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Does the Fama-Franch three-factor model work in the financial industry? Evidence from European bank stocks

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Abstract

The Fama-French three-factor model (Fama and French, 1993) has been subject to extensive testing on samples of US and European non-financial firms over several time windows. The most accepted evidence is that size premium and value premium as well as market risk premium help explain time-series changes in stock returns. However, scholars have always paid little attention to the financial industry because of the intrinsic differences between financial and non-financial firms. The few studies that have tested the model on financial firms have found mixed evidence regarding the role of size and the book-to-market ratio in explaining stock returns. We find, on a sample of European banks, that size and book-to-market (B/M) ratio seem to be sources of undiversifiable risks and should therefore be included as risk premiums for estimating the expected returns of financial firms. Small and high-B/M banks seem to be more risky. Smaller banks are not systemically important financial institutions and therefore do not benefit from government protection. High-B/M banks are likely to be unprofitable, without growth opportunities, and close to financial distress.

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1 Introduction

Pricing models are charged with the task of identifying factors that explain the return of risky assets. They are employed in many theoretical and operational finance areas such as event study to test capital market efficiency and the value effects of corporate finance choices (e.g., capital structure decisions, dividend policy, M&A announcements, etc.), management and performance evaluation of funds and portfolios, cost of capital estimation in capital budgeting issues, and so on.

The theory of capital market equilibrium faces the problem by identifying the appropriate relationship between a risk measure and the expected return. The first formalized theory of market equilibrium can be identified in the Capital Asset Pricing Model (CAPM) independently developed by Treynor (1962), Sharpe (1964), Lintner (1965) and Mossin (1966)—hereafter, the SL model. The validity of the risk-return relationship proposed by the SL model was further tested by several empirical studies (e.g., Black et al., 1972, Fama and MacBeth, 1973, Gibbons, 1982, and Stambaugh, 1982) which largely found results that were inconsistent with the CAPM basic assumptions.

Empirical tests often failed to support the SL model mainly due to the following reasons. First, methodological issues may affect test results. Empirical tests rely on two widely recognized methodologies: times-series regressions, where monthly or weekly portfolio excess returns are regressed on monthly or weekly market excess returns, and cross-section regressions, where average portfolio excess returns are regressed on portfolio betas estimated by first-pass times-series regressions. Cross-section tests may therefore be affected by errors in beta estimation. Some scholars (e.g., Miller and Scholes, 1972, and Roll, 1977) have tried to correct beta estimations whereas others (Beaver et al., 1970) have attempted to estimate the true beta directly using the corporate fundamentals (instrumental beta).

Second, CAPM assumptions may be, to a certain extent, unrealistic. Inconsistent results may be due to frictions and market imperfections such as taxes, non-homogeneous expectations, different lending and borrowing rates, etc. that the CAPM does not incorporate (Brennan, 1970; Black, 1972; Mayers, 1972; Lindenberg, 1979; Mayshar, 1981).

Third, market beta may not be sufficient to explain cross-sectional changes in stock returns since investors need to be rewarded for additional, non-diversifiable risk factors. This means that the market portfolio is inefficient and market risk is not the only source of risk. This explanation led to the existence of the so-called multifactor pricing models which take multiple causes of risk into account. The first formalized multifactor model was the Arbitrage Pricing Theory (Ross, 1976) which may include further risk factors such as macroeconomic and financial variables other than the market index. Multifactor models may also take into account corporate fundamentals such as market capitalization (MV), price-to-earnings ratio (P/E), price-to-cash flow per share ratio (P/CF), book-to-market ratio (B/M), etc., provided that they are linked to risk sources that investors require compensation for. The Fama-French three-factor model (Fama and French, 1993)—hereafter, TFM—is probably the most studied and popular multifactor model. It shows that risk premiums built on market capitalization (MV) and book-to-market ratio (B/M) are significantly correlated with stock excess returns of non-financial firms and, when combined with the market risk premium, significantly improve the model's explanatory power.

This work belongs to the third body of literature and aims to verify whether the TFM is fit to explain changes in stock returns in a sample of financial firms listed on European stock markets. The analysis is motivated by the following reasons:

(a) the topic is highly debated internationally as confirmed by the number and importance of the studies that focus on it;

(b) financial firms are largely neglected by empirical studies since they are considered intrinsically different from industrial firms. The risk exposure of banks and its relation with stock returns is estimated by means of different approaches and takes into account specific risk factors such as interest rate risk, credit risk, real-estate risk, exchange rate risk, etc.;

(c) understanding bank risk factors is becoming increasingly important as a result of deregulation, the recent financial crisis, Basel rules on capital requirements, leverage ratio, and liquidity requirements that increasingly emphasize market risk factors.

The paper is organized as follows: Section 2 summarizes the main empirical evidence, Section 3 describes sample and methodology, Section 4 illustrates and discusses results, and Section 5 concludes.

2 Literature review

According to several scholars, a significant relationship between some fundamental variables and stock returns may arise since the SL model cannot price some risk sources. Market beta could therefore have little information on the cross-section of average returns. If stocks are rationally priced, their returns should reward the sensitivity to the variation of these variables.

Fama and French (1993) model a risk-return relationship in which two fundamental variables such as firm size (market capitalization) and B/M are added to the market risk premium. The same authors, in another essay (Fama and French, 1992), demonstrate that these two variables help explain the cross-section of stock returns and are therefore risk factors that the SL model does not consider.

In their equilibrium model, the risk premium of the i-th asset is defined as follows:

$$R_i - R_f = \beta_i \left(R_m - R_f\right) + s_i SMB + h_i HML. \tag{1}$$

The first risk component (β_i) is the sensitivity to the market risk as defined in the SL model; the second risk component (s_i) is the sensitivity to the risk factor related to firm size (i.e., size premium: small firms are riskier than large firms); the third risk component (h_i) is the sensitivity to the risk factor related to the B/M (i.e., value premium: firms with high B/M values are riskier than firms with low B/M values). SMB (small-minus-big) and HML (high-minus-low) are risk premiums that express the extra-return for one unit of risk, respectively, s_i and h_i; $(R_m - R_f)$ is the risk premium for one unit of market risk (β_i).

Size and B/M should proxy for default risk and uncertainties about growth prospects and future profitability. Small firms are likely to be more exposed to bankruptcy and high-B/M firms should perform poorly compared with low-B/M firms.

TFM has internationally been tested largely on samples of non-financial listed firms. Arshanapalli et al. (1998) test TFM in 18 stock markets, of which 10 are Europe-based, from 1975 to 1995. Their results suggest that size and B/M risk factors are relevant in explaining stock returns both in the US stock exchanges and in other markets. Griffin (2002) shows that TFM performs better if risk factors are defined domestically rather than internationally, including the US, Canada, Japan, and the UK. Moerman (2005), on a sample of stocks coming from 11 countries and investigated from 1991 to 2001, points out that TFM seems to work well in the European stock markets and confirms, according to Griffin (2002), that the Fama-French risk factors are country-specific. Al-Mwalla and Karasneh (2011) find that size and B/M factors also help to explain variations in stock returns in emerging markets. Fama and French (2012) show that there is a negative but not statistically significant size premium in Europe, Japan, and Asia-Pacific and a significant value premium in all regions (North America, Asia-Pacific, Europe, Japan).

