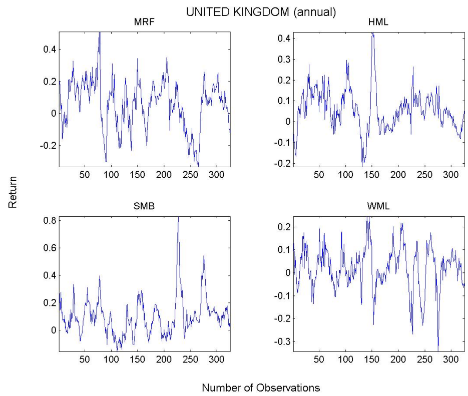
(n) Sweden



(o) Switzerland



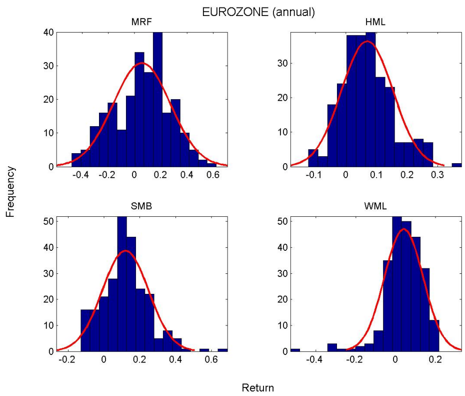
(p) United Kingdom



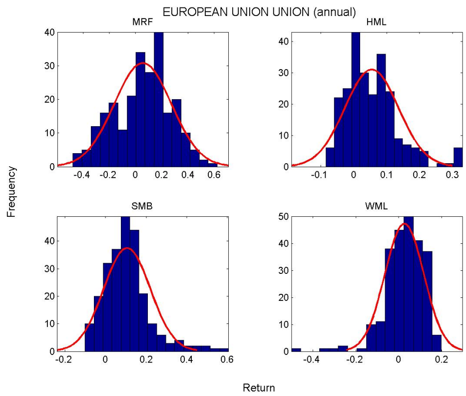
A.2.2 Figures per Region

Figure A.3: Return Histograms per Region (*Note: Histograms consider annually rebalanced portfolios, covering the time frame January 1981 to April 2008.*)

(a) Eurozone



(b) European Union



(c) Europe

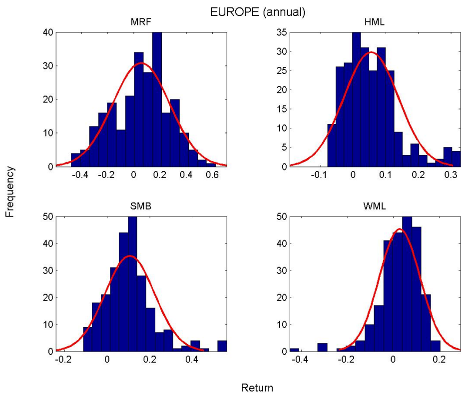
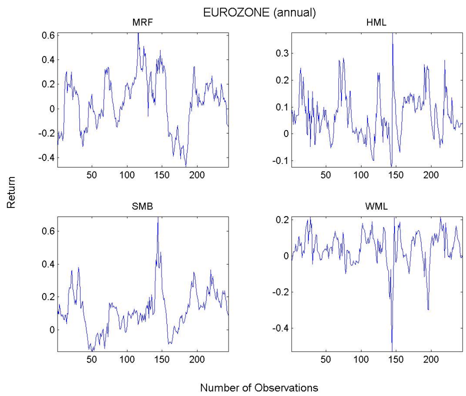
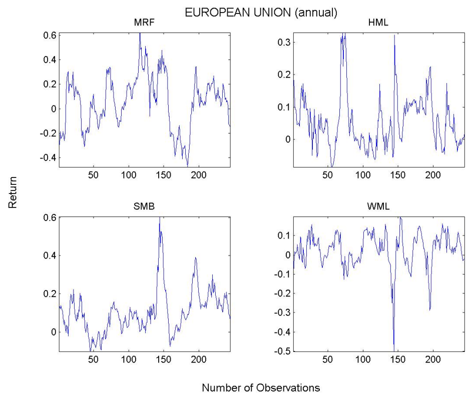


Figure A.4: Return Time Plots per Region (*Note: Time plots consider annually rebalanced portfolios, covering the time frame January 1981 to April 2008.*)

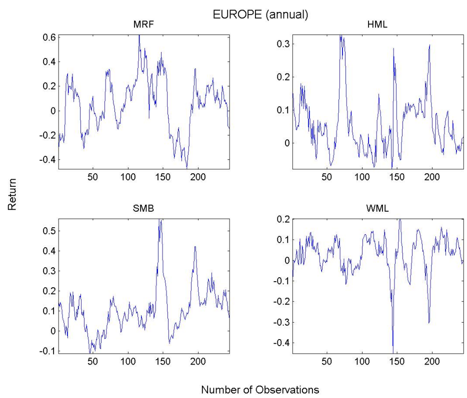
(a) Eurozone



(b) European Union



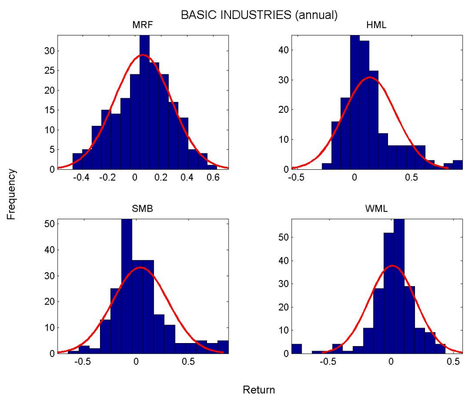
(c) Europe



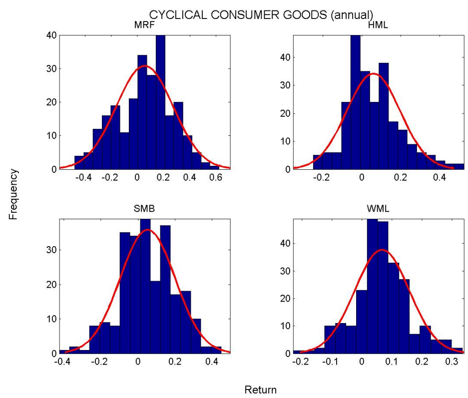
A.2.3 Figures per Industry (Eurozone)

Figure A.5: Return Histograms per Industry (Eurozone) [*Note: Histograms consider annually rebalanced portfolios. Sample periods might differ per industry due to data availability constraints (see Figure 3.2 on page 74.)*]

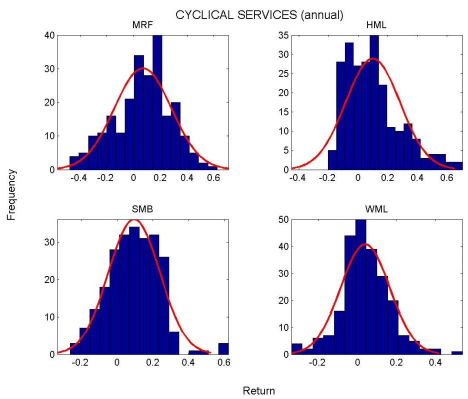
(a) Basic Industries



(b) Cyclical Consumer Goods



(c) Cyclical Services



(d) Financials

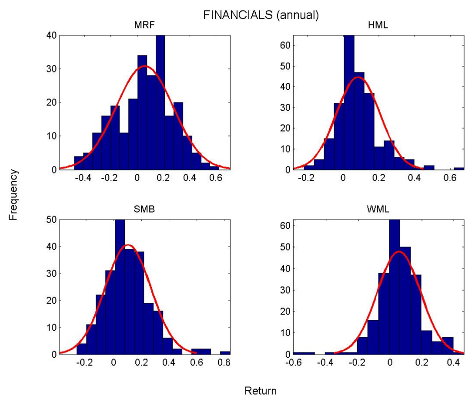
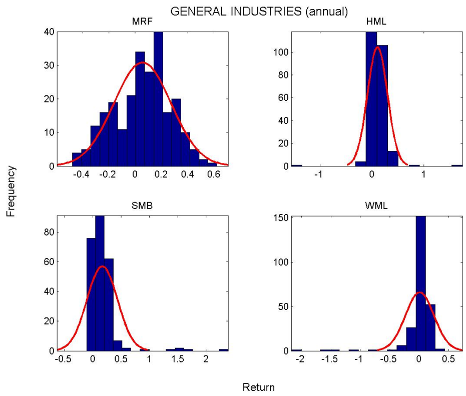
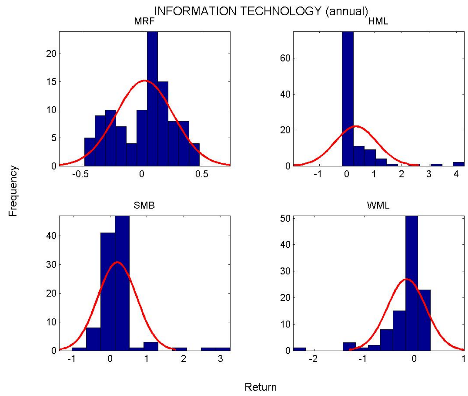


Figure A.5 cont'd: Return Histograms per Industry (Eurozone)

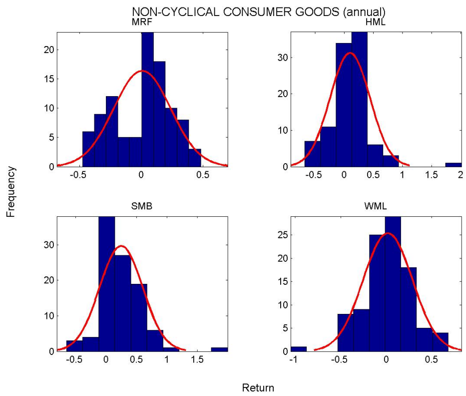
(e) General Industries



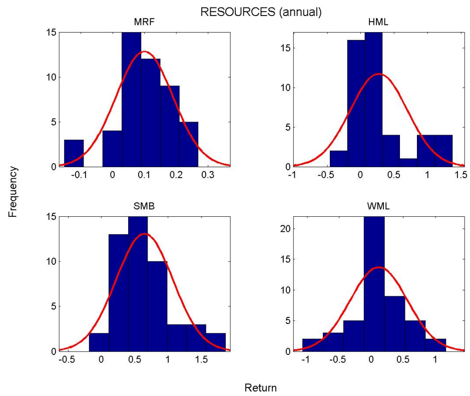
(f) Information Technology



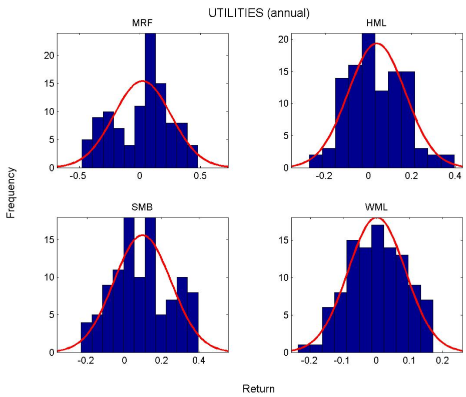
(g) Non-Cyclical Consumer Goods



(h) Resources



(i) Utilities



(j) All Industries

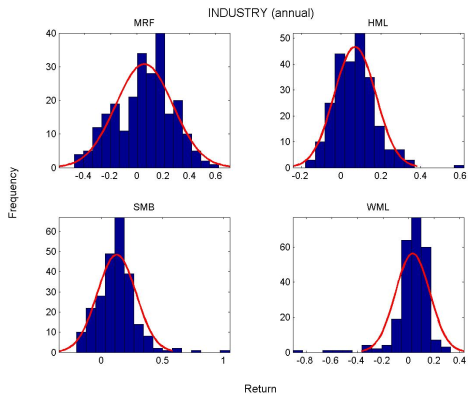


Figure A.5 cont'd: Return Histograms per Industry (Eurozone)

(k) All Services

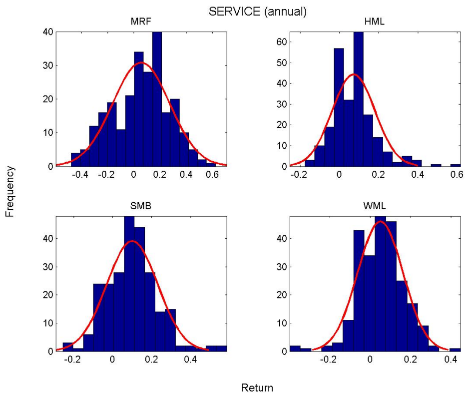
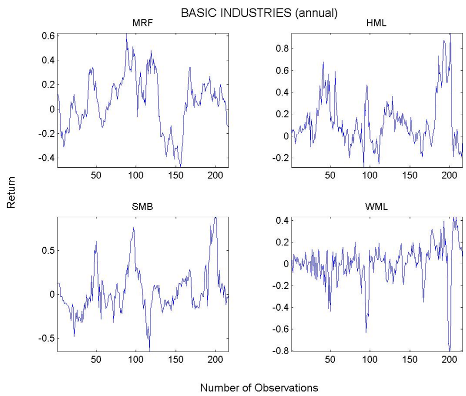


Figure A.6: Return Time Plots per Industry (Eurozone) [*Note: Time plots consider annually rebalanced portfolios. Sample periods might differ per industry due to data availability constraints (see Figure 3.2 on page 74.)*]

(a) Basic Industries



(b) Cyclical Consumer Goods

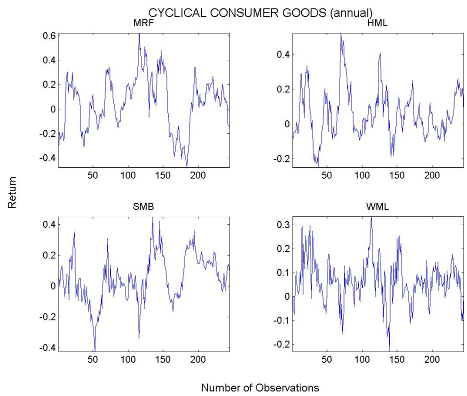
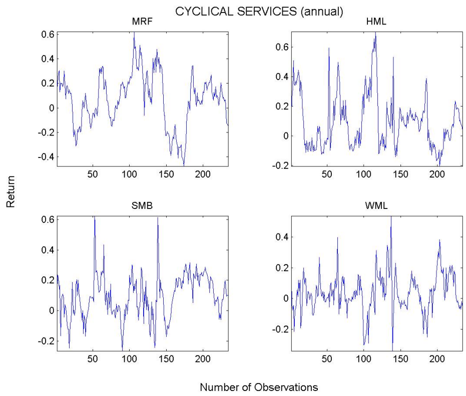
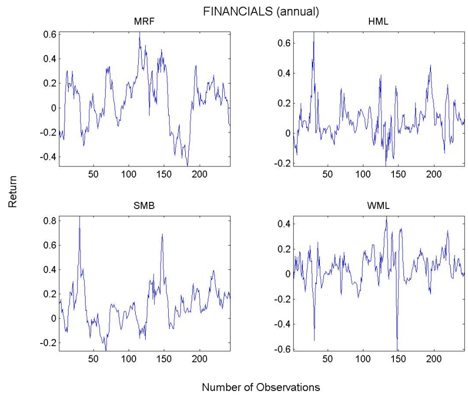


Figure A.6 cont'd: Return Time Plots per Industry (Eurozone)

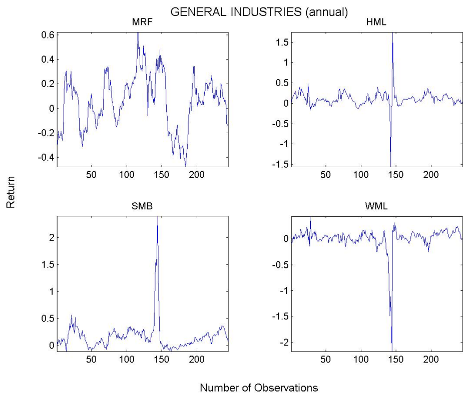
(c) Cyclical Services



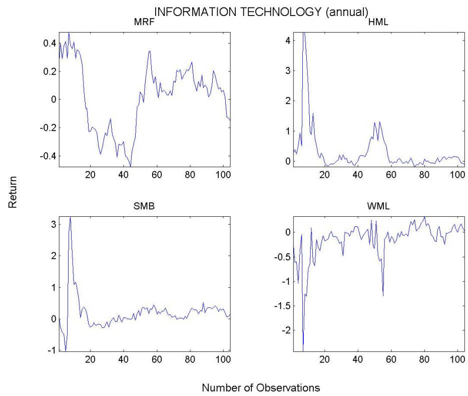
(d) Financials



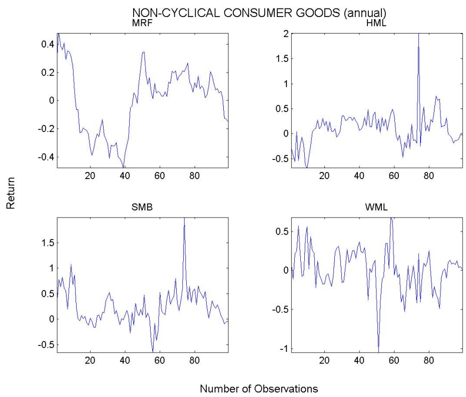
(e) General Industries



(f) Information Technology



(g) Non-Cyclical Consumer Goods



(h) Resources

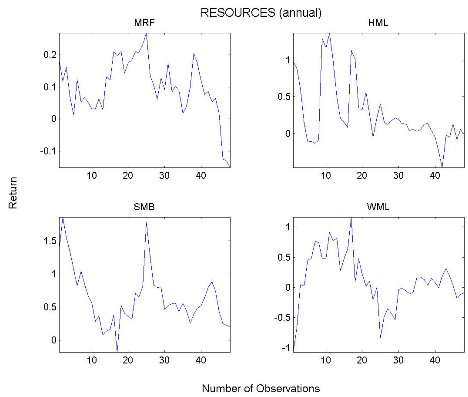
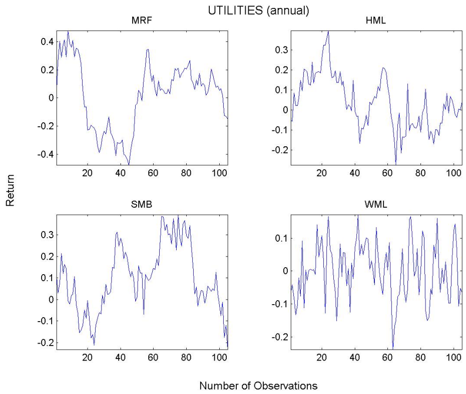
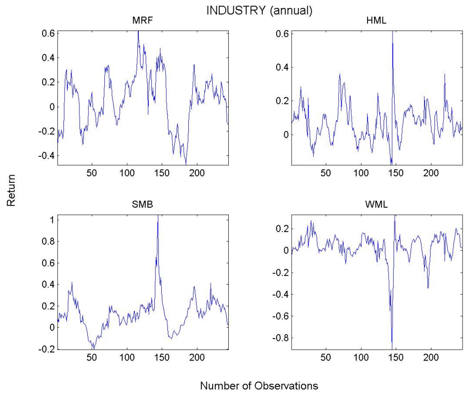


Figure A.6 cont'd: Return Time Plots per Industry (Eurozone)

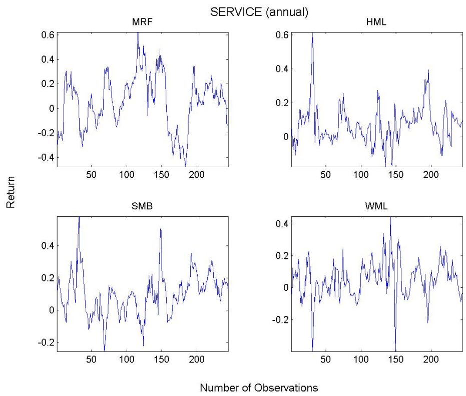
(i) Utilities



(j) All Industries



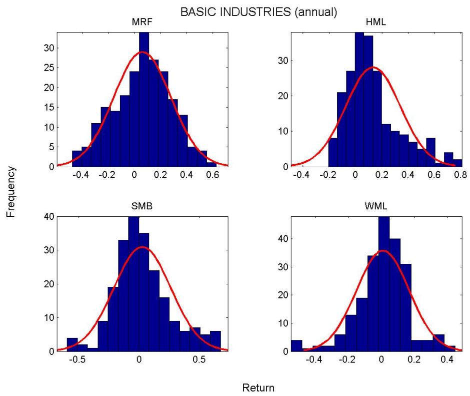
(k) All Services



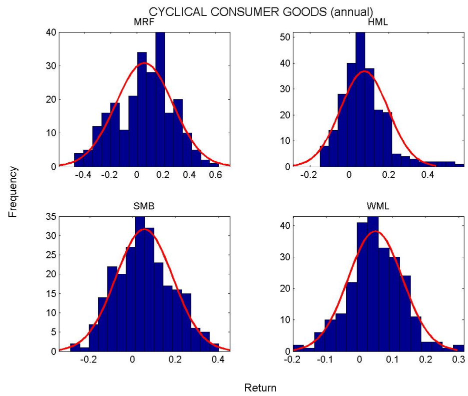
A.2.4 Figures per Industry (EU)

Figure A.7: Return Histograms per Industry (EU) [*Note: Histograms consider annually rebalanced portfolios. Sample periods might differ per industry due to data availability constraints (see Figure 3.2 on page 74.)*]

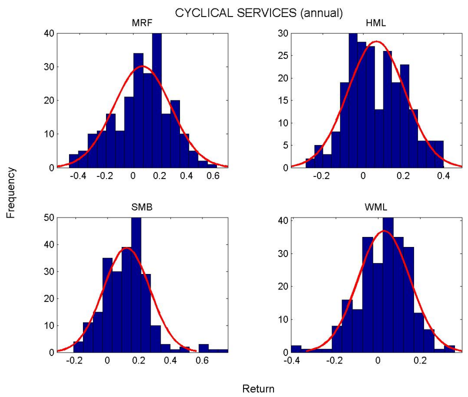
(a) Basic Industries



(b) Cyclical Consumer Goods



(c) Cyclical Services



(d) Financials

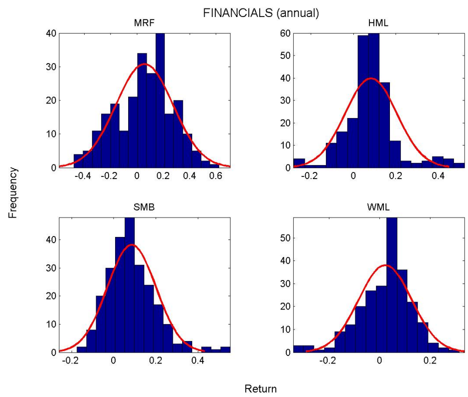
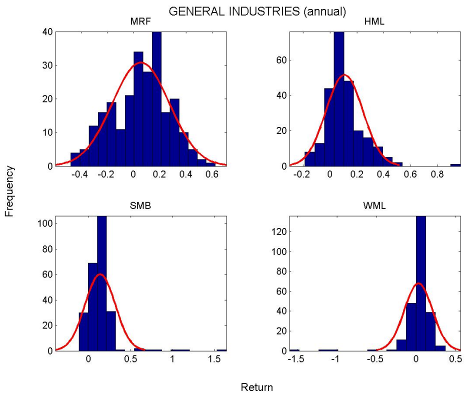
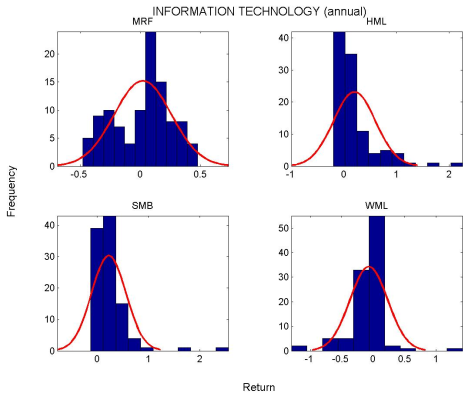


Figure A.7 cont'd: Return Histograms per Industry (EU)

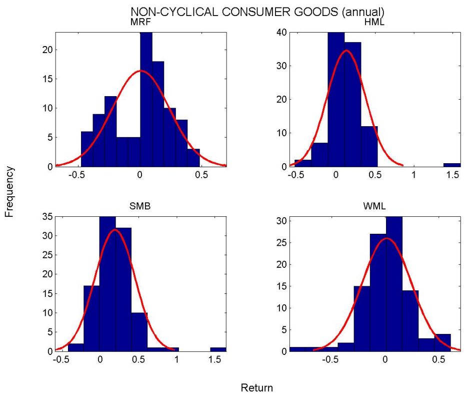
(e) General Industries



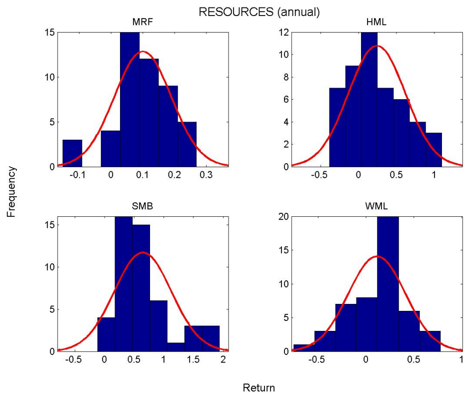
(f) Information Technology



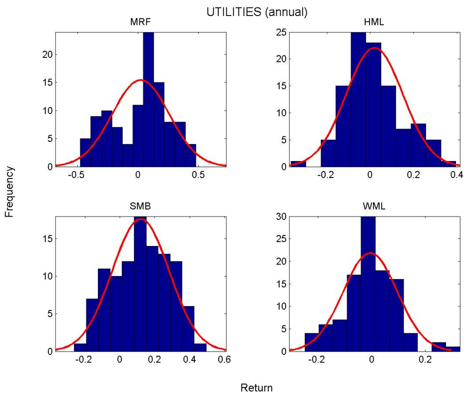
(g) Non-Cyclical Consumer Goods



(h) Resources



(i) Utilities



(j) All Industries

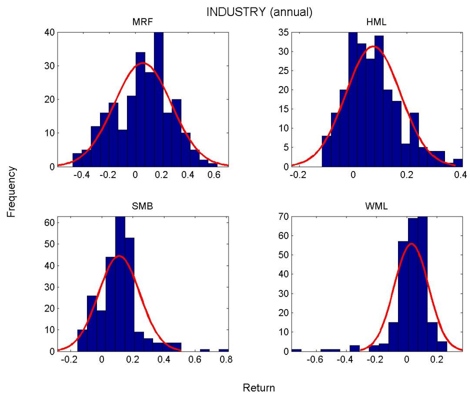


Figure A.7 cont'd: Return Histograms per Industry (EU)

(k) All Services

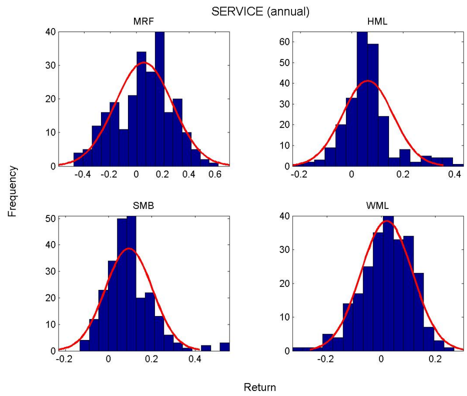
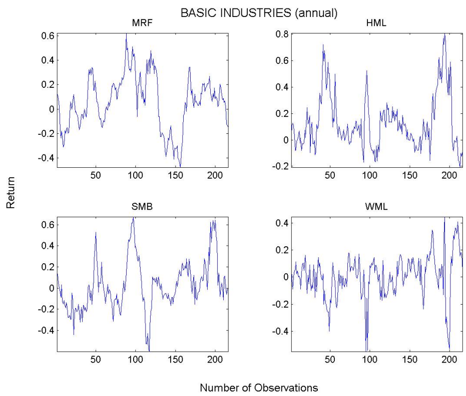


Figure A.8: Return Time Plots per Industry (EU) [*Note: Time plots consider annually rebalanced portfolios. Sample periods might differ per industry due to data availability constraints (see Figure 3.2 on page 74.)*]

(a) Basic Industries



(b) Cyclical Consumer Goods

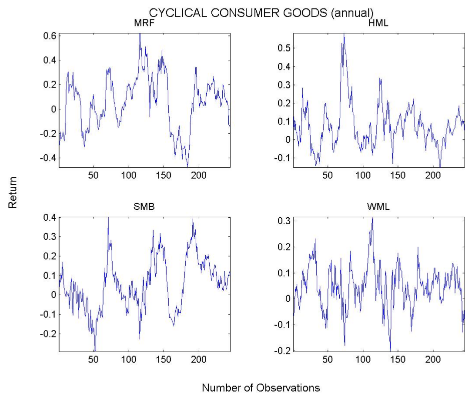
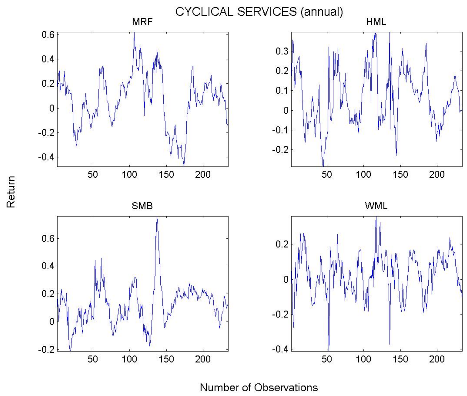
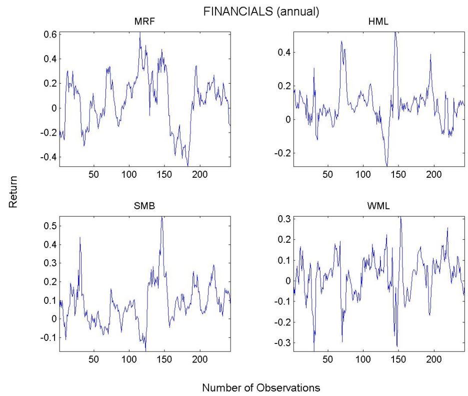


Figure A.8 cont'd: Return Time Plots per Industry (EU)

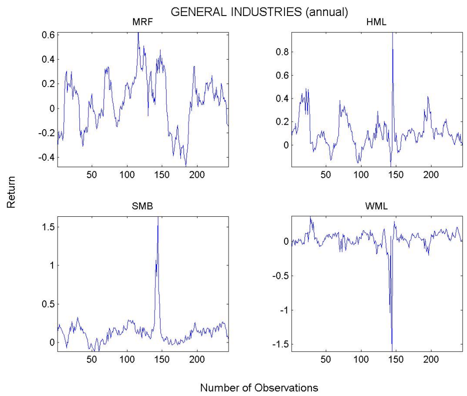
(c) Cyclical Services



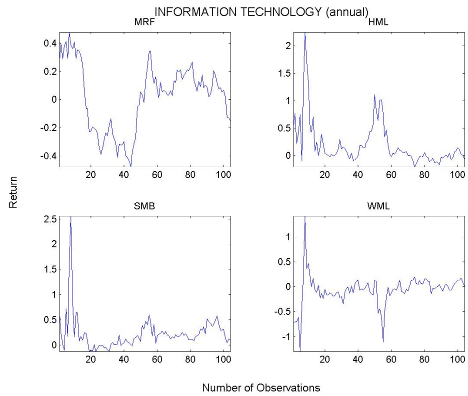
(d) Financials



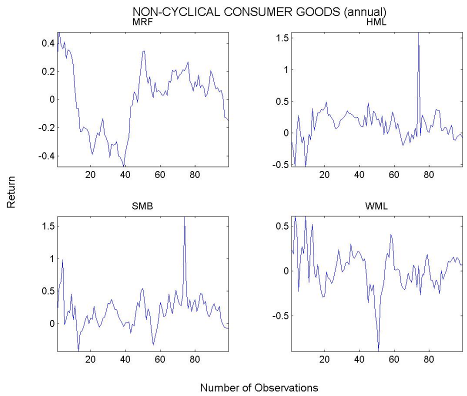
(e) General Industries



(f) Information Technology



(g) Non-Cyclical Consumer Goods



(h) Resources

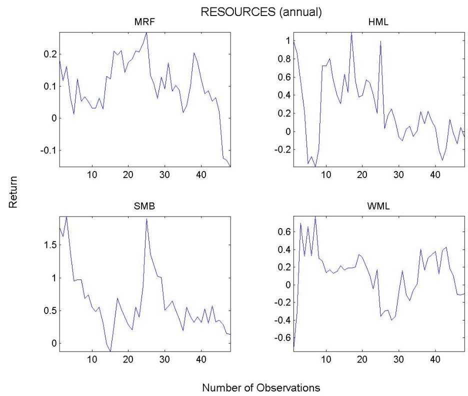
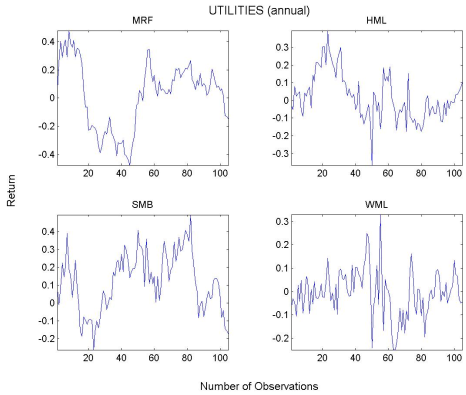
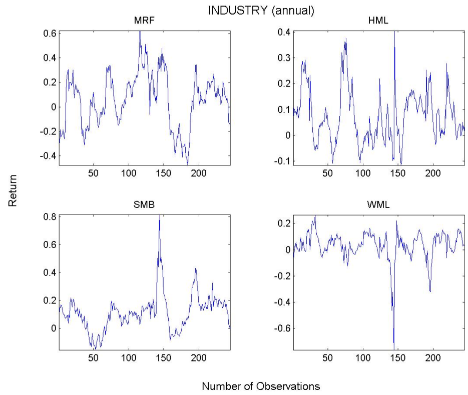


Figure A.8 cont'd: Return Time Plots per Industry (EU)

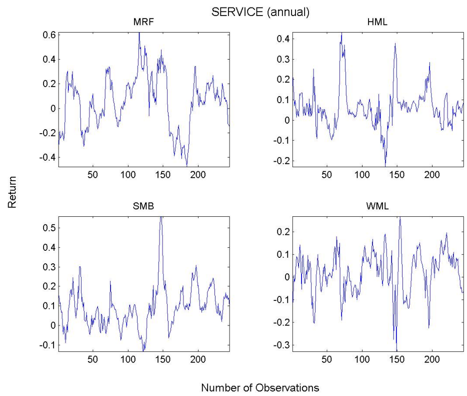
(i) Utilities



(j) All Industries



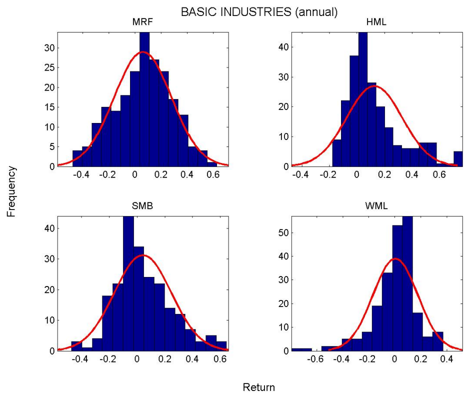
(k) All Services



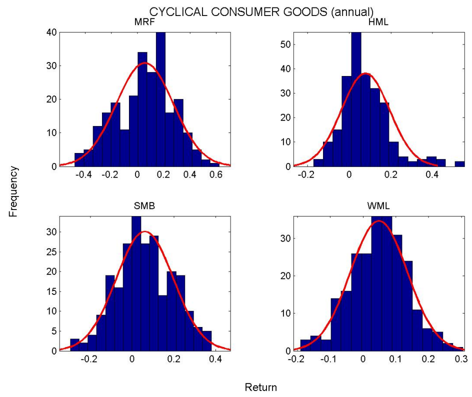
A.2.5 Figures per Industry (Europe)

Figure A.9: Return Histograms per Industry (Europe)[*Note: Histograms consider annually rebalanced portfolios. Sample periods might differ per industry due to data availability constraints (see Figure 3.2 on page 74.)*]

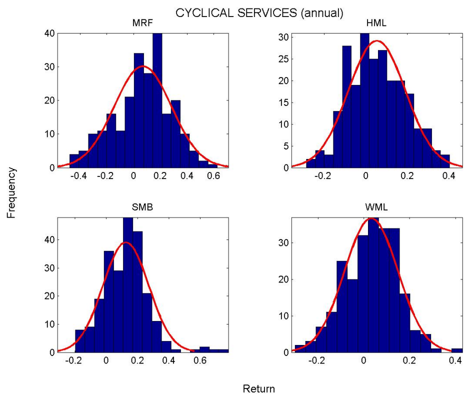
(a) Basic Industries



(b) Cyclical Consumer Goods



(c) Cyclical Services



(d) Financials

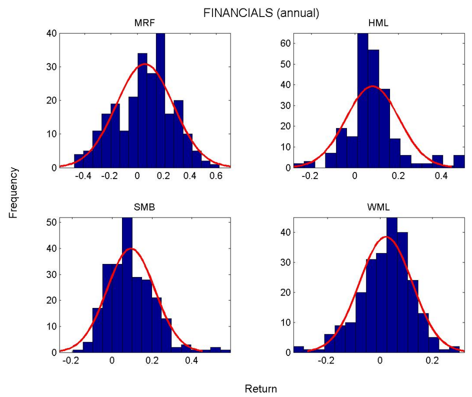
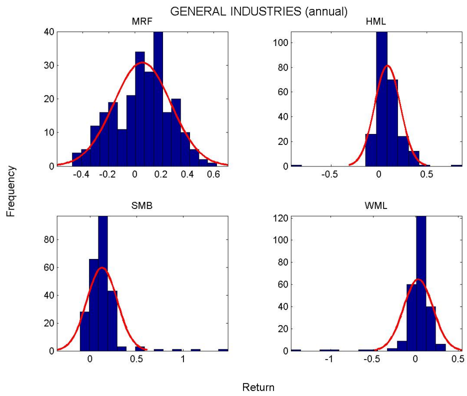
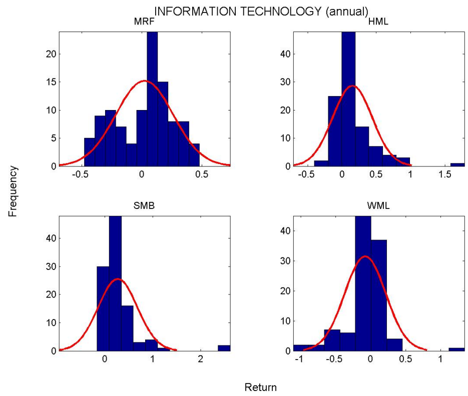


Figure A.9 cont'd: Return Histograms per Industry (Europe)

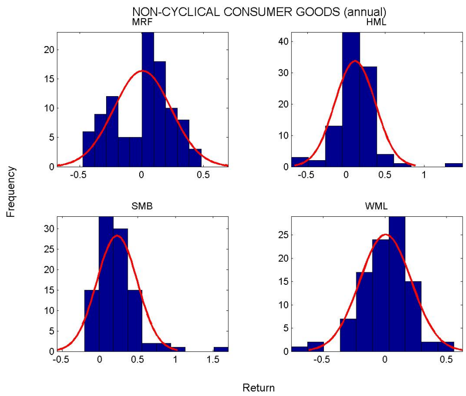
(e) General Industries



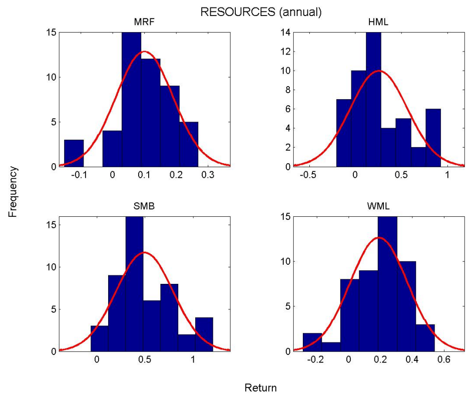
(f) Information Technology



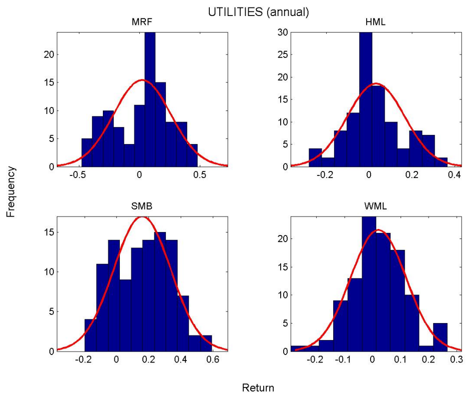
(g) Non-Cyclical Consumer Goods



(h) Resources



(i) Utilities



(j) All Industries

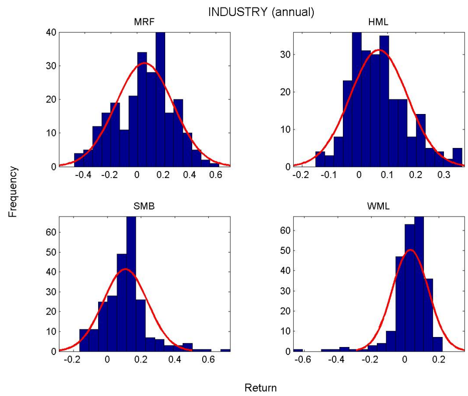


Figure A.9 cont'd: Return Histograms per Industry (Europe)

(k) All Services

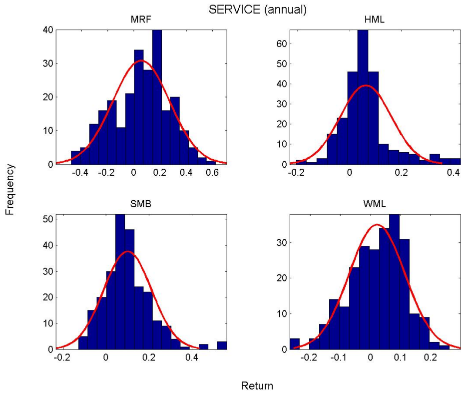
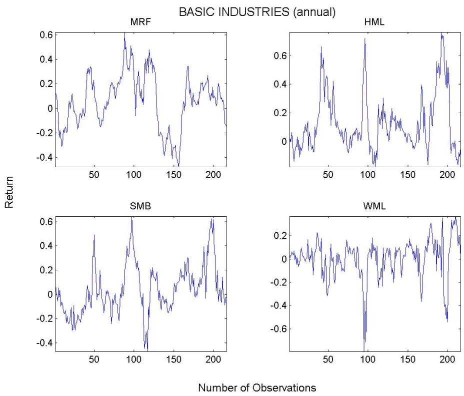


Figure A.10: Return Time Plots per Industry (Europe) [*Note: Histograms consider annually rebalanced portfolios. Sample periods might differ per industry due to data availability constraints (see Figure 3.2 on page 74.)*]

(a) Basic Industries



(b) Cyclical Consumer Goods

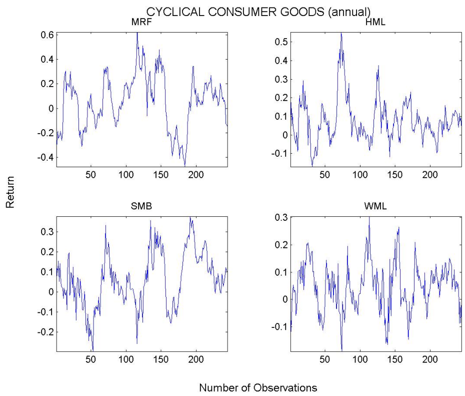
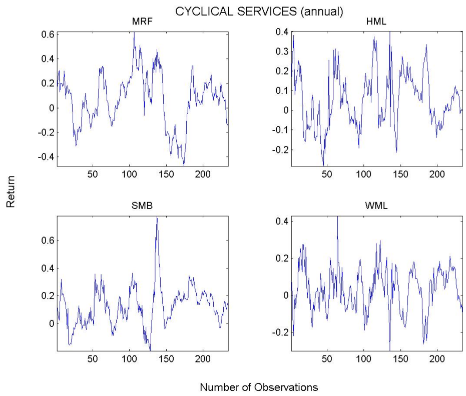
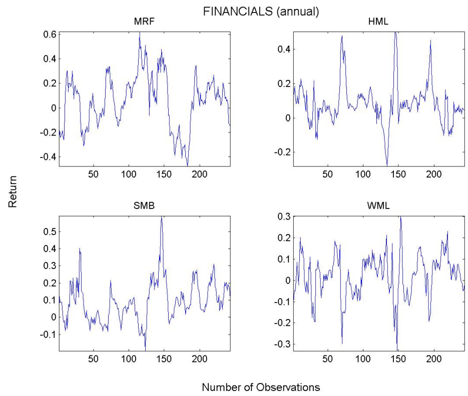


Figure A.10 cont'd: Return Time Plots per Industry (Europe)

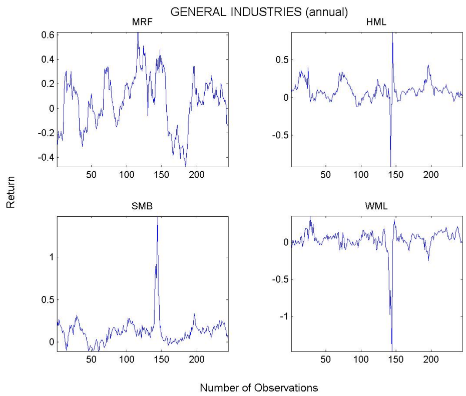
(c) Cyclical Services



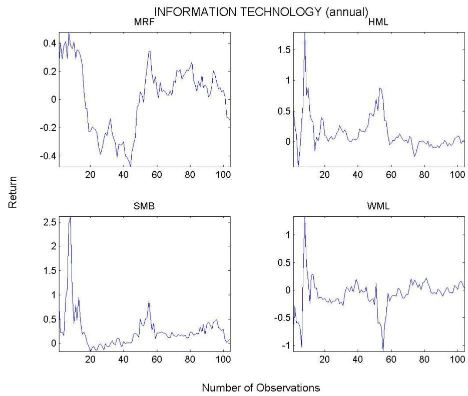
(d) Financials



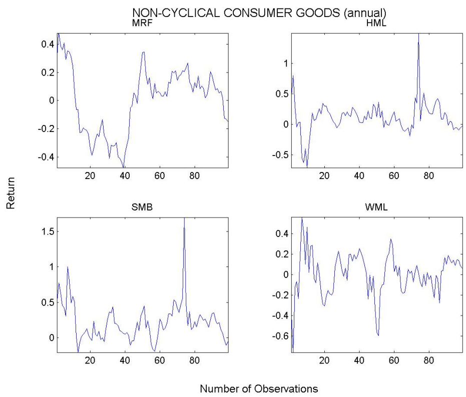
(e) General Industries



(f) Information Technology



(g) Non-Cyclical Consumer Goods



(h) Resources

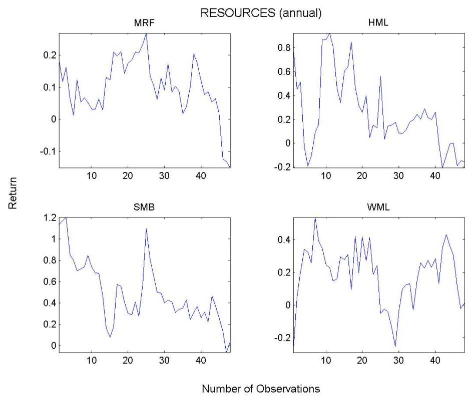
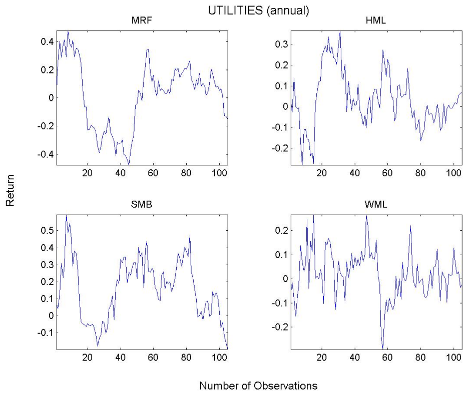
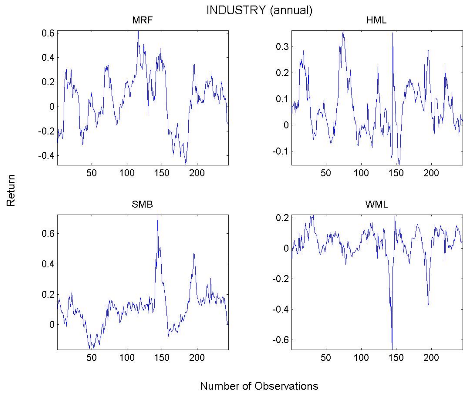


Figure A.10 cont'd: Return Time Plots per Industry (Europe)

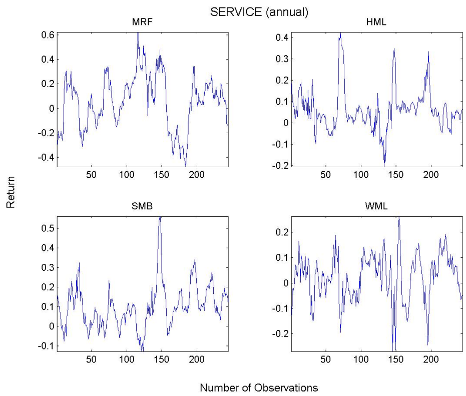
(i) Utilities



(j) All Industries



(k) All Services



A.3 Descriptives for Quarterly & Semi-Annually Rebalanced Portfolios

A.3.1 Summary Statistics per Country & Region

Table A.6: Summary Statistics per Country & Region - Turnover: Quarterly

This table reports the annualized summary statistics for all risk factors considered per country and the total European market, i.e., the Eurozone, European Union and Europe as a whole. The countries are clustered along three dimensions. The first group comprises those countries that belong to the Eurozone. The second cluster represents countries of the European Union that do not belong to the Eurozone. The last cluster contains European countries that neither belong to the Eurozone nor the European Union. The results are based on quarterly rebalanced HML, SMB, and WML portfolios using monthly observations. MRF denotes the market risk factor. HML is the return on a portfolio that is long on high book-to-market stocks and short on low book-to-market securities, holding size and momentum characteristics of the portfolio constant. SMB is the return on a portfolio that is long on small capitalization stocks and short on big capitalization securities, holding book-to-market and momentum characteristics of the portfolio constant. WML is the return on a portfolio that is long on the best performing stocks of the past year ('winners') and short on the worst performing securities of the previous year ('losers') holding book-to-market and size characteristics of the portfolio constant *, **, *** used for the Jarque-Bera (JB) test and for the Augmented Dickey Fuller (ADF) test denote, respectively, significance at the at the 10%, 5%, and 1% significance level.

	Mean (%)	Median (%)	Std. (%)	Skweness	Kurtosis	Jarque-Bera	ADF
Austria							
MRF	14.13	17.75	17.21	-0.49	2.70	3.60	-3.32**
HML	3.80	3.09	13.25	0.19	3.96	2.95	-3.88***
SMB	8.84	3.09	15.87	0.91	4.17	14.74***	-4.01***
WML	7.13	6.75	9.93	0.89	5.02	22.41***	-5.87***
Belgium							
MRF	2.95	4.84	16.63	-0.25	3.15	2.53	-7.03***
HML	5.21	4.89	9.95	-0.52	5.51	68.59***	-7.72***
SMB	6.50	4.37	12.36	1.23	6.49	171.12***	-6.57***
WML	6.69	6.79	9.80	-0.03	3.60	3.12	-7.21***
Finland							
MRF	19.47	22.71	39.56	0.90	6.96	102.15***	-6.64***
HML	30.77	11.25	59.87	6.78	52.08	14248.62***	-8.33***
SMB	31.64	6.39	64.89	6.47	50.03	13073.07***	-8.45***
WML	5.04	4.04	9.64	0.26	4.40	11.62***	-6.65***
France							
MRF	7.04	12.14	21.16	-0.39	4.10	24.04***	-9.12***
HML	11.91	10.10	15.03	0.88	6.05	164.11***	-7.19***
SMB	9.17	6.63	15.65	0.95	7.17	279.10***	-7.84***
WML	7.19	7.76	11.78	-0.45	9.89	642.27***	-9.54***
Germany							
MRF	5.10	7.52	19.51	-0.68	4.31	47.37***	-8.33***
HML	9.80	8.65	10.04	0.19	3.86	11.30***	-8.92***
SMB	8.72	7.31	11.88	0.34	3.08	6.15**	-8.03***
WML	4.40	3.90	9.09	0.10	3.81	8.96**	-8.96***
Greece							
MRF	4.05	4.41	22.21	0.05	2.30	1.96	-4.43***
HML	10.33	7.39	18.62	0.82	4.46	14.83***	-3.92***
SMB	7.89	3.42	20.87	0.46	3.13	2.76	-3.88***
WML	4.65	3.36	16.50	-0.82	4.49	15.14***	-4.50***
Ireland							
MRF	0.82	9.87	17.95	-0.52	2.61	5.48*	-5.76***
HML	31.13	32.08	19.39	0.05	3.13	0.07	-3.45***
SMB	3.74	-1.45	24.41	0.49	4.07	8.47**	-3.81***
WML	1.50	-1.36	16.85	-0.08	2.76	0.47	-5.05***
Italy							
MRF	3.17	5.14	22.11	0.34	4.38	22.88***	-6.95***
HML	8.22	5.86	14.81	1.70	10.01	598.71***	-7.45***
SMB	5.52	6.57	13.10	0.29	4.50	24.99***	-8.00***
WML	6.16	5.35	8.78	0.06	3.20	0.45	-7.44***
Netherlands							
MRF	5.49	9.45	17.42	-0.56	4.39	31.30***	-6.60***

Continued on next page

Table A.6 – continued from previous page

	Mean (%)	Median (%)	Std. (%)	Skweness	Kurtosis	Jarque-Bera	ADF
HML	4.34	1.97	11.90	0.05	5.65	68.82***	-6.91***
SMB	4.19	2.35	13.22	0.36	3.42	6.60**	-7.66***
WML	4.33	4.87	13.44	-0.73	6.95	174.14***	-7.50***
Portugal							
MRF	-0.17	0.43	18.30	-0.18	2.55	1.69	-5.28***
HML	28.05	10.35	62.73	6.19	48.74	9907.30***	-5.66***
SMB	16.50	-7.13	65.63	5.99	44.57	8255.41***	-7.12***
WML	-0.25	3.30	24.51	0.19	12.64	406.73***	-6.17***
Spain							
MRF	6.31	10.17	21.14	-0.02	4.02	9.21***	-7.76***
HML	9.71	9.36	19.04	0.52	12.41	825.46***	-8.65***
SMB	6.54	2.13	20.30	0.95	4.91	66.07***	-6.50***
WML	6.95	8.71	12.60	-0.84	7.33	197.64***	-7.58***
Denmark							
MRF	8.49	15.28	18.84	-0.51	2.76	5.98*	-4.90***
HML	18.07	17.06	14.86	0.61	3.87	11.60***	-5.70***
SMB	13.10	8.61	16.56	0.23	2.64	1.98	-5.78***
WML	1.06	1.65	13.40	-0.23	3.72	3.52	-7.46***
Sweden							
MRF	10.15	19.19	25.50	-0.03	3.74	4.29	-6.41***
HML	8.64	5.42	18.77	1.25	6.59	160.70***	-4.46***
SMB	8.01	10.62	16.77	-1.34	9.22	386.75***	-6.65***
WML	2.24	5.11	14.13	-0.97	7.96	238.14***	-6.26***
United Kingdom							
MRF	5.37	9.27	15.53	-0.82	5.05	91.35***	-9.63***
HML	7.33	7.03	7.37	0.35	3.49	9.45***	-8.06***
SMB	8.44	7.14	10.70	0.48	4.06	26.62***	-9.29***
WML	6.57	6.73	8.07	-0.01	4.41	26.01***	-9.56***
Norway							
MRF	-3.32	0.46	24.68	-0.52	3.70	15.54***	-7.01***
HML	6.85	4.02	13.53	2.10	14.33	1448.32***	-5.97***
SMB	-0.05	1.96	13.90	-0.18	3.58	4.28	-7.15***
WML	6.59	7.74	14.61	-1.29	10.70	652.47***	-7.87***
Switzerland							
MRF	7.75	11.98	17.64	-0.58	4.35	23.14***	-6.59***
HML	11.26	9.93	18.85	0.14	4.06	8.48**	-5.25***
SMB	6.80	2.89	18.25	0.56	3.59	11.80***	-5.92***
WML	4.71	5.53	16.55	-2.20	14.08	1055.03***	-6.10***
Eurozone							
MRF	5.36	8.57	19.62	-0.487	4.529	32.150***	-7.272***
HML	7.89	6.41	6.77	0.643	5.186	63.340***	-7.723***
SMB	8.15	8.09	9.29	1.256	9.142	437.647***	-7.977***
WML	8.42	8.65	8.19	-0.298	6.388	116.688***	-8.382***
European Union							
MRF	5.36	8.57	19.62	-0.487	4.529	32.150***	-7.272***
HML	6.53	5.06	5.74	0.545	3.782	17.661***	-6.210***
SMB	7.65	6.85	8.12	1.203	8.851	397.564***	-7.919***
WML	7.47	8.56	7.88	-0.240	5.162	48.008***	-8.295***
Europe							
MRF	5.36	8.57	19.62	-0.487	4.529	32.150***	-7.272***
HML	6.44	4.38	5.66	0.608	3.459	16.736***	-6.300***
SMB	7.40	6.54	8.09	1.078	8.000	294.24***	-8.068***
WML	7.50	8.56	7.85	-0.415	5.486	67.494***	-8.239***

A.3 Descriptives for Quarterly & Semi-Annually Rebalanced Portfolios

Table A.7: Summary Statistics per Country & Region - Turnover: Semi-Annually

This table reports the annualized summary statistics for all risk factors considered per country and the total European market, i.e., the Eurozone, European Union and Europe as a whole. The countries are clustered along three dimensions. The first group comprises those countries that belong to the Eurozone. The second cluster represents countries of the European Union that do not belong to the Eurozone. The last cluster contains European countries that neither belong to the Eurozone nor the European Union. The results are based on semi-annually rebalanced HML, SMB, and WML portfolios using monthly observations. MRF denotes the market risk factor. HML is the return on a portfolio that is long on high book-to-market stocks and short on low book-to-market securities, holding size and momentum characteristics of the portfolio constant. SMB is the return on a portfolio that is long on small capitalization stocks and short on big capitalization securities, holding book-to-market and momentum characteristics of the portfolio constant. WML is the return on a portfolio that is long on the best performing stocks of the past year ('winners') and short on the worst performing securities of the previous year ('losers') holding book-to-market and size characteristics of the portfolio constant *, **, *** used for the Jarque-Bera (JB) test and for the Augmented Dickey Fuller (ADF) test denote, respectively, significance at the 10%, 5%, and 1% significance level.

	Mean (%)	Median (%)	Std. (%)	Skweness	Kurtosis	Jarque-Bera	ADF
Austria							
MRF	15.84	21.71	18.76	-0.312	2.111	4.251	-1.851
HML	4.35	2.37	16.36	0.415	5.373	19.186***	-2.345
SMB	9.62	3.00	19.49	0.815	3.037	8.636**	-2.810*
WML	9.01	7.77	11.22	1.587	9.291	156.819***	-4.314***
Belgium							
MRF	3.55	5.31	17.77	0.084	3.270	0.828	-4.558***
HML	5.41	7.55	10.41	-0.615	5.868	90.775***	-5.850***
SMB	7.70	4.62	14.44	1.741	8.446	393.066***	-4.317***
WML	6.71	4.25	10.60	0.262	3.201	2.906	-5.584***
Finland							
MRF	20.59	19.74	41.81	1.040	5.218	49.942***	-3.835***
HML	24.29	11.45	47.02	4.522	25.430	3210.349***	-4.603***
SMB	28.22	10.28	54.08	4.035	21.725	2280.879***	-4.973***
WML	3.51	3.61	8.54	-0.002	3.752	2.750***	-6.149***
France							
MRF	7.47	8.30	23.06	0.057	3.694	6.285**	-5.861***
HML	11.16	8.29	19.07	1.645	8.579	558.828***	-4.862***
SMB	8.65	6.65	17.30	0.182	4.893	48.781***	-5.303***
WML	5.94	4.97	11.31	1.137	8.507	472.214***	-6.990***
Germany							
MRF	5.43	8.27	20.65	-0.250	2.955	3.415	-5.692***
HML	9.33	8.15	11.31	0.789	5.539	118.404***	-5.668***
SMB	9.45	5.92	14.09	0.993	4.511	82.701***	-5.438***
WML	4.67	4.26	9.22	-0.280	3.664	9.787***	-6.562***
Greece							
MRF	5.19	7.57	22.45	-0.049	1.959	4.038	-2.593*
HML	11.52	6.47	21.23	0.856	4.193	13.549***	-3.218**
SMB	13.21	10.03	23.99	0.374	2.843	1.989	-2.325
WML	2.83	2.15	17.24	-0.178	2.835	0.596	-3.062**
Ireland							
MRF	0.94	4.51	17.42	-0.556	2.509	6.524**	-2.523
HML	26.91	24.56	22.18	0.630	3.423	7.319**	-2.448
SMB	8.22	-1.14	32.11	1.638	5.980	81.567***	-3.248**
WML	1.27	4.75	18.69	-0.595	4.319	12.723***	-4.304***
Italy							
MRF	3.21	1.94	23.19	0.365	3.605	8.654**	-5.093***
HML	6.26	3.35	15.24	0.753	6.257	126.210***	-5.371***
SMB	6.15	4.63	14.43	0.668	6.115	112.495***	-5.396***
WML	6.48	6.22	11.77	1.861	12.364	1002.919***	-6.330***
Netherlands							
MRF	5.12	8.09	18.79	-0.316	3.022	3.995	-4.927***
HML	4.10	1.80	13.20	0.341	4.627	30.204***	-4.937***
SMB	4.20	1.38	14.20	0.197	3.373	2.756	-4.870***
WML	4.89	4.71	13.49	-0.268	7.254	180.981***	-6.172***
Portugal							
MRF	1.46	2.02	19.35	-0.052	2.332	2.362	-2.776*
HML	25.79	7.57	55.25	5.778	42.327	7410.619***	-4.286***
SMB	13.01	-7.03	60.90	5.589	40.117	6626.928***	-4.574***
WML	0.35	3.36	17.52	0.045	4.528	9.618***	-5.300***
Spain							
MRF	6.93	7.59	21.70	0.126	2.832	0.938	-4.844***

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Table A.7 – continued from previous page

	Mean (%)	Median (%)	Std. (%)	Skweness	Kurtosis	Jarque-Bera	ADF
HML	9.05	10.27	16.01	-0.072	6.438	107.869***	-6.894***
SMB	7.54	1.97	22.97	0.975	4.644	59.502***	-4.145***
WML	5.28	7.27	14.10	-0.739	4.071	30.365***	-5.828***
Denmark							
MRF	9.82	16.51	20.29	-0.361	2.322	5.520*	-2.881*
HML	17.21	16.17	18.68	1.036	5.548	55.561***	-4.757***
SMB	16.95	10.59	19.41	0.682	3.130	9.871***	-3.221**
WML	0.47	3.29	15.11	-0.428	2.854	4.070	-6.284***
Sweden							
MRF	10.23	12.58	28.72	0.156	3.286	1.387	-4.289***
HML	10.51	4.74	26.29	2.764	14.082	1299.577***	-3.695***
SMB	8.33	7.66	18.71	-1.053	9.121	353.377***	-5.101***
WML	-0.81	2.12	19.87	-3.027	20.597	2936.751***	-5.187***
United Kingdom							
MRF	5.43	7.00	15.44	-0.257	3.573	7.670**	-6.249***
HML	6.12	5.66	8.46	0.608	4.185	38.025***	-5.436***
SMB	9.05	7.62	11.35	1.131	6.176	201.891***	-5.598***
WML	4.47	4.85	8.32	-0.409	4.471	37.186***	-7.202***
Norway							
MRF	6.07	6.48	26.38	-0.134	3.026	0.715	-5.079***
HML	5.71	3.42	14.89	1.148	6.502	173.138***	-4.388***
SMB	0.74	2.31	15.46	-0.133	4.414	19.930***	-5.509***
WML	6.20	5.94	15.48	-0.485	5.571	73.988***	-5.805***
Switzerland							
MRF	8.62	11.02	18.99	-0.206	2.662	2.300	-3.773***
HML	11.45	10.92	24.21	0.443	5.601	55.077***	-4.142***
SMB	10.18	8.26	21.30	0.765	4.618	36.277***	-3.796***
WML	1.41	5.26	21.57	-3.146	19.048	2210.284***	-5.096***
Eurozone							
MRF	5.35	7.16	20.56	-0.256	3.239	3.101	-5.222***
HML	7.34	5.55	6.96	0.666	3.313	18.658***	-6.174***
SMB	9.60	8.46	10.31	0.736	4.791	52.980***	-5.014***
WML	7.77	7.99	8.67	-0.258	6.186	102.617***	-6.224
European Union							
MRF	5.35	7.16	20.56	-0.256	3.239	3.101	-5.222***
HML	6.10	4.07	6.70	0.855	3.952	37.997***	-4.684***
SMB	8.88	6.64	9.06	1.219	6.794	201.764***	-4.691***
WML	6.11	6.80	8.36	-0.343	5.444	63.262***	-5.955***
Europe							
MRF	5.35	7.16	20.56	-0.256	3.239	3.101	-5.222***
HML	6.01	4.10	6.77	0.852	3.822	35.547***	-4.751***
SMB	8.76	6.40	9.12	1.194	6.497	177.817***	-4.669***
WML	6.20	7.02	8.31	-0.575	6.118	108.968***	-6.065***

A.3.2 Statistics per Industry (Eurozone)

Table A.8: Summary Statistics per Industry (Eurozone) - Turnover: Quarterly

This table reports the annualized summary statistics for all risk factors considered per industry across the Eurozone. The results are based on quarterly rebalanced HML, SMB, and WML portfolios using monthly observations. MRF denotes the return to the market risk factor. HML is the return on a portfolio that is long on high book-to-market stocks and short on low book-to-market securities, holding size and momentum characteristics of the portfolio constant. SMB is the return on a portfolio that is long on small capitalization stocks and short on big capitalization securities, holding book-to-market and momentum characteristics of the portfolio constant. WML is the return on a portfolio that is long on the best performing stocks of the past year ('winners') and short on the worst performing securities of the previous year ('losers') holding book-to-market and size characteristics of the portfolio constant. *, **, *** used for the Jarque-Bera (JB) test and for the Augmented Dickey Fuller (ADF) test denote, respectively, significance at the at the 10%, 5%, and 1% significance level.

BAS = *basic industries*; CGD = *cyclical consumer goods*; CSER = *cyclical services*; TOLF = *financials*; GN = *general industries*; ITECH = *information technology*; NCGD = *non-cycical consumer goods*; RES = *resources*; UTL = *utilities.*

	Mean (%)	Median (%)	Std. (%)	Skweness	Kurtosis	Jarque-Bera	ADF
BAS							
MRF	4.63	6.99	19.92	-0.311	4.189	15.338***	-6.821***
HML	15.37	13.36	18.63	1.598	8.449	350.278***	-8.577***
SMB	1.75	2.49	19.30	0.550	4.577	31.942***	-7.003***
WML	0.86	4.87	17.95	-1.422	7.209	226.263***	-8.388***
CGD							
MRF	5.36	8.57	19.62	-0.487	4.529	32.150***	-7.272***
HML	6.73	6.22	10.94	0.210	3.276	2.411	-6.779***
SMB	3.91	5.51	12.14	-0.027	2.845	0.353	-6.854***
WML	8.41	8.25	8.81	-0.114	4.534	23.306***	-7.943***
CSER							
MRF	5.46	7.98	19.34	-0.363	4.386	22.789***	-7.197***
HML	12.55	12.51	13.22	-0.096	4.020	9.833***	-6.279***
SMB	7.29	5.31	13.51	0.269	4.065	13.142***	-8.142***
WML	6.00	3.57	10.36	0.553	4.183	24.589***	-8.111***
TOLF							
MRF	5.92	8.82	19.19	-0.395	4.401	25.104***	-7.274***
HML	8.46	6.84	9.03	2.355	17.079	2189.049***	-9.513***
SMB	7.51	4.71	13.34	2.188	13.651	1316.008***	-7.896***
WML	8.37	7.70	12.16	1.698	12.893	1085.297***	-8.522***
GN							
MRF	5.36	8.57	19.62	-0.487	4.529	32.150***	-7.272***
HML	12.23	10.21	11.56	1.191	9.235	442.598***	-8.777***
SMB	10.92	9.41	10.86	0.800	4.367	43.733***	-8.225***
WML	8.05	7.54	10.18	1.341	9.520	494.094***	-9.248***
ITECH							
MRF	-0.90	5.30	20.46	-0.365	4.150	7.218***	-4.261***
HML	36.59	7.66	57.35	5.065	31.752	3864.463***	-5.614***
SMB	23.58	1.34	77.86	5.639	37.225	5402.042***	-7.191***
WML	-12.93	-3.73	48.78	-8.668	83.962	28553.279***	-7.240***
NCGD							
MRF	-2.96	2.94	19.58	-0.685	3.736	9.300***	-4.307***
HML	24.94	15.64	27.75	1.599	12.017	358.561***	-7.053***
SMB	34.19	17.61	42.18	2.843	15.397	732.018***	-5.774***
WML	0.78	9.03	29.53	-1.726	9.776	226.260***	-6.652***
RES							
MRF	4.79	10.01	13.12	-0.814	3.680	5.539*	-2.319
HML	30.25	14.09	26.74	0.492	2.647	2.243	-2.603*
SMB	54.26	54.09	26.46	0.303	3.280	0.730	-4.058***
WML	12.30	17.77	19.86	-0.968	4.589	10.949***	-3.725***
UTL							
MRF	-1.06	4.14	20.38	-0.355	4.171	7.361**	-4.218***
HML	5.81	7.59	10.55	-0.152	3.298	0.632	-4.511***
SMB	8.81	11.24	11.73	-0.113	2.899	0.324	-5.288***
WML	1.29	2.28	11.14	-0.041	3.598	1.256	-5.471***
Industry							
MRF	5.36	8.57	19.62	-0.487	4.529	32.150***	-7.272***
HML	8.62	5.76	8.13	0.692	5.141	64.005***	-7.318***
SMB	8.50	8.07	10.26	1.089	7.132	216.307***	-7.930***
WML	7.97	8.52	8.39	-0.401	5.975	93.495***	-8.593***
Service							
MRF	5.36	8.57	19.62	-0.487	4.529	32.150	-7.272***
HML	7.45	7.92	7.52	0.396	6.093	100.455***	-8.141***
SMB	7.34	5.27	11.41	1.083	7.698	265.503***	-8.446***
WML	8.36	7.79	10.28	0.976	8.468	334.643***	-7.866***

Table A.9: Summary Statistics per Industry (Eurozone) - Turnover: Semi-Annually

This table reports the annualized summary statistics for all risk factors considered per industry across the Eurozone. The results are based on semi-annually rebalanced HML, SMB, and WML portfolios using monthly observations. MRF denotes the return to the market risk factor. HML is the return on a portfolio that is long on high book-to-market stocks and short on low book-to-market securities, holding size and momentum characteristics of the portfolio constant. SMB is the return on a portfolio that is long on small capitalization stocks and short on big capitalization securities, holding book-to-market and momentum characteristics of the portfolio constant. WML is the return on a portfolio that is long on the best performing stocks of the past year ('winners') and short on the worst performing securities of the previous year ('losers') holding book-to-market and size characteristics of the portfolio constant. *, **, *** used for the Jarque-Bera (JB) test and for the Augmented Dickey Fuller (ADF) test denote, respectively, significance at the at the 10%, 5%, and 1% significance level.

BAS = *basic industries*; CGD = *cyclical consumer goods*; CSER = *cyclical services*; TOLF = *financials*; GN = *general industries*; ITECH = *information technology*; NCGD = *non-cycical consumer goods*; RES = *resources*; UTL = *utilities.*

	Mean (%)	Median (%)	Std. (%)	Skweness	Kurtosis	Jarque-Bera	ADF
BAS							
MRF	5.24	5.90	20.57	-0.098	3.147	0.468	-4.559***
HML	15.38	10.69	20.47	1.729	8.768	397.194***	-5.572***
SMB	3.37	2.45	22.68	1.400	8.568	340.740***	-4.917***
WML	0.22	3.45	19.01	-2.323	12.456	976.969***	-6.409***
CGD							
MRF	5.35	7.16	20.56	-0.256	3.239	3.101	-5.222***
HML	5.98	4.21	11.77	0.317	2.991	4.052	-5.140***
SMB	4.26	3.77	12.92	-0.028	2.922	0.138	-4.602***
WML	7.59	8.02	9.03	0.058	3.104	0.198	-5.536***
CSER							
MRF	6.11	7.22	19.97	-0.175	3.299	1.894	-4.793***
HML	11.62	8.00	15.53	0.709	4.507	40.372***	-5.839***
SMB	7.83	7.72	14.43	1.304	12.833	987.222***	-5.828***
WML	6.14	5.84	11.73	0.081	2.947	0.310	-5.965***
TOLF							
MRF	5.62	7.20	20.39	-0.246	3.267	3.007	-5.324***
HML	8.46	7.29	10.12	1.927	15.696	1747.570***	-7.715***
SMB	8.91	5.71	14.46	1.271	7.086	228.888***	-5.174***
WML	8.58	6.02	13.57	1.704	9.036	475.995***	-6.572***
GN							
MRF	5.35	7.16	20.56	-0.256	3.239	3.101	-5.222***
HML	12.90	10.15	13.58	2.224	11.728	956.145***	-6.430***
SMB	13.03	11.07	13.16	1.566	7.821	328.542***	-5.241***
WML	7.41	7.46	11.82	2.170	14.887	1596.270***	-6.737***
ITECH							
MRF	0.21	2.50	21.05	-0.142	3.186	0.406	-2.543
HML	32.03	3.42	63.35	4.902	32.317	3973.648***	-4.681***
SMB	23.44	7.45	61.99	4.779	31.053	3651.765***	-4.448
WML	-8.57	-3.80	35.53	-4.389	33.627	4220.106***	-5.459
NCGD							
MRF	-0.86	0.77	21.10	-0.102	3.206	0.249	-3.322**
HML	15.27	13.64	21.75	-0.471	4.357	10.195***	-4.609***
SMB	26.28	19.47	37.29	1.277	6.137	63.547***	-3.935***
WML	1.35	3.24	27.13	-0.322	4.491	9.748***	-5.553***
RES							
MRF	7.36	10.56	10.91	-0.787	3.297	4.702*	-1.211
HML	27.07	13.45	36.67	1.111	3.813	10.122***	-3.628***
SMB	63.18	53.52	30.97	0.406	2.448	2.088	-2.744*
WML	12.86	5.85	26.89	0.391	3.370	1.255	-2.625*
UTL							
MRF	0.20	1.18	20.95	-0.141	3.216	0.445	-2.539
HML	4.20	4.64	11.84	-0.051	2.639	0.782	-2.972**
SMB	9.41	8.54	12.50	-0.156	2.792	0.711	-3.132**
WML	0.42	1.60	10.28	-0.495	3.024	4.180	-4.100***
Industry							
MRF	5.35	7.16	20.56	-0.256	3.239	3.101	-5.222***
HML	7.82	6.94	8.50	0.676	3.795	24.293***	-5.919***
SMB	9.85	9.48	11.36	0.582	4.215	27.747***	-4.426***
WML	7.11	6.90	9.36	0.173	6.308	109.033***	-6.313***
Service							
MRF	5.35	7.16	20.56	-0.256	3.239	3.101	-5.222***
HML	7.37	6.57	8.84	1.066	8.075	300.768***	-6.351***
SMB	8.79	7.91	12.13	0.613	4.482	36.347***	-5.978***
WML	8.06	7.24	11.22	0.654	5.157	62.641***	-6.652***

A.3.3 Statistics per Industry (EU)

Table A.10: Summary Statistics per Industry (European Union) - Turnover: Quarterly

This table reports the annualized summary statistics for all risk factors considered per industry across the European Union. The results are based on quarterly rebalanced HML, SMB, and WML portfolios using monthly observations. MRF denotes the return to the market risk factor. HML is the return on a portfolio that is long on high book-to-market stocks and short on low book-to-market securities, holding size and momentum characteristics of the portfolio constant. SMB is the return on a portfolio that is long on small capitalization stocks and short on big capitalization securities, holding book-to-market and momentum characteristics of the portfolio constant. WML is the return on a portfolio that is long on the best performing stocks of the past year ('winners') and short on the worst performing securities of the previous year ('losers') holding book-to-market and size characteristics of the portfolio constant. *, **, *** used for the Jarque-Bera (JB) test and for the Augmented Dickey Fuller (ADF) test denote, respectively, significance at the at the 10%, 5%, and 1% significance level.

BAS = *basic industries*; CGD = *cyclical consumer goods*; CSER = *cyclical services*; TOLF = *financials*; GN = *general industries*; ITECH = *information technology*; NCGD = *non-cycical consumer goods*; RES = *resources*; UTL = *utilities*.

	Mean (%)	Median (%)	Std. (%)	Skweness	Kurtosis	Jarque-Bera	ADF
BAS							
MRF	4.63	6.99	19.92	-0.311	4.189	15.338***	-6.821***
HML	14.15	12.32	14.98	1.279	7.236	214.502***	-8.067 ***
SMB	-1.07	-3.64	17.73	0.346	3.908	11.100***	-7.220***
WML	3.78	7.36	14.19	-0.814	6.189	111.800***	-7.811***
CGD							
MRF	5.36	8.57	19.62	-0.487	4.529	32.150***	-7.272***
HML	9.01	6.88	9.90	0.472	3.754	14.257***	-7.483***
SMB	3.57	2.82	10.54	-0.230	3.431	3.771	-7.448***
WML	7.25	7.75	8.04	-0.155	4.793	32.247***	-7.591***
CSER							
MRF	5.46	7.98	19.34	-0.363	4.386	22.789***	-7.197***
HML	7.32	6.84	11.71	-0.170	3.933	8.999**	-6.444***
SMB	10.54	9.80	11.22	0.309	3.276	4.263	-7.420***
WML	7.11	6.14	10.35	0.182	3.771	6.592**	-6.594***
TOLF							
MRF	5.92	8.82	19.19	-0.395	4.401	25.104***	-7.274***
HML	11.40	10.48	9.01	0.786	6.267	129.434***	-8.122***
SMB	5.82	3.93	9.28	1.464	8.308	363.796***	-7.891***
WML	5.88	5.47	10.09	1.796	13.451	1211.595***	-8.372***
GN							
MRF	5.36	8.57	19.62	-0.487	4.529	32.150***	-7.272***
HML	10.33	9.06	8.96	0.600	5.108	57.873***	-7.095***
SMB	9.64	9.03	8.83	0.237	3.281	2.916	-8.487***
WML	9.03	9.90	8.67	0.575	6.570	138.945***	-8.331***
ITECH							
MRF	-0.90	5.30	20.46	-0.365	4.150	7.218**	-4.261***
HML	26.05	13.00	27.73	2.764	15.645	789.016***	-6.227***
SMB	18.88	8.78	38.95	4.504	28.220	2980.992***	-8.075***
WML	-1.55	-0.24	19.87	0.719	6.577	60.312***	-4.140***
NCGD							
MRF	-2.96	2.94	19.58	-0.685	3.736	9.300***	-4.307***
HML	25.86	15.28	23.85	3.104	17.226	948.895***	-6.669***
SMB	24.13	14.42	31.57	2.357	13.703	537.450***	-5.809***
WML	3.49	12.99	23.05	-2.398	14.293	591.609***	-6.210***
RES							
MRF	4.79	10.01	13.12	-0.814	3.680	5.539**	-2.319
HML	25.68	32.07	24.26	0.038	2.880	0.125	-2.759**
SMB	61.73	68.52	25.07	-0.033	2.805	0.202	-3.947***
WML	16.06	11.62	15.08	0.245	3.103	0.453	-2.781**
UTL							
MRF	-1.06	4.14	20.38	-0.355	4.171	7.361**	-4.218***
HML	4.71	3.21	11.78	-0.042	3.207	0.123	-4.594***
SMB	10.78	12.65	15.32	0.001	3.259	0.170	-5.253***
WML	1.58	0.38	10.93	0.041	2.831	0.245	-4.876***
Industry							
MRF	5.36	8.57	19.62	-0.487	4.529	32.150***	-7.272***
HML	8.25	6.38	6.94	0.469	3.768	14.346***	-6.678***
SMB	7.92	7.15	9.13	0.939	7.103	201.726***	-7.824***
WML	7.96	9.19	7.89	-0.738	6.006	110.790***	-8.351***
Service							
MRF	5.36	8.57	19.62	-0.487	4.529	32.150***	-7.272***
HML	7.66	7.85	7.01	0.282	4.750	32.951***	-7.180***
SMB	7.04	6.26	8.53	1.021	6.903	192.344***	-8.200***
WML	6.30	6.85	9.35	1.119	8.932	399.240***	-8.046***

Table A.11: Summary Statistics per Industry (European Union) - Turnover: Semi-Annually

This table reports the annualized summary statistics for all risk factors considered per industry across the European Union. The results are based on semi-annually rebalanced HML, SMB, and WML portfolios using monthly observations. MRF denotes the return to the market risk factor. HML is the return on a portfolio that is long on high book-to-market stocks and short on low book-to-market securities, holding size and momentum characteristics of the portfolio constant. SMB is the return on a portfolio that is long on small capitalization stocks and short on big capitalization securities, holding book-to-market and momentum characteristics of the portfolio constant. WML is the return on a portfolio that is long on the best performing stocks of the past year ('winners') and short on the worst performing securities of the previous year ('losers') holding book-to-market and size characteristics of the portfolio constant. *, **, *** used for the Jarque-Bera (JB) test and for the Augmented Dickey Fuller (ADF) test denote, respectively, significance at the at the 10%, 5%, and 1% significance level.

BAS = *basic industries*; CGD = *cyclical consumer goods*; CSER = *cyclical services*; TOLF = *financials*; GN = *general industries*; ITECH = *information technology*; NCGD = *non-cycical consumer goods*; RES = *resources*; UTL = *utilities*.

