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TOO SMALL OR TOO LOW?
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Abstract

The aim of this paper is to study the pricing factor structure of Italian equity returns. Using twenty five years of data, we focus on the role of other risk factors besides the market beta, namely size, book to market, and momentum. A two step empirical analysis is provided where first we estimate an unrestricted multi-factor model to test if there is any evidence of misspecification. Then, we estimate the restricted model, i.e. with pricing errors equal to zero, through the Generalized Methods of Moments (GMM). We find that the market premium and the size premium for stocks are confirmed for a domestic Italian investor. On the contrary, according to our asset pricing tests, weak evidence is found for the value premium. Finally, we highlight, coherently with recent evidence on other countries but in contrast with previous evidence for the Italian stock market, that augmenting the model with a momentum factor does not improve its performance.

Key words: the Fama-French factors; size effect; value premium; GMM; momentum anomaly.

JEL Classification: G10, G12

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1. Introduction

In 1992 Fama and French published a landmark paper in which it was shown with a cross-sectional analysis strong evidence of explanatory power by size and book-to-market factors, compared with a little or no capacity by the beta to explain equity returns differences. After them, a large body of literature came out with evidence of weak explanatory power by beta for explaining asset returns. Empirical works have mostly used US data and most of them reject beta and CAPM model (see, for example, Grinold, 1993). In another paper, Fama and French (1993) using a time-series approach found basically the same evidence. Despite the fact that this model is a landmark in empirical asset pricing, little evidence has been published concerning markets other than US, with some exceptions for Japan (Chan, Hamao and Lakonishok, 1991; Daniel, Titman, and Wei, 2001; Pham, 2007) and the UK (Fletcher, 1997; Strong and Xu, 1997; Gregory, Harris, and Michou, 2001; Levis and Liodakis, 2001; Gregory, Tharyan, Huang, 2009). Moreover, only a few papers have been produced with reference to small markets (see Faff, 2001, 2004 on the Australian stock market, Trimech, Kortas, Benammou and Benammou, 2009 on the French stock market, and Malin and Veeraraghavan, 2004 for a comparison of small European stock markets).

Building upon Fama and French (1993), we investigate the factor structure of the Italian Stock Market, through a GMM test of their three factor model augmented by a momentum effect, using stock market data from 1986 to 2010. Some studies on the Italian Stock Market have been produced both on the empirical relevance of the Fama and French three factors model (Aleati, Gottardo and Murgia, 2000; Beltratti and Di Tria, 2002), on the source of momentum and contrarian strategies (Mengoli, 2004), and on the relation between equity returns and macroeconomic forces (Panetta, 2002).

Our contribution to the existing empirical evidence on the Italian stock market is twofold: i) We provide an up to date empirical analysis to shed further light on the relevance of different factors besides the beta, with particular emphasis on the momentum effect, to explain equity returns over a medium time-horizon. ii) We show that the expected returns anomalies persist over the time-horizon analysed and are mainly connected to size and value characteristics while the momentum anomaly does not seem to play any role. Which means, in a nutshell, that by estimating a four factor model using a GMM procedure on 25 years of data, we find that the size and the value factor in addition to the beta contributes to the explanation of stock returns in Italy. However, our asset pricing tests do not support the momentum factor as an additional explanatory variable.

The rest of the paper is organized as follows: in section 2 we provide a brief review of the main related literature, while in section 3 we describe the data used for the empirical analysis and we explain the procedure adopted to construct the portfolios and the mimicking portfolios for the explanatory factors. Section 4 presents the results while section 5 concludes.

2. Related literature

In their seminal work Fama and French tries to explain how the stock returns depend not only on market factor measured in the classical theory of CAPM by the beta, but also on other factors. Mainly, they find that the strongest consistency in explaining the average returns is represented by size and book-to market value or indifferently the earning-price ratio, the cash-price ratio or the dividend-price ratio.[1]

[1] According to Gordon's formula good economic proxies for the book-to-market ratio are: dividend-to-price ratio, cash-to price ratio and earning-to-price ratio. An alternative measure of the past growth of a firm is given by growth in sales that are less volatile than either cash flow or earnings. Concerning this point see, among others, Lakonishok, Shleifer and Vishny (1994), Fama and French (1998) and Anderson and Brooks (2006).

The first critics to the standard CAPM emerged in the eighties highlighting a positive relation between the firm leverage and the stock average return (Bhandari, 1988). At the same time some other authors find that the U.S. stock average returns are positively linked to the book-market value ratio (Rosenberg, Reid and Lanstein, 1985). What Fama and French (1992) add to the previous literature is the joint role of market beta, size, earning-price ratio, leverage and book-to-market ratio with reference to NYSE, AMEX and NASDAQ stock returns. They find that the CAPM model does not hold in the U.S. market for the period between 1941-1990. In addition, they show the existence that the univariate relations between average return and size, leverage, E/P, and book-to-market value are strong. Their main conclusion is that stock risks are multidimensional: one dimension of risk is proxied by size, the other one is proxied by the ratio of the book value to its market value. In this way Fama and French (1992) confute the role of beta in the explanation of the stock returns; in other terms if there is a role for beta in average returns, it has to be found in a multi-factor model. Even if the Fama and French insights have given origin to a new and rich stream of the literature their results are not immune by critics that are mainly founded on the observation that the violations of the CAPM model are not simply linked to missing risk factors but to the existence of market imperfections, to the presence of irrational investors and to the inclusion of biases in the empirical methodology (see, for example, De Bondt and Thaler, 1985; Lakonishok, Shleifer and Vishny, 1994; Haugen, 1995; MacKinlay, 1995 and Knez and Ready, 1997).

De Bondt and Thaler (1985), Lakonishok, Shleifer and Vishny (1994) and Haugen (1995) point out that the so called “value” strategies – small market capitalization and high book-to-market equity stocks – yield higher returns than “glamour” strategies – large market capitalization and low book-to-market equity stock – because of investor overreaction rather than compensation for risk bearing. They argue that investors systematically overreact to recent corporate news, unrealistically extrapolating high or low growth into the future. This, in turn, leads to underpricing of value and the overpricing of glamour stocks. The value strategies produce higher returns because these strategies exploit the suboptimal behaviour of the typical investor and not because these strategies are fundamentally riskier. The explanation for this difference has been the subject of numerous studies, using different methods of investigation, to find out whether there is a risk premium for value stocks. Some of the results are controversial.

Lakonishok, Shleifer and Vishny (1994), with reference to the US stock market (NYSE and AMEX) from April 1968 to April 1990, find little support for the view that value strategies are fundamentally riskier than glamour strategies: they report that value betas are higher than growth betas in good times but are lower in bad times.

Petkova and Zhang (2005, 2008) further investigate this aspect finding that value betas tend to covary positively, and growth betas tend to covary negatively with the expected market risk premium. This result holds for most sample periods and for various value and growth strategies. However, although time-varying risk goes in the right direction, the magnitude of the value premium remains positive and mostly significant after having controlled for time-varying risk. Therefore, it is necessary to consider other possible drivers of the value anomaly.

Since the relevant period to evaluate the performance is the medium-term and not the long-term as in Lakonishok, Shleifer and Vishny (1994) some authors – see, for example, Jegadeesh and Titman (1993) and Rouwenhorst (1998) – suggest that a momentum anomaly can exist. They document that over a medium time horizon performance persists: firms with high returns over the past three months to one year continue to outperform firms with low past returns over the same period. In other terms the momentum effect holds. The momentum anomaly takes origin from the investor capacity to extrapolate from the previous stock prices the right market value of future stock prices. With reference to the US market, Jegadeesh and Titman (1993, 2001) show that strategies that involve taking a long (short) position in well (poorly) performing stocks on the basis of past performance over the previous 3-12 months tend to produce significantly positive abnormal returns of about 1% per month for the following year. These return continuation strategies – momentum return in individual stocks – should not be justified if markets were efficient. So, for these time horizons, what goes up tends to keep rising and vice versa. Two reasons can justify these results. One reason can be found in the variability of firms' fundamentals. When earnings growth exceed expectations or consensus forecasts of future earnings are revised upward and an "earnings momentum" is observed (Chan, Narasimhan and Lakonishok, 1999). Another reason can be reconnected to the fact that strategies based on price momentum and earnings momentum may be profitable because they exploit market underreaction to different information. For instance earnings momentum strategies may exploit underreaction to information about the short-term prospects of companies that will ultimately be manifested in near-term earnings. Price momentum strategies may exploit slow reactions to a broader set of value-relevant information, including long-term information that have not been fully captured by near-term earnings forecasts or past earnings growth. If both these explanations hold, then a strategy based on past returns in combination with a strategy based on earnings momentum should lead to higher profits than either strategies individually.

The evidence is mixed. In the recent past a large and growing body of research supported the presence of a momentum anomaly also with reference to European markets (Rouwenhorst, 1998), Asian markets (Chui, Titman. and Wei, 2000), Canadian market (L'Her, Masmoudi and Suret, 2004) and minor markets like Italy (Mengoli, 2004). Recently some authors have further investigated this aspect finding opposite results. Huang and Rubesam (2008), for example, find that the risk-adjusted momentum premium is significantly positive only during certain periods and that is going to disappear since the late 1990s in a process which was delayed by the occurrence of the high-technology stock bubble of the 1990s.

Moreover, Bulkley and Nawosah (2009) point out a general problem in testing asset pricing models because the residual pricing errors from the model specified may erroneously be interpret as momentum. Removing the effect of unconditional expected returns from the raw returns and then testing for momentum in the resulting series over the whole sample period implies the complete disappearance of the momentum effect.

3. Data and methodology

3.1 DATA

The data used to test the multi-factor models are derived from the closing price of the domestic Italian firms listed on the Milan Stock Exchange for the period between the 1-Jan-1986 and the 1-Feb-2010. Our dataset, based on a monthly frequency, includes survivor stocks for all the period considered and delisted stocks just for the period for which the firms are traded.[2] To be included in the sample we require that a firm has complete market and accounting/financial data for price, market capitalization, dividend yield, earnings per share, and book value of equity provided by the Datastream-Worldscope© database. Additionally a firm must have a minimum of twelve consecutive monthly returns. Finally we consider firms with voting shares thus excluding limited-voting shares when a company listed both, while we include limited–voting shares if these are the unique class of securities traded for a particular company. The total number of stocks is 489. All data are expressed in Euros, converted from Italian Lira when a firm has been delisted prior to January 1999.

[2] In this case delisted firms are eliminated from their delisting to the end of our sample period. On the survivorship bias problem see, among others, Banz and Breen (1986) and Fama and French (1998).

We compute the return on a single asset as follows:

$$R_t = \frac{p_t - p_{t-1}}{p_{t-1}} + dy_t \qquad (1)$$

where:

p_t = price at time t ;

dy_t = estimated monthly dividend yield at time t.

In order to estimate the monthly dividend yields, we spread the related annual dividend yields supplied by Datastream so that, compounding the monthly dividends gives back exactly the annual dividends. The risk-free rate used in our empirical tests is the three-month Italian Treasury bill rate, from the Bank of Italy, converted to the equivalent monthly rate.[3]

3.2 METHODOLOGY

The aim of this section is to explain the methodology adopted to test the Fama and French three Factor Model [Fama and French, 1992;1993 and Fama and French, 1996] on the Italian Stock Market. The theoretical *ex-ante* Fama and French model can be expressed as follows:

$$E(\tilde{R}_i) - R_f = \beta_i \left[E(\tilde{R}_m) - R_f \right] + \gamma_i E(\tilde{R}_{SmB}) + \delta_i E(\tilde{R}_{HmL}) \, ; \qquad (2)$$

where:

$E(\tilde{R}_i) - R_f$ = the expected excess return on asset i, with i = 1,…, N;

[3] As alternative proxies for the risk-free rate we also use the average between ask and bid rates of the Italian interbank rate quoted on the London Interbank Market published by Datastream and the three-month Eurodeposit rate converted to the equivalent one month rate from the database of the Bank of International Settlement (BIS). The choice of these variables does not produce significant differences in our results for the expected premia and for asset pricing tests.