Other works (Kothari et al., 1995; Daniel and Titman, 1997; Davis et al., 2000; Taneja, 2010; Manjunatha and Mallikarjunappa, 2011; Eraslan, 2013; Foye et al., 2013; Sehgal and Balakrishnan, 2013; Sharma and Mehta, 2013) show that:

- excess returns are explained well by the SL model; market beta is always positive and R^2 often exceeds 60%;
- SMB and HML alone are significantly related to excess returns, but the explanatory power of the model without the market risk premium is significantly lower;
- the model showing the best fitting is the one including all three risk premiums. In the above studies, except Daniel and Titman (1997), R^2 is greater than 90% in a good number of cases.

Focusing on the financial industry, for years interest rate was thought to be the most important variable to be added to the market risk premium in the SL model. However, Giliberto (1985) shows that studies taking into account interest rate as a common risk factor are not reliable as a result of biases in OLS estimates due to problems in orthogonalization. Following studies have used different approaches to measure the sensitivity of bank stock returns to variables other than the market risk premium such as interest rate risk, credit risk, real-estate risk, exchange rate risk, etc. (Lynge and Zumwalt, 1980; Flannery and James, 1984; Kane and Unal, 1988; Choi et al., 1992; Bessler and Booth, 1994; Allen et al., 1995; Mei and Saunders, 1995; Choi and Elyasiani, 1997; Chamberlain et al., 1997; Demsetz and Strahan, 1997; Hess and Laisathit, 1997; Dewenter and Hess, 1998; Oertmann et al., 2000; Bessler and Murtagh, 2004; Martins et al., 2012; Gounopoulos et al., 2013). They conclude that even if these additional factors matter, being related to the traditional operations of financial intermediaries, they do not allow us to build a multifactor equilibrium model able to reward banks' non-diversifiable risk factors.

TFM finds little application in banking. The main reason is that bank leverage is intrinsically very high and, according to Modigliani and Miller (1958, 1963), financial risk caused by high debt ratios should be incorporated into equity beta. Moreover, bank size and B/M are not likely to proxy for the same risk sources as industrial firms. However, Modigliani-Miller propositions do not reject CAPM assumptions and therefore, restricting empirical tests of CAPM and TFM to non-financial firms is, to some extent, arbitrary.

Barber and Lyon (1997) show that B/M and size risk factors tend to explain stock returns of financial firms listed on the NYSE from 1973 to 1994 in a similar way to non-financial ones. Schuermann and Stiroh (2006) compare several pricing models in a sample of bank stocks observed from 1997 to 2005 and conclude that market, B/M, and size risk factors are the most important in explaining changes in stock returns. Viale et al. (2009) test CAPM, TFM, and ICAPM (intertemporal capital asset pricing model) on a sample of US financial firms over the period 1986–2003 and conclude that (1) ICAPM is the most effective, (2) TFM does not help improve CAPM significantly, and (3) the value premium is a better predictor than size premium. Baek and Bilson (2014), in a sample of financial and non-financial US firms analyzed from 1963 to 2012, document that TFM works worse if applied to financial firms, but may be used to price bank stocks adequately.

3 Sample and methodology

The investigated sample is composed of financial stocks that, on 30 June of each year from 2002 to 2011, are listed on the main European stock exchanges (Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Norway, Poland, Portugal, Spain, Sweden, Switzerland, UK). Variables used in the analysis are collected yearly in June in order to make accounting data available. We use monthly returns and require a stock to be listed for at least 24 months in order to have a sufficient number of monthly observations needed to construct portfolios sorted by pre-ranking beta. Only stocks with complete data are included. All variables are collected from Datastream - Thomson Reuters. The size of the final sample changes over time and ranges from 138 to 171 stocks (Table 1).

Empirical analysis is based on two steps:

- first of all, we perform a descriptive analysis in order to verify whether there is a cross-sectional link between stock returns and potential common risk factors;
- second, at portfolio level, we perform time-series regressions in order to test the TFM.

Details of the methodology followed are reported below.

3.1 Descriptive analysis

This analysis aims to identify causality relationships between returns and potential explanatory variables in a pricing model. For each stock and each year, we detect the value of variables that could proxy for risk factors. Next we build several portfolios sorted by each variable and calculate the times-series mean of portfolio returns over the entire observation period in order to determine whether changes in that variable affect portfolio returns. Table 2 describes the main variables used in the analysis.

Table 1 – Sample

	Year									
Country	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
Austria	6	6	6	6	6	7	6	7	7	7
Belgium	2	2	3	3	3	3	3	3	3	3
Denmark	22	23	23	23	23	23	24	25	25	25
Finland	2	2	2	2	2	2	2	2	2	3
France	13	14	17	17	16	18	18	20	20	20
Germany	6	6	6	6	8	8	9	9	9	9
Greece	7	7	7	7	7	8	8	8	8	8
Ireland	2	2	2	2	2	2	2	2	2	2
Italy	17	17	18	19	19	19	19	19	18	19
Norway	17	17	17	17	17	20	20	22	22	22
Poland	9	10	10	11	12	12	12	12	12	12
Portugal	3	3	3	3	3	3	3	3	2	3
UK	4	4	4	4	4	4	5	5	5	6
Spain	4	5	5	5	5	5	5	6	6	6
Sweden	4	4	4	4	4	4	4	4	4	4
Switzerland	20	21	21	21	20	22	22	22	22	22
Total	**138**	**143**	**148**	**150**	**151**	**160**	**162**	**169**	**167**	**171**

The table shows the number of stocks included in the sample by country and year

3.1.1 Post-ranking beta

On 30 June of each year, sampled stocks are sorted in ascending order by SIZE and pre-ranking beta. Pre-ranking beta is estimated by regressing monthly stock returns on the Datastream Market Index over a 2-year time period. This beta is calculated before the sorting date as opposed to the post-ranking beta which is estimated after the sorting date.

With this double sorting, we have 25 portfolios updated yearly: 5 portfolios sorted by SIZE (SIZE-1, SIZE-2, SIZE-3, SIZE-4, SIZE-5); each of them, in turn, is sorted into further 5 portfolios by pre-ranking beta (BETA-1, BETA-2, BETA-3, BETA-4, BETA-5). Each portfolio therefore contains 4% of all stocks included in the sample for that year. For example, portfolio 1 includes the smallest firms and those with the smallest pre-ranking beta, portfolio 5 includes the smallest stocks, but with the largest pre-ranking beta, and so on.

Every T-th year, for each stock, we estimate monthly returns for the subsequent 12 months, that is, returns from 31 July of year T to 30 June of year $T+1$. We therefore have 18,708 monthly returns (i.e., 12 monthly returns times 1,559 stock-year observations from 2002 to 2011). Returns for security i in month t (R_{it}) and market returns in month t (R_{mt}) are defined as the relative change, respectively, of the official price adjusted for equity issues, stock splits, and dividends, and of the price index calculated by Datastream.

