Testing the Relation Between Beta and Returns in the Athens Stock Exchange: A Second Attempt

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Abstract

This study examines the relationship between beta and returns in the Athens Stock Exchange, taking into account the difference between positive and negative market excess returns' yields. We investigate the period between 1991 and 2002 focusing on the risk-return trade-off by examining separately the up-market and down-market months. Our evidence show that the estimation of *return* and *beta* without differentiating positive and negative market excess returns produces *a flat unconditional relationship* between *return* and *beta*. However, when using the *conditiona*l CAPM and *cross-sectional regression analysis*, there is a *significant positive relationship in up market and a significant negative relationship in down market*. This is a second attempt in testing the relationship between beta and returns in the ASE, using single stocks instead of forming portfolios (first attempt). Although the new results are similar to those of the previous study they are definitely sounder, improved, and statistically significant. Finally, we get better results, also, when we use portfolios and the MLE method for the estimation of beta coefficients of each stock. (JEL G12).

Key words: CAPM, unconditional – conditional relationship, risk-return trade-off.

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1. Introduction

The risk-return relationship is one of the fundamental concepts in finance that is of great importance for investors and portfolio managers, who have as one of their main tasks the estimation of investment risk. The popular Capital Asset Pricing Model, CAPM (Black, 1972; Lintner, 1965; Sharpe, 1964) argues that beta, or the systematic risk is the only relevant risk measure for investment and a positive trade-off between beta and expected returns should exist. Because of its importance and relevance to all investors, it is one of the most extensively tested financial models in the literature. The CAPM postulates that the return on any asset is linearly related to its market beta, with beta being defined as the ratio of the covariance of each asset with the market portfolio to the variance of the market portfolio. In other words, during cross-sectional tests on the returns of assets only the market beta (β) shall be priced.

The empirical evidence to date on the CAPM has been mixed. While the results of many studies, particularly those of the earlier classical work of Black, Jensen and Scholes (1972) and Fama and MacBeth (1973), support the CAPM, some researchers, such as Fama and French (1992), report an inconsistent or a flat relationship between returns and beta. The findings for non-US studies are also inconclusive. For example, studies for France (Hawawini, Michel and Viallet, 1983) and Japan (Hawawini 1991; Chan, Hamao and Lakonishok, 1991) point to a positive relationship between returns and beta, but the empirical findings in Canada (Calvet and Lefoll, 1989), Belgium (Hawawini, Michel and Corhay, 1989), Finland and Sweden (Ostermark, 1991), the United Kingdom (Corhay, Hawawini and Michel, 1987; Chan and Chui, 1996), Singapore (Wong and Tan, 1991), Hong Kong (Cheung and Wong, 1992; Ho, Strange and Piesse, 2000a; 2000b), and Korea and Taiwan (Cheung, Wong and Ho, 1993) suggest either no relationship or an inconsistent relationship between returns and market risk.

Although initial empirical studies supported the CAPM (Fama and MacBeth, 1973; Black, Jensen and Scholes, 1972), new empirical variables were found, e.g., the Market Value of Equity ratio (MVE), the Earnings to Stock Price ratio (E/P) and the Book-to-Market Equity ratio (B/M), that had greater explanatory power than the beta coefficient of the market (Banz, 1981; Basu, 1983; Rosenberg, Reid and Lanstein, 1985).

Ross's (1976) Arbitrage Pricing Theory (APT) commenced a new family of models which have tried to verify that beta is not the only component that could measure the systematic risk of stock returns and other securities. For example, the macroeconomic APT model showed that there are many different variables that have an effect on stock returns (Chen, Roll and Ross, 1986; Chen and Jordan, 1993).

The CAPM studies attempted to test for an unconditional, systematic and positive trade-off between average returns and beta, but failed to take into account the fact that the relationship between realised returns and beta is conditional on the relationship between the realised market returns and the risk-free rate. Pettengill, Sundaram and Mathur (1995) developed a conditional relationship between beta and realised returns by separating periods of positive and negative market excess returns. Using US stock market data in the period 1936 to 1990, they found a significant positive relationship between beta and realised returns when market excess returns are positive and a significant negative relationship between beta and realised returns when market excess returns are negative. This significant relationship is also found when data are divided by months in a year. Furthermore, they found support for a positive risk–return relationship. Isakov (1999) followed the approach of Pettengill, Sundaram and Mathur (1995) and examined the Swiss stock market for the period 1983–1991. He found supporting results that beta is statistically significant related to realised returns and has the expected sign. Hence, Isakov (1999) concluded that beta is a good measure of risk and is still alive.

