JEL Classification: G12, G14
Keywords: asset pricing, CAPM, beta, factor pricing models, three-factor model, market efficiency, Sweden, Scandinavia

Systematic Risk Changes, Negative Realized Excess Returns and Time-Varying CAPM Beta*

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Abstract
We make two methodological modifications to the method of testing CAPM beta and we show that these significantly affect inferences about the association between CAPM beta and stock returns. While the conventional beta proxy is indeed largely unrelated to realized stock returns (in fact the relationship is slightly negative), using forward-looking beta and eliminating unrealistic assumptions about expected market returns makes it (highly) significant. In addition, we show that complementary empirical factors—size and ratio of the book-to-market value of equity—that are sometimes presented as potential remedies to beta's deficiencies do not seem to outperform beta. This suggests that weak empirical support for CAPM beta is likely caused by complications with implementing CAPM rather than by the weakness of the underlying concept.

1. Introduction

The introduction of the Capital Asset Pricing Model (CAPM) (Sharpe, 1964; Lintner, 1965; Mossin, 1966; Black, 1972) initiated a stream in empirical research aimed at verifying the significance of CAPM beta and at identifying the determinants of expected stock returns in general. CAPM implies that there is a positive linear dependence of expected stock returns and CAPM betas that capture the sensitivity of asset returns to market returns and that CAPM beta is sufficient for explaining expected stock returns. Black *et al.* (1972) performed one of the first empirical studies in the area that tested whether portfolios consisting of stocks with high betas generate higher returns on average. It soon became clear that CAPM beta does not suffice to explain the cross-section of expected stock returns. Basu (1977) documented the positive significance of earnings-to-price (E/P) multiples. Banz (1981) found that size measured as the market value of equity (ME) is negatively associated with average stock returns. Stattman (1980) and Rosenberg *et al.* (1985) found that stocks with high book-to-market equity ratios (BE/ME) exhibit higher returns on average than would be warranted by their CAPM betas. More recently, Fama and French (1992) concluded that the combination of size and BE/ME performs best in explaining the cross-sectional variation in stock returns and that when these two factors are accounted for CAPM beta becomes insignificant.

Findings on the low explanatory power of CAPM beta and on the significance of other company-specific measures for average stock returns opened up a controversy over the way these should be interpreted. One stream of researchers argued that

* The author would like to thank Jan-Erik Gröjer, Mattias Hamberg, Johan Lyhagen and Dalibor Petr for their help and comments on the earlier drafts of this paper. I am also grateful to Sezin Koehler for proofreading the manuscript. An earlier version of the paper had the title "Is CAPM Beta Dead or Alive? Depends on How You Measure It". The author gratefully acknowledges financial support from the Czech Science Foundation, grant No. P403/12/2166.

these should be seen as evidence suggesting that the market does not price stocks rationally. They argued that the price-setting process is hindered by numerous frictions and that investors are susceptible to a range of behavioral biases that may drive stock prices far from the fundamentals. These concerns gave rise to a new stream in financial research that was later labeled "behavioral finance" (for reviews see, for example, Pearce, 1987; Fama, 1998). The "behavioralists" argued that returns are not (only) driven by the underlying risk of a portfolio, but rather by quite idiosyncratic market sentiments. Hence, they argued, the search for universal risk factors is bound to be futile and so they were quick to declare CAPM beta "dead". In fact, some argue that adherence to CAPM despite the abundance of contradictory empirical evidence hinders the development of finance as a rigorous discipline, calling it a "*failed revolutionary idea*" (Dempsey, 2013).

Others acknowledged the weak explanatory power of CAPM beta, but they argued that despite the puzzling evidence stock pricing may be rational in the case that risk is multi-dimensional and the company-specific measures are correlated with some hidden risk factors or in the case that a company's project reflects complex real options like characteristics (Da, Guo and Jagannathan, 2012). The obvious candidates for risk factors were measures that previous empirical studies identified as being associated with realized stock returns, namely size (proxied by the market value of equity, ME) and the ratio of book value to market value of equity (BE/ME). It was necessary, however, to propose a conceptual explanation as to why these factors are likely to be correlated with underlying risk characteristics omitted by CAPM beta. Several justifications were proposed (for a critical review, see Lewellen, Nagel and Shanken, 2010). Perhaps the most common explanation is that companies with low market value of their equity (i.e. small companies) and companies with low market value of equity relative to the book value of their equity (i.e. companies with high BE/ME) are likely to be financially distressed and superior returns on their stocks represent a rational compensation investors require for bearing a higher risk of financial distress (Chan and Chen, 1991). Fama and French (1993) formalized this idea into a three-factor asset pricing model that, along with CAPM beta, also employs size and BE/ME as risk factors. Their model became a widespread alternative to CAPM.

This paper revisits the relationship between CAPM beta and realized stock returns. We consider two modifications in testing CAPM beta and show that they have a significant impact on the inferences drawn from the empirical tests. Consistent with prior literature, we show that the association between the conventional backward-looking proxy of CAPM beta estimated over the rolling window of the past 60 monthly return observations and realized returns is flat—in fact, contrary to CAPM predictions, it is slightly negative. Nevertheless, the use of forward-looking beta and the elimination of unrealistic assumptions about expected market returns produce CAPM beta proxies that are significant for explaining the cross-sectional variation in stock returns. Hence, the claims that CAPM beta is "dead" may not be doing justice to the underlying concept.

As our alternative approach documents a strong association with realized returns, we conclude that the failure of CAPM beta to capture the underlying risk characteristics likely results from the difficulties in estimating it rather than from the implausibility of the concept. While our analysis suggests that the customary beta estimates available in the business press and financial databases are not particularly useful for summarizing risk characteristics of underlying stocks, it also suggests that this is primarily driven by the implementation of CAPM. Our results thus lend some support for the subjective beta adjustment techniques that are sometimes used in measuring systematic risk for the sake of estimating the cost of capital. These techniques rely on the conceptual argument about the expected association between systematic risk and expected stock returns that underpin CAPM beta. However, these allow for the use of subjective judgments based on the intuitive understanding of the level of exposure a given firm has to the systematic risk. Despite not being quite rigorous in a quantitative sense, these discretionary adjustments may compensate for the imprecision of the expected return proxies that are bound to contaminate the CAPM beta estimation.

We contribute to the existing literature by demonstrating that weak empirical support for CAPM beta is likely caused by complications with implementing CAPM rather than by the weakness of the underlying concept. We make two methodological modifications that, to the best of our knowledge, have not been tested in prior literature. If a firm's systematic risk changes over time, historical beta may fail to reflect expectations of future risk exposure. We empirically show that beta estimated *ex ante* that is a likely superior proxy for the expected systematic risk exhibits a positive association with realized stock returns while the conventional beta estimated *ex post* does not. In addition, we argue that in months when the realized stock returns are below the risk-free rate, the realized (negative) excess returns are not a good proxy for the risk premium expected at the beginning of the month. We show that disregarding months with negative excess returns renders the association between CAPM beta and realized returns positive and significant. Taken together, our results show that the concept underlying CAPM beta is sound, but the conventional approach of estimating it does not capture the expected systematic risk exposure.