For every t-th month that follows 30 June of T-th year, we calculate the monthly average return (i.e., portfolio return) for each of 25 portfolios. We therefore obtain a series of 120 monthly returns (from July 2002 to June 2012) used to estimate the post-ranking beta (β_p) for the p-th portfolio. We assign the same post-ranking beta

Table 2 – Proxy variables

Variable	Operationalization	Expected cross-sectional link with returns
SIZE	Market capitalization	-
B/M	$\frac{\text{Book value of equity}}{\text{Market value of equity}}$	+
$\boldsymbol{\beta_{post}}$	Post-ranking beta	+

The table shows variables, their operationalization, and the projected relationship with returns

to the same-portfolio stocks. This means that a security may change its beta if it switches portfolio over time.

This methodology is commonly used for two main reasons:

- first, size and beta of stocks are demonstrated to be highly correlated. This makes it undesirable to calculate single-stock beta, but rather beta of portfolios composed of similar stocks in terms of beta and size so as to mask the beta-size relationship. Second, it is well known that beta estimation for single stocks may suffer autocorrelation of residuals that leads to underestimation of the variance of regression coefficients thereby increasing the value of Student t. This makes test statistics unreliable and increases the likelihood of rejecting the null hypothesis that the coefficient is equal to zero. Portfolio beta estimates are less affected by this problem;
- portfolio post-ranking beta is estimated by using the entire series of returns over the period under investigation. This approach may be attacked since it assumes beta to be stable over time. However, Chan and Chen (1988) demonstrate that over long time horizons, post-ranking beta at portfolio level is more accurate and stable as a result of the stationarity of the time series distribution of betas. This ensures that the error we make by assigning the time series average of betas ($\overline{\beta_p}$) to the portfolio p is proportional to the difference between $\overline{\beta_p}$ and the cross-sectional mean of average betas (β). The following relation therefore holds:
$$\beta_{pt} - \overline{\beta_p} = K\left(\overline{\beta_p} - \beta\right). \tag{2}$$
K is a zero-mean constant and does not depend on portfolio characteristics but market trend: it takes negative values during market growth and positive values during market downturns.

The relationship between returns and post-ranking beta is supposed to be positive according to the CAPM. This relationship is not always confirmed by empirical studies which sometimes find non-statistically significant coefficients.

3.1.2 Size

The relationship between size and returns, known as size effect, is generally found to be negative (e.g., Banz, 1981). This means that small firms earn greater risk-adjusted returns than large firms. However, later studies, that take into account the post-eighties period, also find that larger firms perform better than small firms in some sub-periods (e.g., Dimson and Marsh, 1999, Horowitz et al., 1999, 2000, Chan et al., 2000).

This effect may simply be due to the influence of size on equity beta. Yet, sorting stocks by beta and size, the empirical evidence often finds larger returns to small stocks without showing any clear link between size and beta.

A possible explanation is that small firms face higher information asymmetry, uncertainties about future profits, and distress costs. The result is that investors are expected to be rewarded with higher returns. Some scholars (e.g., Berk, 1995) criticize the use of market capitalization as a proxy for firm size. Market capitalization depends on a firm's cash flows and cost of capital. Large firms are likely to produce more cash flows, but this does not guarantee a higher market value since the cost of capital is high as well. However, alternative measures of firm size such as book value of total assets, book value of tangible assets, sales, number of employees, etc., seem to result in the same relationship.

3.1.3 Book-to-market ratio (B/M)

The book-to-market ratio (B/M) is strongly and positively related to stock returns in all studies. What it tells us about a firm's risk is not always clear since many firm characteristics may be reflected by this ratio. Low-B/M firms are generally known as glamour stocks and are supposed to show higher-than-mean growth rates, better growth opportunities, and a lower risk than high-B/M firms, known as value stocks.

Agency theory may also help explain the higher risk of value firms. When growth options are poor, managers may use available cash with more discretion thereby increasing the probability of undertaking bad projects, the risk equity holders bear, and the return they expect.

3.2 Time-series regressions

On 30 June of every year, stocks are sorted in ascending order by SIZE and B/M so as to create 25 SIZE-B/M portfolios. For each portfolio p at month t, we estimate monthly returns (R_{pt}) over 12 months that follow the sorting date, thereby obtaining 25 series composed of 120 monthly average returns (i.e., 10 years times 12 months). Regression analysis involves each portfolio according to 3 different models: (1) portfolio excess returns ($R_{pt} - R_{ft}$) are regressed on market risk premium $R_{mt} - R_{ft}$; (2) portfolio excess returns ($R_{pt} - R_{ft}$) are regressed on size premium (SMB_t) and value premium (HML_t); (3) portfolio excess returns ($R_{pt} - R_{ft}$) are regressed on all three premiums. Time-series regressions allow us to estimate (a) how much the portfolio returns are sensitive to changes of various risk premiums over time, (b) the ability of each model to predict portfolio returns accurately, that is, the share of the portfolio return variability explained by variation in risk premiums.

Variables used in the regression analysis are operationalized as follows:

- R_f: the risk-free rate is the three-month EURIBOR.
- $R_m - R_f$: the market risk premium is the difference between Datastream Market Index and the risk-free rate.

In order to estimate SMB and HML, we sort stocks by SIZE and B/M and obtain 6 portfolios: 2 portfolios sorted by size (B = big portfolio and S = small portfolio) and

Table 3 – Dependent and independent variables

Panel A: correlation matrix

	$(R_m - R_f)$	SMB	HML
$(R_m - R_f)$	1.0000		
SMB	0.1555	1.0000	
HML	0.2990	0.0007	1.0000

Panel B: descriptive statistics

Independent variables	Monthly average returns	Standard deviation
$(R_m - R_f)$	0.0204	0.0641
SMB	0.0018	0.0512
HML	0.0052	0.0369

Panel C: dependent variable $(R_p - R_f)$ (monthly average returns)

	B/M - 1	B/M - 2	B/M - 3	B/M - 4	B/M - 5
SIZE - 1	0.0208	0.0219	0.0283	0.0161	0.0294
SIZE - 2	0.0240	0.0196	0.0224	0.0186	0.0252
SIZE - 3	0.0277	0.0237	0.0207	0.0169	0.0232
SIZE - 4	0.0226	0.0188	0.0272	0.0287	0.0227
SIZE - 5	0.0280	0.0239	0.0277	0.0106	0.0250

Panel A shows Pearson correlations between independent variables; Panel B shows mean and standard deviation of independent variables; Panel C shows monthly average returns of 25 portfolios sorted by size and book-to-market ratio (B/M)

3 portfolios sorted by B/M (L = low-B/M portfolio; M = medium-B/M portfolio; H = high-B/M portfolio); hence:

- SMB (small-minus-big): difference between the average return of three small portfolios and the average return of three big portfolios $\left(\frac{(S/L)+(S/M)+(S/H)}{3} - \frac{(B/L)+(B/M)+(B/H)}{3}\right)$;
- HML (high-minus-low): difference between the average return of two high-B/M portfolios and the average return of two low-B/M portfolios $\left(\frac{(S/H)+(B/H)}{2} - \frac{(S/L)+(B/L)}{2}\right)$.

SMB and HML estimation procedure aims to remove the potential dependence between size and B/M. The reliability of this technique is demonstrated by a very low correlation coefficient between SMB and HML (i.e., 0.0007, Table 3, panel A).