The aim of this study is to determine whether beta has a role to play in explaining cross-sectional differences in the returns of the General Greek Index. The main purpose of this paper is to present evidence of the conditional relationship between returns and beta in the Athens Stock Exchange. We try to verify that the coefficient beta is an important measure of systematic risk and also that there is a symmetrical relation between return and beta in up and down markets. We should note here that Pettengill, Sundaram and Mathur (1995) support this notion of symmetry in up and down markets, while Fletcher (1997) had different results in his research in the UK, i.e., the slope equality hypothesis was rejected in comparison to Pettengill, Sundaram and Mathur (1995)

This cross-sectional regression and the subsequent test of the mean of the coefficients estimated in the monthly regressions can be interpreted as a test of two joint hypotheses. The hypothesis that there is a positive relationship between beta and realised return is tested jointly with the hypothesis that the average market risk premium is positive. One important explanation for this result lies in the fact that realisations of the market risk premium are often negative even if the expected, or ex-ante, risk premium is positive. An ex-post formulation of the CAPM predicts that stocks with a higher beta have higher returns only when the market return is higher than the return of the riskless asset. If the market return falls short of the riskless rate, stocks with a higher beta have lower returns. Pettengill, Sundaram and Mathur (1995) call this 'the conditional' (ex-post) relation between beta and return.

They modify the Fama-MacBeth (1973) test procedure in a way that takes the 'conditional' nature of the relation between beta and return into account. Their empirical results support the conclusion that there is a positive and statistically significant relationship between beta and realised returns. The idea underlying the modified test approach of Pettengill, Sundaram and Mathur (1995) rests on the distinction between the ex-ante CAPM and its ex-post representation used for empirical tests. A crucial difference between these formulations is the fact that the expected market risk premium is always positive ex-ante, whereas the realizations of the risk premium may be, and often are, negative.

The purpose of this study is to examine whether the conditional relationship between beta and returns, which has been shown to exist in developed markets like the US (Pettengill, Sundaram and Mathur, 1995), UK (Fletcher, 1997), Belgium (Crombez and Vennet, 1997), Japan (Hodoshima, Garza–Gomez and Kunimura, 2000), Germany (Elsas, El-Shaer and Theissen, 2003), and Switzerland (Isakov, 1999), holds in ASE. The methodology follows an applied research procedure and has a positivist explanatory form as it is focused on causal relationships, i.e., the risk - return relationship between returns and systematic risk.

Next section covers the literature review of the relation between beta and returns. In the subsequent sections the data collection is presented and there is a detailed analysis on the time series data. In the last section there is a presentation of the conclusions from the data analysis and the corresponding managerial implications on financial institutions are mentioned. Finally, there are proposals for future research on the risk-return trade-off.

2. Literature review

Most of the empirical tests are mainly based on the Fama and MacBeth (1973) methodology using a three-step approach by dividing data into two separate categories of not overlapping time periods (the estimation period and the test period). In the first step, individual stocks' betas are estimated and portfolios are formed according to these estimated betas using data from the estimation period. In the second step, the betas of these formed portfolios are estimated. In the final step, using data from the test period, portfolio (or individual stock) returns are regressed on the estimated portfolio betas to test the relationship between beta and returns. However, Reinganum (1981) found that the cross-sectional differences in portfolio betas and the differences in average portfolio returns are not reliably related, i.e., the returns on high-beta portfolios are not significantly higher than the returns on low-beta portfolios, casting doubts on the empirical content of CAPM.

Schwert (1983) suggested that Fama and MacBeth (1973) only provided a very weak support for a positive risk–return trade-off since the positive risk–return relationship found is not significant across sub-periods. Furthermore, when considering the seasonal behavior of their results, the *t*-statistic becomes highly suspect and the basic risk–return trade-off virtually disappears. Tinic and West (1984) found that January has a larger risk premium than the other months and further that the significant relationship between risk and expected returns only exists in January. When data for the January months are excluded from the analysis of the risk–return trade-off, the estimates of risk premiums are not significantly different from zero. Thus, they concluded that their results reject the validity of CAPM.

Lakonishok and Shapiro (1986) examined the monthly returns of all stocks traded on the New York Stock Exchange (NYSE) and found that the return on individual security is not specifically related to its degree of systematic risk but to the market capitalisation values. They concluded that the traditional (beta) as well as the alternative risk measure (residual standard error) is not able to explain the cross-sectional variation in return; only size can significantly explain it. Haugen and Baker (1991) examined the risk and return characteristics of 1,000 US stocks that had the largest market capitalisation between 1972 and 1989. They found that the market portfolio is not efficient because low-risk stocks seem to have abnormally high returns, contradicting the relationship between beta and returns as prescribed by CAPM.

Fama and French (1992), using the Sharpe-Lintner-Black CAMP, studied the monthly returns of NYSE stocks and found an insignificant relationship between beta and average returns. They concluded that the CAPM cannot describe the last 50 years of average stock returns and only market capitalisation and the ratio of book value to market value have significant explanatory power for portfolio returns. This study also produces a controversial finding on the validity of CAPM: first, as the main model in investigating the relationship beta-return; and second, the beta's role in explaining financial asset return. Other studies, related to static CAPM, are reported in Banz (1981), Reinganum (1981), Gibbons (1982), Basu (1983), Chan, Chen and Hsieh (1985), Shanken (1985), Bhandari (1988) and Jagannathan and Wang (1996), who found that the static CAPM is unable to explain the cross-sectional variation of average returns.