$E(\tilde{R}_m) - R_f$ = the expected excess return on market portfolio;

$E(\tilde{R}_{SmB})$ = the expected return on the mimicking portfolio for the *Small minus Big* size factor;

$E(\tilde{R}_{HmL})$ = the expected return on the mimicking portfolio for the *High minus Low* value-growth factor;

R_f = the return on a risk-free asset

If the market determines the asset *i* price at the beginning of each period according to equation (2), and given the hypothesis of rational expectations for the CAPM, the asset *i* return observed *ex-post* for every period will respect the following empirical expression of the model:

$$R_{it} - R_{ft} = \alpha_i + \beta_i(R_{mt} - R_{ft}) + \gamma_i(R_{SmBt}) + \delta_i(R_{HmLt}) + \varepsilon_{it} \quad (3)$$

where ε_{it} is an i.i.d. error term normally distributed with 0 mean and constant variance.

If the above hypothesis holds we can use the OLS method to estimate the parameters of the model. However, if either the homoscedasticity or the normality assumption are not satisfied, we need an alternative method of estimation such as the Generalized Least Squares (GLS) or the Generalized Methods of Moments (GMM). The latter one requires very weak assumptions (see Hansen 1982), leaving aside the hypothesis of normality of the error term as well as the zero correlation hypothesis between the explicative variables and the error term itself (see Ruud, 2000; Hall, 2005; Greene, 2008).

To estimate equation (3) we perform a two step test. As a preliminary analysis we estimate the unrestricted model with the classical OLS method to test if the pricing errors (alpha) are not significantly different from zero. In fact, comparing the equations (2) and (3), it appears obvious that the model has one important implication: the intercept term (alpha) in a time-series regression should be zero. Given this implication we use the Black, Jensen and Scholes (1972) approach to evaluate this assumption: basically we run a time-series regression for each portfolio of assets and then we use the standard OLS *t*-statistics to test if the pricing errors (alpha) are zero.

As a second more accurate analysis of the factor structure of the Italian stock market, we test the restricted Fama and French Model (alpha = 0) using a GMM procedure. The basic idea of the GMM is to choose the parameters to be estimated to match the moments of the model itself with the empirical ones. The restricted model to be estimated is obtained by converting equation (2) in the following empirical counterpart:

$$R_{it} - R_{ft} = \beta_i (R_{mt} - R_{ft}) + \gamma_i (R_{SmBt}) + \delta_i (R_{HmLt}) + \varepsilon_{it} \qquad [i = 1,..., N] \quad [t = 1,\ldots,T] \qquad (4a)$$

or alternatively:

$$r_{it} = \beta_i r_{mt} + \gamma_i r_{SmBt} + \delta_i r_{HmLt} + \varepsilon_{it} \qquad [i = 1,..., N] \quad [t = 1,\ldots,T] \qquad (4b)$$

where:

r_{it} = $R_{it} - R_{ft}$ is the realized excess return on asset *i* ;

r_{mt} = $R_{mt} - R_{ft}$ is the realized excess return on market portfolio;

r_{SmBt} = R_{SmBt} is the realized return on the mimicking portfolio for the *Small minus Big* size factor;

r_{HmLt} = R_{HmLt} is the realized return on the mimicking portfolio for the *High minus Low* value-growth factor.

with 4N sample moments for each portfolio:

$$\begin{bmatrix} 1/T\sum_{t=1}^{T}\varepsilon_{1t}(R_{mt}-R_f),\ldots,1/T\sum_{t=1}^{T}\varepsilon_{Nt}(R_{mt}-R_f),1/T\sum_{t=1}^{T}\varepsilon_{1t}(R_{SmBt}),\ldots,1/T\sum_{t=1}^{T}\varepsilon_{Nt}(R_{SmBt}),\ldots,1/T\sum_{t=1}^{T}\varepsilon_{1t}(R_{HmLt}),\ldots, \\ 1/T\sum_{t=1}^{T}\varepsilon_{Nt}(R_{HmLt}),\ldots,1/T\sum_{t=1}^{T}\varepsilon_{1t},\ldots,1/T\sum_{t=1}^{T}\varepsilon_{Nt} \end{bmatrix}$$

and 3N parameters ($\boldsymbol{\theta} = \beta_1, \beta_2,\ldots, \beta_N, \gamma_1, \gamma_2,\ldots\gamma_N, \delta_1, \delta_2,\ldots, \delta_N$) to be estimated.

We can test the N over-identifying restrictions using the Hansen's (1982) *J* statistic which is appropriate with the GMM estimator. We compute the GMM estimator (see MacKinlay and Richardson, 1991; Campell, Lo and MacKinlay, 1997) as:

$$\hat{\boldsymbol{\theta}} \equiv \arg\min_{\theta} G(\boldsymbol{\theta}) \qquad (5)$$

where:

$G(\boldsymbol{\theta}) = g_T(\boldsymbol{\theta})^T\, W\, g_T(\boldsymbol{\theta})$ is the quadratic function of the moment conditions;

$g_T(\boldsymbol{\theta}) = \frac{1}{T}\sum_{t=1}^{T} f_T(\boldsymbol{\theta})$ is the empirical moment conditions vector;

$\boldsymbol{W}$ is the weighted matrix used for estimating the parameters.

Under the null hypothesis that the over-identifying restrictions are satisfied, the GMM-statistic times the number of regression observations is asymptotically χ^2 with degrees of freedom equal to the number of over-identifying restrictions (# of moment conditions - # of parameters). Finally for calculating the standard errors of our estimated parameters we use the Newey and West (1987) variance-covariance estimator.

3.3 CONSTRUCTION OF THE RISK FACTORS

In order to obtain the mimicking portfolios for the risk factors, we construct three groups of assets based on Size tertiles and three groups of assets based on the Price-Earnings ratio (P/E) tertiles. By the intersection of these groups we obtain nine portfolios named as R1V, R2V, R3V, R1M, R2M, R3M, R1G, R2G, R3G; where 1, 2, 3 indicate respectively small, medium and big firms, while V, M and G indicate respectively value, medium and growth firms, so that for example R3G is the portfolio containing the firms with an high Market Value (big firms) and an high P/E ratio (growth firms). On those portfolios we calculate the value weighted returns. Each portfolio is rebalanced yearly.

The next step is to construct the mimicking portfolios for each risk factor. The Market Factor (MKT) is constructed by calculating the monthly weighted value return of the stocks included in the sample.[4] The risk factor is calculated by substracting the relevant monthly risk free rate. The Size Factor (SMB) is obtained as the average return on the three "small firms" portfolios minus the average return on the three "big firms" portfolios:

$$SmB_t = \sum_{i=V,M,G} \frac{1}{3} Ri1_t - \sum_{i=V,M,G} \frac{1}{3} Ri3_t \qquad (6)$$

The Value Factor (HML) is obtained as is the average return on the three "value firms" portfolios minus the average return on the three "growth firms" portfolios[5]:

$$HmL_t = \sum_{i=1}^{3} \frac{1}{3} RiV_t - \sum_{i=1}^{3} \frac{1}{3} RiG_t \qquad (7)$$

To obtain the momentum factor, a different sorting procedure is needed. In practice we construct the momentum factor from a three-by-three tertiles sort on size and firm's past return, calculated according to the Cahrart (1997) procedure as the compound eleven-months returns lagged one month. By the intersection of these groups we obtain nine

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[4] To confirm the correctness of our methodology we calculate the correlation between the Market Factor and the Morgan Stanley Capital International Index (MSCI ITALY) and the Milan Stock Exchange Index (FTSE MIBTEL). The results is more than comforting: 98% and 99% on the entire sample period.

[5] We use the Price-Earning ratio (P/E) instead of the Market-to-Book ratio (M/B) used by Fama and French because the P/E ratio is well accepted in literature as proxy to identify a firm as a "value" or as a "growth" firm. We replicate our tests using the Market-to-Book ratio (M/B) and the main results remain unchanged.

portfolios named as R1W, R2W, R3W, R1WL, R2WL, R3WL, R1LS, R2LS, R3LS; where, as above, 1, 2 and 3 indicate small, medium and big firms while W, WL and LS indicate, respectively, "winner", "winner-loser" and "loser" firms so that, for example, R3W is the portfolio containing the "winners" with a high Market Value. The Momentum Factor (WML) is obtained as is the average return on the three "winner firms" portfolios minus the average return on the three "loser firms" portfolios:

$$WmL_t = \sum_{i=1}^{3} \frac{1}{3} RiW_t - \sum_{i=1}^{3} \frac{1}{3} RiLS_t \tag{8}$$

The new unrestricted and restricted models to be estimated are obtained by augmenting the initial 3 factors model with the momentum factor:

$$R_{it} - R_{ft} = \alpha_i + \beta_i (R_{mt} - R_{ft}) + \gamma_i (R_{SmBt}) + \delta_i (R_{HmLt}) + \eta_i (R_{WmLt}) + \varepsilon_{it} \tag{9}$$

$$R_{it} - R_{ft} = \beta_i (R_{mt} - R_{ft}) + \gamma_i (R_{SmBt}) + \delta_i (R_{HmLt}) + \eta_t (R_{WmLt}) + \varepsilon_{it} \quad [i = 1,..., N] \; [t = 1,\dots,T] \tag{10a}$$

or alternatively:

$$r_{it} = \beta_i r_{mt} + \gamma_i r_{SmBt} + \delta_i r_{HmLt} + \eta_t r_{WmL_t} + \varepsilon_{it} \quad [i = 1,..., N] \; [t = 1,\dots,T] \tag{10b}$$

where:

$r_{WmLt} = R_{WmLt}$ is the realized return on the mimicking portfolio for the *Winner minus Loser* momentum factor

with 5N sample moment condition for each portfolio:

$$\begin{bmatrix} 1/T\sum_{t=1}^{T}\varepsilon_{1t}(R_{mt}-R_f),\dots,1/T\sum_{t=1}^{T}\varepsilon_{Nt}(R_{mt}-R_f),1/T\sum_{t=1}^{T}\varepsilon_{1t}(R_{SmBt}),\dots,1/T\sum_{t=1}^{T}\varepsilon_{Nt}(R_{SmBt}),\dots,1/T\sum_{t=1}^{T}\varepsilon_{1t}(R_{HmLt}),\dots, \\ 1/T\sum_{t=1}^{T}\varepsilon_{Nt}(R_{HmLt}),\dots,1/T\sum_{t=1}^{T}\varepsilon_{1t}(R_{WmLt}),\dots,1/T\sum_{t=1}^{T}\varepsilon_{Nt}(R_{WmLt}),\dots,1/T\sum_{t=1}^{T}\varepsilon_{1t},\dots,1/T\sum_{t=1}^{T}\varepsilon_{Nt} \end{bmatrix}$$

and 4N parameters ($\boldsymbol{\theta} = \beta_1, \beta_2,\dots, \beta_N, \gamma_1, \gamma_2,\dots\gamma_N, \delta_1, \delta_2,\dots, \delta_N, \eta_1, \eta_2,\dots, \eta_N$) to be estimated. Hence, we obtained again N over-identifying restrictions.