The remainder of this paper is organized as follows: Section 2 provides an overview of the theoretical background summarizing the major ideas underlying CAPM. Section 3 summarizes the empirical research on variables associated with realized stock returns and provides a brief exposition of the proposed justification of these variables as risk factors. In Section 4 we specify the methodology used in this study and describe the data sample. Section 5 presents the results, and Section 6 concludes the paper.

2. Theoretical Background

The Capital Asset Pricing Model (CAPM) was developed by Sharpe (1964) and Lintner (1965), (Mossin, 1966) and (Black, 1972). CAPM is based on the idea that stock markets should compensate investors only for the systematic component of risk that cannot be diversified away by holding a broad portfolio of assets. Investors are assumed to be risk averse and hence they trade off expected returns on an asset with its systematic risk component that captures the contribution of an asset to the overall volatility of portfolio returns. Investors are also assumed to be fully rational and thus the portfolios they hold are mean-variance efficient, i.e. they minimize the overall portfolio risk (measured as the volatility of total portfolio returns) for any given level of expected return.

Furthermore, it is assumed that there is complete agreement about the future distribution of asset returns and that investors have an unlimited capacity to borrow and lend at a risk-free rate. This implies that investors hold only two kinds of assets—identical portfolios of risky assets (that therefore coincide with the market portfolio of risky assets) and risk-free assets. The diverse risk preferences are thus only reflected by the proportion of the risk-free asset and the market portfolio of risky assets, rather than by the different composition of portfolios consisting of risky assets. As a corollary of the above, the market portfolio is mean-variance efficient, which implies the major conclusion of CAPM that the expected excess return for any of the *N* risky assets *i* is solely determined by the sensitivity of its returns to market returns and it can be expressed as:

$$E\left(R_i\right)-R_f=\beta_i\left[E\left(R_M\right)-R_f\right] \text{ … for } i=1,2,\dots,N \quad (1)$$

Where $E(R_i)$ is the expected return on asset i, R_f is the expected return on a risk-free asset, $E(R_M)$ is the expected market return, and β_i is the market beta of asset i, which is defined as the covariance of an asset's return and the market return normalized by the variance of the market return:

$$\beta_i=\frac{\sigma_{i,M}}{\sigma_M^2}=\frac{\operatorname{cov}\left(R_i,R_M\right)}{\operatorname{var}\left(R_M\right)} \quad (2)$$

where R_i is the return on stock i, R_M is the market return, σ_M^2 denotes the variance of market returns, and $\sigma_{i,M}$ is the covariance between asset returns and market returns. The expression shows that beta can be interpreted as the contribution of an asset to the overall risk of the market portfolio.

CAPM involves several implications that are used for empirical tests. First, it proposes that the expected excess return on an asset is directly dependent on its systematic risk measured by the asset's beta. Second, it implies that there is no excess return that would not be attributable to the underlying systematic risk. In other words, CAPM suggests that beta is the factor that fully explains stock returns, i.e. when regressing excess stock returns on beta, its slope coefficient should be indistinguishable from 1 and the intercept should be indistinguishable from 0. This would, however, be a very radical interpretation that would require CAPM to be exhaustive in capturing the risk characteristics of stocks and would necessitate a noise-free measurement of expected returns. Neither of the above is realistic. CAPM relies on a series of simplifying assumptions (e.g. it assumes away bankruptcy costs) and thus it omits certain (supposedly less prominent) risk characteristics. In addition, the expected stock returns need to be approximated by realized returns, which introduces noise in the dependent variable. Consequently, the first empirical question this study aims to address is not whether CAPM beta fully explains stock returns but rather whether it at all enhances our ability to predict stock returns, i.e. whether the association between CAPM beta and stock returns is positive.

Hypothesis 1: *There is a positive association between the CAPM beta of an asset measured on an ex post basis and its excess returns.*

3. Empirical Research

Some of the early empirical studies aimed at testing CAPM already conclude that CAPM beta does not suffice to explain the cross-sectional variation in stock returns (Banz, 1981; Stattman, 1980; Rosenberg *et al.*, 1985). Instead, risk seems to be multi-dimensional as there are other factors with an incremental explanatory power (Fama and French, 1992). Hence, we will use these measures as complementary risk factors in testing the predictive ability of CAPM beta. One of these additional factors is firm size measured as the market value of equity (ME).

The "size effect" was first documented by Banz (1981), who found that smaller New York Stock Exchange (NYSE) capitalization firms tended to have higher CAPM beta risk-adjusted returns than larger firms. Banz (1981) also provided initial evidence that the size effect is not linear in the market value; the main effect occurs for very small firms while there is little difference in returns between average-sized and large firms. Fama and French (1992) confirm Banz's findings and pinpoint firm size and the book-to-market equity ratio (BE/ME) as the most important determinants of average stock returns.

There are a number of reasons why size is likely to capture some dimension of risk. Chan *et al.* (1985) find that the earning prospects of small capitalization firms are more sensitive to macroeconomic risk factors; in particular, they seem to be more exposed to production risk and changes in the risk premium. Chan and Chen (1991) argue that the higher sensitivity of small firms to macroeconomic events is because many small firms are what they call "marginal firms", i.e. firms with poor past performance that are financially distressed, which manifests itself through high market-imposed financial leverage and cut-downs in dividend payouts. Thus, size can be seen as one of the proxies for the risk of financial distress. In fact, provided that stock prices are rational, there should be a nearly mechanistic relationship between size and risk. Berk (1995) argues that regardless of how investors assess risk, riskier stocks have a higher required return, which *ceteris paribus* leads to lower prices. Hence, even though one remains agnostic about the risk characteristics relevant to investors, one can conclude that price conveys some information about required returns and hence about the perceived risk. Stocks that are deemed riskier (for whatever reason) are overrepresented in small capitalization stocks and therefore size can serve as a risk proxy (albeit a very noisy one). In addition, intuitively, information provided by smaller firms is not as thoroughly scrutinized by stock market analysts, which introduces additional uncertainty about the expectations of a company's prospects and about its valuation. Thus, small capitalization firms seem to be riskier and hence it is reasonable to expect investors to require a premium for holding them.

Another empirically-discovered factor related to the cross-sectional variation in stock returns is the book-to-market ratio (BE/ME) defined as the ratio of a firm's book value of equity to its market value. Early evidence suggesting the relevance of BE/ME for returns of US stocks is provided by Stattman (1980) and Rosenberg *et al.* (1985). Chan *et al.* (1991) confirmed the positive association between BE/ME and stock returns on the Japanese market. Fama and French (1992) conclude that ME and BE/ME are superior to other risk factor candidates (such as E/P ratio or leverage) in explaining the cross-section of stock returns. In a later paper, they use CAPM beta, size and BE/ME to construct the three-factor model that should capture the various dimensions of risk (Fama and French, 1993) and they argue that the three-factor model offers a sound solution for a number of CAPM anomalies (Fama and French, 1996).

