

Capital asset pricing model and international research journal

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International Research Journal of Finance and Economics ISSN 1450-2887
Issue 4 (2006) © Eurojournals Publishing, Inc. 2006 <http://www.eurojournals.com/finance.htm> Testing the Capital Asset Pricing Model (CAPM): The Case of the Emerging Greek Securities Market Grigoris Michailidis University of Macedonia, Economic and Social Sciences Department of Applied Informatics Thessaloniki, Greece E-mail:gr Tel: 00302310891889 Stavros Tsoyoglou University of Macedonia, Economic and Social Sciences Department of Applied Informatics Thessaloniki, Greece E-mail:r Tel: 00302310891889 Demetrios Papanastasiou University of Macedonia, Economic and Social Sciences Department of Applied Informatics Thessaloniki, Greece E-mail:gr Tel: 00302310891878 Eleni Mariola Hagan School of Business, Iona College New Rochelle Abstract The article examines the Capital Asset Pricing Model (CAPM) for the Greek stock market using weekly stock returns from 100 companies listed on the Athens stock exchange for the period of January 1998 to December 2002.

In order to diversify away the firm-specific part of returns thereby enhancing the precision of the beta estimates, the securities were grouped into portfolios. The findings of this article are not supportive of the theory's basic statement that higher risk (beta) is associated with higher levels of return. The model does explain, however, excess returns and thus lends support to the linear structure of the CAPM equation. The CAPM's prediction for the intercept is that it should equal zero and the slope should equal the excess returns on the market portfolio.

The results of the study refute the above hypothesis and offer evidence against the CAPM. The tests conducted to examine the nonlinearity of the relationship between return and betas support the hypothesis that the expected return-beta relationship is linear. Additionally, this paper investigates whether the CAPM adequately captures all-important determinants of returns including the residual International Research Journal of Finance and Economics - Issue 4 (2006) variance of stocks. The results demonstrate that residual risk has no effect on the expected returns of portfolios.

Tests may provide evidence against the CAPM but they do not necessarily constitute evidence in support of any alternative model (JEL G11, G12, and G15). Key words: CAPM, Athens Stock Exchange, portfolio returns, beta, risk free rate, stocks JEL Classification: F23, G15 79 I. Introduction Investors and financial researchers have paid considerable attention during the last few years to the new equity markets that have emerged around the world. This new interest has undoubtedly been spurred by the large, and in some cases extraordinary, returns offered by these markets.

Practitioners all over the world use a plethora of models in their portfolio selection process and in their attempt to assess the risk exposure to different assets. One of the most important developments in modern capital theory is the capital asset pricing model (CAPM) as developed by Sharpe [1964], Lintner [1965] and Mossin [1966]. CAPM suggests that high expected returns are associated with high levels of risk. Simply stated, CAPM postulates that the expected return on an asset above the risk-free rate is linearly related to the non-diversifiable risk as measured by the asset's beta.

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Although the CAPM has been predominant in empirical work over the past 30 years and is the basis of modern portfolio theory, accumulating research has increasingly cast doubt on its ability to explain the actual movements of asset returns. The purpose of this article is to examine thoroughly if the CAPM holds true in the capital market of Greece. Tests are conducted for a period of five years (1998-2002), which is characterized by intense return volatility (covering historically high returns for the Greek Stock market as well as significant decrease in asset returns over the examined period).

These market return characteristics make it possible to have an empirical investigation of the pricing model on differing financial conditions thus obtaining conclusions under varying stock return volatility. Existing financial literature on the Athens stock exchange is rather scanty and it is the goal of this study to widen the theoretical analysis of this market by using modern finance theory and to provide useful insights for future analyses of this market. II. Empirical appraisal of the model and competing studies of the model's validity 2. 1.

Empirical appraisal of CAPM Since its introduction in early 1960s, CAPM has been one of the most challenging topics in financial economics. Almost any manager who wants to undertake a project must justify his decision partly based on CAPM. The reason is that the model provides the means for a firm to calculate the return that its investors demand. This model was the first successful attempt to show how to assess the risk of the cash flows of a potential investment project, to estimate the project's cost of capital and the expected rate of return that investors will demand if they are to invest in the project.