Recent studies (e.g., Pettengill, Sundaram and Mathur, 1995, for the US market; and Isakov, 1999, for the Swiss market) suggested an alternative approach to assess the reliability of beta as a measure of risk. Their argument is that since the CAPM deals with the expected returns, while the realised returns are used as proxies, negative realised risk premia could be observed in some periods. Their model is conditional on the realised risk premium, whether it is positive or negative. When the realised risk premium is positive, there should be a positive relationship between the beta and return, and when the premium is negative, the beta and return should be negatively related. The reason is that high beta stocks are more sensitive to the negative realised risk premium and thus will have a lower return than low beta stocks. Their empirical results, based on estimations conditional on the sign of the market excess returns, indicate that betas and returns are positively related in the US capital market. This conditional positive relationship is observed in the UK (Fletcher, 1997), Germany (Elsas, El-Shaer and Theissen, 2003), Belgium (Crombez and Vennet, 1997), and Taiwan (Jagannathan and Wang, 1996) as well.

There are more recent studies asking whether the standard CAPM can be applied to emerging capital markets in order to estimate the cost of equity capital in these markets. Since the individual emerging market has its unique market structure, institutional background, history, level of the market integration, and local risk-free return, the answer may differ across countries. Karacabey (2001) studies the beta-return relationship in the Istanbul Stock Exchange and shows that only the conditional relationship exists. Thus, beta is still a useful risk measure in this emerging market. Estrada (2001) gives evidence that the cross section of returns in emerging markets can be explained by "downside risk" measures as the semideviation of the means. The semi-deviation method uses only negative deviations from a benchmark return such as the mean return of the asset or a specified target mean. Thus, downside risk defines risk as volatility below the benchmark (Nawrocki, 1999; Sortino and van der Meer, 1991). One of the advantages of the downside risk approach is that a desired benchmark return can be chosen, and the investors care about more downside than upside risk. Estrada (2001) points out that for skewed distributions, the semideviation is a more appropriate risk measure.

In summary, previous empirical studies on the unconditional relationship between beta and returns found that the CAPM only provides an inadequate explanatory power for the risk–return relationship observed in both domestic and international stock markets. However, results from empirical studies on the conditional relationship between beta and returns support the model and found a significant conditional relationship in domestic stock markets. A logical question followed is whether the conditional relationship between beta and returns can also be applied to international stock markets. To the best of our knowledge, no study (except one) has investigated this issue.

Fletcher (2000) examined the conditional relationship between beta and returns in international stock markets between January 1970 and July 1998 using the approach of Pettengill, Sundaram and Mathur (1995). Using monthly returns of the MSCI equity indices of 18 countries and the MSCI world index, Fletcher (2000) found that a consistent relation exists. There is a significant positive relationship between beta and returns in periods when the world market excess returns are positive and a significant negative relationship in periods when the world market excess returns are negative. Besides, this relationship is symmetric and there is a positive mean excess return on the index on an average. Fletcher (2000) also found that the significant conditional relationship in January exists only in periods of positive market excess returns and this relationship is insignificant in periods of negative market excess returns. The results differ from those obtained by Pettengill, Sundaram and Mathur (1995) on the US market data. Although Fletcher's (2000) study supported the conditional relationship between beta and returns in international stock markets, the empirical evidence is still limited.

The ASE for a number of years has been characterised as an emerging market and has attracted international interest. During the past 15 years it has entered a period of new structural reforms and development. As a result, the market has become potentially more efficient and competitive. The number of listed companies increased significantly, market liquidity improved, and structural and legislative reforms provided for a modern and adequate regulatory framework. The ASE contains two market segments, the "main" and the "parallel market". The main market primarily includes larger firms with higher equity capital and operating profits. In contrast, stocks traded in the parallel market typically have lower equity capital, a smaller scale of operation, and lower profits.

There has been limited research on the behaviour of stocks traded on the ASE. Papaioannou (1982; 1984) reports price dependencies in stock returns for a period of at least six days. Panas (1990) provides evidence of weak-form efficiency for ten large Greek firms. Koutmos, Negakis and Theodossiou (1993) find that an exponential generalised ARCH model is an adequate representation of volatility in weekly Greek stock returns. Barkoulas and Travlos (1998) test whether Greek stock returns are characterised by deterministic nonlinear structure (chaos). Papaioannou and Philippatos (2000) examined the impact of non-synchronous trading on the beta estimates of the market model using Greek stock market returns. Niarchos and Georgakopoulos (1986) found that the Greek stock prices respond very slowly to new information and conclude that the Greek market is not efficient.

More recently, Diacogiannis, Glezakos and Segretakis (1998) examined the effect of the Price/Earnings (P/E) ratio and the Dividend Yield (DY) on expected returns of ASE common stocks for the period 1990–1995. They found that P/E is statistically significant variable explaining the cross section variation of expected returns, while the explanatory power of DY was documented rather weak. Karanikas (2000) examined the role of size, book to market ratio and dividend yields on average stock returns in the ASE for the period from January 1991 to March 1997. Following Fama and MacBeth's cross sectional regression methodology enhanced with Shanken's adjustments for the Error in Variables (EIV) problem. He found that a statistically significant positive relationship between book to market ratio, dividend yields and average stock returns is reported. He found also that the market capitalisation variable ("size effect ") does not seem to explain a significant part of the variation in average returns.