	Mean (%)	Median (%)	Std. (%)	Skweness	Kurtosis	Jarque-Bera	ADF
BAS							
MRF	5.24	5.90	20.57	-0.098	3.147	0.468	-4.559***
HML	14.42	11.41	16.16	0.816	4.416	40.636***	-5.099***
SMB	0.36	-0.17	20.32	0.658	5.201	57.087***	-4.761***
WML	1.45	4.18	15.34	-1.113	6.927	178.301***	-5.592***
CGD							
MRF	5.35	7.16	20.56	-0.256	3.239	3.101	-5.222***
HML	7.90	6.24	10.16	0.704	3.624	23.511***	-5.157***
SMB	4.22	5.29	11.13	-0.048	2.773	0.728	-4.698***
WML	6.11	5.57	8.17	0.134	2.882	0.921	-5.412***
CSER							
MRF	6.11	7.22	19.97	-0.175	3.299	1.894	-4.793***
HML	6.86	7.28	12.92	-0.185	3.188	1.568	-5.633***
SMB	11.33	12.58	12.54	0.441	4.499	28.276***	-4.897***
WML	5.49	5.96	12.10	-0.733	7.511	213.508***	-6.969***
TOLF							
MRF	5.62	7.20	20.39	-0.246	3.267	3.007	-5.324***
HML	9.53	8.17	9.73	0.332	5.119	48.087***	-5.888***
SMB	6.68	4.79	10.32	1.694	9.205	495.188***	-5.824***
WML	5.01	5.51	10.32	0.926	6.866	181.236***	-6.503***
GN							
MRF	5.35	7.16	20.56	-0.256	3.239	3.101	-5.222***
HML	10.94	9.34	10.82	1.097	5.575	113.356***	-5.302***
SMB	10.97	10.28	10.01	0.944	6.734	173.418***	-5.370***
WML	7.64	8.10	9.75	0.805	7.799	253.952***	-6.497***
ITECH							
MRF	0.21	2.50	21.05	-0.142	3.186	0.406	-2.543
HML	22.42	8.04	27.23	1.896	8.191	170.362***	-3.663***
SMB	21.26	12.03	26.40	2.032	9.031	218.251***	-3.786***
WML	-1.72	0.34	22.12	-0.242	4.094	5.458*	-2.979**
NCGD							
MRF	-0.86	0.77	21.10	-0.102	3.206	0.249	-3.322**
HML	18.77	12.14	17.76	0.546	3.292	4.976*	-4.419***
SMB	20.34	17.51	29.05	0.351	4.393	8.985**	-4.381***
WML	0.70	4.06	21.18	-0.871	5.167	29.697***	-4.378***
RES							
MRF	7.36	10.56	10.91	-0.787	3.297	4.702*	-1.211
HML	23.32	15.71	29.71	0.297	2.713	0.979	-3.412**
SMB	66.74	65.80	30.90	0.140	2.093	2.122	-2.727*
WML	16.54	10.47	19.59	0.305	2.249	2.123	-2.069
UTL							
MRF	0.20	1.18	20.95	-0.141	3.216	0.445	-2.539
HML	3.01	2.32	12.54	0.201	3.459	1.366	-3.298**
SMB	12.26	15.15	16.02	-0.152	2.477	1.816	-3.543***
WML	0.21	0.58	12.03	0.428	5.255	23.440***	-3.990***
Industry							
MRF	5.35	7.16	20.56	-0.256	3.239	3.101	-5.222***
HML	7.70	6.33	7.63	0.623	3.276	16.228***	-4.744***
SMB	9.09	8.35	9.95	0.725	5.050	62.125***	-4.352***
WML	6.59	6.91	8.30	-0.714	6.141	117.601***	-5.979***
Service							
MRF	5.35	7.16	20.56	-0.256	3.239	3.101	-5.222***
HML	6.96	6.09	8.38	0.657	6.940	170.588***	-5.468***
SMB	8.22	6.21	9.40	1.331	6.884	220.169***	-5.818***
WML	5.12	4.52	9.90	0.675	5.586	83.918***	-6.837***

A.3.4 Statistics per Industry (Europe)

Table A.12: Summary Statistics per Industry (European) - Turnover: Quarterly

This table reports the annualized summary statistics for all risk factors considered per industry across Europe. The results are based on quarterly rebalanced HML, SMB, and WML portfolios using monthly observations. MRF denotes the return to the market risk factor. HML is the return on a portfolio that is long on high book-to-market stocks and short on low book-to-market securities, holding size and momentum characteristics of the portfolio constant. SMB is the return on a portfolio that is long on small capitalization stocks and short on big capitalization securities, holding book-to-market and momentum characteristics of the portfolio constant. WML is the return on a portfolio that is long on the best performing stocks of the past year ('winners') and short on the worst performing securities of the previous year ('losers') holding book-to-market and size characteristics of the portfolio constant. *, **, *** used for the Jarque-Bera (JB) test and for the Augmented Dickey Fuller (ADF) test denote, respectively, significance at the at the 10%, 5%, and 1% significance level.

BAS = *basic industries*; CGD = *cyclical consumer goods*; CSER = *cyclical services*; TOLF = *financials*; GN = *general industries*; ITECH = *information technology*; NCGD = *non-cycical consumer goods*; RES = *resources*; UTL = *utilities.*

	Mean (%)	Median (%)	Std. (%)	Skweness	Kurtosis	Jarque-Bera	ADF
BAS							
MRF	4.63	6.99	19.92	-0.311	4.189	15.338***	-6.821***
HML	12.92	11.22	13.82	0.964	5.272	77.454***	-7.605***
SMB	0.12	-0.49	16.24	0.523	4.328	24.668***	-7.506***
WML	4.24	5.70	14.60	-0.488	4.899	39.374***	-7.594***
CGD							
MRF	5.36	8.57	19.62	-0.487	4.529	32.150***	-7.272***
HML	8.93	8.29	9.36	0.626	4.202	29.614***	-7.204***
SMB	4.05	4.72	10.21	-0.360	3.567	8.139**	-6.971***
WML	7.16	8.20	8.12	-0.397	4.191	19.929***	-7.953***
CSER							
MRF	5.46	7.98	19.34	-0.363	4.386	22.789***	-7.197***
HML	6.47	6.10	11.67	-0.082	3.894	7.485**	-6.408***
SMB	10.03	10.31	11.02	0.268	3.662	6.657**	-7.086***
WML	7.59	7.95	9.64	0.154	3.791	6.533**	-6.888***
TOLF							
MRF	5.92	8.82	19.19	-0.395	4.401	25.104***	-7.274***
HML	10.64	9.54	8.75	0.691	5.836	97.829***	-8.262***
SMB	6.32	3.80	9.33	1.312	7.176	240.426***	-7.739***
WML	6.01	6.42	9.95	1.665	12.655	1034.609***	-7.959***
GN							
MRF	5.36	8.57	19.62	-0.487	4.529	32.150***	-7.272***
HML	9.39	7.95	8.18	0.805	5.484	86.521***	-7.017***
SMB	8.63	8.83	8.46	0.275	3.389	4.362	-8.726***
WML	9.27	10.41	8.74	0.329	6.433	120.527***	-8.308***
ITECH							
MRF	-0.90	5.30	20.46	-0.365	4.150	7.218**	-4.261***
HML	23.16	11.54	29.25	2.879	16.931	941.849***	-6.237***
SMB	23.96	10.08	41.71	5.174	34.357	4534.786***	-6.198***
WML	-6.78	1.12	26.49	-3.644	28.666	2957.383***	-7.254***
NCGD							
MRF	-2.96	2.94	19.58	-0.685	3.736	9.300***	-4.307***
HML	21.01	12.90	18.23	2.926	19.542	1212.791***	-6.681***
SMB	22.50	12.98	27.59	2.102	10.967	318.258***	-5.640***
WML	5.30	8.37	19.80	-1.414	8.106	132.792***	-5.473***
RES							
MRF	4.79	10.01	13.12	-0.814	3.680	5.539*	-2.319
HML	22.87	21.26	16.77	-0.068	2.537	0.680	-3.147**
SMB	44.76	49.30	20.28	-0.124	2.131	1.946	-4.671***
WML	21.35	21.14	12.62	-0.319	3.552	1.094	-4.090***
UTL							
MRF	-1.06	4.14	20.38	-0.355	4.171	7.361**	-4.218***
HML	6.53	7.08	10.49	0.276	3.223	1.414	-4.212***
SMB	13.36	14.10	13.58	0.176	3.032	0.532	-4.924***
WML	1.01	0.60	11.18	0.515	4.032	8.506**	-4.756***
Industry							
MRF	5.36	8.57	19.62	-0.487	4.529	32.150***	-7.272***
HML	8.00	5.79	6.71	0.538	3.150	11.771***	-6.235***
SMB	7.17	6.59	8.93	0.996	7.642	253.092***	-7.730***
WML	7.91	9.28	7.91	-0.855	5.781	105.338***	-8.338***
Service							
MRF	5.36	8.57	19.62	-0.487	4.529	32.150***	-7.272***
HML	7.39	7.37	6.95	0.416	4.894	41.875***	-7.067***
SMB	7.54	6.27	8.48	0.995	6.647	170.985***	-8.301***
WML	6.27	7.75	9.13	0.919	7.848	266.608***	-7.791***

Table A.13: Summary Statistics per Industry (Europe) - Turnover: Semi-Annually

This table reports the annualized summary statistics for all risk factors considered per industry across Europe. The results are based on semi-annually rebalanced HML, SMB, and WML portfolios using monthly observations. MRF denotes the return to the market risk factor. HML is the return on a portfolio that is long on high book-to-market stocks and short on low book-to-market securities, holding size and momentum characteristics of the portfolio constant. SMB is the return on a portfolio that is long on small capitalization stocks and short on big capitalization securities, holding book-to-market and momentum characteristics of the portfolio constant. WML is the return on a portfolio that is long on the best performing stocks of the past year ('winners') and short on the worst performing securities of the previous year ('losers') holding book-to-market and size characteristics of the portfolio constant. *, **, *** used for the Jarque-Bera (JB) test and for the Augmented Dickey Fuller (ADF) test denote, respectively, significance at the at the 10%, 5%, and 1% significance level.

BAS = *basic industries*; CGD = *cyclical consumer goods*; CSER = *cyclical services*; TOLF = *financials*; GN = *general industries*; ITECH = *information technology*; NCGD = *non-cycical consumer goods*; RES = *resources*; UTL = *utilities.*

	Mean (%)	Median (%)	Std. (%)	Skweness	Kurtosis	Jarque-Bera	ADF
BAS							
MRF	5.24	5.90	20.57	-0.098	3.147	0.468	-4.559***
HML	13.35	10.43	15.80	0.746	3.613	22.781***	-5.155***
SMB	2.07	0.59	18.18	0.838	5.462	77.271***	-5.175***
WML	2.14	5.26	16.24	-1.171	6.317	144.244***	-5.467***
CGD							
MRF	5.35	7.16	20.56	-0.256	3.239	3.101	-5.222***
HML	7.93	5.79	9.96	0.659	3.509	19.765***	-5.237***
SMB	4.96	4.64	11.06	-0.087	2.724	1.209	-4.422***
WML	6.49	6.30	8.32	0.041	2.831	0.443	-5.671***
CSER							
MRF	6.11	7.22	19.97	-0.175	3.299	1.894	-4.793***
HML	5.58	5.28	12.43	-0.185	3.023	1.313	-4.831***
SMB	11.14	12.27	11.75	0.180	3.327	2.111	-4.502***
WML	6.44	6.88	10.90	0.036	4.156	12.298***	-6.494***
TOLF							
MRF	5.62	7.20	20.39	-0.246	3.267	3.007	-5.324***
HML	9.11	8.67	9.64	0.468	5.084	50.962***	-6.003***
SMB	7.30	5.44	10.57	1.579	8.483	396.426***	-5.881***
WML	5.19	5.03	10.22	0.787	6.477	143.481***	-6.546***
GN							
MRF	5.35	7.16	20.56	-0.256	3.239	3.101	-5.222***
HML	9.96	7.88	9.85	1.301	5.999	156.513***	-5.305***
SMB	10.10	8.91	9.58	0.947	6.790	177.794***	-5.663***
WML	8.04	8.57	9.59	0.549	8.240	284.048***	-6.574***
ITECH							
MRF	0.21	2.50	21.05	-0.142	3.186	0.406	-2.543
HML	19.46	10.40	24.43	2.158	10.747	324.871***	-4.191***
SMB	25.62	13.98	40.20	4.935	35.614	4828.661***	-4.248***
WML	-5.14	-0.60	21.28	0.092	5.562	26.279***	-3.888***
NCGD							
MRF	-0.86	0.77	21.10	-0.102	3.206	0.249	-3.322**
HML	13.74	11.34	14.58	-0.016	3.115	0.016	-4.654***
SMB	20.68	15.85	26.09	0.868	4.838	24.557***	-3.951***
WML	2.82	8.03	18.78	-1.001	5.241	34.856***	-4.487***
RES							
MRF	7.36	10.56	10.91	-0.787	3.297	4.702*	-1.211
HML	23.25	22.27	20.58	0.381	2.845	1.237	-3.194**
SMB	45.47	41.58	22.64	0.427	2.633	1.823	-3.126**
WML	22.30	17.45	15.67	0.089	3.512	0.328	-3.015**
UTL							
MRF	0.20	1.18	20.95	-0.141	3.216	0.445	-2.539
HML	4.90	4.66	10.68	0.654	3.963	10.735***	-3.333**
SMB	14.94	16.20	14.83	0.062	2.293	2.527	-3.450***
WML	0.79	-0.01	11.59	-0.254	3.086	1.102	-3.540***
Industry							
MRF	5.35	7.16	20.56	-0.256	3.239	3.101	-5.222
HML	7.35	4.89	7.72	0.702	3.138	19.936***	-4.596
SMB	8.56	8.02	9.87	0.814	5.248	76.074***	-4.330
WML	6.48	7.60	8.20	-1.118	7.900	287.892***	-6.087
Service							
MRF	5.35	7.16	20.56	-0.256	3.239	3.101	-5.222
HML	6.72	6.33	8.50	0.909	7.172	205.219***	-5.403
SMB	8.67	6.82	9.34	1.124	5.591	116.600***	-5.709
WML	5.25	5.38	9.87	0.503	5.343	63.921***	-6.680

Appendix B

Method A.I: Conventional Asset Pricing Tests

B.1 Formal Test-Statistics: An Explanation

B.1.1 Time-Series Regressions

Equation (4.5) on page 107 implies that expected excess returns are linear in the coefficients of the respective risk factors. For an asset pricing model to hold, the regression intercepts (or pricing errors) α_j are expected to be zero. Although we may find that each of the previously introduced models holds individually for each of the 27 sample portfolios described in Section 3.3 [i.e., the regression results for portfolios j ($j = 1, \ldots, 27$) show that $\alpha_j = 0$ at a given level of significance], we are primarily interested in whether all pricing errors are *jointly* equal to zero when considering all 27 portfolios at a time. In other words, we are interested in the joint distribution of α estimates from 27 separate time-series regressions running side by side with errors correlated across portfolios, i.e., $E(\varepsilon_{i,t}\varepsilon_{j,t} \neq 0)$.[1]

For means of illustration, let us consider the classical one factor model, i.e., the CAPM [cf. Equation (4.3) on page (107)]. Once we have obtained the regression intercept estimates $\hat{\alpha}$, we may divide them by their variance-covariance matrix, which leads to the following χ^2-test statistic as a means to test whether

[1] The classic form of these tests assume no autocorrelation or heteroscedasticity.

all intercepts are jointly zero

$$T\left[1+\left(\frac{E_T\left(f\right)}{\hat{\sigma}\left(f\right)}\right)^2\right]^{-1}\hat{\alpha}\hat{\Sigma}^{-1}\hat{\alpha}\approx\chi^2,\ \text{d.f. } N \tag{B.1}$$

where $E_T\left(f\right)$ is the sample mean of the risk factor MRF over T periods, $\hat{\sigma}\left(f\right)$ denotes the corresponding sample standard deviation, $\hat{\Sigma}$ represents the residual variance-covariance matrix, i.e., the sample estimate of $E\left(\varepsilon_t\varepsilon_t'\right)$, and N is the number of assets, namely 27 in our case, which also equals in this case the degrees of freedom (d.f.).

One drawback of this test is that it is valid only asymptotically.[2] As pointed out by Cochrane (2005), the asymptotic distribution theory presumes that $\sigma^2\left(f\right)$ and Σ have converged to their probability limits. Thus, albeit the factor is stochastic and Σ is estimated, it is asymptotically valid, but neglects sources of variation in a finite sample. Given this and to allow for sampling variation in $\hat{\Sigma}$, Gibbons, Ross, and Shanken (1989) propose a derived finite-sample F-distribution for the hypothesis that a set of parameters are jointly zero. This so-called Gibbons-Ross-Shanken (GRS) test statistic takes the form

$$\frac{T-N-1}{N}\left[1+\left(\frac{E_T\left(f\right)}{\hat{\sigma}\left(f\right)}\right)^2\right]^{-1}\hat{\alpha}\hat{\Sigma}^{-1}\hat{\alpha}\approx F,\ \text{d.f. } N, T-N-1. \tag{B.2}$$

Like the χ^2 distribution presented in Equation (B.1), this F-distribution assumes that errors are normal, uncorrelated, and homoscedastic. Yet, this distribution is exact in a finite sample.[3] Gibbons et al. (1989) and Cochrane (2005) also remark that this test may be interpreted as a test whether a risk factor is ex-ante mean-variance efficient, i.e., whether it lies on the mean-variance frontier using population moments that have been adjusted for sampling error. In fact, in their paper, Gibbons et al. (1989) show that in the CAPM of Lintner (1965), Sharpe (1964), and Treynor (1965) the following problems are equivalent:

[2]The same holds for the Wald, Lagrange Multiplier (LM) and Likelihood Ratio (LR) tests. Hence, comparing our models via these tests seems not suitable, given our fairly short sample sizes at hand.

[3]Note also that the F-distribution is directly related to the χ^2-distribution, insofar as the F-distribution is a function of the ratio of two independent χ^2 variates which have been divided by their respective degrees of freedom.

1. Are the intercepts α_j in Equation (4.5) (page 107) jointly zero $\forall j$ ($j = 1, \ldots, N$)?
2. Is the market portfolio efficient? Does the market portfolio "span" the efficient set?
3. Is the Sharpe ratio of the market portfolio significantly smaller than the Sharpe ratio of the efficient combination of the market with the test assets $j = 1, \ldots, N$?[4]

As we intend to not only test the CAPM, but also the Fama and French (1993) 3FM and the Carhart (1997) 4FM, we need to modify Equation (B.2) for multiple factor regressions. Assuming independent and identically distributed (i.i.d.) errors, the quadratic form $\hat{\alpha}\hat{\Sigma}^{-1}\hat{\alpha}$ has the distribution

$$\frac{T-N-K}{N}\left[1+E_T\left(f\right)'\hat{\Omega}^{-1}E_T\left(f\right)\right]^{-1}\hat{\alpha}\hat{\Sigma}^{-1}\hat{\alpha} \approx F,\ \text{d.f. } N, T-N-K \quad \text{(B.3)}$$

where K is the number of factors and

$$\hat{\Omega} = \frac{1}{T}\sum_{t=1}^{T}\left[f_t - E_T\left(f\right)\right]\left[f_t - E_T\left(f\right)\right]'$$

is the variance-covariance matrix of factors.

B.1.2 OLS Cross-Sectional Regressions

An alternative way to test asset pricing models is via cross-sectional regressions. The underlying idea in this approach roots in the central economic question why average returns vary across assets. Clearly, the more risk an investor is willing to bear, the higher should be his expected return, i.e., there is a positive relationship between risk and return. This in turn implies that expected returns to an asset j should be high if that asset has high betas, as a measure of systematic risk, or large risk exposure to factors that possess high risk premia.

To test this, we may take our factor loadings of the previously described time-series regression and then estimate the factor risk premia λ from a cross-sectional regression of the average returns to the factor loadings, i.e.,

$$E_T\left(R_j\right) = \beta_j'\lambda + e_j,\ j=1,2,\ldots,\ N \quad \text{(B.4)}$$

[4] For further details, please refer to Cochrane (2005).

where R_j is the excess return to any asset j and β_j denotes the vector of factor loadings for asset j obtained from time-series regressions. Here, however, the βs serve as explanatory variables in the regression, while λ takes the role of the regression coefficients. The cross-sectional regression residuals e_j represent the pricing errors.

If we now impose the intercept of the cross-sectional regression to be zero, the ordinary least squares (OLS) estimates are given as follows:[5]

$$\hat{\lambda} = \left(\beta'\beta\right)^{-1}\beta' E_T\left(R\right) \tag{B.5}$$

$$\hat{e} = E_T\left(R\right) - \hat{\lambda}\beta. \tag{B.6}$$

Then, if we assume standard OLS distributions for the estimated parameters and consider that the true errors and factors are i.i.d. over time, and both the errors and factors are independent of each other, then we can derive the following variance-covariance of errors in the cross-sectional regression

$$Cov\left(e, e'\right) = Cov\left[E_T\left(R\right), E_T\left(R\right)'\right] = \frac{1}{T}\left(\beta\Sigma_f\beta' + \Sigma\right) \tag{B.7}$$

where $\Sigma_f \equiv Cov\left(f_t, f_t'\right)$ and $\Sigma \equiv Cov\left(\varepsilon_t, \varepsilon_t'\right)$. Thence, the common OLS formulas for the variance-covariance matrix of OLS estimates and residuals with correlated errors provide

$$Var\left(\hat{\lambda}\right) = \frac{1}{T}\left[\left(\beta'\beta\right)^{-1}\beta'\Sigma\beta\left(\beta'\beta\right)^{-1} + \Sigma_f\right] \tag{B.8}$$

$$Cov\left(\hat{e}\right) = \frac{1}{T}\left[I - \beta\left(\beta'\beta\right)^{-1}\beta'\right]\Sigma\left[I - \beta\left(\beta'\beta\right)^{-1}\beta'\right]' \tag{B.9}$$

where I denotes an identity matrix. We could eventually test the null hypothesis that all pricing errors are zero, and thus whether an asset pricing model is valid, using the test statistic

$$\hat{e}Cov\left(\hat{e}\right)^{-1}\hat{e} \approx \chi^2,\ \text{d.f. } N-K \tag{B.10}$$

considering a singular and generalized inverse variance-covariance matrix that also leaves us with $N-K$ rather than N degrees of freedom, given that λ needs to be estimated along the way.[6]

[5]Imposing the intercept to be zero is in line with economic theory which states that the constant, or α return, should be zero. In other words, there is no excess return to be made if markets are efficient.

[6]For further details, please refer to Cochrane (2005).

B.1.3 GLS Cross-Sectional Regressions

Given that the residuals in the cross-sectional regression presented in Equation (B.4) are correlated with each other, it might appear plausible to use generalized least squares (GLS) cross-sectional regressions rather than OLS ones. Yet, it is worthy to note that though GLS regressions may provide more precise estimates than OLS ones, this often comes at some sort of sacrifice of robustness vis-à-vis OLS. Considering the variance-covariance matrix of Equation (B.7), our GLS estimates become

$$\hat{\lambda} = \left(\beta'\Sigma^{-1}\beta\right)^{-1}\beta'\Sigma^{-1}E_T(R) \quad \text{(B.11)}$$

$$\hat{e} = E_T(R) - \hat{\lambda}\beta. \quad \text{(B.12)}$$

Moreover, the corresponding variance-covariance matrices of the estimates take the form

$$Var\left(\hat{\lambda}\right) = \frac{1}{T}\left[\left(\beta'\Sigma^{-1}\beta\right)^{-1} + \Sigma_f\right] \quad \text{(B.13)}$$

$$Cov(\hat{e}) = \frac{1}{T}\left[\Sigma - \beta\left(\beta'\Sigma^{-1}\beta\right)^{-1}\beta'\right]. \quad \text{(B.14)}$$

Again, we may test whether all pricing errors are equal to zero through an asymptotically valid χ^2 test statistic:

$$T\hat{e}\Sigma^{-1}\hat{e} \approx \chi^2, \text{ d.f. } N - K. \quad \text{(B.15)}$$

In this case, however, a general inverse variance-covariance matrix is not required.

As it can be shown that $\hat{\Sigma}$ is exactly distributed in finite samples as a Hotelling T^2-distribution (see Cochrane, 2005), and given that the square of a T-distribution equals a F-distribution, we may also formulate a test-statistic for small samples. If we let $Q = T\hat{e}\hat{\Sigma}^{-1}\hat{e}$, and if we impose the regression intercepts to be zero again, then it follows

$$\frac{Q(T-N+K-1)}{(N-K)(T-K)} \approx F, \text{ d.f. } N-K, T-N+K-1. \quad \text{(B.16)}$$

Unless N is fairly small relative to T the use of an asymptotic χ^2 distribution might lead us to reject the validity of an asset pricing model too often. Put differently, if we did not consider F-distributions, we might be inclined to reject our null hypothesis that an asset pricing model holds in too many cases. As such, it seems to be worthy to consider the stochastic behavior of $\hat{\Sigma}$ and to use a F-distribution for small sample sizes.

B.1.3.1 Adjustment for Constant Betas

Using standard OLS/GLS formulas to cross-sectional regressions presumes that βs are fixed. Yet, our βs are not fixed but estimated through time series regressions. This demands an adjustment of standard errors (see Cochrane, 2005, Shanken, 1992), which we consider for our test results. In detail, if we assume again that errors are i.i.d. over time and independent of the factors, the variance-covariances of our λs become actually

$$Var\left(\hat{\lambda}_{OLS}\right) = \frac{1}{T}\left[\left(\beta'\beta\right)^{-1}\beta'\Sigma\beta\left(\beta'\beta\right)^{-1}\left(1+\lambda'\Sigma_f^{-1}\lambda\right)+\Sigma_f\right] \quad \text{(B.17)}$$

$$Var\left(\hat{\lambda}_{GLS}\right) = \frac{1}{T}\left[\left(\beta'\Sigma^{-1}\beta\right)^{-1}\left(1+\lambda'\Sigma_f^{-1}\lambda\right)+\Sigma_f\right] \quad \text{(B.18)}$$

rather than those presented in Equations (B.8) and (B.13), respectively. The adjusted asymptotic variance-covariance matrices of the pricing errors take the form

$$Cov\left(\hat{e}_{OLS}\right) = \frac{1}{T}\left(I-\beta\left(\beta'\beta\right)^{-1}\beta'\right)\Sigma\left(I-\beta\left(\beta'\beta\right)^{-1}\beta'\right)'\left(1+\lambda'\Sigma_f^{-1}\lambda\right) \quad \text{(B.19)}$$

$$Cov\left(\hat{e}_{GLS}\right) = \frac{1}{T}\left(\Sigma-\beta\left(\beta'\Sigma^{-1}\beta\right)^{-1}\beta'\right)\left(1+\lambda'\Sigma_f^{-1}\lambda\right) \quad \text{(B.20)}$$

rather than those introduced in Equations (B.9) and (B.14), respectively. Now, if we divide again the pricing errors by their variance-covariance matrix, our asymptotically valid test statistic for the GLS cross-sectional regressions boils down to

$$T\left(1+\lambda'\Sigma_f^{-1}\lambda\right)\hat{e}'_{GLS}\Sigma^{-1}\hat{e}_{GLS} \approx \chi^2,\ \text{d.f. } N-K. \quad \text{(B.21)}$$

For further details please refer to Cochrane (2005).

B.2 Robustness Check for OLS Regressions

B.2.1 Gauss-Markov Assumptions

In order to interpret the unconditional factor loadings, i.e., the ordinary least square (OLS) estimators, such as β_{MRF}, β_{HML}, β_{SMB}, and β_{WML} along with the corresponding test statistics correctly, several assumptions about the error term ε

and the explanatory variables, i.e., the risk factors *MRF*, *HML*, *SMB*, and *WML*, have to be made. These assumptions are generally known as the Gauss-Markov assumptions:

1. Linearity: The expected value of the error term is zero, i.e., $E(\varepsilon_j) = 0$; $j = 1, ..., N$;

2. Pseudo-isolation: All error terms are independent of all explanatory variables, i.e., $\{\varepsilon_1, ..., \varepsilon_N\}$ and $\{x_1, ..., x_N\}$ are independent;

3. Homoscedasticity: All error terms have the same variance, i.e., $\text{Var}(\varepsilon_j) = \sigma^2$; $j = 1, ..., N$;

4. No autocorrelation: The error terms are mutually uncorrelated, i.e., $\text{Cov}(\varepsilon_j, \varepsilon_i)$ =0; $j, i = 1, ..., N, j \neq i$:

In case assumptions 1 through 4 hold simultaneously, one may reasonably infer that the OLS estimators are unbiased parameters for the factor loadings. If all assumptions 1 through 4 hold, it can be inferred that the OLS estimators are the best linear unbiased estimators (BLUE) for their respective factor loadings. The Gauss-Markov assumptions 1 through 4 are commonly summarized as follows

$$E(\varepsilon|X) = E(\varepsilon) = 0$$
$$V(\varepsilon|X) = V(\varepsilon) = \sigma^2 I_N$$

where I_N is an identity matrix. In other words, $\sigma^2 I_N$ indicates that the covariance matrix of the error terms ε is a diagonal matrix with σ^2 on the diagonal, and zero otherwise.

A fifth assumption - not captured in the Gauss-Markov assumptions - states that the error terms are normally distributed, i.e., $\varepsilon_j \sim N(0; \sigma^2)$. Although the normal error distribution is unnecessary for the OLS estimator to be BLUE, normal errors indicate that the OLS estimator is more efficient than any other unbiased estimator, linear or not. If this condition is violated, and hence the error terms are correlated (i.e., the covariances between different error terms are not all equal to zero), the error terms are said to be autocorrelated or serially correlated (i.e., Cov $(\varepsilon_j, \varepsilon_i) \neq 0$; $j \neq i$. Although the OLS estimators remain unbiased in presence of autocorrelation, OLS becomes inefficient and its standard errors are estimated incorrectly.

B.2.2 Serial Correlation

In order to test for first-order autocorrelation of the error terms, we employ the Durbin-Watson test (Durbin and Watson, 1950). The Durbin-Watson test statistic is defined as

$$d = \frac{\sum_{t=2}^{T}(e_t - e_{t-1})^2}{\sum_{t=1}^{T} e_t^2} \tag{B.22}$$

where d is the test statistic, e_t is the OLS residual, i.e., the modal residual, and t is the time period. This can be simplified to

$$d \approx 2 - 2\hat{\rho} \tag{B.23}$$

where $\hat{\rho}$ is the sample estimate of the correlation ρ between adjacent errors (Verbeek, 2004). It is given by

$$\hat{\rho} = \left(\sum_{t=2}^{T} e_{t-1}^2\right)^{-1} \left(\sum_{t=2}^{T} e_t e_{t-1}\right). \tag{B.24}$$

If the errors are not autocorrelated, then $\hat{\rho}$ is approximately zero and d is close to 2. The range of d is $0 \leq d \leq 4$. A d much smaller than 2 implies a positive autocorrelation ($\rho > 0$). On the other hand, if d is much larger than 2, this is an indication of negative autocorrelation ($\rho < 0$). In other words, positive autocorrelation occurs when $(\rho_i - \rho_{i-1})^2$ is small, which produces a small value for d. Conversely, negative autocorrelation occurs when consecutive residuals differ significantly, i.e., when $(\rho_i - \rho_{i-1})^2$ is large, resulting in a d that is bigger than 2.

Newbold, Carlson, and Thorne (2003) and Verbeek (2004) stress that there is a theoretical complexity involved by employing the Durbin-Watson test statistic in basing tests for autocorrelation of the error terms. The authors emphasize that the actual sampling distribution of d, even when the hypothesis of no autocorrelation is true (H_0: $\rho = 0$), does not solely depend on the sample size T (here: number of quarters) and the number of independent variables K. The distribution of d also depends on the particular values of the independent variables K.

Therefore, it is not feasible to tabulate the critical values of the distribution for every possible set of values of the independent variables. Yet, Savin and White (1977) and Durbin and Watson (1950) argue that whatever the independent variables K, it is possible to compute an upper (d_U) and lower limit (d_L) for the critical values of d that solely depend upon the sample size T and the number of variables K. The distribution of d always lies between that of two other random variables, whose percentage points can be calculated (Newbold et al., 2003). The true critical value d_{crit} should fall between the bounds that are tabulated, i.e., $d_L < d_{crit} < d_U$ (Verbeek, 2004). For instance, it follows for the null hypothesis (H_0: $\rho = 0$) at the 5% significance level:

$$P\{d < d_L\} \leq P\{d < d_{crit}\} = 0.05 \leq P\{d < d_U\}.$$

Consequently, (1) we reject the null hypothesis of no autocorrelation against the alternative of positive autocorrelation (i.e., H_{1a}: $\rho > 0$) if the determined d is less than d_L and, thus, certainly smaller than the true critical value d_{crit}. (2) we fail to reject the null hypothesis if d (and thus also d_{crit}) is larger than d_U but smaller than 4 - d_U. (3) If d falls between d_L and d_U, the test is inconclusive as in this case d might be larger or smaller thand_{crit}. Hence, we may neither reject nor fail to reject the null hypothesis. (4) In the very rare case that d is bigger than 4 - d_L, we reject the null hypothesis against the alternative of negative autocorrelation (i.e., H_{1b}: $\rho < 0$). Figure B.1 illustrates the decision rule for the Durbin-Watson test.

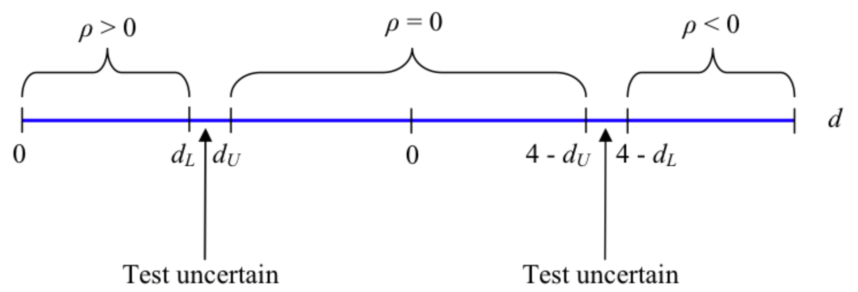

Figure B.1: Decision Rule for Durbin-Watson Test - Source: Own Draft

Given the presence of autocorrelation and heteroscedasticity of the error terms, we use the Newey and West (1987) estimator, setting the lags equal to three.[7] The approach proposed by Newey and West (1987) is one of the most commonly employed methods for adjusted autocorrelated standard errors. Newey and West (1987) noticeably simplified the problem of estimating covariance matrices in the presence of serial correlation. Nonetheless, the Newey-West estimator does not alter the coefficient estimates themselves. It solely eliminates any problems of heteroscedasticity and autocorrelation of the error terms by substituting the actual error terms by adjusted standard error terms. The latter are referred to as heteroscedasticity-and-autocorrelation-consistent (HAC) standard errors or simply Newey-West standard errors. The Newey-West estimator $\hat{\Sigma}_N$ is given by

$$\hat{\Sigma}_N = \frac{1}{N}\sum_{i=1}^{N} e_i^2 x_t x_t' + \frac{1}{N}\sum_{l=1}^{L}\sum_{i=l+1}^{N} w_l e_{i-l}(x_i x_{i-l}' + x_{i-l} x_i') \tag{B.25}$$

where N is the sample size, L is the length of the lag, and w_l is the so-called Bartlett kernel function (Kuan, 2004), or Bartlett weight, which can be decomposed to:

$$w_l = \begin{cases} 1 - \frac{l}{L}, & \text{if } 0 \leq \frac{l}{L} \leq 1 \\ \\ 0, & \text{otherwise.} \end{cases} \tag{B.26}$$

The Bartlett weights decrease linearly with an increase in l. Verbeek (2004) emphasizes that the use of Bartlett weights is compatible with the idea that the impact of the autocorrelation of order l diminishes with $|l|$. Following Newey and West (1987), the consistent estimator for the asymptotic variance ($x\Sigma x'$) of the OLS parameter becomes $N(xx')^{-1}\hat{\Sigma}_N(xx')^{-1}$, which is robust with respect to both autocorrelation and heteroscedasticity.

B.3 Detailed Time Series Regression Results

[Intentionally Blank - Tables B.1 to B.60 on the following pages.]

[7] Heteroscedasticity applies whenever the third assumption of the Gauss-Markov conditions is violated, i.e., the error terms have different variances, i.e., $Var(\varepsilon_i) = \sigma_i^2 \neq Var(\varepsilon_j) = \sigma_j^2$.

Table B.1: Time-Series Regressions CAPM & 3FM - Austria

This table reports the results for the CAPM (Panel A) & Fama and French (1993) 3FM (Panel B) time series regressions for our 27 sorted portfolios (cf. Table 3.2 on page 78). The first row per block depicts all high book-to-market portfolios, i.e., $P1$ to $P9$, with the market capitalization (size) increasing from left to right. The second row per block depicts all medium book-to-market portfolios, i.e., $P10$ to $P17$, with the market capitalization (size) increasing from left to right. The third row per blockshows all low book-to-market portfolios, i.e., $P20$ to $P27$, with the market capitalization (size) increasing from left to right. The shown adjusted R^2 values are adjusted for degrees of freedom. Statistics are corrected for heteroscedasticity and autocorrelation, up to three lags, using the Newey and West (1987) estimator.

	Market Capitalization (Size)																	
BV/MV	Small				Medium				Big	Small				Medium				Big
Panel A: Capital Asset Pricing Model																		
					α									$t(\alpha)$				
High	0.17	0.26	0.16	-0.12	-0.01	-0.01	-0.05	-0.05	0.00	2.16	2.23	1.67	-1.53	-0.25	-0.16	-1.01	-1.20	-0.05
Med.	0.09	0.06	0.04	0.15	0.00	0.12	0.03	-0.01	0.04	1.68	1.37	1.39	1.61	-0.08	2.31	1.09	-0.45	0.70
Low	0.07	0.14	0.14	-0.02	-0.02	-0.02	0.03	-0.02	-0.03	0.07	0.14	0.14	-0.02	-0.02	-0.02	0.03	-0.02	-0.03
					β^{MRF}									$t\left(\beta^{MRF}\right)$				
High	0.64	0.74	0.45	0.71	0.67	0.36	0.80	1.36	1.39	2.57	1.28	1.14	2.28	3.80	1.01	4.30	6.91	12.74
Med.	0.44	1.13	1.17	0.46	0.42	0.67	0.41	0.98	1.30	1.71	3.71	8.83	1.17	5.43	3.94	2.97	7.45	4.02
Low	0.55	0.20	1.31	0.61	0.18	0.31	0.36	0.23	0.64	2.65	0.98	3.88	9.26	2.49	5.82	4.23	3.36	7.82
					Adj. R^2									s(e)				
High	0.07	0.02	0.05	0.13	0.33	0.04	0.39	0.66	0.65	0.21	0.80	0.14	0.14	0.04	0.10	0.04	0.04	0.05
Med.	0.06	0.27	0.56	0.05	0.36	0.25	0.14	0.49	0.36	0.11	0.15	0.05	0.14	0.01	0.06	0.04	0.05	0.13
Low	0.10	0.01	0.14	0.58	0.10	0.40	0.27	0.18	0.51	0.12	0.08	0.43	0.01	0.01	0.01	0.02	0.01	0.02
Panel B: Fama and French (1993) Model																		
					α									$t(\alpha)$				
High	0.04	0.02	0.06	-0.24	-0.02	-0.08	-0.04	-0.02	0.08	0.68	0.29	0.78	-3.77	-0.32	-1.29	-0.68	-0.52	1.66
Med.	-0.01	-0.05	0.01	0.06	-0.02	0.07	0.02	0.00	0.02	-0.26	-1.19	0.22	0.75	-0.95	1.77	0.56	0.05	0.44
Low	-0.03	0.06	-0.08	-0.03	-0.03	-0.03	0.00	-0.03	-0.02	-0.03	0.06	-0.08	-0.03	-0.03	-0.03	0.00	-0.03	-0.02
					β^{MRF}									$t\left(\beta^{MRF}\right)$				
High	0.59	0.17	0.27	0.73	0.57	0.25	0.67	1.28	1.29	3.99	0.69	1.17	4.05	3.87	0.93	3.45	7.29	15.98
Med.	0.56	1.26	1.19	0.27	0.46	0.78	0.43	0.97	1.48	2.45	5.53	7.98	1.16	6.08	4.39	3.28	5.51	4.78
Low	0.85	0.51	2.01	0.62	0.22	0.34	0.41	0.24	0.63	3.73	3.00	4.55	8.17	2.65	6.41	4.62	3.67	5.79
					β^{HML}									$t\left(\beta^{HML}\right)$				
High	0.49	2.38	0.79	0.23	0.31	0.48	0.36	0.18	0.16	1.95	6.71	3.52	1.17	2.61	3.24	2.49	1.50	1.65
Med.	-0.15	-0.18	0.00	0.83	-0.10	-0.25	-0.05	-0.01	-0.53	-0.65	-0.72	0.00	3.99	-2.38	-1.39	-0.44	-0.09	-2.34
Low	-0.73	-0.83	-1.80	0.02	-0.09	-0.07	-0.12	-0.01	0.01	-2.33	-4.01	-2.93	0.40	-0.89	-2.47	-1.32	-0.12	0.07
					β^{SMB}									$t\left(\beta^{SMB}\right)$				
High	0.98	1.66	0.69	0.93	0.01	0.46	-0.16	-0.27	-0.60	4.02	6.15	3.39	4.94	0.04	2.50	-0.94	-1.63	-3.35
Med.	0.76	0.80	0.26	0.65	0.14	0.39	0.11	-0.12	0.21	4.64	3.52	1.76	3.49	2.28	1.92	0.98	-0.96	0.73
Low	0.83	0.66	1.71	0.12	0.11	0.09	0.20	0.05	-0.07	2.83	3.48	2.90	1.73	1.06	2.01	2.05	0.89	-0.84
					Adj. R^2									s(e)				
High	0.40	0.72	0.55	0.45	0.40	0.31	0.46	0.67	0.76	0.13	0.23	0.07	0.09	0.04	0.07	0.04	0.04	0.03
Med.	0.26	0.39	0.58	0.55	0.39	0.32	0.13	0.48	0.41	0.09	0.13	0.05	0.07	0.01	0.05	0.04	0.05	0.12
Low	0.39	0.49	0.53	0.60	0.12	0.43	0.34	0.17	0.51	0.08	0.04	0.23	0.01	0.01	0.01	0.01	0.01	0.02

Table B.2: Time-Series Regressions 4FM - Austria

This table reports the results for the time series regressions of our 27 sorted portfolios (cf. Table 3.2 on page 78) on the Carhart (1997) 4FM. The first row per block depicts all high book-to-market portfolios, i.e., $P1$ to $P9$, with the market capitalization (size) increasing from left to right. The second row per block depicts all medium book-to-market portfolios, i.e., $P10$ to $P17$, with the market capitalization (size) increasing from left to right. The third row per block shows all low book-to-market portfolios, i.e., $P20$ to $P27$, with the market capitalization (size) increasing from left to right. The shown adjusted R^2 values are adjusted for degrees of freedom. Statistics are corrected for heteroscedasticity and autocorrelation, up to three lags, using the Newey and West (1987) estimator.

	Market Capitalization (Size)																	
BV/MV	Small				Medium				Big	Small				Medium				Big
	α									$t\,(\alpha)$								
High	0.06	-0.02	0.06	-0.22	-0.01	-0.09	-0.03	-0.02	0.07	1.09	-0.31	0.79	-3.23	-0.17	-1.57	-0.49	-0.59	1.53
Med.	0.01	-0.02	0.00	0.06	-0.02	0.08	0.04	0.01	-0.02	0.19	-0.60	-0.14	0.75	-1.01	1.82	1.42	0.31	-0.53
Low	0.00	0.07	-0.15	-0.04	-0.03	-0.03	0.00	-0.02	-0.02	0.00	0.07	-0.15	-0.04	-0.03	-0.03	0.00	-0.02	-0.02
	β^{MRF}									t(β^{MRF})								
High	0.87	-0.30	0.30	1.00	0.66	0.04	0.80	1.25	1.17	4.60	-0.85	1.42	4.40	3.77	0.13	3.92	6.89	10.73
Med.	0.82	1.63	1.09	0.28	0.45	0.84	0.67	1.09	1.06	3.19	4.43	6.32	1.34	6.06	5.51	3.39	7.36	3.63
Low	1.28	0.69	1.18	0.56	0.23	0.33	0.44	0.35	0.72	6.23	5.75	3.83	6.44	2.43	6.45	5.79	3.63	7.78
	β^{HML}									t(β^{HML})								
High	0.30	2.70	0.77	0.05	0.25	0.62	0.28	0.21	0.24	1.33	5.86	3.35	0.26	2.10	3.11	1.90	1.44	2.14
Med.	-0.32	-0.43	0.07	0.82	-0.09	-0.29	-0.21	-0.10	-0.25	-1.64	-1.98	0.64	3.85	-1.74	-2.17	-2.06	-0.76	-1.19
Low	-1.01	-0.95	-1.24	0.06	-0.09	-0.06	-0.14	-0.09	-0.05	-4.70	-7.10	-4.46	1.07	-0.92	-1.73	-2.11	-1.69	-0.59
	β^{SMB}									t(β^{SMB})								
High	0.87	1.85	0.68	0.82	-0.03	0.55	-0.21	-0.25	-0.55	3.61	6.33	3.21	4.78	-0.25	2.61	-1.04	-1.61	-3.55
Med.	0.65	0.65	0.30	0.64	0.15	0.37	0.01	-0.18	0.38	4.52	3.78	1.95	3.26	2.47	1.74	0.09	-1.50	1.25
Low	0.66	0.59	2.05	0.15	0.11	0.10	0.19	0.00	-0.10	2.64	3.19	3.94	1.94	1.00	2.26	1.86	0.00	-1.37
	β^{WML}									t(β^{WML})								
High	-0.82	1.36	-0.09	-0.76	-0.24	0.62	-0.36	0.11	0.36	-0.82	1.36	-0.09	-0.76	-0.24	0.62	-0.36	0.11	0.36
Med.	-0.75	-1.07	0.31	-0.06	0.04	-0.18	-0.69	-0.36	1.20	-0.75	-1.07	0.31	-0.06	0.04	-0.18	-0.69	-0.36	1.20
Low	-1.22	-0.51	2.39	0.16	-0.03	0.04	-0.09	-0.33	-0.24	-1.22	-0.51	2.39	0.16	-0.03	0.04	-0.09	-0.33	-0.24
	Adj. R^2									s(e)								
High	0.44	0.75	0.55	0.50	0.41	0.36	0.48	0.68	0.77	0.13	0.21	0.07	0.08	0.04	0.07	0.04	0.04	0.03
Med.	0.32	0.46	0.59	0.55	0.40	0.32	0.26	0.50	0.50	0.08	0.11	0.05	0.07	0.01	0.05	0.04	0.04	0.11
Low	0.54	0.54	0.68	0.61	0.12	0.43	0.35	0.29	0.53	0.06	0.04	0.16	0.01	0.01	0.01	0.01	0.01	0.02

Table B.3: Time-Series Regressions CAPM & 3FM - Belgium

This table reports the results for the CAPM (Panel A) & Fama and French (1993) 3FM (Panel B) time series regressions for our 27 sorted portfolios (cf. Table 3.2 on page 78). The first row per block depicts all high book-to-market portfolios, i.e., $P1$ to $P9$, with the market capitalization (size) increasing from left to right. The second row per block depicts all medium book-to-market portfolios, i.e., $P10$ to $P17$, with the market capitalization (size) increasing from left to right. The third row per blockshows all low book-to-market portfolios, i.e., $P20$ to $P27$, with the market capitalization (size) increasing from left to right. The shown adjusted R^2 values are adjusted for degrees of freedom. Statistics are corrected for heteroscedasticity and autocorrelation, up to three lags, using the Newey and West (1987) estimator.

	Market Capitalization (Size)																		
BV/MV	Small				Medium				Big		Small				Medium				Big
Panel A: Capital Asset Pricing Model																			
					α										$t(\alpha)$				
0.05	0.03	0.07	0.01	0.03	0.08	-0.04	0.02	0.06		1.88	1.02	2.20	0.24	1.07	2.13	-1.97	0.82	2.28	
-0.02	0.03	0.14	0.02	-0.03	0.04	-0.07	-0.08	-0.05		-0.59	0.92	3.02	0.86	-1.37	1.58	-3.21	-5.10	-3.23	
-0.09	-0.02	0.13	0.03	-0.06	-0.05	-0.02	-0.08	-0.09		-0.09	-0.02	0.13	0.03	-0.06	-0.05	-0.02	-0.08	-0.09	
					β^{MRF}										$t\left(\beta^{MRF}\right)$				
High	0.93	0.79	0.84	0.47	0.67	1.13	0.79	0.77	0.75		7.56	7.46	5.35	4.19	5.54	5.27	5.34	7.51	5.26
Med.	1.03	1.18	1.62	0.61	0.80	1.20	0.76	0.89	1.17		5.43	5.17	7.99	4.98	7.54	8.68	6.46	8.89	11.90
Low	0.81	0.84	1.63	0.90	0.45	0.61	0.75	0.48	0.61		8.70	7.19	5.96	8.78	6.36	8.43	8.31	6.00	9.11
					Adj. R^2										s(e)				
High	0.31	0.29	0.22	0.18	0.20	0.27	0.34	0.22	0.31		0.08	0.06	0.10	0.04	0.07	0.14	0.05	0.08	0.05
Med.	0.25	0.27	0.34	0.18	0.37	0.36	0.42	0.58	0.62		0.12	0.15	0.21	0.07	0.04	0.10	0.03	0.02	0.03
Low	0.23	0.22	0.26	0.38	0.27	0.42	0.39	0.41	0.57		0.09	0.10	0.31	0.05	0.02	0.02	0.04	0.01	0.01
Panel B: Fama and French (1993) Model																			
					α										$t(\alpha)$				
High	-0.02	-0.07	-0.01	0.00	-0.11	-0.07	-0.06	-0.08	0.01		-0.66	-2.71	-0.39	-0.10	-4.74	-2.38	-2.43	-1.87	0.25
Med.	-0.13	-0.12	-0.02	-0.06	-0.04	0.03	-0.06	-0.07	-0.03		-5.29	-2.89	-0.65	-1.85	-1.51	0.93	-2.23	-3.57	-1.64
Low	-0.19	-0.07	0.19	-0.05	-0.08	-0.06	-0.01	-0.07	-0.07		-0.19	-0.07	0.19	-0.05	-0.08	-0.06	-0.01	-0.07	-0.07
					β^{MRF}										$t\left(\beta^{MRF}\right)$				
High	0.78	0.61	0.69	0.49	0.38	0.87	0.89	0.59	0.67		6.35	6.30	4.60	3.98	2.98	4.44	7.78	4.37	4.87
Med.	0.72	0.80	1.01	0.43	0.73	1.08	0.86	0.96	1.21		4.86	3.49	6.84	4.01	7.22	7.06	7.71	10.80	11.69
Low	0.53	0.65	1.30	0.60	0.39	0.58	0.71	0.54	0.67		3.87	4.35	4.82	7.64	4.99	8.36	6.78	6.99	11.08
					β^{HML}										$t\left(\beta^{HML}\right)$				
High	0.56	0.79	0.69	0.21	1.13	1.50	0.63	0.89	0.60		2.90	4.09	2.42	0.98	6.10	5.76	3.06	2.70	3.70
Med.	0.52	0.99	0.14	0.55	-0.08	-0.31	0.13	0.07	-0.14		3.06	3.13	0.50	2.23	-0.39	-1.17	1.05	0.61	-1.08
Low	0.59	0.04	-2.37	0.02	0.04	-0.08	-0.29	0.05	0.00		2.19	0.17	-5.15	0.16	0.29	-0.57	-1.93	0.59	-0.05
					β^{SMB}										$t\left(\beta^{SMB}\right)$				
High	0.49	0.58	0.50	-0.07	0.96	0.84	-0.33	0.60	0.24		2.08	2.31	1.79	-0.35	4.22	3.92	-2.98	1.29	1.74
Med.	1.01	1.24	2.03	0.60	0.21	0.40	-0.31	-0.25	-0.12		4.98	4.26	9.77	2.29	1.98	1.75	-3.77	-3.75	-1.49
Low	0.92	0.64	1.16	1.01	0.22	0.12	0.14	-0.21	-0.19		2.47	2.44	5.93	9.89	2.32	1.58	1.14	-3.73	-3.90
					Adj. R^2										s(e)				
High	0.38	0.44	0.30	0.19	0.57	0.48	0.47	0.37	0.39		0.07	0.05	0.09	0.04	0.04	0.10	0.04	0.07	0.04
Med.	0.40	0.46	0.65	0.30	0.38	0.39	0.47	0.60	0.63		0.10	0.11	0.11	0.06	0.04	0.10	0.03	0.02	0.03
Low	0.41	0.29	0.60	0.66	0.30	0.43	0.42	0.46	0.60		0.07	0.09	0.17	0.03	0.02	0.02	0.03	0.01	0.01

Table B.4: Time-Series Regressions 4FM - Belgium

This table reports the results for the time series regressions of our 27 sorted portfolios (cf. Table 3.2 on page 78) on the Carhart (1997) 4FM. The first row per block depicts all high book-to-market portfolios, i.e., $P1$ to $P9$, with the market capitalization (size) increasing from left to right. The second row per block depicts all medium book-to-market portfolios, i.e., $P10$ to $P17$, with the market capitalization (size) increasing from left to right. The third row per block shows all low book-to-market portfolios, i.e., $P20$ to $P27$, with the market capitalization (size) increasing from left to right. The shown adjusted R^2 values are adjusted for degrees of freedom. Statistics are corrected for heteroscedasticity and autocorrelation, up to three lags, using the Newey and West (1987) estimator.

	Market Capitalization (Size)																	
BV/MV	Small				Medium				Big	Small				Medium				Big
					α									$t\ (\alpha)$				
High	-0.01	-0.07	-0.06	0.02	-0.12	-0.18	-0.04	-0.07	-0.04	-0.19	-2.76	-1.87	0.59	-4.70	-6.32	-1.38	-1.96	-1.82
Med.	-0.02	-0.12	-0.07	-0.08	-0.07	0.01	-0.06	-0.07	-0.06	-0.64	-2.72	-2.15	-2.82	-2.85	0.31	-2.22	-3.41	-2.43
Low	-0.19	-0.06	0.08	-0.08	-0.08	-0.07	-0.03	-0.07	-0.08	-0.19	-0.06	0.08	-0.08	-0.08	-0.07	-0.03	-0.07	-0.08
					β^{MRF}									t(β^{MRF})				
High	0.82	0.61	0.49	0.56	0.33	0.45	0.97	0.59	0.47	6.31	6.08	3.64	4.21	2.44	3.11	6.95	4.65	3.62
Med.	1.14	0.80	0.81	0.34	0.64	1.00	0.85	0.95	1.12	5.91	3.14	5.76	3.25	6.48	5.83	6.99	10.04	9.24
Low	0.56	0.68	0.87	0.48	0.37	0.51	0.65	0.53	0.65	3.99	4.27	3.40	6.38	4.22	7.83	5.81	6.36	10.33
					β^{HML}									t(β^{HML})				
High	0.49	0.79	0.97	0.11	1.20	2.08	0.52	0.88	0.89	2.30	4.17	3.36	0.50	6.02	7.59	2.40	2.79	6.01
Med.	-0.06	0.99	0.42	0.69	0.06	-0.19	0.15	0.09	-0.02	-0.28	3.19	1.54	2.92	0.31	-0.69	1.10	0.71	-0.12
Low	0.55	0.00	-1.77	0.18	0.07	0.02	-0.21	0.07	0.02	2.13	-0.01	-3.98	1.40	0.51	0.13	-1.27	0.82	0.28
					β^{SMB}									t(β^{SMB})				
High	0.52	0.58	0.35	-0.02	0.92	0.54	-0.27	0.61	0.09	2.21	2.25	1.21	-0.12	4.14	2.82	-2.34	1.27	0.69
Med.	1.32	1.24	1.88	0.52	0.14	0.34	-0.32	-0.25	-0.18	5.89	4.15	9.25	1.95	1.33	1.59	-3.69	-3.82	-2.12
Low	0.94	0.67	0.84	0.92	0.20	0.07	0.10	-0.22	-0.21	2.48	2.52	4.98	9.18	2.19	0.93	0.88	-3.75	-4.03
					β^{WML}									t(β^{WML})				
High	-0.20	0.01	0.86	-0.30	0.22	1.80	-0.36	-0.03	0.89	-0.20	0.01	0.86	-0.30	0.22	1.80	-0.36	-0.03	0.89
Med.	-1.80	0.01	0.88	0.41	0.42	0.36	0.05	0.05	0.39	-1.80	0.01	0.88	0.41	0.42	0.36	0.05	0.05	0.39
Low	-0.11	-0.13	1.86	0.50	0.10	0.29	0.23	0.07	0.08	-0.11	-0.13	1.86	0.50	0.10	0.29	0.23	0.07	0.08
					Adj. R^2									s(e)				
High	0.38	0.44	0.35	0.21	0.58	0.65	0.49	0.37	0.50	0.07	0.05	0.08	0.04	0.04	0.07	0.04	0.07	0.04
Med.	0.59	0.46	0.67	0.32	0.41	0.40	0.47	0.60	0.64	0.07	0.11	0.10	0.06	0.04	0.10	0.03	0.02	0.03
Low	0.41	0.29	0.68	0.69	0.31	0.45	0.43	0.46	0.60	0.07	0.09	0.13	0.03	0.02	0.02	0.03	0.01	0.01

Table B.5: Time-Series Regressions CAPM & 3FM - Finland

This table reports the results for the CAPM (Panel A) & Fama and French (1993) 3FM (Panel B) time series regressions for our 27 sorted portfolios (cf. Table 3.2 on page 78). The first row per block depicts all high book-to-market portfolios, i.e., $P1$ to $P9$, with the market capitalization (size) increasing from left to right. The second row per block depicts all medium book-to-market portfolios, i.e., $P10$ to $P17$, with the market capitalization (size) increasing from left to right. The third row per blockshows all low book-to-market portfolios, i.e., $P20$ to $P27$, with the market capitalization (size) increasing from left to right. The shown adjusted R^2 values are adjusted for degrees of freedom. Statistics are corrected for heteroscedasticity and autocorrelation, up to three lags, using the Newey and West (1987) estimator.

	Market Capitalization (Size)																	
BV/MV	Small				Medium				Big	Small				Medium				Big
Panel A: Capital Asset Pricing Model																		
	α									$t(\alpha)$								
High	0.30	0.19	0.26	0.05	0.11	0.18	0.10	0.01	0.06	4.26	3.89	0.81	0.97	2.82	4.08	1.92	0.44	1.25
Med.	0.10	0.16	0.19	0.19	0.08	0.11	0.06	0.08	0.06	1.91	4.05	3.74	0.59	2.37	2.04	1.27	1.67	1.38
Low	0.02	0.14	0.10	0.06	0.00	0.03	0.04	-0.01	0.03	0.02	0.14	0.10	0.06	0.00	0.03	0.04	-0.01	0.03
	β^{MRF}									$t\left(\beta^{MRF}\right)$								
High	-0.18	0.06	4.77	0.29	0.17	0.09	0.01	0.11	-0.01	-1.63	0.57	2.13	2.16	3.16	1.56	0.18	2.18	-0.17
Med.	0.31	0.08	0.15	4.77	0.13	0.05	0.05	0.22	0.21	1.86	1.32	1.79	2.13	1.78	0.52	0.65	2.04	2.40
Low	0.32	0.19	0.41	0.07	0.08	0.08	0.02	0.02	0.12	3.26	2.18	2.38	1.68	2.08	1.69	0.36	0.56	1.89
	Adj. R^2									s(e)								
High	0.02	0.00	0.29	0.10	0.07	0.01	-0.01	0.05	-0.01	0.24	0.15	12.82	0.17	0.08	0.11	0.10	0.05	0.09
Med.	0.03	0.01	0.02	0.29	0.05	0.00	0.00	0.09	0.07	0.63	0.08	0.21	12.92	0.07	0.13	0.11	0.11	0.13
Low	0.17	0.07	0.14	0.01	0.04	0.04	-0.01	0.00	0.06	0.12	0.10	0.23	0.05	0.03	0.03	0.05	0.03	0.04
Panel B: Fama and French (1993) Model																		
	α									$t(\alpha)$								
High	0.29	0.18	-0.58	0.05	0.10	0.17	0.12	0.02	0.07	4.09	3.59	-4.65	1.08	2.53	3.62	2.27	0.54	1.61
Med.	0.09	0.16	0.16	-0.65	0.09	0.11	0.07	0.10	0.08	1.29	4.10	3.04	-5.05	2.38	2.09	1.41	2.04	1.67
Low	0.01	0.14	0.09	0.05	0.01	0.04	0.05	0.00	0.04	0.01	0.14	0.09	0.05	0.01	0.04	0.05	0.00	0.04
	β^{MRF}									$t\left(\beta^{MRF}\right)$								
High	-0.25	-0.01	0.63	0.32	0.13	0.08	0.12	0.13	0.07	-1.88	-0.14	3.03	2.29	1.90	0.89	1.61	1.88	0.64
Med.	0.20	0.06	-0.06	0.62	0.14	0.06	0.11	0.34	0.28	1.42	0.89	-0.69	2.86	2.02	0.53	0.97	2.64	2.88
Low	0.26	0.14	0.36	-0.03	0.12	0.10	0.04	0.06	0.18	3.11	1.75	3.43	-0.72	2.58	2.02	0.57	0.98	2.51
	β^{HML}									$t\left(\beta^{HML}\right)$								
High	-0.27	-0.21	5.85	0.03	0.07	0.10	0.34	0.28	0.23	-1.12	-0.98	10.19	0.13	0.53	0.65	3.22	3.04	1.74
Med.	-1.36	-0.25	-0.58	5.89	-0.24	-0.27	0.19	0.10	-0.17	-1.51	-2.02	-2.41	10.33	-2.20	-1.85	1.39	0.60	-1.02
Low	-0.60	-0.51	-1.06	-0.28	-0.01	-0.14	-0.13	0.10	0.07	-3.79	-4.29	-3.84	-2.37	-0.15	-2.03	-1.56	1.47	0.75
	β^{SMB}									$t\left(\beta^{SMB}\right)$								
High	0.31	0.29	2.58	-0.07	0.00	-0.05	-0.43	-0.24	-0.31	1.24	1.25	5.17	-0.25	0.04	-0.28	-3.71	-2.16	-1.97
Med.	1.20	0.22	0.78	2.58	0.15	0.18	-0.24	-0.27	0.01	1.53	1.57	3.36	5.19	1.25	1.06	-1.40	-1.43	0.06
Low	0.55	0.46	0.89	0.38	-0.05	0.08	0.07	-0.13	-0.16	3.31	3.53	2.98	3.30	-0.67	0.98	0.66	-1.54	-1.51
	Adj. R^2									s(e)								
High	0.03	0.02	0.96	0.09	0.07	0.00	0.09	0.11	0.05	0.24	0.15	0.73	0.17	0.08	0.12	0.09	0.05	0.08
Med.	0.17	0.04	0.17	0.96	0.08	0.01	0.01	0.13	0.09	0.53	0.08	0.18	0.74	0.06	0.13	0.11	0.11	0.12
Low	0.30	0.20	0.36	0.16	0.05	0.07	0.01	0.02	0.10	0.10	0.08	0.17	0.04	0.03	0.03	0.05	0.03	0.04

Table B.6: Time-Series Regressions 4FM - Finland

This table reports the results for the time series regressions of our 27 sorted portfolios (cf. Table 3.2 on page 78) on the Carhart (1997) 4FM. The first row per block depicts all high book-to-market portfolios, i.e., $P1$ to $P9$, with the market capitalization (size) increasing from left to right. The second row per block depicts all medium book-to-market portfolios, i.e., $P10$ to $P17$, with the market capitalization (size) increasing from left to right. The third row per block shows all low book-to-market portfolios, i.e., $P20$ to $P27$, with the market capitalization (size) increasing from left to right. The shown adjusted R^2 values are adjusted for degrees of freedom. Statistics are corrected for heteroscedasticity and autocorrelation, up to three lags, using the Newey and West (1987) estimator.

	Market Capitalization (Size)																	
BV/MV	Small				Medium				Big	Small				Medium				Big
					α									$t(\alpha)$				
High	0.29	0.17	-0.60	0.06	0.10	0.17	0.12	0.02	0.07	4.07	3.52	-4.73	1.22	2.54	3.74	2.32	0.52	1.57
Med.	0.13	0.15	0.15	-0.66	0.08	0.11	0.07	0.10	0.07	1.67	4.21	3.03	-5.05	2.34	2.05	1.55	2.03	1.60
Low	0.01	0.14	0.08	0.04	0.01	0.03	0.04	0.00	0.03	0.01	0.14	0.08	0.04	0.01	0.03	0.04	0.00	0.03
					β^{MRF}									$t(\beta^{MRF})$				
High	-0.25	-0.02	0.58	0.34	0.14	0.06	0.13	0.13	0.05	-1.88	-0.24	2.55	2.55	1.90	0.67	1.75	1.86	0.58
Med.	0.31	0.05	-0.09	0.58	0.13	0.04	0.13	0.33	0.25	2.23	0.75	-0.81	2.48	1.98	0.38	1.28	2.49	2.75
Low	0.26	0.14	0.32	-0.05	0.12	0.09	0.02	0.06	0.17	3.07	1.77	3.15	-0.84	2.55	1.99	0.44	1.30	2.33
					β^{HML}									$t(\beta^{HML})$				
High	-0.26	-0.22	5.81	0.05	0.07	0.08	0.34	0.28	0.22	-1.09	-1.04	12.14	0.18	0.54	0.55	3.47	2.99	1.49
Med.	-1.27	-0.26	-0.60	5.85	-0.25	-0.29	0.20	0.09	-0.18	-2.92	-2.06	-3.09	11.84	-2.41	-2.27	1.70	0.54	-1.12
Low	-0.60	-0.52	-1.08	-0.29	-0.01	-0.15	-0.14	0.11	0.07	-3.90	-4.26	-4.85	-3.06	-0.14	-2.24	-1.91	1.78	0.67
					β^{SMB}									$t(\beta^{SMB})$				
High	0.31	0.30	2.64	-0.09	0.00	-0.02	-0.44	-0.24	-0.30	1.21	1.35	5.87	-0.32	0.03	-0.14	-3.89	-2.15	-1.94
Med.	1.08	0.23	0.82	2.62	0.16	0.21	-0.26	-0.26	0.03	2.88	1.71	3.79	5.71	1.51	1.46	-1.77	-1.36	0.20
Low	0.55	0.46	0.93	0.40	-0.05	0.08	0.08	-0.14	-0.15	3.46	3.55	3.76	3.75	-0.68	1.24	0.96	-1.93	-1.42
					β^{WML}									$t(\beta^{WML})$				
High	-0.07	0.28	1.63	-0.55	-0.04	0.63	-0.26	0.04	0.49	-0.07	0.28	1.63	-0.55	-0.04	0.63	-0.26	0.04	0.49
Med.	-3.28	0.30	0.92	1.29	0.30	0.69	-0.55	0.23	0.65	-3.28	0.30	0.92	1.29	0.30	0.69	-0.55	0.23	0.65
Low	0.03	0.07	1.04	0.46	-0.01	0.23	0.42	-0.27	0.19	0.03	0.07	1.04	0.46	-0.01	0.23	0.42	-0.27	0.19
					Adj. R^2									s(e)				
High	0.03	0.03	0.96	0.12	0.07	0.07	0.10	0.12	0.10	0.24	0.15	0.68	0.17	0.08	0.11	0.09	0.05	0.08
Med.	0.50	0.06	0.25	0.96	0.11	0.08	0.07	0.14	0.15	0.33	0.08	0.16	0.72	0.06	0.12	0.10	0.11	0.12
Low	0.30	0.20	0.44	0.24	0.05	0.11	0.08	0.07	0.12	0.10	0.08	0.15	0.04	0.03	0.03	0.04	0.03	0.04

Table B.7: Time-Series Regressions CAPM & 3FM - France

This table reports the results for the CAPM (Panel A) & Fama and French (1993) 3FM (Panel B) time series regressions for our 27 sorted portfolios (cf. Table 3.2 on page 78). The first row per block depicts all high book-to-market portfolios, i.e., $P1$ to $P9$, with the market capitalization (size) increasing from left to right. The second row per block depicts all medium book-to-market portfolios, i.e., $P10$ to $P17$, with the market capitalization (size) increasing from left to right. The third row per blockshows all low book-to-market portfolios, i.e., $P20$ to $P27$, with the market capitalization (size) increasing from left to right. The shown adjusted R^2 values are adjusted for degrees of freedom. Statistics are corrected for heteroscedasticity and autocorrelation, up to three lags, using the Newey and West (1987) estimator.

	Market Capitalization (Size)																	
BV/MV	Small				Medium				Big	Small				Medium				Big
Panel A: Capital Asset Pricing Model																		
					α									$t(\alpha)$				
High	0.20	0.15	0.24	-0.02	0.01	0.04	0.03	0.00	0.01	4.05	4.37	4.91	-0.75	0.55	1.45	1.18	-0.11	0.40
Med.	-0.01	0.03	0.10	0.03	0.00	0.00	-0.04	-0.02	-0.02	-0.55	1.30	3.42	0.91	-0.08	0.16	-2.29	-1.31	-0.85
Low	-0.02	0.00	0.10	0.05	-0.06	-0.03	-0.03	-0.06	-0.04	-0.02	0.00	0.10	0.05	-0.06	-0.03	-0.03	-0.06	-0.04
					β^{MRF}									$t\left(\beta^{MRF}\right)$				
High	0.92	0.99	1.05	0.94	0.99	1.17	1.21	1.11	1.28	4.73	6.59	4.71	7.23	9.27	6.56	7.27	10.13	8.10
Med.	0.60	0.84	0.67	0.53	0.81	1.17	0.96	0.99	1.13	3.87	8.23	6.14	4.69	12.00	8.25	10.34	11.18	10.46
Low	0.93	0.86	0.98	0.44	0.53	0.61	0.79	0.68	0.75	8.01	8.07	7.15	5.29	8.98	12.09	11.30	8.37	12.86
					Adj. R^2									s(e)				
High	0.10	0.27	0.17	0.39	0.55	0.41	0.43	0.62	0.60	0.46	0.16	0.32	0.08	0.05	0.12	0.12	0.05	0.07
Med.	0.16	0.38	0.21	0.14	0.54	0.53	0.49	0.63	0.59	0.12	0.07	0.11	0.10	0.04	0.07	0.06	0.04	0.05
Low	0.35	0.43	0.36	0.18	0.40	0.53	0.58	0.47	0.67	0.10	0.06	0.10	0.05	0.03	0.02	0.03	0.03	0.02
Panel B: Fama and French (1993) Model																		
					α									$t(\alpha)$				
High	-0.07	-0.01	0.01	-0.05	-0.04	-0.02	0.03	-0.01	-0.02	-1.30	-0.24	0.34	-2.25	-2.43	-0.78	0.93	-0.80	-1.09
Med.	-0.08	0.01	0.03	-0.08	-0.03	0.02	-0.01	0.01	0.01	-2.84	0.26	1.35	-4.56	-1.78	0.49	-0.41	0.41	0.41
Low	-0.07	0.00	0.09	0.01	-0.08	-0.05	-0.03	-0.03	-0.03	-0.07	0.00	0.09	0.01	-0.08	-0.05	-0.03	-0.03	-0.03
					β^{MRF}									$t\left(\beta^{MRF}\right)$				
High	0.76	0.74	0.70	0.83	0.82	0.84	0.88	0.92	1.03	5.47	9.68	5.69	8.09	12.92	9.17	7.58	13.46	12.50
Med.	0.76	0.91	0.86	0.33	0.78	1.11	1.03	0.99	1.06	6.61	8.50	8.04	4.95	10.91	8.18	11.93	10.71	12.03
Low	1.14	1.06	1.28	0.58	0.52	0.61	0.77	0.75	0.78	9.61	9.46	12.18	7.05	7.28	10.62	10.09	9.96	12.11
					β^{HML}									$t\left(\beta^{HML}\right)$				
High	1.08	0.99	1.38	0.34	0.54	0.91	0.75	0.48	0.66	4.04	7.89	7.18	2.71	8.31	5.92	4.77	9.06	5.92
Med.	-0.21	-0.12	-0.25	0.74	0.14	0.10	-0.23	-0.09	0.09	-2.14	-1.44	-2.53	6.74	2.17	1.21	-2.55	-1.28	0.93
Low	-0.37	-0.42	-0.69	-0.22	0.05	0.06	0.05	-0.23	-0.10	-4.40	-3.40	-8.36	-3.37	0.70	1.26	0.97	-3.56	-1.97
					β^{SMB}									$t\left(\beta^{SMB}\right)$				
High	1.75	0.72	1.07	0.07	0.10	-0.14	-0.58	-0.27	-0.26	3.57	4.17	4.55	0.49	1.21	-1.00	-3.23	-4.15	-2.40
Med.	0.81	0.30	0.81	0.44	0.18	-0.22	-0.09	-0.19	-0.31	6.12	3.25	5.56	2.64	2.11	-1.09	-0.75	-2.02	-2.33
Low	0.73	0.41	0.58	0.57	0.11	0.17	-0.01	-0.04	-0.07	4.84	3.87	5.46	6.64	1.71	2.67	-0.07	-0.40	-1.17
					Adj. R^2									s(e)				
High	0.51	0.65	0.62	0.44	0.71	0.64	0.62	0.74	0.75	0.25	0.08	0.15	0.08	0.03	0.07	0.08	0.03	0.04
Med.	0.34	0.41	0.40	0.50	0.57	0.55	0.51	0.65	0.62	0.09	0.07	0.08	0.06	0.03	0.07	0.06	0.03	0.05
Low	0.52	0.56	0.57	0.39	0.41	0.56	0.58	0.51	0.68	0.07	0.05	0.07	0.04	0.03	0.02	0.03	0.03	0.02

Table B.8: Time-Series Regressions 4FM - France

This table reports the results for the time series regressions of our 27 sorted portfolios (cf. Table 3.2 on page 78) on the Carhart (1997) 4FM. The first row per block depicts all high book-to-market portfolios, i.e., $P1$ to $P9$, with the market capitalization (size) increasing from left to right. The second row per block depicts all medium book-to-market portfolios, i.e., $P10$ to $P17$, with the market capitalization (size) increasing from left to right. The third row per block shows all low book-to-market portfolios, i.e., $P20$ to $P27$, with the market capitalization (size) increasing from left to right. The shown adjusted R^2 values are adjusted for degrees of freedom. Statistics are corrected for heteroscedasticity and autocorrelation, up to three lags, using the Newey and West (1987) estimator.

	Market Capitalization (Size)																	
BV/MV	Small				Medium				Big	Small				Medium				Big
	α									$t\,(\alpha)$								
High	0.03	-0.03	-0.05	-0.04	-0.05	-0.04	0.07	-0.02	-0.06	1.14	-1.70	-1.90	-1.40	-2.91	-1.78	2.00	-0.89	-3.19
Med.	-0.03	0.00	0.03	-0.11	-0.05	0.01	0.02	0.01	-0.01	-1.04	0.07	1.09	-6.43	-2.48	0.34	0.59	0.21	-0.34
Low	-0.05	-0.01	0.05	0.01	-0.07	-0.06	-0.03	-0.01	-0.03	-0.05	-0.01	0.05	0.01	-0.07	-0.06	-0.03	-0.01	-0.03
	β^{MRF}									$t(\beta^{MRF})$								
High	1.05	0.65	0.53	0.87	0.79	0.77	0.99	0.91	0.92	6.91	8.67	5.13	8.53	12.42	8.56	7.96	12.36	13.18
Med.	0.90	0.90	0.84	0.25	0.74	1.10	1.10	0.98	1.01	6.88	9.35	8.18	3.51	9.83	7.60	12.41	10.03	11.65
Low	1.19	1.04	1.18	0.59	0.54	0.59	0.77	0.81	0.78	10.26	9.80	12.22	6.95	7.41	9.76	9.66	10.35	11.60
	β^{HML}									$t(\beta^{HML})$								
High	1.14	0.97	1.35	0.35	0.53	0.90	0.77	0.48	0.64	4.44	7.75	7.14	2.89	8.60	6.17	5.08	8.87	7.08
Med.	-0.19	-0.12	-0.26	0.72	0.13	0.09	-0.21	-0.09	0.08	-2.00	-1.45	-2.56	6.64	2.25	1.17	-2.64	-1.29	0.90
Low	-0.36	-0.42	-0.71	-0.21	0.05	0.06	0.05	-0.21	-0.10	-4.09	-3.43	-9.49	-3.30	0.78	1.24	0.96	-3.74	-1.97
	β^{SMB}									$t(\beta^{SMB})$								
High	1.24	0.86	1.35	-0.02	0.14	-0.01	-0.78	-0.26	-0.08	4.63	6.15	6.65	-0.15	2.02	-0.10	-4.27	-3.72	-0.88
Med.	0.57	0.33	0.84	0.59	0.26	-0.20	-0.21	-0.17	-0.22	3.65	3.43	5.56	3.99	2.93	-0.89	-1.75	-1.53	-1.52
Low	0.64	0.43	0.76	0.56	0.07	0.21	-0.01	-0.15	-0.08	3.93	3.75	7.04	6.12	1.14	3.30	-0.07	-1.41	-1.05
	β^{WML}									$t(\beta^{WML})$								
High	-2.21	0.61	1.24	-0.37	0.19	0.54	-0.84	0.04	0.78	-2.21	0.61	1.24	-0.37	0.19	0.54	-0.84	0.04	0.78
Med.	-1.02	0.12	0.16	0.63	0.33	0.10	-0.54	0.09	0.40	-1.02	0.12	0.16	0.63	0.33	0.10	-0.54	0.09	0.40
Low	-0.40	0.09	0.82	-0.05	-0.16	0.17	0.00	-0.49	-0.02	-0.40	0.09	0.82	-0.05	-0.16	0.17	0.00	-0.49	-0.02
	Adj. R^2									s(e)								
High	0.64	0.68	0.68	0.46	0.72	0.66	0.67	0.74	0.80	0.18	0.07	0.13	0.08	0.03	0.07	0.07	0.03	0.03
Med.	0.45	0.41	0.41	0.55	0.59	0.55	0.55	0.65	0.64	0.08	0.07	0.08	0.06	0.03	0.07	0.05	0.03	0.05
Low	0.53	0.56	0.63	0.39	0.42	0.57	0.58	0.57	0.68	0.07	0.05	0.06	0.04	0.03	0.02	0.03	0.03	0.02

Table B.9: Time-Series Regressions CAPM & 3FM - Germany

This table reports the results for the CAPM (Panel A) & Fama and French (1993) 3FM (Panel B) time series regressions for our 27 sorted portfolios (cf. Table 3.2 on page 78). The first row per block depicts all high book-to-market portfolios, i.e., $P1$ to $P9$, with the market capitalization (size) increasing from left to right. The second row per block depicts all medium book-to-market portfolios, i.e., $P10$ to $P17$, with the market capitalization (size) increasing from left to right. The third row per blockshows all low book-to-market portfolios, i.e., $P20$ to $P27$, with the market capitalization (size) increasing from left to right. The shown adjusted R^2 values are adjusted for degrees of freedom. Statistics are corrected for heteroscedasticity and autocorrelation, up to three lags, using the Newey and West (1987) estimator.

	Market Capitalization (Size)																	
BV/MV	Small				Medium				Big	Small				Medium				Big
Panel A: Capital Asset Pricing Model																		
					α									$t(\alpha)$				
High	0.10	0.11	0.30	0.02	0.00	0.04	-0.02	-0.03	-0.03	2.75	3.52	5.23	0.77	0.24	1.66	-1.46	-1.98	-1.42
Med.	0.01	0.01	0.09	-0.01	-0.05	0.04	-0.06	-0.05	0.00	0.27	0.66	2.91	-0.34	-3.34	2.04	-3.95	-4.59	0.26
Low	-0.04	0.00	0.06	0.04	-0.07	-0.06	0.00	-0.07	-0.06	-0.04	0.00	0.06	0.04	-0.07	-0.06	0.00	-0.07	-0.06
					β^{MRF}									$t\left(\beta^{MRF}\right)$				
High	0.93	0.99	1.56	0.84	0.87	1.02	1.05	0.84	0.99	4.21	5.35	4.64	8.46	10.26	9.78	12.15	11.83	10.89
Med.	0.89	0.69	0.88	0.46	0.75	0.69	0.84	0.92	1.08	7.03	7.60	6.62	5.92	10.00	7.73	11.58	15.88	12.56
Low	0.85	0.87	0.98	0.68	0.65	0.62	0.55	0.64	0.74	8.58	11.89	6.95	5.88	7.55	9.52	7.44	9.76	16.70
					Adj. R^2									s(e)				
High	0.18	0.26	0.20	0.39	0.53	0.43	0.62	0.64	0.58	0.20	0.14	0.47	0.06	0.03	0.07	0.03	0.02	0.04
Med.	0.31	0.33	0.24	0.22	0.47	0.35	0.56	0.73	0.63	0.09	0.05	0.12	0.04	0.03	0.04	0.03	0.02	0.03
Low	0.36	0.47	0.29	0.23	0.42	0.47	0.37	0.56	0.73	0.06	0.04	0.12	0.08	0.03	0.02	0.03	0.02	0.01
Panel B: Fama and French (1993) Model																		
					α									$t(\alpha)$				
High	-0.12	-0.05	-0.05	-0.06	-0.04	-0.01	-0.06	-0.06	-0.07	-4.22	-2.36	-1.42	-3.10	-2.52	-0.54	-3.39	-3.96	-3.37
Med.	-0.10	-0.06	0.02	-0.07	-0.09	0.03	-0.07	-0.05	0.00	-4.92	-3.68	0.75	-4.75	-5.35	1.28	-4.26	-3.88	-0.26
Low	-0.09	-0.02	-0.01	-0.02	-0.11	-0.10	-0.01	-0.09	-0.07	-0.09	-0.02	-0.01	-0.02	-0.11	-0.10	-0.01	-0.09	-0.07
					β^{MRF}									$t\left(\beta^{MRF}\right)$				
High	0.50	0.70	0.84	0.63	0.72	0.86	0.91	0.72	0.84	5.42	7.98	6.47	8.01	7.44	8.57	12.09	10.54	8.38
Med.	0.79	0.61	0.97	0.29	0.72	0.72	0.84	0.93	1.02	8.83	8.40	7.33	5.69	9.48	7.32	10.55	14.01	12.01
Low	0.83	0.93	1.05	0.73	0.64	0.59	0.56	0.64	0.75	9.03	11.59	6.57	6.70	9.28	9.47	7.19	9.51	14.69
					β^{HML}									$t\left(\beta^{HML}\right)$				
High	1.02	0.61	1.83	0.63	0.48	0.57	0.55	0.44	0.51	4.24	3.86	5.94	4.63	2.78	3.56	4.18	4.67	3.19
Med.	-0.03	0.01	-0.82	0.52	-0.05	-0.18	-0.06	-0.04	0.23	-0.24	0.10	-3.41	4.96	-0.53	-1.49	-0.53	-0.55	1.53
Low	-0.17	-0.43	-0.67	-0.62	-0.16	-0.04	-0.13	-0.10	-0.05	-0.99	-3.08	-2.32	-3.07	-1.75	-0.48	-1.33	-1.08	-0.74
					β^{SMB}									$t\left(\beta^{SMB}\right)$				
High	1.35	1.08	1.93	0.25	0.10	0.04	-0.06	-0.04	0.00	9.33	9.36	10.24	2.88	1.05	0.37	-0.67	-0.66	0.00
Med.	0.99	0.70	1.25	0.22	0.38	0.23	0.16	0.03	-0.08	10.71	9.70	10.23	3.11	5.54	3.30	2.30	0.71	-0.75
Low	0.62	0.51	1.09	1.07	0.50	0.35	0.23	0.21	0.07	4.92	4.75	7.11	9.99	6.59	6.22	3.88	3.60	1.59
					Adj. R^2									s(e)				
High	0.73	0.67	0.74	0.55	0.62	0.49	0.67	0.70	0.63	0.07	0.06	0.15	0.04	0.03	0.06	0.03	0.02	0.03
Med.	0.63	0.62	0.55	0.45	0.56	0.37	0.57	0.73	0.64	0.05	0.03	0.07	0.03	0.03	0.04	0.03	0.02	0.03
Low	0.49	0.57	0.50	0.59	0.59	0.58	0.41	0.59	0.74	0.05	0.03	0.08	0.04	0.02	0.02	0.02	0.01	0.01

Table B.10: Time-Series Regressions 4FM - Germany

This table reports the results for the time series regressions of our 27 sorted portfolios (cf. Table 3.2 on page 78) on the Carhart (1997) 4FM. The first row per block depicts all high book-to-market portfolios, i.e., $P1$ to $P9$, with the market capitalization (size) increasing from left to right. The second row per block depicts all medium book-to-market portfolios, i.e., $P10$ to $P17$, with the market capitalization (size) increasing from left to right. The third row per block shows all low book-to-market portfolios, i.e., $P20$ to $P27$, with the market capitalization (size) increasing from left to right. The shown adjusted R^2 values are adjusted for degrees of freedom. Statistics are corrected for heteroscedasticity and autocorrelation, up to three lags, using the Newey and West (1987) estimator.