To obtain the dependent variables of our time-series regression (i.e. the portfolios to be tested with the factor models), we calculate the value weighted returns for the sixteen portfolios obtained from the 4x4 intersection of market capitalization “size” rankings and P/E “value-growth” rankings of the firms.

4. Results

4.1 SUMMARY STATISTICS AND PRELIMINARY OLS RESULTS

In this subsection we report some preliminary results. Table 1 shows that the correlations between the four factors are low and only in one case (market factor and size factor) statistically different from zero. This result provides some support for using the factors as explanatory variables in our test.

[Insert Table 1&2]

As shown in Table 2 all the mimicking portfolios series exhibit a consistent evidence of non normality in the monthly returns. This is in line with the existing literature (see for example Fama, 1965 or Blattemberg and Gonedes, 1974). This evidence suggests the absence of normality in the series so, as explained above, it could be advisable to move from the OLS test to a GMM procedure. Generally speaking the annualized return on the “size” mimicking portfolio (SMB) is about 4.6%, with a 19% volatility. This is consistent with the theory of a risk premium for the smaller firms. On the contrary the annualized return of the “value-growth” mimicking portfolio (HML) is about 0.7% with a volatility of 13%. The annual excess return of the Market index (MKT) is about 2% with a volatility of about 22% and, hence, consistent with the assumption of risk aversion. Finally, the annual excess return on the momentum mimicking portfolio (WML) is about -0.6% with a volatility of about 22%. This preliminary descriptive analysis seems to suggest the absence of a momentum effect in the Italian Stock Market.

The above intuitions on the economic significance of the risk factors are confirmed also in Figures 1-4. For the time-horizon analyzed we report the average return on the various factor portfolios, namely market, size, value, and momentum. The first observation, for February 1986, is the average between January 1986 and February 1986. Subsequently, the mean is computed by adding one observation at a time until February 2010. Each point can be interpreted as the average (monthly percentage) return of an investment started in January 1986 and ended in the various months. The graphs can also be interpreted as a description of estimates of the time varying risk premium on each portfolio.

Given the length of the sample period, we have decided to split it into three sub-periods to better catch how the external macroeconomic and financial condition could have influenced the average returns of our four factors. We named these three periods as: i) the eighties (1986-1991), characterized by a strong international financial market liberalization with high stock market performance across several markets, and by an unprecedented crash event on October 19, 1987 (see Shiller, 1989); ii) the nineties (1991-2000), characterized by the European convergence process that, under the Maastricht Treaty, led to the European Monetary Union; the new millennium decade (2001-2010) characterized by the new economy bubble at the beginning, and by the subprime crises towards the end of the period.

Starting from the analysis of the market return (see Figure 1) the macroeconomic conditions that characterized Italy along our sample period imply: i) in the eighties a high public debt with a decreasing importance of the market return factor that becomes negative during the speculative attacks that forced Italy outside of the European Monetary System in 1992; ii) the entry in the European Union implies then an increased credibility and the market premium becomes positive; iii) finally we observe a decrease both in 2001 and 2008 in correspondence to the technological bubble in the first case and to the Lehman default in the second case.

Except for the first part of the period analyzed, the size factor contributes (see Figure 2) positively to the average Italian equity return. It is strongly positive during the first nineties; then decreasing during the technological bubble boom and after that once again positive. Its positive persistence could appear as a structural characteristic of the Italian market.

The HML factor (see Figure 3) has been negative in the first part of the sample, but becomes and remained substantially positive since the mid-nineties till the end of our sample period even if after the technological bubble it becomes nearly nil. Our results are coherent with a previous study by Beltratti and Di Tria (2002).[6]

Finally the momentum effect shows an irregular trend (see Figure 4) with a negative effect overall the analyzed period, being strongly negative before the technological bubble, but close to zero during the subprime crisis.

[Insert Figg. 1-2-3-4]

Table 3 reports, as a preliminary analysis, the OLS results to test if the pricing errors (alpha) are different from zero. In nine portfolios the intercept term is not statistically significant. That is, looking at the classical OLS statistics, we can reject the null hypothesis at a 1% confidence level of alpha=0, for seven portfolios out of sixteen. In these seven cases, because of the thinness of the market, the composition of the portfolios is based on one or very few stocks at the beginning of the sample period. This characteristic can lead to reject the null hypothesis because, in practice, we are testing with the same regression two totally different “assets”: a single stock at the beginning of the sample and a diversified portfolio in the remaining period.

[Insert Table 3]

[6] The differences in the size and in the sign of the HML factor, that arise sometime in our graph respect to the one by Beltratti and Di Tria (2002), can be due to the higher number of shares in our sample (489 vs. 205).

4.2 GMM TEST OF THE RESTRICTED FAMA AND FRENCH MODEL

Table 4 reports the results for the GMM analysis to test the restricted Three Factors Model developed by Fama and French applied to the Italian Stock Market. The results seem to support the model in nine out of sixteen portfolios, the null hypothesis cannot be rejected, as shown by the GMM statistics, with a 1% confidence level. We reject the null hypothesis that the over-identifying restrictions are satisfied in seven out of sixteen portfolios: R11, R14, R21, R22, R31, R33 and R34.

[Insert Table 4]

To understand the motivation behind the rejection of the null hypothesis in the above mentioned seven portfolios, we investigate if there are other factors that can be used in the model to explain portfolio returns. First of all, we estimate the unrestricted model (see equations 3 and 4.a) with a GMM procedure to investigate if the model is characterized by some pricing errors.[7] We find that in all these portfolios the constant term is significantly different from zero (see Table 5).

[Insert Table 5]

Even if the descriptive analysis provided above does not support a momentum effect for the Italian market, the lack of this risk factor could represent a possible explanation of the rejection of our model in seven out of sixteen portfolios. To analyze this possibility, we run a GMM test on the restricted Fama and French model augmented by a momentum effect. As shown in Table 6, for all the seven portfolios considered, we reject the null hypothesis that the over-identifying restrictions are satisfied. This result confirms our preliminary intuition that there is a very weak momentum effect in the Italian Stock Market. In fact, only portfolio R22 shows a significant coefficient at a 10% level with a negative sign.

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[7] In this case we use GMM procedure to estimate the unrestricted model to avoid possible biases given to the distribution assumptions.

[Insert Table 6]

5. Conclusions

This paper empirically tests a multi-factor model on the Italian Stock Market using 25 years of data. Our main results can be summarized as follows. Firstly, we find that the size premium is confirmed for a domestic Italian investor. The pricing errors do not appear statistically different from zero in nine out of sixteen portfolios. When they are statistically different from zero is probably due to the composition of the portfolios that, being formed by only a few assets at the beginning of the sample period, can affect the model specification. Secondly, the GMM test of the three factors specification appears to support the Fama and French Model applied to the Italian Stock Market. In nine out of sixteen portfolios the null hypothesis that the over-identifying restrictions are satisfied cannot be rejected. Finally, we found very weak evidence of a momentum effect in the Italian Stock Market.

Some macro factors could explain, as suggested above, some temporary anomaly as the momentum effect. However over a medium-long run horizon the momentum anomaly seems to disappear in line with the most recent literature.

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***Table I.* Correlations between Fama-French-Carhart Factors**

(a) MKT is the Market Factor = averaged weighted value returns of all the assets included in the sample minus the risk free rate. **(b)** SMB = Small Minus Big is the return on the mimicking portfolio for the size factor. **(c)** HML = High Minus Low is the return on the mimicking portfolio for the value-growth factor. **(d)** WML = Winners Minus Losers is the return on the mimicking portfolio for the momentum factor. Monthly data from 1-Jan-86 to 1-Feb-2010.

Correlation	**MKT** [a]	**SMB**[b]	**HML**[c]	**WML**[d]
MKT	1.0000			
SMB	-0.3931	1.0000		
HML	0.0836	-0.0533	1.0000	
WML	-0.0517	0.0214	0.0634	1.0000
p-value				
MKT-SMB	0.0000	***		
MKT-HML	0.1561			
MKT-WML	0.1484			
SMB-HML	0.3664			
SMB-WML	0.9434			
HML-WML	0.1085			

***Table II.* Basic descriptive statistics**

(a) MKT is the Market Factor = averaged weighted value returns of all the assets included in the sample minus the risk free rate. **(b)** SMB = Small Minus Big is the return on the mimicking portfolio for the size factor. **(c)** HML = High Minus Low is the return on the mimicking portfolio for the value-growth factor. **(d)** WML = Winners Minus Losers is the return on the mimicking portfolio for the momentum factor. Monthly data from 1-Jan-86 to 1-Feb-2010.

	MKT [a]	**SMB**[b]	**HML**[c]	**WML**[d]
Mean	0.0016	0.0037	0.0006	-0.0006
Median	-0.0029	0.0042	0.0008	0.0059
Maximum	0.2728	0.1791	0.1951	0.2176
Minimum	-0.1771	-0.1621	-0.1942	-0.6792
Std. Dev.	0.0646	0.0429	0.0373	0.0675
Skewness	0.5324	0.2130	0.4549	-4.2573
Kurtosis	4.7585	5.2593	11.5230	38.8088
Annualized return	0.0191	0.0458	0.0073	-0.0073
Annualized volatilità	0.2239	0.1485	0.1291	0.2340

Table III. OLS preliminary estimation of the unrestricted Fama and French Model

(***) = statistically significant at the 1% level; (**) = statistically significant at the 5% level; (*) = statistically significant at the 1% level. **(a)** The dependent variables are represented by sixteen portfolios. They have been constructed by subdividing the sample in four groups of assets based on value-growth ranking and on size ranking of firms. We identify two distinct set of assets as Growth-Value (four groups of assets based on P/E ratio quartiles) and Size (four groups of assets based on Market Value quartiles). From the intersection of the eight groups of assets we obtain the above sixteen portfolios. **(b)** the associated *p*-value is contained in parentheses below the coefficient estimate. **(c)** MKT is the Market Factor = averaged weighted value returns of all the assets listed minus the risk free rate.**(d)**SMB = Small Minus Big is the return on the mimicking portfolio for the size factor. **(e)** HML = High Minus Low is the return on the mimicking portfolio for the value-growth factor. **(f)** The *p*-value is contained in parentheses below the *F*-stat. Monthly data from 1-Jan-86 to 1-Feb-2010.

