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THE MARKET CAPITALIZATION VALUE AS A RISK FACTOR IN THE ATHENS STOCK EXCHANGE

By

Michalis Glezakos

University of Piraeus

Abstract

Under the joint assumption that CAMP holds and capital markets are efficient, systematic risk is the only priced factor. However a stream of literature casts coubt on the above assumption, suggesting that company size is priced.

The present study, utilizing data from the Athen Stock Exchange, concluded that stock return was negatively related to company capitalization value. However, after controlling for other firm-specific factors, the observed effect remained strong only within the prortfolio of high (historical) earnings yield securities. (JEL Gil)

1. Introduction

Under the joint assumption that Capital Asset Pricing Model (CAMP) holds and the capital markets are efficien, systematic risk is the only priced (risk) factor. However, a stream of literature casts doubt on the validity of the modern portfolio theory, suggesting that some firm-specific parameters as company size and earnings yield, affect returns (Levis 1984, Basu 1983, Roll 1983, Peavy and Goodman 1983 etc.). The plethora of papers documenting the size effect on returns, reflects the considerable interest of this issue among a broad group of economists.

This study reviews a great number of the published empirical works in this field, and discusses possible explanations of their findings. Next, utilizing data of all the quoted companies in the Athens Stock Exchange (ASE) for the twelve years period 1970-1981 tries to indentify a size effect in this market, if any.

Finally, an attempt is made to explain the empirical results (for the ASE) and derive general conclusions.

The Literature Review

The relevant studies, measuring the size of a company by its market capitalization value (MCV), are led to conclusion that smaller companies earn, on average, higher returns than their larger counterparts. In most tests, the observed excess return is persistent for a number of periods, while it is not linearly related to market capitalization.

2. Methodological Issues

From the methodological point of view, two (i.e. Reinganum 1983) to ten portfolios (i.e. Brown et al 1983) were formed each year, on the basis of the MCV of the previous year. They were value weighted (i.e. Lustig 1983) or more often equally weighted (i.e. Reinganum 1981, 1982 and 1983), and their ex-post returns were measured daily (i.e. Basu 1983) or monthly (i.e. Banz 1978). Finally, portfolio returns were compared each other after they were adjusted for risk (i.e. Banz 1981) or withou taking risk into account (i.e. Reinganum 1983).

The above methodology has been questioned in several aspects, the main criticism focusing on the assumed investment strategy and the accuracy of the risk estimates.

2.1. Investment Strategies

Rebalancing to equal weights (most of the studies) and buy-and-hold (i.e. Blume 1983) were the adopted portfolio strategies. The first of them is implicitly assumed when compounded arithmetic average returns are employed and involves daily or monthly rebalancing to attain equal weight of the included securities. On the other hand a buy-and-hold strategy assumes no rebalancing within the measurement time interval. Roll (1983-a) suggested that the first strategy produces higher excess return for small company stocks, while the same conclusion reached Blume and Stambaugh (1983), utilizing data from the NYSE. However, even under a buy-and-hold strategy, the effect associated with market capitalization remains substantial. Moreover, according to Reinganum (1983-a), the two strategies do not produce substantially different results in long periods.

2.2. Systematic Risk Estimates

The studies which compare risk adjusted returns, derive systematic risk estimations through the application of the market model which is the testable form of the CAMP. However, when thin trading exists or the assumptions, on which the method of estimation (Ordinary Least Squares or OLS) is based, do not hold, the obtained risk figures may be misleading.

For example, Fisher (1966), Dimson (1979), etc have argued that betas of thinly traded shares are biased downwards. If this is true, small firms which are associated with lower markerability than the larger ones. However, Reinganum (1982), depicted that only the direction of bias was consistent with this conjecture. Reinganum's conclusions are consistent with those of Stall and Whaley (1983), Roll (1983-a) and Levis (1984b, c). Regarding the underlying assumptions of OLS (mainly normality, homoscedasticity, serial independence and zero mean of residuals), many authors have concluded that they do not always hold. More precisely, the findings of Reinganum (1983-b) and Roll (1983) suggest that autocorrelation is a problem, while Theobald (1980) faced heteroscedasticity problems in his study. However, one cannot conclude whether the violation of the above assumptions favors small or large companies.