	Market Capitalization (Size)																	
BV/MV	Small				Medium				Big	Small				Medium				Big
					α									$t(\alpha)$				
High	-0.08	-0.05	-0.12	-0.04	-0.05	-0.05	-0.05	-0.06	-0.10	-3.33	-2.34	-3.41	-2.07	-2.96	-2.14	-2.37	-3.86	-6.30
Med.	-0.08	-0.07	0.00	-0.08	-0.10	0.00	-0.07	-0.07	-0.03	-3.74	-4.16	-0.06	-5.63	-5.53	0.18	-3.66	-4.77	-1.97
Low	-0.06	-0.03	-0.06	-0.04	-0.10	-0.10	-0.03	-0.08	-0.08	-0.06	-0.03	-0.06	-0.04	-0.10	-0.10	-0.03	-0.08	-0.08
					β^{MRF}									$t(\beta^{MRF})$				
High	0.68	0.69	0.53	0.71	0.69	0.71	0.96	0.71	0.70	7.00	7.80	3.64	8.13	7.09	8.32	10.93	10.35	8.39
Med.	0.84	0.56	0.86	0.25	0.69	0.61	0.86	0.87	0.89	9.09	7.17	7.06	5.25	8.61	7.41	10.69	14.40	12.85
Low	0.97	0.88	0.82	0.64	0.69	0.56	0.47	0.65	0.70	11.55	11.65	6.95	6.67	9.11	8.56	7.41	9.45	14.76
					β^{HML}									$t(\beta^{HML})$				
High	0.98	0.62	1.90	0.61	0.49	0.60	0.53	0.44	0.54	4.83	3.85	7.65	4.44	2.95	4.38	4.06	4.82	4.36
Med.	-0.05	0.02	-0.79	0.53	-0.05	-0.16	-0.06	-0.03	0.25	-0.30	0.22	-3.52	5.43	-0.47	-1.48	-0.56	-0.44	2.01
Low	-0.20	-0.42	-0.62	-0.60	-0.17	-0.03	-0.11	-0.10	-0.04	-1.22	-3.25	-2.49	-3.19	-1.83	-0.42	-1.34	-1.09	-0.65
					β^{SMB}									$t(\beta^{SMB})$				
High	1.36	1.08	1.92	0.26	0.10	0.04	-0.06	-0.04	0.00	11.80	9.26	13.09	3.06	1.08	0.39	-0.68	-0.67	-0.06
Med.	0.99	0.70	1.25	0.22	0.38	0.22	0.16	0.03	-0.08	10.18	9.83	10.59	3.40	5.40	3.08	2.30	0.72	-0.96
Low	0.63	0.50	1.08	1.07	0.51	0.35	0.22	0.21	0.07	5.51	5.27	8.08	10.50	7.17	6.07	3.79	3.59	1.68
					β^{WML}									$t(\beta^{WML})$				
High	-1.05	0.09	1.81	-0.45	0.19	0.85	-0.33	0.09	0.85	-1.05	0.09	1.81	-0.45	0.19	0.85	-0.33	0.09	0.85
Med.	-0.30	0.29	0.61	0.23	0.20	0.61	-0.11	0.34	0.74	-0.30	0.29	0.61	0.23	0.20	0.61	-0.11	0.34	0.74
Low	-0.79	0.32	1.35	0.51	-0.27	0.16	0.53	-0.06	0.28	-0.79	0.32	1.35	0.51	-0.27	0.16	0.53	-0.06	0.28
					Adj. R^2									s(e)				
High	0.77	0.67	0.80	0.57	0.62	0.55	0.68	0.70	0.72	0.06	0.06	0.12	0.04	0.03	0.05	0.03	0.02	0.02
Med.	0.64	0.63	0.57	0.46	0.57	0.42	0.57	0.75	0.70	0.05	0.03	0.07	0.03	0.03	0.04	0.03	0.01	0.03
Low	0.55	0.58	0.62	0.62	0.61	0.59	0.48	0.59	0.76	0.05	0.03	0.06	0.04	0.02	0.02	0.02	0.01	0.01

Table B.11: Time-Series Regressions CAPM & 3FM - Greece

This table reports the results for the CAPM (Panel A) & Fama and French (1993) 3FM (Panel B) time series regressions for our 27 sorted portfolios (cf. Table 3.2 on page 78). The first row per block depicts all high book-to-market portfolios, i.e., $P1$ to $P9$, with the market capitalization (size) increasing from left to right. The second row per block depicts all medium book-to-market portfolios, i.e., $P10$ to $P17$, with the market capitalization (size) increasing from left to right. The third row per blockshows all low book-to-market portfolios, i.e., $P20$ to $P27$, with the market capitalization (size) increasing from left to right. The shown adjusted R^2 values are adjusted for degrees of freedom. Statistics are corrected for heteroscedasticity and autocorrelation, up to three lags, using the Newey and West (1987) estimator.

	Market Capitalization (Size)																	
BV/MV	Small				Medium				Big	Small				Medium				Big
Panel A: Capital Asset Pricing Model																		
					α									$t(\alpha)$				
High	0.23	0.18	0.05	0.10	0.07	0.16	0.03	0.00	0.08	1.83	2.02	0.43	1.94	1.65	2.40	0.94	0.01	1.19
Med.	0.16	0.31	0.31	-0.07	-0.01	-0.11	0.00	-0.01	0.00	1.34	3.79	2.75	-1.15	-0.50	-2.17	0.08	-0.95	-0.10
Low	-0.01	-0.02	0.16	0.12	-0.02	-0.03	-0.07	-0.03	-0.02	-0.01	-0.02	0.16	0.12	-0.02	-0.03	-0.07	-0.03	-0.02
					β^{MRF}									$t\left(\beta^{MRF}\right)$				
High	1.34	1.47	1.14	1.39	1.47	1.93	1.08	0.85	0.88	4.65	6.90	3.39	8.00	11.04	8.53	7.90	8.46	5.93
Med.	1.83	2.06	1.87	0.83	1.02	0.88	1.35	1.24	1.15	4.63	8.77	7.12	4.31	9.12	4.11	6.72	17.35	8.38
Low	1.01	1.48	0.94	0.94	0.82	0.72	0.52	0.68	0.89	4.28	15.09	3.23	7.34	13.93	9.73	4.23	6.77	16.43
					Adj. R^2									s(e)				
High	0.18	0.38	0.20	0.52	0.67	0.53	0.64	0.70	0.27	0.53	0.23	0.34	0.12	0.07	0.23	0.05	0.02	0.14
Med.	0.33	0.57	0.31	0.29	0.61	0.37	0.71	0.91	0.65	0.46	0.22	0.51	0.11	0.04	0.09	0.05	0.01	0.05
Low	0.18	0.74	0.25	0.32	0.70	0.63	0.35	0.72	0.91	0.31	0.05	0.17	0.13	0.02	0.02	0.03	0.01	0.01
Panel B: Fama and French (1993) Model																		
					α									$t(\alpha)$				
High	-0.07	-0.02	-0.18	0.03	-0.01	0.02	0.03	-0.01	0.03	-1.36	-0.76	-2.95	0.71	-0.33	0.61	1.02	-0.43	0.44
Med.	-0.06	0.13	0.07	-0.19	-0.05	-0.19	0.02	0.00	0.00	-0.84	2.70	1.27	-4.46	-1.82	-4.80	0.48	-0.24	0.12
Low	-0.06	-0.05	0.16	0.01	-0.05	-0.05	-0.12	-0.02	-0.01	-0.06	-0.05	0.16	0.01	-0.05	-0.05	-0.12	-0.02	-0.01
					β^{MRF}									$t\left(\beta^{MRF}\right)$				
High	0.20	0.75	0.37	1.09	1.13	1.39	1.02	0.78	0.65	0.87	6.79	1.69	6.90	8.52	8.81	9.18	9.07	3.48
Med.	1.02	1.37	1.14	0.41	0.93	0.63	1.39	1.26	1.19	3.05	7.25	4.78	2.70	9.99	3.64	7.34	16.81	7.49
Low	0.96	1.41	1.05	0.59	0.72	0.67	0.36	0.71	0.91	3.27	12.69	4.01	4.93	13.46	10.26	3.65	7.59	16.72
					β^{HML}									$t\left(\beta^{HML}\right)$				
High	1.55	0.66	0.38	0.84	0.57	0.94	0.44	0.31	0.57	2.97	3.17	1.34	3.64	2.41	2.21	3.05	2.99	1.75
Med.	0.87	1.02	-0.60	0.28	-0.19	-0.18	0.11	0.11	-0.13	1.34	4.53	-1.48	1.59	-1.24	-0.80	0.41	1.35	-0.58
Low	-1.25	-0.22	-0.96	-0.30	0.03	-0.11	-0.08	0.05	0.09	-3.15	-1.55	-2.25	-1.52	0.22	-0.99	-0.64	0.39	1.51
					β^{SMB}									$t\left(\beta^{SMB}\right)$				
High	1.05	0.93	1.24	-0.06	0.23	0.33	-0.23	-0.12	0.02	3.53	4.48	4.53	-0.35	1.61	1.29	-1.78	-1.92	0.09
Med.	0.92	0.58	1.93	0.61	0.33	0.65	-0.17	-0.13	0.03	1.90	2.90	6.32	4.09	2.91	3.99	-0.84	-1.99	0.18
Low	1.08	0.31	0.53	0.94	0.17	0.19	0.38	-0.11	-0.12	3.89	3.60	1.86	6.27	1.86	2.38	4.05	-1.03	-2.41
					Adj. R^2									s(e)				
High	0.68	0.76	0.63	0.61	0.80	0.67	0.67	0.73	0.32	0.21	0.09	0.16	0.10	0.04	0.16	0.04	0.02	0.13
Med.	0.57	0.81	0.66	0.61	0.66	0.57	0.71	0.92	0.65	0.29	0.10	0.26	0.06	0.04	0.06	0.05	0.01	0.05
Low	0.33	0.76	0.34	0.65	0.74	0.66	0.56	0.72	0.92	0.25	0.05	0.15	0.06	0.02	0.02	0.02	0.01	0.00

Table B.12: Time-Series Regressions 4FM - Greece

This table reports the results for the time series regressions of our 27 sorted portfolios (cf. Table 3.2 on page 78) on the Carhart (1997) 4FM. The first row per block depicts all high book-to-market portfolios, i.e., $P1$ to $P9$, with the market capitalization (size) increasing from left to right. The second row per block depicts all medium book-to-market portfolios, i.e., $P10$ to $P17$, with the market capitalization (size) increasing from left to right. The third row per block shows all low book-to-market portfolios, i.e., $P20$ to $P27$, with the market capitalization (size) increasing from left to right. The shown adjusted R^2 values are adjusted for degrees of freedom. Statistics are corrected for heteroscedasticity and autocorrelation, up to three lags, using the Newey and West (1987) estimator.

	Market Capitalization (Size)																	
BV/MV	Small				Medium				Big	Small				Medium				Big
	α									$t\,(\alpha)$								
High	-0.04	-0.05	-0.21	0.05	-0.01	-0.01	0.04	0.00	0.03	-0.70	-1.38	-3.85	1.29	-0.22	-0.18	1.79	-0.06	0.41
Med.	0.00	0.13	0.06	-0.20	-0.05	-0.21	0.03	0.00	0.00	0.03	2.54	1.17	-5.21	-1.91	-6.79	0.81	-0.10	0.04
Low	-0.02	-0.05	0.13	0.00	-0.05	-0.05	-0.13	-0.01	-0.01	-0.02	-0.05	0.13	0.00	-0.05	-0.05	-0.13	-0.01	-0.01
	β^{MRF}									t(β^{MRF})								
High	0.29	0.67	0.26	1.16	1.15	1.30	1.09	0.81	0.65	1.02	4.60	1.31	7.25	9.05	6.71	13.85	9.23	3.47
Med.	1.24	1.38	1.12	0.36	0.92	0.57	1.43	1.27	1.18	6.12	7.10	4.58	2.52	10.29	4.21	8.32	17.46	7.35
Low	1.11	1.40	0.93	0.58	0.73	0.67	0.32	0.73	0.92	4.98	12.76	4.76	4.75	13.46	10.56	4.29	8.74	17.34
	β^{HML}									t(β^{HML})								
High	1.33	0.86	0.67	0.65	0.53	1.18	0.27	0.24	0.57	2.60	3.50	2.67	3.14	2.31	2.57	1.84	2.26	1.49
Med.	0.30	1.00	-0.55	0.42	-0.17	-0.01	0.01	0.09	-0.11	0.63	4.26	-1.36	2.60	-1.02	-0.07	0.03	1.17	-0.44
Low	-1.62	-0.20	-0.64	-0.28	0.02	-0.10	0.02	0.00	0.08	-4.18	-1.44	-1.88	-1.42	0.11	-0.87	0.21	-0.03	1.38
	β^{SMB}									t(β^{SMB})								
High	1.07	0.90	1.21	-0.04	0.23	0.31	-0.21	-0.11	0.02	4.49	4.82	5.98	-0.20	1.62	1.33	-2.37	-1.87	0.08
Med.	0.99	0.58	1.92	0.60	0.33	0.63	-0.16	-0.12	0.02	3.05	3.02	6.35	5.10	2.86	4.41	-0.82	-2.07	0.15
Low	1.12	0.30	0.49	0.94	0.17	0.19	0.37	-0.10	-0.11	3.59	3.73	2.33	6.31	1.93	2.36	4.38	-1.03	-2.54
	β^{WML}									t(β^{WML})								
High	-0.82	0.73	1.06	-0.71	-0.15	0.86	-0.62	-0.28	0.00	-0.82	0.73	1.06	-0.71	-0.15	0.86	-0.62	-0.28	0.00
Med.	-2.11	-0.10	0.19	0.50	0.06	0.62	-0.38	-0.08	0.10	-2.11	-0.10	0.19	0.50	0.06	0.62	-0.38	-0.08	0.10
Low	-1.35	0.08	1.18	0.08	-0.05	0.02	0.37	-0.21	-0.06	-1.35	0.08	1.18	0.08	-0.05	0.02	0.37	-0.21	-0.06
	Adj. R^2									s(e)								
High	0.72	0.81	0.72	0.68	0.80	0.72	0.77	0.77	0.32	0.19	0.07	0.12	0.08	0.04	0.13	0.03	0.02	0.13
Med.	0.80	0.81	0.66	0.66	0.66	0.66	0.74	0.92	0.65	0.14	0.10	0.26	0.05	0.04	0.05	0.05	0.01	0.05
Low	0.49	0.76	0.55	0.65	0.74	0.66	0.65	0.76	0.92	0.19	0.05	0.10	0.06	0.02	0.02	0.02	0.01	0.00

Table B.13: Time-Series Regressions CAPM & 3FM - Ireland

This table reports the results for the CAPM (Panel A) & Fama and French (1993) 3FM (Panel B) time series regressions for our 27 sorted portfolios (cf. Table 3.2 on page 78). The first row per block depicts all high book-to-market portfolios, i.e., $P1$ to $P9$, with the market capitalization (size) increasing from left to right. The second row per block depicts all medium book-to-market portfolios, i.e., $P10$ to $P17$, with the market capitalization (size) increasing from left to right. The third row per blockshows all low book-to-market portfolios, i.e., $P20$ to $P27$, with the market capitalization (size) increasing from left to right. The shown adjusted R^2 values are adjusted for degrees of freedom. Statistics are corrected for heteroscedasticity and autocorrelation, up to three lags, using the Newey and West (1987) estimator.

	Market Capitalization (Size)																	
BV/MV	Small				Medium				Big	Small				Medium				Big
Panel A: Capital Asset Pricing Model																		
					α									$t(\alpha)$				
High	0.40	0.31	0.37	0.20	0.17	0.08	0.13	0.18	0.18	3.03	2.74	3.10	2.04	4.28	1.39	1.80	2.83	1.95
Med.	0.13	0.16	0.24	0.37	0.05	0.20	0.09	0.06	0.12	1.27	1.87	2.77	3.11	1.56	3.19	2.38	1.69	1.65
Low	-0.05	0.00	-0.06	0.08	0.03	0.02	0.07	0.01	0.00	-0.05	0.00	-0.06	0.08	0.03	0.02	0.07	0.01	0.00
					β^{MRF}									$t\left(\beta^{MRF}\right)$				
High	2.12	1.56	1.40	0.90	1.34	0.91	0.32	0.74	1.90	2.25	2.22	2.14	1.57	5.78	2.51	0.83	2.08	4.07
Med.	1.09	1.39	1.40	1.39	0.92	0.79	0.95	0.88	1.47	3.11	5.31	3.90	2.13	6.02	2.01	3.99	6.44	2.65
Low	1.47	0.72	1.83	0.72	0.49	0.68	0.41	0.49	0.57	4.02	3.55	5.35	3.94	2.99	5.84	2.04	4.07	7.26
					Adj. R^2									s(e)				
High	0.11	0.07	0.07	0.05	0.42	0.13	0.00	0.07	0.22	1.10	0.96	0.78	0.40	0.08	0.18	0.24	0.22	0.42
Med.	0.05	0.09	0.12	0.07	0.39	0.08	0.16	0.26	0.10	0.67	0.62	0.44	0.78	0.04	0.23	0.15	0.07	0.63
Low	0.24	0.09	0.31	0.13	0.14	0.39	0.08	0.17	0.38	0.22	0.16	0.25	0.11	0.05	0.02	0.06	0.04	0.02
Panel B: Fama and French (1993) Model																		
					α									$t(\alpha)$				
High	-0.05	-0.02	0.06	-0.10	0.07	-0.05	-0.03	0.01	0.03	-0.48	-0.21	0.69	-1.83	1.46	-0.82	-0.35	0.18	0.34
Med.	0.00	0.08	0.23	0.06	0.03	0.19	0.05	0.07	-0.08	0.06	1.14	2.23	0.71	0.75	2.07	0.90	1.68	-1.05
Low	-0.15	0.03	-0.08	0.08	-0.01	0.00	0.06	-0.01	0.01	-0.15	0.03	-0.08	0.08	-0.01	0.00	0.06	-0.01	0.01
					β^{MRF}									$t\left(\beta^{MRF}\right)$				
High	0.93	0.46	0.29	0.43	1.19	0.63	0.22	0.59	1.87	2.69	1.21	0.72	1.36	6.61	1.98	0.58	2.81	3.74
Med.	0.25	0.86	1.36	0.28	0.97	0.95	0.91	0.96	1.21	0.62	3.27	3.30	0.71	6.85	2.27	4.46	6.24	4.20
Low	1.12	0.49	1.58	0.69	0.42	0.71	0.50	0.47	0.61	3.59	2.25	4.52	3.37	2.65	6.53	2.30	4.69	7.48
					β^{HML}									$t\left(\beta^{HML}\right)$				
High	1.89	1.17	1.07	1.50	0.50	0.62	0.88	1.00	0.89	2.92	2.74	2.26	6.91	3.83	3.83	4.47	7.15	3.25
Med.	0.10	0.10	-0.01	1.07	0.19	0.22	0.21	-0.04	1.07	0.37	0.43	-0.03	2.25	2.18	1.00	1.03	-0.50	1.99
Low	0.36	-0.32	-0.11	0.01	0.17	0.15	0.13	0.12	0.00	1.70	-2.43	-0.61	0.07	1.96	2.37	1.16	1.21	0.01
					β^{SMB}									$t\left(\beta^{SMB}\right)$				
High	0.67	1.04	1.13	-0.28	-0.10	0.03	-0.46	-0.46	-0.59	1.60	2.31	3.06	-1.58	-1.01	0.19	-3.20	-2.81	-1.84
Med.	1.37	0.84	0.09	1.13	-0.23	-0.45	-0.09	-0.10	-0.33	2.41	2.16	0.29	3.07	-3.01	-3.69	-0.72	-1.34	-1.49
Low	0.34	0.63	0.50	0.03	0.00	-0.17	-0.24	-0.06	-0.07	1.35	3.56	2.76	0.20	-0.02	-2.97	-3.93	-0.95	-1.95
					Adj. R^2									s(e)				
High	0.45	0.35	0.42	0.46	0.55	0.29	0.25	0.39	0.34	0.68	0.67	0.49	0.23	0.07	0.15	0.18	0.15	0.36
Med.	0.31	0.18	0.11	0.42	0.46	0.13	0.17	0.26	0.21	0.48	0.56	0.45	0.49	0.04	0.21	0.15	0.07	0.55
Low	0.33	0.28	0.36	0.11	0.17	0.46	0.15	0.18	0.38	0.20	0.13	0.23	0.11	0.04	0.02	0.05	0.04	0.02

Table B.14: Time-Series Regressions 4FM - Ireland

This table reports the results for the time series regressions of our 27 sorted portfolios (cf. Table 3.2 on page 78) on the Carhart (1997) 4FM. The first row per block depicts all high book-to-market portfolios, i.e., $P1$ to $P9$, with the market capitalization (size) increasing from left to right. The second row per block depicts all medium book-to-market portfolios, i.e., $P10$ to $P17$, with the market capitalization (size) increasing from left to right. The third row per block shows all low book-to-market portfolios, i.e., $P20$ to $P27$, with the market capitalization (size) increasing from left to right. The shown adjusted R^2 values are adjusted for degrees of freedom. Statistics are corrected for heteroscedasticity and autocorrelation, up to three lags, using the Newey and West (1987) estimator.

	Market Capitalization (Size)																	
BV/MV	Small				Medium				Big	Small				Medium				Big
					α									$t(\alpha)$				
High	0.02	-0.07	0.01	-0.07	0.06	-0.05	0.01	0.01	-0.02	0.24	-0.75	0.08	-1.26	1.30	-0.87	0.19	0.20	-0.29
Med.	0.04	0.07	0.19	0.01	0.03	0.17	0.08	0.07	-0.12	0.55	1.08	1.96	0.09	0.73	2.03	1.41	1.69	-1.51
Low	-0.12	0.02	-0.10	0.06	0.00	0.00	0.05	0.00	0.01	-0.12	0.02	-0.10	0.06	0.00	0.00	0.05	0.00	0.01
					β^{MRF}									$t(\beta^{MRF})$				
High	1.72	-0.01	-0.22	0.72	1.14	0.62	0.59	0.60	1.34	3.19	-0.04	-0.56	2.60	5.81	2.00	1.61	2.78	3.53
Med.	0.66	0.80	0.95	-0.23	0.97	0.79	1.18	0.95	0.81	1.83	2.45	2.22	-0.57	6.42	2.06	5.05	5.87	3.76
Low	1.41	0.42	1.35	0.49	0.50	0.70	0.41	0.60	0.61	4.48	1.78	3.78	2.28	3.10	6.09	2.08	5.17	6.91
					β^{HML}									$t(\beta^{HML})$				
High	1.44	1.44	1.36	1.33	0.53	0.63	0.66	0.99	1.20	3.47	3.24	3.06	7.42	3.50	3.45	4.55	6.21	4.14
Med.	-0.14	0.13	0.22	1.36	0.19	0.31	0.05	-0.04	1.30	-0.47	0.53	0.86	3.05	2.14	1.54	0.31	-0.44	2.25
Low	0.20	-0.28	0.03	0.13	0.12	0.16	0.18	0.05	0.01	0.93	-2.01	0.15	1.02	1.48	2.40	1.71	0.54	0.12
					β^{SMB}									$t(\beta^{SMB})$				
High	0.20	1.32	1.44	-0.46	-0.07	0.03	-0.68	-0.47	-0.27	0.42	2.73	4.25	-2.48	-0.61	0.20	-5.26	-3.06	-1.52
Med.	1.13	0.87	0.33	1.44	-0.23	-0.35	-0.24	-0.10	-0.08	2.32	1.91	1.07	4.26	-2.65	-2.68	-1.75	-1.08	-0.36
Low	0.16	0.68	0.64	0.15	-0.05	-0.16	-0.19	-0.13	-0.07	0.65	3.61	3.19	1.00	-0.76	-2.58	-2.87	-1.92	-1.55
					β^{WML}									$t(\beta^{WML})$				
High	-1.81	1.09	1.19	-0.68	0.11	0.03	-0.86	-0.02	1.23	-1.81	1.09	1.19	-0.68	0.11	0.03	-0.86	-0.02	1.23
Med.	-0.94	0.12	0.93	1.19	0.01	0.38	-0.61	0.03	0.93	-0.94	0.12	0.93	1.19	0.01	0.38	-0.61	0.03	0.93
Low	-0.67	0.18	0.54	0.47	-0.18	0.02	0.20	-0.30	0.02	-0.67	0.18	0.54	0.47	-0.18	0.02	0.20	-0.30	0.02
					Adj. R^2									s(e)				
High	0.58	0.40	0.50	0.52	0.55	0.29	0.39	0.39	0.47	0.53	0.62	0.43	0.21	0.07	0.15	0.15	0.15	0.29
Med.	0.37	0.18	0.19	0.50	0.46	0.16	0.27	0.26	0.27	0.44	0.56	0.41	0.43	0.04	0.21	0.13	0.07	0.52
Low	0.40	0.29	0.40	0.20	0.20	0.46	0.18	0.28	0.38	0.18	0.13	0.22	0.10	0.04	0.02	0.05	0.03	0.02

Table B.15: Time-Series Regressions CAPM & 3FM - Italy

This table reports the results for the CAPM (Panel A) & Fama and French (1993) 3FM (Panel B) time series regressions for our 27 sorted portfolios (cf. Table 3.2 on page 78). The first row per block depicts all high book-to-market portfolios, i.e., $P1$ to $P9$, with the market capitalization (size) increasing from left to right. The second row per block depicts all medium book-to-market portfolios, i.e., $P10$ to $P17$, with the market capitalization (size) increasing from left to right. The third row per blockshows all low book-to-market portfolios, i.e., $P20$ to $P27$, with the market capitalization (size) increasing from left to right. The shown adjusted R^2 values are adjusted for degrees of freedom. Statistics are corrected for heteroscedasticity and autocorrelation, up to three lags, using the Newey and West (1987) estimator.

	Market Capitalization (Size)																	
BV/MV	Small				Medium				Big	Small				Medium				Big
Panel A: Capital Asset Pricing Model																		
	α									$t(\alpha)$								
High	0.05	0.10	0.10	-0.05	0.02	0.02	-0.03	-0.05	0.02	1.91	3.53	2.70	-2.55	1.04	0.84	-1.08	-2.42	0.71
Med.	-0.03	0.06	0.03	-0.04	-0.04	0.01	-0.02	-0.02	-0.03	-1.18	1.90	1.02	-2.63	-1.70	0.34	-0.70	-1.11	-1.46
Low	-0.04	0.00	0.08	0.00	-0.06	-0.05	-0.02	-0.04	-0.04	-0.04	0.00	0.08	0.00	-0.06	-0.05	-0.02	-0.04	-0.04
	β^{MRF}									$t\left(\beta^{MRF}\right)$								
High	1.21	1.20	0.98	1.10	1.21	1.39	1.17	1.21	1.45	16.00	11.31	9.35	11.86	11.09	9.07	9.36	17.15	13.81
Med.	1.21	1.17	1.19	0.44	0.83	1.24	1.43	1.24	1.12	7.43	10.35	9.08	8.08	9.84	10.80	13.23	7.57	7.41
Low	1.05	0.99	1.08	0.84	0.80	0.66	0.89	0.99	0.98	8.06	5.33	5.71	8.93	6.69	9.52	11.85	13.36	7.35
	Adj. R^2									s(e)								
High	0.61	0.57	0.34	0.68	0.65	0.62	0.51	0.69	0.67	0.06	0.07	0.12	0.04	0.05	0.07	0.08	0.04	0.07
Med.	0.61	0.44	0.36	0.45	0.52	0.69	0.54	0.63	0.59	0.06	0.11	0.16	0.01	0.04	0.04	0.11	0.06	0.05
Low	0.36	0.23	0.26	0.36	0.52	0.53	0.69	0.55	0.62	0.12	0.21	0.21	0.08	0.04	0.02	0.02	0.05	0.04
Panel B: Fama and French (1993) Model																		
	α									$t(\alpha)$								
High	-0.02	0.01	-0.01	-0.09	-0.02	-0.04	-0.07	-0.08	0.01	-0.71	0.31	-0.51	-5.47	-1.21	-1.74	-2.95	-3.96	0.31
Med.	-0.05	0.00	-0.01	-0.07	-0.07	0.00	0.05	0.00	-0.04	-2.20	0.05	-0.32	-5.81	-3.14	0.18	1.42	-0.20	-1.79
Low	-0.08	-0.04	0.03	-0.03	-0.09	-0.07	-0.02	0.00	-0.02	-0.08	-0.04	0.03	-0.03	-0.09	-0.07	-0.02	0.00	-0.02
	β^{MRF}									$t\left(\beta^{MRF}\right)$								
High	0.90	0.99	0.60	0.89	1.13	1.20	1.07	1.07	1.24	14.89	12.11	5.61	11.87	9.28	8.06	6.40	13.61	10.58
Med.	1.08	1.21	1.32	0.30	0.73	1.31	1.56	1.18	0.95	7.61	8.19	5.31	6.07	7.85	11.73	12.16	8.88	7.63
Low	1.19	1.39	1.34	0.93	0.72	0.58	0.95	1.08	0.92	5.08	6.24	4.25	5.57	6.32	7.79	13.10	12.44	8.62
	β^{HML}									$t\left(\beta^{HML}\right)$								
High	1.11	0.85	1.45	0.74	0.35	0.72	0.39	0.49	0.68	7.74	6.74	6.84	7.64	2.15	3.14	1.30	3.56	3.27
Med.	0.47	-0.01	-0.31	0.51	0.39	-0.21	-0.53	0.17	0.57	2.93	-0.02	-0.63	7.23	2.64	-1.56	-2.29	1.25	5.02
Low	-0.34	-1.16	-0.69	-0.21	0.33	0.31	-0.19	-0.38	0.14	-0.75	-2.77	-1.04	-0.64	2.17	2.65	-2.02	-2.45	1.27
	β^{SMB}									$t\left(\beta^{SMB}\right)$								
High	0.33	0.88	0.91	0.20	0.49	0.59	0.32	0.12	-0.28	2.41	8.29	5.51	2.50	4.52	4.06	1.55	1.09	-1.58
Med.	0.12	0.89	0.80	0.25	0.25	0.17	-0.73	-0.38	-0.19	0.98	4.25	3.19	4.55	2.10	1.70	-3.03	-2.77	-1.70
Low	0.81	1.22	1.23	0.53	0.25	0.18	0.13	-0.51	-0.30	3.26	4.35	4.06	3.19	2.03	1.91	1.97	-3.17	-2.74
	Adj. R^2									s(e)								
High	0.74	0.76	0.63	0.76	0.70	0.70	0.53	0.71	0.72	0.04	0.04	0.07	0.03	0.04	0.06	0.08	0.04	0.06
Med.	0.63	0.56	0.43	0.64	0.56	0.69	0.61	0.66	0.64	0.06	0.09	0.14	0.01	0.04	0.04	0.09	0.05	0.05
Low	0.46	0.49	0.44	0.43	0.55	0.56	0.70	0.62	0.65	0.10	0.14	0.16	0.07	0.04	0.02	0.02	0.04	0.03

Table B.16: Time-Series Regressions 4FM - Italy

This table reports the results for the time series regressions of our 27 sorted portfolios (cf. Table 3.2 on page 78) on the Carhart (1997) 4FM. The first row per block depicts all high book-to-market portfolios, i.e., $P1$ to $P9$, with the market capitalization (size) increasing from left to right. The second row per block depicts all medium book-to-market portfolios, i.e., $P10$ to $P17$, with the market capitalization (size) increasing from left to right. The third row per block shows all low book-to-market portfolios, i.e., $P20$ to $P27$, with the market capitalization (size) increasing from left to right. The shown adjusted R^2 values are adjusted for degrees of freedom. Statistics are corrected for heteroscedasticity and autocorrelation, up to three lags, using the Newey and West (1987) estimator.

	Market Capitalization (Size)																	
BV/MV	Small				Medium				Big	Small				Medium				Big
					α									$t(\alpha)$				
High	-0.01	0.00	-0.03	-0.09	-0.03	-0.07	-0.04	-0.08	-0.01	-0.22	0.09	-1.19	-5.58	-1.29	-3.01	-1.81	-3.90	-0.29
Med.	-0.05	0.00	0.01	-0.08	-0.07	-0.01	0.07	-0.02	-0.06	-2.10	0.06	0.17	-6.62	-3.64	-0.43	2.24	-0.96	-2.96
Low	-0.04	-0.05	-0.01	-0.02	-0.09	-0.08	-0.03	0.02	-0.03	-0.04	-0.05	-0.01	-0.02	-0.09	-0.08	-0.03	0.02	-0.03
					β^{MRF}									$t(\beta^{MRF})$				
High	0.93	0.98	0.55	0.91	1.12	1.14	1.14	1.07	1.20	12.14	11.88	5.27	11.44	8.87	10.88	8.50	13.10	11.09
Med.	1.08	1.21	1.37	0.29	0.71	1.28	1.62	1.13	0.90	7.47	8.60	5.55	6.20	7.84	12.35	13.88	9.59	7.71
Low	1.28	1.36	1.23	0.95	0.72	0.57	0.93	1.12	0.89	7.13	6.48	6.66	5.61	6.18	7.76	13.46	14.15	9.24
					β^{HML}									$t(\beta^{HML})$				
High	1.14	0.83	1.39	0.76	0.34	0.65	0.48	0.49	0.63	6.85	5.80	7.05	7.62	2.09	4.41	2.35	3.62	3.80
Med.	0.47	0.00	-0.25	0.49	0.37	-0.25	-0.46	0.12	0.52	3.02	-0.01	-0.70	7.21	2.27	-1.80	-2.41	0.79	3.29
Low	-0.23	-1.20	-0.82	-0.18	0.33	0.29	-0.22	-0.33	0.10	-0.95	-2.98	-1.71	-0.71	2.21	2.23	-2.23	-2.55	0.78
					β^{SMB}									$t(\beta^{SMB})$				
High	0.39	0.86	0.82	0.22	0.47	0.48	0.45	0.13	-0.36	3.35	7.94	5.38	2.66	4.12	3.38	2.64	1.07	-2.09
Med.	0.13	0.89	0.89	0.22	0.22	0.10	-0.60	-0.47	-0.28	1.02	4.49	3.06	3.92	1.80	0.91	-3.00	-3.62	-3.04
Low	0.99	1.16	1.02	0.58	0.25	0.15	0.08	-0.43	-0.36	4.60	4.31	4.66	2.91	1.94	1.63	1.09	-3.11	-3.62
					β^{WML}									$t(\beta^{WML})$				
High	-0.49	0.17	0.70	-0.18	0.13	0.89	-1.03	-0.02	0.65	-0.49	0.17	0.70	-0.18	0.13	0.89	-1.03	-0.02	0.65
Med.	-0.08	-0.01	-0.67	0.23	0.26	0.52	-0.99	0.67	0.69	-0.08	-0.01	-0.67	0.23	0.26	0.52	-0.99	0.67	0.69
Low	-1.39	0.47	1.58	-0.36	-0.03	0.24	0.39	-0.61	0.53	-1.39	0.47	1.58	-0.36	-0.03	0.24	0.39	-0.61	0.53
					Adj. R^2									s(e)				
High	0.77	0.76	0.67	0.76	0.70	0.77	0.63	0.71	0.75	0.03	0.04	0.06	0.03	0.04	0.05	0.06	0.04	0.05
Med.	0.63	0.56	0.46	0.67	0.58	0.72	0.67	0.70	0.69	0.06	0.09	0.14	0.01	0.03	0.04	0.08	0.05	0.04
Low	0.62	0.50	0.58	0.45	0.55	0.58	0.73	0.67	0.70	0.07	0.14	0.12	0.07	0.04	0.02	0.02	0.04	0.03

Table B.17: Time-Series Regressions CAPM & 3FM - Netherlands

This table reports the results for the CAPM (Panel A) & Fama and French (1993) 3FM (Panel B) time series regressions for our 27 sorted portfolios (cf. Table 3.2 on page 78). The first row per block depicts all high book-to-market portfolios, i.e., $P1$ to $P9$, with the market capitalization (size) increasing from left to right. The second row per block depicts all medium book-to-market portfolios, i.e., $P10$ to $P17$, with the market capitalization (size) increasing from left to right. The third row per blockshows all low book-to-market portfolios, i.e., $P20$ to $P27$, with the market capitalization (size) increasing from left to right. The shown adjusted R^2 values are adjusted for degrees of freedom. Statistics are corrected for heteroscedasticity and autocorrelation, up to three lags, using the Newey and West (1987) estimator.

	Market Capitalization (Size)																	
BV/MV	Small				Medium				Big	Small				Medium				Big
Panel A: Capital Asset Pricing Model																		
					α									$t(\alpha)$				
High	0.09	0.06	0.10	-0.01	0.03	0.02	-0.01	-0.01	-0.03	2.07	2.22	2.15	-0.34	1.33	0.81	-0.46	-1.03	-1.21
Med.	-0.05	-0.01	0.11	0.01	0.00	0.01	-0.05	-0.03	-0.03	-1.39	-0.67	3.04	0.14	-0.07	0.29	-2.36	-2.43	-1.68
Low	-0.08	-0.01	0.03	0.04	-0.01	-0.02	-0.02	-0.07	-0.05	-0.08	-0.01	0.03	0.04	-0.01	-0.02	-0.02	-0.07	-0.05
					β^{MRF}									$t\left(\beta^{MRF}\right)$				
High	0.62	0.82	1.04	1.07	0.83	1.22	1.04	0.69	0.92	3.51	7.17	5.55	6.73	7.86	11.28	6.67	10.29	9.76
Med.	1.06	0.70	1.04	0.52	1.01	1.26	1.06	0.98	1.18	5.77	6.24	6.71	3.72	11.10	13.22	9.40	20.02	11.02
Low	1.38	1.50	1.67	0.72	0.86	0.81	0.93	0.74	0.78	7.95	7.52	9.17	6.37	6.53	11.02	13.02	9.79	20.93
					Adj. R^2									s(e)				
High	0.08	0.23	0.17	0.36	0.34	0.42	0.34	0.53	0.50	0.19	0.10	0.22	0.09	0.06	0.08	0.09	0.02	0.03
Med.	0.27	0.30	0.26	0.07	0.45	0.56	0.44	0.64	0.59	0.13	0.05	0.13	0.14	0.05	0.05	0.06	0.02	0.04
Low	0.38	0.43	0.41	0.24	0.26	0.45	0.55	0.44	0.65	0.13	0.12	0.16	0.07	0.09	0.03	0.03	0.03	0.01
Panel B: Fama and French (1993) Model																		
					α									$t(\alpha)$				
High	-0.03	-0.02	-0.04	-0.07	-0.03	-0.04	-0.05	-0.04	-0.05	-1.41	-1.04	-1.59	-2.79	-1.93	-2.17	-2.67	-3.59	-2.83
Med.	-0.12	-0.06	0.05	-0.10	-0.04	0.00	-0.05	-0.03	-0.03	-4.43	-3.60	1.66	-4.26	-1.70	-0.20	-1.66	-2.19	-1.21
Low	-0.13	-0.05	0.01	0.01	-0.04	-0.05	-0.03	-0.06	-0.05	-0.13	-0.05	0.01	0.01	-0.04	-0.05	-0.03	-0.06	-0.05
					β^{MRF}									$t\left(\beta^{MRF}\right)$				
High	0.55	0.81	1.01	1.12	0.79	1.17	1.16	0.73	0.92	4.90	9.43	8.61	9.99	10.79	14.09	9.41	14.58	10.81
Med.	0.91	0.63	0.77	0.55	0.94	1.22	1.14	0.98	1.13	6.06	6.82	6.36	5.64	11.92	11.96	10.06	17.63	10.47
Low	1.18	1.26	1.37	0.51	0.77	0.74	0.87	0.78	0.77	8.47	9.05	8.15	5.62	7.84	11.93	11.72	10.18	18.81
					β^{HML}									$t\left(\beta^{HML}\right)$				
High	1.00	0.81	1.36	0.84	0.54	0.52	0.88	0.42	0.32	4.60	6.75	6.00	4.85	5.01	3.01	4.12	5.92	3.40
Med.	0.19	0.21	-0.37	1.23	0.15	-0.06	0.23	0.01	-0.24	1.01	1.88	-1.63	4.18	1.15	-0.44	1.67	0.14	-2.97
Low	-0.23	-0.53	-0.97	-0.42	-0.09	0.07	-0.18	0.08	-0.05	-1.00	-2.42	-4.21	-2.63	-0.34	0.67	-1.98	0.83	-0.67
					β^{SMB}									$t\left(\beta^{SMB}\right)$				
High	1.19	0.67	1.20	0.32	0.64	0.68	-0.05	0.07	0.21	5.75	6.70	5.97	2.58	5.65	4.01	-0.29	1.25	3.04
Med.	0.98	0.59	1.30	0.73	0.53	0.23	-0.32	-0.01	0.10	5.42	6.43	7.66	3.21	4.22	1.72	-2.23	-0.17	0.96
Low	1.02	1.04	1.04	0.92	0.47	0.43	0.19	-0.18	0.02	5.42	4.88	4.67	7.40	3.38	4.10	1.85	-1.69	0.27
					Adj. R^2									s(e)				
High	0.50	0.54	0.62	0.55	0.64	0.60	0.50	0.67	0.57	0.10	0.06	0.10	0.06	0.03	0.06	0.07	0.01	0.03
Med.	0.45	0.50	0.54	0.55	0.55	0.57	0.47	0.64	0.61	0.09	0.03	0.08	0.07	0.04	0.05	0.06	0.02	0.04
Low	0.52	0.59	0.57	0.53	0.31	0.55	0.57	0.45	0.65	0.10	0.09	0.12	0.04	0.08	0.03	0.03	0.03	0.01

Table B.18: Time-Series Regressions 4FM - Netherlands

This table reports the results for the time series regressions of our 27 sorted portfolios (cf. Table 3.2 on page 78) on the Carhart (1997) 4FM. The first row per block depicts all high book-to-market portfolios, i.e., $P1$ to $P9$, with the market capitalization (size) increasing from left to right. The second row per block depicts all medium book-to-market portfolios, i.e., $P10$ to $P17$, with the market capitalization (size) increasing from left to right. The third row per block shows all low book-to-market portfolios, i.e., $P20$ to $P27$, with the market capitalization (size) increasing from left to right. The shown adjusted R^2 values are adjusted for degrees of freedom. Statistics are corrected for heteroscedasticity and autocorrelation, up to three lags, using the Newey and West (1987) estimator.

	Market Capitalization (Size)																	
BV/MV	Small				Medium				Big	Small				Medium				Big
	α									$t(\alpha)$								
High	0.00	-0.03	-0.07	-0.04	-0.03	-0.07	-0.02	-0.04	-0.06	0.15	-1.45	-3.14	-1.49	-1.60	-3.76	-0.80	-3.65	-3.11
Med.	-0.07	-0.06	0.04	-0.11	-0.05	-0.03	-0.02	-0.04	-0.03	-2.66	-3.51	1.37	-4.53	-1.89	-1.37	-0.88	-1.97	-1.12
Low	-0.07	-0.04	-0.04	0.01	-0.01	-0.06	-0.04	-0.04	-0.05	-0.07	-0.04	-0.04	0.01	-0.01	-0.06	-0.04	-0.04	-0.05
	β^{MRF}									$t(\beta^{MRF})$								
High	0.66	0.78	0.91	1.22	0.80	1.07	1.26	0.73	0.91	5.55	9.13	9.09	12.40	10.55	12.67	9.58	14.25	10.04
Med.	1.04	0.62	0.76	0.53	0.91	1.14	1.21	0.97	1.13	8.07	6.78	6.13	5.18	10.84	12.33	10.66	14.89	10.85
Low	1.37	1.27	1.20	0.51	0.85	0.72	0.82	0.83	0.77	14.92	8.24	8.64	5.30	7.99	10.82	11.90	10.85	15.57
	β^{HML}									$t(\beta^{HML})$								
High	0.69	0.88	1.62	0.58	0.52	0.78	0.61	0.42	0.36	2.90	6.80	6.27	3.16	5.13	4.39	3.55	5.39	3.20
Med.	-0.16	0.24	-0.34	1.30	0.22	0.14	0.05	0.03	-0.25	-0.85	1.81	-1.32	4.34	1.67	1.07	0.35	0.35	-2.89
Low	-0.73	-0.57	-0.53	-0.42	-0.30	0.13	-0.03	-0.06	-0.03	-3.71	-2.28	-2.71	-2.35	-1.02	1.17	-0.36	-0.54	-0.49
	β^{SMB}									$t(\beta^{SMB})$								
High	1.21	0.66	1.18	0.34	0.64	0.67	-0.03	0.07	0.21	6.73	6.46	6.66	3.22	5.69	4.15	-0.16	1.26	2.90
Med.	1.01	0.58	1.30	0.73	0.52	0.21	-0.31	-0.01	0.10	6.55	6.49	7.60	3.19	4.24	1.76	-2.32	-0.19	0.97
Low	1.06	1.05	1.01	0.92	0.48	0.43	0.18	-0.17	0.02	8.01	4.88	5.38	7.34	3.95	4.12	1.90	-1.74	0.25
	β^{WML}									$t(\beta^{WML})$								
High	-0.94	0.20	0.81	-0.79	-0.08	0.77	-0.84	0.00	0.14	-0.94	0.20	0.81	-0.79	-0.08	0.77	-0.84	0.00	0.14
Med.	-1.06	0.07	0.10	0.20	0.21	0.61	-0.53	0.06	-0.03	-1.06	0.07	0.10	0.20	0.21	0.61	-0.53	0.06	-0.03
Low	-1.54	-0.12	1.34	0.00	-0.65	0.17	0.45	-0.41	0.04	-1.54	-0.12	1.34	0.00	-0.65	0.17	0.45	-0.41	0.04
	Adj. R^2									s(e)								
High	0.57	0.55	0.66	0.63	0.64	0.67	0.58	0.67	0.58	0.09	0.06	0.09	0.05	0.03	0.05	0.05	0.01	0.03
Med.	0.56	0.50	0.54	0.56	0.56	0.62	0.52	0.64	0.61	0.08	0.03	0.08	0.07	0.04	0.04	0.05	0.02	0.04
Low	0.71	0.59	0.68	0.53	0.37	0.55	0.62	0.51	0.65	0.06	0.09	0.09	0.04	0.07	0.03	0.02	0.03	0.01

Table B.19: Time-Series Regressions CAPM & 3FM - Portugal

This table reports the results for the CAPM (Panel A) & Fama and French (1993) 3FM (Panel B) time series regressions for our 27 sorted portfolios (cf. Table 3.2 on page 78). The first row per block depicts all high book-to-market portfolios, i.e., $P1$ to $P9$, with the market capitalization (size) increasing from left to right. The second row per block depicts all medium book-to-market portfolios, i.e., $P10$ to $P17$, with the market capitalization (size) increasing from left to right. The third row per blockshows all low book-to-market portfolios, i.e., $P20$ to $P27$, with the market capitalization (size) increasing from left to right. The shown adjusted R^2 values are adjusted for degrees of freedom. Statistics are corrected for heteroscedasticity and autocorrelation, up to three lags, using the Newey and West (1987) estimator.

	Market Capitalization (Size)																	
BV/MV	Small				Medium				Big	Small				Medium				Big
Panel A: Capital Asset Pricing Model																		
					α									$t(\alpha)$				
High	0.26	0.31	0.62	-0.12	-0.09	0.13	0.06	0.08	0.09	1.11	2.09	2.11	-3.87	-4.12	1.68	1.82	1.82	1.36
Med.	0.09	-0.02	0.00	0.52	0.01	0.03	0.02	0.00	-0.07	1.00	-0.39	-0.04	1.78	0.27	0.83	0.45	0.15	-2.21
Low	-0.05	-0.09	-0.18	-0.04	-0.02	-0.01	0.00	-0.03	-0.01	-0.05	-0.09	-0.18	-0.04	-0.02	-0.01	0.00	-0.03	-0.01
					β^{MRF}									$t\left(\beta^{MRF}\right)$				
High	1.67	1.70	1.24	1.24	1.10	1.68	1.20	1.18	1.40	1.99	3.36	1.34	7.95	9.61	4.46	8.65	5.81	3.84
Med.	0.76	0.59	0.44	1.01	1.00	1.39	1.25	1.02	1.19	2.12	2.18	1.51	1.15	8.27	8.70	5.34	8.11	8.72
Low	1.95	0.70	0.76	0.22	0.51	0.70	0.80	0.62	0.71	3.60	4.32	6.05	1.49	4.87	8.01	8.43	5.21	8.77
					Adj. R^2									s(e)				
High	0.01	0.04	0.01	0.60	0.58	0.29	0.42	0.43	0.28	6.56	2.63	3.62	0.04	0.04	0.29	0.08	0.08	0.21
Med.	0.04	0.07	0.04	0.00	0.52	0.50	0.48	0.53	0.58	0.55	0.18	0.17	3.39	0.04	0.08	0.07	0.04	0.04
Low	0.31	0.25	0.31	0.04	0.27	0.51	0.48	0.48	0.55	0.36	0.06	0.05	0.04	0.03	0.02	0.03	0.02	0.02
Panel B: Fama and French (1993) Model																		
					α									$t(\alpha)$				
High	-0.37	-0.03	0.45	-0.13	-0.08	0.01	0.03	0.04	-0.02	-1.29	-0.29	2.08	-4.00	-2.37	0.10	0.79	0.97	-0.61
Med.	0.09	-0.05	0.03	0.34	0.02	0.08	0.03	0.01	-0.06	0.96	-1.08	0.49	1.64	0.75	1.61	0.72	0.42	-1.82
Low	0.15	-0.08	-0.13	-0.02	-0.03	0.00	0.04	-0.02	0.00	0.15	-0.08	-0.13	-0.02	-0.03	0.00	0.04	-0.02	0.00
					β^{MRF}									$t\left(\beta^{MRF}\right)$				
High	0.07	0.57	1.28	1.17	1.14	1.30	1.05	0.93	0.77	0.07	1.58	1.70	7.70	6.80	4.00	6.69	4.77	4.86
Med.	0.98	0.49	0.61	1.01	1.02	1.55	1.28	1.03	1.19	2.35	2.21	1.90	1.44	7.88	6.99	4.62	7.00	9.29
Low	2.80	0.79	0.94	0.31	0.46	0.70	0.92	0.65	0.71	4.45	5.27	6.28	1.89	3.58	7.93	6.80	4.54	7.63
					β^{HML}									$t\left(\beta^{HML}\right)$				
High	2.54	1.90	-0.26	0.14	-0.07	0.62	0.26	0.46	1.12	1.81	3.07	-0.24	1.31	-0.57	2.46	2.09	2.61	2.74
Med.	-0.44	0.15	-0.29	-0.20	-0.02	-0.25	-0.05	0.01	0.01	-1.10	0.76	-1.59	-0.19	-0.21	-1.47	-0.31	0.07	0.13
Low	-1.50	-0.18	-0.33	-0.16	0.09	0.00	-0.19	-0.03	0.01	-3.36	-1.59	-3.56	-1.64	0.96	-0.03	-1.67	-0.42	0.13
					β^{SMB}									$t\left(\beta^{SMB}\right)$				
High	1.44	-0.48	2.60	-0.17	0.05	0.07	-0.20	-0.56	-1.21	1.42	-1.18	2.94	-1.74	0.44	0.27	-1.61	-3.40	-3.13
Med.	1.01	0.03	0.27	2.50	-0.14	-0.01	-0.10	-0.11	-0.19	2.49	0.15	1.62	2.71	-1.72	-0.10	-0.81	-1.71	-2.15
Low	1.14	0.29	0.20	0.13	-0.01	-0.11	0.02	-0.05	-0.09	3.60	2.48	2.36	1.58	-0.15	-1.99	0.22	-0.79	-2.13
					Adj. R^2									s(e)				
High	0.41	0.16	0.33	0.61	0.58	0.48	0.44	0.57	0.60	3.88	2.28	2.43	0.04	0.04	0.22	0.08	0.06	0.12
Med.	0.21	0.08	0.05	0.34	0.57	0.56	0.50	0.55	0.64	0.45	0.18	0.17	2.25	0.04	0.07	0.07	0.04	0.04
Low	0.52	0.33	0.37	0.05	0.28	0.57	0.56	0.50	0.59	0.25	0.06	0.05	0.04	0.03	0.02	0.03	0.02	0.02

Table B.20: Time-Series Regressions 4FM - Portugal

This table reports the results for the time series regressions of our 27 sorted portfolios (cf. Table 3.2 on page 78) on the Carhart (1997) 4FM. The first row per block depicts all high book-to-market portfolios, i.e., $P1$ to $P9$, with the market capitalization (size) increasing from left to right. The second row per block depicts all medium book-to-market portfolios, i.e., $P10$ to $P17$, with the market capitalization (size) increasing from left to right. The third row per block shows all low book-to-market portfolios, i.e., $P20$ to $P27$, with the market capitalization (size) increasing from left to right. The shown adjusted R^2 values are adjusted for degrees of freedom. Statistics are corrected for heteroscedasticity and autocorrelation, up to three lags, using the Newey and West (1987) estimator.

	Market Capitalization (Size)																	
BV/MV	Small				Medium				Big	Small				Medium				Big
	α									$t(\alpha)$								
High	-0.23	-0.08	0.39	-0.13	-0.08	0.00	0.03	0.04	-0.03	-1.60	-0.51	2.42	-3.97	-2.39	-0.04	0.74	1.03	-0.78
Med.	0.09	-0.06	0.03	0.29	0.03	0.09	0.04	0.01	-0.06	0.97	-1.29	0.42	1.79	0.84	1.63	0.99	0.46	-1.86
Low	0.15	-0.08	-0.14	-0.02	-0.03	0.00	0.04	-0.01	0.00	0.15	-0.08	-0.14	-0.02	-0.03	0.00	0.04	-0.01	0.00
	β^{MRF}									$t(\beta^{MRF})$								
High	-0.34	0.73	1.46	1.17	1.14	1.33	1.06	0.92	0.79	-0.56	1.18	2.31	7.66	6.98	4.33	6.91	4.50	5.05
Med.	0.98	0.51	0.62	1.16	1.02	1.54	1.25	1.02	1.19	2.39	2.38	2.04	1.84	8.25	6.93	5.49	7.15	9.21
Low	2.78	0.80	0.95	0.32	0.46	0.70	0.91	0.63	0.70	4.59	5.56	7.08	2.01	3.67	8.26	6.74	5.40	7.84
	β^{HML}									$t(\beta^{HML})$								
High	2.71	1.83	-0.34	0.14	-0.07	0.61	0.26	0.46	1.12	4.95	2.92	-0.44	1.31	-0.60	2.24	2.07	2.75	2.88
Med.	-0.44	0.14	-0.30	-0.26	-0.02	-0.25	-0.04	0.01	0.01	-1.13	0.81	-1.78	-0.34	-0.19	-1.47	-0.28	0.10	0.12
Low	-1.49	-0.18	-0.33	-0.16	0.09	0.00	-0.19	-0.03	0.01	-3.48	-1.54	-3.84	-1.81	1.00	0.00	-1.69	-0.41	0.17
	β^{SMB}									$t(\beta^{SMB})$								
High	-1.84	0.77	4.04	-0.18	0.08	0.26	-0.15	-0.64	-1.06	-1.91	0.67	4.09	-1.75	0.72	0.92	-0.99	-3.73	-3.15
Med.	1.07	0.19	0.40	3.70	-0.18	-0.07	-0.30	-0.15	-0.19	2.34	1.06	2.30	3.42	-1.90	-0.54	-2.36	-2.28	-1.80
Low	0.94	0.35	0.28	0.20	-0.02	-0.14	-0.03	-0.16	-0.12	3.04	1.87	2.58	2.18	-0.25	-2.13	-0.32	-2.44	-2.77
	β^{WML}									$t(\beta^{WML})$								
High	-6.92	2.64	3.05	-0.01	0.07	0.40	0.11	-0.17	0.32	-6.92	2.64	3.05	-0.01	0.07	0.40	0.11	-0.17	0.32
Med.	0.12	0.35	0.29	2.52	-0.10	-0.12	-0.43	-0.08	0.01	0.12	0.35	0.29	2.52	-0.10	-0.12	-0.43	-0.08	0.01
Low	-0.43	0.11	0.17	0.13	-0.03	-0.07	-0.10	-0.23	-0.06	-0.43	0.11	0.17	0.13	-0.03	-0.07	-0.10	-0.23	-0.06
	Adj. R^2									s(e)								
High	0.83	0.31	0.48	0.61	0.58	0.50	0.44	0.58	0.62	1.12	1.90	1.91	0.04	0.04	0.21	0.08	0.06	0.11
Med.	0.21	0.12	0.08	0.45	0.57	0.57	0.58	0.55	0.64	0.45	0.17	0.16	1.90	0.04	0.07	0.06	0.04	0.04
Low	0.54	0.33	0.40	0.07	0.28	0.58	0.57	0.59	0.60	0.24	0.05	0.05	0.04	0.03	0.02	0.03	0.01	0.02

Table B.21: Time-Series Regressions CAPM & 3FM - Spain

This table reports the results for the CAPM (Panel A) & Fama and French (1993) 3FM (Panel B) time series regressions for our 27 sorted portfolios (cf. Table 3.2 on page 78). The first row per block depicts all high book-to-market portfolios, i.e., $P1$ to $P9$, with the market capitalization (size) increasing from left to right. The second row per block depicts all medium book-to-market portfolios, i.e., $P10$ to $P17$, with the market capitalization (size) increasing from left to right. The third row per blockshows all low book-to-market portfolios, i.e., $P20$ to $P27$, with the market capitalization (size) increasing from left to right. The shown adjusted R^2 values are adjusted for degrees of freedom. Statistics are corrected for heteroscedasticity and autocorrelation, up to three lags, using the Newey and West (1987) estimator.

	Market Capitalization (Size)																	
BV/MV	Small				Medium				Big	Small				Medium				Big
Panel A: Capital Asset Pricing Model																		
					α									$t(\alpha)$				
High	0.06	0.04	0.27	-0.07	0.03	0.02	0.05	0.02	0.04	0.83	0.96	3.75	-1.93	0.83	0.70	2.25	0.73	2.27
Med.	-0.07	0.01	0.07	0.04	-0.01	0.01	-0.02	-0.02	0.02	-1.48	0.29	2.02	1.10	-0.55	0.22	-0.95	-1.19	0.98
Low	0.07	-0.02	0.00	0.02	-0.12	-0.03	-0.03	-0.04	-0.03	0.07	-0.02	0.00	0.02	-0.12	-0.03	-0.03	-0.04	-0.03
					β^{MRF}									$t\left(\beta^{MRF}\right)$				
High	1.79	1.42	1.21	1.11	1.36	1.09	1.15	0.83	0.86	6.35	8.46	4.17	6.29	8.60	7.51	11.01	8.64	14.43
Med.	1.68	1.08	1.17	0.59	0.91	0.89	0.86	0.85	0.85	9.47	9.52	8.87	4.49	12.76	10.86	8.12	11.08	13.81
Low	2.59	1.76	0.82	0.83	0.73	0.73	0.64	0.61	0.63	5.53	5.79	7.38	8.83	9.08	12.91	11.11	8.04	11.89
					Adj. R^2									s(e)				
High	0.28	0.43	0.13	0.39	0.54	0.45	0.62	0.56	0.64	0.46	0.15	0.55	0.11	0.09	0.08	0.05	0.03	0.02
Med.	0.41	0.40	0.42	0.17	0.60	0.50	0.55	0.67	0.64	0.23	0.10	0.11	0.10	0.03	0.05	0.04	0.02	0.02
Low	0.41	0.46	0.22	0.42	0.53	0.61	0.52	0.54	0.67	0.57	0.21	0.14	0.06	0.03	0.02	0.02	0.02	0.01
Panel B: Fama and French (1993) Model																		
					α									$t(\alpha)$				
High	-0.11	-0.04	0.02	-0.13	-0.02	-0.03	0.04	0.00	0.03	-3.02	-1.37	0.59	-4.84	-1.04	-1.03	1.72	0.03	1.61
Med.	-0.15	0.00	0.06	-0.07	-0.03	0.00	-0.04	-0.03	0.01	-4.83	-0.16	1.90	-3.93	-1.58	0.20	-2.47	-2.06	0.55
Low	0.12	-0.02	-0.03	0.01	-0.15	-0.05	-0.03	-0.06	-0.05	0.12	-0.02	-0.03	0.01	-0.15	-0.05	-0.03	-0.06	-0.05
					β^{MRF}									$t\left(\beta^{MRF}\right)$				
High	0.76	0.99	-0.31	0.85	0.85	0.71	1.22	0.80	0.86	3.02	5.34	-1.22	4.78	5.26	4.34	8.48	7.33	10.27
Med.	0.93	0.76	0.82	-0.01	0.73	0.84	0.88	0.86	0.84	4.92	4.21	5.86	-0.07	8.09	7.83	8.65	12.21	9.51
Low	1.53	1.32	0.45	0.58	0.47	0.57	0.59	0.60	0.62	4.50	4.48	2.00	5.61	5.80	8.13	7.68	8.54	12.73
					β^{HML}									$t\left(\beta^{HML}\right)$				
High	1.60	0.80	2.40	0.81	0.27	0.34	0.31	0.22	0.19	3.54	4.74	7.31	4.47	1.97	2.25	3.81	2.22	2.35
Med.	0.41	-0.17	-0.27	0.98	0.07	-0.04	0.41	0.25	0.11	1.75	-1.21	-1.51	6.73	0.72	-0.43	4.96	3.67	1.13
Low	-2.10	-0.66	0.00	-0.14	0.27	0.07	0.02	0.31	0.19	-7.60	-2.53	-0.01	-1.06	3.98	0.87	0.27	5.03	3.85
					β^{SMB}									$t\left(\beta^{SMB}\right)$				
High	1.11	0.43	1.62	0.19	0.67	0.47	-0.18	-0.02	-0.05	3.61	2.47	6.02	1.21	5.48	3.88	-1.60	-0.19	-0.65
Med.	0.98	0.50	0.56	0.63	0.24	0.07	-0.12	-0.07	-0.01	4.66	2.76	4.17	5.13	3.08	0.88	-1.27	-1.59	-0.11
Low	2.02	0.79	0.53	0.40	0.31	0.21	0.07	-0.06	-0.03	6.41	3.74	2.29	4.10	4.31	3.41	1.23	-0.90	-0.90
					Adj. R^2									s(e)				
High	0.49	0.53	0.61	0.50	0.65	0.53	0.65	0.57	0.65	0.33	0.13	0.25	0.09	0.07	0.07	0.04	0.03	0.02
Med.	0.54	0.47	0.50	0.58	0.63	0.50	0.62	0.70	0.64	0.18	0.09	0.09	0.05	0.03	0.05	0.03	0.02	0.02
Low	0.74	0.56	0.29	0.49	0.65	0.65	0.52	0.62	0.70	0.25	0.17	0.13	0.05	0.02	0.02	0.02	0.01	0.01

Table B.22: Time-Series Regressions 4FM - Spain

This table reports the results for the time series regressions of our 27 sorted portfolios (cf. Table 3.2 on page 78) on the Carhart (1997) 4FM. The first row per block depicts all high book-to-market portfolios, i.e., $P1$ to $P9$, with the market capitalization (size) increasing from left to right. The second row per block depicts all medium book-to-market portfolios, i.e., $P10$ to $P17$, with the market capitalization (size) increasing from left to right. The third row per block shows all low book-to-market portfolios, i.e., $P20$ to $P27$, with the market capitalization (size) increasing from left to right. The shown adjusted R^2 values are adjusted for degrees of freedom. Statistics are corrected for heteroscedasticity and autocorrelation, up to three lags, using the Newey and West (1987) estimator.

	Market Capitalization (Size)																	
BV/MV	Small				Medium				Big	Small				Medium				Big
	α									$t(\alpha)$								
High	-0.04	-0.03	-0.05	-0.11	-0.01	-0.03	0.06	0.00	0.02	-0.94	-1.02	-1.60	-3.84	-0.48	-1.31	2.65	0.26	1.23
Med.	-0.12	0.01	0.06	-0.09	-0.02	0.01	-0.03	-0.03	0.00	-3.93	0.23	1.76	-5.20	-1.14	0.48	-1.64	-1.83	0.22
Low	0.20	-0.03	-0.07	0.01	-0.14	-0.04	-0.03	-0.05	-0.04	0.20	-0.03	-0.07	0.01	-0.14	-0.04	-0.03	-0.05	-0.04
	β^{MRF}									$t(\beta^{MRF})$								
High	0.38	0.94	0.11	0.72	0.77	0.75	1.11	0.78	0.89	1.08	5.35	0.40	4.89	4.42	4.57	9.35	6.25	10.97
Med.	0.75	0.71	0.84	0.13	0.69	0.81	0.78	0.83	0.87	4.77	3.77	5.96	0.97	7.68	7.51	8.43	11.73	10.26
Low	1.10	1.42	0.71	0.59	0.41	0.53	0.56	0.53	0.60	4.80	4.42	4.44	5.76	4.90	7.55	7.23	8.02	11.71
	β^{HML}									$t(\beta^{HML})$								
High	1.73	0.82	2.26	0.85	0.30	0.33	0.35	0.23	0.18	4.38	4.78	11.31	4.88	2.29	2.16	3.98	2.24	2.19
Med.	0.48	-0.15	-0.28	0.93	0.09	-0.03	0.45	0.26	0.09	1.98	-1.03	-1.57	7.43	0.94	-0.30	5.14	3.83	1.02
Low	-1.95	-0.69	-0.09	-0.14	0.29	0.08	0.03	0.34	0.19	-8.46	-2.60	-0.58	-1.10	4.59	1.10	0.40	5.15	3.97
	β^{SMB}									$t(\beta^{SMB})$								
High	0.77	0.39	1.99	0.07	0.60	0.51	-0.28	-0.04	-0.02	2.69	2.16	9.14	0.47	4.93	3.45	-2.77	-0.45	-0.30
Med.	0.82	0.45	0.58	0.75	0.20	0.04	-0.21	-0.10	0.02	4.03	2.59	3.75	6.64	2.38	0.43	-2.39	-2.04	0.32
Low	1.64	0.88	0.76	0.41	0.25	0.18	0.05	-0.12	-0.05	8.39	3.87	3.89	3.65	3.73	2.64	0.68	-2.03	-1.32
	β^{WML}									$t(\beta^{WML})$								
High	-1.80	-0.23	1.95	-0.60	-0.35	0.20	-0.53	-0.11	0.14	-1.80	-0.23	1.95	-0.60	-0.35	0.20	-0.53	-0.11	0.14
Med.	-0.86	-0.26	0.08	0.64	-0.21	-0.17	-0.45	-0.13	0.15	-0.86	-0.26	0.08	0.64	-0.21	-0.17	-0.45	-0.13	0.15
Low	-2.01	0.45	1.20	0.05	-0.30	-0.17	-0.14	-0.32	-0.08	-2.01	0.45	1.20	0.05	-0.30	-0.17	-0.14	-0.32	-0.08
	Adj. R^2									s(e)								
High	0.61	0.54	0.75	0.55	0.67	0.54	0.70	0.58	0.66	0.25	0.12	0.16	0.08	0.07	0.07	0.04	0.03	0.02
Med.	0.58	0.48	0.50	0.66	0.64	0.50	0.68	0.71	0.65	0.17	0.09	0.09	0.04	0.03	0.05	0.02	0.02	0.02
Low	0.83	0.57	0.47	0.50	0.68	0.66	0.53	0.68	0.71	0.16	0.17	0.09	0.05	0.02	0.02	0.02	0.01	0.01

Table B.23: Time-Series Regressions CAPM & 3FM - Denmark

This table reports the results for the CAPM (Panel A) & Fama and French (1993) 3FM (Panel B) time series regressions for our 27 sorted portfolios (cf. Table 3.2 on page 78). The first row per block depicts all high book-to-market portfolios, i.e., $P1$ to $P9$, with the market capitalization (size) increasing from left to right. The second row per block depicts all medium book-to-market portfolios, i.e., $P10$ to $P17$, with the market capitalization (size) increasing from left to right. The third row per blockshows all low book-to-market portfolios, i.e., $P20$ to $P27$, with the market capitalization (size) increasing from left to right. The shown adjusted R^2 values are adjusted for degrees of freedom. Statistics are corrected for heteroscedasticity and autocorrelation, up to three lags, using the Newey and West (1987) estimator.

	Market Capitalization (Size)																	
BV/MV	Small				Medium				Big	Small				Medium				Big
Panel A: Capital Asset Pricing Model																		
					α									$t(\alpha)$				
High	0.23	0.19	0.29	0.12	0.14	0.19	-0.07	0.08	0.14	3.20	6.04	4.86	2.59	2.65	3.19	-1.91	1.72	2.80
Med.	0.18	0.09	0.15	0.19	0.07	0.05	-0.03	-0.02	0.00	2.05	1.73	2.66	3.53	1.73	1.24	-0.75	-0.53	0.02
Low	0.12	-0.02	0.00	0.04	-0.01	0.02	0.02	-0.05	-0.04	0.12	-0.02	0.00	0.04	-0.01	0.02	0.02	-0.05	-0.04
					β^{MRF}									$t\left(\beta^{MRF}\right)$				
High	1.42	0.63	0.64	1.22	0.92	1.24	1.24	1.28	0.97	2.86	4.49	3.90	5.83	4.01	2.10	7.07	7.13	5.33
Med.	1.69	1.09	0.91	0.41	0.90	0.73	0.73	0.71	0.88	2.93	4.77	4.09	3.34	5.10	4.09	4.29	4.41	4.29
Low	1.82	1.40	1.61	0.45	0.54	0.56	0.45	0.36	0.43	5.29	7.02	4.19	3.98	3.10	4.64	3.74	4.11	4.18
					Adj. R^2									s(e)				
High	0.22	0.20	0.10	0.36	0.19	0.13	0.44	0.38	0.24	0.39	0.09	0.20	0.14	0.20	0.53	0.11	0.14	0.16
Med.	0.14	0.27	0.18	0.07	0.26	0.18	0.21	0.24	0.18	0.91	0.17	0.20	0.12	0.12	0.13	0.11	0.09	0.19
Low	0.20	0.29	0.21	0.17	0.18	0.23	0.17	0.20	0.21	0.70	0.27	0.54	0.05	0.07	0.06	0.05	0.03	0.04
Panel B: Fama and French (1993) Model																		
					α									$t(\alpha)$				
High	-0.19	0.07	0.10	-0.03	-0.09	-0.20	-0.15	0.01	-0.01	-2.01	2.95	1.73	-0.38	-1.40	-1.62	-2.95	0.24	-0.21
Med.	-0.25	-0.11	-0.02	0.10	0.00	-0.04	-0.08	-0.06	0.00	-2.02	-3.06	-0.37	1.80	-0.03	-1.01	-1.78	-1.00	0.05
Low	0.03	-0.03	-0.08	-0.05	-0.12	-0.03	-0.05	-0.08	-0.07	0.03	-0.03	-0.08	-0.05	-0.12	-0.03	-0.05	-0.08	-0.07
					β^{MRF}									$t\left(\beta^{MRF}\right)$				
High	0.44	0.28	0.16	0.82	0.35	0.32	1.04	1.18	0.68	2.06	3.02	0.82	3.58	1.76	1.18	5.62	5.74	4.03
Med.	0.38	0.47	0.38	0.23	0.63	0.40	0.57	0.63	0.85	1.87	2.69	1.91	1.29	3.41	2.97	2.87	3.49	3.84
Low	1.23	1.25	1.20	0.18	0.19	0.36	0.22	0.27	0.36	5.73	5.50	5.30	1.77	1.73	3.22	2.58	2.69	3.39
					β^{HML}									$t\left(\beta^{HML}\right)$				
High	1.85	0.23	0.61	0.51	0.80	1.69	0.31	0.47	0.89	3.72	2.05	1.79	2.72	2.81	2.59	1.26	1.39	4.14
Med.	0.61	0.36	0.29	0.54	-0.01	0.03	0.05	0.16	-0.16	1.15	2.72	0.84	1.55	-0.03	0.27	0.51	0.85	-0.85
Low	-1.13	-0.47	-0.48	0.14	0.13	0.00	0.01	0.02	0.12	-2.40	-1.69	-0.80	0.86	0.73	0.02	0.15	0.49	0.95
					β^{SMB}									$t\left(\beta^{SMB}\right)$				
High	1.27	0.66	0.77	0.62	0.85	1.19	0.30	0.00	0.22	4.23	7.19	2.39	3.43	4.84	3.11	2.13	0.01	1.37
Med.	2.55	1.16	1.01	0.16	0.58	0.70	0.32	0.09	0.15	3.46	9.23	5.38	0.77	4.04	6.34	1.68	0.70	1.00
Low	1.81	0.54	1.10	0.52	0.70	0.43	0.49	0.18	0.10	5.49	2.79	2.63	5.67	6.54	4.78	6.92	1.87	1.26
					Adj. R^2									s(e)				
High	0.64	0.42	0.28	0.48	0.42	0.41	0.47	0.42	0.40	0.18	0.06	0.16	0.12	0.14	0.36	0.10	0.14	0.13
Med.	0.48	0.59	0.41	0.15	0.37	0.36	0.24	0.24	0.18	0.55	0.10	0.15	0.11	0.11	0.10	0.10	0.09	0.19
Low	0.52	0.36	0.33	0.42	0.49	0.37	0.38	0.24	0.22	0.42	0.24	0.45	0.04	0.05	0.05	0.04	0.03	0.04

Table B.24: Time-Series Regressions 4FM - Denmark

This table reports the results for the time series regressions of our 27 sorted portfolios (cf. Table 3.2 on page 78) on the Carhart (1997) 4FM. The first row per block depicts all high book-to-market portfolios, i.e., $P1$ to $P9$, with the market capitalization (size) increasing from left to right. The second row per block depicts all medium book-to-market portfolios, i.e., $P10$ to $P17$, with the market capitalization (size) increasing from left to right. The third row per block shows all low book-to-market portfolios, i.e., $P20$ to $P27$, with the market capitalization (size) increasing from left to right. The shown adjusted R^2 values are adjusted for degrees of freedom. Statistics are corrected for heteroscedasticity and autocorrelation, up to three lags, using the Newey and West (1987) estimator.

	Market Capitalization (Size)																	
BV/MV	Small				Medium				Big	Small				Medium				Big
					α									$t(\alpha)$				
High	-0.20	0.07	0.10	-0.01	-0.09	-0.28	-0.15	0.02	-0.01	-2.00	2.39	1.65	-0.20	-1.49	-2.92	-2.71	0.34	-0.11
Med.	-0.20	-0.11	-0.02	0.10	-0.01	-0.05	-0.07	-0.07	-0.01	-1.92	-3.07	-0.32	1.82	-0.32	-1.17	-1.49	-1.18	-0.10
Low	0.08	-0.03	-0.18	-0.05	-0.13	-0.04	-0.06	-0.07	-0.08	0.08	-0.03	-0.18	-0.05	-0.13	-0.04	-0.06	-0.07	-0.08
					β^{MRF}									t(β^{MRF})				
High	0.45	0.29	0.15	0.81	0.36	0.43	1.04	1.17	0.67	2.09	3.15	0.82	3.53	1.76	1.84	5.72	5.82	4.02
Med.	0.32	0.47	0.38	0.22	0.65	0.41	0.56	0.64	0.86	1.46	2.73	1.87	1.25	3.42	2.94	2.96	3.72	3.98
Low	1.17	1.25	1.32	0.18	0.21	0.37	0.22	0.27	0.37	6.23	5.70	5.91	1.74	2.02	3.24	2.55	2.77	3.65
					β^{HML}									t(β^{HML})				
High	1.85	0.23	0.61	0.51	0.79	1.66	0.31	0.47	0.89	3.89	1.91	1.80	2.84	2.86	3.85	1.25	1.43	4.33
Med.	0.63	0.36	0.29	0.54	-0.01	0.03	0.05	0.16	-0.16	1.35	2.72	0.84	1.60	-0.07	0.25	0.51	0.85	-0.95
Low	-1.11	-0.47	-0.51	0.14	0.12	0.00	0.01	0.02	0.12	-2.41	-1.71	-1.44	0.86	0.85	-0.02	0.13	0.49	0.96
					β^{SMB}									t(β^{SMB})				
High	1.34	0.70	0.76	0.51	0.89	1.82	0.30	-0.04	0.18	4.17	6.60	2.26	3.01	5.18	4.69	1.51	-0.19	1.08
Med.	2.19	1.17	1.01	0.12	0.68	0.74	0.27	0.18	0.23	3.94	7.52	4.31	0.51	4.14	6.64	1.23	1.31	1.39
Low	1.46	0.52	1.81	0.52	0.79	0.51	0.53	0.15	0.16	4.68	2.22	4.48	4.56	6.79	4.94	7.36	1.42	1.80
					β^{WML}									t(β^{WML})				
High	0.26	0.19	-0.03	-0.41	0.15	2.40	-0.01	-0.15	-0.17	0.26	0.19	-0.03	-0.41	0.15	2.40	-0.01	-0.15	-0.17
Med.	-1.38	0.05	-0.03	-0.16	0.40	0.14	-0.21	0.33	0.32	-1.38	0.05	-0.03	-0.16	0.40	0.14	-0.21	0.33	0.32
Low	-1.33	-0.07	2.73	0.00	0.35	0.29	0.13	-0.09	0.22	-1.33	-0.07	2.73	0.00	0.35	0.29	0.13	-0.09	0.22
					Adj. R^2									s(e)				
High	0.64	0.42	0.28	0.50	0.42	0.62	0.47	0.42	0.40	0.18	0.06	0.16	0.11	0.14	0.24	0.10	0.14	0.13
Med.	0.52	0.59	0.41	0.16	0.39	0.36	0.25	0.26	0.19	0.51	0.10	0.15	0.11	0.10	0.10	0.10	0.09	0.19
Low	0.57	0.36	0.58	0.42	0.52	0.39	0.39	0.25	0.24	0.38	0.24	0.29	0.04	0.04	0.05	0.04	0.03	0.04

Table B.25: Time-Series Regressions CAPM & 3FM - Sweden

This table reports the results for the CAPM (Panel A) & Fama and French (1993) 3FM (Panel B) time series regressions for our 27 sorted portfolios (cf. Table 3.2 on page 78). The first row per block depicts all high book-to-market portfolios, i.e., $P1$ to $P9$, with the market capitalization (size) increasing from left to right. The second row per block depicts all medium book-to-market portfolios, i.e., $P10$ to $P17$, with the market capitalization (size) increasing from left to right. The third row per blockshows all low book-to-market portfolios, i.e., $P20$ to $P27$, with the market capitalization (size) increasing from left to right. The shown adjusted R^2 values are adjusted for degrees of freedom. Statistics are corrected for heteroscedasticity and autocorrelation, up to three lags, using the Newey and West (1987) estimator.

	Market Capitalization (Size)																	
BV/MV	Small				Medium				Big	Small				Medium				Big
Panel A: Capital Asset Pricing Model																		
					α									$t(\alpha)$				
High	0.08	0.13	0.08	0.07	0.05	0.00	0.07	0.03	0.01	1.02	2.26	2.24	1.39	1.44	-0.06	0.98	0.64	0.23
Med.	0.08	0.09	0.19	0.00	0.00	0.03	0.02	-0.02	-0.05	1.64	2.53	3.97	-0.14	0.10	0.74	0.69	-0.82	-2.13
Low	-0.01	-0.02	0.12	0.08	-0.04	-0.02	-0.02	-0.03	-0.04	-0.01	-0.02	0.12	0.08	-0.04	-0.02	-0.02	-0.03	-0.04
					β^{MRF}									$t\left(\beta^{MRF}\right)$				
High	0.88	0.83	0.64	0.98	0.62	0.71	1.90	1.24	0.77	3.90	2.76	4.40	3.46	5.64	4.62	2.50	2.79	4.59
Med.	0.83	0.71	0.72	0.54	0.56	0.44	0.62	0.64	0.56	4.60	7.25	4.76	3.58	6.65	4.55	6.90	6.75	5.89
Low	0.96	0.67	0.74	0.45	0.41	0.42	0.29	0.37	0.45	6.11	3.85	5.55	4.30	5.40	6.38	5.07	6.37	6.73
					Adj. R^2									s(e)				
High	0.19	0.23	0.27	0.13	0.37	0.37	0.24	0.34	0.39	0.34	0.23	0.11	0.65	0.07	0.09	1.17	0.31	0.10
Med.	0.26	0.40	0.21	0.26	0.43	0.20	0.40	0.52	0.41	0.20	0.08	0.20	0.08	0.04	0.08	0.06	0.04	0.05
Low	0.38	0.25	0.23	0.19	0.33	0.42	0.25	0.39	0.52	0.16	0.14	0.19	0.09	0.04	0.02	0.03	0.02	0.02
Panel B: Fama and French (1993) Model																		
					α									$t(\alpha)$				
High	-0.13	0.00	0.00	-0.08	-0.01	-0.06	0.01	-0.06	-0.06	-3.30	-0.07	-0.03	-1.39	-0.59	-2.93	0.16	-2.29	-2.23
Med.	-0.04	0.01	0.07	-0.06	-0.03	0.04	0.02	-0.02	-0.05	-1.08	0.45	1.90	-2.35	-1.22	0.75	0.89	-1.01	-2.04
Low	-0.11	-0.10	0.03	0.00	-0.07	-0.05	-0.02	-0.04	-0.05	-0.11	-0.10	0.03	0.00	-0.07	-0.05	-0.02	-0.04	-0.05
					β^{MRF}									$t\left(\beta^{MRF}\right)$				
High	0.43	0.31	0.37	0.30	0.42	0.47	0.75	0.61	0.46	2.85	2.72	5.77	1.77	5.45	5.17	4.82	5.67	4.67
Med.	0.49	0.56	0.62	0.27	0.48	0.45	0.62	0.58	0.57	3.73	7.15	5.30	5.41	5.31	4.40	6.28	5.54	4.69
Low	0.76	0.48	0.68	0.39	0.36	0.35	0.30	0.38	0.41	6.39	3.58	4.67	5.32	4.44	5.11	4.62	6.12	5.48
					β^{HML}									$t\left(\beta^{HML}\right)$				
High	1.00	1.20	0.62	1.58	0.46	0.55	2.75	1.48	0.71	6.03	6.43	5.25	2.80	6.15	4.35	13.04	4.93	9.74
Med.	0.77	0.35	0.19	0.62	0.19	-0.02	0.00	0.13	-0.02	5.83	5.47	2.43	5.44	2.51	-0.25	-0.04	1.58	-0.21
Low	0.45	0.42	0.10	0.10	0.11	0.15	-0.03	-0.02	0.08	3.29	2.74	0.76	1.92	1.63	2.62	-0.72	-0.37	1.37
					β^{SMB}									$t\left(\beta^{SMB}\right)$				
High	1.71	0.81	0.56	0.78	0.42	0.37	-1.01	0.12	0.40	9.29	6.00	4.93	1.77	5.86	4.33	-2.12	0.80	3.71
Med.	0.94	0.67	1.29	0.21	0.24	-0.10	-0.08	-0.03	0.09	7.13	6.38	6.28	2.76	3.01	-0.63	-0.83	-0.39	0.92
Low	0.88	0.66	1.07	0.89	0.35	0.21	0.04	0.04	0.02	5.68	3.68	4.71	6.61	4.46	3.58	0.54	0.79	0.37
					Adj. R^2									s(e)				
High	0.62	0.67	0.51	0.42	0.58	0.58	0.81	0.77	0.68	0.16	0.10	0.08	0.44	0.04	0.06	0.30	0.11	0.05
Med.	0.53	0.59	0.51	0.56	0.49	0.20	0.39	0.53	0.41	0.13	0.05	0.12	0.05	0.04	0.08	0.06	0.04	0.05
Low	0.55	0.39	0.44	0.53	0.43	0.49	0.25	0.39	0.53	0.11	0.11	0.14	0.05	0.03	0.02	0.03	0.02	0.02

Table B.26: Time-Series Regressions 4FM - Sweden

This table reports the results for the time series regressions of our 27 sorted portfolios (cf. Table 3.2 on page 78) on the Carhart (1997) 4FM. The first row per block depicts all high book-to-market portfolios, i.e., $P1$ to $P9$, with the market capitalization (size) increasing from left to right. The second row per block depicts all medium book-to-market portfolios, i.e., $P10$ to $P17$, with the market capitalization (size) increasing from left to right. The third row per block shows all low book-to-market portfolios, i.e., $P20$ to $P27$, with the market capitalization (size) increasing from left to right. The shown adjusted R^2 values are adjusted for degrees of freedom. Statistics are corrected for heteroscedasticity and autocorrelation, up to three lags, using the Newey and West (1987) estimator.