The model was developed to explain the differences in the risk premium across assets. According to the theory these differences are due to differences in the riskiness of the returns on the assets. The model states that the correct measure of the riskiness of an asset is its beta and that the risk premium per unit of riskiness is the same across all assets. Given the risk free rate and the beta of an asset, the CAPM predicts the expected risk premium for an asset. The theory itself has been criticized for more than 30 years and has created a great academic debate about its usefulness and validity.

In general, the empirical testing of CAPM has two broad purposes (Baily et al, [1998]): (i) to test whether or not the theories should be rejected (ii) to provide information that can aid financial decisions. To accomplish (i) tests are conducted which could potentially at least reject the model. The model passes the test if it is not possible to reject the hypothesis that it is true. Methods of statistical analysis need to be applied in order to draw reliable conclusions on whether the 80 International Research Journal of Finance and Economics - Issue 4 (2006) model is supported by the data.

To accomplish (ii) the empirical work uses the theory as a vehicle for organizing and interpreting the data without seeking ways of rejecting the theory. This kind of approach is found in the area of portfolio decision-making, in particular with regards to the selection of assets to be bought or sold. For example, investors are advised to buy or sell assets that according to CAPM are underpriced or overpriced. In this case empirical analysis is needed to evaluate the assets, assess their riskiness, analyze them, and place them into their respective categories.

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A second illustration of the latter methodology appears in corporate finance where the estimated beta coefficients are used in assessing the riskiness of different investment projects. It is then possible to calculate “ hurdle rates” that projects must satisfy if they are to be undertaken. This part of the paper focuses on tests of the CAPM since its introduction in the mid 1960’s, and describes the results of competing studies that attempt to evaluate the usefulness of the capital asset pricing model (Jagannathan and McGrattan [1995]). 2. 2.

The classic support of the theory The model was developed in the early 1960’s by Sharpe [1964], Lintner [1965] and Mossin [1966]. In its simple form, the CAPM predicts that the expected return on an asset above the risk-free rate is linearly related to the non-diversifiable risk, which is measured by the asset’s beta. One of the earliest empirical studies that found supportive evidence for CAPM is that of Black, Jensen and Scholes [1972]. Using monthly return data and portfolios rather than individual stocks, Black et al tested whether the cross-section of expected returns is linear in beta.

By combining securities into portfolios one can diversify away most of the firm-specific component of the returns, thereby enhancing the precision of the beta estimates and the expected rate of return of the portfolio securities. This approach mitigates the statistical problems that arise from measurement errors in beta estimates. The authors found that the data are consistent with the predictions of the CAPM i. e. the relation between the average return and beta is very close to linear and that portfolios with high (low) betas have high (low) average returns.

Another classic empirical study that supports the theory is that of Fama and McBeth [1973]; they examined whether there is a positive linear relation between average returns and beta. Moreover, the authors investigated whether the squared value of beta and the volatility of asset returns can explain the residual variation in average returns across assets that are not explained by beta alone.

2. 3. Challenges to the validity of the theory

In the early 1980s several studies suggested that there were deviations from the linear CAPM riskreturn trade-off due to other variables that affect this tradeoff.

The purpose of the above studies was to find the components that CAPM was missing in explaining the risk-return trade-off and to identify the variables that created those deviations. Banz [1981] tested the CAPM by checking whether the size of firms can explain the residual variation in average returns across assets that remain unexplained by the CAPM's beta. He challenged the CAPM by demonstrating that firm size does explain the cross sectional-variation in average returns on a particular collection of assets better than beta.

The author concluded that the average returns on stocks of small firms (those with low market values of equity) were higher than the average returns on stocks of large firms (those with high market values of equity). This finding has become known as the size effect. The research has been expanded by examining different sets of variables that might affect the riskreturn tradeoff. In particular, the earnings yield (Basu [1977]), leverage, and the ratio of a firm's book value of equity to its market value (e. g.