Dependent variable[a]	CONS[b]	MKT[b, c]	SMB[b, d]	HML[b, e]	F(3,285)[f]	R^2	Adj-R^2
R11	0.0060*	0.9268***	1.1065***	0.5662***	105.52	0.5262	0,5212
	(0.080)	*(0.000)*	*(0.000)*	*(0.000)*	*(0.000)*		
R12	0.0030	0.8696***	0.7633***	0.3067***	129.44	0.5767	0.5723
	(0.913)	*(0.000)*	*(0.000)*	*(0.000)*	*(0.000)*		
R13	-0.002	0.8735***	-0.5970***	0.0284	90.59	0.4881	0.4827
	(0.937)	*(0.000)*	*(0.000)*	*(0.802)*	*(0.000)*		
R14	0.0074**	0.9907***	1.1122***	-0.2551***	133.15	0.5836	0.5792
	(0.020)	*(0.000)*	*(0.000)*	*(0.005)*	*(0.000)*		
R21	0.0098***	1.1534***	0.5826***	0.6553***	158.25	0.6249	0.6209
	(0.002)	*(0.000)*	*(0.000)*	*(0.000)*	*(0.000)*		
R22	0.0064***	0.9182***	0.4307***	0.0925	216.69	0.6952	0.6920
	(0.003)	*(0.000)*	*(0.000)*	*(0.115)*	*(0.000)*		
R23	0.0033	0.8640***	0.4725***	0.2612***	173.87	0.6467	0.6429
	(0.881)	*(0.000)*	*(0.000)*	*(0.000)*	*(0.000)*		
R24	0.0037	0.7988*	0.6252***	-0.1319*	78.37	0.4521	0.4463
	(0.252)	*(0.000)*	*(0.000)*	*(0.137)*	*(0.000)*		
R31	0.0093***	1.0222***	0.3520***	0.5140***	115.76	0.6683	0.6648
	(0.000)	*(0.000)*	*(0.000)*	*(0.000)*	*(0.000)*		
R32	0,0039	0.9440***	0.3137***	-0.923*	137.77	0.6563	0.6527
	(0.121)	*(0.000)*	*(0.000)*	*(0.178)*	*(0.000)*		
R33	0.0046**	0.8388***	0.2407***	0.1931***	159.63	0.6454	0.6416
	(0.036)	*(0.000)*	*(0.000)*	*(0.002)*	*(0.000)*		
R34	0.0032	0.9765***	0.3566***	-0.2631***	116.63	0.6928	0.6895
	(0.180)	*(0.000)*	*(0.000)*	*(0.000)*	*(0.000)*		
R41	0.0006	0.9182***	-0.0630	0.5505***	176.99	0.7259	0.7220
	(0.788)	*(0.000)*	*(0.252)*	*(0.000)*	*(0.000)*		
R42	0.0028	0.9118***	-0.6833	0.4899***	257.98	0.7931	0.7910
	(0.122)	*(0.000)*	*(0.132)*	*(0.000)*	*(0.000)*		
R43	0.0014	0.9197***	-0.1173***	0.1083***	253.59	0.8622	0.8607
	(0.344)	*(0.000)*	*(0.001)*	*(0.007)*	*(0.000)*		
R44	0.0047***	1.0813***	-0.1123***	-0.335***	693.02	0.8758	0.8748
	(0.006)	*(0.009)*	*(0.009)*	*(0.000)*	*(0.000)*		

***Table IV*. GMM Tests of the restricted Fama and French Model**

(***) = statistically significant at the 1% level; (**) = statistically significant at the 5% level; (*) = statistically significant at the 1% level. **(a)** The dependent variables are represented by sixteen portfolios. They have been constructed by subdividing the sample in four groups of assets based on value-growth ranking and on size ranking of firms. We identify two distinct set of assets as Growth-Value (four groups of assets based on P/E ratio quartiles) and Size (four groups of assets based on Market Value quartiles). From the intersection of the eight groups of assets we obtain the above sixteen portfolios. **(b)** the associated *p*-value is contained in parentheses below the coefficient estimate. **(c)** MKT is the Market Factor = averaged weighted value returns of all the assets listed minus the risk free rate. **(d)** SMB = Small Minus Big is the return on the mimicking portfolio for the size factor. **(e)** HML = High Minus Low is the return on the mimicking portfolio for the value-growth factor. **(f)** The generalized method of moments test statistic (GMM) testing the three-factor model holds, is distributed as a chi-square with (# moment conditions - # of parameters) degrees of freedom. Monthly data from 1-Jan-86 to 1-Feb-2010.

Dependent variable[a]	**MKT[b, c]**	**SMB[b, d]**	**HML[b, e]**	**GMM-stat[f]**
R11	0.8047***	0.7970***	0.3001	4.7571*
	(0.000)	(0.000)	(0.404)	(0.029)
R12	0.8668***	0.7592***	0.3062**	0.0145
	(0.000)	(0.000)	(0.009)	(0.904)
R13	0.8769***	0.6007***	0.0212	0.0077
	(0.000)	(0.000)	(0.888)	(0.930)
R14	0.8858***	0.9952***	-0.1283	6.7780**
	(0.000)	(0.000)	(0.450)	(0.009)
R21	1.0460***	0.5598***	0.1333	9.7917**
	(0.000)	(0.000)	(0.511)	(0.002)
R22	0.8659***	0.4891 ***	0.2226*	8.8042**
	(0.000)	(0.000)	(0.058)	(0.003)
R23	0.8621***	0.4732***	0.2627***	0.0236
	(0.000)	(0.000)	(0.001)	(0.878)
R24	0.8090***	0.6383***	-0.0480	1.3458
	(0.000)	(0.000)	(0.643)	(0.246)
R31	0.9585***	0.3571***	0.4232***	13.3407***
	(0.000)	(0.001)	(0.000)	(0.000)
R32	0.9240***	0.3115***	-0.0440	2.6528
	(0.000)	(0.002)	(0.768)	(0.103)
R33	0.8084***	0.2837***	0.2278**	4.3689*
	(0.000)	(0.000)	(0.022)	(0.037)
R34	0.9504***	0.3419***	-0.2285	2.0590
	(0.000)	(0.001)	(0.120)	(0.151)
R41	0.9163***	-0.0591	0.5574	0.0740
	(0.000)	(0.453)	(0.000)	(0.786)
R42	0.8901***	-0.0438	0.5339	2.4581
	(0.000)	(0.549)	(0.000)	(0.117)
R43	0.9180***	-0.1156**	0.1221*	0.9513
	(0.000)	(0.021)	(0.100)	(0.329)
R44	1.0635***	-0.0880	-0.3132***	7.6710**
	(0.000)	(0.109)	(0.000)	(0.006)

***Table V.* GMM Tests of the unrestricted Fama and French Model**

(***) = statistically significant at the 1% level; (**) = statistically significant at the 5% level; (*) = statistically significant at the 1% level. **(a)** The dependent variables are represented by sixteen portfolios. They have been constructed by subdividing the sample in four groups of assets based on value-growth ranking and on size ranking of firms. We identify two distinct set of assets as Growth-Value (four groups of assets based on P/E ratio quartiles) and Size (four groups of assets based on Market Value quartiles). From the intersection of the eight groups of assets we obtain the above sixteen portfolios. **(b)** the associated *p*-value is contained in parentheses below the coefficient estimate. **(c)** MKT is the Market Factor = averaged weighted value returns of all the assets listed minus the risk free rate. **(d)** SMB = Small Minus Big is the return on the mimicking portfolio for the size factor. **(e)** HML = High Minus Low is the return on the mimicking portfolio for the value-growth factor. Monthly data from 1-Jan-86 to 1-Feb-2010.

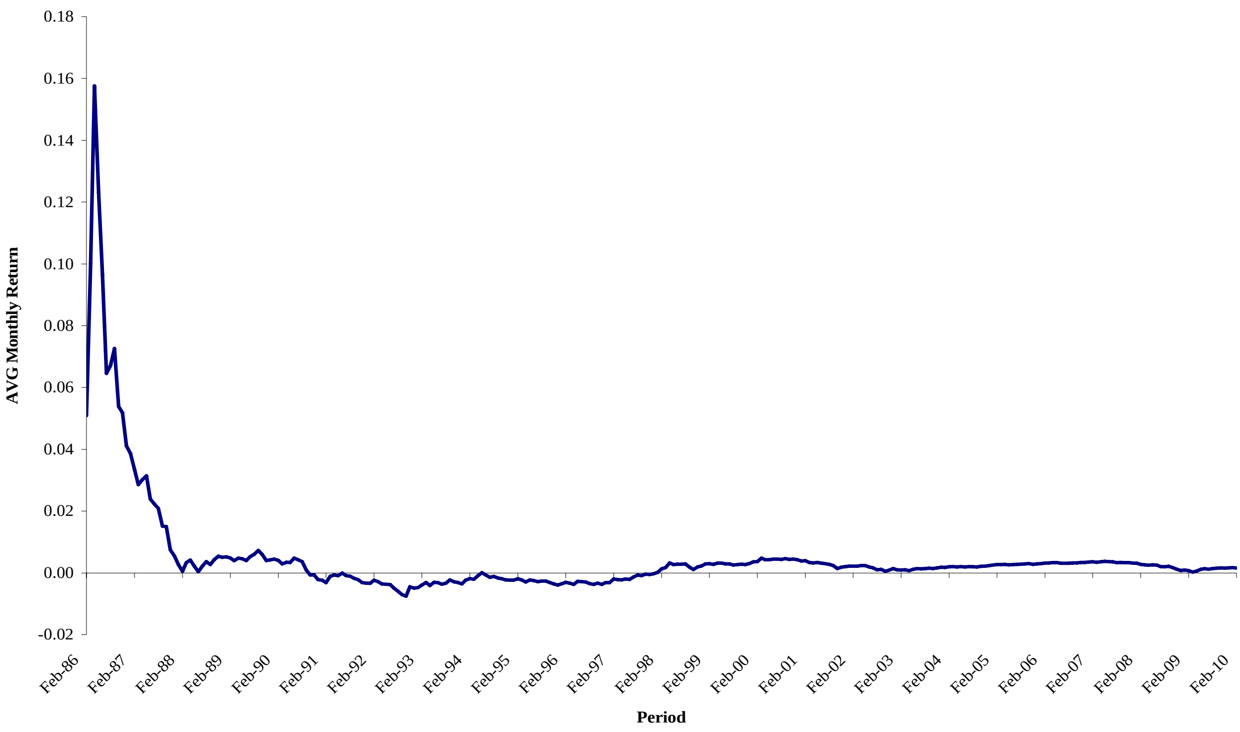
Dependent variable[a]	CONS[b]	MKT[b, c]	SMB[b, d]	HML[b, e]	R^2	Adj-R^2
R11	0.0060***	0.9258***	1.1060***	0.5659	0.5262	0.5212
	(0.029)	*(0.000)*	*(0.000)*	*(0.111)*		
R14	0.0078***	0.9837***	1.1078***	-0.2576	0.5836	0.5712
	(0.009)	*(0.000)*	*(0.000)*	*(0.132)*		
R21	0.0098***	1.1510***	0.5812***	0.6546**	0.6249	0.6209
	(0.002)	*(0.000)*	*(0.000)*	*(0.017)*		
R22	0.0064***	0.9175***	0.4302***	0.0922	0.6952	0.6920
	(0.003)	*(0.000)*	*(0.000)*	*(0.412)*		
R31	0.0093***	1.0177***	0.3494***	0.5125***	0.6683	0.6648
	(0.000)	*(0.000)*	*(0.001)*	*(0.000)*		
R33	0.0047**	0.8342***	0.2384***	0.1917*	0.6453	0.6416
	(0.037)	*(0.000)*	*(0.002)*	*(0.065)*		
R44	0.0047***	1.0820***	-0.1120**	-0.3313***	0.8758	0.8744
	(0.006)	*(0.000)*	*(0.039)*	*(0.000)*		

***Table VI.* GMM Tests of the restricted Fama and French Model augmented with the Momentum factor**

(***) = statistically significant at the 1% level; (**) = statistically significant at the 5% level; (*) = statistically significant at the 1% level. **(a)** The dependent variables are represented by sixteen portfolios. They have been constructed by subdividing the sample in four groups of assets based on value-growth ranking and on size ranking of firms. We identify two distinct set of assets as Growth-Value (four groups of assets based on P/E ratio quartiles) and Size (four groups of assets based on Market Value quartiles). From the intersection of the eight groups of assets we obtain the above sixteen portfolios. **(b)** the associated *p*-value is contained in parentheses below the coefficient estimate. **(c)** MKT is the Market Factor = averaged weighted value returns of all the assets listed minus the risk free rate. **(d)** SMB = Small Minus Big is the return on the mimicking portfolio for the size factor. **(e)** HML = High Minus Low is the return on the mimicking portfolio for the value-growth factor. (**f**) WML = Winners Minus Losers is the return on the mimicking portfolio for the momentum factor. (**g**) The generalized method of moments test statistic (GMM) testing the three-factor model holds, is distributed as a chi-square with (# moment conditions - # of parameters) degrees of freedom. Monthly data from 1-Jan-86 to 1-Feb-2010.