	Market Capitalization (Size)																	
BV/MV	Small				Medium				Big	Small				Medium				Big
					α									$t\,(\alpha)$				
High	-0.11	-0.02	-0.02	-0.05	-0.02	-0.09	0.03	-0.08	-0.08	-2.68	-0.67	-0.85	-1.11	-0.79	-4.22	0.49	-2.67	-2.89
Med.	-0.02	0.00	0.06	-0.07	-0.04	0.02	0.04	-0.04	-0.08	-0.56	-0.09	1.64	-2.92	-1.74	0.41	1.24	-1.43	-3.64
Low	-0.08	-0.11	-0.01	0.00	-0.07	-0.06	-0.03	-0.03	-0.05	-0.08	-0.11	-0.01	0.00	-0.07	-0.06	-0.03	-0.03	-0.05
					β^{MRF}									$t(\beta^{MRF})$				
High	0.44	0.31	0.36	0.31	0.42	0.46	0.76	0.61	0.46	2.83	2.78	6.89	1.88	5.63	6.10	4.93	5.84	5.02
Med.	0.49	0.55	0.62	0.27	0.47	0.44	0.62	0.58	0.56	3.66	7.79	5.22	6.22	5.52	4.58	6.26	5.82	5.42
Low	0.77	0.48	0.67	0.39	0.36	0.35	0.30	0.38	0.41	6.64	3.86	5.23	5.22	4.44	5.30	4.86	6.16	5.79
					β^{HML}									$t(\beta^{HML})$				
High	0.71	1.54	1.02	0.98	0.56	1.02	2.41	1.81	1.03	3.47	8.32	6.00	2.75	5.32	7.69	8.20	6.10	8.39
Med.	0.39	0.64	0.25	0.84	0.37	0.30	-0.30	0.34	0.40	2.06	6.45	1.07	5.66	3.86	2.55	-1.40	2.58	3.43
Low	-0.10	0.75	0.70	0.12	0.11	0.28	0.18	-0.20	0.24	-0.60	3.47	4.44	0.81	1.11	3.82	2.55	-1.48	2.58
					β^{SMB}									$t(\beta^{SMB})$				
High	1.69	0.85	0.60	0.73	0.42	0.42	-1.04	0.15	0.42	9.46	6.46	5.74	1.79	5.79	5.53	-2.24	1.10	4.29
Med.	0.90	0.70	1.30	0.23	0.26	-0.07	-0.11	-0.01	0.13	7.31	6.77	6.35	3.34	3.60	-0.46	-1.23	-0.13	1.73
Low	0.83	0.69	1.12	0.89	0.35	0.23	0.06	0.02	0.03	6.39	4.22	5.15	6.75	4.41	4.24	0.82	0.54	0.73
					β^{WML}									$t(\beta^{WML})$				
High	-0.54	0.64	0.74	-1.11	0.18	0.87	-0.63	0.60	0.58	-0.54	0.64	0.74	-1.11	0.18	0.87	-0.63	0.60	0.58
Med.	-0.70	0.54	0.11	0.40	0.35	0.58	-0.54	0.37	0.77	-0.70	0.54	0.11	0.40	0.35	0.58	-0.54	0.37	0.77
Low	-1.01	0.59	1.11	0.05	-0.01	0.26	0.39	-0.35	0.29	-1.01	0.59	1.11	0.05	-0.01	0.26	0.39	-0.35	0.29
					Adj. R^2									s(e)				
High	0.63	0.69	0.57	0.44	0.58	0.66	0.81	0.79	0.71	0.15	0.09	0.07	0.42	0.04	0.05	0.29	0.10	0.05
Med.	0.55	0.63	0.51	0.58	0.51	0.25	0.44	0.56	0.53	0.12	0.05	0.13	0.05	0.04	0.07	0.06	0.04	0.04
Low	0.61	0.42	0.52	0.53	0.43	0.52	0.32	0.44	0.57	0.10	0.11	0.12	0.05	0.03	0.02	0.02	0.02	0.02

Table B.27: Time-Series Regressions CAPM & 3FM - United Kingdom

This table reports the results for the CAPM (Panel A) & Fama and French (1993) 3FM (Panel B) time series regressions for our 27 sorted portfolios (cf. Table 3.2 on page 78). The first row per block depicts all high book-to-market portfolios, i.e., $P1$ to $P9$, with the market capitalization (size) increasing from left to right. The second row per block depicts all medium book-to-market portfolios, i.e., $P10$ to $P17$, with the market capitalization (size) increasing from left to right. The third row per blockshows all low book-to-market portfolios, i.e., $P20$ to $P27$, with the market capitalization (size) increasing from left to right. The shown adjusted R^2 values are adjusted for degrees of freedom. Statistics are corrected for heteroscedasticity and autocorrelation, up to three lags, using the Newey and West (1987) estimator.

	Market Capitalization (Size)																	
BV/MV	Small				Medium				Big	Small				Medium				Big
Panel A: Capital Asset Pricing Model																		
					α									$t(\alpha)$				
High	0.09	0.09	0.11	0.01	0.03	0.06	0.00	-0.02	-0.02	2.63	3.84	4.31	0.42	2.01	2.93	-0.20	-1.58	-1.09
Med.	0.02	0.03	0.07	-0.07	-0.03	0.01	-0.06	-0.05	0.00	0.55	1.10	3.09	-8.88	-2.08	0.28	-3.72	-3.83	-0.30
Low	0.01	0.02	0.05	0.05	-0.07	-0.04	-0.01	-0.07	-0.06	0.01	0.02	0.05	0.05	-0.07	-0.04	-0.01	-0.07	-0.06
					β^{MRF}									$t\left(\beta^{MRF}\right)$				
High	1.23	1.11	1.25	1.01	0.94	1.04	1.18	1.02	1.03	6.38	8.08	7.70	8.42	12.47	9.77	10.01	15.13	11.66
Med.	1.13	1.05	1.15	0.29	0.95	1.18	0.96	0.83	0.98	6.79	7.13	6.83	6.16	10.94	10.69	8.34	11.77	10.67
Low	1.23	0.97	1.33	0.95	0.87	0.83	0.99	0.81	0.72	8.52	12.39	11.12	6.73	7.08	10.56	10.33	7.99	11.05
					Adj. R^2									s(e)				
High	0.21	0.35	0.33	0.38	0.55	0.44	0.49	0.63	0.54	0.13	0.05	0.07	0.04	0.02	0.03	0.03	0.01	0.02
Med.	0.24	0.33	0.36	0.28	0.52	0.49	0.44	0.50	0.53	0.09	0.05	0.05	0.01	0.02	0.03	0.03	0.02	0.02
Low	0.33	0.39	0.42	0.32	0.37	0.49	0.46	0.43	0.49	0.07	0.03	0.06	0.04	0.03	0.02	0.03	0.02	0.01
Panel B: Fama and French (1993) Model																		
					α									$t(\alpha)$				
High	-0.15	-0.05	-0.02	-0.06	-0.04	-0.04	-0.09	-0.07	-0.07	-6.40	-2.47	-0.99	-2.82	-3.23	-2.46	-4.83	-5.08	-4.18
Med.	-0.13	-0.07	0.00	-0.10	-0.06	-0.03	-0.08	-0.06	-0.03	-5.02	-3.47	-0.09	-12.10	-3.43	-1.47	-4.17	-3.70	-1.91
Low	-0.09	-0.04	-0.04	-0.02	-0.12	-0.07	-0.05	-0.09	-0.07	-0.09	-0.04	-0.04	-0.02	-0.12	-0.07	-0.05	-0.09	-0.07
					β^{MRF}									$t\left(\beta^{MRF}\right)$				
High	0.66	0.78	0.92	0.84	0.78	0.81	0.99	0.90	0.91	5.67	9.02	8.14	7.14	14.57	11.40	10.40	17.82	11.61
Med.	0.76	0.82	0.98	0.23	0.89	1.09	0.91	0.81	0.92	6.38	7.64	7.47	5.74	10.82	10.18	8.11	11.94	10.89
Low	0.98	0.82	1.11	0.78	0.75	0.76	0.91	0.77	0.70	9.29	11.75	10.39	7.44	6.68	10.42	9.82	7.75	11.06
					β^{HML}									$t\left(\beta^{HML}\right)$				
High	1.54	0.91	1.10	0.71	0.50	0.75	0.98	0.44	0.44	8.65	5.95	5.86	4.49	5.12	7.61	4.34	4.12	3.43
Med.	0.24	-0.06	-0.37	0.22	-0.12	-0.12	-0.07	0.19	0.33	1.13	-0.46	-2.17	3.36	-0.88	-0.87	-0.53	1.72	2.67
Low	-0.48	-0.26	-0.33	-0.34	-0.09	-0.11	-0.11	-0.07	0.15	-2.47	-2.02	-2.55	-2.10	-0.61	-0.88	-0.82	-0.59	1.54
					β^{SMB}									$t\left(\beta^{SMB}\right)$				
High	1.82	0.99	0.92	0.41	0.42	0.63	0.36	0.28	0.30	11.71	6.20	3.89	2.31	9.01	7.19	3.71	4.03	3.70
Med.	1.55	1.12	1.05	0.17	0.39	0.48	0.25	-0.02	0.11	7.38	8.31	5.81	2.73	2.91	3.56	1.92	-0.24	0.91
Low	1.46	0.83	1.25	0.96	0.59	0.36	0.45	0.24	0.00	8.31	9.63	7.07	6.27	3.73	3.00	3.76	2.09	0.05
					Adj. R^2									s(e)				
High	0.74	0.68	0.59	0.51	0.72	0.67	0.67	0.73	0.62	0.04	0.03	0.04	0.03	0.01	0.02	0.02	0.01	0.02
Med.	0.60	0.62	0.60	0.43	0.59	0.55	0.46	0.51	0.56	0.05	0.03	0.03	0.00	0.02	0.03	0.03	0.02	0.02
Low	0.69	0.62	0.71	0.58	0.50	0.56	0.53	0.45	0.49	0.03	0.02	0.03	0.03	0.02	0.01	0.02	0.02	0.01

Table B.28: Time-Series Regressions 4FM - United Kingdom

This table reports the results for the time series regressions of our 27 sorted portfolios (cf. Table 3.2 on page 78) on the Carhart (1997) 4FM. The first row per block depicts all high book-to-market portfolios, i.e., $P1$ to $P9$, with the market capitalization (size) increasing from left to right. The second row per block depicts all medium book-to-market portfolios, i.e., $P10$ to $P17$, with the market capitalization (size) increasing from left to right. The third row per block shows all low book-to-market portfolios, i.e., $P20$ to $P27$, with the market capitalization (size) increasing from left to right. The shown adjusted R^2 values are adjusted for degrees of freedom. Statistics are corrected for heteroscedasticity and autocorrelation, up to three lags, using the Newey and West (1987) estimator.

	Market Capitalization (Size)																	
BV/MV	Small				Medium				Big	Small				Medium				Big
	α									$t\,(\alpha)$								
High	-0.09	-0.04	-0.06	-0.02	-0.03	-0.06	-0.05	-0.06	-0.09	-4.32	-2.13	-2.12	-1.02	-1.97	-3.64	-2.95	-4.90	-5.90
Med.	-0.08	-0.06	0.00	-0.10	-0.06	-0.05	-0.04	-0.05	-0.05	-3.11	-2.93	-0.08	-11.43	-2.87	-2.29	-2.14	-2.88	-3.43
Low	-0.05	-0.04	-0.09	-0.02	-0.08	-0.06	-0.06	-0.05	-0.06	-0.05	-0.04	-0.09	-0.02	-0.08	-0.06	-0.06	-0.05	-0.06
	β^{MRF}									$t(\beta^{MRF})$								
High	0.82	0.79	0.82	0.95	0.82	0.75	1.09	0.91	0.84	9.37	8.61	7.78	12.10	17.83	12.46	17.42	18.85	13.22
Med.	0.91	0.84	0.98	0.21	0.89	1.05	1.03	0.83	0.86	7.56	8.37	7.37	5.43	11.23	10.48	12.97	13.35	11.41
Low	1.10	0.82	0.98	0.79	0.86	0.77	0.88	0.88	0.72	13.07	11.64	11.75	7.48	11.52	10.89	10.08	13.21	12.44
	β^{HML}									$t(\beta^{HML})$								
High	1.42	0.91	1.17	0.62	0.47	0.79	0.90	0.44	0.49	9.69	5.96	6.40	4.16	5.15	8.45	4.57	4.15	4.07
Med.	0.13	-0.08	-0.37	0.24	-0.12	-0.09	-0.16	0.17	0.38	0.63	-0.56	-2.15	3.86	-0.92	-0.64	-1.42	1.54	3.19
Low	-0.57	-0.25	-0.24	-0.34	-0.17	-0.11	-0.08	-0.15	0.13	-3.47	-2.02	-1.97	-2.12	-1.34	-0.95	-0.63	-1.49	1.36
	β^{SMB}									$t(\beta^{SMB})$								
High	1.49	0.99	1.10	0.18	0.36	0.75	0.15	0.26	0.44	10.31	5.59	4.27	1.07	6.50	8.91	1.61	3.73	5.06
Med.	1.26	1.09	1.05	0.22	0.38	0.57	0.00	-0.07	0.25	6.99	8.25	5.80	3.09	2.58	4.07	0.01	-0.94	1.80
Low	1.20	0.84	1.50	0.95	0.38	0.35	0.52	0.02	-0.04	9.02	8.92	11.01	6.15	2.70	2.63	4.21	0.23	-0.63
	β^{WML}									$t(\beta^{WML})$								
High	-1.28	-0.01	0.73	-0.92	-0.24	0.48	-0.81	-0.09	0.53	-1.28	-0.01	0.73	-0.92	-0.24	0.48	-0.81	-0.09	0.53
Med.	-1.15	-0.14	0.00	0.18	-0.05	0.33	-0.95	-0.20	0.51	-1.15	-0.14	0.00	0.18	-0.05	0.33	-0.95	-0.20	0.51
Low	-0.98	0.07	0.99	-0.03	-0.84	-0.07	0.26	-0.85	-0.18	-0.98	0.07	0.99	-0.03	-0.84	-0.07	0.26	-0.85	-0.18
	Adj. R^2									s(e)								
High	0.82	0.68	0.63	0.62	0.73	0.70	0.74	0.73	0.67	0.03	0.03	0.04	0.02	0.01	0.02	0.02	0.01	0.01
Med.	0.68	0.62	0.60	0.47	0.59	0.57	0.60	0.52	0.61	0.04	0.03	0.03	0.00	0.02	0.03	0.02	0.02	0.02
Low	0.76	0.62	0.79	0.58	0.61	0.56	0.54	0.61	0.50	0.03	0.02	0.02	0.03	0.02	0.01	0.02	0.01	0.01

Table B.29: Time-Series Regressions CAPM & 3FM - Norway

This table reports the results for the CAPM (Panel A) & Fama and French (1993) 3FM (Panel B) time series regressions for our 27 sorted portfolios (cf. Table 3.2 on page 78). The first row per block depicts all high book-to-market portfolios, i.e., $P1$ to $P9$, with the market capitalization (size) increasing from left to right. The second row per block depicts all medium book-to-market portfolios, i.e., $P10$ to $P17$, with the market capitalization (size) increasing from left to right. The third row per blockshows all low book-to-market portfolios, i.e., $P20$ to $P27$, with the market capitalization (size) increasing from left to right. The shown adjusted R^2 values are adjusted for degrees of freedom. Statistics are corrected for heteroscedasticity and autocorrelation, up to three lags, using the Newey and West (1987) estimator.

	Market Capitalization (Size)																	
BV/MV	Small				Medium				Big	Small				Medium				Big
Panel A: Capital Asset Pricing Model																		
					α									$t(\alpha)$				
High	0.06	0.02	0.06	-0.02	-0.02	0.01	-0.08	-0.03	0.07	1.51	0.91	1.93	-0.70	-0.83	0.47	-2.51	-1.40	2.37
Med.	0.00	-0.03	0.06	-0.06	-0.04	0.03	-0.05	-0.03	-0.07	-0.04	-0.83	1.36	-3.85	-1.65	0.65	-2.43	-1.46	-2.80
Low	0.05	-0.04	0.04	0.01	-0.05	-0.05	0.00	-0.07	-0.04	0.05	-0.04	0.04	0.01	-0.05	-0.05	0.00	-0.07	-0.04
					β^{MRF}									$t\left(\beta^{MRF}\right)$				
High	1.09	0.56	0.59	0.97	0.81	0.87	1.05	1.15	1.35	4.46	4.42	4.16	4.46	8.86	7.75	9.59	13.58	11.40
Med.	0.67	0.55	0.97	0.20	0.65	0.78	0.96	0.83	1.10	4.78	5.59	7.69	3.07	4.96	5.99	6.07	10.83	11.49
Low	0.28	0.50	0.83	0.64	0.65	0.53	0.58	0.64	0.65	2.03	5.23	4.92	7.04	5.29	4.87	5.52	7.10	10.06
					Adj. R^2									s(e)				
High	0.24	0.27	0.17	0.32	0.44	0.44	0.47	0.62	0.54	0.32	0.07	0.14	0.17	0.07	0.08	0.10	0.07	0.13
Med.	0.18	0.26	0.28	0.11	0.29	0.23	0.48	0.56	0.59	0.18	0.07	0.21	0.03	0.09	0.16	0.08	0.05	0.07
Low	0.04	0.22	0.20	0.26	0.28	0.29	0.22	0.52	0.56	0.16	0.07	0.23	0.10	0.09	0.06	0.10	0.03	0.03
Panel B: Fama and French (1993) Model																		
					α									$t(\alpha)$				
High	-0.08	-0.04	0.00	-0.09	-0.05	0.01	-0.10	-0.05	0.07	-2.48	-1.97	-0.17	-2.82	-2.53	0.31	-3.30	-1.98	2.08
Med.	-0.08	-0.07	0.03	-0.08	-0.05	0.03	-0.04	-0.03	-0.07	-2.93	-2.67	0.85	-5.78	-1.95	0.66	-1.68	-1.52	-2.60
Low	0.00	-0.07	-0.01	-0.01	-0.08	-0.06	0.01	-0.07	-0.04	0.00	-0.07	-0.01	-0.01	-0.08	-0.06	0.01	-0.07	-0.04
					β^{MRF}									$t\left(\beta^{MRF}\right)$				
High	0.87	0.53	0.73	0.85	0.75	0.82	0.86	1.02	1.13	6.36	8.75	6.67	6.94	8.92	8.60	8.84	13.16	8.54
Med.	0.90	0.74	1.51	0.25	0.81	1.03	0.91	0.91	1.14	6.73	8.53	9.73	5.01	7.74	7.06	8.72	11.44	9.29
Low	0.65	0.71	1.48	1.04	0.86	0.67	0.79	0.65	0.72	4.81	7.45	7.10	10.40	7.31	7.52	6.67	9.09	11.41
					β^{HML}									$t\left(\beta^{HML}\right)$				
High	1.86	0.67	0.28	0.94	0.48	0.15	0.63	0.41	0.50	4.78	3.19	1.50	2.12	2.48	0.69	3.83	3.06	2.13
Med.	0.30	-0.03	-0.93	0.17	-0.26	-0.62	0.02	-0.15	-0.04	1.31	-0.16	-3.10	1.83	-1.56	-1.69	0.12	-1.21	-0.24
Low	-0.31	-0.11	-0.99	-0.68	-0.15	-0.22	-0.50	-0.01	-0.13	-1.31	-0.73	-3.58	-3.34	-0.81	-1.53	-1.69	-0.06	-1.24
					β^{SMB}									$t\left(\beta^{SMB}\right)$				
High	1.72	0.80	0.96	0.82	0.43	0.01	0.11	0.08	-0.19	4.64	4.86	5.02	2.74	1.75	0.06	0.71	0.52	-0.98
Med.	1.35	0.71	0.87	0.41	0.28	0.16	-0.15	0.12	0.08	4.06	4.33	4.98	4.59	1.88	1.09	-0.71	1.13	0.53
Low	1.02	0.67	1.23	0.67	0.66	0.23	0.13	0.01	0.13	4.32	6.35	5.02	6.08	2.46	1.86	1.06	0.12	1.50
					Adj. R^2									s(e)				
High	0.59	0.52	0.33	0.46	0.52	0.44	0.52	0.64	0.57	0.17	0.05	0.11	0.14	0.06	0.08	0.09	0.06	0.12
Med.	0.42	0.41	0.48	0.26	0.33	0.29	0.48	0.57	0.59	0.12	0.06	0.15	0.02	0.08	0.15	0.08	0.05	0.07
Low	0.26	0.38	0.51	0.50	0.40	0.33	0.28	0.52	0.58	0.12	0.06	0.14	0.07	0.07	0.05	0.09	0.03	0.03

Table B.30: Time-Series Regressions 4FM - Norway

This table reports the results for the time series regressions of our 27 sorted portfolios (cf. Table 3.2 on page 78) on the Carhart (1997) 4FM. The first row per block depicts all high book-to-market portfolios, i.e., $P1$ to $P9$, with the market capitalization (size) increasing from left to right. The second row per block depicts all medium book-to-market portfolios, i.e., $P10$ to $P17$, with the market capitalization (size) increasing from left to right. The third row per block shows all low book-to-market portfolios, i.e., $P20$ to $P27$, with the market capitalization (size) increasing from left to right. The shown adjusted R^2 values are adjusted for degrees of freedom. Statistics are corrected for heteroscedasticity and autocorrelation, up to three lags, using the Newey and West (1987) estimator.

	Market Capitalization (Size)																	
BV/MV	Small				Medium				Big	Small				Medium				Big
					α									$t(\alpha)$				
High	-0.04	-0.04	-0.04	-0.05	-0.06	-0.02	-0.06	-0.05	0.02	-1.33	-1.98	-1.43	-1.41	-2.60	-0.64	-1.86	-2.42	0.74
Med.	-0.06	-0.07	0.01	-0.10	-0.06	0.03	0.00	-0.04	-0.10	-1.86	-2.92	0.25	-6.48	-3.11	0.56	0.00	-1.71	-4.30
Low	0.05	-0.08	-0.06	-0.02	-0.07	-0.07	0.00	-0.04	-0.05	0.05	-0.08	-0.06	-0.02	-0.07	-0.07	0.00	-0.04	-0.05
					β^{MRF}									$t(\beta^{MRF})$				
High	1.04	0.54	0.58	1.05	0.75	0.71	1.06	0.99	0.90	7.05	7.33	5.80	7.88	9.43	6.67	10.82	11.74	6.73
Med.	1.04	0.73	1.40	0.18	0.73	1.02	1.11	0.88	0.98	8.24	7.76	8.65	3.55	8.30	6.94	11.87	10.41	9.75
Low	0.91	0.69	1.25	0.98	0.92	0.61	0.77	0.78	0.70	7.61	8.85	8.30	9.19	8.75	8.26	6.63	13.49	10.68
					β^{HML}									$t(\beta^{HML})$				
High	1.50	0.64	0.61	0.52	0.50	0.38	0.22	0.48	0.98	4.53	3.47	2.51	1.53	2.24	1.48	1.17	2.98	4.06
Med.	0.02	0.00	-0.71	0.30	-0.10	-0.58	-0.40	-0.08	0.29	0.07	0.02	-2.39	2.69	-0.52	-1.52	-2.63	-0.57	1.41
Low	-0.85	-0.07	-0.50	-0.55	-0.26	-0.09	-0.47	-0.28	-0.08	-4.66	-0.44	-2.54	-2.63	-1.29	-0.60	-1.57	-3.04	-0.73
					β^{SMB}									$t(\beta^{SMB})$				
High	1.52	0.78	1.15	0.58	0.44	0.15	-0.13	0.12	0.09	4.44	5.71	6.17	2.20	1.69	0.88	-0.76	0.72	0.49
Med.	1.18	0.73	1.00	0.49	0.38	0.19	-0.40	0.16	0.27	3.53	3.89	4.62	5.64	2.45	1.24	-1.82	1.38	1.71
Low	0.70	0.69	1.52	0.75	0.59	0.30	0.15	-0.15	0.15	3.79	5.41	5.88	5.81	2.07	2.37	1.24	-1.47	1.68
					β^{WML}									$t(\beta^{WML})$				
High	-0.72	-0.05	0.66	-0.86	0.04	0.49	-0.83	0.14	0.98	-0.72	-0.05	0.66	-0.86	0.04	0.49	-0.83	0.14	0.98
Med.	-0.58	0.06	0.46	0.27	0.33	0.08	-0.86	0.13	0.67	-0.58	0.06	0.46	0.27	0.33	0.08	-0.86	0.13	0.67
Low	-1.10	0.08	1.00	0.27	-0.22	0.25	0.06	-0.56	0.08	-1.10	0.08	1.00	0.27	-0.22	0.25	0.06	-0.56	0.08
					Adj. R^2									s(e)				
High	0.62	0.52	0.39	0.53	0.52	0.48	0.61	0.64	0.65	0.16	0.05	0.10	0.12	0.06	0.08	0.08	0.06	0.10
Med.	0.46	0.42	0.49	0.31	0.35	0.29	0.59	0.57	0.65	0.12	0.06	0.14	0.02	0.08	0.15	0.07	0.05	0.06
Low	0.43	0.38	0.59	0.51	0.41	0.35	0.28	0.63	0.58	0.10	0.06	0.12	0.07	0.07	0.05	0.09	0.02	0.03

Table B.31: Time-Series Regressions CAPM & 3FM - Switzerland

This table reports the results for the CAPM (Panel A) & Fama and French (1993) 3FM (Panel B) time series regressions for our 27 sorted portfolios (cf. Table 3.2 on page 78). The first row per block depicts all high book-to-market portfolios, i.e., $P1$ to $P9$, with the market capitalization (size) increasing from left to right. The second row per block depicts all medium book-to-market portfolios, i.e., $P10$ to $P17$, with the market capitalization (size) increasing from left to right. The third row per blockshows all low book-to-market portfolios, i.e., $P20$ to $P27$, with the market capitalization (size) increasing from left to right. The shown adjusted R^2 values are adjusted for degrees of freedom. Statistics are corrected for heteroscedasticity and autocorrelation, up to three lags, using the Newey and West (1987) estimator.

	Market Capitalization (Size)																	
BV/MV	Small				Medium				Big	Small				Medium				Big
Panel A: Capital Asset Pricing Model																		
					α									$t(\alpha)$				
High	-0.05	0.18	0.35	0.03	0.06	0.06	0.10	0.01	0.02	-0.62	2.85	3.81	0.60	2.65	1.84	2.26	0.53	0.54
Med.	0.13	0.06	0.05	0.23	0.04	-0.03	-0.01	0.00	0.01	1.37	1.96	1.37	2.73	1.47	-0.84	-0.25	-0.16	0.40
Low	0.06	0.16	0.00	-0.01	-0.03	0.00	-0.04	-0.04	-0.03	0.06	0.16	0.00	-0.01	-0.03	0.00	-0.04	-0.04	-0.03
					β^{MRF}									$t\left(\beta^{MRF}\right)$				
High	1.42	1.11	2.75	1.50	0.98	0.88	1.31	0.90	0.67	4.14	2.46	3.20	4.11	7.17	6.07	5.60	8.27	3.11
Med.	1.62	0.78	0.60	2.64	0.84	1.17	1.20	1.11	1.04	2.85	3.97	4.35	2.91	7.30	8.75	10.03	11.43	11.98
Low	1.63	1.28	1.58	0.29	0.47	0.56	0.63	0.60	0.70	5.84	4.96	5.98	4.18	5.04	7.60	8.26	10.38	10.25
					Adj. R^2									s(e)				
High	0.13	0.09	0.26	0.24	0.50	0.27	0.29	0.48	0.15	0.53	0.50	0.90	0.30	0.04	0.09	0.18	0.04	0.10
Med.	0.09	0.14	0.08	0.26	0.31	0.36	0.45	0.49	0.42	1.06	0.16	0.16	0.84	0.07	0.10	0.07	0.05	0.06
Low	0.14	0.13	0.25	0.08	0.23	0.31	0.35	0.45	0.49	0.67	0.44	0.31	0.04	0.03	0.03	0.03	0.02	0.02
Panel B: Fama and French (1993) Model																		
					α									$t(\alpha)$				
High	-0.28	-0.04	0.24	-0.12	0.05	0.00	0.01	-0.02	0.04	-6.38	-0.79	2.65	-2.40	1.89	-0.05	0.31	-0.83	0.94
Med.	-0.16	0.03	0.00	0.16	0.04	-0.04	0.01	-0.01	0.01	-1.97	0.85	0.06	1.93	1.32	-0.92	0.20	-0.50	0.39
Low	0.01	0.15	-0.04	-0.04	-0.05	-0.01	-0.05	-0.04	-0.04	0.01	0.15	-0.04	-0.04	-0.05	-0.01	-0.05	-0.04	-0.04
					β^{MRF}									$t\left(\beta^{MRF}\right)$				
High	0.24	0.02	2.15	0.75	0.92	0.55	0.88	0.76	0.77	0.84	0.06	2.72	3.20	6.02	3.87	4.44	7.21	3.51
Med.	0.18	0.60	0.35	2.31	0.84	1.14	1.29	1.06	1.05	0.60	3.11	2.37	2.78	7.27	6.60	10.55	9.33	10.47
Low	1.40	1.29	1.44	0.16	0.35	0.54	0.59	0.63	0.64	6.95	6.83	6.35	2.12	3.63	8.21	6.32	10.73	8.75
					β^{HML}									$t\left(\beta^{HML}\right)$				
High	1.15	0.69	1.00	0.87	0.15	0.36	0.38	0.07	-0.18	5.87	3.81	2.64	4.13	2.74	6.29	2.11	1.48	-2.33
Med.	0.24	0.10	0.10	0.83	-0.36	-0.25	-0.29	-0.04	-0.23	0.60	0.86	0.73	2.30	-3.71	-2.40	-2.59	-0.51	-3.64
Low	-1.69	-1.37	-0.86	0.06	-0.04	-0.25	-0.15	-0.14	-0.06	-6.67	-4.59	-4.07	0.86	-0.64	-3.99	-2.42	-2.39	-1.01
					β^{SMB}									$t\left(\beta^{SMB}\right)$				
High	1.36	1.56	0.34	0.75	0.00	0.35	0.53	0.22	-0.06	5.46	7.18	0.68	2.72	-0.02	4.84	2.68	4.13	-0.54
Med.	2.61	0.26	0.41	-0.04	0.30	0.26	0.07	0.13	0.16	5.15	2.68	3.13	-0.08	3.92	2.40	0.66	1.52	1.98
Low	1.81	1.11	0.99	0.22	0.26	0.25	0.20	0.05	0.15	6.98	4.57	4.76	3.26	3.90	5.54	3.26	0.90	2.83
					Adj. R^2									s(e)				
High	0.58	0.50	0.35	0.55	0.52	0.47	0.42	0.53	0.17	0.26	0.27	0.79	0.18	0.04	0.06	0.14	0.03	0.10
Med.	0.48	0.16	0.15	0.31	0.46	0.42	0.50	0.50	0.46	0.60	0.15	0.15	0.78	0.05	0.09	0.07	0.05	0.06
Low	0.67	0.57	0.52	0.16	0.33	0.51	0.42	0.50	0.52	0.26	0.22	0.20	0.04	0.03	0.02	0.03	0.02	0.02

Table B.32: Time-Series Regressions 4FM - Switzerland

This table reports the results for the time series regressions of our 27 sorted portfolios (cf. Table 3.2 on page 78) on the Carhart (1997) 4FM. The first row per block depicts all high book-to-market portfolios, i.e., $P1$ to $P9$, with the market capitalization (size) increasing from left to right. The second row per block depicts all medium book-to-market portfolios, i.e., $P10$ to $P17$, with the market capitalization (size) increasing from left to right. The third row per block shows all low book-to-market portfolios, i.e., $P20$ to $P27$, with the market capitalization (size) increasing from left to right. The shown adjusted R^2 values are adjusted for degrees of freedom. Statistics are corrected for heteroscedasticity and autocorrelation, up to three lags, using the Newey and West (1987) estimator.

	Market Capitalization (Size)																	
BV/MV	Small				Medium				Big	Small				Medium				Big
					α									$t(\alpha)$				
High	-0.24	0.01	0.08	-0.02	0.03	-0.01	0.09	-0.02	0.02	-6.21	0.21	0.86	-0.59	1.34	-0.44	2.31	-0.64	0.54
Med.	-0.03	0.03	-0.02	0.05	0.05	-0.04	0.04	-0.02	-0.01	-0.40	0.81	-0.45	0.56	1.33	-0.85	1.02	-0.50	-0.46
Low	0.09	0.16	-0.10	-0.05	-0.04	-0.01	-0.05	-0.02	-0.05	0.09	0.16	-0.10	-0.05	-0.04	-0.01	-0.05	-0.02	-0.05
					β^{MRF}									$t(\beta^{MRF})$				
High	0.28	0.08	1.95	0.88	0.90	0.53	0.98	0.76	0.74	1.09	0.28	2.93	4.64	6.14	3.86	5.90	7.08	3.44
Med.	0.35	0.61	0.32	2.16	0.85	1.13	1.33	1.06	1.02	1.41	3.13	2.22	2.96	7.23	6.29	12.21	8.95	10.81
Low	1.52	1.30	1.35	0.14	0.37	0.54	0.58	0.65	0.64	7.08	7.02	6.21	1.96	3.88	7.98	6.06	12.19	8.54
					β^{HML}									$t(\beta^{HML})$				
High	1.06	0.57	1.45	0.60	0.19	0.40	0.16	0.07	-0.13	6.54	3.09	3.82	5.13	3.26	6.54	1.12	1.21	-1.48
Med.	-0.12	0.08	0.15	1.16	-0.37	-0.24	-0.38	-0.03	-0.15	-0.31	0.75	0.99	2.92	-3.60	-2.02	-3.36	-0.39	-2.44
Low	-1.93	-1.41	-0.69	0.09	-0.09	-0.25	-0.14	-0.18	-0.05	-7.37	-4.34	-3.10	1.15	-1.14	-3.53	-2.01	-3.05	-0.79
					β^{SMB}									$t(\beta^{SMB})$				
High	1.12	1.22	1.52	0.04	0.08	0.44	-0.04	0.20	0.09	5.37	5.77	3.93	0.32	0.89	4.59	-0.20	2.77	0.70
Med.	1.66	0.23	0.54	0.81	0.25	0.28	-0.16	0.15	0.35	4.72	1.50	3.74	2.07	2.28	1.66	-1.25	1.25	3.36
Low	1.17	1.01	1.46	0.29	0.14	0.26	0.22	-0.06	0.18	5.40	4.28	6.58	4.03	2.48	3.79	2.40	-0.89	2.61
					β^{WML}									$t(\beta^{WML})$				
High	-0.45	-0.65	2.28	-1.38	0.16	0.16	-1.10	-0.04	0.28	-0.45	-0.65	2.28	-1.38	0.16	0.16	-1.10	-0.04	0.28
Med.	-1.84	-0.06	0.26	1.65	-0.09	0.04	-0.45	0.04	0.37	-1.84	-0.06	0.26	1.65	-0.09	0.04	-0.45	0.04	0.37
Low	-1.26	-0.19	0.90	0.15	-0.22	0.00	0.04	-0.21	0.05	-1.26	-0.19	0.90	0.15	-0.22	0.00	0.04	-0.21	0.05
					Adj. R^2									s(e)				
High	0.59	0.53	0.46	0.68	0.53	0.48	0.55	0.53	0.19	0.25	0.26	0.66	0.12	0.04	0.06	0.11	0.03	0.10
Med.	0.56	0.16	0.16	0.37	0.46	0.42	0.55	0.50	0.50	0.51	0.15	0.15	0.71	0.05	0.09	0.06	0.05	0.06
Low	0.72	0.58	0.57	0.17	0.37	0.51	0.42	0.54	0.52	0.22	0.22	0.18	0.04	0.03	0.02	0.03	0.02	0.02

Table B.33: Time-Series Regressions CAPM & 3FM - Eurozone

This table reports the results for the CAPM (Panel A) & Fama and French (1993) 3FM (Panel B) time series regressions for our 27 sorted portfolios (cf. Table 3.2 on page 78). The first row per block depicts all high book-to-market portfolios, i.e., $P1$ to $P9$, with the market capitalization (size) increasing from left to right. The second row per block depicts all medium book-to-market portfolios, i.e., $P10$ to $P17$, with the market capitalization (size) increasing from left to right. The third row per blockshows all low book-to-market portfolios, i.e., $P20$ to $P27$, with the market capitalization (size) increasing from left to right. The shown adjusted R^2 values are adjusted for degrees of freedom. Statistics are corrected for heteroscedasticity and autocorrelation, up to three lags, using the Newey and West (1987) estimator.

	Market Capitalization (Size)																	
BV/MV	Small				Medium				Big	Small				Medium				Big
Panel A: Capital Asset Pricing Model																		
					α									$t(\alpha)$				
High	0.16	0.11	0.23	0.02	0.04	0.10	0.00	0.00	0.01	4.36	5.03	7.11	0.69	1.76	3.97	-0.19	-0.23	0.45
Med.	0.06	0.06	0.13	-0.08	-0.01	0.02	-0.05	-0.04	-0.02	1.37	2.82	5.15	-12.97	-0.43	1.01	-3.29	-2.43	-1.14
Low	-0.06	0.00	0.10	0.12	-0.05	-0.01	0.02	-0.05	-0.04	-0.06	0.00	0.10	0.12	-0.05	-0.01	0.02	-0.05	-0.04
					β^{MRF}									$t\left(\beta^{MRF}\right)$				
High	1.16	0.81	1.06	0.90	0.78	0.87	0.92	0.74	0.78	7.39	9.23	7.76	8.38	7.89	8.70	9.54	9.41	9.28
Med.	1.28	0.72	1.04	0.08	0.67	0.80	0.88	0.80	0.90	4.60	9.51	10.52	3.24	7.62	8.85	13.73	12.19	12.81
Low	1.07	0.96	1.29	0.99	0.78	0.64	0.76	0.84	0.77	15.33	15.37	11.66	10.49	9.15	7.61	8.86	13.86	12.24
					Adj. R^2									s(e)				
High	0.30	0.43	0.37	0.45	0.46	0.43	0.58	0.58	0.55	0.15	0.04	0.09	0.05	0.03	0.05	0.03	0.02	0.02
Med.	0.23	0.39	0.51	0.12	0.44	0.49	0.70	0.69	0.74	0.26	0.04	0.05	0.00	0.03	0.03	0.02	0.01	0.01
Low	0.59	0.62	0.59	0.51	0.53	0.44	0.49	0.70	0.68	0.04	0.03	0.05	0.04	0.03	0.03	0.03	0.01	0.01
Panel B: Fama and French (1993) Model																		
					α									$t(\alpha)$				
High	-0.18	-0.03	0.01	-0.14	-0.06	-0.03	-0.07	-0.05	-0.05	-4.77	-0.87	0.19	-4.66	-2.22	-0.84	-2.56	-2.70	-2.27
Med.	-0.14	-0.06	0.01	-0.11	-0.06	-0.05	-0.09	-0.07	-0.06	-3.40	-2.42	0.45	-11.65	-2.11	-1.64	-4.55	-2.85	-2.77
Low	-0.17	-0.07	0.03	0.01	-0.12	-0.06	-0.05	-0.09	-0.07	-0.17	-0.07	0.03	0.01	-0.12	-0.06	-0.05	-0.09	-0.07
					β^{MRF}									$t\left(\beta^{MRF}\right)$				
High	0.88	0.69	0.80	0.84	0.74	0.81	0.93	0.76	0.76	7.79	11.38	8.75	10.70	8.44	10.70	11.02	12.15	10.91
Med.	0.75	0.54	0.80	0.05	0.65	0.72	0.87	0.80	0.87	4.95	9.24	8.92	1.92	8.68	8.55	15.78	13.31	12.69
Low	0.94	0.82	1.04	0.76	0.76	0.62	0.69	0.83	0.76	13.63	14.31	10.40	8.83	11.18	8.59	8.50	15.89	13.27
					β^{HML}									$t\left(\beta^{HML}\right)$				
High	2.74	1.09	1.37	1.65	1.10	1.36	1.01	0.78	0.74	5.26	4.23	5.01	6.57	4.96	5.87	4.75	5.52	4.62
Med.	-0.68	0.52	0.08	0.10	0.57	0.48	0.55	0.41	0.34	-0.65	3.17	0.44	2.56	3.09	2.72	3.86	2.86	2.66
Low	0.62	0.05	-0.62	0.06	0.87	0.53	0.44	0.51	0.38	2.92	0.28	-3.13	0.36	4.32	3.04	2.65	3.74	2.75
					β^{SMB}									$t\left(\beta^{SMB}\right)$				
High	1.34	0.57	1.22	0.35	0.24	0.33	-0.03	-0.05	0.10	5.47	2.62	3.75	2.27	1.39	1.64	-0.17	-0.44	0.74
Med.	2.31	0.81	1.05	0.14	0.14	0.34	0.06	0.03	0.14	2.50	4.35	6.06	2.70	0.75	1.88	0.46	0.24	1.22
Low	0.62	0.66	1.11	1.02	0.10	0.14	0.33	0.07	0.04	2.77	3.32	6.71	6.13	0.59	0.77	1.93	0.57	0.32
					Adj. R^2									s(e)				
High	0.70	0.61	0.63	0.71	0.62	0.61	0.69	0.68	0.62	0.06	0.03	0.05	0.02	0.02	0.03	0.02	0.01	0.02
Med.	0.46	0.58	0.67	0.27	0.48	0.55	0.75	0.71	0.76	0.18	0.03	0.03	0.00	0.03	0.03	0.01	0.01	0.01
Low	0.68	0.71	0.73	0.67	0.63	0.49	0.55	0.74	0.71	0.03	0.02	0.04	0.03	0.02	0.02	0.02	0.01	0.01

Table B.34: Time-Series Regressions 4FM - Eurozone

This table reports the results for the time series regressions of our 27 sorted portfolios (cf. Table 3.2 on page 78) on the Carhart (1997) 4FM. The first row per block depicts all high book-to-market portfolios, i.e., $P1$ to $P9$, with the market capitalization (size) increasing from left to right. The second row per block depicts all medium book-to-market portfolios, i.e., $P10$ to $P17$, with the market capitalization (size) increasing from left to right. The third row per block shows all low book-to-market portfolios, i.e., $P20$ to $P27$, with the market capitalization (size) increasing from left to right. The shown adjusted R^2 values are adjusted for degrees of freedom. Statistics are corrected for heteroscedasticity and autocorrelation, up to three lags, using the Newey and West (1987) estimator.

	Market Capitalization (Size)																	
BV/MV	Small				Medium				Big	Small				Medium				Big
					α									$t(\alpha)$				
High	-0.16	-0.08	-0.12	-0.13	-0.10	-0.09	-0.06	-0.06	-0.10	-3.53	-2.93	-4.79	-4.66	-3.51	-2.65	-2.06	-3.27	-3.97
Med.	0.07	-0.11	-0.04	-0.11	-0.12	-0.10	-0.08	-0.09	-0.09	0.89	-4.32	-1.53	-11.38	-4.33	-3.51	-3.77	-3.90	-5.17
Low	-0.17	-0.12	-0.03	-0.04	-0.13	-0.12	-0.10	-0.08	-0.09	-0.17	-0.12	-0.03	-0.04	-0.13	-0.12	-0.10	-0.08	-0.09
					β^{MRF}									$t(\beta^{MRF})$				
High	0.90	0.66	0.72	0.84	0.71	0.76	0.94	0.75	0.73	8.06	10.47	8.95	10.47	8.43	10.39	11.21	11.87	11.36
Med.	0.90	0.51	0.77	0.04	0.61	0.69	0.88	0.78	0.84	5.87	8.37	9.00	1.78	8.29	8.82	16.22	13.16	14.26
Low	0.94	0.78	0.99	0.73	0.76	0.58	0.65	0.84	0.75	12.90	12.58	11.26	8.89	10.63	8.18	8.74	16.40	13.07
					β^{HML}									$t(\beta^{HML})$				
High	2.69	1.23	1.71	1.64	1.20	1.53	0.98	0.81	0.87	4.81	5.37	9.61	7.20	5.40	6.29	4.97	5.71	5.05
Med.	-1.27	0.65	0.22	0.12	0.72	0.63	0.52	0.47	0.45	-1.33	4.36	1.40	3.03	4.51	4.09	4.18	3.60	3.99
Low	0.62	0.18	-0.45	0.20	0.90	0.68	0.59	0.48	0.44	2.97	1.23	-2.11	1.28	4.92	4.46	3.96	4.07	3.47
					β^{SMB}									$t(\beta^{SMB})$				
High	1.29	0.70	1.53	0.33	0.33	0.48	-0.06	-0.02	0.21	5.33	4.40	7.91	2.16	1.97	2.43	-0.38	-0.18	1.46
Med.	1.78	0.92	1.19	0.15	0.28	0.48	0.03	0.09	0.24	4.09	6.59	7.09	2.89	1.82	2.94	0.20	0.81	2.41
Low	0.62	0.78	1.26	1.14	0.13	0.27	0.46	0.04	0.09	3.02	6.53	6.89	7.10	0.87	1.84	2.97	0.29	0.86
					β^{WML}									$t(\beta^{WML})$				
High	-0.26	0.69	1.66	-0.08	0.48	0.82	-0.17	0.14	0.60	-0.26	0.69	1.66	-0.08	0.48	0.82	-0.17	0.14	0.60
Med.	-2.85	0.63	0.72	0.08	0.77	0.75	-0.17	0.32	0.53	-2.85	0.63	0.72	0.08	0.77	0.75	-0.17	0.32	0.53
Low	0.01	0.65	0.83	0.67	0.17	0.73	0.70	-0.18	0.30	0.01	0.65	0.83	0.67	0.17	0.73	0.70	-0.18	0.30
					Adj. R^2									s(e)				
High	0.71	0.67	0.80	0.71	0.65	0.68	0.69	0.68	0.68	0.06	0.02	0.03	0.02	0.02	0.03	0.02	0.01	0.02
Med.	0.66	0.64	0.72	0.29	0.59	0.63	0.75	0.73	0.80	0.11	0.02	0.03	0.00	0.02	0.02	0.01	0.01	0.01
Low	0.68	0.76	0.78	0.71	0.63	0.59	0.63	0.75	0.72	0.03	0.02	0.03	0.03	0.02	0.02	0.02	0.01	0.01

Table B.35: Time-Series Regressions CAPM & 3FM - European Union

This table reports the results for the CAPM (Panel A) & Fama and French (1993) 3FM (Panel B) time series regressions for our 27 sorted portfolios (cf. Table 3.2 on page 78). The first row per block depicts all high book-to-market portfolios, i.e., $P1$ to $P9$, with the market capitalization (size) increasing from left to right. The second row per block depicts all medium book-to-market portfolios, i.e., $P10$ to $P17$, with the market capitalization (size) increasing from left to right. The third row per blockshows all low book-to-market portfolios, i.e., $P20$ to $P27$, with the market capitalization (size) increasing from left to right. The shown adjusted R^2 values are adjusted for degrees of freedom. Statistics are corrected for heteroscedasticity and autocorrelation, up to three lags, using the Newey and West (1987) estimator.

	Market Capitalization (Size)																	
BV/MV	Small				Medium				Big	Small				Medium				Big
Panel A: Capital Asset Pricing Model																		
	α									$t(\alpha)$								
High	0.14	0.10	0.19	0.02	0.02	0.07	0.01	0.00	0.00	4.23	3.95	6.74	0.69	1.10	3.35	0.66	-0.26	0.12
Med.	0.06	0.06	0.13	-0.09	-0.01	0.03	-0.04	-0.03	-0.02	1.76	3.00	5.67	-14.13	-0.40	1.34	-2.55	-2.34	-1.47
Low	-0.04	0.00	0.08	0.12	-0.04	-0.01	0.02	-0.04	-0.03	-0.04	0.00	0.08	0.12	-0.04	-0.01	0.02	-0.04	-0.03
	β^{MRF}									$t\left(\beta^{MRF}\right)$								
High	1.12	0.86	0.90	0.84	0.73	0.83	0.98	0.72	0.81	7.67	7.07	7.89	8.84	9.61	9.71	9.16	11.22	11.71
Med.	1.15	0.72	0.93	0.05	0.68	0.78	0.81	0.74	0.85	5.22	9.81	11.25	2.30	8.60	9.68	11.02	12.29	12.29
Low	1.07	0.90	1.23	0.90	0.73	0.65	0.75	0.78	0.71	13.69	15.19	13.59	11.20	8.60	8.60	9.67	11.01	12.27
	Adj. R^2									s(e)								
High	0.40	0.38	0.39	0.48	0.52	0.48	0.57	0.57	0.63	0.09	0.06	0.06	0.04	0.02	0.04	0.03	0.02	0.02
Med.	0.29	0.45	0.53	0.06	0.48	0.52	0.64	0.67	0.72	0.15	0.03	0.04	0.00	0.02	0.03	0.02	0.01	0.01
Low	0.59	0.65	0.67	0.52	0.47	0.48	0.52	0.64	0.66	0.04	0.02	0.03	0.04	0.03	0.02	0.02	0.02	0.01
Panel B: Fama and French (1993) Model																		
	α									$t(\alpha)$								
High	-0.10	-0.07	0.04	-0.08	-0.05	-0.03	-0.05	-0.06	-0.06	-3.11	-2.92	1.15	-3.11	-2.35	-1.08	-2.35	-3.07	-2.97
Med.	-0.16	-0.03	0.04	-0.11	-0.04	-0.01	-0.08	-0.05	-0.04	-3.67	-1.00	1.54	-12.70	-1.47	-0.35	-3.55	-2.37	-2.07
Low	-0.16	-0.06	0.01	0.04	-0.10	-0.04	-0.01	-0.08	-0.05	-0.16	-0.06	0.01	0.04	-0.10	-0.04	-0.01	-0.08	-0.05
	β^{MRF}									$t\left(\beta^{MRF}\right)$								
High	0.86	0.71	0.72	0.80	0.70	0.76	1.01	0.69	0.77	10.86	12.69	10.76	11.13	14.55	16.10	14.59	13.93	13.39
Med.	0.73	0.59	0.76	0.02	0.67	0.75	0.80	0.74	0.84	7.40	10.26	10.81	0.97	11.36	11.58	14.46	14.90	13.17
Low	0.90	0.78	1.03	0.73	0.70	0.65	0.72	0.78	0.72	14.41	16.23	12.96	10.73	10.61	11.27	11.51	14.33	14.70
	β^{HML}									$t\left(\beta^{HML}\right)$								
High	2.16	1.77	1.21	1.47	1.10	1.25	1.60	0.81	0.73	10.24	5.78	5.18	6.64	6.83	7.14	6.99	5.60	5.07
Med.	0.20	0.46	-0.07	0.07	0.59	0.42	0.68	0.40	0.32	0.32	2.33	-0.39	1.49	3.61	2.18	4.30	2.74	2.53
Low	0.69	0.03	-0.48	-0.08	0.96	0.56	0.40	0.65	0.38	3.48	0.19	-2.94	-0.45	4.85	3.54	2.11	4.22	2.66
	β^{SMB}									$t\left(\beta^{SMB}\right)$								
High	1.26	0.74	0.91	0.17	0.12	0.35	-0.20	0.14	0.20	5.46	4.06	2.58	0.84	0.73	1.77	-1.02	1.04	1.47
Med.	2.19	0.65	0.92	0.16	-0.01	0.12	0.00	-0.06	0.03	2.94	3.09	4.36	3.26	-0.04	0.56	-0.01	-0.43	0.20
Low	0.84	0.64	1.07	0.91	0.13	0.01	0.14	0.01	-0.04	3.94	4.29	6.82	4.42	0.57	0.03	0.63	0.08	-0.33
	Adj. R^2									s(e)								
High	0.80	0.72	0.62	0.69	0.69	0.68	0.77	0.68	0.72	0.03	0.03	0.04	0.02	0.01	0.02	0.02	0.01	0.01
Med.	0.55	0.58	0.64	0.23	0.53	0.54	0.70	0.69	0.73	0.10	0.02	0.03	0.00	0.02	0.02	0.01	0.01	0.01
Low	0.74	0.72	0.79	0.64	0.60	0.53	0.54	0.70	0.69	0.02	0.02	0.02	0.03	0.02	0.02	0.02	0.01	0.01

Table B.36: Time-Series Regressions 4FM - European Union

This table reports the results for the time series regressions of our 27 sorted portfolios (cf. Table 3.2 on page 78) on the Carhart (1997) 4FM. The first row per block depicts all high book-to-market portfolios, i.e., $P1$ to $P9$, with the market capitalization (size) increasing from left to right. The second row per block depicts all medium book-to-market portfolios, i.e., $P10$ to $P17$, with the market capitalization (size) increasing from left to right. The third row per block shows all low book-to-market portfolios, i.e., $P20$ to $P27$, with the market capitalization (size) increasing from left to right. The shown adjusted R^2 values are adjusted for degrees of freedom. Statistics are corrected for heteroscedasticity and autocorrelation, up to three lags, using the Newey and West (1987) estimator.

	Market Capitalization (Size)																	
BV/MV	Small				Medium				Big	Small				Medium				Big
					α									$t(\alpha)$				
High	-0.07	-0.09	-0.05	-0.05	-0.06	-0.07	-0.02	-0.07	-0.09	-2.40	-2.93	-2.02	-1.80	-2.41	-2.44	-0.84	-3.04	-4.15
Med.	0.00	-0.05	0.00	-0.11	-0.07	-0.05	-0.04	-0.06	-0.07	0.06	-1.48	0.12	-12.15	-2.30	-1.74	-1.75	-2.44	-3.80
Low	-0.14	-0.09	-0.03	0.00	-0.08	-0.07	-0.06	-0.05	-0.06	-0.14	-0.09	-0.03	0.00	-0.08	-0.07	-0.06	-0.05	-0.06
					β^{MRF}									$t(\beta^{MRF})$				
High	0.88	0.69	0.65	0.82	0.69	0.73	1.03	0.69	0.75	11.77	12.60	10.09	12.91	14.95	15.69	17.20	14.11	14.89
Med.	0.85	0.58	0.73	0.02	0.65	0.72	0.83	0.74	0.82	8.28	9.96	11.45	0.82	11.13	12.15	18.41	15.04	14.94
Low	0.92	0.76	1.00	0.70	0.71	0.63	0.69	0.80	0.71	16.25	14.52	14.73	11.34	11.67	11.02	12.05	18.36	14.82
					β^{HML}									$t(\beta^{HML})$				
High	2.05	1.87	1.65	1.33	1.15	1.46	1.44	0.84	0.90	10.77	5.94	8.15	6.62	7.07	8.02	6.95	5.93	5.42
Med.	-0.60	0.55	0.12	0.09	0.74	0.65	0.51	0.44	0.49	-0.99	2.69	0.69	2.07	4.40	3.26	3.76	3.10	3.85
Low	0.59	0.16	-0.27	0.11	0.88	0.71	0.62	0.48	0.42	2.50	1.28	-1.19	0.62	4.59	4.34	3.21	3.67	3.03
					β^{SMB}									$t(\beta^{SMB})$				
High	1.19	0.81	1.21	0.08	0.15	0.49	-0.30	0.17	0.32	5.04	4.54	5.65	0.36	0.84	2.39	-1.54	1.08	2.04
Med.	1.65	0.71	1.05	0.18	0.09	0.27	-0.11	-0.03	0.14	4.85	3.18	4.97	3.52	0.44	1.20	-0.66	-0.23	0.99
Low	0.78	0.74	1.21	1.04	0.07	0.11	0.28	-0.10	-0.02	3.84	6.89	6.29	5.04	0.33	0.51	1.27	-0.57	-0.14
					β^{WML}									$t(\beta^{WML})$				
High	-0.35	0.32	1.41	-0.44	0.16	0.64	-0.49	0.10	0.54	-0.35	0.32	1.41	-0.44	0.16	0.64	-0.49	0.10	0.54
Med.	-2.54	0.31	0.61	0.08	0.48	0.70	-0.53	0.12	0.53	-2.54	0.31	0.61	0.08	0.48	0.70	-0.53	0.12	0.53
Low	-0.31	0.44	0.68	0.59	-0.25	0.47	0.69	-0.52	0.12	-0.31	0.44	0.68	0.59	-0.25	0.47	0.69	-0.52	0.12
					Adj. R^2									s(e)				
High	0.80	0.73	0.76	0.71	0.70	0.72	0.79	0.69	0.76	0.03	0.03	0.02	0.02	0.01	0.02	0.02	0.01	0.01
Med.	0.75	0.59	0.68	0.25	0.57	0.61	0.74	0.69	0.77	0.05	0.02	0.03	0.00	0.02	0.02	0.01	0.01	0.01
Low	0.75	0.75	0.82	0.68	0.61	0.57	0.60	0.74	0.69	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01

Table B.37: Time-Series Regressions CAPM & 3FM - Europe (Total)

This table reports the results for the CAPM (Panel A) & Fama and French (1993) 3FM (Panel B) time series regressions for our 27 sorted portfolios (cf. Table 3.2 on page 78). The first row per block depicts all high book-to-market portfolios, i.e., $P1$ to $P9$, with the market capitalization (size) increasing from left to right. The second row per block depicts all medium book-to-market portfolios, i.e., $P10$ to $P17$, with the market capitalization (size) increasing from left to right. The third row per blockshows all low book-to-market portfolios, i.e., $P20$ to $P27$, with the market capitalization (size) increasing from left to right. The shown adjusted R^2 values are adjusted for degrees of freedom. Statistics are corrected for heteroscedasticity and autocorrelation, up to three lags, using the Newey and West (1987) estimator.

	Market Capitalization (Size)																	
BV/MV	Small				Medium				Big	Small				Medium				Big
Panel A: Capital Asset Pricing Model																		
					α									$t(\alpha)$				
High	0.14	0.10	0.19	0.02	0.02	0.07	0.01	0.00	0.00	4.23	3.95	6.74	0.69	1.10	3.35	0.66	-0.26	0.12
Med.	0.06	0.06	0.13	-0.09	-0.01	0.03	-0.04	-0.03	-0.02	1.76	3.00	5.67	-14.13	-0.40	1.34	-2.55	-2.34	-1.47
Low	-0.04	0.00	0.08	0.12	-0.04	-0.01	0.02	-0.04	-0.03	-0.04	0.00	0.08	0.12	-0.04	-0.01	0.02	-0.04	-0.03
					β^{MRF}									$t\left(\beta^{MRF}\right)$				
High	1.12	0.86	0.90	0.84	0.73	0.83	0.98	0.72	0.81	7.67	7.07	7.89	8.84	9.61	9.71	9.16	11.22	11.71
Med.	1.15	0.72	0.93	0.05	0.68	0.78	0.81	0.74	0.85	5.22	9.81	11.25	2.30	8.60	9.68	11.02	12.29	12.29
Low	1.07	0.90	1.23	0.90	0.73	0.65	0.75	0.78	0.71	13.69	15.19	13.59	11.20	8.60	8.60	9.67	11.01	12.27
					Adj. R^2									s(e)				
High	0.40	0.38	0.39	0.48	0.52	0.48	0.57	0.57	0.63	0.09	0.06	0.06	0.04	0.02	0.04	0.03	0.02	0.02
Med.	0.29	0.45	0.53	0.06	0.48	0.52	0.64	0.67	0.72	0.15	0.03	0.04	0.00	0.02	0.03	0.02	0.01	0.01
Low	0.59	0.65	0.67	0.52	0.47	0.48	0.52	0.64	0.66	0.04	0.02	0.03	0.04	0.03	0.02	0.02	0.02	0.01
Panel B: Fama and French (1993) Model																		
					α									$t(\alpha)$				
High	-0.10	-0.07	0.04	-0.08	-0.05	-0.03	-0.05	-0.06	-0.06	-3.11	-2.92	1.15	-3.11	-2.35	-1.08	-2.35	-3.07	-2.97
Med.	-0.16	-0.03	0.04	-0.11	-0.04	-0.01	-0.08	-0.05	-0.04	-3.67	-1.00	1.54	-12.70	-1.47	-0.35	-3.55	-2.37	-2.07
Low	-0.16	-0.06	0.01	0.04	-0.10	-0.04	-0.01	-0.08	-0.05	-0.16	-0.06	0.01	0.04	-0.10	-0.04	-0.01	-0.08	-0.05
					β^{MRF}									$t\left(\beta^{MRF}\right)$				
High	0.86	0.71	0.72	0.80	0.70	0.76	1.01	0.69	0.77	10.86	12.69	10.76	11.13	14.55	16.10	14.59	13.93	13.39
Med.	0.73	0.59	0.76	0.02	0.67	0.75	0.80	0.74	0.84	7.40	10.26	10.81	0.97	11.36	11.58	14.46	14.90	13.17
Low	0.90	0.78	1.03	0.73	0.70	0.65	0.72	0.78	0.72	14.41	16.23	12.96	10.73	10.61	11.27	11.51	14.33	14.70
					β^{HML}									$t\left(\beta^{HML}\right)$				
High	2.16	1.77	1.21	1.47	1.10	1.25	1.60	0.81	0.73	10.24	5.78	5.18	6.64	6.83	7.14	6.99	5.60	5.07
Med.	0.20	0.46	-0.07	0.07	0.59	0.42	0.68	0.40	0.32	0.32	2.33	-0.39	1.49	3.61	2.18	4.30	2.74	2.53
Low	0.69	0.03	-0.48	-0.08	0.96	0.56	0.40	0.65	0.38	3.48	0.19	-2.94	-0.45	4.85	3.54	2.11	4.22	2.66
					β^{SMB}									$t\left(\beta^{SMB}\right)$				
High	1.26	0.74	0.91	0.17	0.12	0.35	-0.20	0.14	0.20	5.46	4.06	2.58	0.84	0.73	1.77	-1.02	1.04	1.47
Med.	2.19	0.65	0.92	0.16	-0.01	0.12	0.00	-0.06	0.03	2.94	3.09	4.36	3.26	-0.04	0.56	-0.01	-0.43	0.20
Low	0.84	0.64	1.07	0.91	0.13	0.01	0.14	0.01	-0.04	3.94	4.29	6.82	4.42	0.57	0.03	0.63	0.08	-0.33
					Adj. R^2									s(e)				
High	0.80	0.72	0.62	0.69	0.69	0.68	0.77	0.68	0.72	0.03	0.03	0.04	0.02	0.01	0.02	0.02	0.01	0.01
Med.	0.55	0.58	0.64	0.23	0.53	0.54	0.70	0.69	0.73	0.10	0.02	0.03	0.00	0.02	0.02	0.01	0.01	0.01
Low	0.74	0.72	0.79	0.64	0.60	0.53	0.54	0.70	0.69	0.02	0.02	0.02	0.03	0.02	0.02	0.02	0.01	0.01

Table B.38: Time-Series Regressions 4FM - Europe (Total)

This table reports the results for the time series regressions of our 27 sorted portfolios (cf. Table 3.2 on page 78) on the Carhart (1997) 4FM. The first row per block depicts all high book-to-market portfolios, i.e., $P1$ to $P9$, with the market capitalization (size) increasing from left to right. The second row per block depicts all medium book-to-market portfolios, i.e., $P10$ to $P17$, with the market capitalization (size) increasing from left to right. The third row per block shows all low book-to-market portfolios, i.e., $P20$ to $P27$, with the market capitalization (size) increasing from left to right. The shown adjusted R^2 values are adjusted for degrees of freedom. Statistics are corrected for heteroscedasticity and autocorrelation, up to three lags, using the Newey and West (1987) estimator.

	Market Capitalization (Size)																	
BV/MV	Small				Medium				Big	Small				Medium				Big
					α									$t(\alpha)$				
High	-0.07	-0.09	-0.05	-0.05	-0.06	-0.07	-0.02	-0.07	-0.09	-2.40	-2.93	-2.02	-1.80	-2.41	-2.44	-0.84	-3.04	-4.15
Med.	0.00	-0.05	0.00	-0.11	-0.07	-0.05	-0.04	-0.06	-0.07	0.06	-1.48	0.12	-12.15	-2.30	-1.74	-1.75	-2.44	-3.80
Low	-0.14	-0.09	-0.03	0.00	-0.08	-0.07	-0.06	-0.05	-0.06	-0.14	-0.09	-0.03	0.00	-0.08	-0.07	-0.06	-0.05	-0.06
					β^{MRF}									$t(\beta^{MRF})$				
High	0.88	0.69	0.65	0.82	0.69	0.73	1.03	0.69	0.75	11.77	12.60	10.09	12.91	14.95	15.69	17.20	14.11	14.89
Med.	0.85	0.58	0.73	0.02	0.65	0.72	0.83	0.74	0.82	8.28	9.96	11.45	0.82	11.13	12.15	18.41	15.04	14.94
Low	0.92	0.76	1.00	0.70	0.71	0.63	0.69	0.80	0.71	16.25	14.52	14.73	11.34	11.67	11.02	12.05	18.36	14.82
					β^{HML}									$t(\beta^{HML})$				
High	2.05	1.87	1.65	1.33	1.15	1.46	1.44	0.84	0.90	10.77	5.94	8.15	6.62	7.07	8.02	6.95	5.93	5.42
Med.	-0.60	0.55	0.12	0.09	0.74	0.65	0.51	0.44	0.49	-0.99	2.69	0.69	2.07	4.40	3.26	3.76	3.10	3.85
Low	0.59	0.16	-0.27	0.11	0.88	0.71	0.62	0.48	0.42	2.50	1.28	-1.19	0.62	4.59	4.34	3.21	3.67	3.03
					β^{SMB}									$t(\beta^{SMB})$				
High	1.19	0.81	1.21	0.08	0.15	0.49	-0.30	0.17	0.32	5.04	4.54	5.65	0.36	0.84	2.39	-1.54	1.08	2.04
Med.	1.65	0.71	1.05	0.18	0.09	0.27	-0.11	-0.03	0.14	4.85	3.18	4.97	3.52	0.44	1.20	-0.66	-0.23	0.99
Low	0.78	0.74	1.21	1.04	0.07	0.11	0.28	-0.10	-0.02	3.84	6.89	6.29	5.04	0.33	0.51	1.27	-0.57	-0.14
					β^{WML}									$t(\beta^{WML})$				
High	-0.35	0.32	1.41	-0.44	0.16	0.64	-0.49	0.10	0.54	-0.35	0.32	1.41	-0.44	0.16	0.64	-0.49	0.10	0.54
Med.	-2.54	0.31	0.61	0.08	0.48	0.70	-0.53	0.12	0.53	-2.54	0.31	0.61	0.08	0.48	0.70	-0.53	0.12	0.53
Low	-0.31	0.44	0.68	0.59	-0.25	0.47	0.69	-0.52	0.12	-0.31	0.44	0.68	0.59	-0.25	0.47	0.69	-0.52	0.12
					Adj. R^2									s(e)				
High	0.80	0.73	0.76	0.71	0.70	0.72	0.79	0.69	0.76	0.03	0.03	0.02	0.02	0.01	0.02	0.02	0.01	0.01
Med.	0.75	0.59	0.68	0.25	0.57	0.61	0.74	0.69	0.77	0.05	0.02	0.03	0.00	0.02	0.02	0.01	0.01	0.01
Low	0.75	0.75	0.82	0.68	0.61	0.57	0.60	0.74	0.69	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01

Table B.39: Time-Series Regressions CAPM & 3FM - Basic Industries (Eurozone)

This table reports the results for the CAPM (Panel A) & Fama and French (1993) 3FM (Panel B) time series regressions for our 27 sorted portfolios (cf. Table 3.2 on page 78). The first row per block depicts all high book-to-market portfolios, i.e., $P1$ to $P9$, with the market capitalization (size) increasing from left to right. The second row per block depicts all medium book-to-market portfolios, i.e., $P10$ to $P17$, with the market capitalization (size) increasing from left to right. The third row per blockshows all low book-to-market portfolios, i.e., $P20$ to $P27$, with the market capitalization (size) increasing from left to right. The shown adjusted R^2 values are adjusted for degrees of freedom. Statistics are corrected for heteroscedasticity and autocorrelation, up to three lags, using the Newey and West (1987) estimator.

	Market Capitalization (Size)																	
BV/MV	Small				Medium				Big	Small				Medium				Big
Panel A: Capital Asset Pricing Model																		
					α									$t(\alpha)$				
High	0.16	0.09	0.08	0.09	0.06	0.05	0.00	0.04	0.10	1.38	1.11	1.57	1.80	1.34	1.09	0.06	1.22	2.12
Med.	-0.10	-0.04	0.02	-0.01	-0.03	-0.02	-0.07	0.00	0.00	-2.42	-0.98	0.47	-0.37	-0.94	-0.38	-3.17	0.18	-0.06
Low	-0.07	0.03	-0.05	-0.02	-0.10	-0.05	-0.04	-0.08	-0.02	-0.07	0.03	-0.05	-0.02	-0.10	-0.05	-0.04	-0.08	-0.02
					β^{MRF}									$t\left(\beta^{MRF}\right)$				
High	1.79	1.08	0.13	0.90	0.83	0.81	0.55	0.73	0.97	4.52	4.13	0.63	5.28	5.44	4.63	4.73	5.21	4.39
Med.	0.82	0.54	0.68	0.11	0.54	0.79	0.55	0.56	0.69	5.22	3.38	2.32	0.97	4.55	4.11	5.91	5.46	5.20
Low	1.53	0.97	0.83	0.46	0.47	0.40	0.49	0.35	0.40	5.77	3.98	4.05	2.31	5.40	4.53	4.42	5.85	5.51
					Adj. R^2									s(e)				
High	0.10	0.07	0.00	0.17	0.20	0.15	0.17	0.19	0.18	1.32	0.75	0.25	0.18	0.13	0.18	0.07	0.11	0.20
Med.	0.14	0.10	0.10	0.00	0.15	0.16	0.28	0.28	0.19	0.19	0.12	0.20	0.08	0.08	0.16	0.04	0.04	0.10
Low	0.29	0.15	0.12	0.10	0.25	0.15	0.14	0.28	0.27	0.28	0.25	0.22	0.09	0.03	0.04	0.07	0.01	0.02
Panel B: Fama and French (1993) Model																		
					α									$t(\alpha)$				
High	-0.09	-0.10	-0.01	0.00	-0.02	-0.04	-0.05	-0.04	-0.04	-1.75	-2.48	-0.34	0.01	-0.52	-0.77	-1.75	-1.16	-1.06
Med.	-0.14	-0.06	0.04	-0.05	-0.04	-0.08	-0.07	0.00	-0.04	-3.95	-1.87	0.76	-1.84	-1.07	-1.46	-2.68	-0.04	-1.24
Low	-0.07	0.00	0.02	0.00	-0.11	-0.06	-0.07	-0.08	-0.03	-0.07	0.00	0.02	0.00	-0.11	-0.06	-0.07	-0.08	-0.03
					β^{MRF}									$t\left(\beta^{MRF}\right)$				
High	0.78	0.37	-0.20	0.72	0.66	0.60	0.47	0.62	0.76	2.31	1.68	-1.19	4.38	4.94	4.21	4.13	5.32	4.52
Med.	0.56	0.32	0.49	-0.06	0.48	0.69	0.57	0.58	0.63	5.01	2.37	1.90	-0.63	4.14	4.05	6.17	4.90	4.96
Low	1.18	0.59	0.71	0.33	0.41	0.35	0.43	0.36	0.40	5.81	3.15	3.62	1.91	4.16	4.08	4.32	5.86	4.81
					β^{HML}									$t\left(\beta^{HML}\right)$				
High	1.81	1.46	0.73	0.71	0.62	0.67	0.48	0.73	1.19	2.50	2.85	2.33	2.76	3.08	3.23	4.30	4.37	5.29
Med.	0.18	0.09	-0.29	0.29	0.05	0.52	0.02	0.05	0.36	1.04	0.62	-0.96	1.58	0.43	2.54	0.23	0.59	2.47
Low	-0.13	0.02	-0.75	-0.18	0.09	0.06	0.26	0.00	0.04	-0.47	0.10	-2.83	-0.90	1.23	0.61	2.33	-0.07	0.60
					β^{SMB}									$t\left(\beta^{SMB}\right)$				
High	1.84	1.18	0.50	0.10	0.11	0.20	-0.06	-0.13	-0.11	2.58	2.94	2.67	0.59	0.94	1.07	-0.64	-1.06	-0.70
Med.	0.65	0.58	0.72	0.30	0.14	-0.04	-0.06	-0.10	-0.05	2.82	4.83	3.64	2.82	1.28	-0.25	-0.80	-0.75	-0.43
Low	1.10	1.09	0.80	0.47	0.13	0.10	0.01	-0.02	-0.04	5.21	5.38	4.43	3.56	1.41	1.23	0.15	-0.40	-0.40
					Adj. R^2									s(e)				
High	0.46	0.40	0.23	0.30	0.33	0.29	0.29	0.36	0.45	0.80	0.48	0.19	0.15	0.11	0.15	0.06	0.08	0.14
Med.	0.29	0.29	0.22	0.16	0.16	0.22	0.28	0.28	0.23	0.16	0.09	0.17	0.07	0.08	0.15	0.04	0.04	0.09
Low	0.47	0.40	0.29	0.22	0.29	0.17	0.19	0.28	0.27	0.20	0.18	0.18	0.07	0.03	0.04	0.06	0.01	0.02

Table B.40: Time-Series Regressions 4FM - Basic Industries (Eurozone)

This table reports the results for the time series regressions of our 27 sorted portfolios (cf. Table 3.2 on page 78) on the Carhart (1997) 4FM. The first row per block depicts all high book-to-market portfolios, i.e., $P1$ to $P9$, with the market capitalization (size) increasing from left to right. The second row per block depicts all medium book-to-market portfolios, i.e., $P10$ to $P17$, with the market capitalization (size) increasing from left to right. The third row per block shows all low book-to-market portfolios, i.e., $P20$ to $P27$, with the market capitalization (size) increasing from left to right. The shown adjusted R^2 values are adjusted for degrees of freedom. Statistics are corrected for heteroscedasticity and autocorrelation, up to three lags, using the Newey and West (1987) estimator.

	Market Capitalization (Size)																	
BV/MV	Small				Medium				Big	Small				Medium				Big
	α									$t(\alpha)$								
High	0.02	-0.17	-0.06	0.00	-0.04	-0.07	-0.05	-0.06	-0.08	0.20	-3.33	-1.45	-0.11	-0.99	-1.93	-1.57	-1.78	-2.63
Med.	-0.13	-0.08	0.01	-0.07	-0.05	-0.11	-0.07	0.00	-0.06	-3.35	-2.37	0.26	-2.61	-1.43	-2.36	-2.69	0.00	-1.87
Low	-0.05	-0.02	-0.03	-0.02	-0.12	-0.07	-0.09	-0.08	-0.03	-0.05	-0.02	-0.03	-0.02	-0.12	-0.07	-0.09	-0.08	-0.03
	β^{MRF}									$t(\beta^{MRF})$								
High	0.60	0.48	-0.13	0.73	0.69	0.66	0.46	0.65	0.82	1.98	2.42	-0.84	4.42	5.15	5.20	4.10	5.78	5.47
Med.	0.55	0.35	0.54	-0.02	0.50	0.74	0.57	0.58	0.66	4.63	2.54	2.08	-0.26	4.32	4.61	6.16	4.90	4.93
Low	1.15	0.63	0.80	0.36	0.42	0.37	0.46	0.36	0.40	5.68	3.31	4.54	2.09	4.23	4.26	5.02	5.85	4.81
	β^{HML}									$t(\beta^{HML})$								
High	1.49	1.65	0.85	0.72	0.68	0.77	0.47	0.78	1.29	3.74	3.79	3.60	2.73	3.28	3.52	4.27	5.25	7.37
Med.	0.16	0.13	-0.22	0.36	0.09	0.60	0.02	0.05	0.40	0.95	0.86	-0.75	2.36	0.66	2.83	0.24	0.60	2.77
Low	-0.18	0.08	-0.60	-0.13	0.10	0.08	0.32	0.00	0.04	-0.71	0.37	-3.26	-0.69	1.61	0.84	2.84	-0.01	0.65
	β^{SMB}									$t(\beta^{SMB})$								
High	1.06	1.65	0.81	0.14	0.23	0.45	-0.09	0.00	0.15	2.72	4.23	5.19	0.80	2.16	2.17	-0.95	0.02	1.09
Med.	0.60	0.69	0.91	0.46	0.22	0.16	-0.06	-0.10	0.05	3.22	5.63	5.12	4.67	1.91	1.02	-0.73	-0.79	0.35
Low	0.96	1.23	1.17	0.59	0.17	0.16	0.16	-0.01	-0.03	4.67	6.12	7.39	5.06	1.73	1.91	1.82	-0.21	-0.37
	β^{WML}									$t(\beta^{WML})$								
High	-3.09	1.85	1.22	0.15	0.49	0.96	-0.10	0.51	1.03	-3.09	1.85	1.22	0.15	0.49	0.96	-0.10	0.51	1.03
Med.	-0.20	0.44	0.74	0.62	0.32	0.78	0.01	-0.02	0.40	-0.20	0.44	0.74	0.62	0.32	0.78	0.01	-0.02	0.40
Low	-0.57	0.57	1.48	0.49	0.18	0.25	0.57	0.04	0.01	-0.57	0.57	1.48	0.49	0.18	0.25	0.57	0.04	0.01
	Adj. R^2									s(e)								
High	0.64	0.52	0.40	0.30	0.37	0.42	0.29	0.42	0.57	0.53	0.38	0.15	0.15	0.10	0.12	0.06	0.08	0.11
Med.	0.29	0.33	0.29	0.30	0.19	0.31	0.28	0.28	0.27	0.16	0.09	0.16	0.06	0.08	0.13	0.04	0.04	0.09
Low	0.50	0.44	0.54	0.29	0.31	0.21	0.31	0.28	0.27	0.20	0.17	0.12	0.07	0.03	0.04	0.05	0.02	0.02

Table B.41: Time-Series Regressions CAPM & 3FM - Cyclical Consumer Goods (Eurozone)

This table reports the results for the CAPM (Panel A) & Fama and French (1993) 3FM (Panel B) time series regressions for our 27 sorted portfolios (cf. Table 3.2 on page 78). The first row per block depicts all high book-to-market portfolios, i.e., $P1$ to $P9$, with the market capitalization (size) increasing from left to right. The second row per block depicts all medium book-to-market portfolios, i.e., $P10$ to $P17$, with the market capitalization (size) increasing from left to right. The third row per blockshows all low book-to-market portfolios, i.e., $P20$ to $P27$, with the market capitalization (size) increasing from left to right. The shown adjusted R^2 values are adjusted for degrees of freedom. Statistics are corrected for heteroscedasticity and autocorrelation, up to three lags, using the Newey and West (1987) estimator.