Stattman [1980], Rosenberg, Reid and Lanstein [1983] and Chan, Hamao, Lakonishok [1991]) have all been utilized in testing the validity of CAPM. International Research Journal of Finance and Economics - Issue 4 (2006) 81 The general reaction to Banz's [1981] findings, that CAPM may be missing some aspects of reality, was to support the view that although the data may suggest deviations from CAPM, these deviations are not so important as to reject the theory. However, this idea has been challenged by Fama and French [1992].

They showed that Banz's findings might be economically so important that it raises serious questions about the validity of the CAPM. Fama and French [1992] used the same procedure as Fama and McBeth [1973] but arrived at very different conclusions. Fama and McBeth find a positive relation between return and risk while Fama and French find no relation at all. 2. 4. The academic debate continues The Fama and French [1992] study has itself been criticized. In general the studies responding to the Fama and French challenge by and large take a closer look at the data used in the study.

Kothari, Shaken and Sloan [1995] argue that Fama and French's [1992] findings depend essentially on how the statistical findings are interpreted. Amihudm, Christensen and Mendelson [1992] and Black [1993] support the view that the data are too noisy to invalidate the CAPM. In fact, they show that when a more efficient statistical method is used, the estimated relation between average return and beta is positive and significant. Black [1993] suggests that the size effect noted by Banz [1981] could simply be a sample period effect i. e. the size effect is observed in some periods and not in others.

Despite the above criticisms, the general reaction to the Fama and French [1992] findings has been to focus on alternative asset pricing models. Jagannathan and Wang [1993] argue that this may not be necessary. Instead they show that the lack of empirical support for the CAPM may be due to the inappropriateness of basic assumptions made to facilitate the empirical analysis. For example, most empirical tests of the CAPM assume that the return on broad stock market indices is a good proxy for the return on the market portfolio of all assets in the economy.

However, these types of market indexes do not capture all assets in the economy such as human capital. Other empirical evidence on stock returns is based on the argument that the volatility of stock returns is constantly changing. When one considers a time-varying return distribution, one must refer to the conditional mean, variance, and covariance that change depending on currently available information. In contrast, the usual estimates of return, variance, and average squared deviations over a sample period, provide an unconditional estimate because they treat variance as constant over time.

The most widely used model to estimate the conditional (hence time-varying) variance of stocks and stock index returns is the generalized autoregressive conditional heteroscedacity (GARCH) model pioneered by Robert. F. Engle. To summarize, all the models above aim to improve the empirical testing of CAPM. There have also been numerous modifications to the models and whether the earliest or the subsequent alternative models validate or not the CAPM is yet to be determined. III. Sample selection and

Data 3. 1. Sample Selection The study covers the period from January 1998 to December 2002.

This time period was chosen because it is characterized by intense return volatility with historically high and low returns for the Greek stock market. The selected sample consists of 100 stocks that are included in the formation of the FTSE/ASE 20, FTSE/ASE Mid 40 and FTSE/ASE Small Cap. These indices are designed to provide real-time measures of the Athens Stock Exchange (ASE). The above indices are formed subject to the following criteria: (i) The FTSE/ASE 20 index is the large cap index, containing the 20 largest blue chip companies listed in the ASE. 82 International Research Journal of Finance and Economics - Issue 4 (2006) ii) The FTSE/ASE Mid 40 index is the mid cap index and captures the performance of the next 40 companies in size. (iii) The FTSE/ASE Small Cap index is the small cap index and captures the performance of the next 80 companies. All securities included in the indices are traded on the ASE on a continuous basis throughout the full Athens stock exchange trading day, and are chosen according to prespecified liquidity criteria set by the ASE Advisory Committee¹. For the purpose of the study, 100 stocks were selected from the pool of securities included in the above-mentioned indices.

Each series consists of 260 observations of the weekly closing prices. The selection was made on the basis of the trading volume and excludes stocks that were traded irregularly or had small trading volumes. 3. 2. Data Selection The study uses weekly stock returns from 100 companies listed on the Athens stock exchange for the period of January 1998 to December 2002. The data are obtained from MetaStock (Greek) Data Base. In order to
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obtain better estimates of the value of the beta coefficient, the study utilizes weekly stock returns. Returns calculated using a longer time period (e. g. monthly) might result in changes of beta over the examined period introducing biases in beta estimates. On the other hand, high frequency data such as daily observations covering a relatively short and stable time p can result in the use of very noisy data and thus yield inefficient estimates. All stock returns used in the study are adjusted for dividends as required by the CAPM. The ASE Composite Share index is used as a proxy for the market portfolio. This index is a market value weighted index, is comprised of the 60 most highly capitalized shares of the main market, and reflects general trends of the Greek stock market.