2.3. Economic Explanations of the Size Effect

The methodological problems may be partly responsible for the observed size effect, but they cannot be considered as a satisfactory explanation. Economic factors, such as taxation, transaction costs, marketability of the stock, cost of information and take-over premiums may affect more seriously small firm returns. More precisely, Roll (1983) and Reinganum (1983-b) provided evidence that the extra-sales at the end of the year for tax purposes ("tax-loss Hypothesis"), affect largely small firms, thus being partly responsible for the observed size effect. Additional studies provided support to tax-loss hypothesis, as Levis' (1984-c) for U.K., Vorhay's et al (1985) for Belgium, France and U.K., Hamon's (1985) for Framce, Brown et al's (1983) for Australia, Tinic et al's (1984) for Canada, Kato et al's (1985) and Jaffe et al's (1985) for Japan and Gultekin et al's (1982) for other countries. However, other studies as those of Reinganum and Shapiro (1983), Berges et al (1984), and Debondt (1985), cast doubt on its validity.

3. The Sample

The sample of the study consists of most of the quoted companies in the ASE, in December 1981. Only five (from a total of 110) companies were excluded, because the available data for them were not complete. The sample period was confined to 12 years (1970-1981), given that no reliable data could be obtained before 1970. Regarding the time interval, it was decided to employ monthly rates of return, because they enhance the reliability of the systematic risk estimates when thin trading exists (Dimson 1979, Ibbotson 1975 and Schwert 1977). Moreover, Blume and Stambaugh (1983) have argued that daily returns introduce a statistical bias which systematically overstates the magnitude of the size effect, while Roll (1983-a) has concluded that monthly returns are apparently much less subject to this kind of bias.

4. Methodology

Assuming that a size effect exists, portfolios formed on the basis of the company MCV should exhibit a higher than average performance. Moreover, small firm portfolios should outperform their large firms counterparts.

Within this framework, the empirical tests have been designed as follows:

(a) At the outset of each year, the companies of the sample were ranked in ascending order, according to their MCV at the end of the previous year. Next, five portfolios were formed corresponding to the quintiles of the above distribution (lowest quintile: the smallest companies portfolio or MV1).

(b) Monthly portfolio rates of return were estimated by averaging the corresponding returns of the component securities, according to the following equation:

$$R_{pt} = \frac{\sum_{i=1}^{N} R_{it}}{N} \quad (1)$$

where: R_{pt}= the value of rate of return on portfolio p in month t.
R_{it}= the value of rate of return on security i in month t.
N = the number of securities in portfolio p.

This methodology implicitly assumes monthly rebalancing to equal weights, a strategy less realistic than that of buy-and-hold, which mimics the actual investment experience. However, according to Reinganum (1983-b) the two strategies produce no significant difference in the excess returns.

(c) The series of portfolios returns were regressed against the market index, to obtain systematic risk estimates (betas). To overcome the problem of thin trading, Dimson's "Aggregated Coefficients Method" (Dimson 1974 and 1979) which utilizes laged values of portfolio returns was employed, given that requires no additional data as, for example, trade-to-trade prices which are needed for the application of the other methods.

(d) The calculation of excess return was based on the market model equation (Lustig-Leinbach 1983, Brown and Barry 1984, Edmister and James 1983):

$$e_{pt} = R_{pt} - (a_p + b_p R_{mt}) \qquad (2)$$

where: R_{pt} and R_{mt} = the rates of return on portfolio P and market index, respectively.
a_p and b_p = estimated coefficients.
e_{pt} = Excess return on portfolio p, at period t.