Three regression models may be summarized as follows:

$$R_{pt} - R_{ft} = \alpha_p + \beta_p \left(R_{mt} - R_{ft}\right) + \varepsilon_{pt}, \tag{3}$$

$$R_{pt} - R_{ft} = \alpha_p + s_p SMB_t + g_p HML_t + \varepsilon_{pt}, \tag{4}$$

$$R_{pt} - R_{ft} = \alpha_p + \beta_p \left(R_{mt} - R_{ft}\right) + s_p SMB_t + g_p HML_t + \varepsilon_{pt}, \tag{5}$$

with $p = 1, 2, \ldots, 25$ and $t = 1, 2, \ldots, 120$. $(R_{pt} - R_{ft})$, $(R_{mt} - R_{ft})$, SMB_t and HML_t are therefore vectors of 120 monthly returns. β_p, s_p and g_p are regression coefficients expressing the sensitivity of portfolio risk premiums to time-series changes in market risk premium, size premium, and value premium, respectively.

Table 3 also shows average values of independent (panel B) and dependent (panel C) variables.

Table 4 – Monthly average returns and post-ranking beta for 25 SIZE-BETA portfolios

Panel A: monthly average returns (%)

	All	BETA - 1	BETA - 2	BETA - 3	BETA - 4	BETA - 5
All	–	**1.1541**	**1.1473**	**0.9984**	**0.8325**	**1.0859**
SIZE - 1	**1.3028**	1.2895	1.3871	1.1981	1.1063	1.5329
SIZE - 2	**1.0977**	1.2875	1.3476	0.8545	0.9765	1.0223
SIZE - 3	**1.0219**	1.1934	1.3577	0.7453	0.6787	1.1345
SIZE - 4	**0.8965**	1.0134	0.8796	0.8563	0.8567	0.8765
SIZE - 5	**0.8992**	0.9865	0.7645	1.3376	0.5441	0.8634

Panel B: post-ranking beta

	All	BETA - 1	BETA - 2	BETA - 3	BETA - 4	BETA - 5
All	–	**0.8400**	**0.9800**	**0.7700**	**0.7700**	**0.8500**
SIZE - 1	**0.7700**	0.7000	1.0200	0.6200	0.6400	0.8700
SIZE - 2	**0.7500**	0.7100	0.8900	0.5400	0.8700	0.7600
SIZE - 3	**0.8000**	0.9100	0.9800	0.7200	0.6500	0.7500
SIZE - 4	**0.9100**	0.8900	0.9900	1.0100	0.7100	0.9600
SIZE - 5	**0.9700**	1.0100	1.0100	0.9400	0.9800	0.9000

Panel A shows monthly average returns of 25 portfolios sorted by size and pre-ranking beta; Panel B shows post-ranking beta of 25 portfolios sorted by pre-ranking beta and size

4 Results

4.1 Descriptive analysis

Table 4 shows average monthly returns (Panel A) and portfolio post-ranking beta (Panel B) for each portfolio sorted by size and pre-ranking beta.

Table 4 allows us to outline a relationship between returns, size, and beta. Sorting stocks by size only (first column, Panel A), the smallest portfolio (SIZE - 1) earns a monthly return equal to 1.3028% compared to the largest portfolio that earns 0.8992% on average. In general, small stocks seem to produce higher average returns than large stocks and this trend appears to hold also for each portfolio sorted by pre-ranking beta. However, when moving from large to small stocks, while returns go up, post-ranking beta does not (first column, Panel B) and this is not consistent with the SL model. Another relevant point is that a beta change (first row, Panel B) does not always go together with a same-type change of returns (first row, Panel A).

In June of each year, stocks are sorted in ascending order by each of the variables shown in Table 2 so as to form 5 portfolios whose monthly average returns are then estimated over a 120-month period (Table 5). Panel A of Table 5 shows these returns. Panel B of Table 5 reports monthly average returns and post-ranking beta of portfolios sorted by size and B/M.

The results show that high-B/M portfolios yield higher returns: Panel A shows that moving from portfolio 1 (B/M - 1) to portfolio 5 (B/M - 5), returns steadily increase from 0.288% to 0.656%. Size confirms the evidence already shown, that is, small firm portfolios earn greater returns than large firm portfolios.

In the same way as for size, high-B/M portfolios are not associated with higher

Table 5 – Monthly average returns and post-ranking beta for 25 SIZE-BETA portfolios

Panel A: monthly average returns (%) of portfolios sorted by fundamental variables

		Portfolios				
		1	**2**	**3**	**4**	**5**
Ordering variable	**Pre-ranking beta**	1.1540	1.1470	0.9980	0.8320	1.0850
	SIZE	1.3020	1.0970	1.0210	0.8960	0.8990
	B/M	0.2880	0.2890	0.3170	0.7530	0.6560

Panel B: returns and post-ranking beta of portfolios sorted by size and B/M

	SIZE - 1	**SIZE - 2**	**SIZE - 3**	**SIZE - 4**	**SIZE - 5**
Returns (%)	1.3020	1.0970	1.0210	0.8960	0.8990
Post-ranking beta	0.7720	0.7540	0.8020	0.9120	0.9680
	B/M - 1	**B/M - 2**	**B/M - 3**	**B/M - 4**	**B/M - 5**
Returns (%)	0.2880	0.2890	0.3170	0.7530	0.6560
Post-ranking beta	0.7880	0.7290	0.6440	0.7710	0.7420

Panel A reports monthly average returns of portfolios sorted by each of the fundamental variables (pre-ranking beta, size, and B/M); Panel B reports returns and post-ranking beta of portfolios sorted by size and B/M

post-ranking beta. This means that higher returns earned by high-B/M portfolios do not seem to be explained by higher betas.

In summary, at this level of analysis, financial firms seem to behave in the same way as industrial firms in terms of risk factors: size and B/M appear to be linked to stock returns with small and high-B/M firms performing better than large and low-B/M firms. These relations do not seem to be explained by market beta and would support the implementation of a multifactor model of risk in which size premium and value premium are added to market risk premium.

4.2 Results of time-series regressions

Tables 6, 7, and 8 show results of time-series regressions run on each of three models, an SL model, a model with size premium and value premium alone, and a three-factor model respectively. Each row corresponds to the respective portfolio that the regression is performed on. Columns of the tables report, for each regression, regression coefficients α_p, β_p, s_p, g_p, adjusted R^2, and F-test significance level.