Furthermore, the 3-month Greek Treasury Bill is used as the proxy for the risk-free asset. The yields were obtained from the Treasury Bonds and Bill Department of the National Bank of Greece. The yield on the 3-month Treasury bill is specifically chosen as the benchmark that better reflects the short-term changes in the Greek financial markets. IV. Methodology The first step was to estimate a beta coefficient for each stock using weekly returns during the period of January 1998 to December 2002. The beta was estimated by regressing each stock's weekly return against the market index according to the following equation: $R_{it} - R_{ft} = \alpha_i + \beta_i (R_{mt} - R_{ft}) + \epsilon_{it}$ (1) where, R_{it} is the return on stock i ($i= 1...100$), R_{ft} is the rate of return on a risk-free asset, R_{mt} is the rate of return on the market index, β_i is the estimate of beta for the stock i , and ϵ_{it} is the corresponding random disturbance term in the regression equation. [Equation 1 could also be

expressed using excess return notation, where $(R_{it} - R_{ft}) = r_{it}$ and $(R_{mt} - R_{ft}) = r_{mt}$]

In spite of the fact that weekly returns were used to avoid short-term noise effects the estimation diagnostic tests for equation (1) indicated, in several occasions, departures from the linear assumption. [www. ase. gr](http://www.ase.gr) International Research Journal of Finance and Economics - Issue 4 (2006) 83 In such cases, equation (1) was re-estimated providing for EGARCH (1, 1) form to comfort with misspecification. The next step was to compute average portfolio excess returns of stocks (r_{pt}) ordered according to their beta coefficient computed by Equation 1. Let, $r_{pt} = \frac{1}{k} \sum_{i=1}^k r_{it}$ (2) where, k is the number of stocks included in each portfolio ($k= 1...10$), p is the number of portfolios ($p= 1...10$), r_{it} is the excess return on stocks that form each portfolio comprised of k stocks each.

This procedure generated 10 equally-weighted portfolios comprised of 10 stocks each. By forming portfolios the spread in betas across portfolios is maximized so that the effect of beta on return can be clearly examined. The most obvious way to form portfolios is to rank stocks into portfolios by the true beta. But, all that is available is observed beta. Ranking into portfolios by observed beta would introduce selection bias. Stocks with high-observed beta (in the highest group) would be more likely to have a positive measurement error in estimating beta.

This would introduce a positive bias into beta for high-beta portfolios and would introduce a negative bias into an estimate of the intercept. (Elton and Gruber [1995], p. 333). Combining securities into portfolios diversifies away most of the firm-specific part of returns thereby enhancing the precision of <https://assignbuster.com/capital-asset-pricing-model-and-international-research-journal/>

the estimates of beta and the expected rate of return on the portfolios on securities. This mitigates statistical problems that arise from measurement error in the beta estimates. The following equation was used to estimate portfolio betas: $r_{pt} = a_p + \beta_p r_{mt} + e_{pt}$ (3) where, r_{pt} is the average excess portfolio return, β_p is the calculated portfolio beta. The study continues by estimating the ex-post Security Market Line (SML) by regressing the portfolio returns against the portfolio betas obtained by Equation 3. The relation examined is the following: $r_p = \alpha_0 + \alpha_1 \beta_p + e_p$ (4) where, r_p is the average excess return on a portfolio p (the difference between the return on the portfolio and the return on a risk-free asset), β_p is an estimate of beta of the portfolio p , α_1

α_1 is the market price of risk, the risk premium for bearing one unit of beta risk, α_0 is the zero-beta rate, the expected return on an asset which has a beta of zero, and e_p is random disturbance term in the regression equation.