	Market Capitalization (Size)																	
BV/MV	Small				Medium				Big	Small				Medium				Big
Panel A: Capital Asset Pricing Model																		
	α									$t(\alpha)$								
High	0.03	0.07	0.17	0.01	0.04	0.05	-0.04	-0.04	0.05	0.76	2.73	4.35	0.41	1.62	1.70	-1.36	-1.34	1.62
Med.	-0.05	0.00	0.07	-0.02	0.01	0.03	-0.03	-0.01	-0.02	-2.15	0.04	2.11	-1.12	0.37	1.02	-1.53	-0.34	-0.96
Low	-0.08	-0.04	0.10	0.04	-0.03	-0.01	0.00	-0.04	-0.02	-0.08	-0.04	0.10	0.04	-0.03	-0.01	0.00	-0.04	-0.02
	β^{MRF}									$t\left(\beta^{MRF}\right)$								
High	0.87	0.69	0.86	0.67	0.72	0.87	0.83	0.75	0.87	4.30	5.91	4.92	4.17	5.49	6.03	6.77	6.11	7.73
Med.	0.65	0.64	0.85	0.33	0.50	0.76	0.60	0.62	0.69	5.36	4.69	6.26	4.39	3.84	5.33	5.84	7.35	6.11
Low	0.71	0.70	1.00	0.63	0.45	0.40	0.57	0.45	0.50	6.91	7.58	6.46	5.92	4.82	3.68	5.11	5.56	7.33
	Adj. R^2									s(e)								
High	0.19	0.27	0.19	0.19	0.29	0.31	0.37	0.35	0.32	0.15	0.06	0.15	0.09	0.06	0.08	0.05	0.05	0.08
Med.	0.26	0.23	0.30	0.14	0.19	0.32	0.36	0.40	0.40	0.06	0.07	0.08	0.03	0.05	0.06	0.03	0.03	0.03
Low	0.27	0.33	0.32	0.28	0.21	0.19	0.30	0.35	0.40	0.07	0.05	0.10	0.05	0.03	0.03	0.04	0.02	0.02
Panel B: Fama and French (1993) Model																		
	α									$t(\alpha)$								
High	-0.11	0.00	0.05	-0.05	0.00	0.00	-0.07	-0.08	0.02	-4.46	0.19	1.89	-1.78	-0.05	-0.13	-2.66	-3.65	0.56
Med.	-0.10	-0.04	0.03	-0.07	-0.02	0.00	-0.02	0.00	-0.01	-5.02	-1.34	1.04	-6.93	-0.93	0.15	-1.13	-0.31	-0.68
Low	-0.11	-0.05	0.08	0.01	-0.06	-0.03	-0.01	-0.04	-0.02	-0.11	-0.05	0.08	0.01	-0.06	-0.03	-0.01	-0.04	-0.02
	β^{MRF}									$t\left(\beta^{MRF}\right)$								
High	0.39	0.46	0.45	0.43	0.55	0.66	0.70	0.58	0.73	3.16	5.33	3.88	2.79	4.96	6.05	6.68	6.79	7.19
Med.	0.49	0.52	0.75	0.15	0.39	0.67	0.61	0.61	0.69	4.62	4.22	6.21	3.22	3.20	4.92	6.63	8.46	6.06
Low	0.65	0.67	0.98	0.56	0.32	0.31	0.51	0.46	0.49	6.11	10.33	7.34	5.92	4.09	3.00	4.59	6.04	8.09
	β^{HML}									$t\left(\beta^{HML}\right)$								
High	1.74	0.79	1.54	1.09	0.73	1.03	0.77	0.90	0.88	6.31	5.22	5.08	4.21	4.19	4.87	4.93	6.41	4.43
Med.	0.49	0.14	0.01	0.65	0.55	0.48	0.17	0.22	0.29	3.07	0.56	0.04	3.98	4.46	2.67	1.66	2.25	2.17
Low	-0.05	-0.23	-0.67	-0.07	0.52	0.41	0.31	0.09	0.13	-0.24	-1.50	-3.32	-0.42	3.79	4.00	2.26	1.08	1.65
	β^{SMB}									$t\left(\beta^{SMB}\right)$								
High	1.20	0.63	1.01	0.27	0.18	0.11	-0.16	0.04	-0.19	4.88	6.00	4.11	1.55	1.03	0.62	-0.97	0.34	-1.09
Med.	0.51	0.75	0.84	0.44	0.09	-0.02	-0.31	-0.25	-0.40	3.10	4.31	4.75	3.67	0.60	-0.09	-2.69	-2.64	-2.88
Low	0.60	0.63	1.23	0.70	0.18	0.10	0.02	-0.19	-0.17	3.33	5.17	8.37	5.06	1.42	0.79	0.12	-1.95	-2.01
	Adj. R^2									s(e)								
High	0.60	0.48	0.50	0.39	0.39	0.46	0.50	0.53	0.45	0.07	0.04	0.09	0.07	0.05	0.06	0.04	0.04	0.06
Med.	0.37	0.36	0.43	0.44	0.28	0.36	0.41	0.45	0.48	0.05	0.05	0.06	0.02	0.04	0.05	0.03	0.02	0.03
Low	0.35	0.47	0.60	0.43	0.32	0.26	0.33	0.38	0.42	0.06	0.04	0.06	0.04	0.03	0.03	0.03	0.02	0.02

Table B.42: Time-Series Regressions 4FM - Cyclical Consumer Goods (Eurozone)

This table reports the results for the time series regressions of our 27 sorted portfolios (cf. Table 3.2 on page 78) on the Carhart (1997) 4FM. The first row per block depicts all high book-to-market portfolios, i.e., $P1$ to $P9$, with the market capitalization (size) increasing from left to right. The second row per block depicts all medium book-to-market portfolios, i.e., $P10$ to $P17$, with the market capitalization (size) increasing from left to right. The third row per block shows all low book-to-market portfolios, i.e., $P20$ to $P27$, with the market capitalization (size) increasing from left to right. The shown adjusted R^2 values are adjusted for degrees of freedom. Statistics are corrected for heteroscedasticity and autocorrelation, up to three lags, using the Newey and West (1987) estimator.

	Market Capitalization (Size)																	
BV/MV	Small				Medium				Big	Small				Medium				Big
					α									$t(\alpha)$				
High	-0.02	-0.01	-0.06	0.01	0.00	-0.07	-0.03	-0.08	-0.08	-0.66	-0.36	-1.63	0.17	0.07	-2.17	-1.04	-2.69	-2.52
Med.	-0.08	-0.05	-0.02	-0.12	-0.05	-0.04	0.01	-0.02	-0.07	-2.54	-1.45	-0.58	-6.33	-1.97	-1.26	0.24	-0.80	-3.25
Low	-0.09	-0.05	0.03	-0.02	-0.07	-0.06	-0.04	-0.02	-0.03	-0.09	-0.05	0.03	-0.02	-0.07	-0.06	-0.04	-0.02	-0.03
					β^{MRF}									$t(\beta^{MRF})$				
High	0.55	0.44	0.24	0.54	0.56	0.53	0.77	0.58	0.54	4.11	5.11	1.74	3.76	4.73	4.62	7.55	7.17	5.58
Med.	0.54	0.51	0.65	0.06	0.33	0.58	0.66	0.59	0.58	4.65	3.86	5.32	0.98	2.62	4.27	7.41	8.35	5.36
Low	0.68	0.67	0.89	0.50	0.31	0.27	0.46	0.50	0.48	5.91	9.25	6.43	5.09	3.78	2.52	4.05	6.89	7.92
					β^{HML}									$t(\beta^{HML})$				
High	1.61	0.81	1.71	1.00	0.72	1.14	0.71	0.89	1.03	7.03	5.48	6.43	4.40	4.13	5.83	4.64	6.74	5.36
Med.	0.45	0.15	0.09	0.72	0.60	0.55	0.13	0.23	0.37	2.71	0.61	0.41	4.79	4.78	3.48	1.27	2.29	2.91
Low	-0.07	-0.23	-0.59	-0.02	0.54	0.45	0.35	0.06	0.15	-0.36	-1.50	-2.77	-0.13	3.84	4.20	2.82	0.69	1.69
					β^{SMB}									$t(\beta^{SMB})$				
High	1.10	0.64	1.14	0.20	0.18	0.20	-0.21	0.04	-0.08	4.81	6.11	5.36	1.18	1.01	1.17	-1.30	0.30	-0.51
Med.	0.48	0.76	0.90	0.50	0.13	0.03	-0.34	-0.24	-0.34	3.06	4.66	5.04	4.38	0.91	0.20	-2.81	-2.54	-2.48
Low	0.58	0.63	1.28	0.73	0.19	0.12	0.05	-0.22	-0.16	3.28	5.47	8.43	5.19	1.58	1.04	0.35	-2.14	-1.94
					β^{WML}									$t(\beta^{WML})$				
High	-1.17	0.17	1.55	-0.82	-0.05	0.98	-0.52	-0.06	1.35	-1.17	0.17	1.55	-0.82	-0.05	0.98	-0.52	-0.06	1.35
Med.	-0.34	0.12	0.70	0.67	0.45	0.60	-0.36	0.17	0.75	-0.34	0.12	0.70	0.67	0.45	0.60	-0.36	0.17	0.75
Low	-0.24	0.02	0.67	0.41	0.13	0.30	0.37	-0.33	0.11	-0.24	0.02	0.67	0.41	0.13	0.30	0.37	-0.33	0.11
					Adj. R^2									s(e)				
High	0.66	0.48	0.60	0.43	0.40	0.52	0.52	0.53	0.57	0.06	0.04	0.08	0.06	0.05	0.06	0.04	0.04	0.05
Med.	0.38	0.36	0.47	0.53	0.30	0.39	0.44	0.45	0.56	0.05	0.05	0.06	0.02	0.04	0.05	0.03	0.02	0.03
Low	0.35	0.47	0.63	0.45	0.32	0.27	0.35	0.41	0.43	0.06	0.04	0.05	0.04	0.03	0.03	0.03	0.02	0.02

Table B.43: Time-Series Regressions CAPM & 3FM - Cyclical Consumer Services (Eurozone)

This table reports the results for the CAPM (Panel A) & Fama and French (1993) 3FM (Panel B) time series regressions for our 27 sorted portfolios (cf. Table 3.2 on page 78). The first row per block depicts all high book-to-market portfolios, i.e., $P1$ to $P9$, with the market capitalization (size) increasing from left to right. The second row per block depicts all medium book-to-market portfolios, i.e., $P10$ to $P17$, with the market capitalization (size) increasing from left to right. The third row per blockshows all low book-to-market portfolios, i.e., $P20$ to $P27$, with the market capitalization (size) increasing from left to right. The shown adjusted R^2 values are adjusted for degrees of freedom. Statistics are corrected for heteroscedasticity and autocorrelation, up to three lags, using the Newey and West (1987) estimator.

	Market Capitalization (Size)																	
BV/MV	Small				Medium				Big	Small				Medium				Big
Panel A: Capital Asset Pricing Model																		
					α									$t(\alpha)$				
High	0.11	0.14	0.20	0.03	0.00	0.10	-0.06	-0.03	0.01	3.06	2.71	4.81	0.72	0.09	2.74	-2.32	-1.50	0.33
Med.	0.00	0.03	0.06	0.03	-0.02	0.04	-0.02	-0.04	-0.05	0.13	1.27	2.15	1.22	-0.77	1.65	-0.89	-2.25	-2.36
Low	-0.08	0.01	0.07	0.01	-0.06	-0.04	0.00	-0.05	-0.06	-0.08	0.01	0.07	0.01	-0.06	-0.04	0.00	-0.05	-0.06
					β^{MRF}									$t\left(\beta^{MRF}\right)$				
High	0.98	0.81	1.31	1.20	0.86	1.11	1.13	1.19	1.10	6.42	4.20	5.02	6.08	4.86	5.91	8.39	8.15	10.95
Med.	1.11	0.89	0.93	0.69	1.06	1.22	0.93	0.91	0.91	6.55	7.15	8.33	4.97	7.02	8.30	7.04	10.97	9.69
Low	0.87	0.88	0.77	0.66	0.69	0.83	0.87	0.66	0.69	5.92	8.47	3.30	7.81	7.91	7.31	7.90	6.95	10.82
					Adj. R^2									s(e)				
High	0.24	0.08	0.27	0.29	0.26	0.29	0.46	0.52	0.44	0.14	0.33	0.21	0.16	0.09	0.13	0.07	0.06	0.07
Med.	0.34	0.39	0.37	0.25	0.44	0.50	0.42	0.51	0.44	0.11	0.06	0.07	0.06	0.07	0.07	0.05	0.04	0.05
Low	0.25	0.33	0.10	0.35	0.39	0.45	0.48	0.43	0.53	0.10	0.07	0.24	0.04	0.03	0.04	0.04	0.03	0.02
Panel B: Fama and French (1993) Model																		
					α									$t(\alpha)$				
High	0.01	-0.08	0.06	-0.05	-0.07	0.00	-0.10	-0.06	-0.01	0.26	-1.14	1.44	-1.04	-2.51	0.14	-3.37	-3.10	-0.46
Med.	-0.07	-0.02	0.00	-0.04	-0.03	0.07	0.02	0.00	-0.03	-2.47	-0.74	0.11	-1.95	-1.29	2.12	0.82	0.19	-0.77
Low	-0.15	-0.04	0.07	-0.03	-0.07	-0.05	0.02	-0.02	-0.03	-0.15	-0.04	0.07	-0.03	-0.07	-0.05	0.02	-0.02	-0.03
					β^{MRF}									$t\left(\beta^{MRF}\right)$				
High	0.82	0.49	0.95	0.86	0.62	0.80	1.00	1.10	0.95	5.61	1.81	4.67	5.86	5.10	5.94	8.78	7.49	9.50
Med.	1.04	0.78	0.93	0.43	1.08	1.20	0.90	0.91	0.92	6.18	6.57	8.88	4.85	7.09	7.74	7.61	12.48	9.66
Low	0.95	0.94	1.17	0.68	0.72	0.87	0.89	0.66	0.72	6.61	11.18	4.64	8.40	7.79	7.43	7.50	7.40	12.00
					β^{HML}									$t\left(\beta^{HML}\right)$				
High	0.48	0.95	1.17	1.10	0.77	0.99	0.41	0.27	0.50	2.23	2.08	4.83	5.14	4.38	4.78	3.03	2.73	3.06
Med.	0.19	0.36	-0.04	0.85	-0.08	0.10	0.14	0.00	-0.03	1.04	2.81	-0.34	5.82	-0.70	0.74	1.04	0.02	-0.29
Low	-0.30	-0.23	-1.38	-0.12	-0.11	-0.12	-0.03	0.01	-0.07	-1.87	-1.56	-4.39	-1.38	-1.12	-1.51	-0.38	0.10	-0.85
					β^{SMB}									$t\left(\beta^{SMB}\right)$				
High	0.70	1.55	0.48	-0.12	0.15	0.19	0.08	0.14	-0.17	2.66	2.32	1.40	-0.39	0.73	0.90	0.45	1.03	-1.16
Med.	0.64	0.15	0.64	0.07	0.21	-0.37	-0.57	-0.45	-0.26	2.94	0.90	3.79	0.40	1.67	-1.99	-4.24	-4.03	-1.56
Low	0.94	0.81	1.06	0.54	0.21	0.22	-0.19	-0.32	-0.27	4.92	4.04	2.74	4.33	1.74	2.16	-1.29	-3.13	-3.35
					Adj. R^2									s(e)				
High	0.34	0.31	0.43	0.45	0.41	0.45	0.50	0.54	0.50	0.12	0.25	0.16	0.12	0.08	0.10	0.06	0.06	0.06
Med.	0.40	0.43	0.45	0.50	0.44	0.51	0.49	0.57	0.45	0.10	0.05	0.06	0.04	0.06	0.07	0.05	0.03	0.05
Low	0.38	0.45	0.35	0.45	0.41	0.46	0.49	0.48	0.57	0.09	0.06	0.17	0.03	0.03	0.04	0.04	0.02	0.02

Table B.44: Time-Series Regressions 4FM - Cyclical Consumer Services (Eurozone)

This table reports the results for the time series regressions of our 27 sorted portfolios (cf. Table 3.2 on page 78) on the Carhart (1997) 4FM. The first row per block depicts all high book-to-market portfolios, i.e., $P1$ to $P9$, with the market capitalization (size) increasing from left to right. The second row per block depicts all medium book-to-market portfolios, i.e., $P10$ to $P17$, with the market capitalization (size) increasing from left to right. The third row per block shows all low book-to-market portfolios, i.e., $P20$ to $P27$, with the market capitalization (size) increasing from left to right. The shown adjusted R^2 values are adjusted for degrees of freedom. Statistics are corrected for heteroscedasticity and autocorrelation, up to three lags, using the Newey and West (1987) estimator.

	Market Capitalization (Size)																	
BV/MV	Small				Medium				Big	Small				Medium				Big
	α									$t(\alpha)$								
High	0.07	-0.08	-0.03	-0.03	-0.08	-0.06	-0.07	-0.08	-0.03	1.85	-0.97	-0.72	-0.56	-2.67	-1.70	-2.04	-3.29	-0.92
Med.	-0.01	-0.01	-0.01	-0.08	-0.05	0.04	0.03	0.00	-0.04	-0.48	-0.51	-0.21	-3.52	-2.15	1.33	1.22	-0.11	-1.18
Low	-0.10	-0.05	-0.01	-0.04	-0.06	-0.06	0.00	-0.02	-0.03	-0.10	-0.05	-0.01	-0.04	-0.06	-0.06	0.00	-0.02	-0.03
	β^{MRF}									$t(\beta^{MRF})$								
High	0.94	0.49	0.77	0.90	0.61	0.68	1.07	1.07	0.92	6.38	1.70	4.74	5.85	5.02	6.13	9.21	8.48	9.46
Med.	1.15	0.79	0.91	0.36	1.03	1.14	0.92	0.90	0.90	7.52	6.53	8.63	4.63	8.71	8.25	7.72	11.92	10.28
Low	1.03	0.92	1.01	0.67	0.75	0.83	0.84	0.68	0.71	6.77	10.77	4.98	8.13	7.32	8.94	7.91	7.43	11.37
	β^{HML}									$t(\beta^{HML})$								
High	0.27	0.94	1.47	1.04	0.80	1.19	0.30	0.33	0.55	1.36	1.94	6.40	5.36	4.41	5.68	2.38	2.89	3.22
Med.	0.00	0.34	-0.01	0.97	-0.01	0.19	0.10	0.02	0.00	-0.01	2.83	-0.09	6.85	-0.04	1.49	0.69	0.20	0.04
Low	-0.45	-0.21	-1.11	-0.09	-0.15	-0.06	0.04	-0.02	-0.05	-2.91	-1.32	-5.10	-1.00	-1.56	-0.67	0.39	-0.26	-0.72
	β^{SMB}									$t(\beta^{SMB})$								
High	0.63	1.55	0.59	-0.14	0.16	0.27	0.04	0.16	-0.15	2.54	2.28	1.86	-0.45	0.78	1.28	0.22	1.03	-1.04
Med.	0.58	0.15	0.65	0.11	0.24	-0.34	-0.59	-0.44	-0.25	3.56	0.86	3.83	0.68	1.70	-1.96	-4.23	-4.05	-1.55
Low	0.89	0.82	1.16	0.55	0.20	0.24	-0.17	-0.33	-0.27	5.18	4.00	3.65	4.39	1.79	2.15	-1.21	-3.15	-3.39
	β^{WML}									$t(\beta^{WML})$								
High	-1.17	-0.03	1.69	-0.36	0.13	1.13	-0.62	0.36	0.28	-1.17	-0.03	1.69	-0.36	0.13	1.13	-0.62	0.36	0.28
Med.	-1.07	-0.07	0.17	0.68	0.41	0.54	-0.24	0.11	0.21	-1.07	-0.07	0.17	0.68	0.41	0.54	-0.24	0.11	0.21
Low	-0.81	0.16	1.53	0.14	-0.21	0.32	0.40	-0.18	0.08	-0.81	0.16	1.53	0.14	-0.21	0.32	0.40	-0.18	0.08
	Adj. R^2									s(e)								
High	0.45	0.31	0.58	0.46	0.41	0.56	0.54	0.56	0.51	0.10	0.25	0.12	0.12	0.08	0.08	0.06	0.05	0.06
Med.	0.51	0.43	0.45	0.58	0.46	0.54	0.50	0.57	0.46	0.08	0.05	0.06	0.04	0.06	0.06	0.05	0.03	0.05
Low	0.45	0.46	0.48	0.46	0.42	0.48	0.52	0.49	0.57	0.08	0.06	0.14	0.03	0.03	0.04	0.03	0.02	0.02

Table B.45: Time-Series Regressions CAPM & 3FM - Financials (Eurozone)

This table reports the results for the CAPM (Panel A) & Fama and French (1993) 3FM (Panel B) time series regressions for our 27 sorted portfolios (cf. Table 3.2 on page 78). The first row per block depicts all high book-to-market portfolios, i.e., $P1$ to $P9$, with the market capitalization (size) increasing from left to right. The second row per block depicts all medium book-to-market portfolios, i.e., $P10$ to $P17$, with the market capitalization (size) increasing from left to right. The third row per blockshows all low book-to-market portfolios, i.e., $P20$ to $P27$, with the market capitalization (size) increasing from left to right. The shown adjusted R^2 values are adjusted for degrees of freedom. Statistics are corrected for heteroscedasticity and autocorrelation, up to three lags, using the Newey and West (1987) estimator.

	Market Capitalization (Size)																	
BV/MV	Small				Medium				Big	Small				Medium				Big
Panel A: Capital Asset Pricing Model																		
					α									$t(\alpha)$				
High	0.08	0.07	0.33	0.08	0.00	0.08	0.01	0.00	0.00	1.89	2.58	5.77	1.39	-0.02	2.89	0.34	-0.16	0.00
Med.	-0.02	0.03	0.14	-0.03	-0.01	0.01	-0.05	-0.04	-0.03	-0.81	1.34	4.40	-2.87	-0.58	0.40	-2.45	-2.47	-1.38
Low	-0.05	-0.01	0.10	0.10	-0.06	-0.03	0.00	-0.05	-0.05	-0.05	-0.01	0.10	0.10	-0.06	-0.03	0.00	-0.05	-0.05
					β^{MRF}									$t\left(\beta^{MRF}\right)$				
High	0.89	0.46	1.04	0.67	0.73	0.71	1.05	0.74	0.84	3.85	4.22	4.07	4.25	7.24	6.09	7.07	9.50	7.04
Med.	0.85	0.76	0.89	0.19	0.50	0.59	0.88	0.74	0.78	7.36	8.59	7.09	4.32	5.65	5.09	8.07	8.30	7.73
Low	0.72	0.67	1.36	0.75	0.52	0.44	0.49	0.73	0.63	7.64	6.43	7.44	6.90	7.54	5.67	4.95	7.91	8.19
					Adj. R^2									s(e)				
High	0.12	0.12	0.13	0.08	0.44	0.27	0.52	0.53	0.48	0.26	0.07	0.35	0.23	0.03	0.06	0.05	0.02	0.04
Med.	0.37	0.37	0.26	0.15	0.21	0.22	0.50	0.53	0.46	0.06	0.05	0.10	0.01	0.04	0.06	0.04	0.02	0.03
Low	0.23	0.23	0.38	0.26	0.39	0.22	0.20	0.49	0.51	0.08	0.07	0.14	0.08	0.02	0.03	0.04	0.03	0.02
Panel B: Fama and French (1993) Model																		
					α									$t(\alpha)$				
High	-0.16	-0.04	0.06	-0.12	-0.02	0.03	0.00	-0.01	-0.01	-3.52	-1.26	1.07	-2.55	-0.95	0.94	-0.04	-0.31	-0.23
Med.	-0.07	0.01	0.10	-0.07	-0.07	0.00	-0.02	-0.04	-0.02	-2.09	0.27	2.68	-6.23	-2.49	0.06	-0.75	-2.14	-0.73
Low	-0.12	-0.07	0.10	0.07	-0.08	-0.07	-0.01	-0.03	-0.05	-0.12	-0.07	0.10	0.07	-0.08	-0.07	-0.01	-0.03	-0.05
					β^{MRF}									$t\left(\beta^{MRF}\right)$				
High	0.64	0.35	0.77	0.45	0.70	0.66	1.02	0.73	0.83	4.08	3.31	4.52	2.46	7.82	5.26	9.21	10.99	7.77
Med.	0.79	0.74	0.87	0.15	0.44	0.58	0.90	0.73	0.78	7.99	8.16	6.30	4.33	4.88	4.89	11.13	10.98	8.41
Low	0.65	0.63	1.39	0.74	0.49	0.38	0.49	0.75	0.62	6.90	7.05	7.51	6.24	7.62	5.04	4.71	10.53	10.58
					β^{HML}									$t\left(\beta^{HML}\right)$				
High	1.58	0.96	1.58	1.97	0.43	0.39	0.70	0.33	0.38	5.12	4.58	2.47	4.19	3.02	2.15	3.45	2.95	2.21
Med.	0.50	-0.21	-0.53	0.23	0.61	0.05	0.15	0.38	0.16	1.64	-1.33	-1.86	2.46	2.81	0.22	0.92	3.52	1.11
Low	-0.01	-0.26	-1.06	-0.51	0.24	0.50	0.01	0.11	0.32	-0.05	-1.51	-3.43	-2.13	1.96	2.94	0.06	0.75	3.09
					β^{SMB}									$t\left(\beta^{SMB}\right)$				
High	1.19	0.36	1.46	0.40	-0.12	0.22	-0.48	-0.23	-0.25	3.22	1.52	3.22	0.87	-0.84	1.21	-2.98	-2.66	-1.98
Med.	0.08	0.38	0.80	0.24	0.09	0.05	-0.44	-0.31	-0.22	0.55	2.34	4.35	3.39	0.57	0.31	-3.99	-3.03	-1.80
Low	0.74	0.76	0.78	0.66	0.08	0.07	0.06	-0.34	-0.25	4.68	6.69	2.39	4.31	0.66	0.52	0.40	-3.38	-2.67
					Adj. R^2									s(e)				
High	0.44	0.38	0.43	0.35	0.48	0.32	0.61	0.57	0.51	0.17	0.05	0.23	0.16	0.03	0.06	0.04	0.02	0.03
Med.	0.41	0.41	0.37	0.41	0.31	0.21	0.57	0.59	0.48	0.05	0.04	0.09	0.01	0.04	0.06	0.03	0.02	0.03
Low	0.37	0.39	0.48	0.37	0.43	0.32	0.20	0.54	0.57	0.07	0.06	0.11	0.06	0.02	0.03	0.04	0.02	0.02

Table B.46: Time-Series Regressions 4FM - Financials (Eurozone)

This table reports the results for the time series regressions of our 27 sorted portfolios (cf. Table 3.2 on page 78) on the Carhart (1997) 4FM. The first row per block depicts all high book-to-market portfolios, i.e., $P1$ to $P9$, with the market capitalization (size) increasing from left to right. The second row per block depicts all medium book-to-market portfolios, i.e., $P10$ to $P17$, with the market capitalization (size) increasing from left to right. The third row per block shows all low book-to-market portfolios, i.e., $P20$ to $P27$, with the market capitalization (size) increasing from left to right. The shown adjusted R^2 values are adjusted for degrees of freedom. Statistics are corrected for heteroscedasticity and autocorrelation, up to three lags, using the Newey and West (1987) estimator.

	Market Capitalization (Size)																	
BV/MV	Small				Medium				Big	Small				Medium				Big
	α									$t(\alpha)$								
High	-0.04	-0.05	-0.12	-0.05	-0.05	-0.02	0.01	-0.03	-0.05	-0.88	-1.92	-2.40	-1.41	-2.05	-0.58	0.25	-1.40	-2.39
Med.	-0.06	-0.02	0.07	-0.10	-0.09	-0.04	-0.02	-0.06	-0.06	-1.85	-1.01	1.84	-9.55	-3.17	-1.25	-0.59	-2.89	-2.46
Low	-0.08	-0.06	0.02	0.04	-0.09	-0.09	-0.05	-0.03	-0.07	-0.08	-0.06	0.02	0.04	-0.09	-0.09	-0.05	-0.03	-0.07
	β^{MRF}									$t(\beta^{MRF})$								
High	0.83	0.33	0.49	0.56	0.66	0.58	1.04	0.69	0.76	4.83	3.13	4.06	3.10	7.93	4.89	9.14	11.35	8.07
Med.	0.80	0.69	0.82	0.11	0.41	0.52	0.90	0.70	0.72	8.14	8.59	6.54	4.25	4.61	4.98	11.16	11.42	9.18
Low	0.72	0.65	1.25	0.69	0.48	0.36	0.43	0.75	0.59	7.74	6.64	8.34	6.42	7.20	4.76	4.76	10.54	10.96
	β^{HML}									$t(\beta^{HML})$								
High	1.07	1.01	2.37	1.69	0.55	0.61	0.67	0.44	0.57	3.50	5.54	4.36	4.69	3.99	3.23	3.17	4.06	3.85
Med.	0.47	-0.08	-0.39	0.35	0.69	0.23	0.14	0.47	0.32	1.63	-0.60	-1.58	4.38	3.32	1.26	0.82	4.27	2.48
Low	-0.19	-0.30	-0.69	-0.37	0.27	0.57	0.17	0.11	0.39	-0.59	-1.54	-2.45	-1.82	2.21	3.54	1.11	0.70	3.86
	β^{SMB}									$t(\beta^{SMB})$								
High	1.23	0.35	1.40	0.42	-0.12	0.21	-0.47	-0.24	-0.26	4.62	1.49	5.65	0.91	-1.06	1.43	-2.88	-3.46	-2.45
Med.	0.09	0.37	0.79	0.23	0.09	0.03	-0.44	-0.32	-0.23	0.54	2.76	4.45	5.46	0.54	0.25	-3.94	-3.59	-2.20
Low	0.75	0.76	0.75	0.65	0.08	0.07	0.04	-0.34	-0.25	4.87	6.85	2.71	4.55	0.67	0.49	0.36	-3.36	-3.19
	β^{WML}									$t(\beta^{WML})$								
High	-1.61	0.15	2.49	-0.88	0.35	0.70	-0.12	0.33	0.60	-1.61	0.15	2.49	-0.88	0.35	0.70	-0.12	0.33	0.60
Med.	-0.11	0.42	0.46	0.37	0.24	0.57	-0.03	0.26	0.52	-0.11	0.42	0.46	0.37	0.24	0.57	-0.03	0.26	0.52
Low	-0.55	-0.13	1.19	0.44	0.09	0.24	0.52	-0.01	0.24	-0.55	-0.13	1.19	0.44	0.09	0.24	0.52	-0.01	0.24
	Adj. R^2									s(e)								
High	0.59	0.39	0.69	0.40	0.51	0.41	0.62	0.61	0.61	0.12	0.05	0.12	0.15	0.03	0.05	0.04	0.02	0.03
Med.	0.41	0.45	0.40	0.61	0.33	0.28	0.57	0.62	0.55	0.05	0.04	0.09	0.00	0.04	0.05	0.03	0.02	0.03
Low	0.42	0.39	0.59	0.40	0.43	0.35	0.28	0.54	0.60	0.06	0.06	0.09	0.06	0.02	0.03	0.04	0.02	0.01

Table B.47: Time-Series Regressions CAPM & 3FM - General Industries (Eurozone)

This table reports the results for the CAPM (Panel A) & Fama and French (1993) 3FM (Panel B) time series regressions for our 27 sorted portfolios (cf. Table 3.2 on page 78). The first row per block depicts all high book-to-market portfolios, i.e., $P1$ to $P9$, with the market capitalization (size) increasing from left to right. The second row per block depicts all medium book-to-market portfolios, i.e., $P10$ to $P17$, with the market capitalization (size) increasing from left to right. The third row per blockshows all low book-to-market portfolios, i.e., $P20$ to $P27$, with the market capitalization (size) increasing from left to right. The shown adjusted R^2 values are adjusted for degrees of freedom. Statistics are corrected for heteroscedasticity and autocorrelation, up to three lags, using the Newey and West (1987) estimator.

	Market Capitalization (Size)																	
BV/MV	Small				Medium				Big	Small				Medium				Big
Panel A: Capital Asset Pricing Model																		
					α									$t(\alpha)$				
High	0.15	0.23	0.30	0.05	0.08	0.10	0.01	0.05	0.05	5.15	4.33	7.15	1.69	3.00	3.54	0.29	1.66	1.63
Med.	0.23	0.06	0.13	-0.02	0.00	0.07	-0.04	-0.03	-0.04	1.85	2.28	3.87	-2.05	0.07	2.58	-1.68	-1.56	-1.83
Low	-0.01	0.07	0.08	0.10	-0.05	-0.01	0.04	-0.05	-0.04	-0.01	0.07	0.08	0.10	-0.05	-0.01	0.04	-0.05	-0.04
					β^{MRF}									$t\left(\beta^{MRF}\right)$				
High	0.97	1.56	1.18	0.95	1.01	0.88	1.11	0.97	0.94	6.35	3.32	6.08	7.49	9.20	8.39	9.14	8.52	8.60
Med.	2.11	0.71	1.01	0.23	0.81	1.10	0.83	0.77	0.74	2.47	5.89	6.35	4.97	6.66	11.85	8.29	8.93	8.64
Low	1.52	1.11	1.16	0.84	0.74	0.70	0.93	0.69	0.67	4.01	9.47	8.75	6.49	8.78	6.79	12.44	8.43	8.99
					Adj. R^2									s(e)				
High	0.27	0.11	0.27	0.35	0.42	0.35	0.43	0.36	0.39	0.11	0.95	0.18	0.08	0.07	0.07	0.08	0.08	0.06
Med.	0.06	0.20	0.27	0.18	0.29	0.45	0.42	0.43	0.41	3.28	0.09	0.13	0.01	0.08	0.07	0.04	0.04	0.04
Low	0.14	0.32	0.37	0.27	0.40	0.30	0.48	0.41	0.43	0.64	0.12	0.11	0.09	0.04	0.05	0.04	0.03	0.03
Panel B: Fama and French (1993) Model																		
					α									$t(\alpha)$				
High	0.11	-0.33	0.27	0.02	0.02	0.08	-0.02	0.01	0.01	1.68	-1.94	3.92	0.47	0.72	1.86	-0.48	0.15	0.18
Med.	-0.58	0.00	0.12	-0.04	0.00	0.06	-0.04	-0.04	-0.06	-2.23	0.05	2.52	-2.16	-0.09	1.66	-1.48	-1.51	-2.09
Low	0.08	0.07	0.06	0.09	-0.06	-0.01	0.04	-0.05	-0.05	0.08	0.07	0.06	0.09	-0.06	-0.01	0.04	-0.05	-0.05
					β^{MRF}									$t\left(\beta^{MRF}\right)$				
High	0.90	0.51	1.16	0.92	0.94	0.85	1.09	0.91	0.88	6.03	1.80	5.03	7.06	8.90	7.91	8.76	8.35	7.38
Med.	-0.15	0.55	0.92	0.22	0.81	1.09	0.86	0.78	0.71	-0.26	4.55	5.67	4.28	7.14	11.12	8.66	9.14	7.54
Low	1.48	1.10	1.08	0.76	0.74	0.70	0.92	0.71	0.68	3.91	9.36	7.29	5.76	8.02	7.19	11.58	8.82	9.19
					β^{HML}									$t\left(\beta^{HML}\right)$				
High	0.47	3.64	0.55	0.40	0.59	0.23	0.43	0.43	0.31	1.36	2.76	1.94	1.59	3.94	1.37	1.78	1.67	1.33
Med.	0.05	0.11	-0.41	0.16	0.13	0.05	0.19	0.19	0.24	0.03	0.42	-2.18	1.77	0.78	0.43	1.59	1.86	2.17
Low	-1.98	-0.14	-0.15	-0.36	0.21	0.11	0.05	0.15	0.16	-1.54	-0.67	-1.51	-2.26	1.65	0.79	0.46	1.59	1.88
					β^{SMB}									$t\left(\beta^{SMB}\right)$				
High	0.00	1.37	-0.14	-0.06	0.00	-0.02	-0.09	-0.01	0.05	0.00	3.00	-0.68	-0.59	-0.05	-0.14	-0.97	-0.08	0.49
Med.	5.50	0.35	0.36	-0.01	-0.05	0.01	-0.13	-0.09	-0.01	4.83	1.85	2.10	-0.21	-0.37	0.05	-2.09	-1.68	-0.17
Low	0.75	0.09	0.25	0.31	-0.08	-0.05	0.00	-0.10	-0.08	2.38	0.39	1.61	2.26	-0.99	-0.49	0.02	-2.02	-1.71
					Adj. R^2									s(e)				
High	0.32	0.60	0.32	0.40	0.53	0.36	0.49	0.41	0.42	0.11	0.43	0.16	0.07	0.05	0.07	0.07	0.07	0.06
Med.	0.61	0.26	0.36	0.25	0.29	0.45	0.45	0.46	0.43	1.37	0.09	0.11	0.01	0.08	0.07	0.04	0.04	0.04
Low	0.41	0.32	0.40	0.37	0.43	0.31	0.47	0.44	0.46	0.44	0.12	0.10	0.08	0.04	0.05	0.05	0.03	0.03

Table B.48: Time-Series Regressions 4FM - General Industries (Eurozone)

This table reports the results for the time series regressions of our 27 sorted portfolios (cf. Table 3.2 on page 78) on the Carhart (1997) 4FM. The first row per block depicts all high book-to-market portfolios, i.e., $P1$ to $P9$, with the market capitalization (size) increasing from left to right. The second row per block depicts all medium book-to-market portfolios, i.e., $P10$ to $P17$, with the market capitalization (size) increasing from left to right. The third row per block shows all low book-to-market portfolios, i.e., $P20$ to $P27$, with the market capitalization (size) increasing from left to right. The shown adjusted R^2 values are adjusted for degrees of freedom. Statistics are corrected for heteroscedasticity and autocorrelation, up to three lags, using the Newey and West (1987) estimator.

	Market Capitalization (Size)																	
BV/MV	Small				Medium				Big	Small				Medium				Big
					α									$t(\alpha)$				
High	0.11	-0.49	0.17	0.03	0.00	0.04	-0.01	0.00	-0.01	1.52	-2.55	2.08	0.62	-0.11	0.67	-0.23	0.05	-0.19
Med.	-0.13	-0.04	0.05	-0.05	-0.05	0.01	-0.04	-0.05	-0.09	-0.74	-0.67	1.01	-2.38	-0.92	0.22	-1.10	-1.74	-2.87
Low	0.09	-0.01	-0.04	0.03	-0.07	-0.05	-0.01	-0.04	-0.06	0.09	-0.01	-0.04	0.03	-0.07	-0.05	-0.01	-0.04	-0.06
					β^{MRF}									$t(\beta^{MRF})$				
High	0.91	0.31	1.04	0.94	0.90	0.80	1.10	0.91	0.85	5.92	1.03	4.76	6.69	8.24	6.78	8.57	8.04	7.09
Med.	0.42	0.49	0.82	0.20	0.76	1.02	0.87	0.77	0.68	1.01	3.87	5.28	3.95	6.46	10.07	8.80	8.80	7.17
Low	1.50	0.99	0.95	0.68	0.72	0.66	0.87	0.72	0.66	4.26	8.89	7.61	5.33	7.47	6.50	10.44	8.98	8.87
					β^{HML}									$t(\beta^{HML})$				
High	0.48	3.30	0.36	0.43	0.53	0.14	0.45	0.42	0.28	1.47	3.14	0.96	1.73	2.96	0.64	1.96	1.69	1.16
Med.	0.97	0.01	-0.55	0.13	0.04	-0.06	0.20	0.16	0.18	0.66	0.05	-2.17	1.32	0.18	-0.33	1.80	1.47	1.33
Low	-1.96	-0.31	-0.35	-0.48	0.18	0.04	-0.04	0.16	0.14	-1.46	-1.24	-2.02	-2.24	1.25	0.22	-0.30	1.82	1.52
					β^{SMB}									$t(\beta^{SMB})$				
High	-0.03	2.55	0.52	-0.16	0.20	0.31	-0.16	0.02	0.17	-0.10	3.26	1.65	-0.70	1.35	1.53	-0.92	0.09	1.05
Med.	2.32	0.68	0.87	0.08	0.27	0.39	-0.17	0.01	0.19	3.62	2.36	3.94	0.95	1.05	2.25	-1.58	0.05	1.85
Low	0.68	0.67	0.95	0.73	0.03	0.20	0.31	-0.15	0.00	1.59	2.69	5.66	4.09	0.21	0.99	2.27	-1.64	-0.04
					β^{WML}									$t(\beta^{WML})$				
High	-0.05	1.79	1.01	-0.14	0.32	0.49	-0.10	0.04	0.18	-0.05	1.79	1.01	-0.14	0.32	0.49	-0.10	0.04	0.18
Med.	-4.84	0.49	0.79	0.14	0.48	0.59	-0.07	0.15	0.31	-4.84	0.49	0.79	0.14	0.48	0.59	-0.07	0.15	0.31
Low	-0.11	0.89	1.06	0.64	0.16	0.38	0.47	-0.07	0.12	-0.11	0.89	1.06	0.64	0.16	0.38	0.47	-0.07	0.12
					Adj. R^2									s(e)				
High	0.32	0.68	0.44	0.40	0.55	0.42	0.49	0.41	0.42	0.11	0.34	0.14	0.07	0.05	0.06	0.07	0.07	0.06
Med.	0.79	0.32	0.45	0.28	0.35	0.52	0.45	0.47	0.48	0.73	0.08	0.10	0.01	0.07	0.06	0.04	0.03	0.03
Low	0.41	0.44	0.58	0.46	0.44	0.36	0.54	0.44	0.47	0.45	0.10	0.07	0.07	0.04	0.05	0.04	0.03	0.03

Table B.49: Time-Series Regressions CAPM & 3FM - Information Technology (Eurozone)

This table reports the results for the CAPM (Panel A) & Fama and French (1993) 3FM (Panel B) time series regressions for our 27 sorted portfolios (cf. Table 3.2 on page 78). The first row per block depicts all high book-to-market portfolios, i.e., $P1$ to $P9$, with the market capitalization (size) increasing from left to right. The second row per block depicts all medium book-to-market portfolios, i.e., $P10$ to $P17$, with the market capitalization (size) increasing from left to right. The third row per blockshows all low book-to-market portfolios, i.e., $P20$ to $P27$, with the market capitalization (size) increasing from left to right. The shown adjusted R^2 values are adjusted for degrees of freedom. Statistics are corrected for heteroscedasticity and autocorrelation, up to three lags, using the Newey and West (1987) estimator.

	Market Capitalization (Size)																	
BV/MV	Small				Medium				Big	Small				Medium				Big
Panel A: Capital Asset Pricing Model																		
					α									$t(\alpha)$				
High	0.88	0.52	0.33	0.60	0.24	0.27	0.02	0.00	0.11	2.22	3.83	2.13	2.88	2.13	2.31	0.27	-0.05	1.72
Med.	0.00	0.00	0.02	0.29	0.03	0.18	0.07	0.00	0.13	0.04	0.10	0.29	1.74	0.66	2.50	0.84	-0.04	1.37
Low	0.25	0.01	-0.04	-0.01	0.03	0.01	0.09	0.01	-0.04	0.25	0.01	-0.04	-0.01	0.03	0.01	0.09	0.01	-0.04
					β^{MRF}									$t\left(\beta^{MRF}\right)$				
High	6.40	2.67	4.03	4.28	1.44	1.83	1.31	1.57	1.97	2.10	4.52	3.86	3.99	3.71	3.68	2.83	5.88	5.13
Med.	1.41	1.48	1.33	3.40	1.69	1.49	2.28	1.98	2.70	3.33	8.86	5.01	3.02	8.76	4.29	4.73	9.27	4.37
Low	2.66	1.74	1.78	0.73	1.10	1.23	0.87	1.29	1.28	10.87	8.70	5.49	4.95	7.70	8.97	4.05	5.01	9.09
					Adj. R^2									s(e)				
High	0.18	0.23	0.42	0.33	0.16	0.17	0.20	0.34	0.38	9.80	1.30	1.26	2.08	0.59	0.86	0.37	0.27	0.34
Med.	0.23	0.53	0.33	0.32	0.63	0.32	0.41	0.62	0.47	0.36	0.11	0.20	1.34	0.10	0.26	0.42	0.14	0.45
Low	0.66	0.59	0.44	0.31	0.45	0.61	0.30	0.40	0.61	0.21	0.12	0.23	0.07	0.08	0.05	0.10	0.14	0.06
Panel B: Fama and French (1993) Model																		
					α									$t(\alpha)$				
High	-0.32	0.28	-0.09	0.12	0.15	0.10	0.07	-0.02	-0.02	-2.58	3.04	-1.29	1.51	1.73	1.11	0.97	-0.46	-0.50
Med.	0.07	0.01	0.00	-0.15	-0.03	0.25	0.09	-0.03	-0.04	1.03	0.31	0.01	-2.16	-0.82	3.36	1.76	-0.74	-0.77
Low	0.27	0.00	-0.09	-0.01	0.03	-0.03	0.14	0.01	-0.05	0.27	0.00	-0.09	-0.01	0.03	-0.03	0.14	0.01	-0.05
					β^{MRF}									$t\left(\beta^{MRF}\right)$				
High	0.41	1.50	1.93	2.06	1.06	1.01	1.58	1.50	1.34	0.83	3.88	7.38	4.97	2.32	2.75	3.84	5.80	6.75
Med.	1.77	1.50	1.22	1.21	1.40	1.87	2.43	1.84	1.90	5.61	10.70	4.03	3.88	8.00	5.10	9.62	7.79	6.09
Low	2.76	1.65	1.50	0.69	1.09	1.03	1.09	1.38	1.19	9.51	9.97	4.94	4.18	5.56	7.74	4.79	8.93	7.91
					β^{HML}									$t\left(\beta^{HML}\right)$				
High	2.67	0.71	0.90	2.32	0.57	0.59	0.40	0.42	0.62	5.31	2.11	5.95	8.18	1.88	2.26	1.90	3.09	5.24
Med.	0.07	-0.13	-0.11	0.99	0.14	0.04	0.84	0.20	0.76	0.41	-1.23	-0.76	5.30	1.36	0.31	6.82	1.87	2.77
Low	-0.07	-0.24	-0.05	-0.07	0.00	0.11	-0.01	0.44	0.08	-0.53	-1.89	-0.44	-0.80	0.02	1.23	-0.14	6.66	1.04
					β^{SMB}									$t\left(\beta^{SMB}\right)$				
High	2.38	0.18	0.90	-1.17	-0.47	-0.02	-0.91	-0.58	-0.28	6.33	0.61	2.84	-2.87	-1.17	-0.08	-2.68	-2.66	-1.68
Med.	-0.50	0.17	0.28	0.85	0.10	-0.48	-1.47	-0.16	-0.30	-2.27	1.25	1.55	2.22	0.62	-3.23	-8.25	-1.05	-0.82
Low	0.00	0.47	0.39	0.15	0.02	0.06	-0.23	-0.79	-0.04	-0.01	2.95	2.57	1.44	0.11	0.48	-2.32	-9.03	-0.39
					Adj. R^2									s(e)				
High	0.84	0.40	0.86	0.81	0.25	0.31	0.38	0.43	0.58	1.96	1.01	0.30	0.58	0.53	0.71	0.29	0.23	0.24
Med.	0.31	0.54	0.34	0.85	0.69	0.43	0.71	0.64	0.68	0.32	0.11	0.19	0.30	0.08	0.22	0.21	0.13	0.27
Low	0.65	0.66	0.49	0.32	0.44	0.67	0.39	0.66	0.62	0.21	0.10	0.20	0.07	0.08	0.05	0.08	0.08	0.06

Table B.50: Time-Series Regressions 4FM - Information Technology (Eurozone)

This table reports the results for the time series regressions of our 27 sorted portfolios (cf. Table 3.2 on page 78) on the Carhart (1997) 4FM. The first row per block depicts all high book-to-market portfolios, i.e., $P1$ to $P9$, with the market capitalization (size) increasing from left to right. The second row per block depicts all medium book-to-market portfolios, i.e., $P10$ to $P17$, with the market capitalization (size) increasing from left to right. The third row per block shows all low book-to-market portfolios, i.e., $P20$ to $P27$, with the market capitalization (size) increasing from left to right. The shown adjusted R^2 values are adjusted for degrees of freedom. Statistics are corrected for heteroscedasticity and autocorrelation, up to three lags, using the Newey and West (1987) estimator.

	Market Capitalization (Size)																	
BV/MV	Small				Medium				Big	Small				Medium				Big
					α									$t\ (\alpha)$				
High	-0.42	0.32	-0.09	0.11	0.17	0.17	0.05	-0.02	-0.03	-3.16	3.20	-1.18	1.44	2.16	2.64	0.79	-0.34	-0.74
Med.	0.07	0.02	-0.01	-0.15	-0.02	0.26	0.07	-0.03	-0.04	0.94	0.50	-0.15	-2.05	-0.64	3.48	1.47	-0.75	-0.80
Low	0.26	0.00	-0.07	-0.02	0.03	-0.03	0.14	0.00	-0.05	0.26	0.00	-0.07	-0.02	0.03	-0.03	0.14	0.00	-0.05
					β^{MRF}									$t(\beta^{MRF})$				
High	0.03	1.69	1.94	1.99	1.14	1.29	1.51	1.53	1.29	0.06	3.89	7.27	5.11	2.78	5.15	4.29	6.42	6.11
Med.	1.75	1.53	1.18	1.22	1.44	1.89	2.35	1.84	1.89	5.89	11.13	3.94	3.90	9.96	5.25	10.71	7.89	6.05
Low	2.70	1.66	1.57	0.67	1.10	1.06	1.11	1.33	1.20	9.16	9.51	5.46	4.09	5.66	9.57	5.00	10.52	7.92
					β^{HML}									$t(\beta^{HML})$				
High	1.07	1.50	0.93	2.03	0.91	1.76	0.08	0.56	0.41	2.92	4.45	3.12	9.25	2.95	5.22	0.23	2.58	2.77
Med.	-0.05	-0.02	-0.28	1.01	0.31	0.14	0.50	0.20	0.71	-0.16	-0.12	-1.19	2.87	2.53	0.87	2.63	1.38	2.50
Low	-0.30	-0.21	0.24	-0.16	0.04	0.22	0.07	0.24	0.11	-1.58	-1.27	1.87	-1.19	0.44	2.16	0.64	1.92	1.08
					β^{SMB}									$t(\beta^{SMB})$				
High	2.91	-0.08	0.88	-1.07	-0.58	-0.41	-0.81	-0.62	-0.21	9.74	-0.31	2.74	-3.00	-1.62	-1.91	-2.47	-3.20	-1.34
Med.	-0.47	0.13	0.33	0.85	0.04	-0.51	-1.35	-0.16	-0.29	-1.98	0.97	1.82	2.16	0.31	-3.70	-8.42	-1.05	-0.78
Low	0.08	0.46	0.29	0.18	0.00	0.02	-0.25	-0.72	-0.05	0.32	2.64	2.57	1.67	0.02	0.18	-2.84	-10.30	-0.47
					β^{WML}									$t(\beta^{WML})$				
High	-3.42	1.69	0.08	-0.62	0.74	2.50	-0.67	0.29	-0.44	-3.42	1.69	0.08	-0.62	0.74	2.50	-0.67	0.29	-0.44
Med.	-0.24	0.24	-0.36	0.04	0.35	0.22	-0.73	-0.01	-0.09	-0.24	0.24	-0.36	0.04	0.35	0.22	-0.73	-0.01	-0.09
Low	-0.50	0.05	0.62	-0.19	0.09	0.25	0.18	-0.44	0.06	-0.50	0.05	0.62	-0.19	0.09	0.25	0.18	-0.44	0.06
					Adj. R^2									s(e)				
High	0.89	0.49	0.86	0.82	0.29	0.65	0.43	0.44	0.60	1.33	0.87	0.30	0.56	0.50	0.37	0.27	0.23	0.23
Med.	0.32	0.55	0.37	0.85	0.72	0.44	0.75	0.64	0.68	0.32	0.10	0.19	0.30	0.07	0.22	0.18	0.13	0.28
Low	0.68	0.66	0.55	0.34	0.44	0.69	0.40	0.71	0.62	0.20	0.10	0.18	0.06	0.09	0.04	0.08	0.07	0.06

Table B.51: Time-Series Regressions CAPM & 3FM - Non-Cyclical Consumer Goods (Eurozone)

This table reports the results for the CAPM (Panel A) & Fama and French (1993) 3FM (Panel B) time series regressions for our 27 sorted portfolios (cf. Table 3.2 on page 78). The first row per block depicts all high book-to-market portfolios, i.e., $P1$ to $P9$, with the market capitalization (size) increasing from left to right. The second row per block depicts all medium book-to-market portfolios, i.e., $P10$ to $P17$, with the market capitalization (size) increasing from left to right. The third row per blockshows all low book-to-market portfolios, i.e., $P20$ to $P27$, with the market capitalization (size) increasing from left to right. The shown adjusted R^2 values are adjusted for degrees of freedom. Statistics are corrected for heteroscedasticity and autocorrelation, up to three lags, using the Newey and West (1987) estimator.

	Market Capitalization (Size)																	
BV/MV	Small				Medium				Big	Small				Medium				Big
Panel A: Capital Asset Pricing Model																		
					α									$t(\alpha)$				
High	0.59	0.47	0.30	0.06	0.15	0.21	0.06	0.15	0.24	4.43	2.25	3.08	0.75	2.71	3.79	0.70	3.43	4.12
Med.	0.20	0.24	0.48	0.17	0.02	0.27	0.06	0.12	0.17	3.29	4.09	5.54	2.94	0.52	4.14	1.38	2.77	1.62
Low	0.41	0.12	0.37	0.22	0.00	-0.01	0.13	0.00	0.06	0.41	0.12	0.37	0.22	0.00	-0.01	0.13	0.00	0.06
					β^{MRF}									$t\left(\beta^{MRF}\right)$				
High	1.28	0.98	0.47	0.96	0.34	0.38	1.02	0.42	-0.27	2.63	1.18	1.63	2.71	1.37	1.61	2.87	2.15	-0.96
Med.	0.83	0.65	2.14	0.30	0.44	-0.09	1.11	1.12	1.20	3.75	2.59	6.26	1.19	2.71	-0.40	4.10	5.30	4.28
Low	2.43	1.28	2.27	1.11	0.20	0.31	-0.01	0.57	0.75	4.17	6.29	4.25	6.86	1.73	2.71	-0.05	4.07	4.78
					Adj. R^2									s(e)				
High	0.09	0.00	0.01	0.13	0.04	0.03	0.19	0.10	0.01	0.81	3.44	0.66	0.31	0.12	0.17	0.23	0.08	0.15
Med.	0.11	0.10	0.32	0.00	0.21	-0.01	0.34	0.39	0.12	0.26	0.18	0.51	0.31	0.04	0.24	0.13	0.10	0.53
Low	0.21	0.46	0.30	0.33	0.06	0.21	-0.01	0.34	0.35	1.13	0.10	0.63	0.13	0.03	0.02	0.07	0.03	0.05
Panel B: Fama and French (1993) Model																		
					α									$t(\alpha)$				
High	0.34	-0.55	0.27	0.12	0.20	0.19	0.14	0.14	0.27	2.18	-2.16	2.27	1.26	3.17	3.05	1.76	2.84	4.11
Med.	0.11	0.21	0.39	0.15	0.02	0.26	0.17	0.12	0.40	1.59	3.47	3.99	2.26	0.42	3.38	3.79	2.16	2.23
Low	0.34	0.15	0.22	0.17	0.01	-0.01	0.12	0.06	0.06	0.34	0.15	0.22	0.17	0.01	-0.01	0.12	0.06	0.06
					β^{MRF}									$t\left(\beta^{MRF}\right)$				
High	1.03	0.26	0.84	1.43	0.66	0.60	1.65	0.57	-0.08	2.04	0.48	1.92	3.68	2.32	1.99	5.85	2.91	-0.29
Med.	0.41	0.39	1.41	0.46	0.46	-0.23	1.59	1.07	2.18	1.88	1.66	5.08	1.71	2.94	-1.02	6.35	4.30	3.87
Low	1.52	1.41	1.17	0.74	0.29	0.34	-0.07	0.82	0.74	3.20	7.31	2.78	5.22	2.88	3.02	-0.61	6.59	3.94
					β^{HML}									$t\left(\beta^{HML}\right)$				
High	0.73	3.44	0.68	0.44	0.24	0.39	0.58	0.23	0.13	1.10	3.56	1.90	2.76	2.34	2.40	3.23	2.51	1.17
Med.	-0.21	-0.27	-0.72	0.36	0.04	-0.16	0.25	-0.05	0.48	-1.59	-1.72	-3.01	1.78	0.58	-1.25	3.28	-0.39	1.60
Low	-1.06	0.06	-0.96	-0.32	0.05	0.03	-0.06	0.14	-0.01	-2.22	0.58	-3.04	-2.62	0.89	0.60	-0.92	3.51	-0.06
					β^{SMB}									$t\left(\beta^{SMB}\right)$				
High	0.73	2.78	-0.17	-0.43	-0.32	-0.10	-0.58	-0.08	-0.18	1.31	3.17	-0.52	-2.51	-2.54	-0.68	-3.98	-0.95	-1.36
Med.	0.48	0.23	0.66	-0.05	-0.02	0.10	-0.54	0.05	-1.13	3.43	2.30	2.80	-0.22	-0.24	0.83	-5.49	0.43	-2.07
Low	0.73	-0.15	1.04	0.35	-0.10	-0.02	0.06	-0.28	0.01	1.82	-1.31	2.97	2.98	-1.86	-0.43	0.81	-5.61	0.10
					Adj. R^2									s(e)				
High	0.22	0.69	0.06	0.20	0.13	0.11	0.39	0.14	0.02	0.70	1.07	0.62	0.29	0.11	0.16	0.17	0.08	0.15
Med.	0.18	0.14	0.42	0.03	0.20	-0.02	0.49	0.38	0.33	0.25	0.17	0.44	0.31	0.04	0.25	0.10	0.11	0.40
Low	0.30	0.46	0.48	0.42	0.08	0.20	-0.02	0.50	0.34	1.00	0.10	0.46	0.11	0.03	0.02	0.07	0.02	0.06

Table B.52: Time-Series Regressions 4FM - Non-Cyclical Consumer Goods (Eurozone)

This table reports the results for the time series regressions of our 27 sorted portfolios (cf. Table 3.2 on page 78) on the Carhart (1997) 4FM. The first row per block depicts all high book-to-market portfolios, i.e., $P1$ to $P9$, with the market capitalization (size) increasing from left to right. The second row per block depicts all medium book-to-market portfolios, i.e., $P10$ to $P17$, with the market capitalization (size) increasing from left to right. The third row per block shows all low book-to-market portfolios, i.e., $P20$ to $P27$, with the market capitalization (size) increasing from left to right. The shown adjusted R^2 values are adjusted for degrees of freedom. Statistics are corrected for heteroscedasticity and autocorrelation, up to three lags, using the Newey and West (1987) estimator.

	Market Capitalization (Size)																	
BV/MV	Small				Medium				Big	Small				Medium				Big
	α									$t(\alpha)$								
High	0.41	-0.58	0.23	0.15	0.22	0.18	0.16	0.16	0.26	3.12	-2.29	2.09	1.67	3.73	2.82	2.12	3.22	4.16
Med.	0.12	0.22	0.36	0.12	0.02	0.26	0.19	0.13	0.35	1.78	3.80	3.63	1.88	0.69	3.70	4.08	2.12	2.71
Low	0.44	0.16	0.16	0.16	0.02	0.00	0.13	0.07	0.07	0.44	0.16	0.16	0.16	0.02	0.00	0.13	0.07	0.07
	β^{MRF}									$t(\beta^{MRF})$								
High	0.76	0.41	1.04	1.26	0.57	0.63	1.54	0.52	-0.05	1.92	0.69	2.77	4.81	2.51	2.03	5.97	2.89	-0.18
Med.	0.33	0.34	1.55	0.58	0.43	-0.22	1.52	1.02	2.37	1.44	1.42	5.09	2.33	3.29	-1.00	7.45	5.56	4.71
Low	1.07	1.37	1.45	0.81	0.26	0.31	-0.08	0.78	0.70	2.34	7.51	4.69	5.20	3.02	3.37	-0.65	7.75	5.30
	β^{HML}									$t(\beta^{HML})$								
High	0.60	3.51	0.78	0.36	0.20	0.41	0.53	0.20	0.15	1.12	3.76	2.00	2.59	1.80	2.21	3.49	2.60	1.23
Med.	-0.24	-0.29	-0.65	0.41	0.03	-0.16	0.22	-0.07	0.57	-2.00	-2.10	-3.50	1.81	0.32	-1.36	2.20	-0.54	2.22
Low	-1.27	0.04	-0.83	-0.28	0.04	0.02	-0.07	0.13	-0.03	-3.76	0.41	-3.62	-3.00	0.82	0.32	-1.00	2.44	-0.28
	β^{SMB}									$t(\beta^{SMB})$								
High	0.64	2.83	-0.11	-0.48	-0.35	-0.09	-0.61	-0.09	-0.17	1.30	3.31	-0.38	-2.81	-2.66	-0.60	-3.96	-1.19	-1.23
Med.	0.46	0.21	0.70	-0.01	-0.03	0.11	-0.56	0.04	-1.07	3.29	1.93	2.84	-0.05	-0.39	0.87	-5.14	0.26	-2.64
Low	0.59	-0.16	1.13	0.37	-0.11	-0.03	0.06	-0.29	-0.01	1.38	-1.35	4.07	3.03	-2.37	-0.58	0.81	-5.28	-0.05
	β^{WML}									$t(\beta^{WML})$								
High	-1.40	0.72	1.00	-0.89	-0.43	0.18	-0.54	-0.25	0.18	-1.40	0.72	1.00	-0.89	-0.43	0.18	-0.54	-0.25	0.18
Med.	-0.38	-0.28	0.68	0.59	-0.19	0.04	-0.37	-0.26	0.96	-0.38	-0.28	0.68	0.59	-0.19	0.04	-0.37	-0.26	0.96
Low	-2.27	-0.20	1.40	0.35	-0.13	-0.14	-0.02	-0.19	-0.24	-2.27	-0.20	1.40	0.35	-0.13	-0.14	-0.02	-0.19	-0.24
	Adj. R^2									s(e)								
High	0.37	0.70	0.17	0.36	0.23	0.12	0.46	0.19	0.04	0.57	1.04	0.56	0.23	0.10	0.16	0.15	0.08	0.15
Med.	0.21	0.17	0.46	0.11	0.25	-0.01	0.54	0.40	0.43	0.24	0.17	0.41	0.29	0.04	0.25	0.09	0.10	0.34
Low	0.56	0.47	0.64	0.46	0.11	0.26	-0.02	0.55	0.38	0.64	0.10	0.33	0.11	0.03	0.02	0.07	0.02	0.05

Table B.53: Time-Series Regressions CAPM & 3FM - Resources (Eurozone)

This table reports the results for the CAPM (Panel A) & Fama and French (1993) 3FM (Panel B) time series regressions for our 27 sorted portfolios (cf. Table 3.2 on page 78). The first row per block depicts all high book-to-market portfolios, i.e., $P1$ to $P9$, with the market capitalization (size) increasing from left to right. The second row per block depicts all medium book-to-market portfolios, i.e., $P10$ to $P17$, with the market capitalization (size) increasing from left to right. The third row per blockshows all low book-to-market portfolios, i.e., $P20$ to $P27$, with the market capitalization (size) increasing from left to right. The shown adjusted R^2 values are adjusted for degrees of freedom. Statistics are corrected for heteroscedasticity and autocorrelation, up to three lags, using the Newey and West (1987) estimator.

	Market Capitalization (Size)																	
BV/MV	Small				Medium				Big	Small				Medium				Big
Panel A: Capital Asset Pricing Model																		
					α									$t(\alpha)$				
High	0.58	0.96	0.53	-0.10	0.45	0.89	0.43	0.06	0.15	1.68	1.34	1.94	-0.69	1.42	1.95	2.09	0.51	0.96
Med.	0.36	0.29	1.07	0.53	0.09	0.06	0.00	0.17	0.05	1.49	1.75	3.14	1.94	1.65	0.58	-0.02	3.03	0.87
Low	0.14	0.39	1.27	0.50	-0.03	0.02	-0.01	-0.04	0.05	0.14	0.39	1.27	0.50	-0.03	0.02	-0.01	-0.04	0.05
					β^{MRF}									$t\left(\beta^{MRF}\right)$				
High	2.86	-2.52	4.51	5.82	1.74	0.67	0.80	2.87	3.19	1.14	-0.68	2.37	3.89	0.90	0.25	0.85	2.36	2.75
Med.	5.03	3.79	2.77	4.51	2.11	2.72	1.32	0.38	0.98	1.57	2.13	1.73	2.37	4.02	3.10	5.98	1.51	2.35
Low	1.80	1.92	2.33	1.42	0.93	1.46	1.39	0.69	0.22	1.36	1.81	0.91	1.74	3.89	3.95	3.19	5.81	1.61
					Adj. R^2									s(e)				
High	0.01	-0.01	0.07	0.37	0.00	-0.02	-0.01	0.16	0.15	1.94	3.22	1.65	0.44	1.32	1.87	0.39	0.30	0.42
Med.	0.06	0.07	0.01	0.07	0.31	0.24	0.34	0.01	0.08	2.29	1.21	1.92	1.65	0.08	0.17	0.03	0.04	0.07
Low	0.01	0.00	0.00	0.01	0.27	0.32	0.25	0.33	0.01	0.82	1.34	2.01	0.49	0.02	0.03	0.04	0.01	0.01
Panel B: Fama and French (1993) Model																		
					α									$t(\alpha)$				
High	-0.79	0.08	0.01	-0.60	0.26	0.96	0.14	0.06	0.24	-2.02	0.19	0.02	-2.69	0.88	2.45	0.57	0.52	1.24
Med.	-0.07	0.43	0.68	0.01	0.07	0.05	-0.05	0.11	0.01	-0.11	1.74	1.43	0.02	0.78	0.37	-1.01	2.16	0.08
Low	-0.27	-0.27	0.64	0.30	-0.01	0.03	-0.01	-0.07	0.01	-0.27	-0.27	0.64	0.30	-0.01	0.03	-0.01	-0.07	0.01
					β^{MRF}									$t\left(\beta^{MRF}\right)$				
High	-0.44	-5.73	3.36	4.45	0.66	0.00	-0.12	2.54	3.01	-0.17	-1.95	2.03	2.80	0.40	0.00	-0.17	2.54	3.20
Med.	4.37	3.88	1.99	3.36	2.02	2.69	1.15	0.20	0.82	2.22	2.57	0.83	2.03	3.42	2.81	4.73	0.84	1.76
Low	0.86	0.38	1.00	1.02	0.93	1.46	1.36	0.59	0.12	0.76	0.23	0.45	0.84	3.69	3.60	2.83	4.57	0.93
					β^{HML}									$t\left(\beta^{HML}\right)$				
High	0.43	2.73	-0.04	0.55	1.47	1.83	0.61	0.71	0.83	0.94	4.42	-0.08	2.30	2.63	3.34	3.44	3.86	3.73
Med.	-0.67	0.53	-0.21	-0.04	0.14	0.04	0.12	0.10	0.13	-1.69	1.37	-0.48	-0.08	1.89	0.27	2.22	1.76	2.11
Low	0.02	0.12	-0.25	-0.09	0.10	0.06	0.03	0.07	0.06	0.06	0.44	-0.44	-0.42	2.09	1.27	0.43	2.46	2.04
					β^{SMB}									$t\left(\beta^{SMB}\right)$				
High	2.47	0.72	1.00	0.76	-0.16	-0.77	0.34	-0.24	-0.46	5.52	1.45	2.16	3.65	-0.36	-1.72	1.09	-1.25	-1.67
Med.	1.04	-0.46	0.81	1.00	-0.02	-0.01	0.06	0.07	0.04	0.86	-1.60	1.11	2.16	-0.19	-0.04	0.88	1.31	0.36
Low	0.78	1.21	1.30	0.41	-0.07	-0.04	0.00	0.03	0.04	2.34	1.84	2.03	1.10	-2.32	-0.59	0.00	0.90	1.30
					Adj. R^2									s(e)				
High	0.54	0.40	0.13	0.57	0.27	0.35	0.17	0.42	0.47	0.90	1.91	1.54	0.31	0.96	1.19	0.32	0.21	0.26
Med.	0.14	0.10	0.03	0.13	0.31	0.21	0.39	0.03	0.08	2.10	1.17	1.88	1.54	0.08	0.18	0.02	0.04	0.07
Low	0.10	0.16	0.12	0.03	0.36	0.31	0.22	0.39	0.06	0.75	1.13	1.77	0.48	0.02	0.03	0.05	0.01	0.01

Table B.54: Time-Series Regressions 4FM - Resources (Eurozone)

This table reports the results for the time series regressions of our 27 sorted portfolios (cf. Table 3.2 on page 78) on the Carhart (1997) 4FM. The first row per block depicts all high book-to-market portfolios, i.e., $P1$ to $P9$, with the market capitalization (size) increasing from left to right. The second row per block depicts all medium book-to-market portfolios, i.e., $P10$ to $P17$, with the market capitalization (size) increasing from left to right. The third row per block shows all low book-to-market portfolios, i.e., $P20$ to $P27$, with the market capitalization (size) increasing from left to right. The shown adjusted R^2 values are adjusted for degrees of freedom. Statistics are corrected for heteroscedasticity and autocorrelation, up to three lags, using the Newey and West (1987) estimator.

	Market Capitalization (Size)																	
BV/MV	Small				Medium				Big	Small				Medium				Big
	α									$t(\alpha)$								
High	-0.42	-0.63	0.32	-0.31	0.24	0.34	-0.19	-0.17	-0.05	-1.09	-1.68	0.79	-1.50	0.88	1.35	-1.01	-1.02	-0.24
Med.	0.45	0.25	-0.19	0.32	0.04	-0.08	-0.09	0.04	-0.08	0.90	1.02	-0.45	0.79	0.36	-0.39	-1.48	0.72	-0.85
Low	0.29	-0.36	-0.44	-0.14	-0.04	0.02	-0.08	-0.09	-0.02	0.29	-0.36	-0.44	-0.14	-0.04	0.02	-0.08	-0.09	-0.02
	β^{MRF}									$t(\beta^{MRF})$								
High	-0.58	-5.45	3.24	4.34	0.67	0.25	0.01	2.63	3.12	-0.29	-2.68	2.04	3.69	0.41	0.18	0.01	2.43	2.93
Med.	4.17	3.95	2.33	3.24	2.03	2.74	1.17	0.23	0.86	2.55	2.49	1.05	2.04	3.31	2.53	4.47	1.27	1.76
Low	0.64	0.42	1.42	1.19	0.94	1.46	1.39	0.60	0.14	0.79	0.26	1.00	1.06	3.91	3.52	2.54	4.36	1.45
	β^{HML}									$t(\beta^{HML})$								
High	0.57	2.46	0.08	0.66	1.47	1.60	0.49	0.63	0.73	1.48	5.43	0.19	4.35	2.75	4.16	2.43	3.82	4.27
Med.	-0.48	0.47	-0.53	0.08	0.13	-0.01	0.10	0.08	0.09	-0.88	1.20	-0.97	0.19	1.64	-0.08	2.04	1.15	1.45
Low	0.23	0.08	-0.65	-0.26	0.09	0.05	0.00	0.06	0.05	0.93	0.28	-2.06	-0.92	1.85	1.10	0.07	2.25	1.35
	β^{SMB}									$t(\beta^{SMB})$								
High	2.01	1.60	0.61	0.40	-0.14	0.00	0.74	0.03	-0.10	3.45	2.11	1.10	2.00	-0.31	-0.01	2.85	0.23	-0.43
Med.	0.41	-0.24	1.89	0.61	0.02	0.16	0.11	0.15	0.14	0.43	-0.77	3.49	1.10	0.18	0.88	1.45	1.85	1.22
Low	0.08	1.33	2.63	0.95	-0.04	-0.02	0.09	0.06	0.09	0.25	2.09	5.04	3.49	-0.98	-0.29	0.97	1.58	1.99
	β^{WML}									$t(\beta^{WML})$								
High	-0.84	1.61	-0.71	-0.65	0.04	1.40	0.74	0.50	0.65	-0.84	1.61	-0.71	-0.65	0.04	1.40	0.74	0.50	0.65
Med.	-1.16	0.41	1.97	-0.71	0.07	0.30	0.09	0.15	0.20	-1.16	0.41	1.97	-0.71	0.07	0.30	0.09	0.15	0.20
Low	-1.28	0.22	2.42	1.00	0.06	0.03	0.16	0.06	0.08	-1.28	0.22	2.42	1.00	0.06	0.03	0.16	0.06	0.08
	Adj. R^2									s(e)								
High	0.60	0.52	0.17	0.65	0.27	0.51	0.38	0.53	0.59	0.81	1.57	1.51	0.25	0.98	0.93	0.24	0.18	0.21
Med.	0.22	0.12	0.32	0.17	0.31	0.27	0.42	0.11	0.15	1.95	1.17	1.34	1.51	0.08	0.17	0.02	0.04	0.07
Low	0.38	0.16	0.54	0.33	0.38	0.31	0.28	0.44	0.15	0.52	1.15	0.94	0.34	0.02	0.04	0.04	0.01	0.01

Table B.55: Time-Series Regressions CAPM & 3FM - Utilities (Eurozone)

This table reports the results for the CAPM (Panel A) & Fama and French (1993) 3FM (Panel B) time series regressions for our 27 sorted portfolios (cf. Table 3.2 on page 78). The first row per block depicts all high book-to-market portfolios, i.e., $P1$ to $P9$, with the market capitalization (size) increasing from left to right. The second row per block depicts all medium book-to-market portfolios, i.e., $P10$ to $P17$, with the market capitalization (size) increasing from left to right. The third row per blockshows all low book-to-market portfolios, i.e., $P20$ to $P27$, with the market capitalization (size) increasing from left to right. The shown adjusted R^2 values are adjusted for degrees of freedom. Statistics are corrected for heteroscedasticity and autocorrelation, up to three lags, using the Newey and West (1987) estimator.

	Market Capitalization (Size)																	
BV/MV	Small				Medium				Big	Small				Medium				Big
Panel A: Capital Asset Pricing Model																		
	α									$t(\alpha)$								
High	0.03	0.01	0.10	0.19	0.14	0.11	0.04	0.09	0.21	1.03	0.28	2.68	4.61	2.40	3.50	1.13	2.82	4.87
Med.	0.17	0.13	0.16	0.08	0.03	-0.02	0.01	0.03	0.02	3.30	2.98	2.17	2.54	0.94	-0.71	0.36	1.03	0.62
Low	0.26	0.13	0.22	0.05	-0.02	0.00	-0.03	-0.03	0.01	0.26	0.13	0.22	0.05	-0.02	0.00	-0.03	-0.03	0.01
	β^{MRF}									$t\left(\beta^{MRF}\right)$								
High	0.30	0.27	0.07	0.68	0.22	0.15	0.44	0.29	0.33	2.68	2.37	0.42	3.12	0.81	1.16	2.49	1.80	2.03
Med.	0.72	0.48	0.77	-0.03	0.34	0.30	0.49	0.46	0.54	3.43	2.35	2.81	-0.20	2.47	2.64	3.46	3.01	3.48
Low	0.43	0.57	0.24	0.38	0.30	0.24	0.16	0.24	0.32	1.55	4.00	1.11	2.67	3.52	2.43	2.44	3.23	2.92
	Adj. R^2									s(e)								
High	0.06	0.09	-0.01	0.24	0.02	0.01	0.15	0.07	0.06	0.07	0.04	0.06	0.08	0.10	0.05	0.06	0.06	0.08
Med.	0.18	0.15	0.13	-0.01	0.16	0.10	0.25	0.24	0.23	0.12	0.07	0.21	0.04	0.03	0.04	0.04	0.04	0.05
Low	0.03	0.22	0.01	0.12	0.26	0.16	0.10	0.23	0.23	0.26	0.06	0.16	0.05	0.01	0.02	0.01	0.01	0.02
Panel B: Fama and French (1993) Model																		
	α									$t(\alpha)$								
High	-0.06	-0.03	0.00	0.13	0.09	0.04	0.04	0.10	0.11	-1.42	-1.02	0.00	2.84	1.54	1.50	1.14	3.67	2.92
Med.	0.06	0.07	-0.08	0.00	0.02	0.01	0.04	0.10	0.05	2.21	1.90	-1.80	-0.02	0.63	0.40	1.69	3.08	1.51
Low	0.22	0.11	0.18	-0.08	-0.01	-0.01	-0.01	-0.02	0.05	0.22	0.11	0.18	-0.08	-0.01	-0.01	-0.01	-0.02	0.05
	β^{MRF}									$t\left(\beta^{MRF}\right)$								
High	0.25	0.24	0.03	0.68	0.24	0.14	0.45	0.29	0.32	2.44	2.42	0.18	3.62	1.01	1.38	2.82	1.80	2.09
Med.	0.64	0.42	0.64	-0.05	0.33	0.30	0.50	0.48	0.53	4.86	3.40	2.82	-0.38	2.28	2.95	3.53	3.27	3.82
Low	0.35	0.55	0.18	0.31	0.30	0.23	0.16	0.24	0.33	1.27	4.29	1.00	2.66	3.41	2.22	2.81	3.25	3.13
	β^{HML}									$t\left(\beta^{HML}\right)$								
High	0.31	-0.18	0.75	0.89	0.99	0.98	0.31	-0.04	1.17	0.83	-1.11	2.66	3.37	2.35	4.89	1.18	-0.20	3.65
Med.	-0.13	-0.48	0.58	0.75	-0.17	-0.63	-0.51	-0.75	-0.61	-0.71	-2.42	1.37	3.49	-0.89	-2.86	-2.45	-3.43	-2.51
Low	-1.32	-0.25	-0.92	0.29	-0.29	-0.12	-0.40	-0.26	-0.55	-2.49	-0.99	-2.23	1.30	-1.96	-0.88	-3.15	-2.35	-3.41
	β^{SMB}									$t\left(\beta^{SMB}\right)$								
High	0.80	0.45	0.79	0.30	0.04	0.33	-0.13	-0.07	0.54	2.47	2.44	3.01	1.63	0.15	2.40	-0.58	-0.35	2.13
Med.	1.20	0.88	2.34	0.55	0.15	-0.09	-0.14	-0.42	-0.01	4.34	4.44	5.55	2.92	0.83	-0.47	-0.73	-2.36	-0.04
Low	0.96	0.25	0.76	1.21	0.06	0.13	-0.05	-0.03	-0.24	2.11	0.92	2.36	5.65	0.53	1.09	-0.45	-0.29	-1.85
	Adj. R^2									s(e)								
High	0.19	0.25	0.16	0.33	0.17	0.23	0.18	0.05	0.23	0.06	0.03	0.05	0.07	0.08	0.04	0.05	0.06	0.07
Med.	0.42	0.55	0.55	0.18	0.19	0.22	0.31	0.38	0.31	0.09	0.04	0.11	0.03	0.03	0.03	0.04	0.03	0.05
Low	0.32	0.25	0.27	0.56	0.34	0.21	0.25	0.30	0.38	0.18	0.06	0.12	0.03	0.01	0.01	0.01	0.01	0.01

Table B.56: Time-Series Regressions 4FM - Utilities (Eurozone)

This table reports the results for the time series regressions of our 27 sorted portfolios (cf. Table 3.2 on page 78) on the Carhart (1997) 4FM. The first row per block depicts all high book-to-market portfolios, i.e., $P1$ to $P9$, with the market capitalization (size) increasing from left to right. The second row per block depicts all medium book-to-market portfolios, i.e., $P10$ to $P17$, with the market capitalization (size) increasing from left to right. The third row per block shows all low book-to-market portfolios, i.e., $P20$ to $P27$, with the market capitalization (size) increasing from left to right. The shown adjusted R^2 values are adjusted for degrees of freedom. Statistics are corrected for heteroscedasticity and autocorrelation, up to three lags, using the Newey and West (1987) estimator.

	Market Capitalization (Size)																	
BV/MV	Small				Medium				Big	Small				Medium				Big
	α									$t(\alpha)$								
High	-0.06	-0.03	0.00	0.13	0.09	0.04	0.05	0.10	0.11	-1.42	-1.01	-0.07	2.89	1.54	1.39	1.22	3.65	3.54
Med.	0.06	0.06	-0.08	0.00	0.02	0.01	0.04	0.10	0.04	2.31	1.85	-1.74	-0.06	0.62	0.39	1.86	3.10	1.40
Low	0.22	0.11	0.18	-0.08	-0.01	-0.01	-0.01	-0.02	0.05	0.22	0.11	0.18	-0.08	-0.01	-0.01	-0.01	-0.02	0.05
	β^{MRF}									$t(\beta^{MRF})$								
High	0.20	0.24	0.09	0.64	0.24	0.18	0.40	0.30	0.39	1.74	2.44	0.51	3.73	1.05	1.70	2.46	1.81	2.96
Med.	0.61	0.46	0.68	-0.02	0.34	0.31	0.46	0.49	0.57	4.54	4.03	3.01	-0.17	2.38	3.11	3.29	3.49	4.04
Low	0.24	0.59	0.25	0.33	0.30	0.23	0.17	0.22	0.34	0.99	4.57	1.41	2.84	3.45	2.30	3.01	3.01	3.30
	β^{HML}									$t(\beta^{HML})$								
High	0.36	-0.17	0.70	0.92	0.98	0.95	0.35	-0.04	1.11	0.96	-1.10	2.72	3.55	2.32	4.59	1.32	-0.21	3.98
Med.	-0.10	-0.51	0.55	0.73	-0.18	-0.64	-0.49	-0.76	-0.64	-0.53	-2.67	1.30	3.53	-0.94	-2.94	-2.33	-3.48	-2.63
Low	-1.24	-0.28	-0.97	0.27	-0.29	-0.13	-0.41	-0.25	-0.56	-2.47	-1.20	-2.51	1.24	-1.98	-0.91	-3.26	-2.24	-3.44
	β^{SMB}									$t(\beta^{SMB})$								
High	0.79	0.45	0.81	0.29	0.05	0.34	-0.15	-0.07	0.56	2.44	2.44	3.46	1.66	0.16	2.38	-0.64	-0.34	2.50
Med.	1.19	0.89	2.35	0.56	0.15	-0.09	-0.15	-0.42	0.00	4.20	4.72	5.52	3.13	0.85	-0.46	-0.75	-2.40	-0.01
Low	0.93	0.26	0.78	1.21	0.07	0.14	-0.05	-0.03	-0.24	2.16	1.01	2.58	5.62	0.54	1.11	-0.43	-0.33	-1.88
	β^{WML}									$t(\beta^{WML})$								
High	-0.85	-0.02	0.85	-0.51	0.10	0.58	-0.81	0.05	1.18	-0.85	-0.02	0.85	-0.51	0.10	0.58	-0.81	0.05	1.18
Med.	-0.49	0.56	0.59	0.41	0.12	0.23	-0.50	0.22	0.54	-0.49	0.56	0.59	0.41	0.12	0.23	-0.50	0.22	0.54
Low	-1.52	0.55	1.04	0.30	0.08	0.06	0.16	-0.25	0.14	-1.52	0.55	1.04	0.30	0.08	0.06	0.16	-0.25	0.14
	Adj. R^2									s(e)								
High	0.26	0.25	0.25	0.35	0.17	0.28	0.25	0.05	0.34	0.06	0.03	0.05	0.07	0.08	0.04	0.05	0.06	0.06
Med.	0.43	0.58	0.56	0.22	0.19	0.23	0.34	0.38	0.34	0.09	0.03	0.10	0.03	0.03	0.03	0.03	0.03	0.05
Low	0.39	0.28	0.32	0.57	0.35	0.21	0.27	0.33	0.39	0.16	0.06	0.11	0.03	0.01	0.01	0.01	0.01	0.01

Table B.57: Time-Series Regressions CAPM & 3FM - Industry (aggregated) (Eurozone)

This table reports the results for the CAPM (Panel A) & Fama and French (1993) 3FM (Panel B) time series regressions for our 27 sorted portfolios (cf. Table 3.2 on page 78). The first row per block depicts all high book-to-market portfolios, i.e., $P1$ to $P9$, with the market capitalization (size) increasing from left to right. The second row per block depicts all medium book-to-market portfolios, i.e., $P10$ to $P17$, with the market capitalization (size) increasing from left to right. The third row per blockshows all low book-to-market portfolios, i.e., $P20$ to $P27$, with the market capitalization (size) increasing from left to right. The shown adjusted R^2 values are adjusted for degrees of freedom. Statistics are corrected for heteroscedasticity and autocorrelation, up to three lags, using the Newey and West (1987) estimator.