4.2.1 Regressions between portfolio risk premium and market risk premium

Table 6 reports the following main results:

- Intercept is always statistically different from zero (except regression 18). This is not consistent with the SL model.
- Slope (β_p) is always positive and significantly different from zero. Market risk premium is therefore strongly linked to the risk premium of each portfolio according to the SL model. Market beta goes from a minimum of 0.4042 (portfolio 14) to a maximum of 1.4124 (portfolio 24). The bigger the firms in the portfolio, the larger the market beta seems to be, therefore showing that

Table 6 – Time-series regressions: returns and market risk premium

			α_p	β_p	Adj. R^2	sign(F)
1		**B/M - 1**	*0.0041	*0.5895	0.3300	0.0000
2		**B/M - 2**	*0.0146	*0.4045	0.2359	0.0100
3	**SIZE - 1**	**B/M - 3**	*0.0174	*0.5307	0.3958	0.0120
4		**B/M - 4**	*0.0041	*0.5895	0.3380	0.0030
5		**B/M - 5**	*0.0155	*0.4351	0.3314	0.0040
6		**B/M - 1**	*0.0101	*0.4148	0.3054	0.0000
7		**B/M - 2**	*0.0044	*0.7417	0.3005	0.0000
8	**SIZE - 2**	**B/M - 3**	*0.0118	*0.5193	0.4210	0.0060
9		**B/M - 4**	*0.0101	*0.4148	0.3054	0.0080
10		**B/M - 5**	*0.0150	*0.5019	0.3992	0.0000
11		**B/M - 1**	*0.0136	*0.6902	0.4477	0.0020
12		**B/M - 2**	*0.0034	*0.9916	0.3959	0.0010
13	**SIZE - 3**	**B/M - 3**	*0.0035	*0.8449	0.3665	0.0000
14		**B/M - 4**	*0.0086	*0.4042	0.2284	0.0080
15		**B/M - 5**	*0.0130	*0.4980	0.2012	0.0000
16		**B/M - 1**	*0.0005	*1.0841	0.6684	0.0050
17		**B/M - 2**	*0.0051	*0.6708	0.5149	0.0110
18	**SIZE - 4**	**B/M - 3**	0.0096	*0.8614	0.6247	0.0000
19		**B/M - 4**	*0.0096	*0.9319	0.4766	0.0000
20		**B/M - 5**	*0.0057	*0.9445	0.4239	0.0060
21		**B/M - 1**	*0.0086	*0.9525	0.5882	0.0000
22		**B/M - 2**	*0.0023	*1.0559	0.6907	0.0000
23	**SIZE - 5**	**B/M - 3**	*0.0070	*1.0148	0.5266	0.0000
24		**B/M - 4**	*0.0149	*1.4124	0.2887	0.0000
25		**B/M - 5**	*0.0096	*0.9251	0.3433	0.0000
* Statistically significant at 1% level						

The table reports the results of the regression model in which returns of each portfolio are regressed on market risk premium: α_p is the intercept, β_p is the slope, adj. R^2 measures the model goodness-of-fit, sign(F) is the F-test level of significance

returns of large firms appear to be more sensitive to market risk. However, this result should be taken with caution because of the intervalling-effect bias in beta estimates. The sensitivity of a stock's excess returns to the market excess returns is influenced by the length (e.g., daily, weekly, monthly, etc.) of the return interval used in estimating betas. Indeed, stock prices respond to new information more or less quickly depending on stock liquidity that, in turn, is affected by firm size. Small caps are less known, infrequently traded, and therefore adjust with delay, while large caps are better known, traded, and their price changes faster. As a consequence, for large firms, the smaller the length of the return interval, the higher the sensitivity of stock prices to market movements tends to be. Undersized return interval may therefore cause betas to be overestimated. While small caps show an opposite trend: betas tend to be overestimated when the return interval is oversized (e.g., Cohen et al., 1983, Jones and Yeoman, 2012, and Hong and Satchell, 2014).

- F-test always shows a high level of significance whereas the model goodness-of-fit is not always good: adjusted R^2 is higher than 50% in 6 portfolios and

Table 7 – Time-series regressions: returns, SMB and HML

			α_p	s_p	g_p	Adj. R^2	sign(F)
1		**B/M - 1**	0.0147	-0.1985	**-0.2166	0.0239	0.0903
2		**B/M - 2**	0.0209	*-0.1216	**-0.1919	0.0129	0.1876
3	**SIZE - 1**	**B/M - 3**	0.0271	*-0.1396	-0.1792	0.0163	0.1416
4		**B/M - 4**	0.0147	-0.1985	**-0.2166	0.0239	0.0903
5		**B/M - 5**	0.0205	-0.1535	**0.0803	0.0140	0.1625
6		**B/M - 1**	0.0186	-0.2558	**0.0986	0.0658	0.0069
7		**B/M - 2**	0.0150	-0.3610	-0.7475	0.1349	0.0001
8	**SIZE - 2**	**B/M - 3**	0.0210	-0.3077	**-0.1689	0.0953	0.0011
9		**B/M - 4**	0.0186	-0.2558	0.0986	0.0658	0.0069
10		**B/M - 5**	0.0253	-0.2966	0.1218	0.0827	0.0024
11		**B/M - 1**	0.0225	-0.5203	-0.8046	0.3571	0.0000
12		**B/M - 2**	0.0164	-1.0308	-1.0353	0.0120	0.0000
13	**SIZE - 3**	**B/M - 3**	0.0178	-0.7231	**-0.3022	0.0760	0.0000
14		**B/M - 4**	0.0180	-0.3214	**0.3331	0.0330	0.0001
15		**B/M - 5**	0.0240	-0.3344	0.2690	0.0642	0.0077
16		**B/M - 1**	0.0159	-0.9951	-0.9453	0.3225	0.0000
17		**B/M - 2**	0.0171	-0.6003	-0.1163	0.3584	0.0000
18	**SIZE - 4**	**B/M - 3**	0.0243	-0.8910	-0.2538	0.0380	0.0000
19		**B/M - 4**	0.0256	-1.0426	-0.2250	0.0838	0.0000
20		**B/M - 5**	0.0205	-1.0674	0.0406	0.0586	0.0000
21		**B/M - 1**	0.0224	-1.2221	-0.6530	0.0098	0.0000
22		**B/M - 2**	0.0184	-1.2292	-0.6406	0.0799	0.0000
23	**SIZE - 5**	**B/M - 3**	0.0227	-1.1586	-0.5741	0.0898	0.0000
24		**B/M - 4**	0.0049	-1.9485	-0.3430	0.0753	0.0000
25		**B/M - 5**	0.0256	-1.3210	0.6055	0.0085	0.0000

* Statistically significant at 5% level

** Statistically significant at 10% level

The table reports the results of the regression model in which returns of each portfolio are regressed on SMB and HML factors: α_p is the constant, s_p is the SMB coefficient, g_p is the HML coefficient, adj. R^2 measures the model goodness-of-fit, sign(F) is the F-test level of significance

in 3 of them exceeds 60%. In the remainder of them, it is almost always lower than 30% and shows the need to find additional risk factors other than market risk.

- Larger R^2 (i.e., greater than 50%) are found in portfolios with large firms (SIZE-4 and SIZE-5). This shows that portfolio return variability explained by market risk premium is bigger in large-sized firms.

4.2.2 Regressions between portfolio risk premium, SMB, and HML

SMB and HML factors on their own cannot describe portfolio excess returns well (Table 7). F-test is almost always significant (except 5 portfolios), but R^2 is very poor: it exceeds 30% in only 3 portfolios and the others show R^2 always lower than 10% (except portfolio 7).

SMB regression coefficients are negative and decrease the larger the firm size. This means that s_p is greater in absolute value in portfolios of large firms. However, SMB coefficients are almost never statistically significant (only portfolios 2 and 3 show statistically significant coefficients at the 5% level). Portfolio excess returns are not therefore sensitive to size premium.