Niarchos and Alexakis (2000) investigated whether it is possible to predict stock market returns with the use of macroeconomic variables in the ASE for the period from January 1984 to December 1995 on a monthly base using cointegration analysis and as explanatory variables some macroeconomics factors. With the results of their investigations, they reject statistically the Efficient Market Hypothesis for the case of the Athens Stock Exchange; they noted the statistical significance of the lagged returns which suggest that the monthly returns in the ASE are positively correlated. The above findings can not be explained as a thin trading effect or as non synchronous trading effect because of the monthly time interval used in the investigation.

Emerging markets have proved extremely attractive over the last ten years to international investors hoping to benefit from abnormal returns as well as portfolio risk diversification (Harvey, 1995), and therefore the extent to which cross-sectional return behaviour matches that of more developed markets is of particular interest. However, studies of such markets present a number of problems, ranging from the availability of suitable data on the one hand to methodological problems on the other. The few studies that have been conducted on this market have focused on the dynamic behaviour of Greek stock prices, the market's informational efficiency, or the reaction to announcements (e.g., Koutmos, Theodossiou and Negakis, 1993; Karathanassis and Patsos, 1993; Tsangarakis, 1996; Barkoulas and Travlos, 1998; Phylaktis, Kavussanos and Manalis, 1999; Barkoulas, Baum and Travlos, 2000; Papaioannou, Travlos and Tsangarakis, 2000; and Leledakis, Davidson and Karathanasis, 2003).

3. Data and methodology

Our data consists of daily closing prices of the common stocks traded in the Athens Stock Exchange. They are row prices in the sense that they do not include dividends but are adjusted for capital splits. The data was taken from the ASE database.The market return is obtained from the ASE Composite (General) Share Price Index. Time series of excess returns on the market and individual securities are taken over the three-month Government Treasury Bill rate, which is considered to be the short-term interest rate (risk free interest rate).

Daily returns are calculated using the logarithmic approximation:

$$R_{i,t} = \log\left(P_{i,t} \big/ P_{i,t-1} \right) \qquad \textbf{(1)}$$

where $P_{i,t}$ is the closing price of day *t* for asset *i*. Then daily returns are aggregated to compose the monthly returns that are the input of our investigation.

The sample period for our study extends from January 1991 to December 2002. The 12 years of our sample period are divided into four 6-year periods so that the test periods do not overlap (table 1).

Table 1: Separation of the sample period

Estimation period (beta calculation)	**Test period**
1/1991 – 12/1994	1/1995 – 12/1996
1/1993 – 12/1996	1/1997 – 12/1998
1/1995 – 12/1998	1/1999 – 12/2000
1/1997 – 12/2000	1/2001 – 12/2002

Each 6-year period is then subdivided into a 4-year beta calculation period, and a 2-year test period. Securities are included in a 6-year period sample if, in the estimation period, have been traded at least for the last 24 months (no missing values and no suspensions) and in the test period have a complete relative price history. We use all listed companies, manufacturing and nonmanufacturing, excluding only the financial firms because they have capital structures which differ from all other firms in the sample and thus would show drastically different return behaviour (Fama and French, 1992).

In the **estimation period** we regress the monthly returns of the individual stocks (dependent variable) on the market (independent variable) using the Maximum Likelihood Estimation (MLE). The outputs of the regressions are the beta coefficients of the individual stocks. The formula used for the above estimation is the following:

$$R_{it} = R_{ft} + \beta_i \left(R_{mt} - R_{ft} \right) \qquad \textbf{(2)}$$

where, R_{it} is the average monthly returns of the security *i* (dependent variable), R_{ft} is the risk free interest rate and R_{mt} is the average monthly return of the market (independent variable). Shares with adjusted R^2 <0 or F significant >0.05 of the first pass regression are excluded from the sample.

In our previous study (Theriou, Aggelidis and Maditinos, 2004) we have used returns on portfolios as regressors in the first and second pass regressions. However, the current analysis has been conducted using data on individual stocks in the asset pricing tests. This has been commanded for the reason that the small sample size (maximum 157 stocks) is quite restrictive in forming adequate portfolios to counter the error in variable (EIV) problem in estimating betas at the first pass regressions. Moreover, in order to correct the error in variable problem of the estimated betas we use the method of Maximum Likelihood Estimation (MLE) adopted first by Litzenberger and Ramaswamy (1979) and later by many other scholars. Their correction method is N- consistent, i.e., consistent when the size of time series sample, T, is fixed and the number of assets N is allowed to increase without bound. Given the relative scarcity of empirical studies on Greek data, our study would be subject to less data-snooping bias in the sense of Lo and McKinlay (1990), and also is subject to less survivorship bias because very few firms from the ASE were either delisted or merged during the examined period (1991-2002). However, several firms were newly listed and added to our sample, and this might have induced some forward-looking bias (Kubota and Takehara, 1996).