	Market Capitalization (Size)																	
BV/MV	Small				Medium				Big	Small				Medium				Big
Panel A: Capital Asset Pricing Model																		
	α									$t(\alpha)$								
High	0.18	0.12	0.21	0.02	0.06	0.09	-0.01	0.00	0.04	4.36	4.43	6.55	0.55	2.22	3.28	-0.58	0.23	1.99
Med.	0.10	0.05	0.13	-0.08	0.00	0.04	-0.04	-0.02	-0.01	1.62	2.10	4.50	-10.98	0.13	1.84	-2.75	-1.56	-0.55
Low	-0.05	0.02	0.10	0.12	-0.05	0.00	0.03	-0.05	-0.03	-0.05	0.02	0.10	0.12	-0.05	0.00	0.03	-0.05	-0.03
	β^{MRF}									$t\left(\beta^{MRF}\right)$								
High	1.38	0.88	1.09	0.93	0.86	0.86	0.85	0.73	0.82	6.16	7.91	7.03	7.64	7.86	8.18	8.79	8.80	8.66
Med.	1.50	0.71	1.00	0.11	0.62	0.85	0.83	0.71	0.79	3.42	6.90	8.47	4.22	6.43	8.78	12.02	10.44	11.21
Low	1.25	1.04	1.34	0.93	0.77	0.57	0.79	0.77	0.66	14.91	15.89	11.74	8.51	8.09	6.42	8.79	12.22	10.51
	Adj. R^2									s(e)								
High	0.25	0.35	0.36	0.39	0.40	0.38	0.49	0.49	0.46	0.26	0.07	0.10	0.06	0.05	0.06	0.04	0.03	0.04
Med.	0.14	0.29	0.41	0.19	0.31	0.46	0.65	0.59	0.60	0.62	0.06	0.07	0.00	0.04	0.04	0.02	0.02	0.02
Low	0.57	0.61	0.56	0.40	0.44	0.32	0.46	0.65	0.58	0.06	0.03	0.07	0.06	0.04	0.03	0.03	0.02	0.01
Panel B: Fama and French (1993) Model																		
	α									$t(\alpha)$								
High	-0.17	0.00	0.07	-0.12	-0.04	-0.01	-0.08	-0.05	-0.02	-2.88	0.10	1.58	-3.32	-1.30	-0.25	-2.96	-2.42	-0.94
Med.	-0.19	-0.04	0.03	-0.10	-0.05	0.00	-0.09	-0.04	-0.04	-2.53	-1.15	0.96	-10.41	-1.50	0.11	-4.21	-1.84	-2.22
Low	-0.16	-0.04	0.03	0.02	-0.11	-0.05	0.00	-0.09	-0.04	-0.16	-0.04	0.03	0.02	-0.11	-0.05	0.00	-0.09	-0.04
	β^{MRF}									$t\left(\beta^{MRF}\right)$								
High	0.83	0.70	0.85	0.75	0.72	0.72	0.78	0.68	0.76	5.77	7.37	6.54	7.72	7.73	9.66	8.97	9.56	9.59
Med.	0.19	0.42	0.67	0.06	0.54	0.79	0.76	0.71	0.76	0.62	4.83	6.11	2.17	6.50	8.75	11.09	10.11	10.25
Low	1.01	0.85	1.01	0.61	0.72	0.50	0.73	0.70	0.66	11.42	10.87	9.13	6.08	8.45	6.43	8.63	11.20	10.10
	β^{HML}									$t\left(\beta^{HML}\right)$								
High	3.13	1.04	1.25	1.32	1.00	0.99	0.85	0.75	0.87	4.09	3.09	4.41	4.94	4.71	3.95	3.99	4.94	4.42
Med.	-1.52	0.15	0.02	0.16	0.44	0.33	0.33	0.26	0.39	-1.24	0.63	0.12	3.18	2.17	1.60	2.21	2.21	3.55
Low	0.61	0.05	-0.47	0.00	0.78	0.40	0.30	0.29	0.24	2.98	0.27	-2.21	0.02	3.66	2.19	1.60	2.16	2.17
	β^{SMB}									$t\left(\beta^{SMB}\right)$								
High	1.27	0.41	0.58	0.40	0.30	0.32	0.12	0.07	0.08	4.45	1.22	1.62	2.31	1.47	1.35	0.99	0.92	0.76
Med.	3.75	0.81	0.93	0.13	0.18	0.16	0.18	-0.01	0.06	2.89	3.57	3.98	2.47	0.93	0.67	1.98	-0.08	0.53
Low	0.61	0.52	0.95	0.87	0.10	0.17	0.15	0.18	0.00	2.57	2.51	4.79	4.11	0.62	0.96	0.69	2.12	0.03
	Adj. R^2									s(e)								
High	0.65	0.49	0.50	0.61	0.55	0.51	0.60	0.60	0.58	0.12	0.05	0.08	0.04	0.04	0.05	0.03	0.02	0.03
Med.	0.54	0.44	0.54	0.39	0.36	0.47	0.68	0.60	0.64	0.33	0.05	0.05	0.00	0.04	0.04	0.02	0.02	0.02
Low	0.65	0.66	0.68	0.54	0.54	0.36	0.48	0.68	0.60	0.04	0.03	0.05	0.05	0.03	0.03	0.03	0.01	0.01

Table B.58: Time-Series Regressions 4FM - Industry (aggregated) (Eurozone)

This table reports the results for the time series regressions of our 27 sorted portfolios (cf. Table 3.2 on page 78) on the Carhart (1997) 4FM. The first row per block depicts all high book-to-market portfolios, i.e., $P1$ to $P9$, with the market capitalization (size) increasing from left to right. The second row per block depicts all medium book-to-market portfolios, i.e., $P10$ to $P17$, with the market capitalization (size) increasing from left to right. The third row per block shows all low book-to-market portfolios, i.e., $P20$ to $P27$, with the market capitalization (size) increasing from left to right. The shown adjusted R^2 values are adjusted for degrees of freedom. Statistics are corrected for heteroscedasticity and autocorrelation, up to three lags, using the Newey and West (1987) estimator.

	Market Capitalization (Size)																	
BV/MV	Small				Medium				Big	Small				Medium				Big
	α									$t(\alpha)$								
High	-0.14	-0.08	-0.09	-0.11	-0.09	-0.10	-0.06	-0.05	-0.05	-2.46	-2.34	-3.46	-3.08	-2.90	-2.69	-1.99	-2.23	-1.81
Med.	0.12	-0.09	-0.04	-0.11	-0.11	-0.07	-0.08	-0.07	-0.08	1.54	-2.35	-1.45	-12.36	-3.45	-2.16	-3.38	-2.77	-4.67
Low	-0.16	-0.09	-0.04	-0.04	-0.13	-0.10	-0.07	-0.08	-0.07	-0.16	-0.09	-0.04	-0.04	-0.13	-0.10	-0.07	-0.08	-0.07
	β^{MRF}									$t(\beta^{MRF})$								
High	0.86	0.61	0.66	0.76	0.66	0.61	0.81	0.68	0.73	6.48	6.78	6.86	7.61	7.31	8.58	9.72	9.51	9.61
Med.	0.56	0.36	0.58	0.04	0.47	0.70	0.76	0.68	0.72	3.03	4.10	5.89	1.73	5.66	8.31	11.44	9.74	10.46
Low	1.01	0.79	0.93	0.54	0.70	0.43	0.65	0.70	0.63	11.37	9.65	9.31	5.87	8.05	5.62	8.20	11.61	9.72
	β^{HML}									$t(\beta^{HML})$								
High	3.09	1.16	1.47	1.31	1.07	1.11	0.82	0.74	0.91	4.00	3.90	6.35	5.19	5.27	4.47	4.10	5.11	4.32
Med.	-1.95	0.22	0.12	0.17	0.52	0.44	0.32	0.29	0.44	-1.88	0.93	0.66	3.68	2.82	2.50	2.20	2.60	4.24
Low	0.61	0.12	-0.37	0.09	0.80	0.48	0.40	0.28	0.27	2.98	0.79	-2.18	0.55	3.94	2.82	2.46	2.15	2.54
	β^{SMB}									$t(\beta^{SMB})$								
High	1.13	0.83	1.38	0.35	0.54	0.76	0.00	0.05	0.23	3.98	4.53	7.85	2.06	3.17	3.94	0.04	0.57	1.46
Med.	2.18	1.06	1.30	0.19	0.48	0.55	0.15	0.11	0.24	5.41	4.49	7.37	4.08	2.79	2.94	1.30	1.16	2.75
Low	0.61	0.78	1.31	1.20	0.18	0.44	0.50	0.15	0.11	2.94	6.54	6.10	7.64	1.31	2.84	2.94	1.33	1.18
	β^{WML}									$t(\beta^{WML})$								
High	-0.31	0.88	1.71	-0.09	0.52	0.93	-0.24	-0.05	0.32	-0.31	0.88	1.71	-0.09	0.52	0.93	-0.24	-0.05	0.32
Med.	-3.34	0.53	0.79	0.12	0.65	0.83	-0.05	0.26	0.39	-3.34	0.53	0.79	0.12	0.65	0.83	-0.05	0.26	0.39
Low	-0.02	0.56	0.75	0.70	0.17	0.59	0.75	-0.06	0.23	-0.02	0.56	0.75	0.70	0.17	0.59	0.75	-0.06	0.23
	Adj. R^2									s(e)								
High	0.66	0.59	0.75	0.61	0.59	0.63	0.61	0.60	0.60	0.12	0.04	0.04	0.04	0.04	0.03	0.03	0.02	0.03
Med.	0.74	0.48	0.61	0.45	0.46	0.60	0.68	0.62	0.68	0.18	0.04	0.05	0.00	0.03	0.03	0.02	0.02	0.02
Low	0.65	0.71	0.73	0.61	0.54	0.45	0.59	0.68	0.62	0.04	0.02	0.04	0.04	0.03	0.03	0.03	0.01	0.01

Table B.59: Time-Series Regressions CAPM & 3FM - Service (aggregated) (Eurozone)

This table reports the results for the CAPM (Panel A) & Fama and French (1993) 3FM (Panel B) time series regressions for our 27 sorted portfolios (cf. Table 3.2 on page 78). The first row per block depicts all high book-to-market portfolios, i.e., $P1$ to $P9$, with the market capitalization (size) increasing from left to right. The second row per block depicts all medium book-to-market portfolios, i.e., $P10$ to $P17$, with the market capitalization (size) increasing from left to right. The third row per blockshows all low book-to-market portfolios, i.e., $P20$ to $P27$, with the market capitalization (size) increasing from left to right. The shown adjusted R^2 values are adjusted for degrees of freedom. Statistics are corrected for heteroscedasticity and autocorrelation, up to three lags, using the Newey and West (1987) estimator.

	Market Capitalization (Size)																	
BV/MV	Small				Medium				Big	Small				Medium				Big
Panel A: Capital Asset Pricing Model																		
					α									$t(\alpha)$				
High	0.11	0.08	0.30	0.04	0.00	0.07	-0.01	-0.02	-0.01	2.69	3.34	6.47	1.23	0.14	3.00	-0.42	-0.91	-0.78
Med.	-0.02	0.05	0.12	-0.05	-0.04	0.01	-0.04	-0.05	-0.03	-1.14	2.62	4.23	-5.84	-1.89	0.30	-2.57	-3.04	-1.71
Low	-0.06	-0.02	0.10	0.10	-0.07	-0.04	0.00	-0.05	-0.05	-0.06	-0.02	0.10	0.10	-0.07	-0.04	0.00	-0.05	-0.05
					β^{MRF}									$t\left(\beta^{MRF}\right)$				
High	0.87	0.57	1.06	0.80	0.72	0.73	1.10	0.75	0.83	5.10	5.65	5.35	6.30	6.59	7.46	7.77	10.44	8.58
Med.	0.77	0.66	1.06	0.15	0.76	0.83	0.97	0.91	1.02	8.47	8.48	9.18	4.35	8.36	7.66	13.10	13.40	10.85
Low	0.84	0.80	1.16	0.94	0.75	0.68	0.72	0.86	0.81	10.44	11.50	8.16	8.93	8.11	8.40	7.67	13.02	13.50
					Adj. R^2									s(e)				
High	0.19	0.23	0.21	0.20	0.45	0.39	0.56	0.57	0.56	0.15	0.05	0.20	0.12	0.03	0.04	0.05	0.02	0.03
Med.	0.37	0.30	0.38	0.16	0.52	0.47	0.67	0.68	0.67	0.05	0.05	0.09	0.01	0.03	0.04	0.02	0.02	0.02
Low	0.42	0.49	0.43	0.37	0.52	0.51	0.47	0.67	0.67	0.05	0.03	0.08	0.07	0.02	0.02	0.03	0.02	0.02
Panel B: Fama and French (1993) Model																		
					α									$t(\alpha)$				
High	-0.15	-0.03	0.07	-0.11	-0.03	0.02	-0.03	-0.02	-0.02	-4.45	-1.19	1.26	-2.78	-1.24	0.67	-1.02	-1.18	-1.00
Med.	-0.10	-0.04	0.08	-0.08	-0.05	-0.02	-0.02	-0.04	-0.05	-3.84	-1.77	2.10	-7.24	-2.27	-0.60	-0.83	-2.01	-2.28
Low	-0.15	-0.07	0.09	0.06	-0.10	-0.06	-0.02	-0.03	-0.05	-0.15	-0.07	0.09	0.06	-0.10	-0.06	-0.02	-0.03	-0.05
					β^{MRF}									$t\left(\beta^{MRF}\right)$				
High	0.92	0.59	1.10	0.83	0.73	0.74	1.11	0.76	0.84	7.95	7.11	6.94	8.96	8.14	8.03	10.51	12.53	10.26
Med.	0.79	0.68	1.07	0.15	0.77	0.83	0.97	0.90	1.02	9.43	10.41	8.19	4.69	9.38	8.06	15.52	15.73	11.28
Low	0.86	0.81	1.17	0.95	0.75	0.68	0.73	0.85	0.81	11.32	12.15	7.79	7.96	9.27	9.31	7.92	14.83	15.34
					β^{HML}									$t\left(\beta^{HML}\right)$				
High	1.91	0.93	0.90	2.21	0.70	0.62	0.96	0.36	0.43	10.79	5.01	1.71	4.34	4.06	3.47	4.04	2.34	2.20
Med.	0.40	0.18	-0.51	0.10	0.38	0.35	0.16	0.22	0.32	1.46	0.96	-1.51	1.48	2.91	2.02	0.79	1.57	2.58
Low	0.13	-0.11	-0.86	-0.51	0.52	0.31	0.25	0.11	0.16	0.50	-0.83	-3.07	-1.65	2.77	2.57	1.58	0.58	1.25
					β^{SMB}									$t\left(\beta^{SMB}\right)$				
High	1.16	0.42	1.63	-0.08	-0.19	0.04	-0.49	-0.18	-0.23	3.97	2.13	3.67	-0.33	-1.05	0.24	-2.50	-1.59	-1.58
Med.	0.44	0.74	0.74	0.21	-0.10	-0.03	-0.35	-0.22	-0.05	3.18	5.98	3.04	2.76	-0.74	-0.15	-2.74	-1.96	-0.37
Low	0.76	0.52	0.67	0.68	-0.06	-0.08	0.00	-0.27	-0.16	5.11	4.74	2.19	3.04	-0.34	-0.60	0.01	-2.28	-1.56
					Adj. R^2									s(e)				
High	0.64	0.49	0.47	0.58	0.54	0.46	0.66	0.60	0.59	0.07	0.03	0.13	0.06	0.03	0.04	0.04	0.02	0.02
Med.	0.45	0.45	0.44	0.33	0.54	0.49	0.70	0.69	0.69	0.04	0.04	0.08	0.00	0.02	0.03	0.02	0.02	0.02
Low	0.56	0.56	0.50	0.43	0.58	0.54	0.48	0.68	0.68	0.03	0.03	0.07	0.06	0.02	0.02	0.03	0.02	0.02

Table B.60: Time-Series Regressions 4FM - Service (aggregated) (Eurozone)

This table reports the results for the time series regressions of our 27 sorted portfolios (cf. Table 3.2 on page 78) on the Carhart (1997) 4FM. The first row per block depicts all high book-to-market portfolios, i.e., $P1$ to $P9$, with the market capitalization (size) increasing from left to right. The second row per block depicts all medium book-to-market portfolios, i.e., $P10$ to $P17$, with the market capitalization (size) increasing from left to right. The third row per block shows all low book-to-market portfolios, i.e., $P20$ to $P27$, with the market capitalization (size) increasing from left to right. The shown adjusted R^2 values are adjusted for degrees of freedom. Statistics are corrected for heteroscedasticity and autocorrelation, up to three lags, using the Newey and West (1987) estimator.

	Market Capitalization (Size)																	
BV/MV	Small				Medium				Big	Small				Medium				Big
	α									$t(\alpha)$								
High	-0.06	-0.05	-0.10	-0.08	-0.07	-0.05	-0.03	-0.06	-0.08	-1.86	-2.25	-2.59	-2.44	-2.99	-1.69	-1.05	-3.35	-5.03
Med.	-0.07	-0.03	0.02	-0.10	-0.09	-0.07	-0.02	-0.06	-0.10	-2.45	-1.41	0.45	-10.30	-3.97	-2.73	-0.85	-2.94	-4.90
Low	-0.13	-0.08	-0.02	0.00	-0.11	-0.09	-0.07	-0.03	-0.07	-0.13	-0.08	-0.02	0.00	-0.11	-0.09	-0.07	-0.03	-0.07
	β^{MRF}									$t(\beta^{MRF})$								
High	1.05	0.56	0.85	0.87	0.67	0.64	1.10	0.70	0.75	7.83	6.48	7.17	7.35	8.67	8.80	10.48	13.68	12.79
Med.	0.83	0.68	0.98	0.12	0.71	0.76	0.97	0.87	0.95	9.32	10.51	9.11	4.54	10.26	9.09	14.87	16.85	13.22
Low	0.88	0.79	1.01	0.86	0.73	0.63	0.65	0.85	0.78	11.37	11.77	9.55	8.82	8.87	10.29	9.21	14.21	16.39
	β^{HML}									$t(\beta^{HML})$								
High	1.39	1.08	1.90	2.06	0.92	1.01	0.97	0.59	0.78	6.45	5.83	4.71	4.59	5.28	6.75	3.97	4.52	5.23
Med.	0.22	0.16	-0.13	0.23	0.60	0.66	0.16	0.34	0.62	0.85	0.90	-0.48	4.43	4.92	4.24	0.88	2.73	4.47
Low	0.03	-0.04	-0.20	-0.16	0.60	0.52	0.54	0.12	0.29	0.14	-0.30	-0.73	-0.63	3.05	4.57	3.85	0.68	2.38
	β^{SMB}									$t(\beta^{SMB})$								
High	1.18	0.41	1.57	-0.07	-0.21	0.02	-0.49	-0.19	-0.24	5.46	2.24	5.22	-0.28	-1.30	0.15	-2.50	-2.10	-2.41
Med.	0.45	0.74	0.71	0.20	-0.11	-0.04	-0.35	-0.23	-0.06	2.87	6.02	3.45	3.31	-1.02	-0.31	-2.72	-2.26	-0.62
Low	0.76	0.51	0.63	0.66	-0.06	-0.09	-0.01	-0.27	-0.17	4.77	4.78	2.70	3.45	-0.38	-0.85	-0.12	-2.28	-1.83
	β^{WML}									$t(\beta^{WML})$								
High	-1.20	0.34	2.32	-0.36	0.51	0.91	0.02	0.53	0.82	-1.20	0.34	2.32	-0.36	0.51	0.91	0.02	0.53	0.82
Med.	-0.42	-0.05	0.88	0.31	0.52	0.71	0.00	0.30	0.68	-0.42	-0.05	0.88	0.31	0.52	0.71	0.00	0.30	0.68
Low	-0.22	0.16	1.52	0.81	0.17	0.48	0.67	0.02	0.28	-0.22	0.16	1.52	0.81	0.17	0.48	0.67	0.02	0.28
	Adj. R^2									s(e)								
High	0.72	0.51	0.68	0.59	0.58	0.58	0.66	0.66	0.70	0.05	0.03	0.08	0.06	0.02	0.03	0.04	0.02	0.02
Med.	0.47	0.45	0.49	0.48	0.60	0.56	0.70	0.71	0.75	0.04	0.04	0.07	0.00	0.02	0.03	0.02	0.02	0.02
Low	0.57	0.56	0.66	0.49	0.58	0.59	0.56	0.68	0.69	0.03	0.03	0.05	0.06	0.02	0.02	0.02	0.02	0.01

Appendix C

Method A.II: Pan-European Risk Factors

C.1 Asset Pricing Tests

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[Tables C.1 on the following page.]

C. METHOD A.II: PAN-EUROPEAN RISK FACTORS

Table C.1: Time-Series Regressions per Country - Pan-European 3FM

This table presents the goodness-of-fit statistics for regressing per country 27 portfolios on a pan-European Fama and French (1993) three-factor model (3FM). The first and second columns contain the two performance measures: average $|\alpha|$ and average adjusted R^2 (in %). The third and last columns show the Gibbons et al. (1989) F-statistics and their p-values for testing the null hypothesis that all estimated pricing errors $\hat{\alpha}_j$ $(j = 1, \ldots, 27)$ are jointly zero. The time-series regressions consider annually rebalanced portfolios and three different time periods. Panel A covers the entire sample period from 01/1990 to 04/2008. Panel B spans from 01/1990 to 04/1998 (pre euro) and Panel C from 01/2000 to 04/2008 (post euro). The countries are clustered along three dimensions. The first group comprises those countries that belong to the Eurozone. The second cluster represents countries of the European Union that do not belong to the Eurozone. The last cluster contains European countries that neither belong to the Eurozone nor the European Union. All statistics are corrected for heteroscedasticity and autocorrelation, up to three lags, using the Newey and West (1987) estimator.

	Av. $\lvert\alpha\rvert$	Av. $\bar{R}^2$ [%]	GRS F-Stats.	GRS p-Value
Panel A: Total Period [01/1990 to 04/2008]				
Belgium	0.054	22.098	3.157	0.000
France	0.041	42.164	4.051	0.000
Germany	0.043	38.010	4.709	0.000
Italy	0.053	35.481	3.558	0.000
Netherlands	0.046	37.638	3.640	0.000
Spain	0.086	29.268	3.027	0.000
United Kingdom	0.033	40.788	3.822	0.000
Norway	0.052	39.244	2.259	0.003
Panel B: Sub-Period I [01/1990 to 04/1998]				
Belgium	0.096	19.237	5.278	0.000
France	0.150	44.431	5.961	0.000
Germany	0.108	39.385	5.018	0.000
Italy	0.164	39.120	5.783	0.000
Netherlands	0.078	45.694	4.472	0.000
Spain	0.105	16.029	3.774	0.000
United Kingdom	0.088	52.110	4.536	0.000
Norway	0.178	50.900	4.392	0.000
Panel C: Sub-Period II [01/2000 to 04/2008]				
Belgium	0.057	46.636	2.836	0.000
France	0.053	58.398	2.713	0.000
Germany	0.066	63.943	2.678	0.000
Italy	0.151	52.429	5.030	0.000
Netherlands	0.046	48.995	2.285	0.001
Spain	0.066	49.400	3.309	0.000
United Kingdom	0.035	54.150	2.270	0.001
Norway	0.066	49.944	2.610	0.000

C.2 Stochastic Discount Factor Tests

C.2.1 From General Pricing Equation to Return-Beta Representation

The following lines highlight the necessary steps to arrive to the expected return-beta representation when starting from the general pricing equation.

Consider the general pricing equation

$$P_{j,t} = E_t(M_{t+1}X_{j,t+1}) \tag{C.1}$$

where $P_{j,t}$ is the price of an asset j at time t, $E_t(\cdot)$ is the expectations operator, which is conditional on information at time t; $X_{j,t+1}$ is the payoff to be received at time *t+1* by owners of asset j; and M_{t+1} is the stochastic discount factor (SDF) for a payoff accruing at time *t+1*.[1] In case of a risk-free environment and, thus, total payoff certainty, prices can be expressed in form of the present value formula

$$P_t = \frac{1}{R_f} X_{t+1} \tag{C.2}$$

where R_f is the gross risk-free rate, which is known ahead of time. $1/R_f$ is the corresponding discount factor, i.e., $M = 1/R_f$. If the risk-free rate is not traded, then R_f can be defined as the shadow gross risk-free rate (Cochrane, 2005). As riskier assets have usually lower prices than equivalent risk-free assets, they are often valued using asset-specific risk-adjusted discount factors, i.e., $1/R_j$. This can generally be expressed as follows:

$$P_{j,t} = \frac{1}{R_j} E_t(X_{j,t+1}). \tag{C.3}$$

In this context, asset specific risk corrections are captured by the correlation between the random components of the common discount factor M (note that here

[1] In particular, the stochastic discount factor M is defined as:

$$M_{t+1} \equiv \beta \left[\frac{u'(c_{t+1})}{u'(c_t)} \right] = \beta \left(\frac{c_{t+1}}{c_t} \right)^{-\gamma}$$

where $u'(c_t)$ denotes the marginal utility of consumption c at time t, β represents the subjective discount factor, which captures the impatience of an agent, and γ denotes the relative risk aversion coefficient. For a more detailed description, please refer to Cochrane (2005).

$M = 1/R_j$) and the asset-specific payoff X_j. Using the definition of covariance, Equation (C.1) can also be expressed as

$$P_{j,t} = E_t(M_{t+1}X_{j,t+1}) = E_t(M_{t+1})E_t(X_{j,t+1}) + COV_t(M_{t+1}, X_{j,t+1}) \tag{C.4}$$

where $COV(\cdot)$ represents the conditional covariance operator, which captures the risk adjustment for non-risk-free assets.[2] When divided by lagged prices, $P_{j,t}$, Equation (C.4) results in the following expression:

$$1 = E_t\left(M_{t+1}\frac{X_{j,t+1}}{P_{j,t}}\right) = E_t(M_{t+1})E_t\left(\frac{X_{j,t+1}}{P_{j,t}}\right) + COV_t\left(M_{t+1}, \frac{X_{j,t+1}}{P_{j,t}}\right). \tag{C.5}$$

Now, let $R_{j,t+1} = X_{j,t+1}/P_{j,t}$ (note, that this assumes that there are no dividends at time $t+1$, i.e., $D_{j,t+1} = 0$). This results in the following simplification of Equation (C.5):

$$1 = E_t(M_{t+1}R_{j,t+1}) = E_t(M_{t+1})E_t(R_{j,t+1}) + COV_t(M_{t+1}, R_{j,t+1}). \tag{C.6}$$

Subtracting $COV(\cdot)$ from each side and dividing by the expectation of the discount factor, i.e., $E_t(M_{t+1})$, we obtain

$$E_t(R_{j,t+1}) = \frac{1 - COV_t(M_{t+1}, R_{j,t+1})}{E_t(M_{t+1})} \tag{C.7}$$

or in a slightly different manner

$$E_t(R_{j,t+1}) = \frac{1}{E_t(M_{t+1})} - \frac{COV_t(M_{t+1}, R_{j,t+1})}{E_t(M_{t+1})}. \tag{C.8}$$

Simultaneously multiplying and dividing each side by the variance of the discount factor, i.e., $VAR(M_{t+1})$, leads to the following expression:

$$E_t(R_{j,t+1}) = \underbrace{\frac{1}{E_t(M_{t+1})}}_{\delta_{t+1}} + \left[\underbrace{\left(\frac{COV_t(M_{t+1}, R_{j,t+1})}{VAR(M_{t+1})}\right)}_{\beta_j} \times \underbrace{\left(-\frac{VAR(M_{t+1})}{E_t(M_{t+1})}\right)}_{\lambda^M}\right]. \tag{C.9}$$

This can be simplified to

$$E_t(R_{j,t+1}) = \delta_{t+1} + \beta_j\lambda^M_{t+1}. \tag{C.10}$$

[2] An asset whose payoff covaries positively (negatively) with the discount factor has its price raised (lowered). Obviously, in case of a risk-free asset, $COV_t(M_{t+1}, X_{j,t+1}) = 0$.

where δ_{t+1} is the discount factor, λ_{t+1}^M can be interpreted as the *price* of risk, and β_j as the *quantity* of risk in each asset.[3] The coefficient λ^M is the same for all assets i, while the β_j varies from asset to asset. Equation (C.10) shows that the price of risk λ^M depends on the volatility of the discount factor.

Recalling that $\delta_{t+1} \equiv 1/E_t(M_{t+1}) = R_{f,t+1}$, Equation (C.10) may also be expressed in form of excess returns, i.e.,

$$E_t(R_{j,t+1}) - R_{f,t+1} = \beta_j \lambda_{t+1}^M. \tag{C.11}$$

C.2.2 Model (Mis-)Specifications

It is worthy to note that we need to consider whether our implemented covariance model are well specified or not. If our implemented covariance-model is well specified, then Equation (4.10) [page 143], i.e.,

$$R_{j,t} = \delta_{j,t} + \sum_{n=1}^{N} \beta_j^n f_t^n + \varepsilon_{j,t} \tag{C.12}$$

suffices and can be rewritten as:

$$R_{j,t} - \sum_{n=1}^{N} \beta_j^n f_t^n = \mu_{j,t} = \delta_{j,t} + \varepsilon_{j,t}. \tag{C.13}$$

This implies for the variance-covariance matrix, Σ, between μ_j and μ_i:

$$\Sigma_{\mu_{j,i}} = \begin{bmatrix} \sigma_\delta^2 + \sigma_{\varepsilon,j}^2 & \sigma_\delta^2 \\ \sigma_\delta^2 & \sigma_\delta^2 + \sigma_{\varepsilon,i}^2 \end{bmatrix} = \begin{bmatrix} \sigma_{\varepsilon,j}^2 & 0 \\ 0 & \sigma_{\varepsilon,j}^2 \end{bmatrix} + \sigma_\delta^2 \begin{bmatrix} 1 & 1 \\ 1 & 1 \end{bmatrix} \Rightarrow COV(\cdot) \neq 0 = \sigma_\delta^2.$$

Hence, we may test in a straightforward manner whether $\delta_{j,t} = \delta_{i,t} = \delta_t \quad \forall j, i$.

On the other hand, there might be a chance that we omit one (or more) factor(s) F that are actually required to derive valid and reliable estimates of $\delta_{j,t}$. Omitting relevant factor(s) F implies that our implemented covariance models are not well specified and that Equation (4.10) should be extended by an additional term υ_j:

$$R_{j,t} - \sum_{n=1}^{N} \beta_j^n f_t^n = \mu_{j,t} = \delta_{j,t} + \varepsilon_{j,t} + \underbrace{\gamma_j F_t}_{\upsilon_j}. \tag{C.14}$$

[3] λ^M is negative for marginal utility growth; positive returns are associated with consumption growth and are, hence, negatively correlated with marginal utility growth.

As υ_j is idiosyncratic $\forall j$ (given that the loadings γ_j might differ across markets), $E(\mu_{j,t}) \neq E(\mu_{i,t})$ and, thus, $E(\delta_{j,t}) \neq E(\delta_{i,t})$ unless $\upsilon_j = \upsilon_i$ (i.e., unless $\gamma_j = \gamma_i$).[4] Moreover, we are confronted with a variance-covariance matrix of residuals, Σ, of the form

$$\Sigma_{\mu_{j,i}} = \begin{bmatrix} \sigma_\delta^2 + \sigma_{\varepsilon,j}^2 + \sigma_F^2\gamma_j^2 & \sigma_\delta^2 + \sigma_F^2\gamma_j\gamma_i \\ \sigma_\delta^2 + \sigma_F^2\gamma_j\gamma_i & \sigma_\delta^2 + \sigma_{\varepsilon,i}^2 + \sigma_F^2\gamma_i^2 \end{bmatrix}$$

which does not allow us to disentangle the individual σ^2, as we face more unknowns than equations required to solve for these σ^2 values, i.e.,

$$\begin{aligned} \sigma_j^2 &= \sigma_\delta^2 + \sigma_{\varepsilon,j}^2 + \sigma_F^2\gamma_j^2 \\ \sigma_i^2 &= \sigma_\delta^2 + \sigma_{\varepsilon,i}^2 + \sigma_F^2\gamma_i^2 \\ \sigma_{j,i} &= \sigma_\delta^2 + \sigma_F^2\gamma_j\gamma_i. \end{aligned}$$

In brief, a failure to find that $\delta_{j,t} = \delta_{i,t}$ may be due to 2 reasons: (a) markets are segmented or (b) our employed covariance models are not well specified.

C.2.3 Principal Components

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[Figures C.1 to C.5 & Tables C.2 to C.3 on the following pages.]

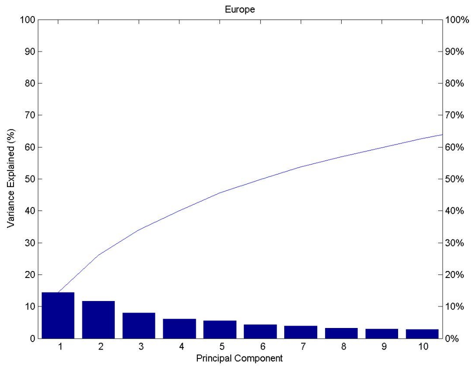
[4]For illustrative purposes, we only consider one omitted factor F in Equation (C.14). In fact, we could omit more than one factor. Hence, in a more elaborated framework, Equation (C.13) should be re-written as:

$$R_{j,t} - \sum_{n=1}^{N} \beta_j^n f_t^n = \mu_{j,t} = \delta_t + \varepsilon_{j,t} + \underbrace{\sum_{m=1}^{M} \gamma_j^m F_t^m}_{\upsilon_j}. \tag{C.15}$$

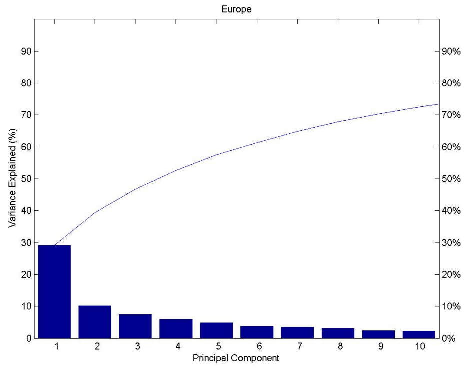
Figure C.1: % Variability Explained by Each Principal Component: Country/Region

⊣ Europe ⊢

(a) Sub-Period I (01/1990 - 04/1998)

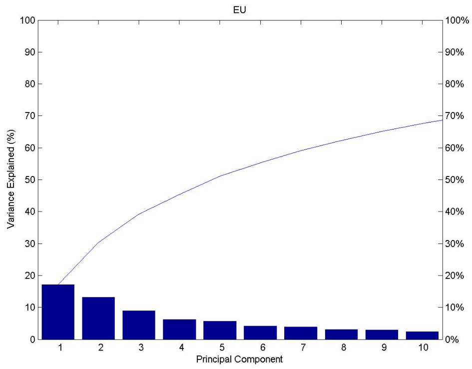


(b) Sub-Period II (01/2000 - 04/2008)

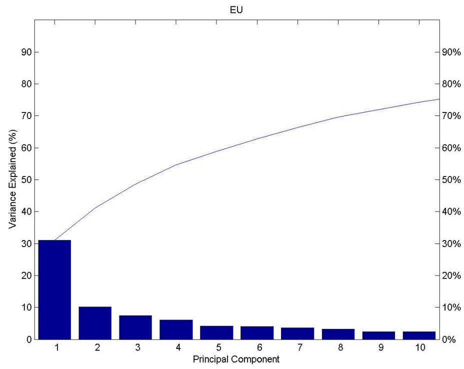


⊣ European Union ⊢

(a) Sub-Period I (01/1990 - 04/1998)

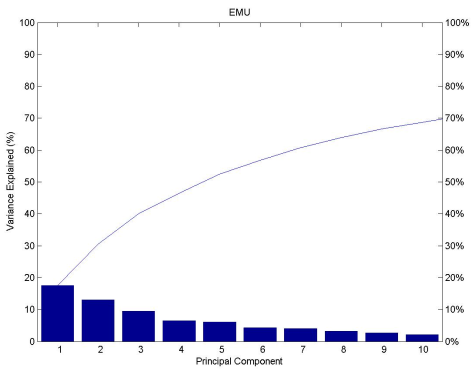


(b) Sub-Period II (01/2000 - 04/2008)



⊣ Eurozone ⊢

(a) Sub-Period I (01/1990 - 04/1998)



(b) Sub-Period II (01/2000 - 04/2008)

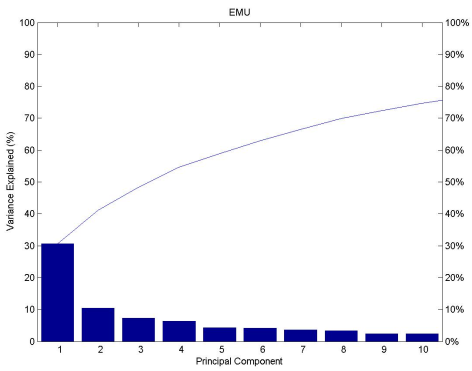
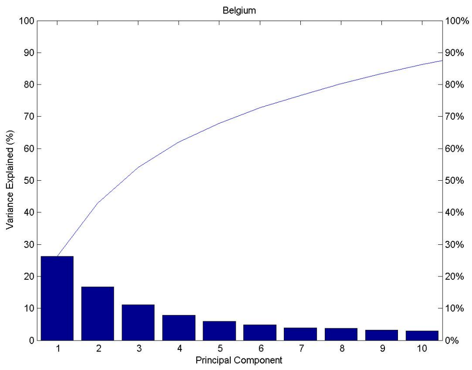


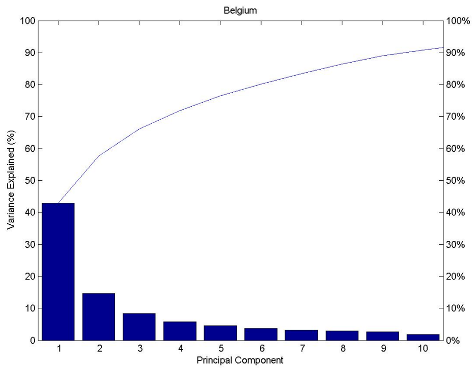
Figure C.1 cont'd: % Variability Explained by Each Principal Component

⊣ **Belgium** ⊢

(a) Sub-Period I (01/1990 - 04/1998)

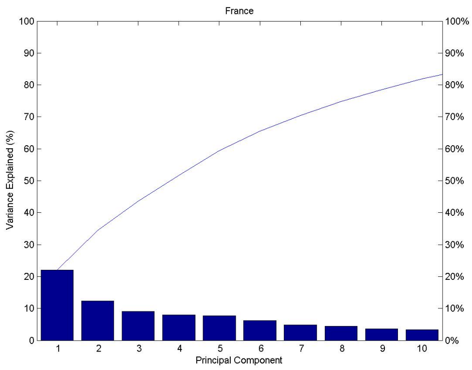


(b) Sub-Period II (01/2000 - 04/2008)

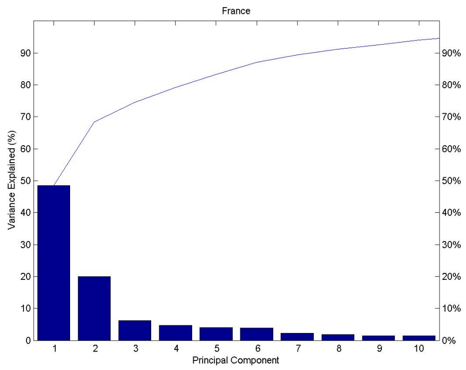


⊣ **France** ⊢

(a) Sub-Period I (01/1990 - 04/1998)

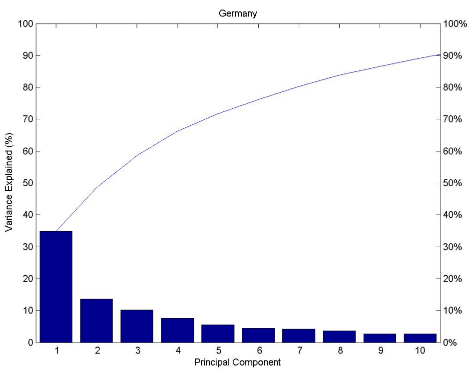


(b) Sub-Period II (01/2000 - 04/2008)



⊣ **Germany** ⊢

(a) Sub-Period I (01/1990 - 04/1998)



(b) Sub-Period II (01/2000 - 04/2008)

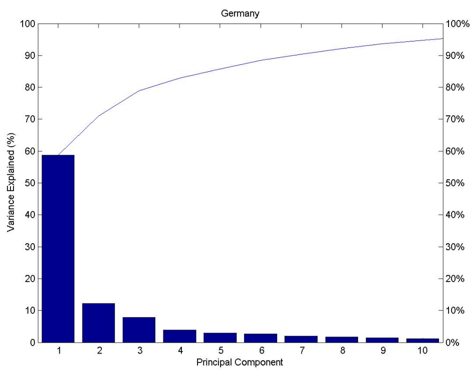
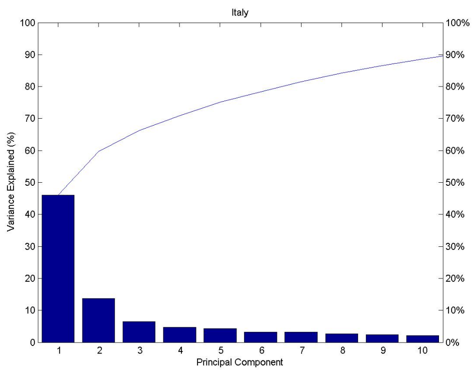


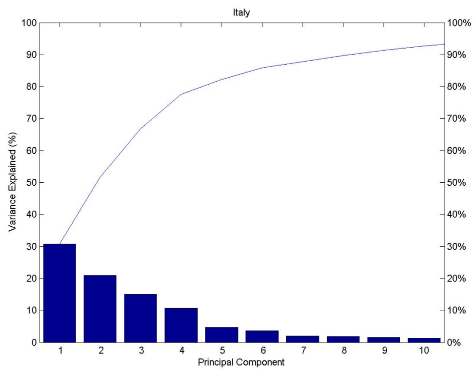
Figure C.1 cont'd: % Variability Explained by Each Principal Component

⊣ Italy ⊢

(a) Sub-Period I (01/1990 - 04/1998)

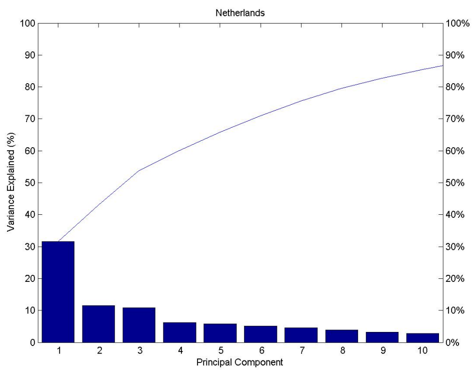


(b) Sub-Period II (01/2000 - 04/2008)

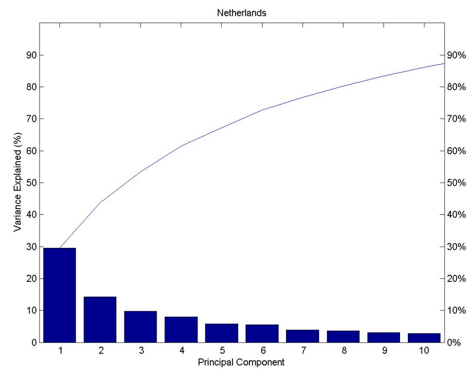


⊣ Netherlands ⊢

(a) Sub-Period I (01/1990 - 04/1998)

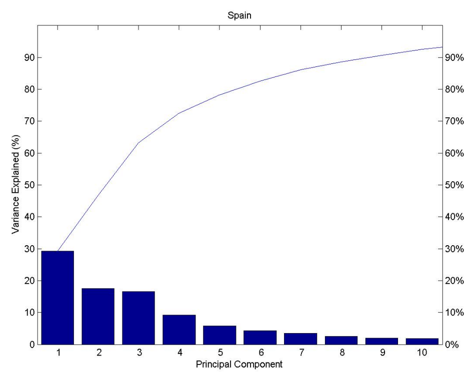


(b) Sub-Period II (01/2000 - 04/2008)



⊣ Spain ⊢

(a) Sub-Period I (01/1990 - 04/1998)



(b) Sub-Period II (01/2000 - 04/2008)

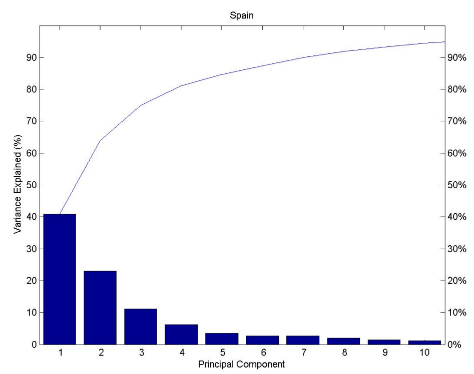
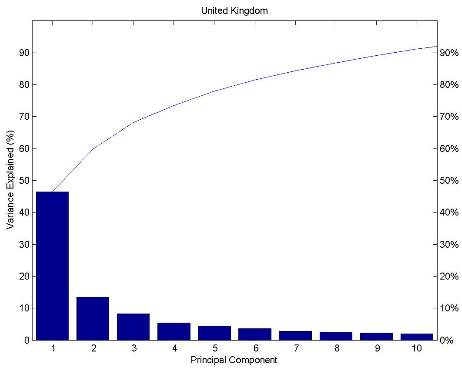


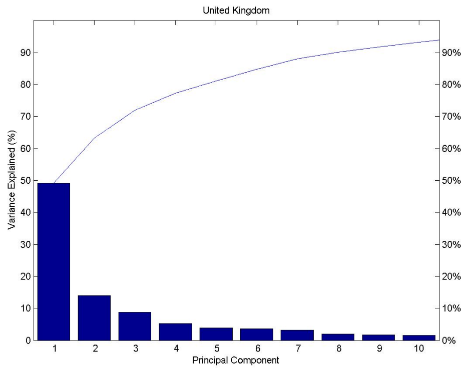
Figure C.1 cont'd: % Variability Explained by Each Principal Component

⊣ **United Kingdom** ⊢

(a) Sub-Period I (01/1990 - 04/1998)

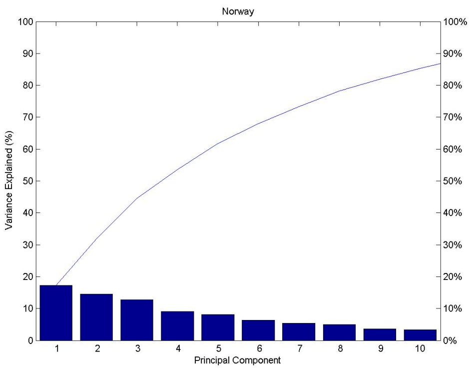


(b) Sub-Period II (01/2000 - 04/2008)



⊣ **Norway** ⊢

(a) Sub-Period I (01/1990 - 04/1998)



(b) Sub-Period II (01/2000 - 04/2008)

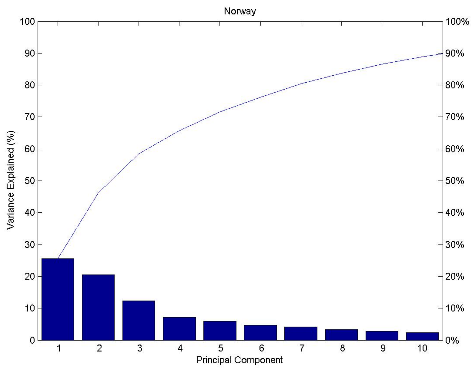
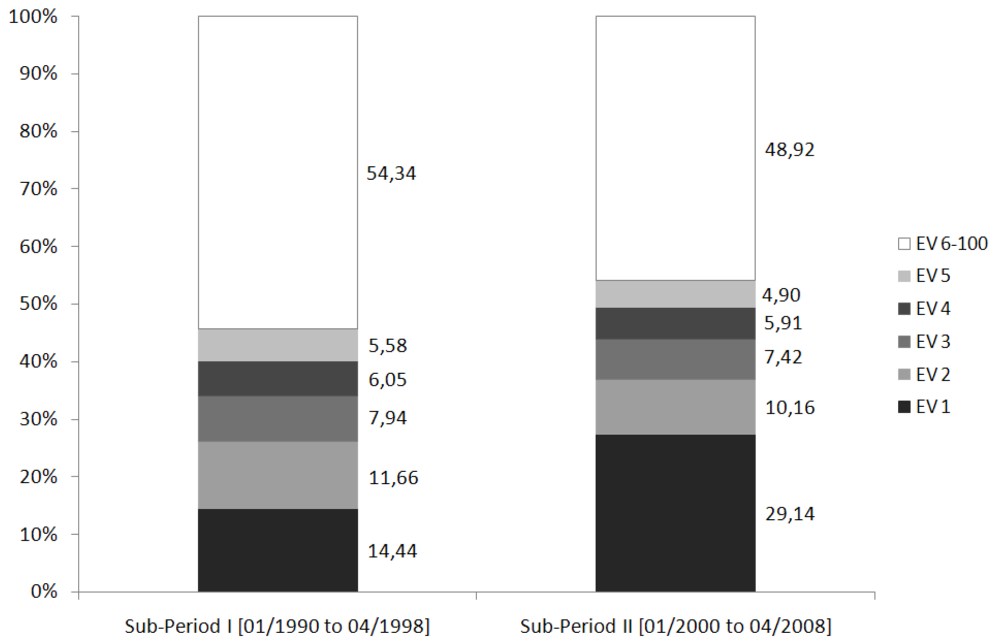


Figure C.2: Cumulative % of Variance Explained by Sorted Eigenvalues: Europe & European Union

(a) Europe (Total)



(b) European Union

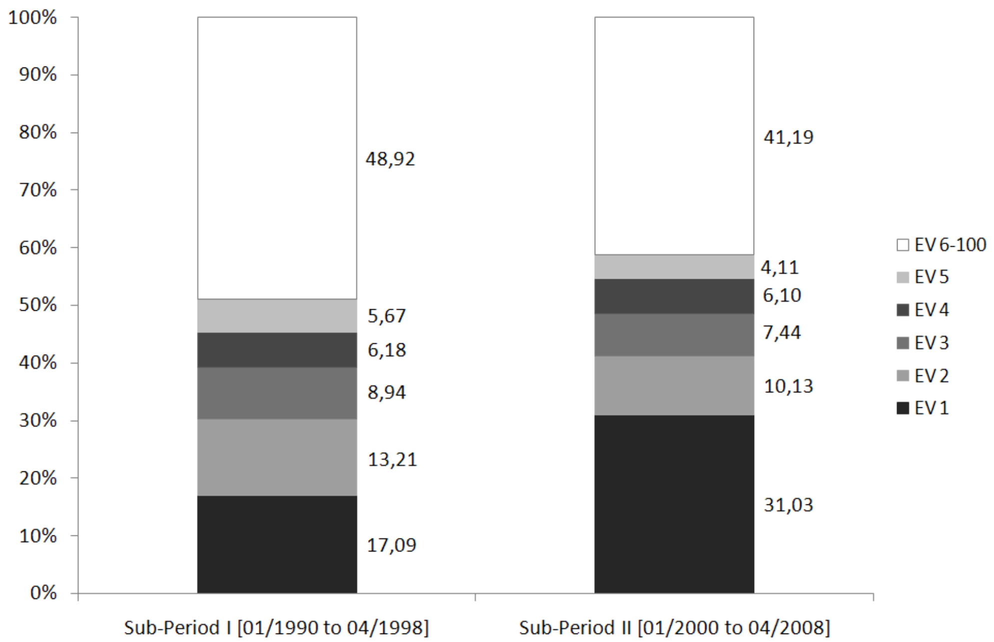


Table C.2: Correlation Between 2. Principal Components & Selective Variables: Countries

This table reports the correlation coefficients and corresponding p-values between the second principal component and selective variables. Column 1 depicts the country, column 2 the sub-period, column 3 the percentage of variance explained by the second principal component (relative to all other components extracted), column 5 the inverse of the European risk-free rate, column 6 the inverse of the country specific risk-free rate, column 7 the country specific market factor (MRF), column 8 the country specific book-to-market (HML) factor, and column 9 the country specific size (SMB) factor.

				Variables				
Country	Sub-	% of Variance		Euro	Country			
	Period	Explained		$\frac{1}{(1+r_f)}$	$\frac{1}{(1+r_f)}$	*MRF*	*HML*	*SMB*
Belgium	I	16.649	Correlation	0.309	0.372	0.152	-0.404	-0.302
			p-Value	0.002	0.000	0.132	0.000	0.002
	II	14.69	Correlation	-0.400	-0.241	-0.290	-0.704	0.467
			p-Value	0.000	0.016	0.003	0.000	0.000
France	I	12.411	Correlation	0.113	0.076	0.067	0.476	-0.433
			p-Value	0.261	0.450	0.506	0.000	0.000
	II	19.961	Correlation	-0.010	-0.065	0.008	0.140	0.199
			p-Value	0.920	0.521	0.939	0.165	0.047
Germany	I	13.592	Correlation	-0.122	-0.114	-0.075	-0.549	-0.132
			p-Value	0.228	0.257	0.456	0.000	0.192
	II	12.257	Correlation	-0.064	-0.090	-0.004	-0.228	-0.075
			p-Value	0.527	0.375	0.967	0.023	0.460
Italy	I	13.65	Correlation	-0.240	-0.216	-0.024	0.046	0.500
			p-Value	0.016	0.031	0.812	0.647	0.000
	II	20.896	Correlation	0.388	0.391	-0.111	0.164	-0.220
			p-Value	0.000	0.000	0.271	0.104	0.028
Netherlands	I	11.47	Correlation	-0.103	0.017	0.032	0.456	0.101
			p-Value	0.309	0.869	0.755	0.000	0.317
	II	14.20	Correlation	-0.030	-0.145	-0.079	0.285	0.127
			p-Value	0.767	0.150	0.436	0.004	0.208
Spain	I	17.477	Correlation	-0.245	0.008	-0.077	-0.435	-0.199
			p-Value	0.014	0.937	0.444	0.000	0.047
	II	22.989	Correlation	0.308	0.368	0.278	-0.487	-0.317
			p-Value	0.002	0.000	0.005	0.000	0.001
United Kingdom	I	13.404	Correlation	0.008	-0.058	0.165	0.771	-0.131
			p-Value	0.938	0.567	0.102	0.000	0.193
	II	14.019	Correlation	-0.155	-0.371	-0.204	0.471	0.511
			p-Value	0.124	0.000	0.042	0.000	0.000
Norway	I	14.505	Correlation	0.178	0.016	-0.073	0.181	0.042
			p-Value	0.076	0.877	0.471	0.071	0.678
	II	20.583	Correlation	-0.374	-0.293	-0.267	-0.715	-0.159
			p-Value	0.000	0.003	0.007	0.000	0.114

Table C.3: Cumulative % of Variance Explained by Sorted Eigenvalues: P1-P27

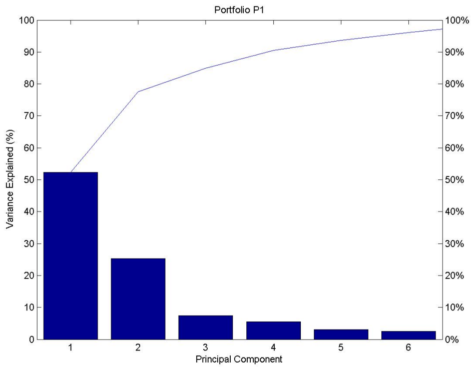
This table reports per portfolio j ($j = 1, \ldots, 27$) and sub-period (a) the percentage of variance explained by the biggest eigenvalue (columns 2 & 3) and (b) the cumulative percentage of variance explained by the 2 biggest eigenvalues (columns 5 & 6). Columns 4 and 7 depict the difference (Δ) between sub-period II and sub-period I for these values. The last three columns contain information about the book-to-market, size (market capitalization), and momentum characteristics of each portfolio j. The bottom of the table depicts information for an unsorted portfolio (A27) that is comprised of all portfolios j.

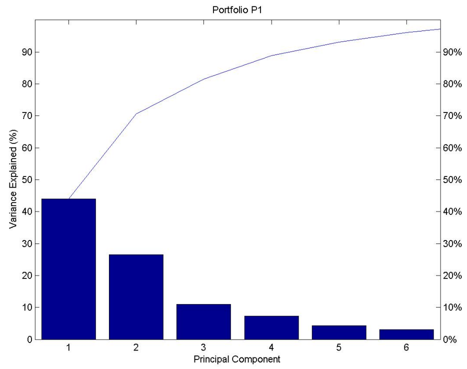
Portfolio	% of Variance Explained by Biggest Eigenvalue			Cumulative % of Variance Explained by 2 Biggest Eigenvalues			Portfolio Characteristics		
	Sub-Period I	Sub-Period II	ΔPII-PI	Sub-Period I	Sub-Period II	ΔPII-PI	Book-to-Market	Market Cap.	Momentum
P1	52.32	43.96	-8.36	77.58	70.54	-7.04	High	Small	Losers
P2	43.26	47.38	4.12	61.21	69.65	8.45			Medium
P3	48.94	43.45	-5.49	63.84	73.66	9.82			Winners
P4	29.70	57.97	28.27	52.69	70.14	17.44		Medium	Losers
P5	41.87	47.74	5.86	62.30	67.05	4.75			Medium
P6	33.14	54.05	20.91	51.79	73.16	21.37			Winners
P7	26.44	49.48	23.04	49.09	69.49	20.41		Big	Losers
P8	34.98	62.56	27.58	63.79	73.20	9.41			Medium
P9	37.61	59.64	22.03	67.79	73.04	5.25			Winners
P10	32.12	35.48	3.37	57.01	58.69	1.68	Medium	Small	Losers
P11	40.18	39.09	-1.09	62.82	65.01	2.19			Medium
P12	37.67	30.15	-7.52	58.32	56.48	-1.83			Winners
P13	50.37	46.85	-3.52	76.62	72.49	-4.13		Medium	Losers
P14	25.75	52.37	26.62	45.16	71.72	26.56			Medium
P15	24.54	43.08	18.54	44.23	72.01	27.78			Winners
P16	35.33	48.74	13.41	57.26	62.67	5.41		Big	Losers
P17	42.08	55.75	13.67	58.85	66.79	7.94			Medium
P18	31.57	47.26	15.69	51.00	68.23	17.23			Winners
P19	62.06	32.43	-29.63	79.72	52.45	-27.27	Low	Small	Losers
P20	45.14	51.70	6.57	67.16	68.61	1.45			Medium
P21	37.32	37.23	-0.09	55.10	66.35	11.25			Winners
P22	31.03	32.45	1.42	53.90	56.26	2.36		Medium	Losers
P23	26.66	33.92	7.26	49.75	59.59	9.84			Medium
P24	22.88	53.03	30.15	41.89	71.74	29.86			Winners
P25	21.97	44.20	22.23	42.23	72.63	30.40		Big	Losers
P26	35.10	51.03	15.93	57.46	67.33	9.87			Medium
P27	44.09	57.26	13.17	60.23	68.35	8.12			Winners
A27	31.57	73.06	41.49	51.00	85.33	34.33		*Unsorted*	

Figure C.3: % Variability Explained by Each Principal Component: P1-P27

⊣ Portfolio P1 ⊢

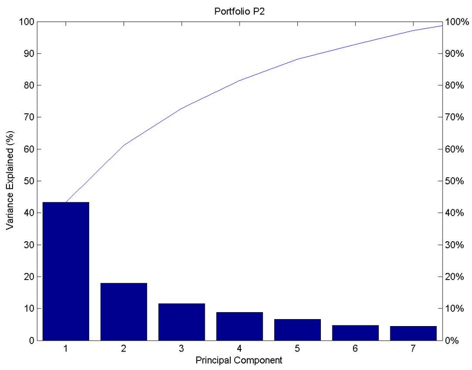
(a) Sub-Period I (01/1990 - 04/1998) **(b)** Sub-Period II (01/2000 - 04/2008)

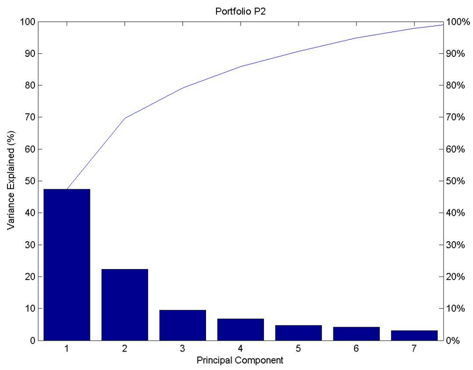




⊣ Portfolio P2 ⊢

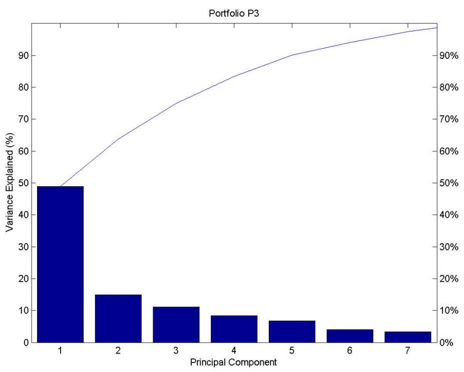
(a) Sub-Period I (01/1990 - 04/1998) **(b)** Sub-Period II (01/2000 - 04/2008)





⊣ Portfolio P3 ⊢

(a) Sub-Period I (01/1990 - 04/1998) **(b)** Sub-Period II (01/2000 - 04/2008)



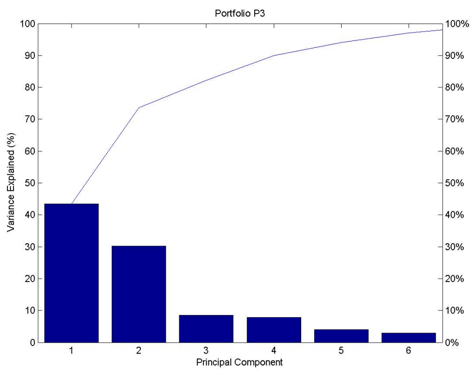
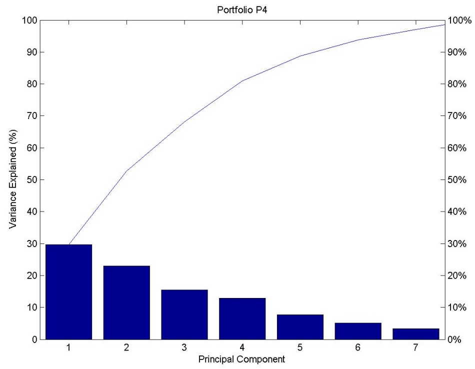


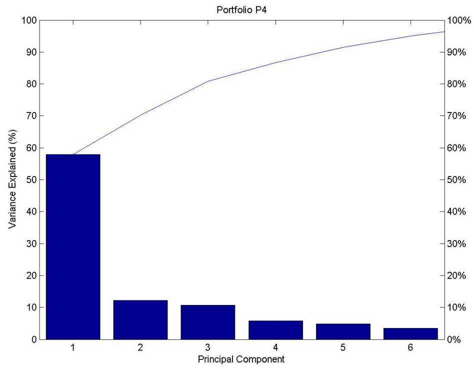
Figure C.3 cont'd: % Variability Explained by Each Principal Component

⊣ **Portfolio P4** ⊢

(a) Sub-Period I (01/1990 - 04/1998)

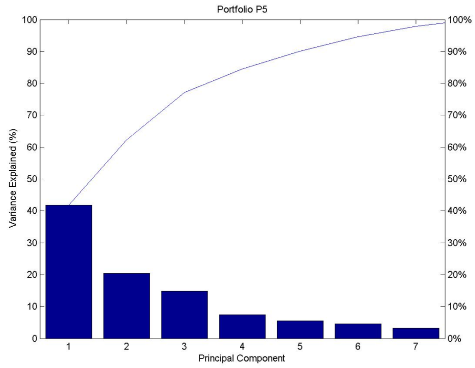


(b) Sub-Period II (01/2000 - 04/2008)

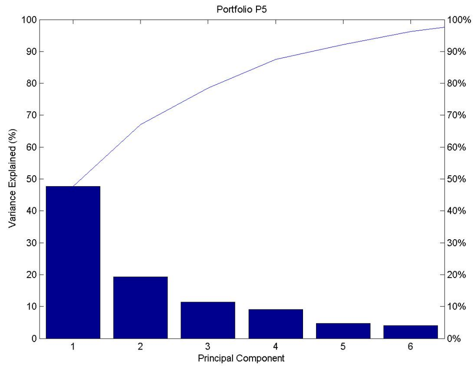


⊣ **Portfolio P5** ⊢

(a) Sub-Period I (01/1990 - 04/1998)

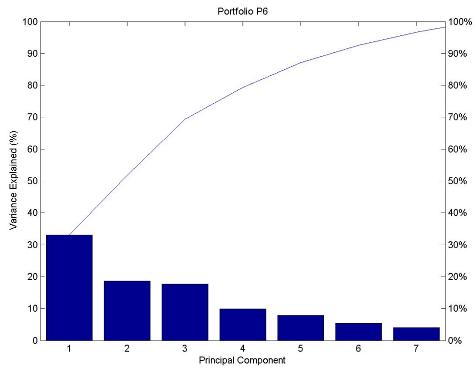


(b) Sub-Period II (01/2000 - 04/2008)



⊣ **Portfolio P6** ⊢

(a) Sub-Period I (01/1990 - 04/1998)



(b) Sub-Period II (01/2000 - 04/2008)

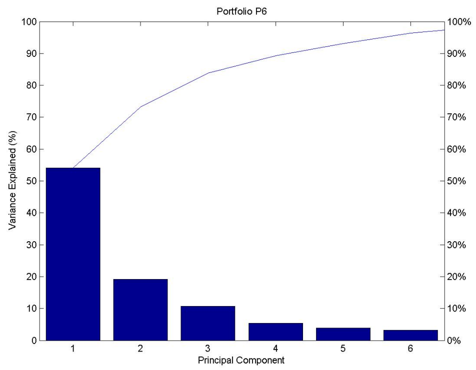
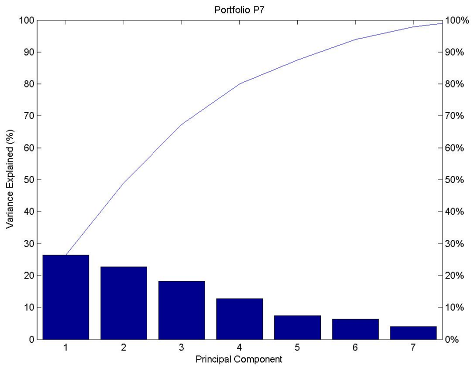


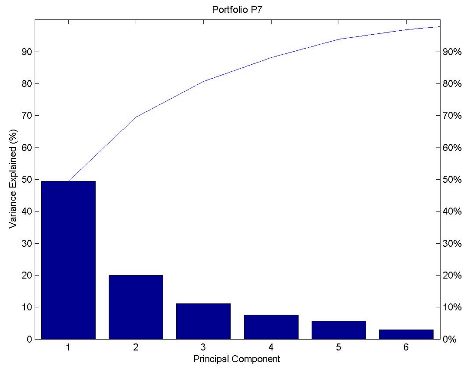
Figure C.3 cont'd: % Variability Explained by Each Principal Component

⊣ Portfolio P7 ⊢

(a) Sub-Period I (01/1990 - 04/1998)

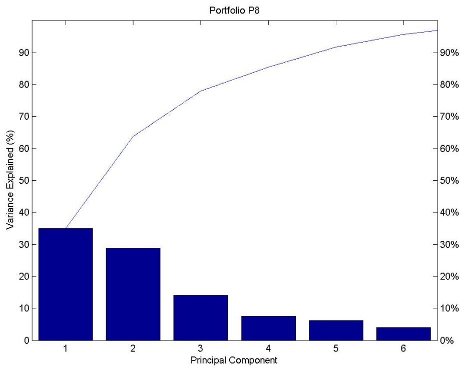


(b) Sub-Period II (01/2000 - 04/2008)

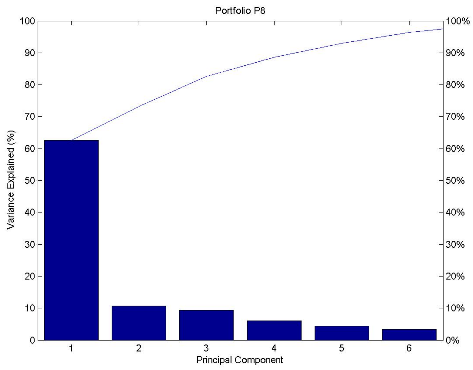


⊣ Portfolio P8 ⊢

(a) Sub-Period I (01/1990 - 04/1998)

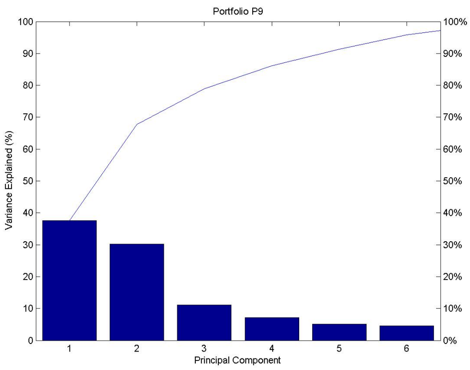


(b) Sub-Period II (01/2000 - 04/2008)



⊣ Portfolio P9 ⊢

(a) Sub-Period I (01/1990 - 04/1998)



(b) Sub-Period II (01/2000 - 04/2008)

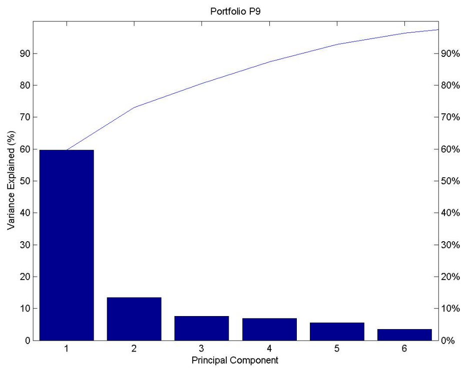
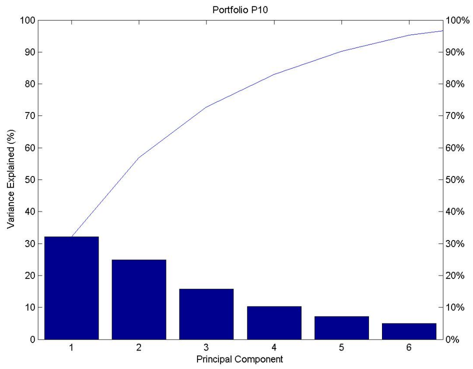


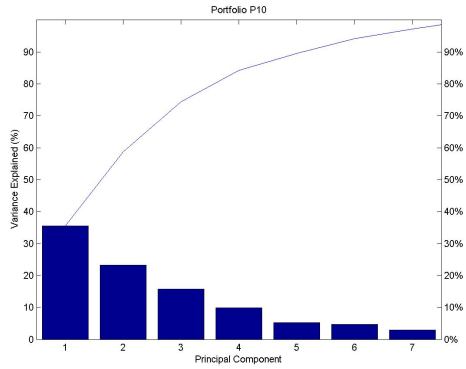
Figure C.3 cont'd: % Variability Explained by Each Principal Component

⊣ Portfolio P10 ⊢

(a) Sub-Period I (01/1990 - 04/1998)

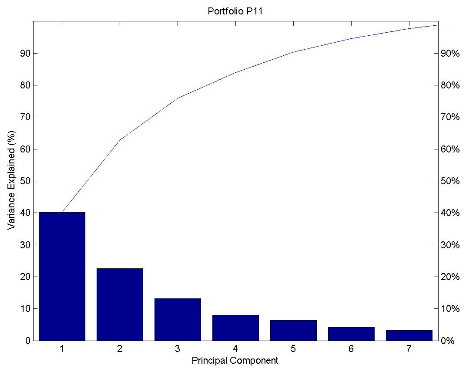


(b) Sub-Period II (01/2000 - 04/2008)

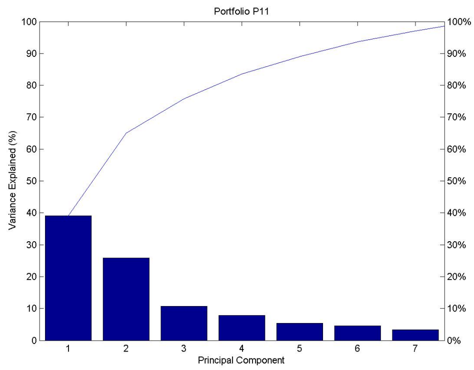


⊣ Portfolio P11 ⊢

(a) Sub-Period I (01/1990 - 04/1998)

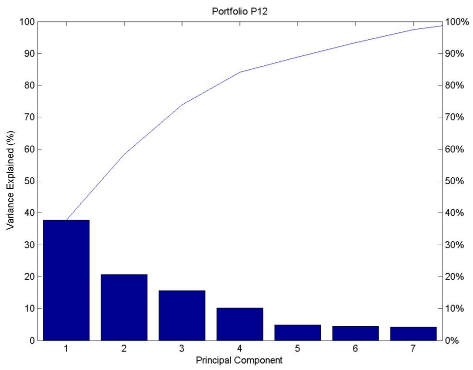


(b) Sub-Period II (01/2000 - 04/2008)



⊣ Portfolio P12 ⊢

(a) Sub-Period I (01/1990 - 04/1998)



(b) Sub-Period II (01/2000 - 04/2008)

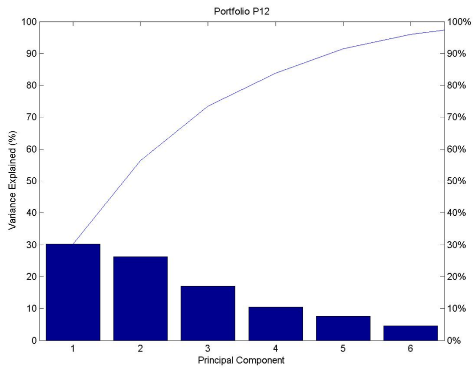
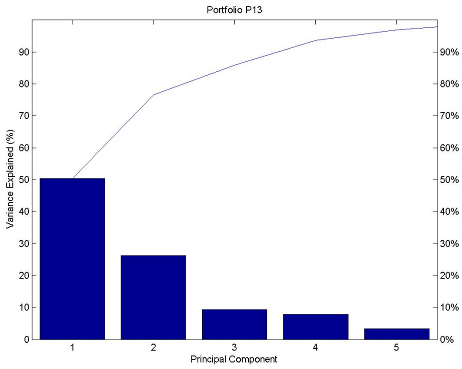


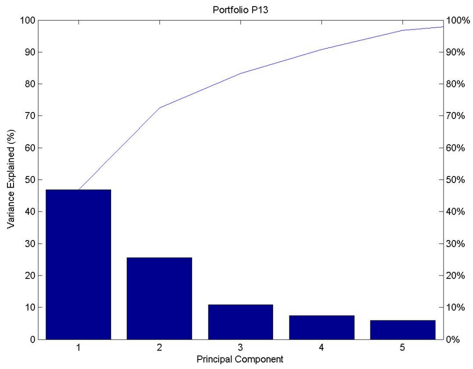
Figure C.3 cont'd: % Variability Explained by Each Principal Component

⊣ Portfolio P13 ⊢

(a) Sub-Period I (01/1990 - 04/1998)

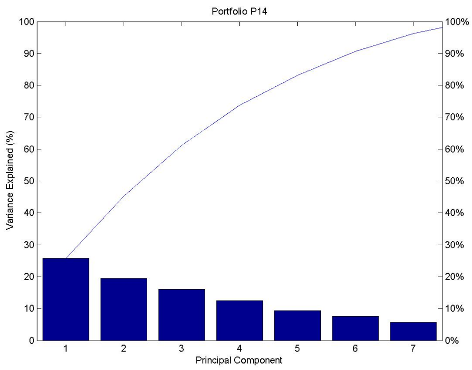


(b) Sub-Period II (01/2000 - 04/2008)

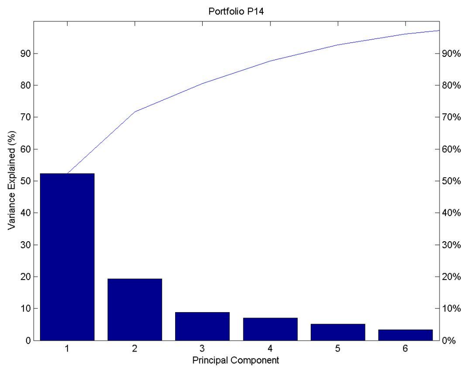


⊣ Portfolio P14 ⊢

(a) Sub-Period I (01/1990 - 04/1998)

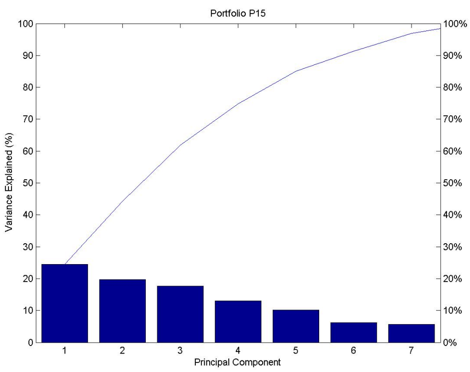


(b) Sub-Period II (01/2000 - 04/2008)



⊣ Portfolio P15 ⊢

(a) Sub-Period I (01/1990 - 04/1998)



(b) Sub-Period II (01/2000 - 04/2008)

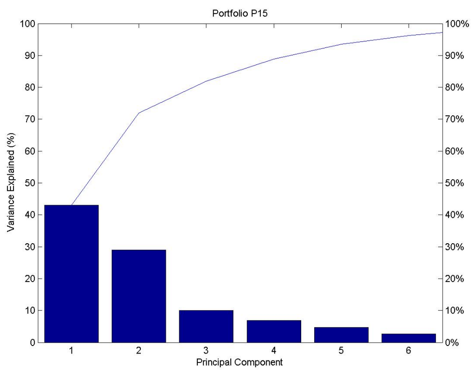
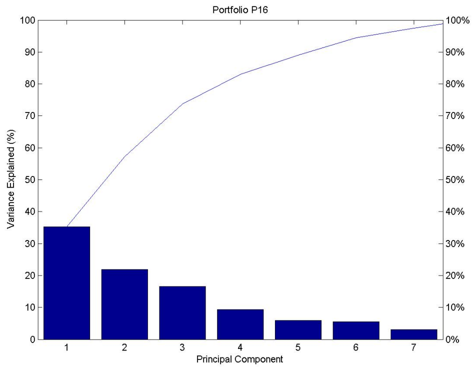


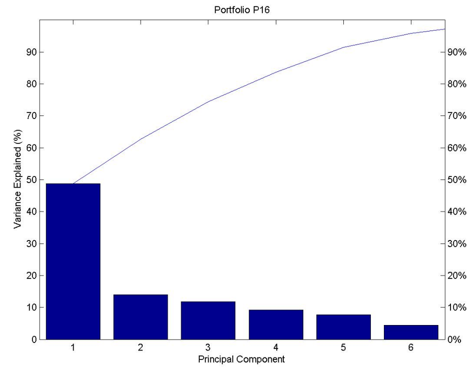
Figure C.3 cont'd: % Variability Explained by Each Principal Component

⊣ Portfolio P16 ⊢

(a) Sub-Period I (01/1990 - 04/1998)

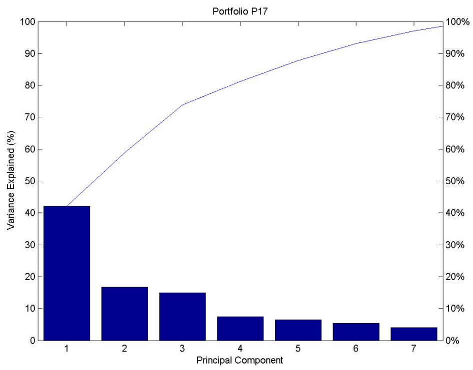


(b) Sub-Period II (01/2000 - 04/2008)

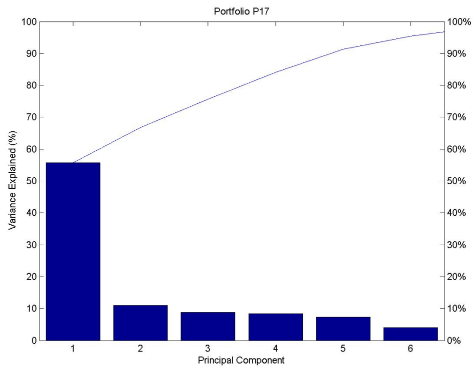


⊣ Portfolio P17 ⊢

(a) Sub-Period I (01/1990 - 04/1998)

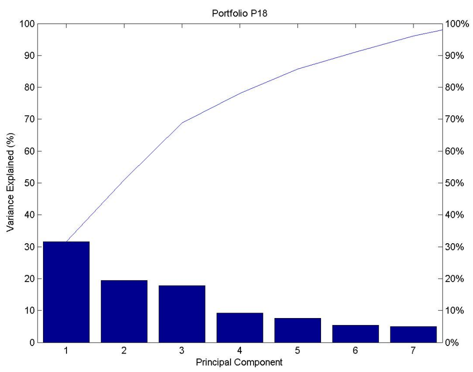


(b) Sub-Period II (01/2000 - 04/2008)



⊣ Portfolio P18 ⊢

(a) Sub-Period I (01/1990 - 04/1998)



(b) Sub-Period II (01/2000 - 04/2008)

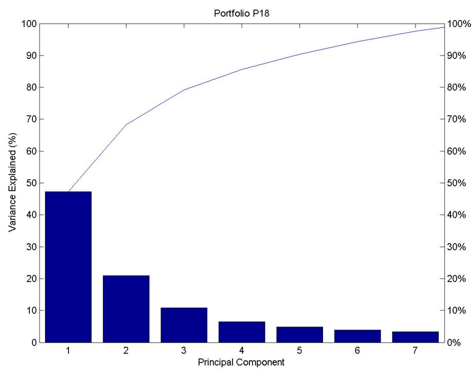
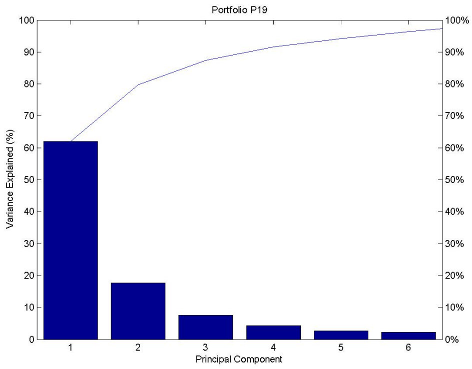


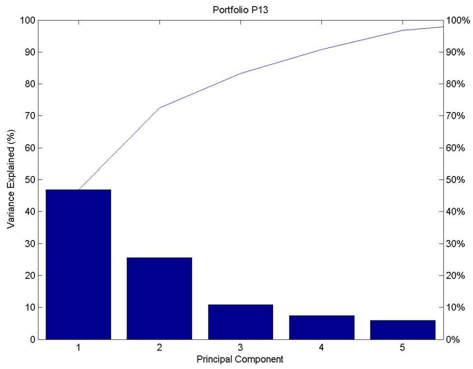
Figure C.3 cont'd: % Variability Explained by Each Principal Component

⊣ **Portfolio P19** ⊢

(a) Sub-Period I (01/1990 - 04/1998)

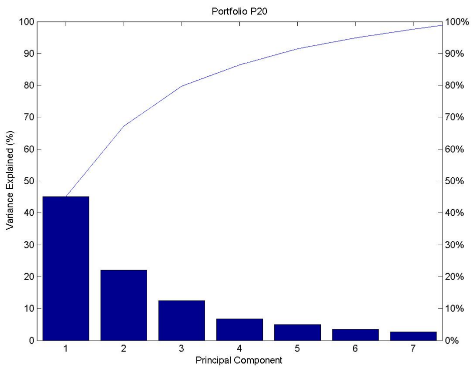


(b) Sub-Period II (01/2000 - 04/2008)