It is often argued that, similarly to size, BE/ME also captures some dimension of financial distress risk.[1] BE/ME seems to be related to the operating performance of a company. Penman (1991) and Fama and French (1995) show that firms with low BE/ME equity exhibit persistent higher profitability than firms with high BE/ME equity. This result holds across different-sized BE/ME groups of stocks. High BE/ME corresponds to low relative market valuation of equity, which indicates that the market on average is skeptical about company prospects, which entails a higher required cost of equity. Griffin and Lemmon (2002) show that returns required on firms exposed to high distress risk exhibit much greater sensitivity to the unit change in the BE/ME of these firms than do the returns of non-distressed firms. They further show that the BE/ME effect is most prominent for small firms with poor analyst reports. From the "agnostic perspective" that infers information about investors' risk assessment from stock prices disregarding the way risk is actually assessed, Berk (1995) argues that as a risk indicator BE/ME should be superior to size (ME) because by relating ME to BE one partially controls for differences in cash flow expectations across firms. High BE/ME firms have low market valuation relative to the book value of equity, which indicates that they are likely to be distressed. Investors require compensation for holding high BE/ME stocks.

Contrary to international evidence, however, size and BE/ME seem to perform rather oddly on the Swedish Stock Exchange. Asgharian and Hansson (2000) tested the three-factor model with time-varying CAPM beta on the Swedish data extracted from the Trust database for the 1980–1996 period. They conclude that in the Swedish capital market CAPM beta and size are both insignificant. They attribute this result to the considerable effect of the Swedish crisis period of 1990–1994 and the length of their sample. In this study we will examine if considering these measures affects the ability of CAPM beta to predict future stock returns.

4. Research Design

4.1 Methodology

The major methodological apparatus used to test the specified hypotheses are monthly cross-sectional Fama-MacBeth (1973) regressions of dividend-adjusted excess returns on different estimates of CAPM beta and other explanatory factors following this specification:

$$R_{i,t} - R_{f,t} = \lambda_{0,t} + \lambda_{1,t}\hat{\beta}_{i,t} \; \ldots \text{ for } t = 1, 2, \ldots, T \quad (3)$$

Each month t realized excess returns ($R_{i,t} - R_{f,t}$) are matched with explanatory variables computed at the beginning of the month. For each regression specification this approach produces a series of monthly estimates $\lambda_{k,t}$ for each explanatory variable k. The mean values of these monthly estimates are reported in the tables as

[1] Alternatively, it is also possible to interpret the relevance of BE/ME for stock returns as a result of market overreaction to series of news about the company's prospects. Gradual unraveling may lead to a stock price correction that can be anticipated by high or low relative market valuation, i.e. the inverse of BE/ME (Lakonishok *et al.*, 1994).

the estimated slope coefficients and their significance is assessed with the use of the t-statistic computed as the ratio of the mean estimated monthly coefficient $\bar{\lambda}_k$ divided by the ratio of their standard deviation s_{λ_k} and the square root of the number of monthly regressions $\sqrt{T}$.

$$t_{\lambda_k} = \frac{\bar{\lambda}_k}{s_{\lambda_k} / \sqrt{T}} \quad (4)$$

Realized monthly excess returns—defined as the raw stock return minus the risk-free return—are used as a proxy for expected returns. This is a standard approach substantiated by the assumption that the market is on average "right", which implies that the realized market returns will on average correspond to the correct market expectations. Qualifications to this assumption are discussed below, where we analyze how the results are dependent on the methodology used. Monthly returns on three-month Swedish Government Bonds are used as a proxy for the risk-free asset. This is because data on one-month Swedish Government Bonds prior to 1993 are not available. We do not expect the choice of a risk-free proxy to have any significant impact on the results since the correlation between the two series over the period between November 1993 and May 2005 is 0.972 and the average difference between the two return series is merely 0.002%.

As a company's operating characteristics may change over time, its exposure to systematic risk may also vary. Ang and Kristensen (2012) argue that *"overwhelming empirical evidence shows that factor loadings, especially for the standard capital asset pricing model (CAPM) and Fama and French (1993) models, vary substantially over time"* (p. 132), which may render the statistical inference about the validity of the factor models misleading. Also Chordia *et al.* (2015) argue that allowing individual stock betas to vary over time substantially increases the proportion of cross-sectional variation in expected returns attributed to factor loadings. We acknowledge that a firm's systematic risk may change over the sample period (27 years) and hence for every stock the CAPM beta is re-estimated at the beginning of each month by means of longitudinal rolling window regressions of individual stock excess returns on market excess returns over the past 60 months—this beta estimate is referred to as beta *ex post*.[2] For example, for the second stage cross-sectional regression of month 0, beta is estimated at the first stage based on months (-60, -1), for month 1 the estimate is based on months (-59, 0), etc. A standard Swedish stock market index (AFGX) is used as a proxy for market return. This follows Bartholdy and Peare's (2001, 2005) recommendation which concludes that the use of five years of monthly data and an equal-weighted market index provide the most efficient beta estimates.

Affärsvärldens generalindex (AFGX) is a broadly defined stock index provided by Ecovision AB, the oldest Swedish stock index with a history dating back to 1937. It covers a wide range of stocks and therefore it is commonly used as a proxy for Swedish stock market returns. Stock returns are value-weighted and they exclude dividends. As the Stockholm Stock Exchange (SSE) is a rather large market within

[2] There is a minimum requirement of at least 48 pairs of observations to be available.

the Scandinavian context, the index is not significantly dominated by any of the stock, which can potentially have important implications for the interpretation of CAPM betas. When using indices that are dominated by one or a few stocks, the estimated CAPM betas capture a great deal of correlation between individual stocks and this/these large stock(s). Consequently, they are sensitive to the variance of returns on this/these large stock(s). In the case of the SSE, this issue does not seem to constitute a severe problem. The weights of individual stocks vary over the sample period; however, in January 2005 the largest stock (Ericsson) constituted approximately 12.3% of the index and none of the other stocks exceeded 8% of the value of the index (more details about the composition of the index can be found in *Table 10*).

In order to assess the dependence of beta's ability to explain the cross-section of stock returns, we make several modifications to the standard Fama-MacBeth (1973) methodology. First, *ex post* beta estimates are replaced by *ex ante* estimates based on 60 future, rather than past, monthly observations, which may better represent expected future volatility. The importance of considering *ex ante* estimates in general is stressed by Levy (2010), who argues that *ex post* estimates are unlikely to reliably reflect the estimated measured. Ang *et al.* (2006) argue that stock returns are sensitive to innovations in aggregate volatility. Bollerslev *et al.* (2014) use intraday data and show that the "rough" betas that relate to price jumps are associated with higher stock returns while the "smooth" betas are not. As large price jumps in the future may not resemble the past as well as the more continuous measures of risk do, distinguishing between past realizations and future expectations seems crucial. In the case that the expected future volatility differs from the realized past volatility, using *ex ante* betas may yield different inferences on the ability to explain the cross-section of stock returns.