In order to test for nonlinearity between total portfolio returns and betas, a regression was run on average portfolio returns, calculated portfolio beta, and beta-square from equation 3: $2 r_p = \alpha_0 + \alpha_1 \beta_p + \alpha_2 \beta_p^2 + e_p$ (5)

Finally in order to examine whether the residual variance of stocks affects portfolio returns, an additional term was included in equation 5, to test for the explanatory power of nonsystematic risk: $2 r_p = \alpha_0 + \alpha_1 \beta_p + \alpha_2 \beta_p^2 + \alpha_3 RV_p + e_p$ (6) where RV_p is the residual variance of portfolio returns (Equation 3), $RV_p = \sum (e_{pt})^2$. The estimated parameters allow us to test a series of hypotheses regarding the CAPM. The tests are: i) $\alpha_3 = 0$ or residual risk does not affect return, ii) $\alpha_2 = 0$ or there are no nonlinearities in the

security market line, iii) $\beta_1 > 0$ that is, there is a positive price of risk in the capital markets (Elton and Gruber [1995], p. 336).

Finally, the above analysis was also conducted for each year separately (1998-2002), by changing the portfolio compositions according to yearly estimated betas. V. Empirical results and Interpretation of the findings The first part of the methodology required the estimation of betas for individual stocks by using observations on rates of return for a sequence of dates. Useful remarks can be derived from the results of this procedure, for the assets used in this study. The range of the estimated stock betas is between 0.0984 the minimum and 1.4369 the maximum with a standard deviation of 0.240 (Table 1). Most of the beta coefficients for individual stocks are statistically significant at a 95% level and all estimated beta coefficients are statistical significant at a 90% level. For a more accurate estimation of betas an EGARCH (1, 1) model was used wherever it was necessary, in order to correct for nonlinearities. Table 1: Stock beta coefficient estimates (Equation 1)

Stock name	beta	Stock name	beta	Stock name	beta
OLYMP	.0984	THEMEL	.8302		
PROOD	.4192	AIOLK	.8303	ALEK	.4238
EYKL	.4192			AEGEK	.8305
				EPATT	
MPTSK	.5526	AEEXA	.8339	SIDEN	.5643
				FOIN	.5643
				SPYR	.8344
SARANT	.8400	ELYF	.6318	GEK	.862
		PAPAK	.6318	GKOYT	.862
		ELTEX	.8422		
		MOYZK	.6323		
		ABK	.6323		
		ELEXA			
		TITK	.6526		
		MYTIL	.6526		
		MPENK	.8610		
		NIKAS	.6578		
		FELXO	.6578		
		HRAKL	.8668		
		ETHENEX	.6874		
		ABAX	.6874		
		PEIR	.8698		
		IATR	.6950		
		TSIP	.6950		
		BIOXK	.8747		
		METK			
		AAAK			
		ELMEK	.8830		
		ALPHA	.7097		
		EEEEK	.7097		
		LAMPSA	.8848		
		AKTOR			
		ERMHS			
		MHXK	.8856		
		INTKA	.7297		
		LAMDA	.7297		
		DK	.8904		
		MAIK	.7309		
		OTE	.7309		
		FOLI			
		PETZ	.7423		
		MARF	.7423		
		THELET	.9088		
		ETEM	.7423		
		MRFKO	.7423		
		ATT	.9278		

FINTO KORA . 7520 ARBA . 9302 ESXA RILK . 7682 KATS . 9333 BIOSK LYK .
 7684 ALBIO . 9387 XATZK ELASK . 7808 XAKOR . 9502 KREKA NOTOS . 8126
 SAR . 9533 ETE KARD . 8290 NAYP . 577 SANYO Source: Metastock (Greek)
 Data Base and calculations (S-PLUS) beta . 9594 . 9606 . 9698 . 9806 . 9845 .
 9890 . 9895 . 9917 . 9920 1. 0059 1. 0086 1. 0149 1. 0317 1. 0467 1. 0532
 1. 0542 1. 0593 1. 0616 1. 0625 1. 0654 1. 0690 1. 0790 1. 0911 1. 1127 1.
 1185 Stock name EMP NAOYK ELBE ROKKA SELMK DESIN ELBAL ESK TERNA
 KERK POYL EEGA KALSK GENAK FANKO PLATH STRIK EBZ ALLK GEBKA AXON
 RINTE KLONK ETMAK ALTEK beta 1. 1201 1. 1216 1. 1256 1. 1310 1. 1312 1.
 1318 1. 1348 1. 1359 1. 1392 1. 1396 1. 1432 1. 1628 1. 1925 1. 1996 1.
 2322 1. 2331 1. 2500 1. 2520 1. 2617 1. 2830 1. 3030 1. 3036 1. 3263 1.
 3274 1. 4369