After the first pass regression summary statistics are produced to check out the null hypothesis of the normal distribution of our sample data. These include mean, standard deviation, skewness, kurtosis, and the normality test of Kolmogorov & Smirnov, for each share included in the sub period under examination (table 2).

In the *testing period*, using the last two years of the period under investigation, we estimate the excess returns ($R_{it} - R_{ft}$) of each security from a time series of returns of ASE listed stocks and the market premium ($R_{mt} - R_{ft}$). Then, monthly excess returns are regressed on betas. The number of observations in the cross-sectional regressions is equal to the number of stocks in the period under investigation (table 2, column G). We estimated the regressions both using the traditional test procedure and the conditional approach.

3.1. Traditional test:

$$R_{pt} = \hat{\gamma}_{0t} + \hat{\gamma}_{1t} * \beta_{pt} + \varepsilon_{pt} \quad \text{p=1… N,} \quad \text{t=1… T} \qquad \textbf{(3)}$$

where R_{pt} is the excess return estimated in the second step, β_{pt} is the beta of the individual stocks estimated in the first step, ε_{pt} denotes an error term with $\mathrm{E}(\varepsilon_{pt}) = 0$ and N and T are the number of stocks and observations, respectively.

3.2. Conditional approach:

$$R_{pt} = \hat{\gamma}_{0t} + D_t * \hat{\gamma}_{2t} * \beta_{pt} + (1 - D_t) * \hat{\gamma}_{3t} * \beta_{pt} + \varepsilon_{pt} \quad \text{p=1… N,} \quad \text{t=1… T} \qquad \textbf{(4)}$$

where D_t a dummy variable which takes on the value 1 [0] if the market risk premium in the month under consideration is positive [negative].

Discarding the earliest two years of data and adding two new years we repeat this two-step procedure of six years. This procedure was used by Lakonishok and Shapiro (1984) and is very similar to the 5-5-5 procedure used by Pettengill, Sundaram and Mathur (1995). Finally the coefficients estimated in the cross-sectional regressions were averaged and hypothesis tests are based on these averages.

The main objective of this study is to examine the conditional relationship between beta and return. Pettengill, Sundaram and Mathur (1995) argued that studies focusing on the relationship between return and beta need to take into consideration the fact that ex post returns have been used in the tests and not ex ante returns. When realised returns are used, a conditional relationship between beta and return should exist, where investors expect that their realised return on a low beta portfolio should be greater than the return on a high beta portfolio, otherwise no investor would hold the low beta portfolio. Pettengill, Sundaram and Mathur (1995) assumed that this occurs only when the market return is lower than the risk-free return, something that comes out of the excess returns market model. The implication of this line of thinking is that there should be a positive relationship between beta and return when the excess market return (premium) is positive, and a negative relationship when the excess market return is negative.

To test the conditional relationship, the sample period was divided into up market months and down market months for all the months. The hypotheses proposed by Pettengill, Sundaram and Mathur (1995) are:

$$\mathrm{H}_0 : \bar{\gamma}_2 = 0$$
$$\mathrm{H}_a : \bar{\gamma}_2 > 0$$

$$\mathrm{H}_0 : \bar{\gamma}_3 = 0$$
$$\mathrm{H}_a : \bar{\gamma}_3 < 0$$

where $\hat{\gamma}_2$ and $\hat{\gamma}_3$ are the average values of the coefficients $\hat{\gamma}_{2t}$ and $\hat{\gamma}_{3t}$ of the equation (4). Since $\hat{\gamma}_2$ is estimated in periods with positive market excess returns, the expected sign of this coefficient is positive. On the other hand, since $\hat{\gamma}_3$ is estimated in periods with negative market excess returns, the expected sign of this coefficient is negative. A systematic conditional relationship between beta and realised returns is supported if, in both cases, the null hypothesis is rejected in favour of the alternate.

These can be tested by the standard t-tests of Fama and MacBeth (1973). Hence, given the time series of γ_i we could test the implications using a standard t-test. Defining ω as the t-statistic, we have:

$$\omega(\hat{\gamma}_i) = \frac{\hat{\gamma}_i}{\sqrt{T} * s(\gamma_i)}$$

W here, T is the number of months in the period, which is also the number of the estimates γ_i used to compute the mean $\hat{\gamma}_i$ and the standard deviation $s(\gamma_i)$ of γ_i.

Pettengill, Sundaram and Mathur (1995), pointed out that the above conditional relationship does not guarantee a positive risk and return trade-off. They stated that two conditions are necessary to hold, simultaneously, for a positive trade-off between risks and return: (a) the excess market return should be positive on average and (b) the risk premium in up markets and down markets should be symmetrical. The symmetrical relationship can be tested by the following hypothesis:

$$\mathrm{H}_0 : \bar{\gamma}_2 - \bar{\gamma}_3 = 0$$

This can be tested by a two-population t tests, but the sign of the $\hat{\gamma}_{3t}$ coefficient needs to be reversed and its mean value is recalculated.