Ex post beta estimates are seen as "default" CAPM beta estimates that are readily available in the business press (e.g. the business weekly *Affärsvärlden* for companies listed on the Stockholm Stock Exchange) as well as financial databases (e.g. the Trust database provided by Six Estimates and DataStream provided by Thomson Financial). In addition, *ex post* estimation requires solely data that actually are available at the beginning of the regression month and hence can be used in constructing a feasible investment tool. Consequently, *ex post* betas represent estimates that are likely to be customarily used in business practice. Conversely, *ex ante* beta estimates use future data relative to the time of a fictitious investment that are not available at the beginning of the month and therefore do not represent an approach that is feasible for investors. However, since they are forward looking, it is argued that that they better represent the expectation of investors about future risk characteristics of assets. *Ex post* betas well represent market expectations only in the cases where investors simply extrapolate past risk characteristics into the future. For *ex ante* betas to meet the same criterion it is enough that investors are on average "right", which is much more realistic. Therefore, *ex ante* betas are expected to better reflect expected future risk characteristics than *ex post* beta, and thus we propose that using *ex ante* rather than *ex post* beta estimates is likely to improve the ability to explain the cross-sectional variation of stock returns.

Hypothesis 2: *There is a positive association between the CAPM beta of an asset measured on an ex ante basis and its excess returns.*

Furthermore, to complement the analysis we also compute beta *au point,* using a combination of 30 past months and 30 future months. This approach should produce beta estimates that combine the characteristics of *ex post* and *ex ante* estimates and it is used to verify the expected benefits of the forward-looking estimation approach. The *au point* beta estimation method is used to provide additional insight into the analysis of the differences in significance between *ex ante* and *ex post* betas.

The following modification of the estimation procedure concerns the use of a proxy for expected returns. We propose that the general assumption that the realized stock returns proxy well for the returns expected at the beginning of the period breaks down in the case that the realized market excess return is negative. Therefore, in the following section of empirical analysis we drop all the months with negative market excess returns in order to avoid this unsound assumption. More details as well as the motivation for this methodological modification can be found in subsection 5.3.

Hypothesis 3: *There is a positive association between the CAPM beta of an asset measured excluding months with negative market excess returns and its excess returns.*

4.2 Data Sample

We gather data on all companies listed on the Stockholm Stock Exchange (SSE) between 1979 and 2005 from the Six Trust Database. We follow a standard procedure (e.g. Fama and French, 1992) and exclude all financial and insurance companies because their specific asset and liability structure typically produces high financial leverage, which hinders the comparability of their BE/ME ratios with those of non-financial firms.

The SSE is of interest for several reasons. First, most of the risk factors have been tested on several large Anglo-American markets that feature rather similar corporate governance systems. The risks faced by investors on those markets are likely to be affected by these systems that aim at mitigating the agency problem arising between shareholders and managers. The quality of corporate governance systems is likely to affect the risk faced by investors. The Scandinavian corporate governance system is usually described as distinct from both the Anglo-American and Germanic corporate governance systems (La Porta and Lopez-de-Silanes, 1999). The SSE is thus an example of a rather large and liquid market suitable for verifying the significance of the factors in an environment with potentially different risk characteristics. Second, the empirical risk factors (size, BE/ME) have been discovered and analyzed on several large, typically Anglo-American markets. Stock return performances on these markets are highly correlated (Engsted and Tanggaard, 2004). The lack of theoretical underpinning for these factors raises concern about their generalizability. Swedish data thus provide out-of-sample evidence that allows us to assess whether the size and BE/ME risk factors are specific to the Anglo-American markets or whether their validity is universal.

Table 1 shows the descriptive statistics of the data pooled across all months. In total, the sample comprises 609 stocks (59,248 firm-month observations with data available for excess returns) for which a maximum of 254 monthly regressions are run (the actual number of regressions run for various beta estimates differs somewhat

Table 1 Descriptive Statistics

stats	exret	beta	ln(me)	ln(beme)	me	beme
Panel A Unadjusted Full-Sample Data						
N	59 248	39 594	57 740	54 881	57 857	54 881
mean	0.008	0.917	6.575	-0.789	6 501	8.219
sd	0.165	0.521	1.901	0.965	49 568	229.339
min	-1.013	-0.482	-2.469	-9.020	-10 427	0.000
p25	-0.061	0.567	5.267	-1.335	193	0.263
p50	-0.003	0.854	6.373	-0.770	583	0.463
p75	0.065	1.167	7.791	-0.247	2 409	0.781
max	5.026	4.370	14.680	9.461	2 373 928	12 844.800
Panel B Winsorized Data (3 st. dev.)						
N	59 248	39 594	57 740	54 881	57 857	54 881
mean	0.005	0.910	6.570	-0.791	4 757	1.733
sd	0.135	0.493	1.887	0.941	16 041	26.810
min	-0.487	-0.482	-2.469	-9.020	-10 427	0.000
p25	-0.061	0.567	5.267	-1.335	193	0.263
p50	-0.003	0.854	6.373	-0.770	583	0.463
p75	0.065	1.167	7.791	-0.247	2 409	0.781
max	0.503	2.480	11.953	6.546	155 205	696.235

Notes: Descriptive statistics for excess stock returns (*exret*), *ex post* estimate of CAPM beta (*beta*), natural logarithm of the market value of equity (*ln(me)*), natural logarithm of the book-to-market equity ratio (*ln(beme)*), market value of equity (*me*) and book-to-market equity ratio (*beme*). Panel A is based on an unadjusted data sample, while Panel B is based on a sample Winsorized at three standard deviations.

due to data requirements applicable for each estimation procedure). Following regression analysis, natural logarithmic transformation is applied for ME and BE/ME in order to bring their distribution closer to normal. For the sake of completeness, *Table 1* also includes complementary descriptives for the underlying variables (ME and BE/ME). All results are presented for the full sample comprising all observations as well as for a sample that is treated for outliers. The full-sample results are reported because there has been some concern that the risk characteristics captured by some of the variables (e.g. ME) may possibly be in the extremes, and therefore removing the extreme observations may potentially bias the results. On the other hand, outliers are treated by Winsorizing all variables at three standard deviations, i.e. all values that are further than three standard deviations away from the mean are replaced with the value equal to the mean plus or minus three standard deviations. This adjusted sample should be robust to potential mistakes in the database or to the effect of outlying observations. For example, Winsorizing reduces the range of excess stock returns from -101.3% to 502.6% in the original sample to -48.7% to 50.3% in the adjusted sample and *ex post* estimates of CAPM beta from -0.482 to 4.370 in the full sample to -0.482 to 2.480 in the Winsorized sample.