The article argues that certain hypotheses can be tested irregardless of whether one believes in the validity of the simple CAPM or in any other version of the theory. Firstly, the theory indicates that higher risk (beta) is associated with a higher level of return. However, the results of the study do not International Research Journal of Finance and Economics - Issue 4 (2006) 85 support this hypothesis. The beta coefficients of the 10 portfolios do not indicate that higher beta portfolios are related with higher returns. Portfolio 10 for example, the highest beta portfolio ($\beta = 1.2024$), yields negative portfolio returns.

In contrast, portfolio 1, the lowest beta portfolio ($\beta = 0.5474$) produces positive returns. These contradicting results can be partially explained by the significant fluctuations of stock returns over the period examined (Table 2).

Table 2: Average excess portfolio returns and betas (Equation 3) r_p beta (p)

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a10 . 0001 . 5474 b10 . 0000 . 7509 c10 -. 0007 . 9137 d10 -. 0004 . 9506
 e10 -. 0008 . 9300 f10 -. 0009 . 9142 g10 -. 0006 1. 0602 h10 -. 0013 1.
 1066 i10 -. 0004 1. 1293 j10 -. 0004 1. 2024 Average Rf . 0014 Average
 $r_m = (R_m - R_f) . 0001$ Source: Metastock (Greek) Data Base and calculations (S-
 PLUS) Portfolio Var.

Error . 0012 . 0013 . 0014 . 0014 . 0009 . 0010 . 0012 . 0019 . 0020 . 0026
 R2 . 4774 . 5335 . 5940 . 6054 . 7140 . 6997 . 6970 . 6057 . 6034 . 5691 In
 order to test the CAPM hypothesis, it is necessary to find the counterparts to
 the theoretical values that must be used in the CAPM equation. In this study
 the yield on the 3-month Greek Treasury Bill was used as an approximation
 of the risk-free rate. For the R_m , the ASE Composite Share index is taken as
 the best approximation for the market portfolio. The basic equation used was
 $r_P = \beta_0 + \beta_1 r_P + e_P$ (Equation 4) where β_0 is the expected excess return
 on a zero beta portfolio and β_1 is the market price of risk, the difference
 between the expected rate of return on the market and a zero beta portfolio.
 One way for allowing for the possibility that the CAPM does not hold true is to
 add an intercept in the estimation of the SML. The CAPM considers that the
 intercept is zero for every asset. Hence, a test can be constructed to
 examine this hypothesis. In order to diversify away most of the firm-specific
 part of returns, thereby enhancing the precision of the beta estimates, the
 securities were previously combined into portfolios.

This approach mitigates the statistical problems that arise from
 measurement errors in individual beta estimates. These portfolios were
 created for several reasons: (i) the random influences on individual stocks
 tend to be larger compared to those on suitably constructed portfolios
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(hence, the intercept and beta are easier to estimate for portfolios) and (ii) the tests for the intercept are easier to implement for portfolios because by construction their estimated coefficients are less likely to be correlated with one another than the shares of individual companies.