An alternative choice could be the "controlled portfolio" approach, which suggests formation of portfolios of a beta equal to one, thus defining excess return as the difference between portfolio return and market return (Brown and Barry 1984, etc.). Both methods are theoritically equally acceptable, but the first is easier to apply.

(e) Given that the employment of the market model for systematic risk estimations, is theoritically acceptable (Fama 1973), only the usual statistical and econometric criteria were used to assess the reliability of the obtained figures. More precisely, R^2, F and t-tests and the validity of the underlying assumptions of the OLS were examined:

— Randomness of the error term was assumed, while homoscedasticity was tested through Spearman's and Golgfeld-Quandt's tests (1965), which are prefetable to Ġlejser's (1969) or other tests, as Johnson (1972) asserts.

— Normality of the random term reduces to normality of the original data, and was tested by the Studentized Range Test (Fama 1973).

— Finally, autocorrelation as a whole was tested by Pierce-Box Statistic (Makridakis et al 1983), while the significance of individual autocorrelation coefficients was assessed using standard tests (Makridakis et al 1983).

5. Analysis of the Data and Interpretation of Results

5.1. Properties of Portfolio Returns

The formed portfolios suggest marked differences in market capitalization between the two extreme portfolios, the largest one being, on average, 98 times the smallest, during the entire 1970-81 period.

Average returns for the five portfolios as well as differencial return of the extreme ones, are given in Table 1. One can see that, although MV1 outperformed MV5, the difference was very small. However, if banks are excluded from the large firms portfolio, differencial return is seriously increased, reaching 9% per annum. That is, in th absence of the industry effect, produced by the inclusion of the financial sector, it can be said that an unadjusted size effect is identified, similar to that of Levis (1984-c) for the LSE (6%) but clearly lower than those of Stall and Whaley (1983), Basu (1983) and Reinganum (1983-a) for the NYSE and AMEX (they range from 11% to 36%).

In order to adjust for risk, estimations of portfolios' betas must be obtained through the application of the Market Model in the data of the sample, the properties of the latter being crucial for the reliability of the obtained figures.

As Table 2 reveals, the return distributions of the five portfolios were marginally normal, because of their slight kurtosis (leptokurtic distributions), while they exhibited average variability.

The findings were congruent with those reported in other studies, for several European Markets (Pogue and Solnic 1974, Uhlir 1979, Deterk 1975, Hawawini and Mitchel 1975, Fabry et al 1977, Jennergen et al 1977, and Daloz 1973).

Regarding the time pattern of the rates of return, it can be seen (Table 3) that autocorrelation was a problem which disappeared when distributions were adjusted for abnormally high returns of 1972. Also, the data exhibited insignificant seasonality, according to the findings which were obtained through the application of Levis' (1984-a) methodology.

The serial independence was even stronger when the abnormally high returns of 1972 were excluded from the sample. The above findings are consistent with Papaioannou's (1984) conclusion that in the ASE, autocorrelation exists when intervals of twenty or less days are used, while it disappears if monthly returns are employed. Also, Solnic (1973) Bertoneche (1979) and Hawawini and Mitchel (1984), agreed that autocorrelation was not a problem in monthly security returns of several European stock exchanges.

5.2. **Estimation of Portfolios' Systematic Risk and** Excess **Return**

The previously stated findings, regarding the difference among the returns of the formed portfolios, must be assessed in the light of the systematic variability of the corresponding distributions. To this end, portfolio betas were calculated using the Market Model equation, as well as the Aggregated Coefficients Method (AC) of Dimson, which takes into account thin trading.

As Table 4 reveals, the obtained OLS results for the whole period are biased, because of the observed marked heteroscedasticity of the regression residuals (normality and serial independence are also marginally accepted). Again, exclusion of the outlying values of 1972 (and the preceding two years) resulted to quite better estimations, as the relevant tests suggest (Table 4). Several other studies, utilizing data of different stock exchanges, concluded that homoscedasticity and serial independence might be reasonably assumed for OLS residuals (Alexander 1980, Martin and Klemosky 1975, Brown 1977 and Fama et al 1969 for the USA, Thobald 1980 for the UK and Berkaoui 1977 for Canada). As a final step, Dimson's AC betas were obtained by utilizing the more effective sub-sample 1973-81 (Table 4).