Moving from low-B/M portfolios to high-B/M portfolios, HML coefficients g_p tend to grow according to Fama and French (1993), but in 17 out of 25 portfolios, they are not statistically significant. As a consequence, we cannot draw reliable conclusions about the effect of the value premium on the portfolio excess return. Combining size- and value-based portfolios does not seem to be useful to construct an efficient portfolio.

4.2.3 Regressions between portfolio risk premium, market risk premium, SMB, and HML

Table 8 shows the results of the third model in which portfolio risk premium is regressed on market risk premium, SMB, and HML simultaneously. The explanatory power of the model significantly improves and this is not due to collinearity between independent variables (Table 3, Panel A). We can draw the following main conclusions:

- β_p is positive and statistically significant (except for portfolios 2, 9, and 10). This confirms that market risk premium is a risk factor that should be included in the model.

- s_p is now statistically significant in almost all portfolios and seems to be positive for small portfolios (SIZE - 1 and SIZE - 2) and negative for larger portfolios. This result is consistent with the presence of a small size effect in the financial industry too. Investors seem to require an additional risk premium to be willing to hold small stocks (see Section 2 for the relevant literature on non-financial firms). A plausible explanation is that small banks do not benefit from government assistance should distress occur. Large banks are protected by implicit government guarantees linked to their systemic role.

- g_p is not statistically significant in only 5 portfolios and, within a size class, high-B/M portfolios show higher regression coefficients than low-B/M portfolios. High-B/M firms seem to be more sensitive to the value premium and therefore pay a higher risk premium to investors that hold these stocks.

- Adjusted R^2 are significantly higher than those found in the previous two models. They are below 50% in only 7 portfolios, range between 50% and 70% in an additional 12 portfolios, and get to about 80% in the remaining 6 portfolios. Higher values concentrate on portfolios of large firms. The three-factor model appears to have good power in explaining portfolio excess return variability in the financial sector.

- The constant of the model α_p is never statistically different from zero, demonstrating that time-series variations of returns are systematically explained by three risk premiums.

Table 8 – Time-series regressions: returns, market risk premium, SMB and HML

			α_p	β_p	s_p	g_p	**Adj. R^2**	**sign(F)**
1		**B/M - 1**	0.0020	*0.7700	0.3358	*0.1830	0.4779	0.0000
2		**B/M - 2**	0.0131	0.5325	*0.2494	0.0644	0.5627	0.0000
3	**SIZE - 1**	**B/M - 3**	0.0151	*0.7265	0.3646	*0.1979	0.5725	0.0000
4		**B/M - 4**	0.0020	*0.7700	*0.3358	*0.1830	0.4779	0.0000
5		**B/M - 5**	0.0101	*0.6315	*0.2849	*0.4082	0.5449	0.0000
6		**B/M - 1**	0.0099	*0.5279	*0.1105	*0.3726	0.5695	0.0000
7		**B/M - 2**	0.0026	*0.7514	*0.1604	-0.3574	0.4219	0.0000
8	**SIZE - 2**	**B/M - 3**	0.0113	*0.5868	0.0995	*0.1357	0.5238	0.0000
9		**B/M - 4**	0.0099	0.5279	*0.1105	*0.3726	0.4695	0.0000
10		**B/M - 5**	0.0146	0.6489	*0.1537	*0.4587	0.5928	0.0000
11		**B/M - 1**	0.0138	*0.5326	*-0.1507	*-0.5282	0.6180	0.0000
12		**B/M - 2**	0.0067	*0.5909	*-0.6208	*-0.7286	0.5950	0.0000
13	**SIZE - 3**	**B/M - 3**	0.0049	*0.7381	-0.1796	*0.1043	0.4664	0.0000
14		**B/M - 4**	0.0093	*0.5290	*0.0457	*0.6077	0.4742	0.0000
15		**B/M - 5**	0.0132	*0.6566	0.1213	*0.6098	0.3797	0.0000
16		**B/M - 1**	0.0028	*0.7963	*-0.4425	*-0.5319	0.8424	0.0000
17		**B/M - 2**	0.0066	*0.6378	*-0.1577	*0.2147	0.6421	0.0000
18	**SIZE - 4**	**B/M - 3**	0.0127	*0.7007	*-0.4047	0.1099	0.7901	0.0000
19		**B/M - 4**	0.0138	*0.7142	*-0.5470	0.1452	0.6532	0.0000
20		**B/M - 5**	0.0098	*0.7458	*-0.5540	*0.3998	0.6092	0.0000
21		**B/M - 1**	0.0143	*0.4944	*-0.8690	*-0.3963	0.8059	0.0000
22		**B/M - 2**	0.0074	*0.6641	*-0.7684	*-0.2958	0.8467	0.0000
23	**SIZE - 5**	**B/M - 3**	0.0117	*0.6670	*-0.6957	*-0.2279	0.7271	0.0000
24		**B/M - 4**	0.0058	*0.7284	*-1.4409	*0.0076	0.5176	0.0000
25		**B/M - 5**	0.0160	*0.6991	*-0.8530	0.9241	0.7387	0.0000
* Statistically significant at 5% level								

The table reports the results of the regression model in which returns of each portfolio are regressed on market risk premium, SMB and HML factors: α_p is the constant, β_p is the market risk premium coefficient, s_p is the SMB coefficient, g_p is the HML coefficient, adj. R^2 measures the model goodness-of-fit, sign(F) is the F-test level of significance

5 Conclusions

In this study we test the Fama-French three-factor model employed in the estimation of financial stock returns in Europe. The analysis shows the following main results:

- Market risk premium significantly affects stock returns in every model and its presence is required if the model is to have sufficient explanatory power. When it is used alone as in the SL model, it works better in portfolios of large firms.
- Size and B/M are demonstrated to be cross-sectionally linked to stock returns: small firms and high-B/M firms show higher returns that market beta cannot explain.
- Size premium and value premium help explain time-series changes of returns only when they are used with market risk premium. Regression coefficients s_p and g_p are almost always significantly different from zero in the three-factor model but not in the model that drops the market excess return.

- Investors require an extra return for small and high-B/M stocks that seem to be more sensitive to changes in the risk premium related to size and B/M factors.

In light of the above results, financial stocks traded in the European stock exchanges yield returns that reward risks linked to small size and high B/M in addition to market risk. This means that the need to price financial stocks may benefit from a multifactor model of risk in which size and B/M appear to be sources of risk as in non-financial industries. We do not mean that size and B/M necessarily proxy for the same risk sources as for non-financial firms, but rather that being small and with a high B/M induces investors to ask for an additional risk premium in the financial sector too.

All of this has relevant implications for financial system and banking authorities. In the last decades, banks have diversified their revenue streams by significantly increasing proceeds generated by non-traditional, high-income activities such as investment banking. This, among other things, was the result of increased competition, deregulation, and financial market integration (e.g., Bessler and Kurmann, 2014). Moreover, the level of opaqueness of bank balance sheets has increased because of the expansion of complex and hard-to-value financial instruments and the rise of the originate-to-distribute model that took the place of the traditional, originate-to-hold model. Finally, bank leverage has increased significantly over the past 100 years (e.g., DeAngelo and Stulz, 2013) especially in large financial institutions.