The high value of the estimated correlation coefficient between the intercept and the slope indicates that the model used explains excess returns (Table 3). 86 International Research Journal of Finance and Economics - Issue 4 (2006) Table 3: Statistics of the estimation of the SML (Equation 4)

Coefficient β_0 Value	.0005	t-value	(.9011)	p-value	.3939
Residual standard error:	.0004	on 8 degrees of freedom	Multiple R-Squared:	.2968	F-statistic:
	3.3760	on 1 and 8 degrees of freedom,	the p-value is	.1034	Correlation of
Coefficients β_0, β_1	= .9818	β_1	-.0011	(-1.8375)	.1034

However, the fact that the intercept has a value around zero weakens the above explanation. The results of this paper appear to be inconsistent with the zero beta version of the CAPM because the intercept of the SML is not greater than the interest rate on risk free-bonds (Table 2 and 3). In the estimation of SML, the CAPM's prediction for β_0 is that it should be equal to zero. The calculated value of the intercept is small (0.0005) but it is not significantly different from zero (the tvalue is not greater than 2) Hence, based on the intercept criterion alone the CAPM hypothesis cannot clearly be rejected.

According to CAPM the SLM slope should equal the excess return on the market portfolio. The excess return on the market portfolio was 0.0001 while the estimated SLM slope was - 0.0011. Hence, the latter result also indicates that there is evidence against the CAPM (Table 2 and 3). In order to <https://assignbuster.com/capital-asset-pricing-model-and-international-research-journal/>

test for nonlinearity between total portfolio returns and betas, a regression was run between average portfolio returns, calculated portfolio betas, and the square of betas (Equation 5). Results show that the intercept (0.0036) of the equation was greater than the risk-free interest rate (0.014), β_1 was negative and different from zero while β_2 , the coefficient of the square beta was very small (0.0041 with a t-value not greater than 2) and thus consistent with the hypothesis that the expected return-beta relationship is linear (Table 4). Table 4: Testing for Non-linearity (Equation 5)

Coefficient	β_0	β_1	β_2
Value	.0036	-1.7771	.0041
t-value	(1.7771)	(-1.8013)	(1.5686)
p-value	0.1188	0.1147	0.1607

Residual standard error: .0003 on 7 degrees of freedom Multiple R-Squared: .4797 F-statistic: 3.2270 on 2 and 7 degrees of freedom, the p-value is .1016

According to the CAPM, expected returns vary across assets only because the assets' betas are different. Hence, one way to investigate whether CAPM adequately captures all-important aspects of the risk-return tradeoff is to test whether other asset-specific characteristics can explain the cross-sectional differences in average returns that cannot be attributed to cross-sectional differences in beta. To accomplish this task the residual variance of portfolio returns was added as an additional explanatory variable (Equation 6). The coefficient of the residual variance of portfolio returns β_3 is small and not statistically different from zero.

It is therefore safe to conclude that residual risk has no effect on the expected return of a security. Thus, when portfolios are used instead of individual stocks, residual risk no longer appears to be important (Table 5).

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Table 5: Testing for Non-Systematic risk (Equation 6) Coefficient β_0 β_1
 Value .0017 -.0043 t-value (.5360) (-.6182) p-value 0.6113 0.5591
 Residual standard error: .0003 on 6 degrees of freedom Multiple R-Squared: .5302 F-statistic: 2.2570 on 3 and 6 degrees of freedom, the p-value is .1821 β_2 .0015 (.3381) 0.7468 β_3 .3503 (.8035) 0.52387 Since the analysis on the entire five-year period did not yield strong evidence in favor of the CAPM we examined whether a similar approach on yearly data would provide more supportive evidence. All models were tested separately for each of the five-year period and the results were statistically better for some years but still did not support the CAPM hypothesis (Tables 6, 7 and 8).

Table 6: Statistics of the estimation SML (yearly series, Equation 4) 1998 1999 2000 2001 2002 Coefficient β_0 β_1 β_0 β_1 β_0 β_1 β_0 β_1 β_0 β_1 Value .0053 .0050 .0115 .0134 -.0035 -.0149 .0000 -.0057 -.0017 -.0088 t-value (3.7665) (2.231) (2.8145) (4.0237) (-1.9045) (-9.4186) (.0025) (-2.4066) (-.8452) (-5.3642) Std. Error .0014 .0022 .0041 .0033 .0019 .0016 .0024 .0028 .0020 .0016 p-value .0050 .0569 .2227 .0038 .0933 .0000 .9981 .0427 .4226 .0007 Table 7: Testing for Non-linearity (yearly series, Equation 5) 1998 Coefficient β_0 β_1 β_2 β_0 β_1 β_2 β_0 β_1 β_2 β_0 β_1 β_2 β_0 β_1 β_2 Value .0035 .0139 -.0078 .0030 -.0193 .0135 -.0129 .0036 -.0083 .0092 -.0240 .0083 -.0077 .0046 -.0059 t-value (1.7052) (1.7905) (-1.1965) (2.1093) (-.7909) (1.3540) (-3.5789) (.5435) (-2.8038) (1.2724) (-1.7688) (1.3695) (-2.9168) (.139) (-2.7438) Std. Error .0020 .0077 .0065 .0142 .0243 .0026 .0036 .0067 .0030 .0072 .0136 .0060 .0026 .0050 .0022 p-value .1319 .1165 .2705 .0729 .4549 .0100 .0090 .6037 .0264 .2439 .1202 .2132 .0224 .3911 .0288 1999 2000 2001 2002