Dependent variable[a]	**MKT[b, c]**	**SMB[b, d]**	**HML[b, e]**	**WML[b, f]**	**GMM-stat[g]**
R11	0.7842***	0.8375***	0.3731	-0.1246	4.6090*
	(0.000)	*(0.000)*	*(0.237)*	*(0.401)*	*(0.032)*
R14	0.8892***	0.9998***	-0.1193	0.0121	6.8365**
	(0.000)	*(0.000)*	*(0.473)*	*(0.885)*	*(0.009)*
R21	1.0734***	0.6060***	0.2218	0.0397	10.5276***
	(0.000)	*(0.000)*	*(0.334)*	*(0.757)*	*(0.001)*
R22	0.8583***	0.4801***	01833	-06805*	8.694***
	(0.000)	*(0.000)*	*(0.131)*	*(0.058)*	*(0.003)*
R31	0.9598***	0.3629***	0.4206***	-0.1393	13.3870***
	(0.000)	*(0.000)*	*(0.000)*	*(0.797)*	*(0.000)*
R33	0.8188**	0.2842***	0.2493***	0.0561	4.5736*
	(0.000)	*(0.000)*	*(0.008)*	*(0.343)*	*(0.032)*
R44	1.0753***	-0.8777	-0.2857**	0.0607	8.3298***
	(0.000)	*(0.104)*	*(0.000)*	*(0.157)*	*(0.004)*

Market factor 02/01/1986-02/01/2010



Market factor 02/01/1986-03/01/1991

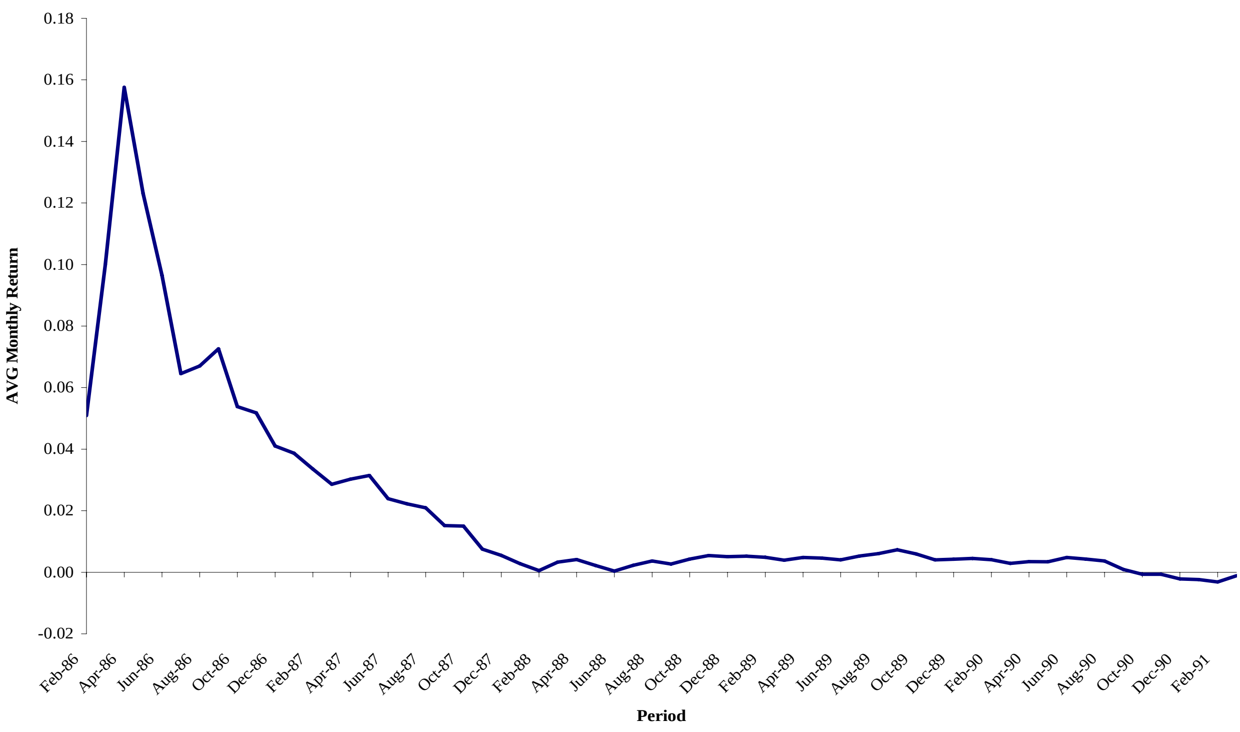


Figure1 Market Factor-Part A. The first observation, for February 1986, is the average between January 1986 and February 1986. The mean is computed by adding one observation at a time until February 2010. Market Factor-Part B. The first observation, for February 1986, is the average between January 1986 and February 1986. The mean is computed by adding one observation at a time until February 1991. Each point can be interpreted as the average (monthly percentage) market return of an investment started in January 1986 and ended in the various months.

Market factor 04/01/1991-12/01/2000

Market factor 01/01/2001-02/01/2010

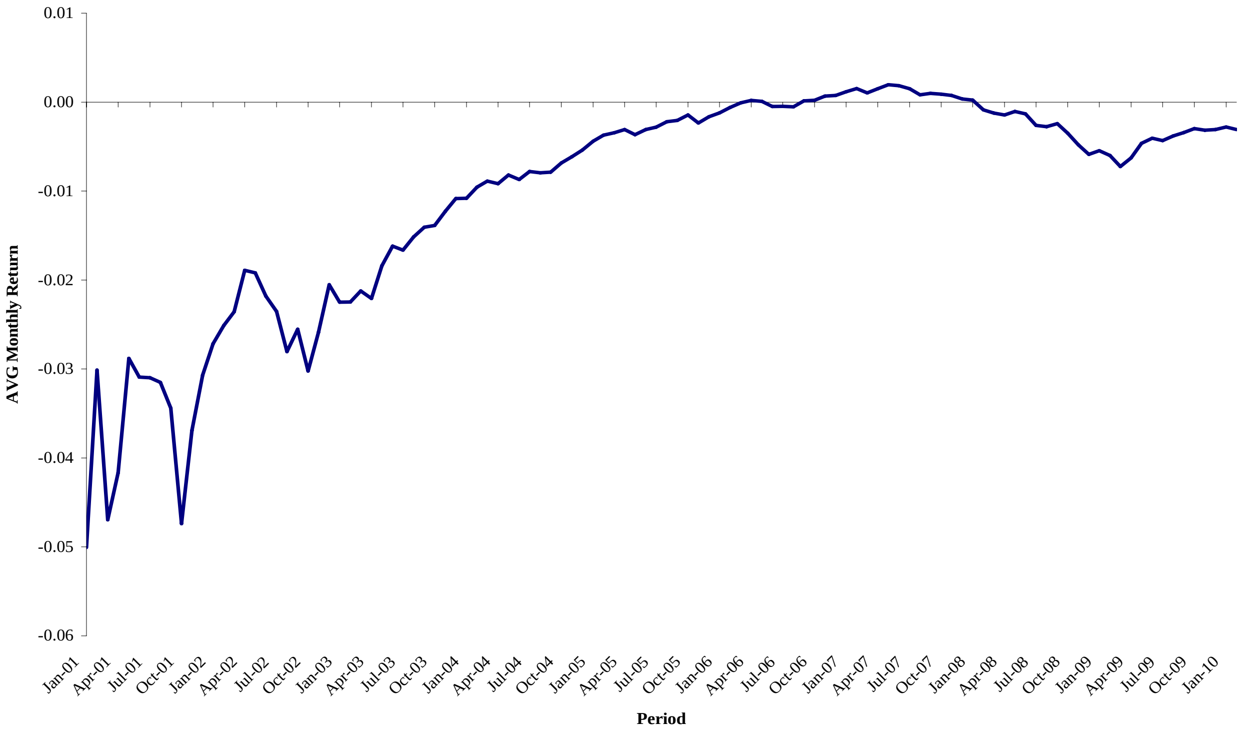
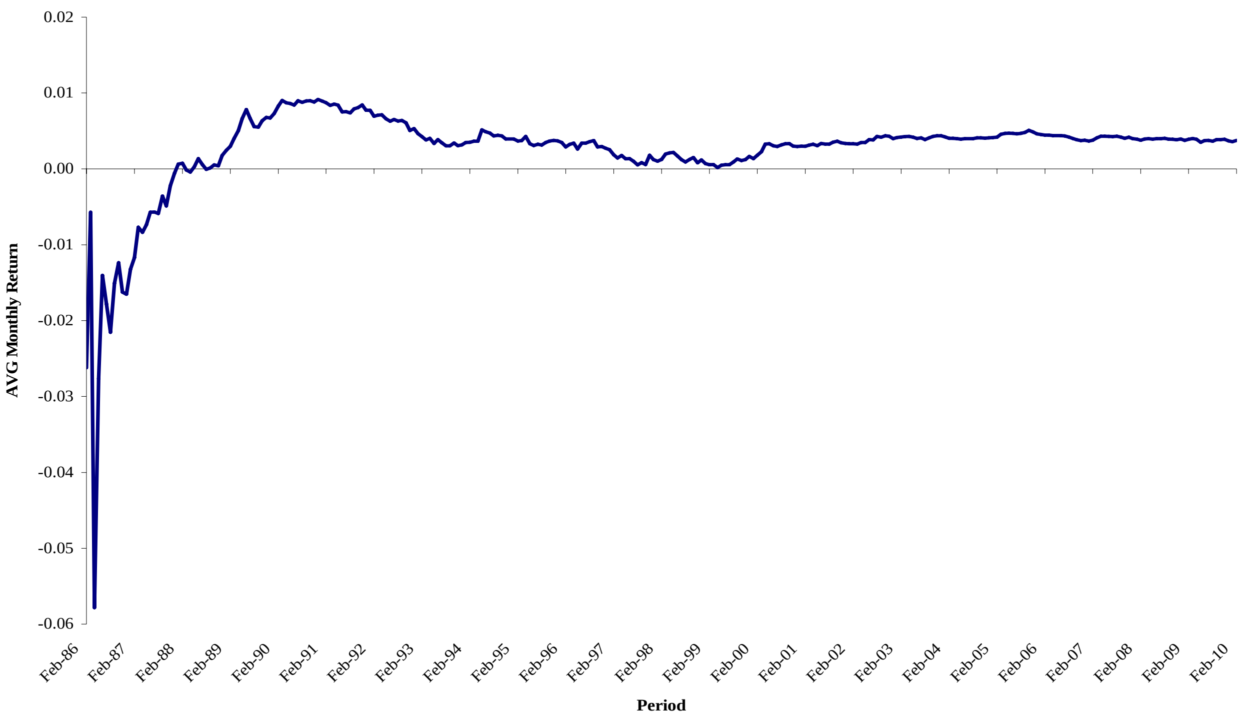


Figure 1 Market Factor-Part C. The first observation, for April 1991, is the average between March 1991 and April 1991. The mean is computed by adding one observation at a time until December 2000. Market Factor-Part D. The first observation, for January 2001, is the average between December 2000 and January 2001. The mean is computed by adding one observation at a time until January 2010. Each point can be interpreted as the average (monthly percentage) market return of an investment started in January 1986 and ended in the various months.