These factors contributed to change bank risk exposure, made prudential rules on capital requirements outdated, and induced supervisors to introduce new frameworks for regulating capital adequacy, stress testing, and market liquidity risk. Banking authorities therefore require instruments to control for factors reflecting a large number of risks, from the traditional ones to the emerging ones. In this context, the use of market measures in the regulatory process, such as the book-to-market ratio and the market leverage, may help supervisory institutions to assess bank risk exposure better.

While value premium seems to be relevant in estimating risk premium of financial and non-financial firms, the existence of a size premium is more ambiguous. In the financial sector, one can presume that large banks are more diversified and therefore less risky than smaller banks. However, the too big to fail policy may encourage irresponsible risk taking. The empirical evidence is mixed: some studies (e.g., Demsetz and Strahan, 1997) demonstrate that large and diversified banks work with less capital and undertake riskier projects, while some other (e.g., Konishi and Yasuda, 2004) finds a negative relationship between size and bank risk taking. More recent studies on size anomalies in US bank stock returns (Gandhi and Lustig, 2015) confirm that shareholders of large banks bear less risk and earn significantly lower risk-adjusted returns than those of small banks even though the former are significantly more leveraged than the latter. This evidence may be a result of government protections that support large banks. We confirm this result and show that investors seem to require higher returns to smaller banks but this point is still controversial (e.g., Goyal, 2014).

References

Allen, M. T., Madura, J., and Wiant, K. J. (1995). "Commercial Bank Exposure and Sensitivity to the Real Estate Market", *Journal of Real Estate Research*, **10**:129–140.

Al-Mwalla, M., and Karasneh, M. (2011). "Fama & French Three Factor Model: Evidence from Emerging Market", *European Journal of Economics, Finance and Administrative Sciences*, **41**:132–140.

Arshanapalli, B. G., Coggin, T. D., and Doukas J. (1998). "Multifactor Asset Pricing Analysis of International Value Investment Strategies", *The Journal of Portfolio Management*, **24**:10–23.

Baek, S., and Bilson, J. F. O. (2014). "Size and Value Risk in Financial Firms", *Journal of Banking and Finance*, in press.

Banz, R. (1981). "The Relationship Between Return and Market Value of Common Stocks", *Journal of Financial Economics*, **9**:3–18.

Barber, B. M., and Lyon, J. D. (1997). "Firm Size, Book-to-Market Ratio, and Security Returns: A Holdout Sample of Financial Firms", *The Journal of Finance*, **52**:875–883.

Beaver, W., Kettler, P., and Scholes, M. (1970). "The Association Between Market Determined and Accounting Determined Risk Measures", *Accounting Review*, **45**:654–682.

Berk, J. (1995). "A Critique of Size Related Anomalies", *Review of Financial Studies*, **8**:275–286.

Bessler, W., and Booth, G. (1994). "Interest Rate Sensitivity of Bank Stock Returns in a Universal Banking System", *Journal of International Financial Markets, Institutions, and Money*, **3**:117–136.

Bessler, W., and Kurmann, P. (2014). "Bank Risk Factors and Changing Risk Exposures: Capital Market Evidence Before and During the Financial Crisis", *Journal of Financial Stability*, **13**:151–166.

Bessler, W., and Murtagh, J. P. (2004). "Risk Characteristics of Banks and Non-Banks: An International Comparison", in Geberl, S., Kaufmann, H. R., Menichetti, M. J., and Wiesner, D. F. (Eds.), *Aktuelle Entwicklungen im Finanzdienstleistungsbereich* (pp. 65–78). Berlin: Springer-Verlag.

Black, F. (1972). "Capital Market Equilibrium with Restricted Borrowing", *Journal of Business*, **45**:444–455.

Black, F., Jensen, M. C., and Scholes, M. (1972). "The Capital Asset Pricing Model: Some Empirical Tests". In Jensen, M. C. (ed.), *Studies in the Theory of Capital Markets* (pp. 79–121). New York: Praeger Publishers, Inc.

Brennan, M. J. (1970). "Taxes, Market Valuation and Corporate Financial Policy", *National Tax Journal*, **23**:417–427.

Chamberlain, S., Howe, J. S., and Popper, H. (1997). "The Exchange Rate Exposure of US and Japanese Banking Institutions", *Journal of Banking and Finance*, **21**:871–892.

Chan, K. C., and Chen, N. (1988). "An Unconditional Asset Pricing Test and the Role of Firm Size as an Instrumental Variable for Risk", *Journal of Finance*, **43**:309–325.

Chan, K. C., Karceski, J., and Lakonishok, J. (2000). "New Paradigm or Same Old Hype in Equity Investing?", *Financial Analysts Journal*, **56**:23–36.

Choi, J. J., Elyasiani, E. (1997). "Derivative Exposure and the Interest Rate and Exchange Rate Risks of US Banks", *Journal of Financial Services Research*, **12**: 267–286.

Choi, J. J., Elyasiani, E., and Kopecky, K. (1992). "The Sensitivity of Bank Stock Returns to Market, Interest and Exchange Rate Risks", *Journal of Banking and Finance*, **16**:983–1004.

Cohen, K. J., and Hawawini, G. A., Maier, S. F., Schwartz, R. A., and Whitcomb, D. K. (1983). "Estimating and Adjusting for the Intervalling-Effect Bias in Beta", *Management Science*, **29**:135–148.

Daniel, K., and Titman, S. (1997). "Evidence on the Characteristics of Cross Sectional Variation in Stock Returns", *The Journal of Finance*, **52**:1–33.

Davis, J. L., Fama, E. F., and French, K. R. (2000). "Characteristics, Covariances, and Average Returns: 1929 to 1997", *The Journal of Finance*, **55**:389–406.

DeAngelo, H., and Stulz, R. M. (2013). *Why High Leverage is Optimal for Banks*, NBER Working Paper No. 19139.

Demsetz, R. S., and Strahan, P. E. (1997). "Diversification, Size, and Risk at Bank Holding Companies", *Journal of Money, Credit and Banking*, **29**:300–313.

Dewenter, K. L., and Hess, A. C. (1998). "An International Comparison of Banks' Equity Returns", *Journal of Money, Credit and Banking*, **30**:472–492.

Dimson, E., and Marsh, P. (1999). "Murphy's Law and Market Anomalies", *Journal of Portfolio Management*, **25**:53–69.

Eraslan, V. (2013). "Fama and French Three-factor Model: Evidence from Istanbul Stock Exchange", *Business and Economics Research Journal*, **4**:11–22.

Fama, E. F., and French, K. R. (1992). "The Cross-Section of Expected Stock Returns", *The Journal of Finance*, **47**:427–465.

Fama, E. F., and French, K. R. (1993). "Common Risk Factors in the Returns on Stocks and Bonds", *Journal of Financial Economics*, **33**:3–56.

Fama, E. F., and French, K. R. (2012). “Size, Value, and Momentum in International Stock Returns”, *Journal of Financial Economics*, **105**:457–472.

Fama, E. F., and MacBeth, J. (1973). “Risk, Return and Equilibrium: Empirical Tests”, *The Journal of Political Economy*, **81**:607–636.

Flannery, M. J., and James, C. M. (1984). “The Effect of Interest Rate Changes on the Common Stock Returns of Financial Institutions”, *The Journal of Finance*, **39**:1141–1153.