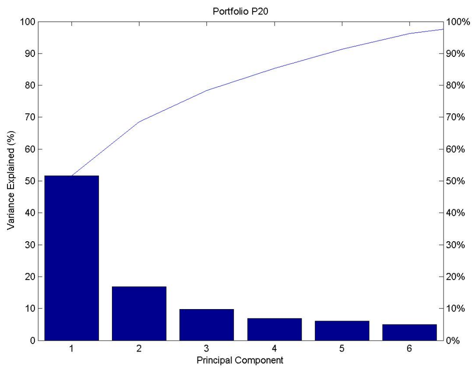


⊣ **Portfolio P20** ⊢

(a) Sub-Period I (01/1990 - 04/1998)

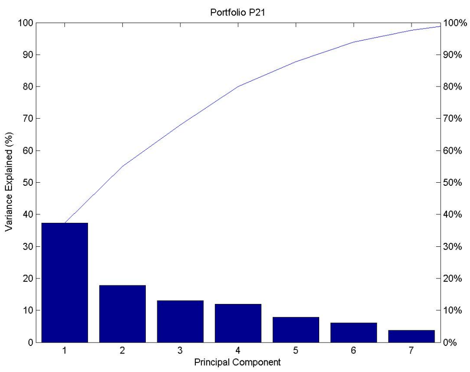


(b) Sub-Period II (01/2000 - 04/2008)



⊣ **Portfolio P21** ⊢

(a) Sub-Period I (01/1990 - 04/1998)



(b) Sub-Period II (01/2000 - 04/2008)

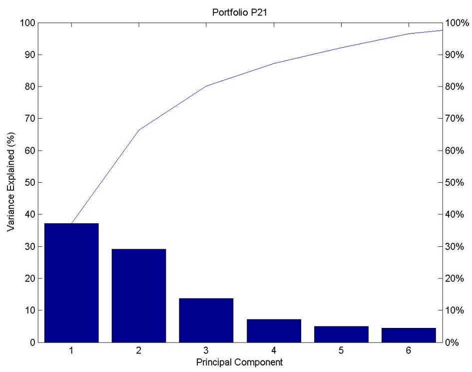
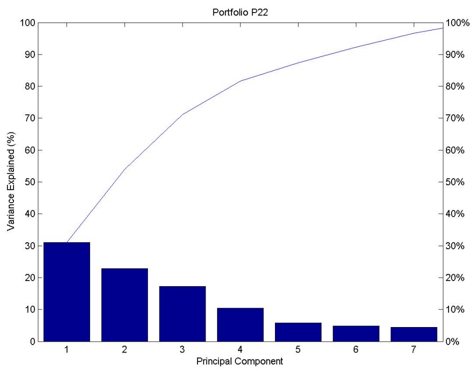
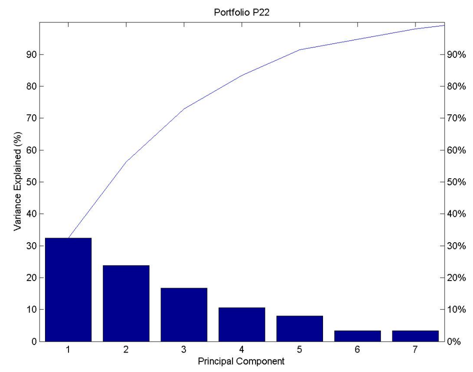


Figure C.3 cont'd: % Variability Explained by Each Principal Component

⊣ Portfolio P22 ⊢

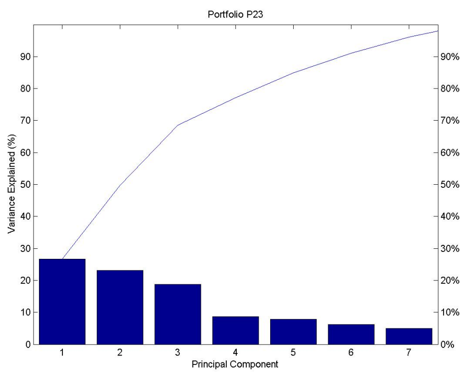
(a) Sub-Period I (01/1990 - 04/1998) **(b)** Sub-Period II (01/2000 - 04/2008)

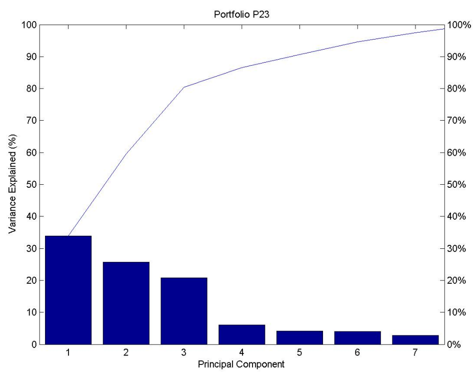




⊣ Portfolio P23 ⊢

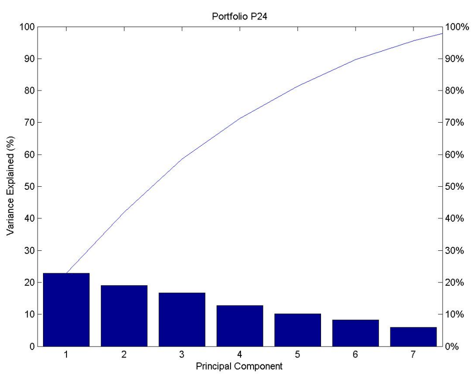
(a) Sub-Period I (01/1990 - 04/1998) **(b)** Sub-Period II (01/2000 - 04/2008)





⊣ Portfolio P24 ⊢

(a) Sub-Period I (01/1990 - 04/1998) **(b)** Sub-Period II (01/2000 - 04/2008)



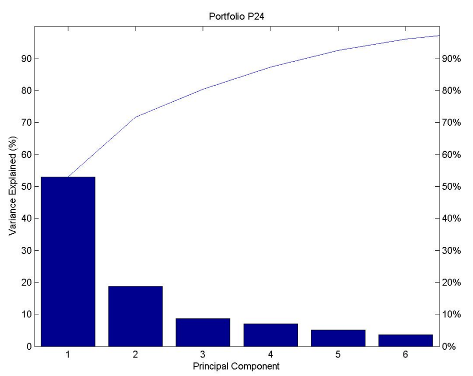
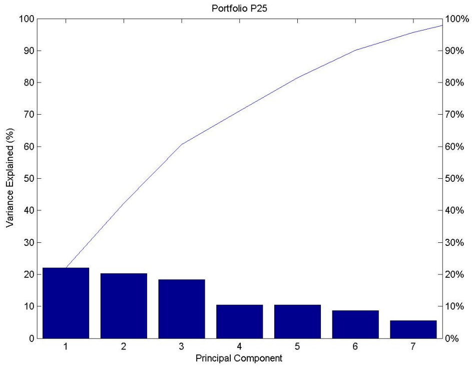


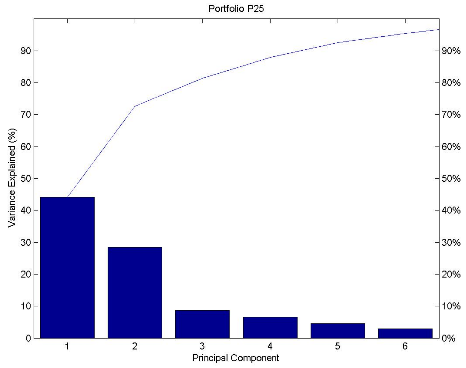
Figure C.3 cont'd: % Variability Explained by Each Principal Component

⊣ Portfolio P25 ⊢

(a) Sub-Period I (01/1990 - 04/1998)

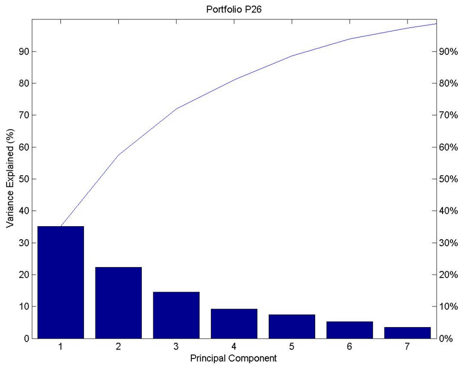


(b) Sub-Period II (01/2000 - 04/2008)

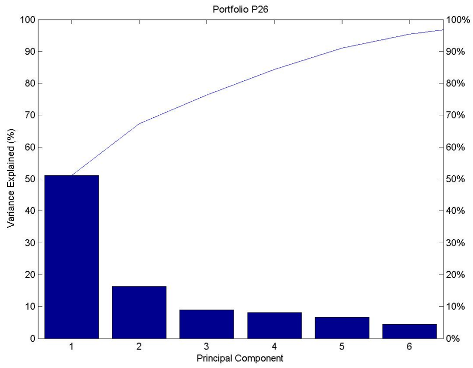


⊣ Portfolio P26 ⊢

(a) Sub-Period I (01/1990 - 04/1998)

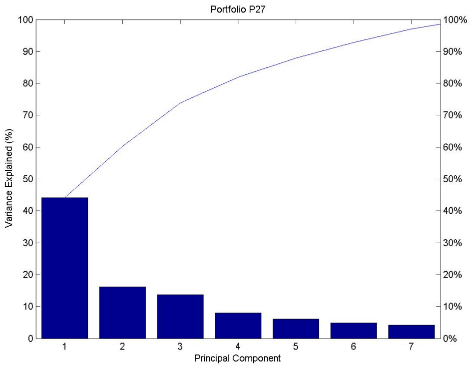


(b) Sub-Period II (01/2000 - 04/2008)



⊣ Portfolio P27 ⊢

(a) Sub-Period I (01/1990 - 04/1998)



(b) Sub-Period II (01/2000 - 04/2008)

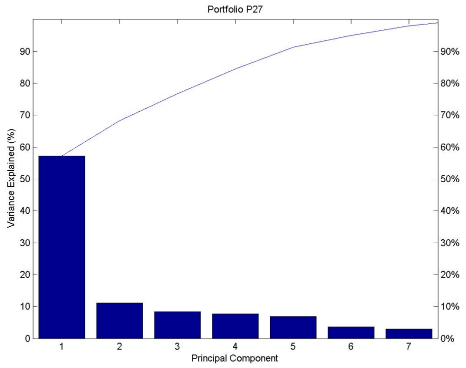
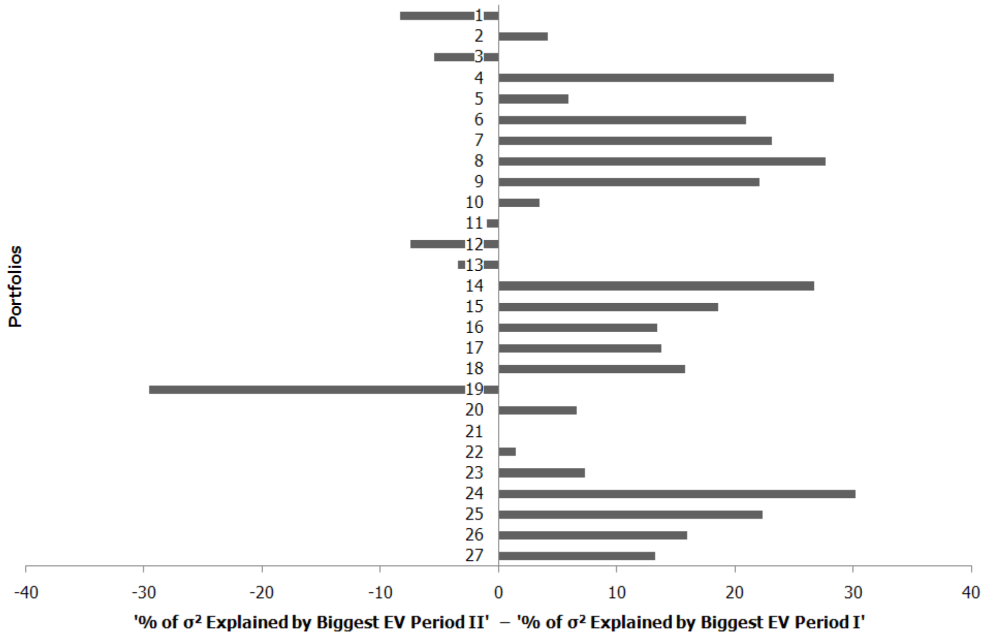


Figure C.4: Δ Between Cumulative % of Variance Explained by Sorted Eigenvalues of Sub-Period II & Sub Period I: P1-P27

(a) Only Biggest Eigenvalue



(b) Two Biggest Eigenvalues

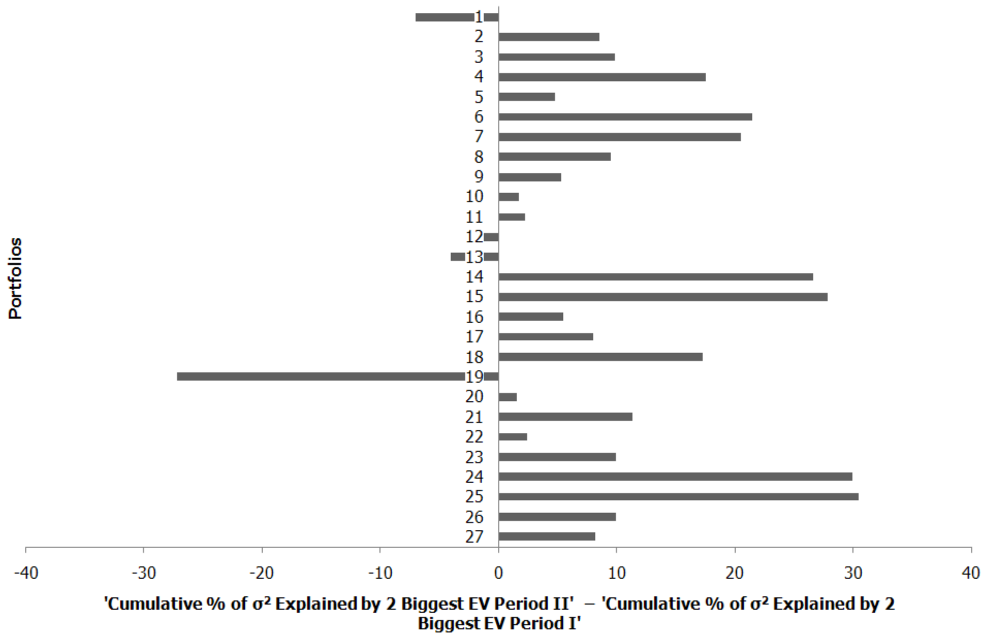
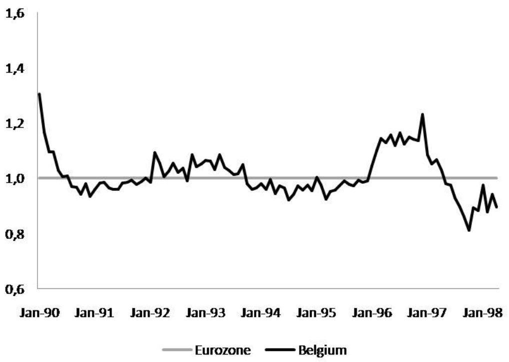


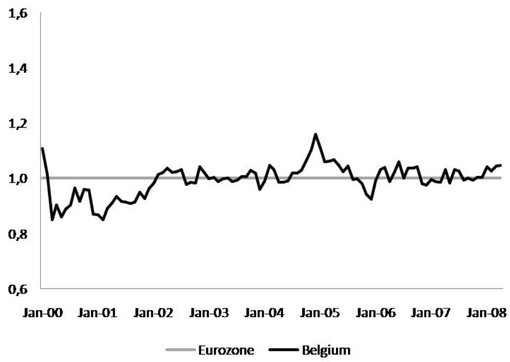
Figure C.5: Evolution δ_t AP_{27}: Eurozone vs. Country

⊣ Belgium ⊢

(a) Sub-Period I (01/1990 - 04/1998)

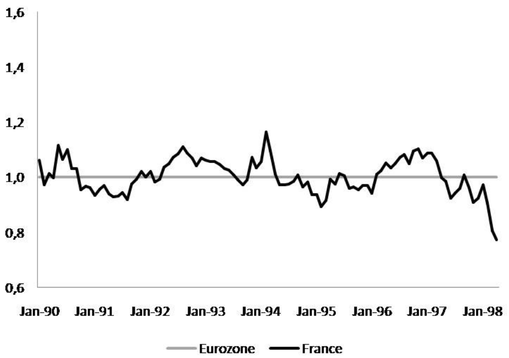


(b) Sub-Period II (01/2000 - 04/2008)

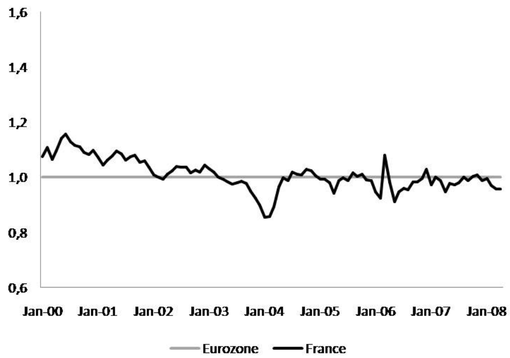


⊣ France ⊢

(a) Sub-Period I (01/1990 - 04/1998)

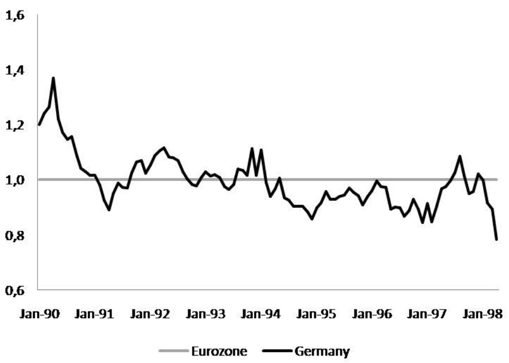


(b) Sub-Period II (01/2000 - 04/2008)



⊣ Germany ⊢

(a) Sub-Period I (01/1990 - 04/1998)



(b) Sub-Period II (01/2000 - 04/2008)

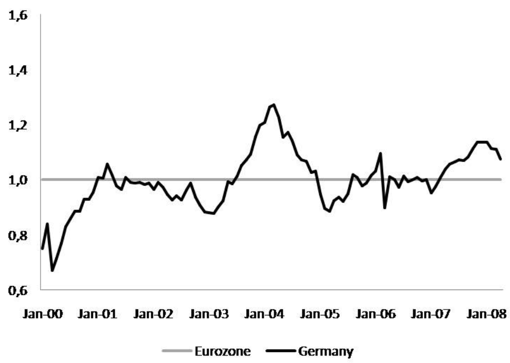
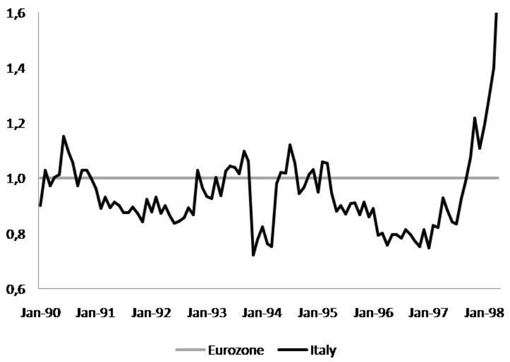


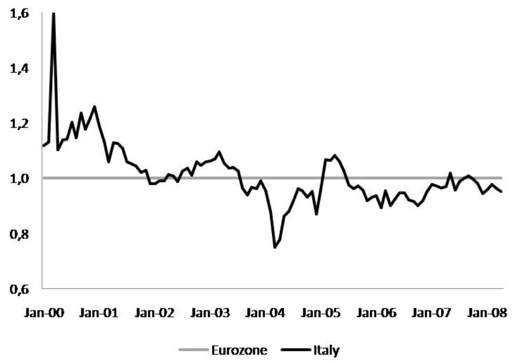
Figure C.5 cont'd: Evolution δ_t AP_{27}: Eurozone vs. Country

⊣ Italy ⊢

(a) Sub-Period I (01/1990 - 04/1998)

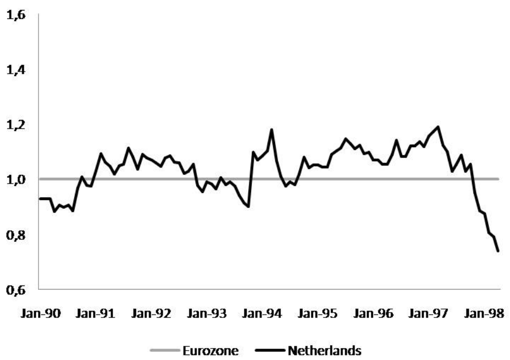


(b) Sub-Period II (01/2000 - 04/2008)

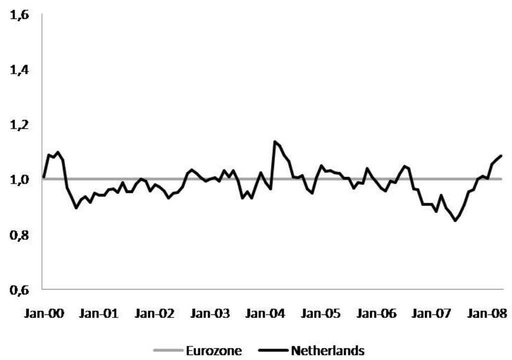


⊣ Netherlands ⊢

(c) Sub-Period I (01/1990 - 04/1998)

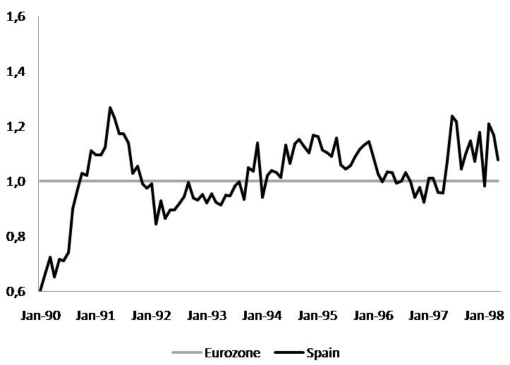


(d) Sub-Period II (01/2000 - 04/2008)



⊣ Spain ⊢

(a) Sub-Period I (01/1990 - 04/1998)



(b) Sub-Period II (01/2000 - 04/2008)

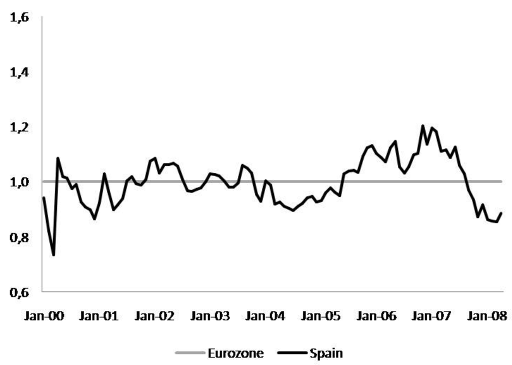
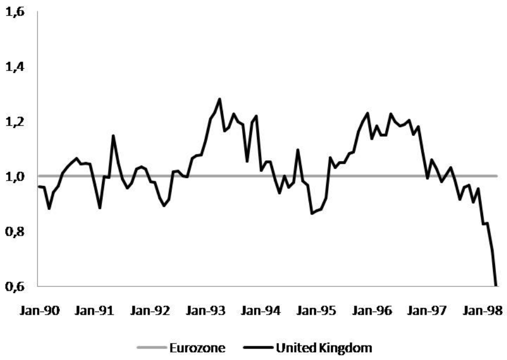


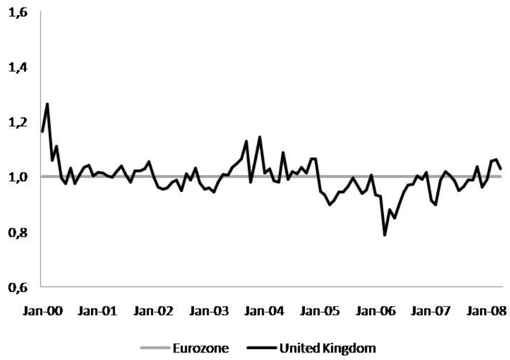
Figure C.5 cont'd: Evolution δ_t AP_{27}: Eurozone vs. Country

⊣ **United Kingdom** ⊢

(**a**) Sub-Period I (01/1990 - 04/1998)

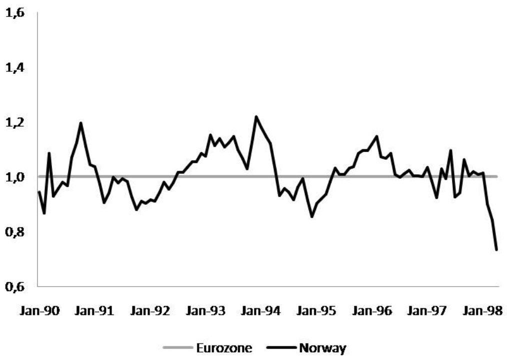


(**b**) Sub-Period II (01/2000 - 04/2008)

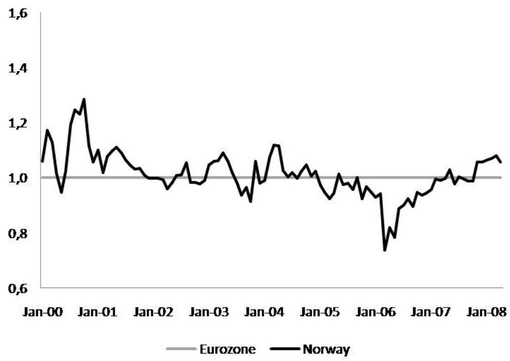


⊣ **Norway** ⊢

(**a**) Sub-Period I (01/1990 - 04/1998)



(**b**) Sub-Period II (01/2000 - 04/2008)



Appendix D

Method B.I: *SMB* & *HML* and Future Growth in GDP

D.1 Adjusted Distribution of Stocks & Summary Statistics for Risk Factors

Table D.1: Summary Statistics per Country and Region [01/1990 - 04/2008]

This table reports the annualized summary statistics or all risk factors considered per country and the Eurozone. The countries are clustered along three dimensions. The first group comprises those countries that belong to the Eurozone. The second cluster represents countries of the European Union that do not belong to the Eurozone. The last cluster contains European countries that neither belong to the Eurozone nor the European Union. The results are based on annually rebalanced HML, SMB, and WML portfolios. MRF denotes the market risk factor. HML is the return on a portfolio that is long on high book-to-market stocks and short on low book-to-market securities, holding size and momentum characteristics of the portfolio constant. SMB is the return on a portfolio that is long on small capitalization stocks and short on big capitalization securities, holding book-to-market and momentum characteristics of the portfolio constant. WML is the return on a portfolio that is long on the best performing stocks of the past year ('winners') and short on the worst performing securities of the previous year ('losers') holding book-to-market and size characteristics of the portfolio constant. *, **, *** used for the Jarque-Bera (JB) test and for the Augmented Dickey Fuller (ADF) test denote, respectively, significance at the 10%, 5%, and 1% significance level.

	Mean (%)	Median (%)	Std. (%)	Skweness	Kurtosis	Jarque-Bera	ADF
Austria							
MRF	18.89	14.35	19.83	0.295	1.642	2.715	-1.254
HML	8.26	4.09	20.41	1.291	4.780	8.600**	-1.555
SMB	11.73	9.96	20.77	0.481	2.047	2.218	-2.566
WML	4.86	5.21	10.93	-0.478	3.729	1.098	-2.413
Belgium							
MRF	9.94	12.79	21.37	-0.396	2.169	2.820	-1.997
HML	5.12	7.26	12.82	-0.636	2.843	3.120	-2.920*
SMB	10.34	9.42	12.90	0.248	2.248	1.855	-2.999**
WML	7.73	6.25	14.44	0.318	2.053	2.835	-2.832*
Finland							
MRF	23.01	21.50	48.13	0.724	3.691	4.090	-2.491
HML	23.58	11.33	53.07	3.499	16.341	375.146***	-3.674***
SMB	28.65	13.73	55.46	3.100	14.393	277.488***	-4.021***
WML	1.18	0.79	10.72	-0.004	3.476	0.187	-2.678*
France							
MRF	8.41	10.24	25.33	0.161	2.660	1.127	-4.737***
HML	10.97	5.36	24.81	2.398	11.153	381.172***	-3.847***
SMB	9.56	9.75	19.95	-0.266	3.083	1.226	-4.015***
WML	4.51	2.65	13.66	1.232	5.270	47.337***	-5.486***
Germany							
MRF	6.10	11.83	21.98	-0.317	2.551	1.768	-3.178**
HML	10.44	7.05	17.75	1.814	7.635	85.077***	-4.694***
SMB	13.53	4.56	24.75	1.689	5.958	49.524***	-2.438
WML	6.58	5.45	8.67	0.511	3.228	2.697	-3.816***
Greece							
MRF	5.10	13.82	25.57	-0.254	1.699	2.381	-1.649
HML	12.41	9.25	23.92	0.257	2.218	1.196	-2.275

Continued on next page

Table D.1 – continued from previous page

	Mean (%)	Median (%)	Std. (%)	Skweness	Kurtosis	Jarque-Bera	ADF
SMB	15.61	1.43	33.52	0.846	2.591	3.026	-1.116
WML	0.47	2.59	21.62	0.411	3.995	1.106	-3.481**
Ireland							
MRF	4.52	7.93	16.81	-0.454	2.390	1.814	-1.407
HML	25.42	16.29	32.25	1.927	6.973	36.024***	-2.670*
SMB	10.15	1.46	31.93	1.086	4.170	7.077**	-2.929*
WML	-3.95	3.02	28.93	-1.325	6.498	22.107***	-3.608**
Italy							
MRF	3.63	4.62	24.47	0.429	3.317	2.472	-2.954**
HML	5.14	3.77	13.37	-0.121	2.916	0.265	-4.591***
SMB	6.41	6.34	15.94	-0.062	3.488	0.565	-3.399**
WML	3.84	3.73	10.92	-0.318	3.447	1.682	-5.468***
Netherlands							
MRF	5.73	8.05	20.69	0.134	3.718	1.537	-3.030**
HML	4.58	1.00	16.30	0.875	3.978	12.401***	-3.806***
SMB	6.74	4.59	17.45	0.558	3.087	3.994	-3.081**
WML	3.83	2.50	13.06	-0.126	3.104	0.206	-4.147***
Portugal							
MRF	1.13	3.58	21.68	-0.139	1.564	3.491	-1.856
HML	18.07	7.58	31.11	1.995	7.989	51.329***	-3.627**
SMB	4.41	-1.80	37.10	2.320	9.621	82.661***	-3.087**
WML	-0.85	-2.28	17.19	0.131	4.210	1.470	-2.876*
Spain							
MRF	13.57	14.68	23.13	0.058	2.570	0.601	-1.734
HML	10.91	13.40	17.72	-0.238	3.904	1.530	-2.941*
SMB	16.12	4.51	26.97	1.273	4.206	14.298***	-2.501
WML	-0.69	0.72	18.77	-1.022	7.142	37.455***	-3.896***
Denmark							
MRF	12.79	14.85	23.74	-0.192	2.222	1.604	-2.941*
HML	14.63	16.06	18.17	0.158	3.175	0.164	-4.354***
SMB	21.21	9.95	27.32	0.910	3.134	5.392*	-2.094
WML	-2.24	-1.04	16.84	-0.178	3.457	0.359	-3.176***
Sweden							
MRF	16.91	19.42	33.22	0.441	3.907	3.101	-3.207**
HML	14.08	7.22	37.98	3.913	19.230	699.514***	-5.403***
SMB	12.57	12.37	22.88	-0.214	3.300	0.481	-2.544
WML	-4.01	-3.03	21.40	-2.296	9.740	142.028***	-5.512***
United Kingdom							
MRF	5.86	6.55	14.84	-0.402	3.278	3.006	-3.871***
HML	5.35	5.26	9.73	0.345	4.269	8.370**	-4.824***
SMB	10.13	7.64	14.24	1.769	8.762	194.023***	-4.964***
WML	2.26	2.56	9.54	-0.892	4.667	24.931***	-5.938***
Norway							
MRF	12.17	9.97	28.66	0.335	2.336	3.176	-3.738***
HML	5.29	3.21	18.06	1.021	5.238	28.196***	-5.191***
SMB	2.80	3.70	18.40	0.071	5.079	12.771***	-3.806***
WML	3.73	2.27	18.05	0.065	3.370	0.326	-4.756***
Switzerland							
MRF	10.04	10.82	20.94	-0.103	2.697	0.484	-3.004**
HML	12.22	12.61	31.25	-0.037	3.309	0.113	-2.573
SMB	15.05	8.68	27.53	1.104	4.531	16.348***	-3.432**
WML	-2.75	2.19	21.66	-2.064	9.056	123.345***	-3.988***
Eurozone							
MRF	5.73	6.82	22.30	-0.239	2.469	1.820	-3.377**
HML	6.91	6.96	8.38	0.224	2.617	1.260	-4.583***
SMB	11.34	10.58	12.56	0.555	3.825	5.414*	-2.960**
WML	4.04	4.04	9.08	-1.255	6.092	46.405***	-4.793***
European Union							
MRF	5.73	6.82	22.30	-0.239	2.469	1.820	-3.377**
HML	5.46	5.34	8.16	0.978	4.465	17.396***	-4.469***
SMB	10.16	9.27	11.77	1.161	4.986	27.325***	-3.923**
WML	2.62	3.37	8.60	-1.046	4.948	23.797***	-4.809***
Europe							
MRF	5.73	6.82	22.30	-0.239	2.469	1.820	-3.377**
HML	5.44	4.35	8.04	0.985	4.488	17.754***	-4.245***
SMB	10.10	8.90	11.62	1.333	5.482	38.945***	-3.884**
WML	2.65	2.69	8.70	-1.235	6.277	49.269***	-5.075***

D.1 Adjusted Distribution of Stocks & Summary Statistics for Risk Factors

Table D.2: Summary Statistics per Industry (Eurozone) [01/1990 - 04/2008]

This table reports the annualized summary statistics for all risk factors considered per industry. The results are based on annually rebalanced HML, SMB, and WML portfolios using monthly observations. MRF denotes the return to the market risk factor. HML is the return on a portfolio that is long on high book-to-market stocks and short on low book-to-market securities, holding size and momentum characteristics of the portfolio constant. SMB is the return on a portfolio that is long on small capitalization stocks and short on big capitalization securities, holding book-to-market and momentum characteristics of the portfolio constant. WML is the return on a portfolio that is long on the best performing stocks of the past year ('winners') and short on the worst performing securities of the previous year ('losers') holding book-to-market and size characteristics of the portfolio constant. *, **, *** used for the Jarque-Bera (JB) test and for the Augmented Dickey Fuller (ADF) test denote, respectively, significance at the at the 10%, 5%, and 1% significance level.

BAS = *basic industries*; CGD = *cyclical consumer goods*; CSER = *cyclical services*; TOLF = *financials*; GN = *general industries*; ITECH = *information technology*; NCGD = *non-cycical consumer goods*; RES = *resources*; UTL = *utilities*.

	Mean (%)	Median (%)	Std. (%)	Skweness	Kurtosis	Jarque-Bera	ADF
BAS							
MRF	5.97	6.27	21.77	-0.221	2.680	1.028	-2.900*
HML	12.13	5.64	22.33	1.108	3.888	15.945***	-3.280**
SMB	4.33	-1.31	25.71	1.048	4.427	17.746***	-3.255**
WML	1.62	2.12	17.31	-0.879	7.610	66.970***	-5.928***
CGD							
MRF	5.67	7.23	21.70	-0.242	2.580	1.549	-3.478*
HML	6.81	4.57	14.04	0.405	3.263	2.251	-4.578***
SMB	4.94	5.70	15.40	-0.431	3.322	2.606	-2.870*
WML	6.68	5.00	9.00	0.689	3.698	7.413**	-4.154***
CSER							
MRF	6.86	8.46	21.24	-0.316	2.799	1.487	-2.985**
HML	9.60	6.72	18.14	0.989	3.422	12.588***	-3.974***
SMB	10.27	9.27	14.67	0.485	4.135	6.390**	-4.167***
WML	3.72	3.57	13.17	-0.358	4.005	4.255	-4.478***
TOLF							
MRF	5.67	7.23	21.70	-0.242	2.580	1.549	-3.478*
HML	8.30	7.32	11.24	0.847	4.446	15.366***	-5.649***
SMB	10.23	8.61	16.95	0.651	3.932	7.874**	-4.135***
WML	5.44	4.59	15.56	-1.173	8.242	103.615***	-7.011***
GN							
MRF	5.67	7.23	21.70	-0.242	2.580	1.549	-3.478**
HML	10.43	9.56	12.55	1.655	10.270	201.848***	-5.365***
SMB	16.03	13.43	23.69	3.950	25.540	1823.498***	-5.314***
WML	1.24	4.66	22.09	-5.012	33.356	3271.297***	-5.426***
ITECH							
MRF	1.68	5.77	23.11	-0.456	2.055	2.682	-2.186
HML	28.74	5.49	64.62	3.572	17.314	317.094***	-7.393***
SMB	16.56	14.29	42.89	2.529	12.258	136.635***	-7.430***
WML	-7.59	-2.52	28.68	-2.568	11.418	119.402***	-6.205***
NCGD							
MRF	0.86	5.41	22.95	-0.423	2.045	2.492	-2.249
HML	9.26	6.72	26.40	-0.542	3.841	1.986	-3.158**
SMB	18.89	19.16	30.59	-0.008	2.564	0.477	-2.505
WML	4.06	7.43	26.86	0.147	2.791	0.302	-3.742***
RES							
MRF	10.02	10.20	8.95	-0.774	3.999	5.896*	-0.941
HML	27.02	13.12	42.60	1.152	3.446	10.151***	-3.354**
SMB	64.46	55.23	42.80	1.003	3.974	8.865**	-3.023**
WML	11.72	8.36	44.53	-0.167	3.419	0.365	-1.877
UTL							
MRF	1.72	5.41	22.76	-0.467	2.118	2.631	-1.976
HML	3.16	1.68	13.03	0.198	2.228	1.384	-2.014
SMB	9.88	9.66	15.77	0.039	1.973	1.896	-1.773
WML	-1.09	-1.24	8.48	0.015	1.993	1.829	-5.609***
Industry							
MRF	5.67	7.23	21.70	-0.242	2.580	1.549	-3.478**
HML	6.52	5.42	9.84	0.401	3.040	2.093	-4.552***
SMB	12.15	12.48	15.01	0.950	6.780	55.814***	-3.013**
WML	3.67	5.14	12.15	-2.401	13.347	413.811***	-4.966***
Service							
MRF	5.67	7.23	21.70	-0.242	2.580	1.549	-3.478**
HML	7.25	7.75	10.66	1.081	5.629	36.147***	-5.018***
SMB	10.45	10.74	13.55	0.613	4.626	12.609***	-3.981***
WML	4.78	5.29	11.53	-0.814	5.105	21.850***	-6.693***

Table D.3: Adjusted Number of Stocks per Year - Country & Region

This table reports the number of stocks available per country in a given year. The average number of stocks reported is computed solely on the numbers highlighted in bold, starting with a marked *. These stocks represent those used for the country regressions. The limitation of the time period is due to the necessity to have a limited amount of stocks available for the construction of the HML, SMB, and WML risk factors. For instance, in case of Austria, we run country regressions merely for the time period July 2001 to April 2008. The remaining stocks of the period January 1990 to June 2001 are, however, not neglected, since they are used for pan-European (across the Eurozone, the European Union, and Europe as a whole) portfolios and are considered also for industry regressions.

	Austria	Belgium	Finland	France	Germany	Greece	Ireland	Italy	Luxembourg	Netherlands	Portugal	Spain	Denmark	Sweden	United Kingdom	Norway	Switzerland	Eurozone	European Union[a]	Europe[b]
1990	13	***35**	19	***115**	***116**	15	24	***58**		***64**	17	***52**	26	34	***269**	15	76	***528**	***857**	***948**
1991	13	**35**	23	**124**	**123**	16	24	**62**		**65**	18	**55**	28	***35**	**280**	16	84	**558**	**901**	**1001**
1992	16	**35**	25	**127**	**126**	18	25	**63**	4	**68**	18	**58**	32	**36**	**290**	16	86	**583**	**941**	**1043**
1993	19	**35**	26	**128**	**128**	18	25	**63**	25	**71**	22	**62**	33	**37**	**296**	19	***86**	**622**	**988**	**1093**
1994	19	**35**	29	**131**	**129**	18	25	**64**	25	**73**	22	**64**	33	**38**	**308**	19	**89**	**634**	**1013**	**1121**
1995	21	**37**	32	**145**	**131**	23	27	**65**	26	**76**	24	**65**	33	**41**	**326**	20	**92**	**672**	**1072**	**1184**
1996	24	**37**	***33**	**149**	**136**	25	27	**72**	26	**79**	28	**65**	34	**44**	**340**	20	**97**	**701**	**1119**	**1236**
1997	25	**41**	**36**	**155**	**144**	26	27	**75**	27	**82**	28	**68**	38	**49**	**362**	21	**98**	**734**	**1183**	**1302**
1998	28	**45**	**38**	**162**	**149**	28	29	**79**	30	**90**	32	**76**	***38**	**52**	**382**	***28**	**105**	**786**	**1258**	**1391**
1999	28	**53**	**41**	**180**	**160**	31	31	**86**	32	**97**	38	**79**	**40**	**54**	**389**	**29**	**112**	**856**	**1339**	**1480**
2000	32	**63**	**43**	**191**	**177**	34	***34**	**97**	32	**105**	***40**	**83**	**41**	**57**	**398**	**29**	**118**	**931**	**1427**	**1574**
2001	***34**	**64**	**44**	**202**	**195**	38	**36**	**111**	35	**106**	**43**	**86**	**44**	**60**	**415**	**29**	**127**	**994**	**1513**	**1669**
2002	**35**	**66**	**44**	**207**	**198**	***43**	**36**	**121**	35	**106**	**43**	**90**	**44**	**62**	**422**	**32**	**131**	**1024**	**1552**	**1715**
2003	**36**	**68**	**44**	**212**	**200**	**44**	**36**	**127**	36	**106**	**43**	**92**	**44**	**65**	**438**	**34**	**134**	**1044**	**1591**	**1759**
2004	**40**	**71**	**44**	**212**	**202**	**46**	**36**	**131**	36	**109**	**44**	**93**	**44**	**65**	**448**	**34**	**135**	**1064**	**1621**	**1790**
2005	**40**	**73**	**44**	**219**	**205**	**46**	**37**	**137**	36	**109**	**45**	**95**	**44**	**65**	**468**	**38**	**138**	**1086**	**1663**	**1839**
2006	**42**	**79**	**47**	**228**	**215**	**47**	**39**	**143**	37	**112**	**46**	**96**	**45**	**65**	**488**	**44**	**143**	**1131**	**1729**	**1916**
2007	**46**	**82**	**49**	**239**	**232**	**49**	**45**	**154**	37	**120**	**47**	**105**	**49**	**70**	**513**	**50**	**148**	**1205**	**1837**	**2035**
2008	**50**	**90**	**49**	**248**	**249**	**50**	**50**	**159**	38	**128**	**50**	**119**	**50**	**70**	**535**	**50**	**150**	**1280**	**1935**	**2135**
Average	40	55	43	178	169	46	39	98	-	93	45	79	44	54	388	29	119	865	1344	1486

[a] Includes Eurozone countries plus Denmark, Sweden, and United Kingdom
[b] Includes European Union countries plus Norway and Switzerland

Table D.4: Adjusted Number of Stocks per Year - Industry (Eurozone)

This table reports the number of stocks available per industry (Eurozone) in a given year. The average number of stocks reported is computed solely on the numbers highlighted in bold, starting with a marked *. These stocks represent those used for the industry regressions. The limitation of the time period is due to the necessity to have a limited amount of stocks available for the construction of the HML, SMB, and WML risk factors. For instance, in case of *information technology*, we run industry regressions merely for the time period August 1999 to April 2008. The remaining stocks of the period January 1990 to July 1999 are, however, not neglected, since they are used for pan-European (across the Eurozone, the European Union, and Europe as a whole) portfolios.

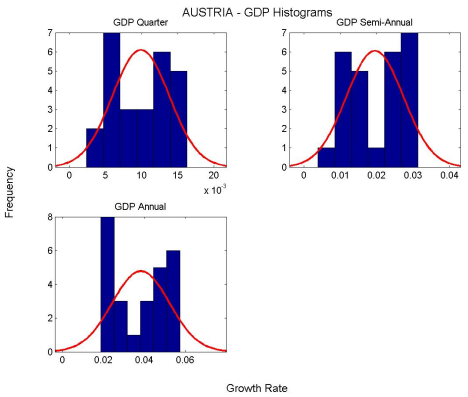
BAS = *basic industries*; CGD = *cyclical consumer goods*; CSER = *cyclical services*; TOLF = *financials*; GN = *general industries*; ITECH = *information technology*; NCGD = *non-cycical consumer goods*; NCSR = *non-cycical services*; RES = *resources*; UTL = *utilities.*

	BAS	CGD	CSER	TOLF	GN	ITECH	NCGD	NCSR	RES	UTL	Total	Industry	Service	Total
1990	41	***81**	***53**	***145**	***126**	22	22	4	12	22	***528**	***326**	***202**	***528**
1991	***42**	**83**	**58**	**155**	**135**	22	24	4	12	23	**558**	**341**	**217**	**558**
1992	**44**	**88**	**58**	**166**	**139**	22	26	4	12	24	**583**	**355**	**228**	**583**
1993	**45**	**95**	**62**	**177**	**147**	23	28	4	14	27	**622**	**379**	**243**	**622**
1994	**46**	**97**	**63**	**178**	**150**	24	31	4	14	27	**634**	**389**	**245**	**634**
1995	**49**	**101**	**67**	**188**	**163**	24	32	4	15	29	**672**	**413**	**259**	**672**
1996	**54**	**105**	**67**	**193**	**171**	26	34	5	17	29	**701**	**436**	**265**	**701**
1997	**55**	**109**	**74**	**200**	**178**	28	36	7	17	30	**734**	**453**	**281**	**734**
1998	**57**	**120**	**84**	**208**	**189**	31	38	8	19	32	**786**	**486**	**300**	**786**
1999	**61**	**133**	**92**	**223**	**202**	***36**	43	10	21	***35**	**856**	**531**	**325**	**856**
2000	**62**	**139**	**99**	**240**	**224**	**46**	***47**	12	23	**39**	**931**	**580**	**351**	**931**
2001	**62**	**143**	**110**	**254**	**237**	**54**	**53**	15	24	**42**	**994**	**615**	**379**	**994**
2002	**63**	**145**	**115**	**262**	**242**	**57**	**54**	15	26	**45**	**1024**	**632**	**392**	**1024**
2003	**64**	**146**	**116**	**268**	**245**	**59**	**56**	16	27	**47**	**1044**	**644**	**400**	**1044**
2004	**65**	**147**	**118**	**274**	**249**	**62**	**56**	17	***28**	**48**	**1064**	**655**	**409**	**1064**
2005	**66**	**149**	**123**	**279**	**252**	**64**	**57**	18	**28**	**50**	**1086**	**666**	**420**	**1086**
2006	**68**	**153**	**130**	**290**	**264**	**64**	**60**	19	**33**	**50**	**1131**	**692**	**439**	**1131**
2007	**74**	**156**	**138**	**309**	**282**	**69**	**63**	20	**41**	**53**	**1205**	**738**	**467**	**1205**
2008	**77**	**159**	**148**	**327**	**306**	**72**	**71**	20	**42**	**58**	**1280**	**785**	**495**	**1280**
Average	59	124	93	228	205	58	57	-	34	47	865	532	332	865

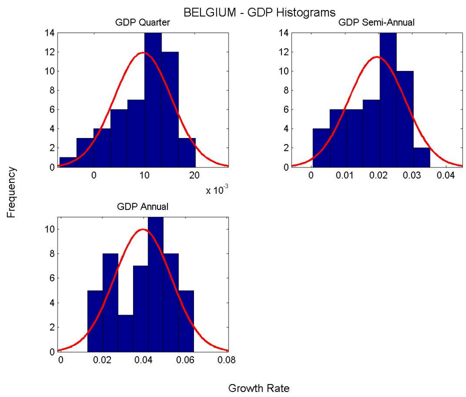
D.2 GDP Growth Rates - Descriptives

Figure D.1: Nominal GDP Growth Rates: Histograms per Country & Eurozone [*Note: Sample periods might differ per country due to data availability constraints (see Figure 3.1 on page 73.)*]

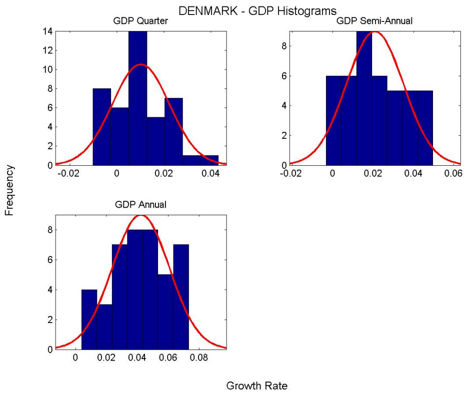
(a) Austria



(b) Belgium



(c) Denmark



(d) Finland

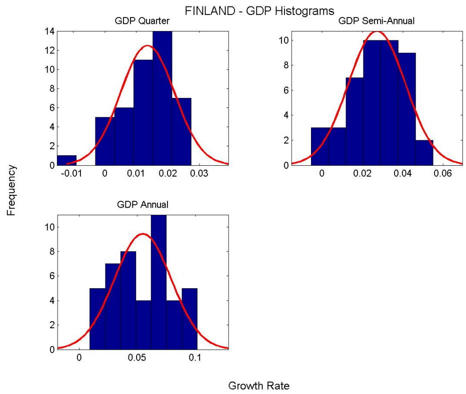
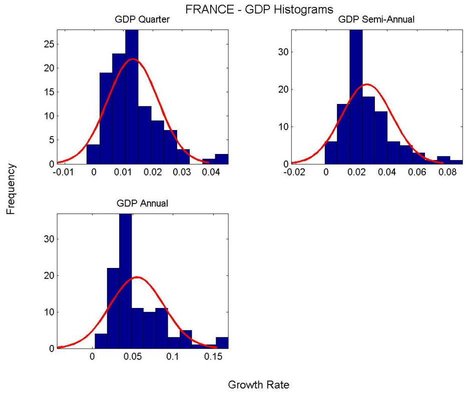
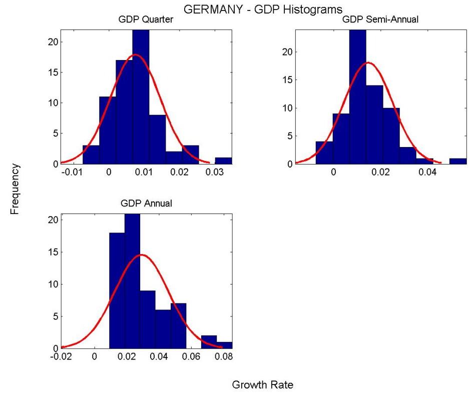


Figure D.1 cont'd: Nominal GDP Growth Rates: Histograms per Country & Eurozone

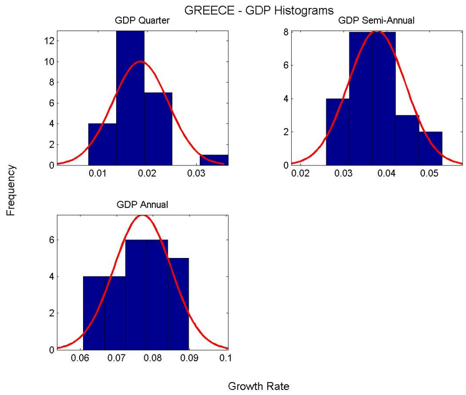
(e) France



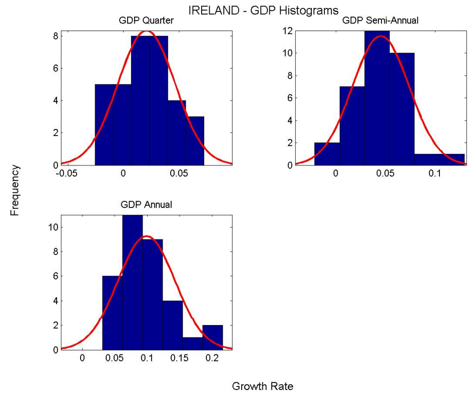
(f) Germany



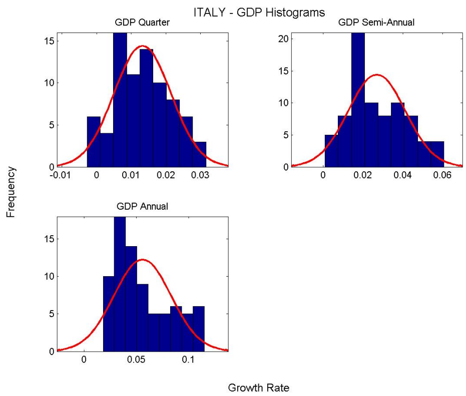
(g) Greece



(h) Ireland



(i) Italy



(j) The Netherlands

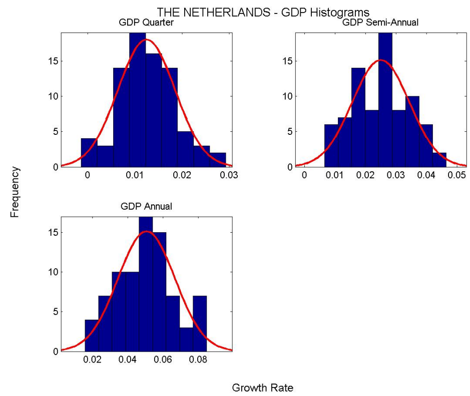
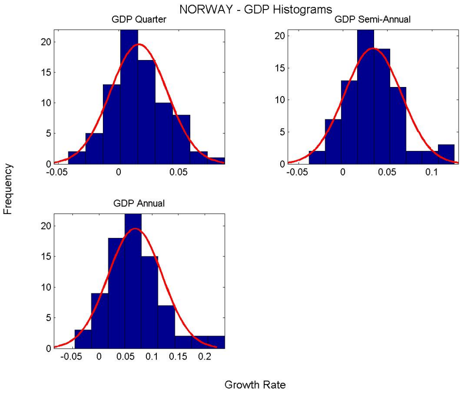
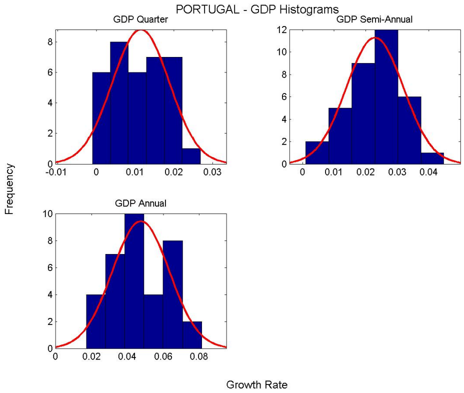


Figure D.1 cont'd: Nominal GDP Growth Rates: Histograms per Country & Eurozone

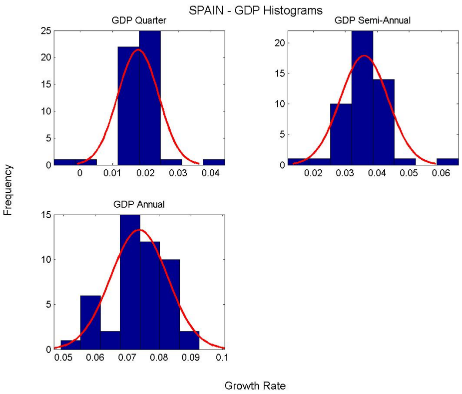
(k) Norway



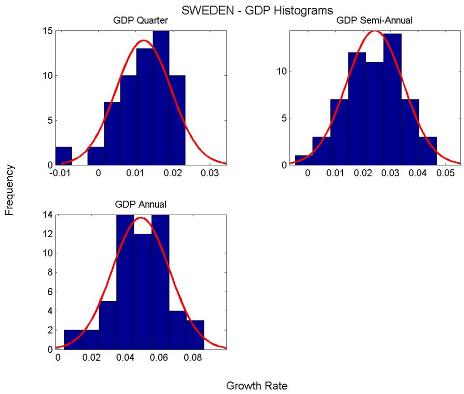
(l) Portugal



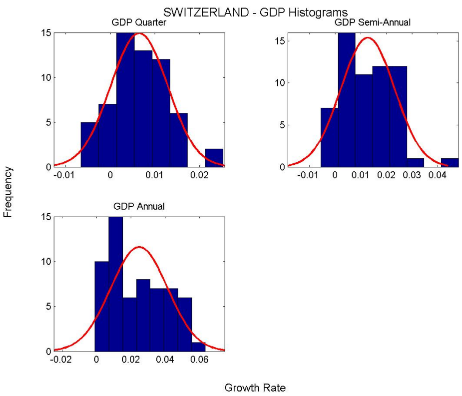
(m) Spain



(n) Sweden



(o) Switzerland



(p) United Kingdom

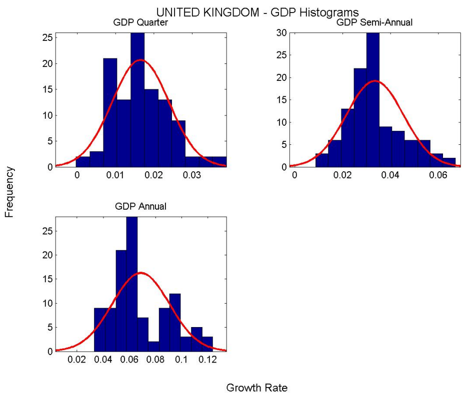


Figure D.1 cont'd: Nominal GDP Growth Rates: Histograms per Country & Eurozone

(q) Eurozone

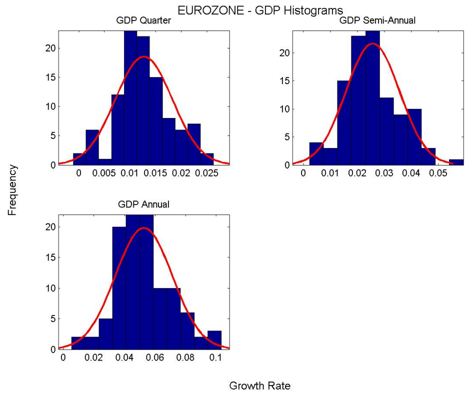
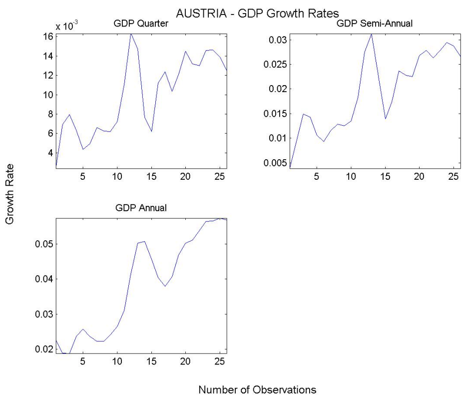


Figure D.2: Nominal GDP Growth Rates: Time Series Plots per Country & Eurozone [*Note: Sample periods might differ per country due to data availability constraints (see Figure 3.1 on page 73.)*]

(a) Austria



(b) Belgium

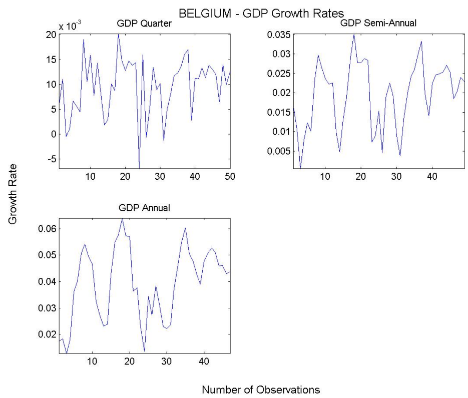
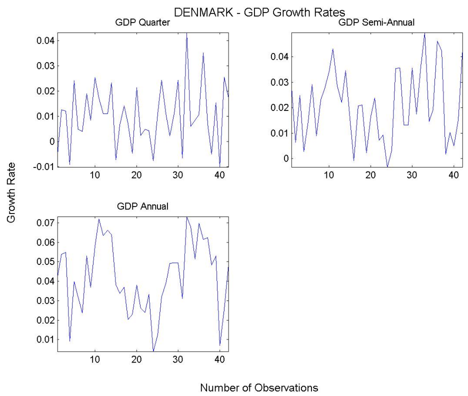
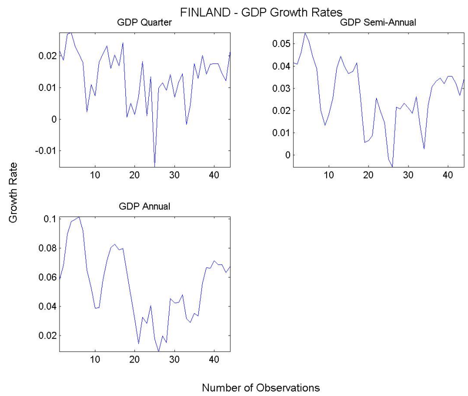


Figure D.2 cont'd: Nominal GDP Growth Rates: Time Series Plots per Country & Eurozone

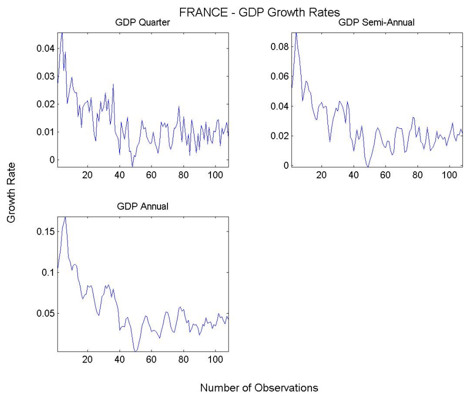
(c) Denmark



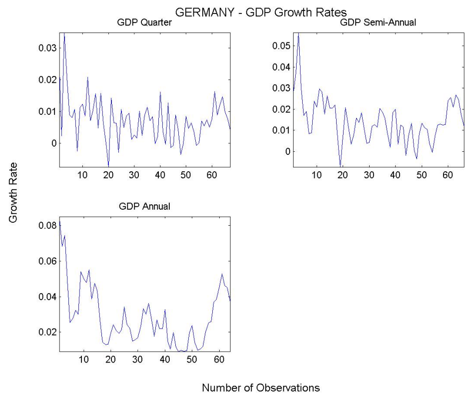
(d) Finland



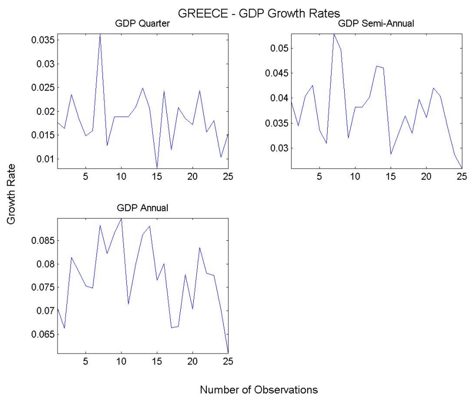
(e) France



(f) Germany



(g) Greece



(h) Ireland

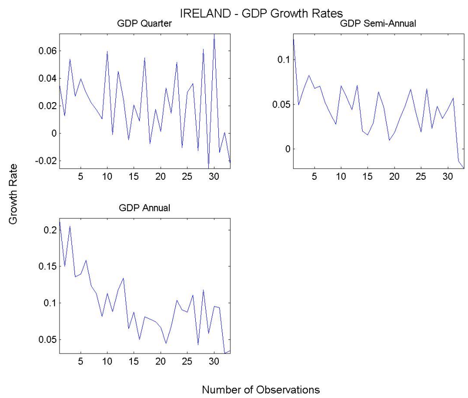
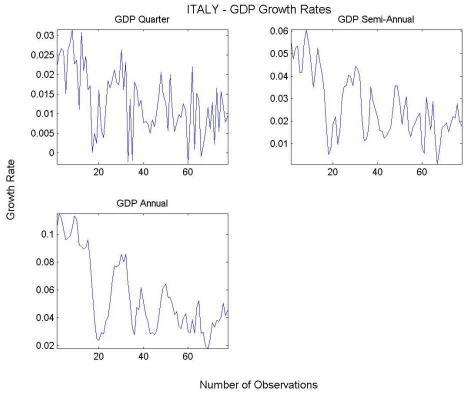
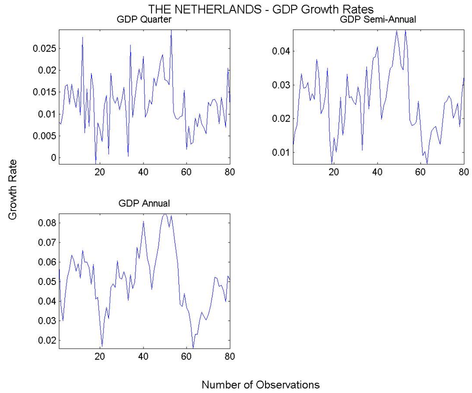


Figure D.2 cont'd: Nominal GDP Growth Rates: Time Series Plots per Country & Eurozone

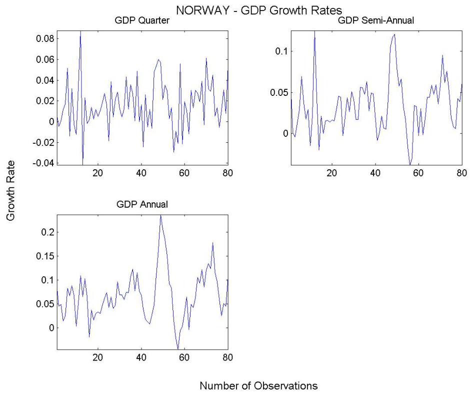
(i) Italy



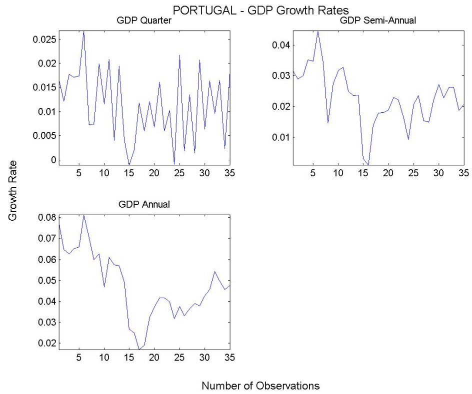
(j) The Netherlands



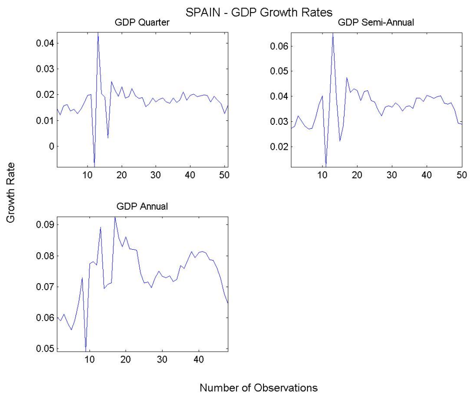
(k) Norway



(l) Portugal



(m) Spain



(n) Sweden

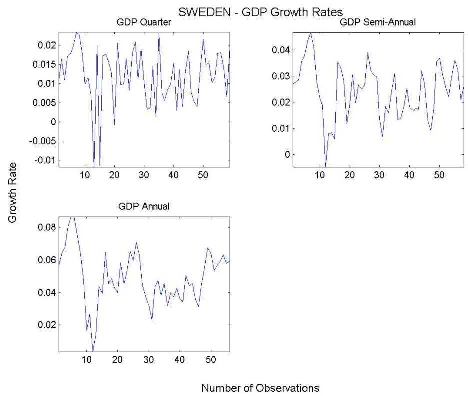
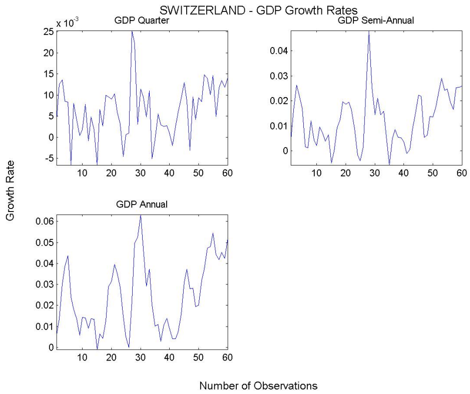
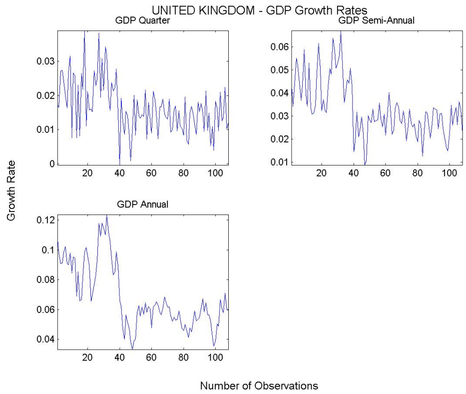


Figure D.2 cont'd: Nominal GDP Growth Rates: Time Series Plots per Country & Eurozone

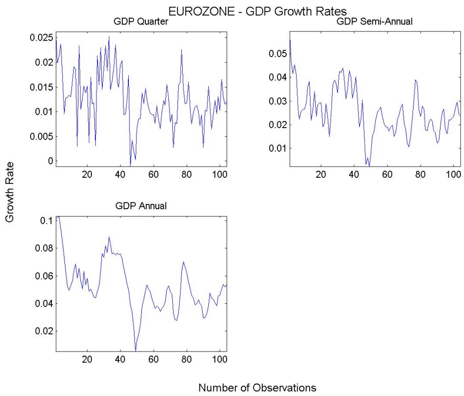
(o) Switzerland



(p) United Kingdom



(q) Eurozone



D.3 Relationship between Equity Returns & Economic Activity - 8 Quarter Lag

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[Tables D.5 to D.22 on the following pages.]

Table D.5: Performance of Risk Factors at Different States of the Economy per Country - 8 Quarter Lag

The results are based on annually rebalanced HML, SMB, and WML portfolios using quarterly observations. HML is the annual return on a portfolio that is long on high book-to-market stocks and short on low book-to-market securities, holding size and momentum characteristics of the portfolio constant. SMB is the annual return on a portfolio that is long on small capitalization stocks and short on big capitalization securities, holding book-to-market and momentum characteristics of the portfolio constant. WML is the annual return on a portfolio that is long on the best performinbg stocks of the past year ('winners') and short on the worst performing securities of the previous year ('losers') holding book-to-market and size characteristics of the portfolio constant. The GDP growth rate is calculated as the continuously compounded rate in a country's Gross Domestic Product, which is seasonally adjusted. We define as 'good states' of the economy those states that exhibit the highest 33.33% future GDP growth rate in the individual countries/the Eurozone. 'Bad states' are those states that exhibit the lowest 33.33% future GDP growth. The remaining third is classified as 'mid state'. The presented Δ depicts the difference between the 'good states' and the 'bad states' of the respective economies. T-values are computed for this difference.

Country	Past year return on factor sorted by future GDP growth														
	HML					SMB					WML				
	Good State (%)	Mid State (%)	Bad State (%)	Δ Go./Bad (%)	T-value	Good State (%)	Mid State (%)	Bad State (%)	Δ Go./Bad (%)	T-value	Good State (%)	Mid State (%)	Bad State (%)	Δ Go./Bad (%)	T-value
Austria	7.16	25.78	16.61	-9.45	-1.58	12.76	27.46	4.70	8.06	1.59	8.58	-2.83	2.31	6.28	2.12
Belgium	8.67	6.14	1.95	6.72	3.55	10.51	8.07	5.38	5.13	2.49	-1.45	2.67	7.52	-8.97	-4.78
Finland	3.89	25.71	61.19	-57.29	-5.33	13.43	30.26	55.79	-42.36	-3.77	4.73	-6.30	-4.34	9.07	5.54
France	2.02	7.78	8.08	-6.06	-3.46	5.65	12.49	3.78	1.88	0.99	4.31	3.36	3.48	0.83	0.73
Germany	9.45	13.52	4.52	4.93	2.25	9.72	13.94	3.50	6.22	2.03	9.97	3.94	2.78	7.19	5.37
Greece	3.95	-3.12	8.09	-4.13	-0.77	-10.10	-4.36	9.25	-19.35	-4.74	-2.13	-4.78	-14.62	12.49	2.82
Ireland	35.30	25.87	39.34	-4.03	-0.53	35.94	-7.98	12.17	23.76	3.01	-11.82	-12.76	-9.87	-1.95	-0.29
Italy	5.95	3.06	1.93	4.02	2.43	4.45	5.70	4.40	0.05	0.03	0.60	3.64	3.43	-2.83	-2.10
Netherlands	0.22	8.97	6.54	-6.32	-3.05	5.37	10.69	-2.14	7.51	3.63	5.97	-2.66	2.37	3.60	2.35
Portugal	36.74	2.44	9.65	27.10	3.77	34.08	-5.76	9.32	24.76	2.92	-16.47	0.27	-2.26	-14.20	-4.85
Spain	3.66	14.90	9.39	-5.73	-2.33	20.50	-1.12	31.27	-10.78	-2.50	-14.26	1.84	1.71	-15.97	-5.26
Denmark	16.41	12.83	22.39	-5.98	-1.71	18.25	10.02	6.17	12.09	3.21	6.99	3.80	-1.64	8.63	3.09
Sweden	3.53	14.75	20.52	-16.99	-3.07	-2.16	10.84	2.51	-4.66	-1.63	3.70	-3.28	-12.38	16.09	5.19
UK	1.80	4.00	10.85	-9.05	-7.44	7.31	6.57	13.81	-6.50	-3.29	1.87	4.00	-2.31	4.17	3.20
Norway	9.83	5.13	0.37	9.46	4.05	5.24	-3.39	11.13	-5.89	-2.55	0.37	3.13	1.91	-1.54	-0.71
Switzerland	29.34	13.69	-2.67	32.01	6.85	22.47	2.19	11.67	10.80	2.56	-11.90	2.77	-4.13	-7.77	-2.43
Eurozone	7.52	6.81	6.95	0.57	0.56	12.44	12.13	5.98	6.45	4.18	2.79	3.62	3.87	-1.08	-0.97

Table D.6: Performance of Risk Factors at Different States of the Economy per Industry - 8 Quarter Lag

The results are based on annually rebalanced HML, SMB, and WML portfolios using quarterly observations. HML is the annual return on a portfolio that is long on high book-to-market stocks and short on low book-to-market securities, holding size and momentum characteristics of the portfolio constant. SMB is the annual return on a portfolio that is long on small capitalization stocks and short on big capitalization securities, holding book-to-market and momentum characteristics of the portfolio constant. WML is the annual return on a portfolio that is long on the best performinbg stocks of the past year ('winners') and short on the worst performing securities of the previous year ('losers') holding book-to-market and size characteristics of the portfolio constant. The GDP growth rate is calculated as the continuously compounded rate in the Eurozone's Gross Domestic Product, which is seasonally adjusted. We define as 'good states' of the economy those states that exhibit the highest 33.33% future GDP growth rate in the individual industries. 'Bad states' are those states that exhibit the lowest 33.33% future GDP growth. The remaining third is classified as 'mid state'. The presented Δ depicts the difference between the 'good states' and the 'bad states' of the respective economies. *T*-values are computed for this difference.

BAS = *basic industries*; CGD = *cyclical consumer goods*; CSER = *cyclical services*; TOLF = *financials*; GN = *general industries*; ITECH = *information technology*; NCGD = *non-cycical consumer goods*; RES = *resources*; UTL = *utilities.*

Industry	Past year return on factor sorted by future GDP growth														
	HML					SMB					WML				
	Good State (%)	Mid State (%)	Bad State (%)	Δ Go./Bad (%)	T-value	Good State (%)	Mid State (%)	Bad State (%)	Δ Go./Bad (%)	T-value	Good State (%)	Mid State (%)	Bad State (%)	Δ Go./Bad (%)	T-value
BAS	3.85	12.91	10.58	-6.73	-3.02	8.11	-1.13	-6.84	14.95	5.40	-1.52	-3.41	0.42	-1.94	-1.09
CGD	8.72	7.15	9.69	-0.97	-0.64	6.40	8.25	-2.71	9.11	4.99	2.14	5.49	4.45	-2.31	-2.15
CSER	11.04	3.31	7.47	3.57	2.05	10.11	20.22	7.37	2.74	1.40	0.80	6.09	-2.62	3.42	2.13
TOLF	5.35	13.18	9.45	-4.10	-2.64	7.82	10.88	4.27	3.55	2.40	3.47	2.36	-1.14	4.61	3.38
GN	13.95	7.40	9.73	4.22	2.63	12.53	16.55	9.47	3.06	1.40	-0.13	-0.44	4.23	-4.35	-1.99
ITECH	41.17	39.84	10.47	30.69	3.26	23.63	23.86	-0.85	24.48	4.62	-15.37	-4.97	-15.78	0.41	0.08
NCGD	19.56	7.31	28.23	-8.67	-2.17	10.47	22.35	-4.15	14.62	2.30	-2.53	20.04	5.63	-8.16	-1.41
RES[a]	38.66	25.34	61.08	-22.42	-0.56	35.75	59.27	158.38	-122.63	-5.27	24.65	36.70	-21.53	46.18	1.02
Utilities	2.45	-0.35	13.02	-10.57	-3.70	15.20	14.93	3.19	12.01	3.38	1.30	1.74	5.00	-3.70	-1.62
Industry	6.95	4.87	8.29	-1.34	-1.05	11.72	12.80	3.67	8.05	4.83	0.65	3.16	3.80	-3.15	-2.52
Service	3.89	9.68	6.07	-2.18	-1.77	6.56	12.87	5.39	1.17	0.82	2.60	2.49	-1.36	3.96	3.30

[a] Results for *Resources* (RES) refer to 4 quarter lag, given small sample size and hence lack of data

Table D.7: Univariate Regressions of GDP Growth Conditional on Past Factor Returns per Country

$$\Delta GDP_{(t,t+4)} = \alpha + \beta FactorRet_{t-4,t} + \varepsilon_{t,t+4}$$

In the regression notation, ΔGDP depicts the GDP growth rate. *FactorRet* refers to MRF, HML, SMB, and WML. MRF is the market risk premium in each country/the Eurozone. The risk free rate is given by the one-month ecu deposit quoted in London. The regressions use annually rebalanced HML, SMB, and WML portfolios. HML is the annual return on a portfolio that is long on high book-to-market stocks and short on low book-to-market securities, holding size and momentum characteristics of the portfolio constant. SMB is the annual return on a portfolio that is long on small capitalization stocks and short on big capitalization securities, holding book-to-market and momentum characteristics of the portfolio constant. WML is the annual return on a portfolio that is long on the best performinbg stocks of the past year ('winners') and short on the worst performing securities of the previous year ('losers') holding book-to-market and size characteristics of the portfolio constant. GDP is calculated as the continously compounded growth rate in each country/the Eurozone. The GDP is seasonally adjusted. T-statistics are corrected for heteroscedasticity and autocorrelation, up to three lags, using the Newey and West (1987) estimator. The adjusted R^2 is corrected for degrees of freedom. *, **, and *** are used as indicators of statistical significance at, respectively, the 10%, 5%, and 1% signicance level.

Country	Slope Coefficients				T-Statistics				Adjusted R^2 (%)			
	MRF	HML	SMB	WML	MRF	HML	SMB	WML	MRF	HML	SMB	WML
Austria	0.044	0.023	0.013	0.002	6.510***	1.703*	0.735	0.070	66.637	11.761	-1.383	-6.214
Belgium	0.015	-0.014	0.031	0.039	1.303	-0.483	1.656*	2.605***	3.828	-0.988	6.089	13.411
Finland	0.030	0.005	0.010	0.063	4.110***	1.667*	1.518	1.476	40.125	-1.598	3.575	3.287
France	0.011	0.009	0.024	-0.005	0.922	0.481	1.370	-0.322	1.491	-0.791	4.620	-1.341
Germany	-0.004	-0.035	-0.014	-0.053	-0.240	-2.929***	-2.015**	-1.398	-1.409	11.906	2.557	5.786
Greece	-0.005	0.008	0.021	-0.015	-1.203	0.988	2.871***	-2.381**	-2.067	-0.194	14.387	8.397
Ireland	0.016	-0.015	0.016	-0.019	0.464	-0.879	1.477	-1.336	-3.326	-1.133	-0.290	-0.122
Italy	-0.007	0.011	0.038	-0.022	-0.454	0.323	1.476	-0.726	-0.891	-1.130	4.389	-0.540
Netherlands	0.036	-0.022	0.016	0.004	3.278***	-1.348	1.258	0.188	19.869	3.401	1.512	-1.342
Portugal	-0.004	0.010	0.010	-0.039	-0.168	1.391	2.255**	-1.982**	-3.775	0.379	2.182	8.176
Spain	0.006	-0.006	0.004	0.001	1.080	-0.701	0.922	0.147	-0.085	-1.279	-0.655	-2.322
Denmark	0.008	-0.030	0.021	-0.006	0.438	-1.997	1.523	-0.428	-1.933	7.408	5.737	-2.832
Sweden	0.014	0.019	-0.019	-0.026	1.409	3.884***	-1.220	-1.725*	7.101	18.128	4.259	9.310
United Kingdom	-0.011	0.024	-0.011	0.017	-0.705	1.393	-1.198	1.739*	-0.341	1.090	-0.024	-0.060
Norway	0.000	0.005	0.037	-0.043	0.001	0.121	0.916	-1.336	-1.429	-1.394	0.348	0.879
Switzerland	-0.005	0.004	0.003	0.014	-0.353	0.403	0.284	1.418	-1.615	-1.437	-1.800	1.717
Eurozone	0.009	0.005	0.063	0.006	0.746	0.232	3.181***	0.238	0.038	-1.354	22.017	-1.297

D.3 Relationship between Equity Returns & Economic Activity - 8 Quarter Lag

Table D.8: Bivariate Regressions of GDP Growth Conditional on Past Factor Returns per Country

$$\Delta GDP_{(t,t+4)} = \alpha + \beta MRF_{t-4,t} + \gamma FactorRet_{t-4,t} + \varepsilon_{t,t+4}$$

In the regression notation, ΔGDP depicts the GDP growth rate. $FactorRet$ refers to HML, SMB, and WML. MRF is the market risk premium in each country/the Eurozone. The risk free rate is given by the one-month ecu deposit quoted in London. The regressions use annually rebalanced HML, SMB, and WML portfolios. HML is the annual return on a portfolio that is long on high book-to-market stocks and short on low book-to-market securities, holding size and momentum characteristics of the portfolio constant. SMB is the annual return on a portfolio that is long on small capitalization stocks and short on big capitalization securities, holding book-to-market and momentum characteristics of the portfolio constant. WML is the annual return on a portfolio that is long on the best performinbg stocks of the past year ('winners') and short on the worst performing securities of the previous year ('losers') holding book-to-market and size characteristics of the portfolio constant. GDP is calculated as the continously compounded growth rate in each country/the Eurozone. The GDP is seasonally adjusted. T-statistics are corrected for heteroscedasticity and autocorrelation, up to three lags, using the Newey and West (1987) estimator. The adjusted R^2 is corrected for degrees of freedom. *, **, and *** are used as indicators of statistical significance at, respectively, the 10%, 5%, and 1% signicance level.