Size factor 02/01/1986-02/01/2010



Size factor 02/01/1986-03/01/1991

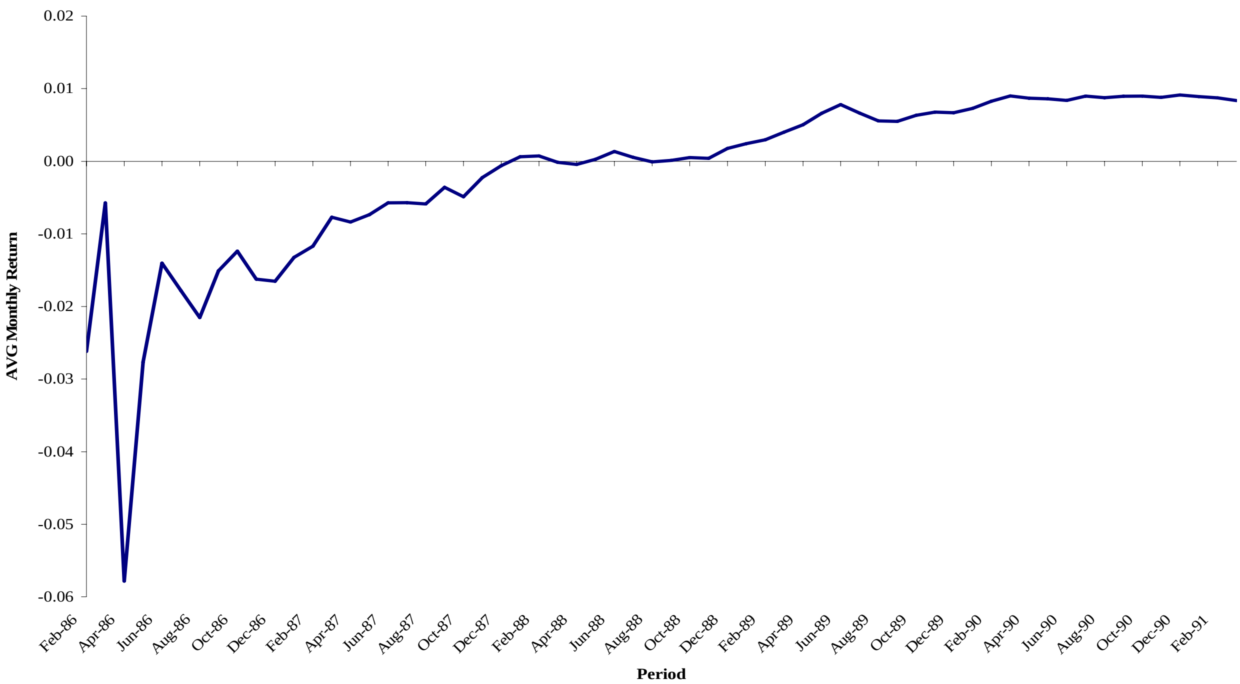
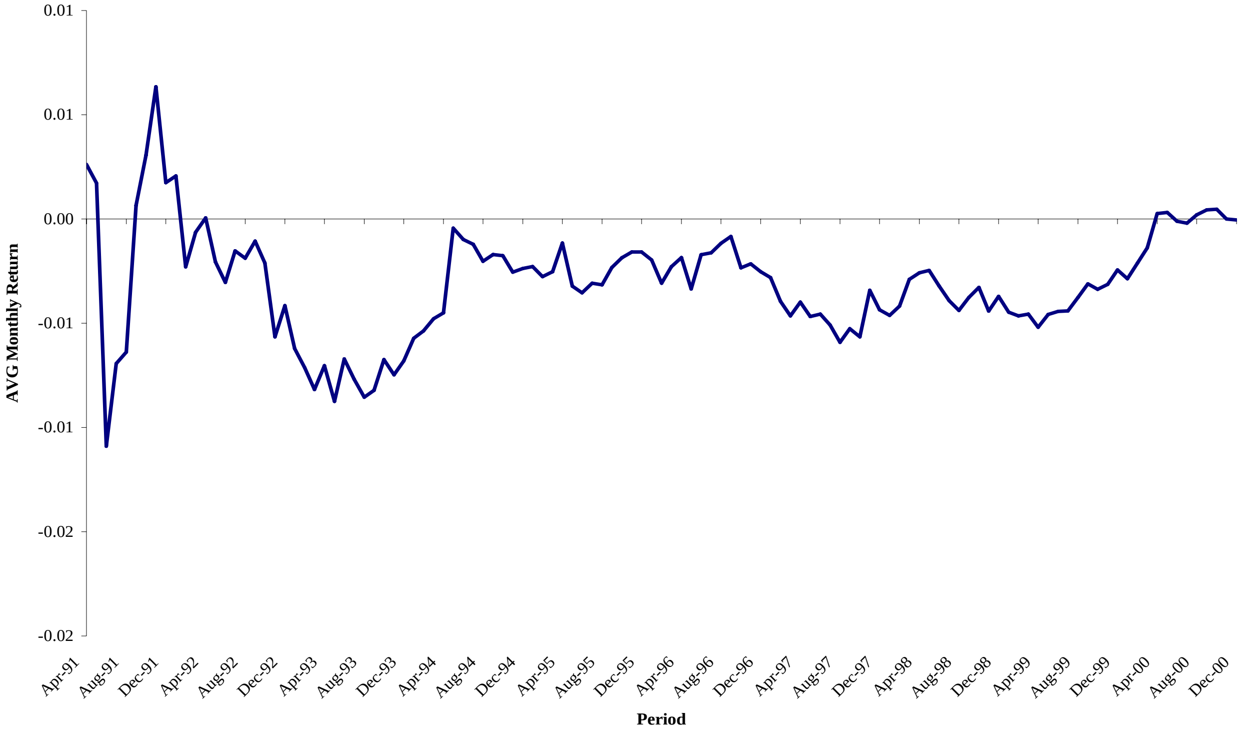


Figure 2 Size Factor-Part A. The first observation, for February 1986, is the average between January 1986 and February 1986. The mean is computed by adding one observation at a time until February 2010. Size Factor-Part B. The first observation, for February 1986, is the average between January 1986 and February 1986. The mean is computed by adding one observation at a time until February 1991. Each point can be interpreted as the average (monthly percentage) market return of an investment started in January 1986 and ended in the various months.

Size factor 04/01/1991-12/01/2000



Size factor 01/01/2001-02/01/2010

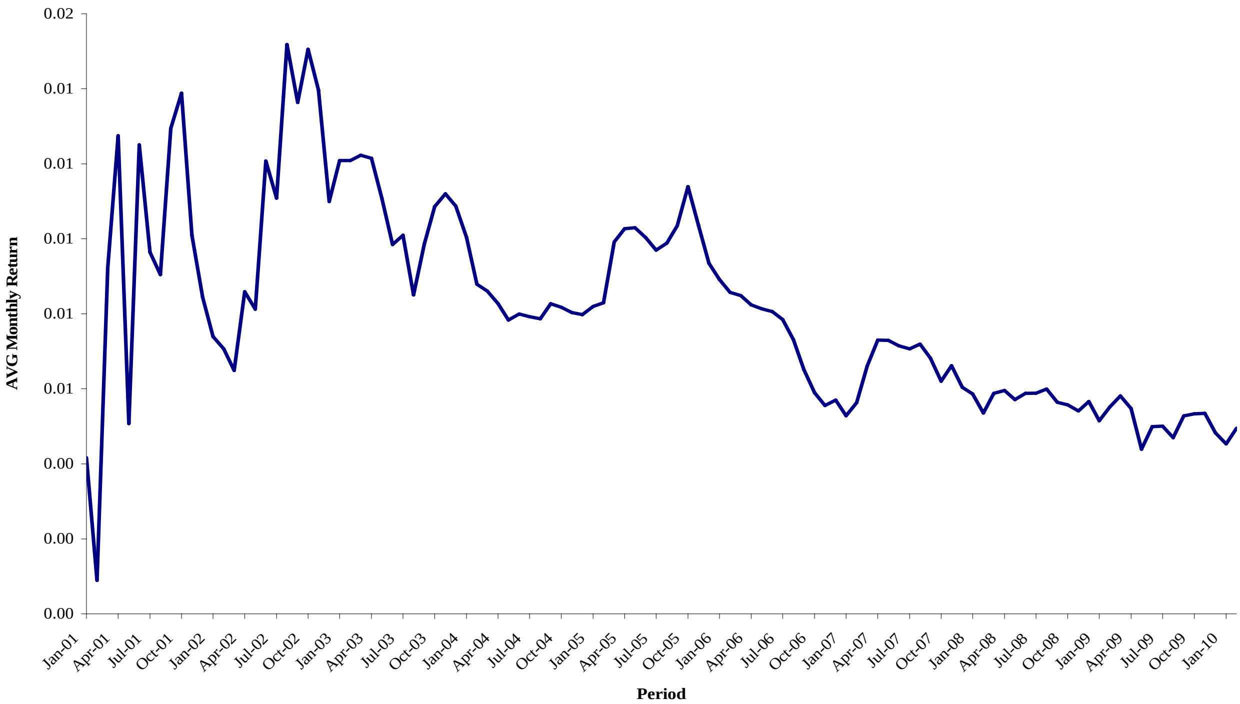
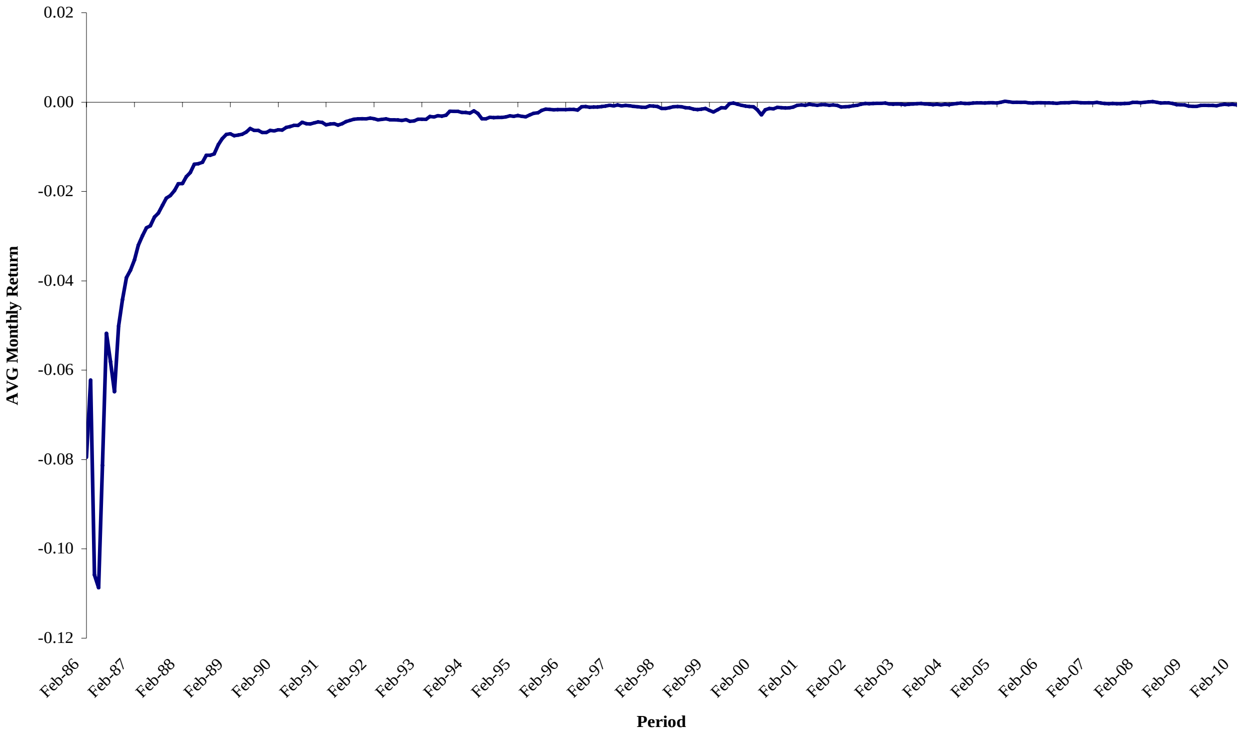


Figure 2 Size Factor-Part C. The first observation, for April 1991, is the average between March 1991 and April 1991. The mean is computed by adding one observation at a time until December 2000. Size Factor-Part D. The first observation, for January 2001, is the average between December 2000 and January 2001. The mean is computed by adding one observation at a time until January 2010. Each point can be interpreted as the average (monthly percentage) market return of an investment started in January 1986 and ended in the various months.