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Table 8: Testing for Non-Systematic risk (yearly series, Equation 6) 1998

Coefficient	0	1	2	3	0	1	2	3	0	1	2	3	0	1	2	3	0	1	2	3
Value	.0016	.0096	-.0037	3.0751	.0017	-.0043	.0015	.3503	-.0203	.0199	-.0185	2.2673	.0062	-.0193	.0053	1.7024	-.0049	.000	-.0026	-5.1548
t-value	(.7266)	(1.2809)	(-.5703)	(.5862)	(1.4573)	(-.0168)	(.0201)	(2.2471)	(-4.6757)	(2.2305)	(-3.6545)	(2.2673)	(.6019)	(-1.0682)	(.5635)	(.4324)	(-.9507)	(.0054)	(-.4576)	(-.6265)
Std. Error	.0022	.0075	.0065	1.9615	.0125	.0211	.0099	1.4278	.0043	.0089	.0051	.9026	.0103	.0181	.0094	3.9369	.0052	.0089	.0058	8.2284
p-value	.4948	.2475	.5892	.1680	.1953	.9846	.9846	.0657	.0034	.0106	.0106	.0639	.5693	.3265	.5935	.6805	.3785	.9959	.6633	.5541
	1999	2000	2001	2002	VI.															

Concluding Remarks The article examined the validity of the CAPM for the Greek stock market.

The study used weekly stock returns from 100 companies listed on the Athens stock exchange from January 1998 to December 2002. The findings of the article are not supportive of the theory's basic hypothesis that higher risk (beta) is associated with a higher level of return. In order to diversify away most of the firm-specific part of returns thereby enhancing the precision of the beta estimates, the securities were combined into portfolios to mitigate the statistical problems that arise from measurement errors in individual beta estimates. The model does explain, however, excess returns.

The results obtained lend support to the linear structure of the CAPM equation being a good explanation of security returns. The high value of the estimated correlation coefficient between the intercept and the slope

indicates that the model used, explains excess returns. However, the fact that the intercept has a value around zero weakens the above explanation. The CAPM's prediction for the intercept is that it should be equal to zero and the slope should equal the excess returns on the market portfolio. The findings of the study contradict the above hypothesis and indicate evidence against the CAPM.

The inclusion of the square of the beta coefficient to test for nonlinearity in the relationship between returns and betas indicates that the findings are according to the hypothesis and the expected returnbeta relationship is linear. Additionally, the tests conducted to investigate whether the CAPM adequately captures all-important aspects of reality by including the residual variance of stocks indicates that the residual risk has no effect on the expected return on portfolios. The lack of strong evidence in favor of CAPM necessitated the study of yearly data to test the validity of the model.

The findings from this approach provided better statistical results for some years but still did not support the CAPM hypothesis. The results of the tests conducted on data from the Athens stock exchange for the period of January 1998 to December 2002 do not appear to clearly reject the CAPM. This does not mean that the data do not support CAPM. As Black [1972] points out these results can be explained in two ways. First, measurement and model specification errors arise due to the use of a proxy instead of the actual market International Research Journal of Finance and Economics - Issue 4 (2006) 89 ortfolio. This error biases the regression line estimated slope towards zero and its estimated intercept away from zero. Second, if no risk-free asset exists, the CAPM does not predict an intercept of zero.

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