The findings suggest that, in the free-of-outliers period 1973-81, small firms portfolio was clearly riskier that the large firms one, the difference being larger when AC betas are considered (1,03 to 0,50). Moreover, the obtained estimates are robust as the performed first and second order tests suggest.

One should pay attention to the high values of F-tests which reveal the strong significance of the overall regressions, as well as to the percentage of the total variability of portfolios which is explained by market movements (high R^2's). Also, it can be said that thin trading is a problem, given that betas of large firm portfolios were lowered (MV4 and MV5), while the reverse happened to MV1.

Our findings are not surprising, given that almost all the relevant studies have shown similar results [exception: Levis (1984-c)].

After the computation of reliable systematic risk estimates, the question is whether they explain the observed differences among portfolio returns. A proper answer should be based on the excess return figures, which can be obtained through equation (1) shown back in paragraph 4. In this equation, the error term is zero by construction, so it may be rewritten as follows:

$$\hat{\alpha}_p = \widetilde{R}_{pt} - \hat{b}_p \widetilde{R}_{mt} \tag{3}$$

The above relationship is reduced to the following, if substituting random variables by their mean values:

$$\alpha_p = \overline{R}_p - \hat{b}_p R_m \tag{α}$$

Equation (α) suggests that mean alpha estimate encapsulates the effect of non-market fctors. However, alpha may capture any other non-market factor in addition to size. Moreover, alpha has to be stationary over time, otherwise it cannot be considered as an effective measure of excess return. Table 5 reveals alpha estimations which result from the application of equation (α), to the free-of-outliers data of period 1973-81. The results are in line to those of similar studies: Small firms portfolios outperformed their large firms counterpart. However, one could expect that, the quite higher variability of MV1 (Table 4) would result to the elimination of the difference which was observed between the unadjusted returns of the two portfolios. The explanation is that, in our case, the value of Rm (equation α) was practically zero (-0,17% per annum), thus the application of equation (α) led to values of α_p almost equal to R_p.

If the data of the total period 1970-81 are utilized, then the size effect is considerably reduced (OLS betas) or disappeared, when thin trading is taken into account (AC betas). But it was stated in the previous paragraph, that beta estimates for period 1970-81 were biased, as the relevant tests showed, due to the heteroscedastic residuals of the performed regressions.

As a final attempt to solve the problem, excess returns of period 1970-81 were recalculated after excluding banks from the sample, given that bank shares of the ASE have been proved (for long) the most profitable ones. Indeed, if these shares are not taken into account, the differencial return is quite stronger, exceeding 7% per annum.

In conclusion, the analysis suggests that the joint hypothesis that market is efficient and CAMP holds, is rather violated in the ASE, where small size and industry effects were observed, in the period 1973-81.

5.3. Interaction Between Size Effect and Earning Yield Effect

In his study for the ASE, Glezakos (1987), utilizing data of several periods (including 1970-81), concluded that high earnings yield portfolios outperformed their lower yield counterparts. Moreover, the differential return of the extreme portfolios was statistically significant for both periods 1970-81 and 1973-81.

Given that, in this study, there is evidence of a small size premium if the financial sector is excluded (or if non-adjusted for risk returns are considered), it is interesting to find-out whether the two effects are independent or interrelated. For example, Reinganum (1983-c) depicted that earnings yield effect is included in the size effect, while Basu (1983) was led to the reverse conclusion.

Several methodologies have been developed to carry out the above test (Reinganum 1981-c, Banz 1981, Basu 1983). Taking into account the suggestions of this literature, the following testing procedure was developed:

(a) All stocks in the sample were ranked in ascending order by their market capitalization. Next, beginning from security one, the first n:3 securities were included in portfolio MCV1, the next n:3 in MCV2 and the final n:3 in the large firms portfolio, MCV3.