Value factor 02/01/1986-02/01/2010



Value factor 02/01/1986-03/01/1991

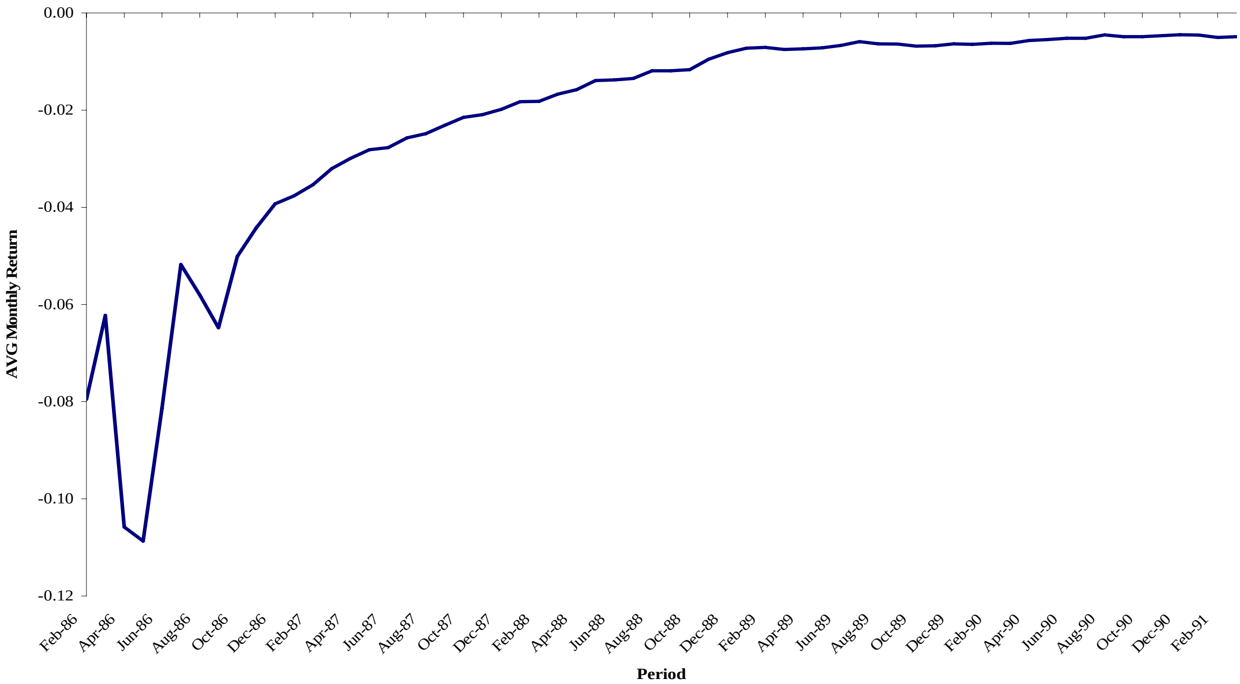
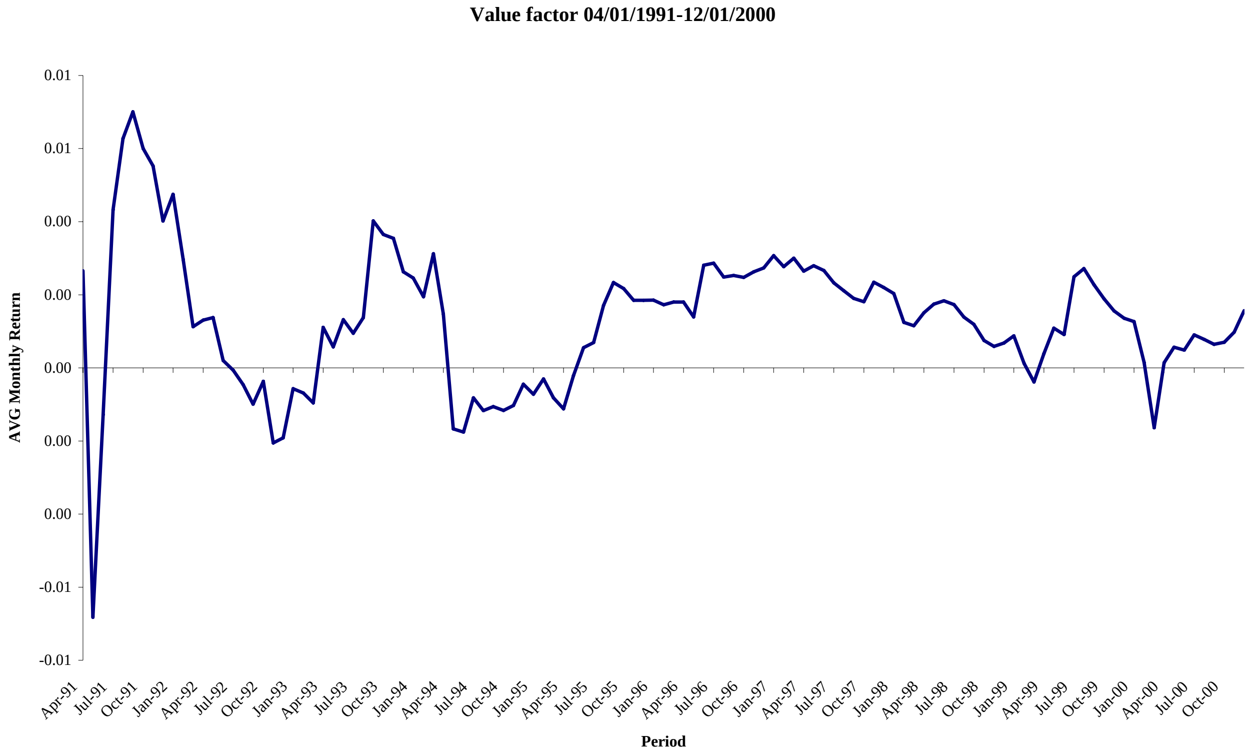


Figure 3 Value/Growth Factor-Part A. The first observation, for February 1986, is the average between January 1986 and February 1986. The mean is computed by adding one observation at a time until February 2010. Value/Growth Factor-Part B. The first observation, for February 1986, is the average between January 1986 and February 1986. The mean is computed by adding one observation at a time until February 1991. Each point can be interpreted as the average (monthly percentage) market return of an investment started in January 1986 and ended in the various months.



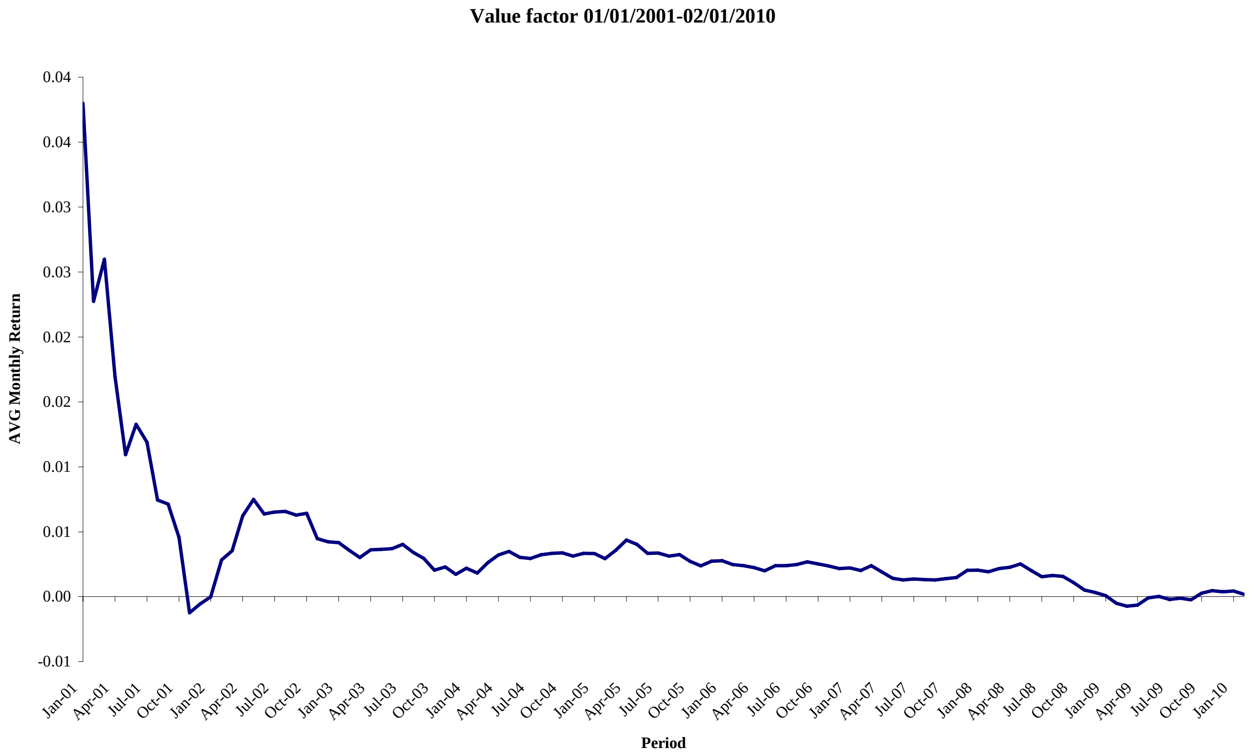
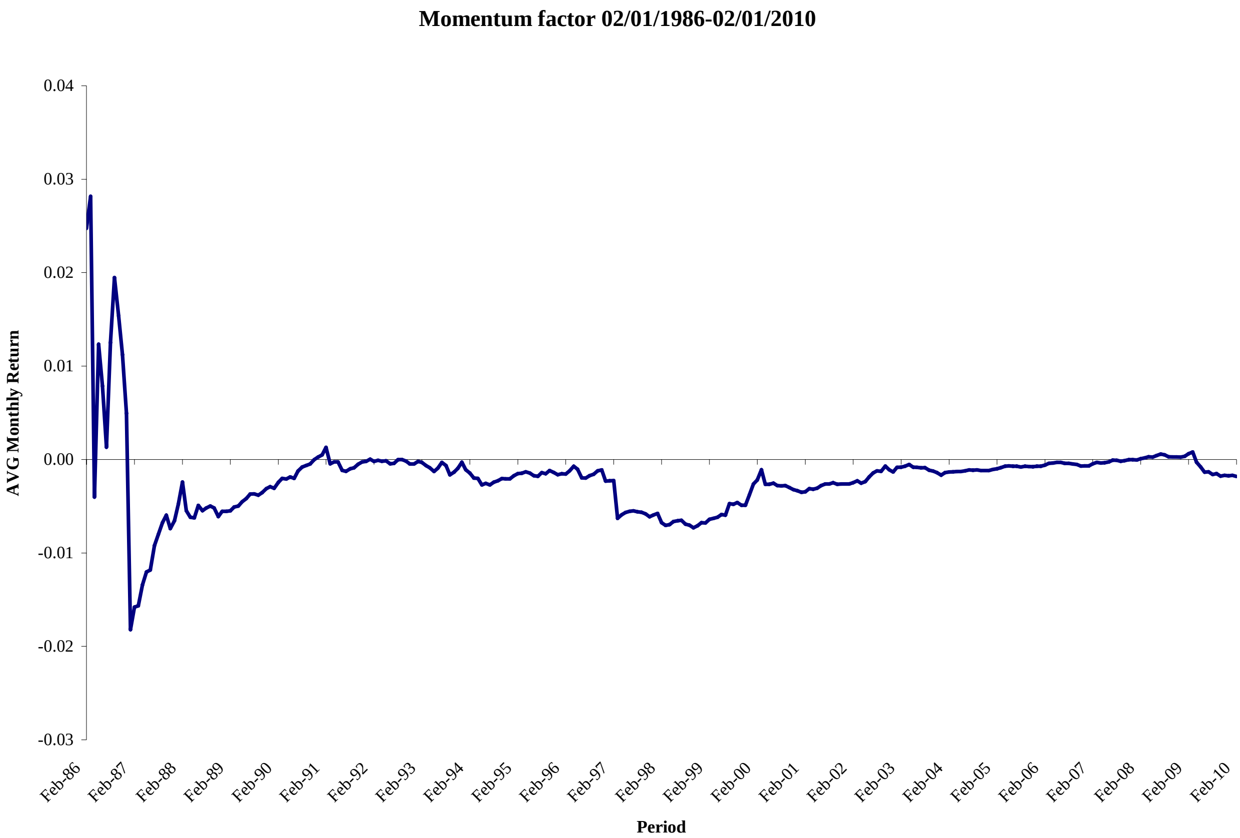