Table 2 shows the correlations between the four variables (excess returns, beta, size and BE/ME). It provides some initial evidence about the relevance

Table 2 Correlation Matrix

	exret	beta	ln(me)	ln(beme)	me	beme
Panel A Unadjusted Full-Sample Data						
exret	1					
beta	0.006	1				
ln(me)	-0.019	0.049	1			
ln(beme)	0.032	-0.013	-0.378	1		
me	-0.003	0.062			1	
beme	0.003	0.005			-0.006	1
Panel B Winsorized Data (3 st. dev.)						
exret	1					
beta	-0.005	1				
ln(me)	-0.001	0.054	1			
ln(beme)	0.023	-0.010	-0.367	1		
me	0.004	0.055			1	
beme	0.000	0.010			-0.020	1

Notes: Correlation coefficients for excess stock returns (exret), *ex post* estimate of CAPM beta (*beta*), natural logarithm of the market value of equity (*ln(me)*), natural logarithm of the book-to-market equity ratio (*ln(beme)*), market value of equity (*me*) and book-to-market equity ratio (*beme*). Panel A is based on an unadjusted data sample, while Panel B is based on a sample Winsorized at three standard deviations.

of the three risk factors. Consistent with the three-factor model prediction, in the full sample the correlation between beta and excess returns and also between BE/ME and excess returns are both positive, while the correlation between size and excess returns is negative. However, all these correlations are very weak and the relationship between beta and excess returns actually turns negative when outliers are Winsorized. In addition, *Table 2* also gives some insight into the relationship between the three risk factors. Most notably, it shows a fairly strong negative correlation between ln(ME) and ln(BE/ME) of -0.378. This indicates that they may indeed capture some risk dimension, for example distress risk, as it is sometimes suggested. The weakness of these correlations, however, underlines the need for a rigorous regression analysis, the results of which are reported in the following section.

5. Results

Tables 3–9 present results from the monthly Fama-MacBeth (1973) regressions of excess stock returns on proposed risk factors. We first discuss the results obtained for the conventional estimate of CAPM beta and evaluate its power to explain the cross-section of realized stock returns (Hypothesis 1). Subsequently we analyze whether modifications of the estimation procedure of CAPM beta impact the conclusions about its explanatory power (Hypotheses 2 and 3).

5.1 Beta Estimated *ex post* and *ex ante*

Table 3 shows the results for beta estimated *ex post*. This represents the conventional method of beta estimation in which the value is obtained by regressing 60 historical excess returns on a stock on market excess returns. It can be easily seen

Table 3 Beta Estimated Ex Post

	T	254	254	254	254
Panel A Unadjusted Full-Sample Data					
cons	mean	0.009	0.015	0.007	0.012
	t-stat	2.519	1.859	1.663	1.945
beta	mean	-0.001			-0.002
	t-stat	-0.343			-0.576
ln(me)	mean		-0.001		0.0
	t-stat		-1.55		-0.536
ln(beme)	mean			0.002	0.0
	t-stat			1.574	0.089
Panel B Winsorized Data (3 st. dev.)					
cons	mean	0.009	0.002	0.006	0.007
	t-stat	2.511		1.334	1.315
beta	mean	-0.004			-0.005
	t-stat	-0.962			-1.355
ln(me)	mean		0.0		0.0
	t-stat		0.613		0.688
ln(beme)	mean			0.001	0.0
	t-stat			1.01	0.332

Notes: Average regression coefficients and corresponding *t*-statistics from monthly Fama-MacBeth regressions using the *ex post* CAPM beta estimate. Each month *t* excess stock returns are regressed on an estimate of CAPM beta (*beta*), natural logarithm of the market value of equity (*ln(me)*), natural logarithm of the book-to-market equity ratio (*ln(beme)*). *T* is the number of monthly regressions used. Panel A is based on an unadjusted data sample, while Panel B is based on a sample Winsorized at three standard deviations.

that these results are not consistent with CAPM predictions. The slope coefficients for *ex post* beta are insignificant and in fact slightly negative (with *t*-statistics of -0.343 for the full sample and -0.962 for the outlier-free sample). At the same time, the intercepts turn out to be positive (with *t*-statistics of 2.519 for the full sample and 2.511 for the outlier-free sample) indicating a substantial portion of unexplained excess return. Taken together, these results indicate that the conventionally measured CAPM beta indeed fails to capture the risk characteristics of stocks. *Table 3* also shows that the inclusion of empirical risk proxies does not affect the significance of CAPM beta. In fact, the slope coefficients become even slightly more negative. Viewed from this perspective, beta may indeed appear to be "dead".

However, rather than stopping at this conclusion, we perform several modifications to the Fama-MacBeth (1973) methodology to see if this finding is robust to these alternative approaches. First, we use *ex ante* or forward-looking rather than *ex post* or backward-looking beta estimates. These are obtained by regressing 60 future (rather than historical) excess stock returns on market excess returns. For example, for the second stage cross-sectional regression of month 0, beta is estimated at the first stage based on months (+1, +60), for month 1 the estimate is based on months (+2, +61), etc. Provided that the investors are on average "right", these estimates may better reflect market expectations and prospective risk characteristics.

Table 4 Beta Estimated Ex Ante

	T	207	207	207	207
Panel A Unadjusted Full-Sample Data					
cons	mean	0.001	0.023	0.01	0.013
	t-stat	0.151	2.799	2.166	2.137
beta	mean	0.013			0.01
	t-stat	2.254			1.718
ln(me)	mean		-0.002		-0.001
	t-stat		-2.211		-1.119
ln(beme)	mean			0.002	0.004
	t-stat			0.961	2.595
Panel B Winsorized Data (3 st. dev.)					
cons	mean	0.003	0.012	0.009	0.011
	t-stat	1.067	1.733	1.963	1.863
beta	mean	0.008			0.007
	t-stat	1.677			1.343
ln(me)	mean		0.0		0.0
	t-stat		-0.69		-0.409
ln(beme)	mean			0.001	0.005
	t-stat			0.466	3.222

Notes: Average regression coefficients and corresponding *t*-statistics from monthly Fama-MacBeth regressions using the *ex ante* CAPM beta estimate. Each month *t* excess stock returns are regressed on an estimate of CAPM beta (*beta*), natural logarithm of the market value of equity (*ln(me)*), natural logarithm of the book-to-market equity ratio (*ln(beme)*). *T* is the number of monthly regressions used. Panel A is based on an unadjusted data sample, while Panel B is based on a sample Winsorized at three standard deviations.

The results are reported in *Table 4*. Clearly, these results convey quite a different story than those for *ex post* beta. Not only is the slope coefficient for *ex ante* beta positive and significant (*t*-statistic of 2.254), but the intercept terms also shrink substantially (*t*-statistic of 0.151). Rather oddly, however—though following the same trend—the Winsorized results are somewhat weaker with the beta *t*-statistic of 1.667 and the intercept *t*-statistic of 1.067. The inclusion of ME and BE/ME affects the significance of the slope coefficients and especially the significance of the intercept, but it does not affect the main conclusion that the CAPM beta estimated *ex ante* is positively associated with realized stock returns and the relationship is significant for the non-Winsorized sample. These results provide the first indication that the conclusion that CAPM beta is dead may be premature, as its explanatory power is highly dependent on the way it is estimated.