4. Results

The statistics in table 2 (column F) show that the null hypothesis of normality cannot be rejected at the 5 per cent level of confidence in 51 per cent of the shares in the period 1991–1994, 57 per cent in the period 1993–1996, 57 per cent in the period 1995–1998 and 70 per cent in the period 1997-2000. These results are in accord with the findings of Mandelbrot (1963) and Fama (1965) for the US market.

Table 2: Summary statistics

Period	A	B	C	D	E	F	G
1/1991 – 12/1994	77	0%	11.6%	76.6%	2.5%	51%	68
1/1993 – 12/1996	110	0%	27.2%	80%	3.5%	57%	82
1/1995 – 12/1998	150	0%	29%	85%	3%	57%	106
1/1997 – 12/2000	176	0%	10.8%	90.5%	0%	70%	157

A: Sample size, **B: %** of Negative Adjusted R^2, **C:** % of F significant > 0.05, **D: %** of Durbin Watson (1.8-2.2), **E:** % of Durbin Watson < 1.5, **F:** % of Gaussian distribution, **G:** sample size after filtering,

The filtering procedure (i.e., (a) the shares included in each of the estimation periods must have been traded at least in the last 24 month with no missing values and no suspensions, (b) in the testing periods all shares must have a complete price relative history, and (c) the coefficient of the F statistics in the first pass regression must be less than 0.05) produces sample sizes of 68, 82, 106 and 157 for the four sub-periods, respectively (table 2, column G).

The statistics in table 3 give some insights into the characteristics of the ‘up’ and ‘down’ market periods during the 96-month test period from January 1995 to December 2002. It is observed that there are significant positive (8.22 per cent per month) and negative (-5.95 per cent per month) rewards for bearing market risk during the ‘up’ and ‘down’ market periods respectively, which might imply that the relationship between realised returns and beta is conditional on market situations.

Table 3: Average Monthly Excess Market Returns

		All Months		**Up Markets**		**Down Markets**	
Full sample 1995- 2002	**Number of Months**	96		40		56	
	Excess Market Return	-0.047%		8.22%		-5.95%	
		t - statistics	**p-value**	**t - statistics**	**p-value**	**t - statistics**	**p-value**
		-0.049	0.96	7.30	0.000	-7.764	0.000
Period 1 1995 - 1998	**Number of Months**	48		21		27	
	Excess Market Return	1.35%		9.4%		-4.9%	
		t - statistics	**p-value**	**t - statistics**	**p-value**	**t - statistics**	**p-value**
		0.915	0.36	4.89	0.000	-4.32	0.000
Period 2 1999 - 2002	**Number of Months**	48		19		29	
	Excess Market Return	-1.44%		6.92%		-6.92%	
		t - statistics	**p-value**	**t - statistics**	**p-value**	**t – statistics**	**p-value**
		-1.17	0.24	6.68	0.000	-6.77	0.000

Whilst the evidence also indicates a marginally negative compensation (-0.047 per cent per month) for holding the market portfolio during the entire test period, this does not necessarily mean that a negative relationship exists between beta and returns.

Furthermore, the existence of a large number of negative excess market return periods suggests that the previous studies that tested for an unconditional positive correlation between beta and realised returns were biased against finding a systematic relationship. In contrast, the test procedures employed in the present study have taken into consideration the segmented relationship (in “up” and “down” market periods).

Table 4 presents the results both for the full sample and two sub periods of equal length (48 months). The coefficients estimated in the monthly cross – sectional regressions are averaged. Then, a t-test is used to determine whether the mean of the coefficient is significantly different from zero. The results for the unconditional (traditional) relationship between beta and realised returns are, as expected, not significant and are consistent with Fama and French (1992) and many other studies documenting no significant relation between beta and return. According to the traditional CAPM, $\hat{\gamma}_1$ (equation 3) should equal the expected excess return on the market portfolio and since the investors are risk averse it should be positive. As we can notice in all three periods (the overall period and the two sub periods) average $\hat{\gamma}_1$ are negative and not statistically significant. Consequently, the null hypothesis of no relation between beta and returns cannot be rejected for the full sample and the sub periods.

Table 4: The Results (traditional CAPM)

Period	$\widehat{\gamma}_1$	t - statistics	p-value
Full sample 1995- 2002	-0.325%	-0.402	0.685
Period 1 1995 - 1998	-0.226%	-0.332	0.742
Period 2 1999 - 2002	-0.425%	0.292	0.771

(The slope coefficient estimates from the unconditional cross-sectional regression $R_{pt} = \gamma_{0t} + \gamma_{1t}\beta_p + \varepsilon_{pt}$ were averaged over the indicated periods. The third column reports the t-statistics and the forth column reports the corresponding p-value for a t-test of the null hypothesis that the mean is zero.)