Figure 3 Value/Growth Factor-Part C. The first observation, for April 1991, is the average between March 1991 and April 1991. The mean is computed by adding one observation at a time until December 2000. Value/Growth Factor-Part D. The first observation, for January 2001, is the average between December 2000 and January 2001. The mean is computed by adding one observation at a time until January 2010. Each point can be interpreted as the average (monthly percentage) market return of an investment started in January 1986 and ended in the various months.



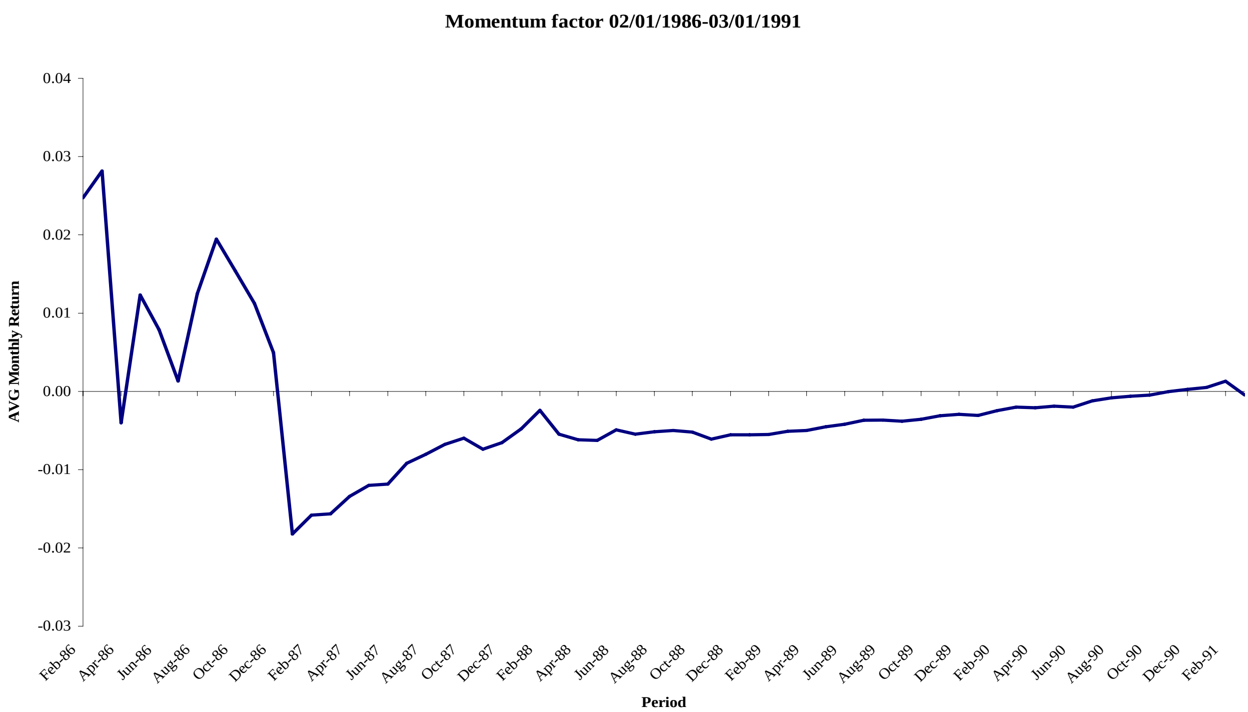
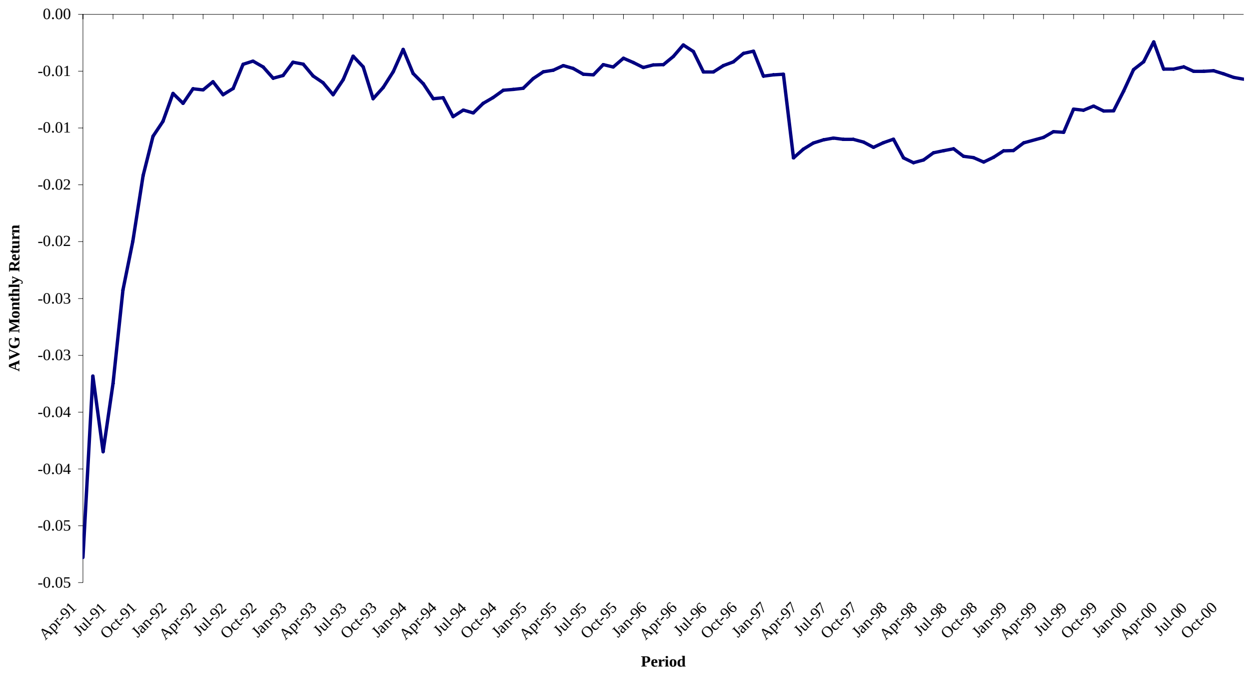


Figure 4 Momentum-Part A. The first observation, for February 1986, is the average between January 1986 and February 1986. The mean is computed by adding one observation at a time until February 2010. Momentum Factor-Part B. The first observation, for February 1986, is the average between January 1986 and February 1986. The mean is computed by adding one observation at a time until February 1991. Each point can be interpreted as the average (monthly percentage) market return of an investment started in January 1986 and ended in the various months.

Momentum factor 04/01/1991-12/01/2000



Momentum factor 01/01/2001-02/01/2010

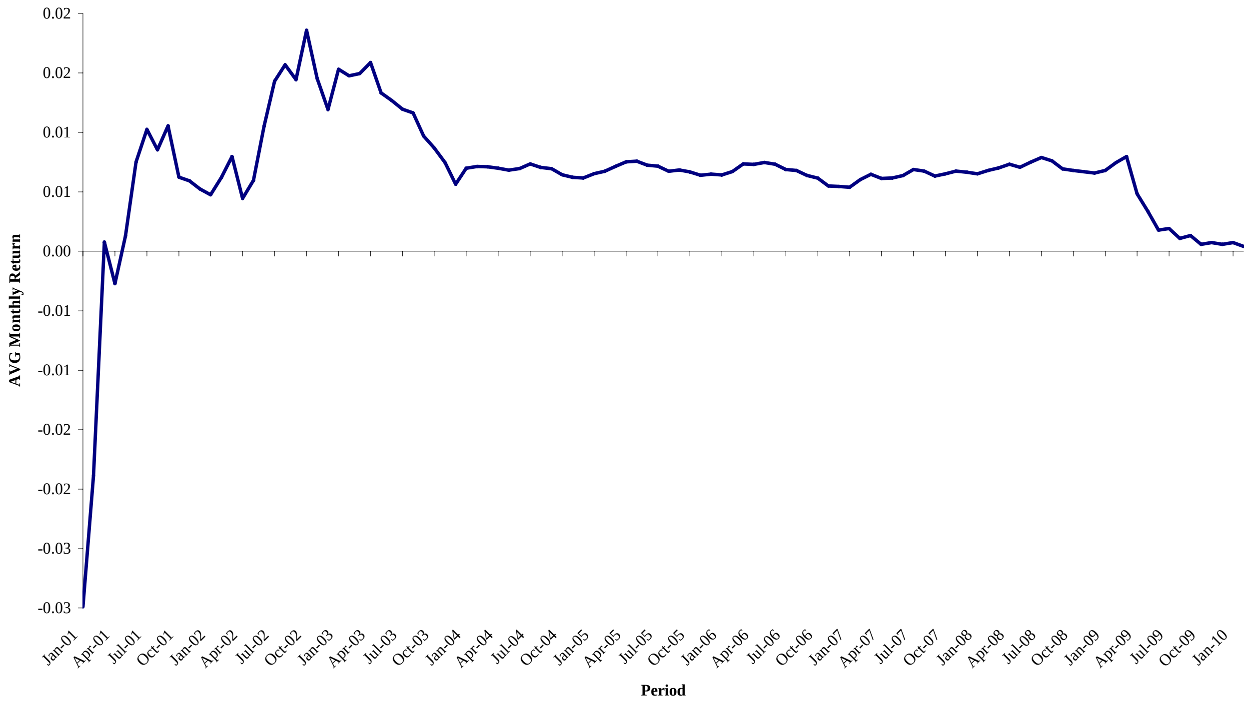


Figure 4 Momentum-Part C. The first observation, for April 1991, is the average between March 1991 and April 1991. The mean is computed by adding one observation at a time until December 2000. Momentum-Part D. The first observation, for January 2001, is the average between December 2000 and January 2001. The mean is computed by adding one observation at a time until January 2010. Each point can be interpreted as the average (monthly percentage) market return of an investment started in January 1986 and ended in the various month.