(b) The whole sample was divided again into three portfolios as follows:
- Portfolio P3 comprised the negative earnings yield securities.
- The remaining securities were ranked in ascending order of earnings yield and divided equally into two portfolios, El being the high yield one.

(c) Securities which were common to both MCV1 and El, formed subportfolio MCV1/E1. Repeating the same procedure, nine subportfolios were constructed. Obtained results are summarized in Table 6 and reveal mean annual return as well as the corresponding abnormal return of each portfolio. The evidence suggests a marked and linear earnings yield effect within each size portfolio, regardless of the period under study.

Company size seems to affect seriously the returns only within the framework of high earnings yield securities. Consequently, small firms premium is a proxy for the effect of several factors on stock returns, one of them being earnings yield. Other factors might be marketability, speculation, bid-ask spreads etc., which are related, on a priori grounds, to size (Klein et al 1977, Arbel et al 1983 etc.).

6. Summary and Conclusions

A great number of empirical studies, utilizing data from several foreign stock markets, have provided evidence that systematic risk is not the only priced factor. More precisely, the empirical results suggest that firm-specific factors, particularly market capitalization value and earnings yield, affect returns.

If it is true, then the joint hypothesis of market efficiency and the validity of CAMP, is violated. Regarding the Athens Stock Exchange, it has been pointed out by Glezakos (1987) that historical earnings yields affect seriously stock returns. The present study examines the corresponding effect of the market capitalization value.

The findings imply that, in general, a small firm premium could be observed, providing that banks were excluded from the sample. However, after controlling for earnings yield, the premium was strong within the high earnings yield group.

Obviously, the evidence is inconclusive. A possible explanation could be that size serves as proxy for several related factors, such as marketability, large bid-ask spreads, lack of information etc.

Appendix

TABLE 1

Mean annual rates of return for the whole period 1970-81 (%)

	MV1	MV2	MV3	MV4	MV5	MV1-MV5	Index
Including banks	10.4	4,7	7,9	8,4	7,1	3,3	7,7
Excluding banks	10,4	4,7	7,9	6,2	1,5	8,9	—

TABLE 2

Distributional properties of the monthly rates of return of the five portfolios and the index for the whole period 1970-81

	Standard Deviation (%)	Skewness	Kurtosis	Studentized Range
MV1	4,6	0,18	4,6*	6,5**
MV2	5,1	0,21	4,4*	6,4**
MV3	4,7	0,23	3,9*	6,6**
MV4	4,7	0,10	4,0*	5,7**
MV5	5,0	0,04	5,0*	6,5**
Index	4,0	0.03	4,3*	5,4**

* leptokurtic distribution

** significant normality at 1% level of significance

TABLE 3

Time pattern of the monthly rates of return, for the whole period 1970-81, as well as for perido 1973-81

Period 1970-81	MV1	MV2	MV3	MV4	MV5	MV1-MV5	Index
Unadjusted returns							
Pierce-Box test(*)	32,9	34,0	38,9	48,4	38,8	45,0	50,9
Seasonality: F-test	0,3	0,4	0,4	0,8	0,8	—	0,6
Seasonality: R^2(%)	5,6	4,7	4,6	1,1	1,7	—	2,0
Adjusted Returns							
Pierce-Box test(*)	27,9	13,9	24,7	17,8	28,3	21,0	15,4

Period 1973-81	MV1	MV2	MV3	MV4	MV5	MV1-MV5	Index
Pierce-Box statistic	15,2	7,2	18,4	13,5	9,4	32,0	12,7
Seasonality: F-test	0,5	0,6	0,7	1,0	1,3	—	0,9
Seasonality: R^2(%)	5,4	4,7	3,5	0.7	3,0	—	1,2

(*) significant autocorrelation (at 5% level of significance) exists when this statistic takes values higher than 36,4.