However, the main purpose of this paper is to examine the conditional relation between beta and returns. Thus, the second step is to run the regression equation that takes under consideration the conditional nature between beta and returns. Table 5 presents the results after taking into consideration the segregation effect, for the overall sample period and the two sub periods. The mean value of $\widehat{\gamma}_2$ during up markets (positive market excess returns) is 4.14 per cent for the full sample, 2.21 per cent for the first sub period and 6.28 per cent for the second sub period. The values for the overall period and the sub periods are significant at the 0.05 level.

Table 5: The Results (conditional CAPM)

Period	***Positive market risk premium*** $\widehat{\gamma}_2$		***Negative market risk premium*** $\widehat{\gamma}_3$		***Symmetry*** $\widehat{\gamma}_2 - \widehat{\gamma}_3 = 0$	
Full sample 1995- 2002	4.14%		-3.43%		**t - statistics**	**p-value**
	t - statistics	**p-value**	**t - statistics**	**p-value**		
	3.42	0.001	-4.06	0.000	7.691	0.000
Period 1 1995 - 1998	2.21%		-1.93%		**t - statistics**	**p-value**
	t - statistics	**p-value**	**t - statistics**	**p-value**		
	2.176	0.041	-2.652	0.013	2.059	0.001
Period 2 1999 - 2002	6.28%		-4.82%		**t - statistics**	**p-value**
	t - statistics	**p-value**	**t - statistics**	**p-value**		
	2.83	0.011	-3.32	0.002	4.385	0.000

(The slope coefficient estimates from the conditional cross-sectional regression $R_{pt} = \gamma_{0t} + \gamma_{2t} D_t \beta_p + \gamma_{3t}(1 - D_t)\beta_p \varepsilon_{pt}$ were averaged over the indicated periods. t-statistics and p-values are reported for a t-test of the null hypothesis that the mean is zero).

The mean value of $\widehat{\gamma}_3$ during down markets (negative market excess returns) is -3.43 per cent for the full sample, -1.93 per cent for the first sub period and -4.82 per cent for the second sub period. The values for the overall period and the sub periods are also significant at the 0.05 level. The results show that in all three periods under investigation (a) there is a statistically significant relation between beta and return, and (b) all the coefficients' means have the expected sign. In other words, stocks with higher betas have higher returns when the market risk premium is positive and lower returns when the market risk premium is negative. Thus, the results of the conditional test tend to support the prediction of CAPM that betas are related to the realised returns.

Pettengill, Sundaram and Mathur (1995), however, argue that the results indicating of a systematic conditional relation between beta and returns do not guarantee a positive risk return trade-off. In order to examine the positive risk return trade-off we should test whether the risk premium, in up and down markets, is symmetrical ($\widehat{\gamma}_2 - \widehat{\gamma}_3 = 0$). Table 5 (last column) reports the results of this test. The hypothesis that the relation between beta and return in up and down market is symmetrical is accepted for all periods, the overall period and the two sub periods, at the 0.001 level. This is consistent with Pettengill, Sundaram and Mathur (1995) findings. We notice that above results are very similar with those of our first study (Theriou, Aggelidis and Maditinos, 2004), where we used the same methodology based on the formation of portfolios (table 6) instead of single stocks:

Table 6: The Results (conditional CAPM with the use of portfolios)

Period	***Positive market risk premium*** $\widehat{\gamma}_2$		***Negative market risk premium*** $\widehat{\gamma}_3$		***Symmetry*** H_o: $\widehat{\gamma}_2 - \widehat{\gamma}_3 = 0$	
Full sample 1995- 2002	0.0376		-0.03082		**t - statistics**	**p-value**
	t - statistics	**p-value**	**t – statistics**	**p-value**		
	2.479	0.017	-2.1420	0.036	3.23	0.001
Period 1 1995 - 1998	0.053		-0.05891		**t - statistics**	**p-value**
	t - statistics	**p-value**	**t - statistics**	**p-value**		
	3.533	0.002	-3.69699	0.001	5.14	0.000
Period 2 1999 - 2002	0.018		-0.0056		**t - statistics**	**p-value**
	t - statistics	**p-value**	**t – statistics**	**p-value**		
	0.689	0.500	-0.251	0.804	0.632	0.530

However, the new results are definitely sounder, improved, and statistically significant for all three covered periods: (a) the mean values of coefficients $\widehat{\gamma}_2$ and $\widehat{\gamma}_3$, for all periods and for positive and negative market risk premium months, have the right sign, higher explanatory power, and all are statistically significant at least at the 0.05 level, and (b) the test for the symmetrical relationship hypothesis, $H_0 : \overline{\gamma}_2 - \overline{\gamma}_3 = 0$, gives us significant statistical results at the 0.001 level. Furthermore, we proceeded to a third and final analysis, trying to cover, more or less the whole research spectrum of testing the conditional CAPM.