Foye, J., Mramor, D., and Pahor, M. (2013). “A Respecified Fama French Three-Factor Model for the New European Union Member States”, *Journal of International Financial Management & Accounting*, **24**:3–25.

Gandhi, P., and Lustig, H. (2015). “Size Anomalies in US Bank Stock Returns”, *The Journal of Finance*, **70**:733–768.

Gibbons, M. R. (1982). “Multivariate Tests of Financial Models: A New Approach”, *Journal of Financial Economics*, **10**:3–27.

Giliberto, M. (1985). “Interest Rate Sensitivity in the Common Stocks of Financial Intermediaries: A Methodological Note”, *Journal of Financial and Quantitative Analysis*, **20**:123–126.

Gounopoulos, D., Molyneux, P., Staikouras, S. K., Wilson, J. O. S., and Zhao, G. (2013). “Exchange Rate Risk and the Equity Performance of Financial Intermediaries”, *International Review of Financial Analysis*, **29**:271–282.

Goyal, A. (2014). *No Size Anomalies in U.S. Bank Stock Returns*, available at SSRN: `http://ssrn.com/abstract=2410542`.

Griffin, J. M. (2002). “Are the Fama and French Factors Global or Country Specific?”, *Review of Financial Studies*, **15**:783–803.

Hess, A. C., and Laisathit, K. (1997). “A Market-Based Risk Classification of Financial Institutions”, *Journal of Financial Services Research*, **12**:133-158.

Hong, K. H. J., and Satchell, S. (2014). “The Sensitivity of Beta to the Time Horizon when Log Prices Follow an Ornstein-Uhlenbeck Process”, *The European Journal of Finance*, **20**:264–290.

Horowitz, J. L., Loughran, T., and Savin, N. E. (1999). “The Disappearing Size Effect”, *Research in Economics*, **54**:83–100.

Horowitz, J. L., Loughran, T., and Savin, N. E. (2000). “Three Analyses of the Firm Size Premium”, *Journal of Empirical Finance*, **7**:143–153.

Jones, S. L., and Yeoman, J. C. (2012). “Bias in Estimating the Systematic Risk of Extreme Performers: Implications for Financial Analysis, the Leverage Effect, and Long-Run Reversals”, *Journal of Corporate Finance*, **18**:1–21.

Kane, E. J., and Unal, H. (1988). "Change in Market Assessments of Deposit-Institution Riskiness", *Journal of Financial Services Research*, **1**:207–229.

Konishi, M., and Yasuda, Y. (2004). "Factors Affecting Bank Risk Taking: Evidence from Japan", *Journal of Banking and Finance*, **28**:215–232.

Kothari, S. P., Shanken, J., and Sloan, R. (1995). "Another Look at the Cross-Section of Expected Stock Returns", *The Journal of Finance*, **50**:185–224.

Lindenberg, E. (1979). "Capital Market Equilibrium with Price Affecting Institutional Investors", in Elton, E. J., and Gruber, M. J. (Eds.), *Portfolio Theory 25 Years After*. Amsterdam: North-Holland Publishing Company.

Lintner, J. (1965). "The Valuation of Risk Assets and the Selection of Risky Investments in Stock Portfolios and Capital Budgets", *Review of Economics and Statistics*, **47**:13–37.

Lynge, M. J., and Zumwalt, J. K. (1980). "An Empirical Study of the Interest Rate Sensitivity of Commercial Bank Returns: A Multi-Index Approach", *Journal of Financial and Quantitative Analysis*, **15**:731–742.

Manjunatha, T., and Mallikarjunappa, T. (2011). "Does Three-Factor Model Explain Asset Pricing in Indian Capital Market?", *Decision*, **38**:119–140.

Martins, A. M., Serra, A. P., and Martins, F. V. (2012). *Real Estate Market Risk in Bank Stock Returns: Evidence for 15 European Countries*, CEF.UP Working Paper No. 1203, University of Porto.

Mayers, D. (1972), "Nonmarketable Assets and Capital Market Equilibrium under Uncertainty", in Jensen, M. C., (Ed.), *Studies in the Theory of Capital Markets*. New York: Praeger Publishers, Inc.

Mayshar, J. (1981). "Transaction Costs and the Pricing of Assets", *The Journal of Finance*, **36**:583–597.

Mei, J., and Saunders, A. (1995). "Bank Risk and Real Estate: An Asset Pricing Perspective", *Journal of Real Estate Finance and Economics*, **10**:199–224.

Miller, M., and Scholes, M. (1972). "Rates of Return in Relation to Risk: A Re-Examination of Some Recent Findings", in Jensen, M. C. (Ed.), *Studies in the Theory of Capital Markets*. New York: Praeger Publishers, Inc.

Modigliani, F., and Miller, M. (1958). "The Cost of Capital, Corporation Finance and the Theory of Investment", *The American Economic Review*, **48**:261–297.

Modigliani, F., and Miller, M. (1963). "Corporate Income Taxes and the Cost of Capital: A Correction, *The American Economic Review*, **53**:433–443.

Moerman, G. A. (2005). *How Domestic is the Fama and French Three-Factor Model? An Application to the Euro Area*, ERIM Report Series Reference No. ERS-2005-035-F&A.

Mossin, J. (1966). "Equilibrium in A Capital Asset Market", *Econometrica*, **34**:768–783.

Oertmann, P., Rendu, C., and Zimmermann, H. (2000). "Interest Rate Risk of European Financial Corporations", *European Financial Management*, **6**:459–478.

Roll, R. (1977). "A Critique of the Asset Pricing Theory's Tests: Part I: On Past and Potential Testability of the Theory", *Journal of Financial Economics*, **4**:129–176.

Ross, S. (1976). "The Arbitrage Theory of Capital Asset Pricing", *Journal of Economic Theory*, **13**:341–360.

Schuermann, T., and Stiroh, K. J. (2006). *Visible and Hidden Risk Factors for Banks*, Staff Report No. 252, Federal Reserve Bank of New York.

Sehgal, S., and Balakrishnan, A. (2013). "Robustness of Fama-French Three Factor Model: Further Evidence for Indian Stock Market", *Vision: The Journal of Business Perspective*, **17**:119–127.

Sharma, R., and Mehta, K. (2013). "Fama and French: Three Factor Model", *Journal of Indian Management*, **1**:90–105.

Sharpe, W. F. (1964). "Capital Asset Prices: A Theory of Market Equilibrium under Conditions of Risk", *The Journal of Finance*, **19**:425–442.

Stambaugh, R. F. (1982). "On the Exclusion of Assets from Tests of the Two-Parameter Model: A Sensitivity Analysis", *Journal of Financial Economics*, **10**:237–268.

Taneja, Y. P. (2010). "Revisiting Fama French Three-Factor Model in Indian Stock Market", *The Journal of Business Perspective*, **14**:267–274.

Treynor, J. (1962). *Toward a Theory of the Market Value of Risky Assets*, unpublished manuscript.

Viale, A. M., Kolari, J. W., and Fraser, D. R. (2009). "Common Risk Factors in Bank Stocks", *Journal of Banking and Finance*, **33**:464–472.

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