TABLE 4

Systematic risk estimates and relevant tests of significance

	MV1	MV2	MV3	MV4	MV5
Period: 1970-81					
Betas (t-test)	0,8(14,1)	1,12(22,0)	1,0(20,6)	1,0(21,3)	0,96(13,2)
F-test	200,00	487,00	424,00	453,00	175,00
R^2 (adjusted) %	58,20	77,10	74,80	76,00	54,70
Residuals:					
SR	6,50	6,40	6,40	6,60	6,50
G.Q.	2,20	2,30	1,80	2,10	1,80
Spearman	0,24	0,19	0,00	0,06	0,17
Pierce-Box 27,30	31,90	32,20	30,00	31,70	30,9
Period: 1973-81					
Betas (t-test)	1,05(13,4)	1,23(19,1)	1,01(16,6)	0,92(15,9)	0,79(9,4)
F-test	181,60	446,70	279,00	252,00	110,80
R^2 (adjusted) %	62,5	80,6	73,4	70,0	50,70
Residuals:					
SR	6,20	4,70	5,40	6,40	6,50
G.Q.	1,70	1,30	1,30	1,80	0,90
Spearman	0,21	0,03	-0,02	0,13	0,05
Pierce-Box 15,8	28,0	17,0	20,6	23,5	22,6

	MV1	MV2	MV3	MV4	MV5
DIMSON'S BETAS (1973-81)					
A.C. Betas	1.03	1,08	1,00	0,88	0,50
F-test	62,20	188,6	80,3	60,4	32,0
R^2 (adjusted) %	70,2	83,1	75,3	70,0	51,7
Pierce-Box (residuals)	12,8	28,5	24,4	24,4	23,6

Explanations:

All OLS betas are statistically significant. -OLS and AC regressions' F-tests are statistically significant. - SR (Studentised Range Test) suggests normality at 1% level when its values lie between 4,4 and 6,6. - G.Q. (Goldfed-Quant test for homoscedasticity) reveals homoscedastic residuals, at 5% level, if it does not exceed 1,59 (1,7 for period 1973-81). - Spearman's coefficient implies significant homoscedasticity for values under 0,167 (0,19 for period 1973-81). - Pierce-Box test for random correlogrm: X^2 (95%) = 36,4.

TABLE 5

Excess annual return of the five size portfolios (%)

	MV1	MV2	MV3	MV4	MV5	MV1-MV5
A. Period 1973-81						
Using OLS betas	4,14	-3,45	-1,17	-0,66	-0,63	4,77
Using AC betas	4,14	-3,42	-1,17	-0,65	-0,58	4,72
B. Period 1970-81						
Using OLS betas	2,32	-4,77	0,12	1,32	1,01	1,31
Using AC betas	2,47	-3,62	0,13	1,62	3,25	-0,78
C. Period 1970-81 without banks						
Using OLS betas	2,32	-4,77	0,12	-0,48	-4,90	7,22
Using AC betas	2,47	-3,62	0,13	-0,18	-3,45	5,92

TABLE 6

Mean annual returns and excess returns of the nine MCV/E subportfolios (%)

	Ei	E1		E2		E3	E1-E3
MCVi	return	excess return	return	excess return	return	excess return	mean return
Period: 1973-81							
MCV1	23,4*	15,7*	6,2	-1,5	2,4	-5,3	21,0
MCV2	16,9*	9,2	6,6	-1,1	-8,3	-16,0	25,2
MCV3	14,4	6,7	8,5	0,9	-2,5	-10,2	16,9
MCV1-MCV3	9,0	9,0	-2,3	-2,4	4,9	4,9	—
Period: 1973-81							
MCV1	21,0*	21,1*	1,8	1,9	-6,5	-6,4	27,5
MCV2	8,8	8,9	-3,2	-3,1	-20,9	-20,8	29,6
MCV3	5,3	5,4	-5,2	-5,0	-8,1	-7,9	13,4
MCV1-MCV3	17,8*	15,7*	7,0	6,9	2,4	1,5	—

(*) Statistically significant at 5% level.

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