In the *estimation period* we formed nine (9) portfolios as follows: We formed three (3) equally weighted portfolios based on size (capitalisation) and then each of these portfolios was subdivided into three more, based on beta coefficients of single stocks calculated with the use of the Maximum Likelihood Estimation-MLE method. Then, we estimated the portfolios' beta coefficients by taking the average of the betas of the stocks assigned to that portfolio (Fama and MacBeth, 1973). This way of beta's calculation corrects the phenomenon known as reversion to the mean).

In the *testing period*, we estimate the monthly excess returns of each portfolio by averaging the excess returns of the stocks of each portfolio. Then monthly portfolio excess returns are regressed on the portfolio betas. The number of observations in the cross-sectional regressions is equal to the number of portfolios. We estimate the regressions using both the traditional (unconditional) test procedure and the conditional approach. The results are as follows:

Table 7: The Results (traditional-unconditional CAPM : 9 portfolios according to size and beta)

Period	$\widehat{\gamma}_1$	t - statistics	p-value
Full sample 1995- 2002	-0.74%	-0.520	0.605
Period 1 1995 - 1998	-0.11%	-0.056	0.955
Period 2 1999 - 2002	-1.36%	-0.658	0.514

As far as the traditional (unconditional) results are concerned we notice no real improvement (in comparison with those in table 4) after the adoption of portfolios in our

Table 8: The Results (conditional CAPM : 9 portfolios according to size and beta)

Period	*Positive market risk premium* $\widehat{\gamma}_2$		*Negative market risk premium* $\widehat{\gamma}_3$		*Symmetry* $\widehat{\gamma}_2 - \widehat{\gamma}_3$	
Full sample 1995- 2002	7.88%		-9.73%		**t - statistics**	**p-value**
	t - statistics	**p-value**	**t - statistics**	**p-value**		
	4.789	0.000	-6.629	0.000	7.961	0.000
Period 1 1995 - 1998	6.17%		-8.90		**t - statistics**	**p-value**
	t - statistics	**p-value**	**t - statistics**	**p-value**		
	2.960	0.006	-3.314	0.003	4.439	0.000
Period 2 1999 - 2002	10.18%		-10.34%		**t - statistics**	**p-value**
	t - statistics	**p-value**	**t - statistics**	**p-value**		
	3.874	0.001	-6.297	0.000	7.046	0.000

analysis, even when we used the MLE method for the estimation of beta coefficients of each stock. According to the traditional CAPM, $\widehat{\gamma}_1$ (equation 3) should equal the expected excess return on the market portfolio and since the investors are risk averse it should be positive. As we can notice, in all three periods, average $\widehat{\gamma}_1$ are negative and not statistically significant. Consequently, the null hypothesis of no relation between beta and returns cannot be rejected for the full sample and the sub periods.

However, results are getting better in the conditional testing when we use portfolios and the MLE method for the estimation of beta coefficients of each stock. The mean value of $\widehat{\gamma}_2$ during up markets (positive market excess returns) is 7.88 per cent for the full sample, 6.17 per cent for the first sub period and 10.18 per cent for the second sub period. The values for the overall period and the sub periods are significant at the 0.01 level. The mean value of $\widehat{\gamma}_3$ during down markets (negative market excess returns) is -6.73 per cent for the full sample, -8.90 per cent for the first sub period and -10.34 per cent for the second sub period. The values for the overall period and the sub periods are also significant at the 0.05 level. The new results (table 8) show that in all three periods under investigation (a) there is a statistically significant relation between beta and return, and (b) all the coefficients' means have the expected sign. In other words, portfolios with higher betas have higher returns when the market risk premium is positive and lower returns when the market risk premium is negative. Consequently, the new results of the conditional test tend to support, again, the prediction of CAPM that betas are related to the realised returns.

5. Conclusions

Previous studies testing for a systematic relationship between risk (as measured by beta) and returns find weak and intertemporally inconsistent results. These test results are biased due to the conditional relation between beta and realised returns. A positive relation is always predicted between beta and expected returns, but this relation is conditional on the market excess returns when realised returns are used for tests. In this study, Pettengill, Sundaram and Mathur (1995) methodology is employed, which considers the positive relation between beta and returns during up markets and the negative relation during down markets. This methodology yields the following findings:

- Our results for an unconditional relationship between beta and realised returns are, as expected, not significant and consistent with the findings of Fama and French (1992) that document, among others, no significant positive relationship between risk and return.
- However, when we take into consideration the conditional nature between beta and returns, the results prove the existence of a statistically significant systematic relation between beta and return for the total sample period and is consistent across subperiods and across months in a year.
- Stocks (or portfolios) with higher betas have higher returns, when the market risk premium is positive, and lower returns when the market risk premium is negative. Thus, the results of the conditional test support the prediction of CAPM that betas are related to the realised returns. Although these results indicate a systematic conditional relation between risk and returns they do not guarantee a positive risk-return trade-off. For such a positive relation to hold, two conditions are necessary: (a) the excess market return should be positive on average, and (b) the risk premium in up and down markets should be symmetrical. From our findings both conditions hold.

Consequently, since the concerns regarding the weak correlation between beta and the cross-section of returns appear to be unfounded, the results support the continued use of beta as a measure of market risk.

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