To complement these findings, *Table 5* presents results for beta estimated *au point*, i.e. using data on 30 historical and 30 future returns and so it represents a "hybrid" method of beta estimation (we do not suggest that this is the way beta should be estimated in practice; rather, we report this result so as to confirm or dismiss the general trend of the growing significance of CAPM beta when moving from historical to future data). In line with the expectations, the *au point* beta represents a case in between *ex post* and *ex ante* betas. In the full sample its slope

Table 5 Beta Estimated Au Point

	T	237	237	237	237
Panel A Unadjusted Full-Sample Data					
cons	mean	0.005	0.015	0.007	0.013
	t-stat	1.382	1.767	1.511	2.03
beta	mean	0.003			0.0
	t-stat	0.5			0.012
ln(me)	mean		-0.001		0.0
	t-stat		-1.59		-0.588
ln(beme)	mean			0.003	0.005
	t-stat			1.551	2.831
Panel B Winsorized Data (3 st. dev.)					
cons	mean	0.006	0.002	0.006	0.01
	t-stat	1.934	0.344	1.247	1.667
beta	mean	-0.001			-0.003
	t-stat	-0.216			-0.611
ln(me)	mean		0.0		0.0
	t-stat		0.291		0.152
ln(beme)	mean			0.001	0.003
	t-stat			0.992	2.515

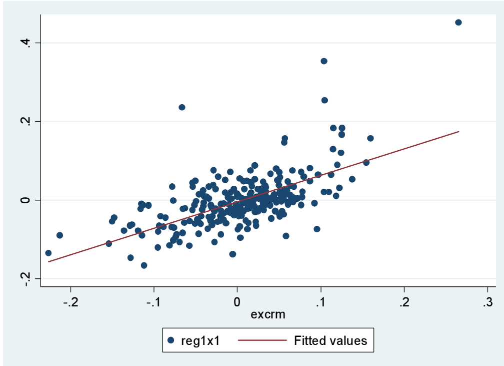
Notes: Average regression coefficients and corresponding *t*-statistics from monthly Fama-MacBeth regressions using the *au point* estimate of CAPM beta. Each month *t* excess stock returns are regressed on an estimate of CAPM beta (*beta*), natural logarithm of the market value of equity (*ln(me)*), natural logarithm of the book-to-market equity ratio (*ln(beme)*). *T* is the number of monthly regressions used. Panel A is based on an unadjusted data sample, while Panel B is based on a sample Winsorized at three standard deviations.

coefficient is slightly positive but insignificant (*t*-statistic of 0.500) while the intercept is lower than in the case of *ex post* beta but higher than for *ex ante* beta (*t*-statistic of 1.382). Again, a Winsorized sample produces weaker results with the slope coefficient at beta slightly negative (*t*-statistic of -0.216, which is still less negative than the corresponding case of *ex post* beta) and a somewhat higher intercept that nevertheless still falls between the *ex post* and *ex ante* cases (*t*-statistic of 1.934). Hence, these results seem to confirm the proposition that as one moves from historical data to future data when estimating beta, its explanatory power increases and there is less space for unexplained returns (captured in the intercept).

5.2 Positive and Negative Market Excess Returns

So far we have analyzed how the different beta estimates explain the cross-sectional variation of monthly returns assuming that these returns well reflect return expectations from the beginning of each period. While this seems to be a sound assumption in general, it is possible to identify situations in which it is not reasonable. In particular, provided that investors are on the margin of risk averse, the expected return on the market portfolio must be larger than the risk-free rate or the expected market excess return must be positive because otherwise the investors would simply buy the risk-free asset and the market for risky assets would cease to

Figure 1 Dependence of Beta's Explanatory Power on Realized Market Returns



Notes: Scatter plot of the monthly slope coefficients of *ex post* CAPM beta estimates ($\lambda_{1,t}$) against the realized excess market returns in the month t (excrm). The fitted value uses the OLS regression of $\lambda_{1,t}$ on excrm.

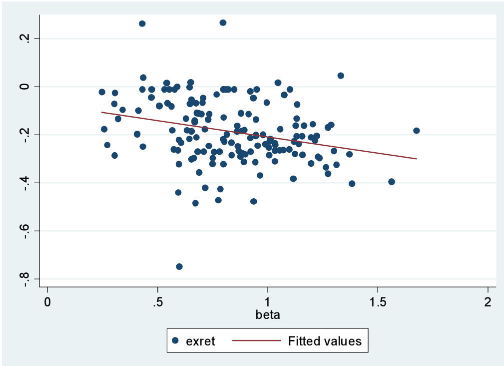
exist. There are months, however, when realized market returns fall below the risk-free rate. We propose that in these months the realized stock returns cannot be seen as a good proxy for expected returns because the market realization was clearly at odds with what was expected at the beginning of the period.

In addition, besides this conceptual argument, there is a related technical reason why it is reasonable to a *priori* expect that the inclusion of months with negative market return should bias the results. By the very nature of the systematic risk, returns on high-beta stocks are highly correlated with the market return. Hence, when the market performance is poor (e.g. when the market excess return is negative) the high-beta stocks are likely to perform worse than the low-beta stocks (after all, that is the reason they are considered to be more risky). Consequently, in these months the slope coefficient at CAPM beta $\lambda_{1,t}$ is likely to be negative (i.e. the higher the beta, the lower the realized return). In the case that CAPM beta well captures stocks' risk characteristics, following the standard Fama-MacBeth (1973) methodology should produce a number of positive $\lambda_{1,t}$ coefficients for months of good stock market performance and a number of (possibly less) negative $\lambda_{1,t}$ coefficients for months of poor stock market performance. Assuming that the number of months with positive excess market returns is higher than the number of months with negative excess market returns when averaging the slope coefficients $\lambda_{1,t}$ across time, the months with negative excess market returns are likely to bias the resulting coefficient downwards, thus impairing their significance.

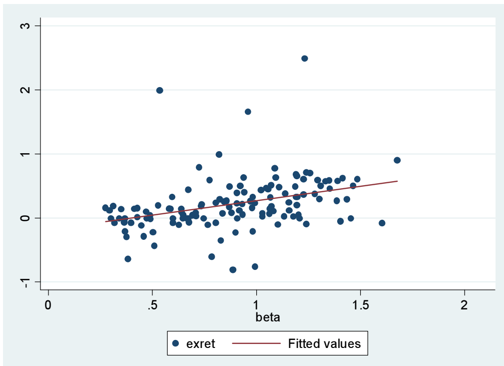
To verify this suspicion, we first analyze how the slope coefficients $\lambda_{1,t}$ obtained in different months depend on the realized market excess return. *Figure 1* shows a scatter plot of $\lambda_{1,t}$ slope coefficients for *ex post* beta against excess market returns. It can be easily seen that in months with a high excess market return the $\lambda_{1,t}$ coefficients tend to be high and vice versa. Note also that the fitted line passes almost perfectly through the origin, indicating that the zero market excess return cut-off on average separates the positive and negative $\lambda_{1,t}$ coefficients. To establish this relationship formally, we regress the monthly $\lambda_{1,t}$ coefficients on monthly market excess

Figure 2 Lambda Coefficients in the Best and the Worst Month

Panel A September 1990 (Excess Market Return of -22.6%)



Panel B November 1992 (Excess Market Return of 26.5%)



Notes: Scatter plot of realized excess stock returns (exret) in September 1990 (Panel A) and November 1992 (Panel B) on *ex post* CAPM beta estimates (beta). September 1990 is the month of the worst market performance when the excess market return is -22.6%, while November 1992 is the month of the best market performance when the excess market return is 26.5%. The fitted value uses the OLS regression of exret on beta.

returns. Consistent with expectations, the resulting positive coefficient of 0.673 turns out to be highly significant with the corresponding *t*-statistic of 12.780 (not tabulated). This indicates that the explanatory power of beta is high in months with high realized market excess returns and low when the realized market return is poor. As previously argued we propose that this is because in bad months realized returns do not reflect market expectations and therefore the $\lambda_{1,t}$ coefficient fails to capture the relationship between the risk captured by beta and expected returns.