Country	MRF		HML		Adj. R^2
	Slope	T-Statistics	Slope	T-Statistics	(%)
Austria	0.043	6.412***	0.020	3.656***	79.596
Belgium	0.015	1.224	-0.012	-0.428	2.481
Finland	0.039	5.768***	-0.015	-2.736***	47.013
France	0.011	0.946	0.008	0.525	0.592
Germany	0.003	0.222	-0.036	-3.384***	10.567
Greece	-0.010	-1.657*	0.014	1.681*	6.038
Ireland	0.029	0.622	-0.019	-0.930	-2.914
Italy	-0.013	-0.782	0.022	0.713	-1.272
Netherlands	0.035	3.145***	-0.017	-1.393	21.628
Portugal	-0.010	-0.468	0.012	2.393**	-2.327
Spain	0.005	0.852	-0.004	-0.468	-1.987
Denmark	0.013	0.815	-0.034	-2.285**	7.692
Sweden	0.005	0.601	0.017	2.651***	17.271
United Kingdom	-0.012	-0.808	0.026	1.520	1.131
Norway	-0.003	-0.084	0.007	0.164	-2.849
Switzerland	-0.007	-0.511	0.005	0.567	-2.694
Eurozone	0.009	0.758	0.007	0.328	-1.270

Country	MRF		SMB		Adj. R^2
	Slope	T-Statistics	Slope	T-Statistics	(%)
Austria	0.044	6.652***	0.014	1.922*	70.119
Belgium	0.009	0.704	0.024	1.112	5.722
Finland	0.042	7.068***	-0.015	-3.035***	46.192
France	0.009	0.819	0.022	1.352	5.305
Germany	-0.002	-0.141	-0.014	-1.957*	0.953
Greece	-0.011	-2.715***	0.030	6.114***	27.467
Ireland	0.006	0.174	0.015	1.273	-4.542
Italy	-0.006	-0.378	0.037	1.453	3.324
Netherlands	0.035	3.243***	0.010	1.011	19.926
Portugal	-0.008	-0.413	0.011	3.774***	-0.744
Spain	0.004	0.433	0.002	0.238	-2.272
Denmark	-0.001	-0.046	0.021	1.672*	2.706
Sweden	0.012	1.415	-0.014	-1.192	8.831
United Kingdom	-0.009	-0.570	-0.010	-1.024	-0.765
Norway	0.006	0.240	0.039	1.041	-0.979
Switzerland	-0.007	-0.539	0.004	0.493	-3.151
Eurozone	-0.003	-0.240	0.065	3.085***	21.019

Country	MRF		WML		Adj. R^2
	Slope	T-Statistics	Slope	T-Statistics	(%)
Austria	0.045	6.656***	-0.014	-1.953*	66.393
Belgium	0.005	0.408	0.035	1.986**	11.881
Finland	0.029	3.888***	0.016	0.395	38.684
France	0.012	0.983	-0.009	-0.689	0.369
Germany	0.000	0.022	-0.054	-1.505	4.135
Greece	-0.005	-1.070	-0.016	-2.630***	7.133
Ireland	0.018	0.613	-0.020	-1.272	-3.396
Italy	-0.006	-0.355	-0.020	-0.610	-1.665
Netherlands	0.037	3.282***	-0.007	-0.310	18.970
Portugal	-0.017	-0.816	-0.048	-2.405**	8.476
Spain	0.007	1.060	0.004	0.461	-1.907
Denmark	0.007	0.404	-0.003	-0.245	-5.148
Sweden	0.009	1.126	-0.019	-1.375	10.421
United Kingdom	-0.010	-0.682	0.016	1.764*	-0.484
Norway	0.008	0.300	-0.046	-1.666*	-0.375
Switzerland	-0.001	-0.102	0.014	1.300	-0.253
Eurozone	0.009	0.725	0.005	0.186	-1.341

Table D.9: Multiple Regressions of GDP Growth Conditional on Past Fama and French (1993) Factor Returns per Country

$$\Delta GDP_{(t,t+4)} = \alpha + \beta^{MRF} MRF_{t-4,t} + \beta^{HML} HML_{t-4,t} + \beta^{SMB} SMB_{t-4,t} + \varepsilon_{t,t+4}$$

In the regression notation, ΔGDP depicts the GDP growth rate. MRF is the market risk premium in each country/the Eurozone. The risk free rate is given by the one-month ecu deposit quoted in London. The regressions use annually rebalanced HML, and SMB portfolios. HML is the annual return on a portfolio that is long on high book-to-market stocks and short on low book-to-market securities, holding size and momentum characteristics of the portfolio constant. SMB is the annual return on a portfolio that is long on small capitalization stocks and short on big capitalization securities, holding book-to-market and momentum characteristics of the portfolio constant. GDP is calculated as the continously compounded growth rate in each country/the Eurozone. The GDP is seasonally adjusted. T-statistics are corrected for heteroscedasticity and autocorrelation, up to three lags, using the Newey and West (1987) estimator. The adjusted R^2 is corrected for degrees of freedom. *, **, and *** are used as indicators of statistical significance at, respectively, the 10%, 5%, and 1% signicance level.

Country	MRF		HML		SMB		Adj. R^2
	Slope	T-Statistics	Slope	T-Statistics	Slope	T-Statistics	(%)
Austria	0.042	6.322***	0.024	3.844***	-0.006	-0.873	78.668
Belgium	0.009	0.728	0.000	0.003	0.024	1.147	3.365
Finland	0.040	7.122***	-0.011	-0.519	-0.004	-0.188	45.476
France	0.009	0.824	0.003	0.202	0.022	1.261	3.982
Germany	0.004	0.253	-0.041	-2.324**	0.005	0.448	9.278
Greece	-0.012	-2.781***	0.001	0.129	0.029	2.814***	22.368
Ireland	0.019	0.447	-0.038	-2.054**	0.035	2.190***	5.040
Italy	-0.012	-0.807	0.024	0.795	0.037	1.573	3.156
Netherlands	0.033	3.068***	-0.020	-1.742*	0.014	1.360	22.776
Portugal	-0.007	-0.373	-0.005	-0.246	0.015	0.914	-4.975
Spain	0.004	0.411	-0.004	-0.474	0.001	0.176	-4.412
Denmark	0.005	0.359	-0.030	-2.074**	0.017	1.386	9.692
Sweden	0.005	0.604	0.015	2.168**	-0.006	-0.522	16.240
United Kingdom	-0.010	-0.654	0.029	1.659*	-0.013	-1.205	1.380
Norway	-0.001	-0.037	0.025	0.639	0.046	1.294	-1.953
Switzerland	-0.008	-0.634	0.005	0.485	0.003	0.369	-4.561
Eurozone	-0.003	-0.219	0.008	0.304	0.065	3.093***	23.394

Table D.10: Multiple Regressions of GDP Growth Conditional on Past Carhart (1997) Factor Returns per Country

$$\Delta GDP_{(t,t+4)} = \alpha + \beta^{MRF} MRF_{t-4,t} + \beta^{HML} HML_{t-4,t} + \beta^{SMB} SMB_{t-4,t} + \beta^{WML} WML_{t-4,t} \varepsilon_{t,t+4}$$

In the regression notation, ΔGDP depicts the GDP growth rate. MRF is the market risk premium in each country/the Eurozone. The risk free rate is given by the one-month ecu deposit quoted in London. The regressions use annually rebalanced HML, SMB, and WML portfolios. HML is the annual return on a portfolio that is long on high book-to-market stocks and short on low book-to-market securities, holding size and momentum characteristics of the portfolio constant. SMB is the annual return on a portfolio that is long on small capitalization stocks and short on big capitalization securities, holding book-to-market and momentum characteristics of the portfolio constant. WML is the annual return on a portfolio that is long on the best performinbg stocks of the past year ('winners') and short on the worst performing securities of the previous year ('losers') holding book-to-market and size characteristics of the portfolio constant. GDP is calculated as the continously compounded growth rate in each country/the Eurozone. The GDP is seasonally adjusted. T-statistics are corrected for heteroscedasticity and autocorrelation, up to three lags, using the Newey and West (1987) estimator. The adjusted R^2 is corrected for degrees of freedom. *, **, and *** are used as indicators of statistical significance at, respectively, the 10%, 5%, and 1% signicance level.

Country	MRF		HML		SMB		WML		Adj. R^2
	Slope	T-Statistics	Slope	T-Statistics	Slope	T-Statistics	Slope	T-Statistics	(%)
Austria	0.040	6.133***	0.028	3.612***	-0.003	-0.594	0.019	1.180	79.159
Belgium	0.000	0.013	0.014	0.527	0.022	1.281	0.036	2.376**	10.328
Finland	0.040	8.186***	-0.011	-0.495	-0.004	-0.188	0.002	0.055	43.726
France	0.009	0.882	0.002	0.154	0.021	1.251	-0.003	-0.175	2.573
Germany	0.007	0.601	-0.038	-2.296**	0.003	0.308	-0.050	-1.554	14.052
Greece	-0.011	-2.516**	0.001	0.113	0.027	2.211**	-0.002	-0.557	16.683
Ireland	0.030	0.698	-0.041	-1.838*	0.025	1.484	-0.022	-1.142	4.453
Italy	-0.009	-0.649	0.026	0.906	0.043	1.741*	-0.036	-1.213	4.036
Netherlands	0.034	3.516***	-0.027	-2.413**	0.016	1.544	-0.020	-0.949	23.837
Portugal	-0.014	-0.736	-0.029	-0.875	0.021	0.956	-0.058	-1.448	3.964
Spain	0.005	0.455	-0.005	-0.631	0.003	0.310	0.006	0.790	-5.722
Denmark	0.006	0.383	-0.030	-2.090**	0.018	1.254	0.004	0.310	6.713
Sweden	0.005	0.623	0.022	1.631	-0.006	-0.452	0.014	0.663	15.432
United Kingdom	-0.011	-0.696	0.030	1.695*	-0.008	-0.656	0.013	0.996	0.514
Norway	0.011	0.407	0.004	0.100	0.035	0.982	-0.041	-1.363	-1.881
Switzerland	-0.010	-0.862	0.009	0.873	0.020	1.642	0.034	2.192**	4.790
Eurozone	-0.006	-0.452	0.015	0.610	0.076	3.826***	0.042	1.941*	23.60

Table D.11: Univariate Regressions of GDP Growth Conditional on Past Factor Returns per Industry

$$\Delta GDP_{(t,t+4)} = \alpha + \beta FactorRet_{t-4,t} + \varepsilon_{t,t+4}$$

In the regression notation, ΔGDP depicts the GDP growth rate. *FactorRet* refers to MRF, HML, SMB, and WML. MRF is the market risk premium in each industry. The risk free rate is given by the one-month ecu deposit quoted in London. The regressions use annually rebalanced HML, SMB, and WML portfolios. HML is the annual return on a portfolio that is long on high book-to-market stocks and short on low book-to-market securities, holding size and momentum characteristics of the portfolio constant. SMB is the annual return on a portfolio that is long on small capitalization stocks and short on big capitalization securities, holding book-to-market and momentum characteristics of the portfolio constant. WML is the annual return on a portfolio that is long on the best performinbg stocks of the past year ('winners') and short on the worst performing securities of the previous year ('losers') holding book-to-market and size characteristics of the portfolio constant. GDP is calculated as the continously compounded growth rate in each industry. The GDP is seasonally adjusted. T-statistics are corrected for heteroscedasticity and autocorrelation, up to three lags, using the Newey and West (1987) estimator. The adjusted R^2 is corrected for degrees of freedom. *, **, and *** are used as indicators of statistical significance at, respectively, the 10%, 5%, and 1% signicance level.

Country	Slope Coefficients				T-Statistics				Adjusted R^2 (%)			
	MRF	HML	SMB	WML	MRF	HML	SMB	WML	MRF	HML	SMB	WML
Basic Industries	0.013	0.009	0.003	0.008	1.950*	0.838	0.168	0.745	4.792	0.413	-1.430	-0.653
Cyclical Consumer Goods	0.008	-0.007	0.032	0.014	0.760	-0.529	1.756*	0.545	0.076	-1.099	7.783	-0.845
Cyclical Services	0.019	0.015	0.000	0.020	2.198**	0.658	0.039	1.443	7.038	0.605	-1.490	1.725
Financials	0.008	0.005	0.039	-0.016	0.760	0.373	2.329**	-1.361	0.076	-1.243	7.271	-0.123
General Industries	0.008	0.048	0.029	-0.008	0.760	2.535**	2.256**	-0.878	0.076	14.552	9.266	-0.512
Information Technology	0.019	0.001	0.010	-0.007	3.407***	0.172	1.821*	-0.717	39.380	-4.245	4.681	-0.547
Non-Cyclical Consumer Goods	0.017	-0.022	0.006	0.001	3.200***	-2.733***	1.740*	0.220	35.699	29.311	0.580	-4.350
Resources	-0.014	-0.003	-0.009	0.006	-0.626	-0.599	-22.909***	1.979**	-15.422	-15.154	92.114	12.479
Utilities	0.020	-0.020	0.010	-0.031	3.290***	-2.231**	1.233	-2.372**	31.082	5.635	-0.230	12.010
Industry	0.008	0.020	0.040	0.000	0.760	0.896	2.054**	0.012	0.076	0.338	10.357	-1.428
Service	0.008	0.029	0.029	-0.003	0.760	1.360	1.643	-0.231	0.076	1.936	3.156	-1.390

D.3 Relationship between Equity Returns & Economic Activity - 8 Quarter Lag

Table D.12: Bivariate Regressions of GDP Growth Conditional on Past Factor Returns per Industry

$$\Delta GDP_{(t,t+4)} = \alpha + \beta MRF_{t-4,t} + \gamma FactorRet_{t-4,t} + \varepsilon_{t,t+4}$$

In the regression notation, ΔGDP depicts the GDP growth rate. $FactorRet$ refers to HML, SMB, and WML. MRF is the market risk premium in each industry. The risk free rate is given by the one-month ecu deposit quoted in London. The regressions use annually rebalanced HML, SMB, and WML portfolios. HML is the annual return on a portfolio that is long on high book-to-market stocks and short on low book-to-market securities, holding size and momentum characteristics of the portfolio constant. SMB is the annual return on a portfolio that is long on small capitalization stocks and short on big capitalization securities, holding book-to-market and momentum characteristics of the portfolio constant. WML is the annual return on a portfolio that is long on the best performinbg stocks of the past year ('winners') and short on the worst performing securities of the previous year ('losers') holding book-to-market and size characteristics of the portfolio constant. GDP is calculated as the continously compounded growth rate in each industry. The GDP is seasonally adjusted. T-statistics are corrected for heteroscedasticity and autocorrelation, up to three lags, using the Newey and West (1987) estimator. The adjusted R^2 is corrected for degrees of freedom. *, **, and *** are used as indicators of statistical significance at, respectively, the 10%, 5%, and 1% signicance level.

Sector	MRF		HML		Adj. R^2
	Slope	T-Statistics	Slope	T-Statistics	(%)
Basic Industries	0.012	1.658*	0.005	0.423	3.696
Cyclical Consumer Goods	0.010	0.860	-0.010	-0.824	-0.680
Cyclical Services	0.018	2.296**	0.010	0.492	6.695
Financials	0.008	0.708	0.004	0.248	-1.281
General Industries	0.004	0.396	0.047	2.434**	13.685
Information Technology	0.022	3.927***	-0.005	-2.137**	43.425
Non-Cyclical Consumer Goods	0.012	1.739*	-0.011	-1.214	38.563
Resources	-0.010	-0.515	-0.002	-0.463	-41.465
Utilities	0.018	3.177***	-0.013	-2.249**	32.210
Industry	0.009	0.820	0.022	1.003	0.732
Service	0.007	0.654	0.027	1.218	1.635

Sector	MRF		SMB		Adj. R^2
	Slope	T-Statistics	Slope	T-Statistics	(%)
Basic Industries	0.013	2.009**	-0.002	-0.111	3.303
Cyclical Consumer Goods	0.004	0.366	0.030	1.593	6.811
Cyclical Services	0.020	2.191**	-0.007	-0.611	6.187
Financials	0.006	0.599	0.037	2.201**	6.760
General Industries	0.003	0.240	0.028	2.042**	8.095
Information Technology	0.025	3.209***	-0.009	-1.725*	40.986
Non-Cyclical Consumer Goods	0.017	2.990***	0.000	0.155	32.674
Resources	-0.006	-2.307**	-0.009	-21.894***	91.327
Utilities	0.019	3.249***	0.006	0.980	29.608
Industry	-0.002	-0.137	0.041	1.780*	9.112
Service	0.007	0.684	0.028	1.497	2.891

Sector	MRF		WML		Adj. R^2
	Slope	T-Statistics	Slope	T-Statistics	(%)
Basic Industries	0.017	2.892***	0.019	1.770*	7.565
Cyclical Consumer Goods	0.008	0.693	0.009	0.393	-1.108
Cyclical Services	0.018	2.103**	0.018	1.466	8.292
Financials	0.009	0.835	-0.017	-1.520	0.096
General Industries	0.008	0.744	-0.008	-0.868	-0.538
Information Technology	0.019	3.764***	-0.002	-0.313	37.136
Non-Cyclical Consumer Goods	0.017	3.045	0.000	0.010	32.638
Resources	0.005	0.312	0.006	1.665*	-8.917
Utilities	0.018	3.568***	-0.026	-2.723***	39.703
Industry	0.008	0.759	0.000	0.016	-1.372
Service	0.009	0.780	-0.004	-0.344	-1.300

Table D.13: Multiple Regressions of GDP Growth Conditional on Past Fama and French (1993) Factor Returns per Industry

$$\Delta GDP_{growth(t,t+4)} = \alpha + \beta^{MRF} MRF_{t-4,t} + \beta^{HML} HML_{t-4,t} + \beta^{SMB} SMB_{t-4,t} + \varepsilon_{t,t+4}$$

In the regression notation, ΔGDP depicts the GDP growth rate. MRF is the market risk premium in each industry. The risk free rate is given by the one-month ecu deposit quoted in London. The regressions use annually rebalanced HML, and SMB portfolios. HML is the annual return on a portfolio that is long on high book-to-market stocks and short on low book-to-market securities, holding size and momentum characteristics of the portfolio constant. SMB is the annual return on a portfolio that is long on small capitalization stocks and short on big capitalization securities, holding book-to-market and momentum characteristics of the portfolio constant. GDP is calculated as the continously compounded growth rate in each industry. The GDP is seasonally adjusted. T-statistics are corrected for heteroscedasticity and autocorrelation, up to three lags, using the Newey and West (1987) estimator. The adjusted R^2 is corrected for degrees of freedom. *, **, and *** are used as indicators of statistical significance at, respectively, the 10%, 5%, and 1% signicance level.

BAS = *basic industries*; CGD = *cyclical consumer goods*; CSER = *cyclical services*; TOLF = *financials*; GN = *general industries*; ITECH = *information technology*; NCGD = *non-cycical consumer goods*; RES = *resources*; UTL = *utilities.*

Sector	MRF		HML		SMB		Adj. R^2
	Slope	T-Statistics	Slope	T-Statistics	Slope	T-Statistics	(%)
BAS	0.012	1.579	0.005	0.483	-0.002	-0.141	2.211
CGD	0.006	0.505	-0.016	-1.246	0.032	1.666*	7.022
CSER	0.019	2.181**	0.012	0.558	-0.009	-0.728	6.185
TOLF	0.006	0.585	-0.001	-0.090	0.037	2.184**	5.401
GN	-0.003	-0.269	0.052	2.674***	0.032	2.471**	24.992
ITECH	0.023	2.799***	-0.004	-0.969	-0.002	-0.237	40.885
NCGD	0.012	1.700*	-0.011	-1.196	0.000	-0.039	35.493
RES	-0.006	-2.281**	0.000	-0.079	-0.009	-22.929***	88.438
UTL	0.018	3.183***	-0.020	-1.440	-0.006	-0.459	29.691
Industry	-0.001	-0.064	0.020	0.933	0.040	1.788*	9.590
Service	0.007	0.627	0.017	0.697	0.022	1.064	2.547

D.3 Relationship between Equity Returns & Economic Activity - 8 Quarter Lag

Table D.14: Multiple Regressions of GDP Growth Conditional on Past Carhart (1997) Factor Returns per Industry

$$\Delta GDP_{(t,t+4)} = \alpha + \beta^{MRF} MRF_{t-4,t} + \beta^{HML} HML_{t-4,t} + \beta^{SMB} SMB_{t-4,t} + \beta^{WML} WML_{t-4,t} \varepsilon_{t,t+4}$$

In the regression notation, ΔGDP depicts the GDP growth rate. MRF is the market risk premium in industry. The risk free rate is given by the one-month ecu deposit quoted in London. The regressions use annually rebalanced HML, SMB, and WML portfolios. HML is the annual return on a portfolio that is long on high book-to-market stocks and short on low book-to-market securities, holding size and momentum characteristics of the portfolio constant. SMB is the annual return on a portfolio that is long on small capitalization stocks and short on big capitalization securities, holding book-to-market and momentum characteristics of the portfolio constant. WML is the annual return on a portfolio that is long on the best performinbg stocks of the past year ('winners') and short on the worst performing securities of the previous year ('losers') holding book-to-market and size characteristics of the portfolio constant. GDP is calculated as the continously compounded growth rate in each industry. The GDP is seasonally adjusted. T-statistics are corrected for heteroscedasticity and autocorrelation, up to three lags, using the Newey and West (1987) estimator. The adjusted R^2 is corrected for degrees of freedom. *, **, and *** are used as indicators of statistical significance at, respectively, the 10%, 5%, and 1% signicance level.

Sector	MRF		HML		SMB		WML		Adj. R^2
	Slope	T-Statistics	Slope	T-Statistics	Slope	T-Statistics	Slope	T-Statistics	(%)
Basic Industries	0.016	2.008**	0.009	0.930	0.001	0.062	0.023	2.006**	6.351
Cyclical Consumer Goods	0.004	0.326	-0.012	-0.969	0.034	1.763*	0.016	0.715	6.301
Cyclical Services	0.017	1.890*	0.016	0.674	-0.005	-0.410	0.021	1.459	7.886
Financials	0.007	0.621	-0.004	-0.234	0.036	2.091**	-0.007	-0.519	4.177
General Industries	-0.005	-0.422	0.051	2.534**	0.044	2.095**	0.017	1.021	26.036
Information Technology	0.024	3.287***	-0.004	-1.061	-0.004	-0.418	0.001	0.189	37.982
Non-Cyclical Consumer Goods	0.012	1.682*	-0.012	-1.280	0.000	-0.129	-0.001	-0.245	32.315
Resources	-0.003	-0.878	0.003	1.229	-0.008	-9.049***	0.004	1.286	85.084
Utilities	0.017	3.297***	-0.020	-1.183	-0.003	-0.230	-0.028	-2.694***	41.163
Industry	-0.004	-0.279	0.025	1.086	0.054	2.226**	0.034	1.187	12.274
Service	0.006	0.535	0.023	0.799	0.025	1.199	0.015	0.838	1.849

Table D.15: Univariate Regressions of GDP Growth Conditional on Past Factor Returns per Country - 8 Quarter Lag

$$\Delta GDP_{(t,t+4)} = \alpha + \beta FactorRet_{t-8,t-4} + \varepsilon_{t,t+4}$$

In the regression notation, ΔGDP depicts the GDP growth rate. *FactorRet* refers to MRF, HML, SMB, and WML. MRF is the market risk premium in each country/the Eurozone. The risk free rate is given by the one-month ecu deposit quoted in London. The regressions use annually rebalanced HML, SMB, and WML portfolios. HML is the annual return on a portfolio that is long on high book-to-market stocks and short on low book-to-market securities, holding size and momentum characteristics of the portfolio constant. SMB is the annual return on a portfolio that is long on small capitalization stocks and short on big capitalization securities, holding book-to-market and momentum characteristics of the portfolio constant. WML is the annual return on a portfolio that is long on the best performing stocks of the past year ('winners') and short on the worst performing securities of the previous year ('losers') holding book-to-market and size characteristics of the portfolio constant. GDP is calculated as the continuously compounded growth rate in each country/the Eurozone. The GDP is seasonally adjusted. T-statistics are corrected for heteroscedasticity and autocorrelation, up to three lags, using the Newey and West (1987) estimator. The adjusted R^2 is corrected for degrees of freedom. *, **, and *** are used as indicators of statistical significance at, respectively, the 10%, 5%, and 1% significance level.

Country	Slope Coefficients				T-Statistics				Adjusted R^2 (%)			
	MRF	HML	SMB	WML	MRF	HML	SMB	WML	MRF	HML	SMB	WML
Austria	0.028	-0.003	0.016	0.021	1.930*	-0.327	0.947	1.166	23.069	-7.937	3.417	-1.489
Belgium	0.012	0.020	0.021	-0.026	0.886	1.124	1.088	-2.051**	1.407	0.926	1.968	3.076
Finland	0.006	-0.011	-0.006	0.095	0.519	-2.149**	-1.260	2.301**	-0.625	6.722	-0.111	14.445
France	0.005	-0.017	0.005	0.016	0.444	-1.942*	0.346	0.906	-0.647	2.549	-1.071	-0.116
Germany	0.014	0.006	0.003	0.069	1.086	0.627	0.408	2.077**	2.139	-1.303	-1.531	17.440
Greece	-0.014	-0.004	-0.031	0.018	-4.227***	-0.676	-3.050***	2.451**	16.216	-7.061	31.283	7.124
Ireland	0.015	-0.003	0.020	0.007	0.512	-0.261	0.982	0.284	-4.064	-4.762	4.184	-4.256
Italy	0.013	0.014	0.001	-0.029	0.901	0.543	0.024	-0.942	0.509	-0.897	-1.537	0.312
Netherlands	0.042	-0.022	0.011	0.019	4.372***	-1.153	0.600	0.881	28.069	3.426	-0.259	0.595
Portugal	0.011	0.010	0.008	-0.027	0.907	2.157**	2.507**	-2.236**	-0.909	4.066	2.278	5.405
Spain	0.008	-0.013	-0.001	-0.008	1.263	-1.349	-0.080	-0.797	3.231	3.366	-2.322	0.606
Denmark	0.013	-0.012	0.020	0.031	1.140	-0.650	1.058	2.008**	0.247	-1.882	1.590	3.004
Sweden	-0.004	-0.013	-0.009	0.031	-0.473	-2.164**	-0.577	2.678***	-1.108	7.066	-0.656	14.426
United Kingdom	-0.011	-0.032	-0.007	0.006	-0.817	-2.766***	-0.726	0.618	0.703	6.240	-0.631	-1.144
Norway	0.006	0.059	-0.025	0.008	0.276	1.740*	-0.471	0.165	-1.416	2.942	-0.706	-1.448
Switzerland	0.022	0.019	0.015	-0.010	1.513	2.485**	1.420	-0.705	6.572	11.693	4.572	-0.209
Eurozone	0.013	0.016	0.015	0.001	1.038	0.804	1.156	0.068	2.672	-0.593	0.308	-1.512

D.3 Relationship between Equity Returns & Economic Activity - 8 Quarter Lag

Table D.16: Bivariate Regressions of GDP Growth Conditional on Past Factor Returns per Country - 8 Quarter Lag

$$\Delta GDP_{(t,t+4)} = \alpha + \beta MRF_{t-8,t-4} + \gamma FactorRet_{t-8,t-4} + \varepsilon_{t,t+4}$$

In the regression notation, ΔGDP depicts the GDP growth rate. $FactorRet$ refers to HML, SMB, and WML. MRF is the market risk premium in each country/the Eurozone. The risk free rate is given by the one-month ecu deposit quoted in London. The regressions use annually rebalanced HML, SMB, and WML portfolios. HML is the annual return on a portfolio that is long on high book-to-market stocks and short on low book-to-market securities, holding size and momentum characteristics of the portfolio constant. SMB is the annual return on a portfolio that is long on small capitalization stocks and short on big capitalization securities, holding book-to-market and momentum characteristics of the portfolio constant. WML is the annual return on a portfolio that is long on the best performinbg stocks of the past year ('winners') and short on the worst performing securities of the previous year ('losers') holding book-to-market and size characteristics of the portfolio constant. GDP is calculated as the continously compounded growth rate in each country/the Eurozone. The GDP is seasonally adjusted. T-statistics are corrected for heteroscedasticity and autocorrelation, up to three lags, using the Newey and West (1987) estimator. The adjusted R^2 is corrected for degrees of freedom. *, **, and *** are used as indicators of statistical significance at, respectively, the 10%, 5%, and 1% signicance level.

Country	MRF		HML		Adj. R^2
	Slope	T-Statistics	Slope	T-Statistics	(%)
Austria	0.036	2.870***	-0.015	-4.548***	28.513
Belgium	0.013	0.922	0.022	1.311	2.855
Finland	0.018	1.676*	-0.020	-2.927***	21.093
France	0.005	0.519	-0.018	-1.969**	2.165
Germany	0.014	1.000	0.000	0.012	0.422
Greece	-0.015	-2.875***	0.004	0.456	9.553
Ireland	0.026	0.818	-0.010	-0.692	-8.053
Italy	0.012	0.923	0.003	0.127	-1.021
Netherlands	0.041	4.310***	-0.016	-1.120	29.692
Portugal	0.007	0.652	0.009	2.485**	0.489
Spain	0.007	1.035	-0.011	-1.123	4.868
Denmark	0.017	1.332	-0.018	-1.000	0.059
Sweden	0.004	0.472	-0.015	-2.465**	5.810
United Kingdom	-0.009	-0.687	-0.030	-2.449**	6.290
Norway	-0.021	-0.874	0.076	2.173**	2.370
Switzerland	0.014	0.940	0.016	1.841*	13.220
Eurozone	0.013	1.081	0.019	0.842	5.291

Country	MRF		SMB		Adj. R^2
	Slope	T-Statistics	Slope	T-Statistics	(%)
Austria	0.025	1.782*	0.005	0.351	17.168
Belgium	0.021	1.675*	-0.041	-3.877***	10.573
Finland	0.021	1.378	-0.018	-2.191**	13.055
France	0.004	0.415	0.005	0.312	-1.852
Germany	0.005	0.398	0.066	1.939*	16.521
Greece	-0.006	-1.516	-0.025	-2.384**	28.854
Ireland	-0.014	-0.377	0.023	1.005	-0.237
Italy	0.013	0.884	0.003	0.103	-1.008
Netherlands	0.042	4.185***	0.005	0.319	27.215
Portugal	0.008	0.795	0.007	3.233***	-0.645
Spain	0.013	1.618	-0.008	-0.746	4.893
Denmark	0.009	0.645	0.016	0.756	-0.468
Sweden	-0.006	-0.579	-0.011	-0.675	-1.263
United Kingdom	-0.011	-0.765	-0.005	-0.557	-0.353
Norway	0.002	0.097	-0.025	-0.432	-2.240
Switzerland	0.017	0.993	0.010	0.752	7.184
Eurozone	0.011	0.865	0.009	0.622	4.668

Country	MRF		WML		Adj. R^2
	Slope	T-Statistics	Slope	T-Statistics	(%)
Austria	0.028	2.181**	0.024	3.203***	25.100
Belgium	0.021	1.675*	-0.041	-3.877***	10.573
Finland	0.001	0.081	0.093	2.023**	11.547
France	0.004	0.381	0.014	0.918	-1.085
Germany	0.005	0.398	0.066	1.939*	16.521
Greece	-0.011	-2.842***	0.010	1.782*	12.606
Ireland	0.017	0.590	0.008	0.342	-8.440
Italy	0.015	1.001	-0.034	-1.025	1.549
Netherlands	0.042	4.359***	0.009	0.844	27.392
Portugal	0.005	0.315	-0.024	-1.404	1.246
Spain	0.007	1.031	-0.005	-0.487	1.878
Denmark	0.017	1.537	0.036	2.459**	5.635
Sweden	0.006	0.693	0.035	3.194***	13.915
United Kingdom	-0.011	-0.789	0.006	0.603	-0.523
Norway	0.005	0.207	0.006	0.119	-2.937
Switzerland	0.020	1.271	-0.006	-0.361	5.063
Eurozone	0.013	1.052	-0.001	-0.092	4.131

Table D.17: Multiple Regressions of GDP Growth Conditional on Past Fama and French (1993) Factor Returns per Country - 8 Quarter Lag

$$\Delta GDP_{(t,t+4)} = \alpha + \beta^{MRF} MRF_{t-8,t-4} + \beta^{HML} HML_{t-8,t-4} + \beta^{SMB} SMB_{t-8,t-4} + \varepsilon_{t,t+4}$$

In the regression notation, ΔGDP depicts the GDP growth rate. MRF is the market risk premium in each country/the Eurozone. The risk free rate is given by the one-month ecu deposit quoted in London. The regressions use annually rebalanced HML, and SMB portfolios. HML is the annual return on a portfolio that is long on high book-to-market stocks and short on low book-to-market securities, holding size and momentum characteristics of the portfolio constant. SMB is the annual return on a portfolio that is long on small capitalization stocks and short on big capitalization securities, holding book-to-market and momentum characteristics of the portfolio constant. GDP is calculated as the continously compounded growth rate in each country/the Eurozone. The GDP is seasonally adjusted. T-statistics are corrected for heteroscedasticity and autocorrelation, up to three lags, using the Newey and West (1987) estimator. The adjusted R^2 is corrected for degrees of freedom. *, **, and *** are used as indicators of statistical significance at, respectively, the 10%, 5%, and 1% signicance level.

Country	MRF		HML		SMB		Adj. R^2
	Slope	T-Statistics	Slope	T-Statistics	Slope	T-Statistics	(%)
Austria	0.030	2.671***	-0.031	-3.468***	0.029	1.639	41.869
Belgium	0.004	0.267	0.040	2.823***	0.036	1.468	8.339
Finland	0.015	1.162	-0.030	-1.568	0.012	0.533	19.490
France	0.005	0.471	-0.020	-1.980**	0.009	0.615	1.923
Germany	0.014	0.995	-0.003	-0.144	0.003	0.223	-1.246
Greece	-0.007	-2.260**	0.019	3.087***	-0.040	-4.807***	40.057
Ireland	0.002	0.065	-0.022	-1.624	0.031	1.636	1.107
Italy	0.012	0.911	0.003	0.130	0.003	0.107	-2.584
Netherlands	0.040	4.175***	-0.018	-1.268	0.009	0.598	29.441
Portugal	0.006	0.612	0.012	0.561	-0.002	-0.144	-4.678
Spain	0.014	1.716*	-0.018	-2.110**	-0.013	-1.333	11.755
Denmark	0.012	0.825	-0.017	-0.989	0.015	0.704	-1.034
Sweden	0.004	0.502	-0.018	-2.807***	-0.020	-1.223	9.436
United Kingdom	-0.009	-0.681	-0.030	-2.280**	-0.002	-0.231	4.902
Norway	-0.021	-0.874	0.075	1.972**	-0.001	-0.021	0.847
Switzerland	0.012	0.666	0.015	1.797*	0.006	0.655	12.379
Eurozone	0.012	0.909	0.018	0.848	0.009	0.614	1.3855

Table D.18: Multiple Regressions of GDP Growth Conditional on Past Carhart (1997) Factor Returns per Country - 8 Quarter Lag

$$\Delta GDP_{(t,t+4)} = \alpha + \beta^{MRF} MRF_{t-8,t-4} + \beta^{HML} HML_{t-8,t-4} + \beta^{SMB} SMB_{t-8,t-4} + \beta^{WML} WML_{t-8,t-4} \varepsilon_{t,t+4}$$

In the regression notation, ΔGDP depicts the GDP growth rate. MRF is the market risk premium in each country/the Eurozone. The risk free rate is given by the one-month ecu deposit quoted in London. The regressions use annually rebalanced HML, SMB, and WML portfolios. HML is the annual return on a portfolio that is long on high book-to-market stocks and short on low book-to-market securities, holding size and momentum characteristics of the portfolio constant. SMB is the annual return on a portfolio that is long on small capitalization stocks and short on big capitalization securities, holding book-to-market and momentum characteristics of the portfolio constant. WML is the annual return on a portfolio that is long on the best performinbg stocks of the past year ('winners') and short on the worst performing securities of the previous year ('losers') holding book-to-market and size characteristics of the portfolio constant. GDP is calculated as the continously compounded growth rate in each country/the Eurozone. The GDP is seasonally adjusted. T-statistics are corrected for heteroscedasticity and autocorrelation, up to three lags, using the Newey and West (1987) estimator. The adjusted R^2 is corrected for degrees of freedom. *, **, and *** are used as indicators of statistical significance at, respectively, the 10%, 5%, and 1% signicance level.

Country	MRF		HML		SMB		WML		Adj. R^2
	Slope	T-Statistics	Slope	T-Statistics	Slope	T-Statistics	Slope	T-Statistics	(%)
Austria	0.026	3.011***	-0.024	-2.604***	0.033	2.224**	0.024	2.133**	41.453
Belgium	0.012	0.927	0.020	1.153	0.045	2.079**	-0.049	-3.746***	18.120
Finland	0.010	0.855	-0.027	-1.862*	0.010	0.564	0.077	2.082**	27.820
France	0.004	0.456	-0.019	-1.723*	0.009	0.620	0.005	0.325	0.517
Germany	0.007	0.470	-0.014	-0.624	0.011	0.702	0.070	1.973**	14.801
Greece	-0.007	-2.281**	0.021	2.036**	-0.037	-2.091**	0.005	0.216	33.738
Ireland	-0.006	-0.148	-0.019	-1.776*	0.040	2.364**	0.022	1.360	2.334
Italy	0.014	1.060	0.005	0.232	0.008	0.286	-0.037	-1.082	-1.281
Netherlands	0.040	4.250***	-0.019	-1.140	0.009	0.599	0.000	-0.021	28.322
Portugal	0.004	0.290	0.007	0.321	-0.002	-0.133	-0.016	-0.490	-8.725
Spain	0.014	1.598	-0.017	-1.837*	-0.013	-1.565	-0.005	-0.581	10.633
Denmark	0.015	1.093	-0.013	-0.875	0.015	0.772	0.034	2.249**	3.315
Sweden	0.004	0.579	0.002	0.133	-0.018	-1.146	0.041	1.894*	15.456
United Kingdom	-0.009	-0.691	-0.030	-2.272**	-0.001	-0.115	0.002	0.199	3.428
Norway	-0.032	-1.350	0.096	2.021**	0.009	0.143	0.041	0.846	0.781
Switzerland	0.010	0.633	0.017	2.302**	0.014	1.111	0.016	0.950	12.534
Eurozone	0.011	0.872	0.019	0.879	0.011	0.668	0.007	0.440	-0.023

Table D.19: Univariate Regressions of GDP Growth Conditional on Past Factor Returns per Industry - 8 Quarter Lag

$$\Delta GDP_{(t,t+4)} = \alpha + \beta FactorRet_{t-8,t-4} + \varepsilon_{t,t+4}$$

In the regression notation, ΔGDP depicts the GDP growth rate. *FactorRet* refers to MRF, HML, SMB, and WML. MRF is the market risk premium in each industry. The risk free rate is given by the one-month ecu deposit quoted in London. The regressions use annually rebalanced HML, SMB, and WML portfolios. HML is the annual return on a portfolio that is long on high book-to-market stocks and short on low book-to-market securities, holding size and momentum characteristics of the portfolio constant. SMB is the annual return on a portfolio that is long on small capitalization stocks and short on big capitalization securities, holding book-to-market and momentum characteristics of the portfolio constant. WML is the annual return on a portfolio that is long on the best performinbg stocks of the past year ('winners') and short on the worst performing securities of the previous year ('losers') holding book-to-market and size characteristics of the portfolio constant. GDP is calculated as the continously compounded growth rate in each industry. The GDP is seasonally adjusted. T-statistics are corrected for heteroscedasticity and autocorrelation, up to three lags, using the Newey and West (1987) estimator. The adjusted R^2 is corrected for degrees of freedom. *, **, and *** are used as indicators of statistical significance at, respectively, the 10%, 5%, and 1% signicance level.

Sector	Slope Coefficients				T-Statistics				Adjusted R^2 (%)			
	MRF	HML	SMB	WML	MRF	HML	SMB	WML	MRF	HML	SMB	WML
Basic Industries	0.018	-0.002	0.023	-0.014	1.703*	-0.261	2.310**	-1.002	11.326	-1.626	16.473	1.022
Cyclical Consumer Goods	0.012	0.012	0.019	-0.012	1.049	0.588	1.574	-0.473	2.768	-0.352	2.781	-0.960
Cyclical Services	0.022	0.027	0.002	0.018	1.989**	1.619	0.153	1.214	13.516	7.037	-1.543	1.829
Financials	0.012	-0.009	0.000	0.021	1.049	-0.581	0.007	1.817*	2.768	-0.874	-1.515	1.414
General Industries	0.012	0.022	0.003	-0.005	1.049	1.466	0.470	-0.917	2.768	2.874	-1.337	-1.029
Information Technology	0.009	0.003	0.010	-0.003	1.411	0.821	1.171	-0.963	8.651	-1.678	9.308	-3.977
Non-Cyclical Consumer Goods	0.009	-0.005	0.001	-0.001	1.332	-0.558	0.164	-0.168	8.285	-3.931	-5.480	-5.299
Resources[a]	-0.014	-0.003	-0.009	0.006	-0.626	-0.599	-22.909***	1.979**	-15.422	-15.154	92.114	12.479
Utilities	0.009	-0.019	0.016	-0.007	1.430	-1.817*	1.831*	-0.462	9.136	11.432	12.075	-3.766
Industry	0.012	0.008	0.017	-0.009	1.049	0.435	1.201	-0.855	2.768	-1.151	1.468	-1.018
Service	0.012	-0.009	-0.011	0.024	1.049	-0.569	-0.743	1.937*	2.768	-1.058	-0.562	1.337

[a] Results for *Resources* refer to 4 quarter lag, given small sample size and hence lack of data

D.3 Relationship between Equity Returns & Economic Activity - 8 Quarter Lag

Table D.20: Bivariate Regressions of GDP Growth Conditional on Past Factor Returns per Industry - 8 Quarter Lag

$$\Delta GDP_{(t,t+4)} = \alpha + \beta MRF_{t-8,t-4} + \gamma FactorRet_{t-8,t-4} + \varepsilon_{t,t+4}$$

In the regression notation, ΔGDP depicts the GDP growth rate. $FactorRet$ refers to HML, SMB, and WML. MRF is the market risk premium in each industry. The risk free rate is given by the one-month ecu deposit quoted in London. The regressions use annually rebalanced HML, SMB, and WML portfolios. HML is the annual return on a portfolio that is long on high book-to-market stocks and short on low book-to-market securities, holding size and momentum characteristics of the portfolio constant. SMB is the annual return on a portfolio that is long on small capitalization stocks and short on big capitalization securities, holding book-to-market and momentum characteristics of the portfolio constant. WML is the annual return on a portfolio that is long on the best performinbg stocks of the past year ('winners') and short on the worst performing securities of the previous year ('losers') holding book-to-market and size characteristics of the portfolio constant. GDP is calculated as the continously compounded growth rate in each industry. The GDP is seasonally adjusted. T-statistics are corrected for heteroscedasticity and autocorrelation, up to three lags, using the Newey and West (1987) estimator. The adjusted R^2 is corrected for degrees of freedom. *, **, and *** are used as indicators of statistical significance at, respectively, the 10%, 5%, and 1% signicance level.

Sector	MRF		HML		Adj. R^2
	Slope	T-Statistics	Slope	T-Statistics	(%)
Basic Industries	0.020	1.897	-0.011	-1.409	12.077
Cyclical Consumer Goods	0.012	1.036	0.007	0.383	1.706
Cyclical Services	0.019	2.017	0.021	1.645	17.633
Financials	0.013	1.118	-0.012	-0.881	2.478
General Industries	0.011	0.913	0.019	1.275	4.508
Information Technology	0.009	1.387	0.000	0.012	3.576
Non-Cyclical Consumer Goods	0.011	1.598	0.006	0.591	4.438
Resources[a]	-0.010	-0.515	-0.002	-0.463	-41.465
Utilities	0.008	1.371	-0.017	-1.988	17.846
Industry	0.013	1.074	0.010	0.510	1.879
Service	0.013	1.075	-0.013	-0.755	2.131

Sector	MRF		SMB		Adj. R^2
	Slope	T-Statistics	Slope	T-Statistics	(%)
Basic Industries	0.013	1.468	0.019	2.368**	21.238
Cyclical Consumer Goods	0.010	0.904	0.016	1.364	4.153
Cyclical Services	0.023	2.092	-0.007	-0.647	12.818
Financials	0.012	1.053	-0.002	-0.165	1.316
General Industries	0.013	0.996	-0.001	-0.138	1.290
Information Technology	0.005	1.038	0.006	0.814	6.705
Non-Cyclical Consumer Goods	0.010	1.387	-0.002	-0.470	3.727
Resources[a]	-0.006	-2.307**	-0.009	-21.894***	91.327
Utilities	0.008	1.591	0.015	2.004**	20.099
Industry	0.010	0.777	0.011	0.702	2.194
Service	0.013	1.085	-0.013	-0.928	2.569

Sector	MRF		WML		Adj. R^2
	Slope	T-Statistics	Slope	T-Statistics	(%)
Basic Industries	0.017	1.542	-0.002	-0.167	9.811
Cyclical Consumer Goods	0.014	1.270	-0.020	-0.813	2.826
Cyclical Services	0.021	2.095	0.016	1.093	14.916
Financials	0.012	1.039	0.020	1.896*	4.037
General Industries	0.012	1.027	-0.005	-0.675	1.628
Information Technology	0.009	1.315	0.000	-0.076	3.589
Non-Cyclical Consumer Goods	0.010	1.527	-0.003	-0.464	4.156
Resources[a]	0.005	0.312	0.006	1.665*	-8.917
Utilities	0.009	1.346	-0.004	-0.319	4.841
Industry	0.012	1.042	-0.009	-0.680	1.722
Service	0.012	1.032	0.023	2.011**	3.903

Table D.21: Multiple Regressions of GDP Growth Conditional on Past Fama and French (1993) Factor Returns per Industry - 8 Quarter Lag

$$\Delta GDP_{growth(t,t+4)} = \alpha + \beta^{MRF} MRF_{t-8,t-4} + \beta^{HML} HML_{t-8,t-4} + \beta^{SMB} SMB_{t-8,t-4} + \varepsilon_{t,t+4}$$

In the regression notation, ΔGDP depicts the GDP growth rate. MRF is the market risk premium in each industry. The risk free rate is given by the one-month ecu deposit quoted in London. The regressions use annually rebalanced HML, and SMB portfolios. HML is the annual return on a portfolio that is long on high book-to-market stocks and short on low book-to-market securities, holding size and momentum characteristics of the portfolio constant. SMB is the annual return on a portfolio that is long on small capitalization stocks and short on big capitalization securities, holding book-to-market and momentum characteristics of the portfolio constant. GDP is calculated as the continously compounded growth rate in each industry. The GDP is seasonally adjusted. T-statistics are corrected for heteroscedasticity and autocorrelation, up to three lags, using the Newey and West (1987) estimator. The adjusted R^2 is corrected for degrees of freedom. *, **, and *** are used as indicators of statistical significance at, respectively, the 10%, 5%, and 1% signicance level.

BAS = *basic industries*; CGD = *cyclical consumer goods*; CSER = *cyclical services*; TOLF = *financials*; GN = *general industries*; ITECH = *information technology*; NCGD = *non-cycical consumer goods*; RES = *resources*; UTL = *utilities.*

Sector	MRF		HML		SMB		Adj. R^2
	Slope	T-Statistics	Slope	T-Statistics	Slope	T-Statistics	(%)
BAS	0.015	1.619	-0.012	-1.452	0.019	2.455**	22.697
CGD	0.010	0.926	0.004	0.184	0.015	1.384	2.754
CSER	0.021	2.198**	0.024	1.819*	-0.012	-1.240	18.275
TOLF	0.013	1.115	-0.012	-0.830	0.000	-0.014	0.954
GN	0.011	0.847	0.019	1.275	0.000	0.070	3.020
ITECH	0.004	0.882	-0.005	-0.942	0.013	1.117	4.786
NCGD	0.012	1.513	0.005	0.559	-0.002	-0.432	-0.764
RES[a]	-0.006	-2.281**	0.000	-0.079	-0.009	-22.929***	88.438
UTL	0.008	1.461	-0.006	-0.521	0.011	0.959	16.384
Industry	0.010	0.804	0.010	0.487	0.010	0.693	1.221
Service	0.013	1.084	-0.008	-0.354	-0.011	-0.595	1.309

[a] Results for *Resources* (RES) refer to 4 quarter lag, given small sample size and hence lack of data

Table D.22: Multiple Regressions of GDP Growth Conditional on Past Carhart (1997) Factor Returns per Industry - 8 Quarter Lag

$$\Delta GDP_{(t,t+4)} = \alpha + \beta^{MRF} MRF_{t-8,t-4} + \beta^{HML} HML_{t-8,t-4} + \beta^{SMB} SMB_{t-8,t-4} + \beta^{WML} WML_{t-8,t-4} \varepsilon_{t,t+4}$$

In the regression notation, ΔGDP depicts the GDP growth rate. MRF is the market risk premium in industry. The risk free rate is given by the one-month ecu deposit quoted in London. The regressions use annually rebalanced HML, SMB, and WML portfolios. HML is the annual return on a portfolio that is long on high book-to-market stocks and short on low book-to-market securities, holding size and momentum characteristics of the portfolio constant. SMB is the annual return on a portfolio that is long on small capitalization stocks and short on big capitalization securities, holding book-to-market and momentum characteristics of the portfolio constant. WML is the annual return on a portfolio that is long on the best performinbg stocks of the past year ('winners') and short on the worst performing securities of the previous year ('losers') holding book-to-market and size characteristics of the portfolio constant. GDP is calculated as the continously compounded growth rate in each industry. The GDP is seasonally adjusted. T-statistics are corrected for heteroscedasticity and autocorrelation, up to three lags, using the Newey and West (1987) estimator. The adjusted R^2 is corrected for degrees of freedom. *, **, and *** are used as indicators of statistical significance at, respectively, the 10%, 5%, and 1% signicance level.

Sector	MRF		HML		SMB		WML		Adj. R^2
	Slope	T-Statistics	Slope	T-Statistics	Slope	T-Statistics	Slope	T-Statistics	(%)
Basic Industries	0.015	1.500	-0.012	-1.277	0.019	2.236**	-0.001	-0.064	21.272
Cyclical Consumer Goods	0.012	1.321	0.000	-0.020	0.014	1.191	-0.015	-0.583	1.943
Cyclical Services	0.020	2.390**	0.027	1.899*	-0.008	-0.769	0.020	1.221	20.675
Financials	0.012	1.064	-0.004	-0.269	0.005	0.362	0.020	1.473	1.271
General Industries	0.012	0.941	0.019	1.318	-0.007	-0.507	-0.010	-0.955	2.519
Information Technology	-0.004	-0.870	-0.006	-1.165	0.025	2.129**	-0.011	-4.144***	5.777
Non-Cyclical Consumer Goods	0.012	1.595	0.004	0.507	-0.003	-0.548	-0.003	-0.464	-6.482
Resources[a]	-0.003	-0.878	0.003	1.229	-0.008	-9.049***	0.004	1.286	85.084
Utilities	0.007	1.320	-0.006	-0.541	0.013	1.136	-0.012	-1.192	15.498
Industry	0.010	0.825	0.010	0.486	0.010	0.515	-0.002	-0.105	-0.335
Service	0.012	1.041	-0.002	-0.076	-0.007	-0.417	0.019	1.491	1.231

[a] Results for *Resources* refer to 4 quarter lag, given small sample size and hence lack of data

Appendix E

Method B.II: *SMB* & *HML* as Proxies for Yield Spreads

E.1 Relation Between FF Factors & Yield Spreads

Table E.1: *SMB* & *HML* Factor Regressions per Country

The numbers reported are coefficient estimates of the regressions with the associated t-statistics in parentheses. The t-statistics are computed using Newey-West heteroskedastic-robust standard errors with three lags. The R^2 are adjusted for the number of degrees of freedom. MRF denotes the return to the local TOTMK indices in excess to the one-month ecu-markt deposit. SMB is the return on a portfolio that is long on small capitalization stocks and short on big capitalization securities, holding book-to-market and momentum characteristics of the portfolio constant. HML is the return on a portfolio that is long on high book-to-market stocks and short on low book-to-market securities, holding size and momentum characteristics of the portfolio constant. The default and term spread factors are defined as follows: $\Delta def_t \equiv def_t - def_{t-1}$, and $\Delta term_t \equiv term_t - term_{t-1}$ where def_t and $term_t$ are the default spread and term spread at time T. The default spread is defined as the spread between yield to maturity on the all-maturities iBoxx BBB Corporate Bond Index for the Eurozone and the all-maturities FTSE Global Government Eurozone index. The term spread is defined as the spread between the 10- and one-year Eurozone government bond for constant maturities. The sample period is May 1999 to October 2006 and the results are based on monthly data.

Country	Dependent Variable	Independent Variables				
		Constant	MRF	Δdef	Δterm	Adj. R^2
Austria	SMB	0.086	0.025	-1.479	2.892	0.018
		(2.141)	(0.126)	(-0.956)	(0.808)	
		0.090	-0.010	-1.102		0.005
		(2.109)	(-0.055)	(-0.813)		
		0.079	0.037		2.446	0.010
		(1.968)	(0.181)		(0.682)	
	HML	0.107	0.116	-2.117	5.291	0.051
		(2.328)	(0.560)	(-1.268)	(2.057)	
		0.113	0.052	-1.427		0.011
		(2.238)	(0.263)	(-0.810)		
		0.098	0.132		4.651	0.036
		(2.285)	(0.648)		(1.912)	
Belgium	SMB	0.035	0.113	0.455	1.591	0.081
		(2.187)	(2.019)	(0.665)	(1.243)	
		0.034	0.097	0.263		0.047
		(2.075)	(1.700)	(0.312)		
		0.036	0.108		1.422	0.072
		(2.373)	(1.994)		(1.042)	
	HML	0.089	0.060	-0.021	-0.385	0.014
		(4.313)	(0.555)	(-0.028)	(-0.319)	

Continued on next page

Table E.1 – continued from previous page

Country	Dependent Variable	Constant	MRF	Δdef	Δterm	Adj. R^2
		0.089	0.063	0.026		0.012
		(4.384)	(0.608)	(0.033)		
		0.089	0.060		-0.378	0.014
		(4.381)	(0.565)		(-0.307)	
Finland	SMB	0.116	0.537	6.092	-12.680	0.432
		(2.249)	(2.323)	(3.551)	(-1.677)	
		0.112	0.635	7.460		0.387
		(2.269)	(2.344)	(2.675)		
		0.133	0.523		-14.989	0.396
		(2.446)	(2.092)		(-1.759)	
	HML	0.169	0.465	6.355	-9.595	0.393
		(3.419)	(2.372)	(3.309)	(-1.483)	
		0.166	0.538	7.391		0.362
		(3.476)	(2.217)	(2.953)		
		0.187	0.449		-12.004	0.344
		(3.475)	(2.143)		(-1.601)	
France	SMB	0.159	-0.043	0.675	-3.266	0.044
		(5.493)	(-0.310)	(0.933)	(-1.669)	
		0.158	0.018	1.067		0.013
		(5.254)	(0.142)	(1.225)		
		0.161	-0.050		-3.559	0.039
		(5.685)	(-0.349)		(-1.793)	
	HML	0.111	-0.237	-0.977	2.221	0.190
		(5.006)	(-2.420)	(-1.693)	(1.190)	
		0.111	-0.279	-1.244		0.174
		(4.966)	(-2.583)	(-1.964)		
		0.108	-0.227		2.646	0.179
		(4.846)	(-2.349)		(1.360)	
Germany	SMB	0.254	0.562	-0.973	5.033	0.207
		(4.893)	(2.312)	(-0.742)	(1.513)	
		0.251	0.467	-1.569		0.177
		(4.808)	(2.020)	(-1.073)		
		0.252	0.572		5.450	0.203
		(4.919)	(2.359)		(1.547)	
	HML	0.139	0.344	-0.768	5.720	0.148
		(3.533)	(1.776)	(-0.867)	(2.048)	
		0.135	0.236	-1.445		0.084
		(3.388)	(1.352)	(-1.611)		
		0.137	0.352		6.049	0.144
		(3.438)	(1.842)		(2.184)	
Greece	SMB	0.067	0.383	-0.775	-0.357	0.161
		(1.293)	(2.481)	(-0.642)	(-0.066)	
		0.068	0.386	-0.819		0.161
		(1.243)	(2.580)	(-0.930)		
		0.065	0.390		-0.572	0.160
		(1.207)	(2.517)		(-0.111)	
	HML	0.052	0.388	0.708	1.436	0.267
		(1.563)	(4.517)	(0.568)	(0.368)	
		0.051	0.376	0.885		0.263
		(1.406)	(3.878)	(0.727)		
		0.055	0.382		1.632	0.265
		(1.557)	(4.530)		(0.427)	
Ireland	SMB	0.055	0.640	1.957	-4.071	0.133
		(0.960)	(2.266)	(1.080)	(-1.191)	
		0.059	0.681	2.363		0.117
		(0.986)	(2.525)	(1.106)		
		0.061	0.610		-4.696	0.121
		(1.096)	(2.171)		(-1.238)	
	HML	0.260	0.459	-0.096	3.825	0.075
		(5.336)	(1.312)	(-0.098)	(1.541)	
		0.257	0.420	-0.477		0.058
		(5.256)	(1.226)	(-0.529)		
		0.260	0.460		3.855	0.075
		(5.363)	(1.331)		(1.615)	

Continued on next page

Table E.1 – continued from previous page

Country	Dependent Variable	Constant	MRF	Δdef	Δterm	Adj. R^2
Italy	SMB	0.113	0.337	1.526	-1.746	0.419
		(7.071)	(4.268)	(3.513)	(-1.365)	
		0.113	0.375	1.731		0.401
		(6.814)	(4.547)	(3.230)		
		0.117	0.320		-2.381	0.370
		(6.870)	(3.819)		(-1.568)	
	HML	0.016	-0.058	-0.736	0.118	0.021
		(0.693)	(-0.407)	(-0.978)	(0.085)	
		0.016	-0.060	-0.750		0.021
		(0.692)	(-0.455)	(-1.093)		
		0.014	-0.049		0.424	0.009
		(0.610)	(-0.346)		(0.315)	
Netherlands	SMB	0.090	0.271	-0.009	-3.416	0.196
		(2.975)	(2.231)	(-0.010)	(-2.374)	
		0.093	0.342	0.407		0.160
		(3.030)	(2.944)	(0.395)		
		0.090	0.271		-3.412	0.196
		(2.947)	(2.301)		(-2.642)	
	HML	0.061	-0.249	-0.635	3.602	0.317
		(3.211)	(-3.524)	(-1.422)	(2.758)	
		0.058	-0.324	-1.074		0.249
		(2.755)	(-3.876)	(-3.022)		
		0.060	-0.240		3.873	0.310
		(3.108)	(-3.327)		(2.979)	
Portugal	SMB	0.078	-0.161	2.034	-16.437	0.145
		(1.072)	(-0.590)	(0.657)	(-1.575)	
		0.097	0.242	4.109		0.035
		(1.102)	(0.657)	(1.153)		
		0.082	-0.195		-17.378	0.139
		(1.125)	(-0.729)		(-1.674)	
	HML	0.198	0.401	1.618	-14.959	0.230
		(3.109)	(1.673)	(0.578)	(-1.526)	
		0.215	0.767	3.507		0.128
		(2.711)	(2.431)	(1.237)		
		0.201	0.373		-15.709	0.226
		(3.219)	(1.596)		(-1.669)	
Spain	SMB	0.046	0.275	-0.207	-1.186	0.061
		(1.325)	(1.404)	(-0.343)	(-0.507)	
		0.046	0.283	-0.051		0.058
		(1.335)	(1.403)	(-0.077)		
		0.045	0.281		-1.111	0.061
		(1.292)	(1.501)		(-0.471)	
	HML	0.191	0.412	0.714	0.060	0.220
		(8.606)	(3.343)	(1.618)	(0.043)	
		0.191	0.411	0.707		0.219
		(8.540)	(3.242)	(1.430)		
		0.194	0.390		-0.198	0.213
		(8.674)	(3.305)		(-0.142)	
Denmark	SMB	0.184	0.704	-0.804	-1.655	0.353
		(5.681)	(3.973)	(-0.716)	(-0.745)	
		0.182	0.732	-0.617		0.349
		(5.559)	(4.632)	(-0.568)		
		0.181	0.710		-1.344	0.350
		(5.789)	(4.017)		(-0.625)	
	HML	0.164	0.296	1.647	4.373	0.089
		(5.279)	(1.489)	(3.376)	(1.747)	
		0.167	0.222	1.152		0.054
		(5.232)	(1.259)	(1.904)		
		0.169	0.284		3.736	0.072
		(5.478)	(1.412)		(1.454)	
Sweden	SMB	0.200	0.054	0.735	-3.653	0.080
		(5.651)	(0.610)	(0.807)	(-1.913)	
		0.198	0.111	1.154		0.049
		(5.426)	(1.343)	(1.187)		

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Table E.1 – continued from previous page

Country	Dependent Variable	Constant	MRF	Δdef	Δterm	Adj. R^2
		0.202	0.049		-3.981	0.075
		(5.863)	(0.538)		(-2.077)	
	HML	0.091	-0.133	-0.148	1.775	0.231
		(5.047)	(-3.280)	(-0.371)	(1.568)	
		0.092	-0.161	-0.352		0.212
		(5.017)	(-3.797)	(-0.693)		
		0.091	-0.132		1.841	0.231
		(5.159)	(-3.259)		(1.583)	
United Kingdom	SMB	0.181	0.418	-0.090	-3.042	0.226
		(6.096)	(2.861)	(-0.131)	(-1.276)	
		0.184	0.482	0.333		0.191
		(5.896)	(3.482)	(0.410)		
		0.181	0.421		-3.003	0.226
		(6.214)	(2.826)		(-1.288)	
	HML	0.069	-0.094	-0.375	0.027	0.084
		(8.182)	(-2.427)	(-1.205)	(0.033)	
		0.069	-0.094	-0.379		0.084
		(7.895)	(-2.425)	(-1.224)		
		0.068	-0.083		0.191	0.067
		(8.330)	(-2.079)		(0.237)	
Norway	SMB	0.038	-0.170	0.964	-4.664	0.128
		(1.322)	(-1.733)	(1.000)	(-1.446)	
		0.034	-0.110	1.608		0.062
		(1.180)	(-1.229)	(1.174)		
		0.042	-0.184		-5.093	0.119
		(1.450)	(-1.824)		(-1.477)	
	HML	0.046	0.393	0.183	3.724	0.276
		(1.851)	(2.423)	(0.212)	(1.638)	
		0.049	0.345	-0.332		0.239
		(1.930)	(2.337)	(-0.330)		
		0.046	0.390		3.643	0.276
		(1.928)	(2.467)		(1.701)	
Switzerland	SMB	0.202	1.158	1.820	1.850	0.434
		(4.570)	(3.971)	(1.984)	(0.619)	
		0.201	1.124	1.585		0.431
		(4.576)	(4.169)	(1.975)		
		0.207	1.128		1.092	0.424
		(4.689)	(3.897)		(0.365)	
	HML	0.085	0.193	-1.251	2.824	0.018
		(1.140)	(0.471)	(-0.563)	(0.590)	
		0.084	0.141	-1.610		0.013
		(1.130)	(0.387)	(-0.766)		
		0.082	0.213		3.345	0.015
		(1.079)	(0.535)		(0.720)	

Table E.2: *SMB* & *HML* Factor Regressions per Industry (Eurozone)

The numbers reported are coefficient estimates of the regressions with the associated t-statistics in parentheses. The t-statistics are computed using Newey-West heteroskedastic-robust standard errors with three lags. The R^2 are adjusted for the number of degrees of freedom. MRF denotes the return to the DJ Euro Stoxx index in excess to the one-month ecu-markt deposit. SMB is the return on a portfolio that is long on small capitalization stocks and short on big capitalization securities, holding book-to-market and momentum characteristics of the portfolio constant. HML is the return on a portfolio that is long on high book-to-market stocks and short on low book-to-market securities, holding size and momentum characteristics of the portfolio constant. The default and term spread factors are defined as follows: $\Delta def_t \equiv def_t - def_{t-1}$, and $\Delta term_t \equiv term_t - term_{t-1}$ where def_t and $term_t$ are the default spread and term spread at time T. The default spread is defined as the spread between yield to maturity on the all-maturities iBoxx BBB Corporate Bond Index for the Eurozone and the all-maturities FTSE Global Government Eurozone index. The term spread is defined as the spread between the 10- and one-year Eurozone government bond for constant maturities. The sample period is May 1999 to October 2006 and the results are based on monthly data.

BAS = *basic industries*; CGD = *cyclical consumer goods*; CSER = *cyclical services*; TOLF = *financials*; GN = *general industries*; ITECH = *information technology*; NCGD = *non-cycical consumer goods*; RES = *resources*; UTL = *utilities*.

Industry	Dependent Variable	Independent Variables				
		Constant	MRF	Δdef	Δterm	Adj. R^2
BAS	SMB	0.019	-0.012	0.230	-3.537	0.026
		(0.415)	(-0.066)	(0.280)	(-1.150)	
		0.021	0.053	0.643		0.005
		(0.440)	(0.320)	(0.673)		
		0.020	-0.014		-3.634	0.025
		(0.442)	(-0.077)		(-1.201)	
	HML	0.161	0.247	0.277	-2.606	0.106
		(3.658)	(1.764)	(0.475)	(-0.940)	
		0.163	0.295	0.581		0.094
		(3.658)	(2.451)	(0.955)		
		0.162	0.244		-2.722	0.105
		(3.720)	(1.722)		(-0.987)	
CGD	SMB	0.131	0.252	-1.154	-0.586	0.294
		(5.647)	(2.424)	(-2.543)	(-0.558)	
		0.131	0.263	-1.085		0.292
		(5.640)	(2.715)	(-2.371)		
		0.128	0.263		-0.103	0.265
		(5.489)	(2.463)		(-0.093)	
	HML	0.016	-0.109	0.325	-0.138	0.105
		(1.145)	(-1.801)	(0.916)	(-0.167)	
		0.016	-0.106	0.341		0.105
		(1.151)	(-1.961)	(0.931)		
		0.017	-0.112		-0.273	0.100
		(1.218)	(-1.834)		(-0.317)	
CSER	SMB	0.130	-0.061	0.683	-5.775	0.188
		(5.368)	(-0.691)	(0.870)	(-4.053)	
		0.132	0.045	1.358		0.037
		(4.886)	(0.405)	(1.121)		
		0.132	-0.068		-6.061	0.181
		(5.495)	(-0.755)		(-4.012)	
	HML	0.047	-0.095	0.151	-0.713	0.030
		(2.296)	(-1.141)	(0.154)	(-0.573)	
		0.048	-0.082	0.234		0.027
		(2.313)	(-0.995)	(0.227)		
		0.048	-0.097		-0.776	0.029
		(2.296)	(-1.193)		(-0.571)	
TOLF	SMB	0.151	0.368	0.834	-2.105	0.519
		(9.094)	(5.666)	(1.814)	(-1.594)	
		0.152	0.406	1.080		0.498
		(8.807)	(5.080)	(1.820)		
		0.153	0.360		-2.454	0.507
		(9.151)	(5.660)		(-1.704)	
	HML	0.096	0.078	0.287	0.539	0.021
		(4.498)	(0.806)	(0.654)	(0.296)	
		0.096	0.068	0.224		0.019
		(4.541)	(0.809)	(0.520)		
		0.097	0.076		0.419	0.019
		(4.584)	(0.772)		(0.229)	
GN	SMB	0.163	0.718	-2.368	2.232	0.197
		(2.531)	(2.133)	(-1.741)	(0.681)	
		0.162	0.677	-2.628		0.193
		(2.519)	(2.079)	(-1.659)		

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Table E.2 – continued from previous page

Industry	Dependent Variable	Independent Variables				
		Constant	MRF	Δdef	Δterm	Adj. R^2
		0.157	0.741		3.222	0.184
		(2.456)	(2.086)		(0.896)	
	HML	0.120	0.189	0.207	5.327	0.047
		(3.450)	(0.894)	(0.148)	(1.180)	
		0.117	0.091	-0.416		0.008
		(3.538)	(0.521)	(-0.299)		
		0.120	0.187		5.241	0.047
		(3.697)	(0.855)		(1.164)	
ITECH	SMB	0.134	0.625	3.154	-15.446	0.262
		(2.172)	(1.948)	(1.637)	(-1.811)	
		0.150	0.920	4.607		0.192
		(2.143)	(2.047)	(1.599)		
		0.142	0.599		-16.607	0.251
		(2.192)	(1.839)		(-1.837)	
	HML	0.323	1.278	4.801	-11.515	0.251
		(2.926)	(2.848)	(0.915)	(-0.920)	
		0.336	1.498	5.885		0.232
		(2.822)	(2.262)	(0.957)		
		0.337	1.238		-13.283	0.238
		(2.994)	(2.853)		(-0.954)	
NCGD	SMB	0.249	0.747	2.038	2.475	0.230
		(4.514)	(3.241)	(1.861)	(0.570)	
		0.245	0.694	1.952		0.226
		(4.418)	(3.906)	(1.946)		
		0.257	0.748		2.164	0.219
		(4.693)	(3.234)		(0.491)	
	HML	0.091	-0.419	-1.896	0.284	0.107
		(1.859)	(-2.089)	(-1.422)	(0.083)	
		0.090	-0.425	-1.906		0.107
		(1.918)	(-2.583)	(-1.495)		
		0.083	-0.420		0.573	0.096
		(1.640)	(-2.057)		(0.169)	
RES	SMB	0.660	-0.220	-27.207	-10.353	0.094
		(2.857)	(-0.123)	(-2.707)	-(1.094)	
		0.721	-0.327	-21.035		0.065
		(3.054)	(-0.187)	(-1.626)		
		0.577	0.362		-3.075	0.005
		(2.422)	(0.196)		(-0.363)	
	HML	0.538	-0.572	24.117	21.699	0.135
		(1.473)	(-0.293)	(2.601)	(1.325)	
		0.410	-0.348	11.183		0.027
		(1.100)	(-0.165)	(0.744)		
		0.612	-1.088		15.247	0.075
		(1.717)	(-0.576)		(1.070)	
UTL	SMB	0.117	0.012	-0.922	-2.184	0.036
		(3.873)	(0.114)	(-1.371)	(-1.251)	
		0.120	0.054	-0.717		0.017
		(3.930)	(0.511)	(-0.969)		
		0.115	0.020		-1.845	0.023
		(3.737)	(0.185)		(-1.001)	
	HML	0.051	0.062	1.175	3.392	0.074
		(1.962)	(0.723)	(2.140)	(2.048)	
		0.048	-0.002	0.856		0.015
		(1.738)	(-0.025)	(1.505)		
		0.055	0.053		2.960	0.046
		(2.094)	(0.597)		(1.565)	
Industry	SMB	0.160	0.553	-0.752	-0.499	0.507
		(6.426)	(4.441)	(-1.301)	-(0.457)	
		0.161	0.562	-0.693		0.506
		(6.445)	(4.730)	(-1.204)		
		0.159	0.560		-0.185	0.501
		(6.376)	(4.362)		(-0.167)	
	HML	0.086	-0.009	-0.217	1.519	0.031
		(5.024)	(-0.112)	(-0.447)	(0.875)	
		0.086	-0.037	-0.394		0.012
		(5.149)	(-0.537)	(-0.727)		
		0.086	-0.007		1.610	0.029

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Table E.2 – continued from previous page

Industry	Dependent Variable	Independent Variables				
		Constant	MRF	Δdef	Δterm	Adj. R^2
		(5.055)	(-0.086)		(0.914)	
Service	SMB	0.141	0.192	0.776	-2.645	0.365
		(8.700)	(3.108)	(1.782)	(-2.440)	
		0.142	0.240	1.085		0.309
		(8.381)	(3.504)	(1.702)		
		0.143	0.185		-2.970	0.347
		(8.925)	(2.934)		(-2.450)	
	HML	0.090	-0.059	0.220	1.428	0.060
		(4.874)	(-0.752)	(0.523)	(1.194)	
		0.089	-0.085	0.053		0.041
		(4.841)	(-1.311)	(0.141)		
		0.090	-0.061		1.337	0.059
		(4.944)	(-0.774)		(1.081)	

Table E.3: Fama-MacBeth: Augmented Alternative Model - Industry

This table reports the regression coefficients and the associated t-statistics from the Fama-MacBeth (1973) regressions for the sample period May 1999 to October 2006. The dependent variable, R_t, is the cross section of the monthly return on the 27 portfolios per industry depicted in Table 3.2 in excess of the one-month ecu rate. The independent variables are a constant and the cross-section of $\hat{\beta}^{MRF}$, $\hat{\beta}^{SMB\perp}$, $\hat{\beta}^{HML\perp}$, $\hat{\beta}^{def}$, and $\hat{\beta}^{term}$, which are the estimated factor loadings from a time-series regression of R_j on a constant, MRF, $SMB\perp$, $HML\perp$, Δdef, and $\Delta term$ for each portfolio j. MRF denotes the return to the DJ Euro Stoxx index in excess to the one-month ecu-markt deposit. $SMB\perp$ is the sum of the intercept and residual from regressing SMB on a constant, Δdef, and $\Delta term$. $HML\perp$ is the sum of the intercept and residual from regressing HML on a constant, Δdef, and $\Delta term$. SMB is the return to a portfolio long on small capitalization stocks and short on big capitalization stocks, holding book-to-market and momentum characteristics of the portfolio constant. HML is the return to a portfolio long on high book-to-market stocks and short on low book-to-market stocks, holding size and momentum characteristics of the portfolio constant. The default and term spread factors are defined as follows: $\Delta def_t \equiv def_t - def_{t-1}$, and $\Delta term_t \equiv term_t - term_{t-1}$ where def_t and $term_t$ are the default spread and term spread at time T. The default spread is defined as the spread between yield to maturity on the all-maturities iBoxx BBB Corporate Bond Index for the Eurozone and the all-maturities FTSE Global Government Eurozone index. The term spread is defined as the spread between the 10- and one-year Eurozone government bond for constant maturities. The T-statistics are computed using Shanken's (1992) adjusted standard errors. The R^2s of the regressions are adjusted R^2 from the regression of the average portfolio returns and a constant and the estimated betas. The F-statistics and the associated p-value (in parentheses) report Shanken's (1985) cross-sectional regression test of the linear expected return-beta relation.

BAS = *basic industries*; CGD = *cyclical consumer goods*; CSER = *cyclical services*; TOLF = *financials*; GN = *general industries*; ITECH = *information technology*; NCGD = *non-cyclical consumer goods*; UTL = *utilities.*

$$R_t = \gamma_0 + \gamma_{MRF}\hat{\beta}^{MRF} + \gamma_{SMB\perp}\hat{\beta}^{SMB\perp} + \gamma_{HML\perp}\hat{\beta}^{HML\perp} + \gamma_{def}\hat{\beta}^{def} + \gamma_{term}\hat{\beta}^{term} + \varepsilon_t$$

		γ_0	γ_{MRF}	$\gamma_{SMB\perp}$	$\gamma_{HML\perp}$	γ_{def}	γ_{term}	R^2 (%)	F-Test
BAS	Coefficient	0.044	0.078	0.015	0.142	0.005	0.000	54.57	2.120
	T-Statistic	1.624	2.017	0.807	3.750	0.390	0.091		(0.010)
CGD	Coefficient	0.060	0.151	0.116	-0.038	0.007	-0.007	61.25	2.431
	T-Statistic	3.232	3.122	4.297	-1.374	0.471	-1.434		(0.003)
CSER	Coefficient	-0.045	0.130	0.043	0.031	-0.020	-0.006	32.77	2.693
	T-Statistic	-1.274	2.765	2.085	0.834	-3.636	-1.769		(0.000)
TOLF	Coefficient	0.057	0.161	0.167	0.039	-0.015	0.003	80.97	1.935
	T-Statistic	2.743	4.854	5.543	3.609	-2.165	0.366		(0.018)
GN	Coefficient	0.014	0.187	0.102	0.081	-0.001	-0.010	87.40	1.775
	T-Statistic	0.507	3.805	3.866	6.483	-0.093	-3.281		(0.038)
ITECH	Coefficient	0.001	0.070	0.146	0.371	0.002	0.001	88.18	1.154
	T-Statistic	0.020	1.687	1.633	3.264	0.516	0.250		(0.320)
NCGD	Coefficient	0.194	0.085	0.159	-0.043	-0.012	-0.008	53.00	1.668
	T-Statistic	4.211	2.847	7.689	-2.737	-1.945	-3.652		(0.062)
UTL	Coefficient	0.046	0.071	0.116	-0.020	0.024	0.005	36.34	5.862
	T-Statistic	1.302	1.217	3.701	-0.376	1.929	1.823		(0.000)
Industry	Coefficient	0.043	0.089	0.038	0.081	-0.007	-0.021	85.42	2.351
	T-Statistic	1.739	2.005	1.433	8.712	-0.569	-10.549		(0.003)
Service	Coefficient	-0.010	0.156	0.172	0.000	-0.019	0.006	74.03	2.039
	T-Statistic	-0.345	3.725	5.782	-0.009	-2.879	1.146		(0.012)

Table E.4: Fama-MacBeth: Augmented Alternative Model - Country

This table reports the regression coefficients and the associated t-statistics from the Fama-MacBeth (1973) regressions for the sample period May 1999 to October 2006. The dependent variable, R_t, is the cross section of the monthly return on the 27 portfolios per country depicted in Table 3.2 in excess of the one-month ecu rate. The independent variables are a constant and the cross-section of $\hat{\beta}^{MRF}$, $\hat{\beta}^{SMB\perp}$, $\hat{\beta}^{HML\perp}$, $\hat{\beta}^{def}$, and $\hat{\beta}^{term}$, which are the estimated factor loadings from a time-series regression of R_j on a constant, MRF, $SMB\perp$, $HML\perp$, Δdef, and $\Delta term$ for each portfolio j. MRF denotes the return to the local TOTMK indices in excess to the one-month ecu-markt deposit. $SMB\perp$ is the sum of the intercept and residual from regressing SMB on a constant, Δdef, and $\Delta term$. $HML\perp$ is the sum of the intercept and residual from regressing HML on a constant, Δdef, and $\Delta term$. SMB is the return to a portfolio long on small capitalization stocks and short on big capitalization stocks, holding book-to-market and momentum characteristics of the portfolio constant. HML is the return to a portfolio long on high book-to-market stocks and short on low book-to-market stocks, holding size and momentum characteristics of the portfolio constant. The default and term spread factors are defined as follows: $\Delta def_t \equiv def_t - def_{t-1}$, and $\Delta term_t \equiv term_t - term_{t-1}$ where def_t and $term_t$ are the default spread and term spread at time T. The default spread is defined as the spread between yield to maturity on the all-maturities iBoxx BBB Corporate Bond Index for the Eurozone and the all-maturities FTSE Global Government Eurozone index. The term spread is defined as the spread between the 10- and one-year Eurozone government bond for constant maturities. The T-statistics are computed using Shanken's (1992) adjusted standard errors. The R^2s of the regressions are adjusted R^2 from the regression of the average portfolio returns and a constant and the estimated betas. The F-statistics and the associated p-value (in parentheses) report Shanken's (1985) cross-sectional regression test of the linear expected return-beta relation.

$$R_t = \gamma_0 + \gamma_{MRF}\hat{\beta}^{MRF} + \gamma_{SMB\perp}\hat{\beta}^{SMB\perp} + \gamma_{HML\perp}\hat{\beta}^{HML\perp} + \gamma_{def}\hat{\beta}^{def} + \gamma_{term}\hat{\beta}^{term} + \varepsilon_t$$

		γ_0	γ_{MRF}	$\gamma_{SMB\perp}$	$\gamma_{HML\perp}$	γ_{def}	γ_{term}	R^2 (%)	F-Test
Austria	Coefficient	0.035	0.178	0.089	0.070	-0.017	-0.005	52.80	4.154
	T-Statistic	0.767	2.680	3.626	0.985	-2.685	-0.508		(0.000)
Belgium	Coefficient	0.013	0.104	0.003	0.051	0.027	0.007	59.93	1.466
	T-Statistic	0.305	2.841	0.161	5.295	2.893	1.006		(0.113)
Finland	Coefficient	0.137	-0.055	0.155	0.122	0.003	-0.002	87.90	6.525
	T-Statistic	2.411	-0.402	1.013	1.125	0.278	-0.363		(0.000)
France	Coefficient	0.120	-0.004	0.114	0.036	0.054	0.006	68.65	1.816
	T-Statistic	4.855	-0.115	4.073	1.279	4.192	0.649		(0.033)
Germany	Coefficient	-0.078	0.219	0.166	0.154	-0.028	-0.015	89.72	1.060
	T-Statistic	-2.561	4.601	3.708	4.242	-1.621	-4.264		(0.415)
Greece	Coefficient	-0.135	0.197	0.043	0.047	-0.017	-0.004	56.13	3.664
	T-Statistic	-2.976	4.294	1.496	1.665	-2.395	-1.860		(0.000)
Ireland	Coefficient	0.104	0.029	0.070	0.201	0.014	-0.004	64.89	6.027
	T-Statistic	4.304	0.725	1.580	6.655	3.616	-1.285		(0.000)
Italy	Coefficient	0.039	0.024	0.127	0.004	0.003	0.001	82.53	1.554
	T-Statistic	1.704	0.911	19.628	0.436	1.643	0.539		(0.080)
Netherlands	Coefficient	0.064	-0.032	0.109	0.003	-0.007	0.001	49.08	1.940
	T-Statistic	1.680	-0.821	1.840	0.081	-0.869	0.100		(0.017)
Portugal	Coefficient	0.020	-0.022	0.048	0.118	0.013	-0.005	90.55	1.950
	T-Statistic	1.000	-0.840	1.315	2.939	10.439	-2.164		(0.019)
Spain	Coefficient	0.048	0.099	0.060	0.164	-0.017	0.007	85.28	2.048
	T-Statistic	1.677	2.784	4.206	13.655	-1.502	1.863		(0.011)
Denmark	Coefficient	0.008	0.121	0.235	0.090	0.010	0.010	61.05	2.578
	T-Statistic	0.162	3.528	6.264	5.835	1.583	3.241		(0.002)
Sweden	Coefficient	0.017	0.079	0.199	0.022	0.007	0.000	76.53	1.479
	T-Statistic	0.587	0.772	3.290	0.482	1.108	0.045		(0.106)
United Kingdom	Coefficient	0.042	0.062	0.093	0.012	-0.036	-0.006	71.18	3.054
	T-Statistic	0.991	1.477	6.718	0.818	-3.868	-1.743		(0.000)
Norway	Coefficient	-0.019	0.182	-0.030	0.055	-0.006	-0.015	51.87	1.998
	T-Statistic	-0.747	6.338	-1.322	2.490	-1.496	-3.844		(0.014)
Switzerland	Coefficient	0.053	-0.008	0.065	0.079	0.005	-0.020	63.54	2.132
	T-Statistic	1.449	-0.149	1.711	2.123	0.824	-3.107		(0.008)