Figure 2 further illustrates the relationship between the $\lambda_{1,t}$ coefficients and market excess returns. It shows a scatter plot of excess stock returns on *ex post* beta estimates in the worst stock market month, September 1990 (Panel A), when the excess market return reached its minimum of -22.6%, and in the best stock market month, November 1992 (Panel B), when the excess market return reached its maximum of 26.5%. The slope of the fitted line corresponds to the $\lambda_{1,t}$ coefficient

Table 6 Ex Post Beta in Positive Months

	T	142	142	142	142
Panel A Unadjusted Full-Sample Data					
cons	mean	0.028	0.055	0.048	0.031
	t-stat	5.945	4.951	10.869	3.359
beta	mean	0.023			0.018
	t-stat	3.874			3.337
ln(me)	mean		-0.001		0.0
	t-stat		-0.947		0.171
ln(beme)	mean			0.005	0.003
	t-stat			2.378	1.355
Panel B Winsorized Data (3 st. dev.)					
cons	mean	0.027	0.035	0.044	0.023
	t-stat	6.393	4.187	11.408	2.939
beta	mean	0.02			0.015
	t-stat	4.129			3.407
ln(me)	mean		0.001		0.002
	t-stat		1.453		1.598
ln(beme)	mean			0.003	0.003
	t-stat			1.687	1.421

Notes: Average regression coefficients and corresponding *t*-statistics from monthly Fama-MacBeth regressions using *ex post* CAPM beta estimates averaged only for months with positive realized market excess returns. Each month *t* excess stock returns are regressed on an estimate of CAPM beta (*beta*), natural logarithm of the market value of equity (*ln(me)*), natural logarithm of the book-to-market equity ratio (*ln(beme)*). *T* is the number of monthly regressions used. Panel A is based on an unadjusted data sample, while Panel B is based on a sample Winsorized at three standard deviations.

of that month. The $\lambda_{1,t}$ coefficient is significantly negative in September 1990 (-0.134 with the corresponding *t*-statistic of -3.53) while it is significantly positive in November 1992 (0.450 with the *t*-statistic of 4.30) (not tabulated). This analysis thus demonstrates the importance of the differential treatment of months with positive and negative excess returns for the computation of the average λ_1 coefficients that are reported in the tables.

To address this issue, we separate months with positive market excess returns (when we expect the realized stock returns to proxy well for expected returns) from months with negative market excess returns and compute the average λ_1 coefficients separately for each group. We expect to find positive $\lambda_{1,+}$ in the good months and low or negative $\lambda_{1,-}$ in the bad months. The results reported in *Tables 6* through *9* are consistent with this expectation.

Tables 6 and *7* show the results for *ex post* beta estimates. When only 142 months with positive realized excess market returns are considered (*Table 6*) the slope coefficient for CAPM beta is positive and highly significant with a corresponding *t*-statistic of 3.874 (significant at the 0.02% level). This result gets marginally stronger when the outliers are Winsorized (*t*-statistic of 4.129). Conversely, when considering only the 112 months when the realized market excess

Table 7 Ex Post Beta in Negative Months

	T	112	112	112	112
Panel A Unadjusted Full-Sample Data					
cons	mean	-0.014	-0.037	-0.044	-0.011
	t-stat	-2.481	-3.985	-8.42	-1.35
beta	mean	-0.033			-0.028
	t-stat	-6.421			-5.498
ln(me)	mean		-0.001		-0.001
	t-stat		-1.443		-1.359
ln(beme)	mean			-0.001	-0.004
	t-stat			-0.685	-1.5
Panel B Winsorized Data (3 st. dev.)					
cons	mean	-0.014	-0.04	-0.043	-0.012
	t-stat	-2.935	-4.652	-8.452	-1.591
beta	mean	-0.033			-0.029
	t-stat	-7.507			-6.336
ln(me)	mean		-0.001		-0.001
	t-stat		-0.946		-1.095
ln(beme)	mean			-0.001	-0.002
	t-stat			-0.545	-1.185

Notes: Average regression coefficients and corresponding *t*-statistics from monthly Fama-MacBeth regressions using *ex post* CAPM beta estimates averaged only for months with negative realized market excess returns. Each month *t* excess stock returns are regressed on an estimate of CAPM beta (*beta*), natural logarithm of the market value of equity (*ln(me)*), natural logarithm of the book-to-market equity ratio (*ln(beme)*). *T* is the number of monthly regressions used. Panel A is based on an unadjusted data sample, while Panel B is based on a sample Winsorized at three standard deviations.

return is negative (*Table 7*) the λ_1 coefficient is strongly negative (*t*-statistic of -6.421). Again this result gets even stronger after Winsorizing the outliers (*t*-statistic of -7.507). Including ME and BE/ME reduces the magnitude of all the slope coefficients, but it does not affect the conclusion on its statistical significance. Furthermore, none of the empirical risk factors is significant in the predicted direction.

A very similar story is delivered when using *ex ante* beta estimates instead of *ex post* estimates. *Table 8* shows that in the case of months with positive market excess returns, the λ_1 coefficients are even more strongly positive (*t*-statistic of 5.982 for the full sample and 6.370 for the Winsorized sample) than in the case of *ex post* beta. Furthermore, similarly to the *ex post* case, the λ_1 coefficients for the months with negative market excess returns in *Table 9* are significantly negative (*t*-statistic of -7.453 for the full sample and -7.495 for the Winsorized sample). These results are only marginally affected by the inclusion of ME and BE/ME.

Taken together, these results support the initial expectations that the explanatory power of CAPM beta is highly dependent on the methodology used for obtaining its estimates and on the proxy used for expected returns. When using *ex ante* rather than *ex post* beta estimates, the relevance of beta switches from insignificantly negative to

Table 8 Ex Ante Beta in Positive Months

	T	120	120	120	120
Panel A Unadjusted Full-Sample Data					
cons	mean	0.004	0.05	0.047	0.014
	t-stat	0.887	4.249	9.615	1.672
beta	mean	0.049			0.044
	t-stat	5.982			5.496
ln(me)	mean		-0.001		0.0
	t-stat		-0.398		-0.049
ln(beme)	mean			0.005	0.006
	t-stat			2.079	2.621
Panel B Winsorized Data (3 st. dev.)					
cons	mean	0.009	0.031	0.045	0.011
	t-stat	2.538	3.527	9.717	1.456
beta	mean	0.041			0.039
	t-stat	6.37			5.962
ln(me)	mean		0.002		0.001
	t-stat		1.82		0.786
ln(beme)	mean			0.004	0.007
	t-stat			1.747	3.422

Notes: Average regression coefficients and corresponding *t*-statistics from monthly Fama-MacBeth regressions using *ex ante* CAPM beta estimates averaged only for months with positive realized market excess returns. Each month *t* excess stock returns are regressed on an estimate of CAPM beta (*beta*), natural logarithm of the market value of equity (*ln(me)*), natural logarithm of the book-to-market equity ratio (*ln(beme)*). *T* is the number of monthly regressions used. Panel A is based on an unadjusted data sample, while Panel B is based on a sample Winsorized at three standard deviations.

significantly positive. At the same time, the significantly positive intercept becomes insignificant when using *ex ante* estimates. Furthermore, when considering only months with positive excess returns, for which the assumption that the realized stock returns are a good proxy for expected returns seems to be justified, beta becomes strongly significant and again the *ex ante* estimates are even more positive than the *ex post* estimates while at the same time rendering the intercept term insignificant. This suggests that the claims that CAPM beta is "dead" may have been premature, possibly affected by the mythology used to assess its explanatory power.

Despite this finding, there is still a note of caution that needs to be made: Even though the modifications of methodology lead to significantly positive slope coefficients at CAPM beta, the magnitude of these coefficients is still very small. The maximum λ_1 coefficient is 0.049 for the *ex ante* beta estimates considering only months with positive market excess returns. This is far lower than the 1.000 that would ideally be expected in the case that CAPM comprehensively captures all the risk associated with a particular stock. Consequently, even though after modifying the methodology beta seems to be relevant for explaining stock returns, it is rather far from being an exhaustive risk measure. This is the idea that motivated the search for additional risk factors that may possibly capture other risk dimensions omitted by CAPM beta.

Table 9 Ex Ante Beta in Negative Months

	T	87	87	87	87
Panel A Unadjusted Full-Sample Data					
cons	mean	-0.004	-0.013	-0.04	0.013
	t-stat	-0.808	-1.313	-6.58	1.323
beta	mean	-0.036			-0.037
	t-stat	-7.453			-7.076
ln(me)	mean		-0.004		-0.002
	t-stat		-3.696		-2.13
ln(beme)	mean			-0.003	0.002
	t-stat			-1.375	0.802
Panel B Winsorized Data (3 st. dev.)					
cons	mean	-0.005	-0.016	-0.04	0.011
	t-stat	-0.887	-1.635	-6.681	1.159
beta	mean	-0.036			-0.037
	t-stat	-7.495			-7.08
ln(me)	mean		-0.004		-0.002
	t-stat		-3.761		-1.895
ln(beme)	mean			-0.004	0.002
	t-stat			-1.686	0.954

Notes: Average regression coefficients and corresponding *t*-statistics from monthly Fama-MacBeth regressions using *ex ante* CAPM beta estimates averaged only for months with negative realized market excess returns. Each month *t* excess stock returns are regressed on an estimate of CAPM beta (*beta*), natural logarithm of the market value of equity (*ln(me)*), natural logarithm of the book-to-market equity ratio (*ln(beme)*). *T* is the number of monthly regressions used. Panel A is based on an unadjusted data sample, while Panel B is based on a sample Winsorized at three standard deviations.

6. Conclusion

The relationship between expected return and risk is a fundamental question in asset pricing. Numerous attempts have been made to identify measures that capture the risk of stocks and thus explain the cross-sectional variation in stock returns. The most prominent theory designed to model this relationship is CAPM, which proposes that the systematic risk of a stock can be neatly summarized by its beta measure, which reflects the sensitivity of stock returns to market returns. However, despite the theoretical prevalence of CAPM, the early empirical tests already documented that not only does CAPM not suffice to explain stock returns as other factors seems to be associated with stock returns, but its relevance as such has been questioned. This opened up an ongoing debate concerning the relative relevance of CAPM beta *vis-à-vis* other empirically discovered risk factors. This paper contributes to this debate by revisiting the assertions that CAPM beta is dead by proposing several modifications to the methodology used for its testing and by comparing its relevance with the relevance of two empirical risk factors, namely size and the book-to-market multiple.

The findings presented in this paper suggest that the concept underlying CAPM beta is sound, but the conventional approach of estimating it does not capture the expected systematic risk exposure. While we start with confirming the previous findings which conclude that the relationship between beta estimated *ex post* and realized stock returns is flat (or even slightly negative in the case of the sample used for this study), we also show that when beta is estimated *ex ante* it becomes positive and significant. Furthermore, another relevant issue seems to be the use of the expected return proxy. This study concludes that when removing months of negative realized market returns, for which the assumptions that the realized return proxies for the expected return do not seem to be reasonable, beta is rendered highly significant in explaining stock returns. These findings suggest that the weak empirical support for CAPM beta is likely caused by complications with implementing CAPM rather than by the weakness of the underlying concept.

Table 10 Composition of Affärsvärldens Generalindex

Symbol	Name	Market Cap (M SEK)	Weight (%)
ERIC B	Ericsson B	340 391	12.299
NDA SEK	Nordea Bank	192 850	6.968
HM B	Hennes & Mauritz AB H & M B	188 678	6.817
TLSN	TeliaSonera	188 412	6.808
SHB A	Svenska Handelsbanken A	118 569	4.284
VOLV B	Volvo B	118 328	4.275
AZN	AstraZeneca PLC	92 690	3.349
SEB A	Skandinaviska Enskilda Banken A	90 888	3.284
FSPA A	FöreningsSparbanken A	87 352	3.156
SAND	Sandvik	71 954	2.600
SCA B	Svenska Cellulosa SCA B	67 103	2.425
INVE B	Investor B	66 744	2.412
ATCO A	Atlas Copco A	64 138	2.317
SCV B	Scania B	53 900	1.948
ELUX B	Electrolux B	46 493	1.680
ASSA B	Assa Abloy B	40 800	1.474
SECU B	Securitas B	40 704	1.471
TEL2 B	Tele2 B	38 882	1.405
SKA B	Skanska B	34 531	1.248
SKF B	SKF B	34 322	1.240
GAMB A	Gambro A	34 293	1.239
SDIA SEK	Skandia Försäkrings	33 595	1.214
INDU A	Industrivärden A	32 833	1.186
SWMA	Swedish Match	26 086	0.943
HOLM B	Holmen B	20 172	0.729
KINV B	Kinnevik Investment B	18 753	0.678
LUND B	Lundbergföretagen AB L E B	17 743	0.641
ABB	ABB Ltd	17 188	0.621
GETI B	Getinge B	16 907	0.611
STE R	Stora Enso R	16 701	0.603
SSAB A	SSAB Svenskt StÍl A	16 598	0.600
NOKI	Nokia Abp SDB	16 449	0.594
WIHL	Wihlborgs Fastigheter	13 507	0.488
SAAB B	Saab B	12 771	0.461
MTG B	Modern Times Group MTG B	12 279	0.444
AXFO	Axfood	12 082	0.437
RATO B	Ratos B	11 980	0.433
ALFA	Alfa Laval	11 837	0.428
SAS	SAS	11 022	0.398
TREL B	Trelleborg B	10 990	0.397

ENRO	Eniro	10 873	0.393
LUPE	Lundin Petroleum	10 597	0.383
CAST	Castellum	10 084	0.364

Notes: List of stocks included in the Affärsvärldens Generalindex (AFGX) in January 2005 with market capitalization larger than 10 billion Swedish crowns. Market Cap denotes the market value of a common shareholder's equity in millions of Swedish crowns. Weight shows the percentage proportion of each stock in AFGX.

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