Inzinerine Ekonomika-Engineering Economics, **2014, 25(1), 5–12**

Further Evidence on the Validity of CAPM: the Istanbul Stock Exchange Application

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crossref http://dx.doi.org/10.5755/j01.ee.25.1.1847

As one of the most important models in the finance literature, the Capital Asset Pricing Model (CAPM) assumes the existence of a positive and linear relationship between the systematic risk and required rates of return on stocks. The model is extensively researched in the academia and frequently used in business world since its development half a century ago. Its popularity comes from the simplification it provides for the complex process of asset pricing by making the assumption that only one single factor affects stock returns. But, as this is an unrealistic assumption, the validity of the model in its standard (unconditional) form is repeatedly rejected by empirical tests. Pettengill et al., (1995) developed an alternative conditional CAPM approach where the standard model is improved by taking bull and bear market conditions into consideration. According to this model, there is a positive (negative) risk-return relationship during up (down) market periods. Using this reasoning, Pettengill et al., (1995) tested up and down market periods separately and reached highly significant results that support CAPM. In this study, both the unconditional and conditional versions of CAPM are tested in the Istanbul Stock Exchange (ISE) for the period of nine years from 2003 to 2011. The test period is divided into four sub-periods. The unconditional CAPM is rejected for the sample period. A result of the conditional test shows that there is a statistically significant conditional relationship during some sub-periods. However, since the risk-return relationship in up and down markets is not symmetric, this conditional relationship does not indicate a positive risk-return tradeoff. Thus, CAPM may not be a useful asset pricing model for the ISE.

Keywords: *asset pricing, risk-return relationship, the standard CAPM, the conditional CAPM, Istanbul Stock Exchange.*

Introduction

Asset pricing is one of the fundamental subjects of finance. The price of an asset depends on the buyer's willingness to buy it. According to the mainstream finance, buyers only consider the riskiness of an asset to decide the amount they are willing to pay for it. Thus, assets are priced based on their risks. The Capital Asset Pricing Model (CAPM) is the most famous asset pricing model in finance literature. It states that the return of a stock is influenced by only one single factor, i.e. the return on the market. The risk of an asset can be measured by its responsiveness to that single factor. If the systematic risk and return relationship implied in this basic model could be validated in real world stock markets, that would be a true revolution in finance.

Empirically testing the validity of CAPM has always been an attractive subject among finance scholars. Since its development half a century ago, the model is tested frequently in order to assess its ability in explaining risk-return relationships in stock markets. As researchers have not reached universal consensus about the predictive ability of the model yet, empirical studies about the subject is still necessary. Numerous test methodologies are developed in order to test the model. One of the earliest is the one developed by Fama and MacBeth in 1973. Their three-stage methodology is frequently used by the later researchers and became the foundation of many subsequent test methodologies. Earliest studies usually found support for the model, but later ones did not provide much favorable evidence. In addition, many of CAPM test methodologies are criticized for being subject to various statistical biases. Even, the testability of CAPM as an ex-ante model is questioned by some finance scholars. Despite all problems related to its testability and results against its validity; the model is a normative one and cannot be invalidated because of questionable empirical test results.

During the past half-century, a considerable effort was made to cover the shortcomings of the model and to improve it. As a result of this process, numerous derivations of the standard CAPM and two other asset pricing models have been developed.

Beside these improvements, some researchers find supporting evidence to CAPM when they use it in a conditional form (Jagannathan & Wang, 1996; Ang & Chen, 2007; Petkova & Zhang, 2005). One branch of the conditional CAPM literature investigates the risk-return relationship by separately testing data from up and down market months (Pettengill, Sundaram & Mathur, 1995). Supporters of this view argue that when excess market return is positive, there is a positive relationship between stock betas (risk) and returns. Similarly, when market risk premium is negative the risk-return relationship also becomes negative. When research periods are divided into up and down market periods and research findings from these two periods are tested separately, substantial support for the validity of CAPM is found by many previous researchers in various stock markets. The validity of any theoretical model can only be established through empirical results. Thus, conducting empirical tests of

CAPM in various stock markets is a necessity for assessing its quality as an asset pricing model. If the risk-return relationship proposed by CAPM exists in stock markets, then, investors can use this model to make better investment decisions. The purpose of this paper is to make a contribution to CAPM literature by bringing further evidence from an emerging market.

The aim of the article is to investigate the validity of CAPM in its unconditional and conditional forms in the Istanbul Stock Exchange (ISE). Investigating the validity of CAPM in an emerging market with an increasing foreign investor interest like Istanbul Stock Exchange would be very valuable for asset pricing literature.

The ISE began operating in 1986 as the only stock market of Turkey. It is a fast growing emerging market with a total trading volume of 423,6 billion US dollars by 2011. Among emerging market stock exchanges, the exchange is ranked as the 15^{th} in terms of market value and 16^{th} in terms of the number of companies traded by World Federation of Exchanges (WFE). Another important feature of the ISE is the intense foreign investor interest. By end of the year 2011, 62,1 per cent of shares of publicly traded companies in ISE are owned by foreign investors. Investigating the risk-return relationship in the ISE would be beneficial for understanding emerging stock markets. In this paper, CAPM is tested using two different test methodologies. Firstly, the standard CAPM test methodology developed by Fama and MacBeth (1973) is applied to assess the model's predictive ability in the ISE for the period of 2003–2011. Secondly, Pettingill *et al.*,'s conditional approach is used in order to understand whether the model is effective in explaining the risk-return relationship in the same market for the same research period. In the next section a brief literature review related to the standard CAPM and its conditional form is presented. Then, the test data and methodology are explained in the third section. The test results are given and analyzed in the fourth section. The last section concludes with summarizing the study and its results.

The Literature Review

CAPM was independently developed by Sharpe (1964), Lintner (1965), Treynor (1965) and Mossin (1966) and later improved by Black (1972). It theorizes that stock returns are dependent on only the return on the market portfolio which includes all feasible investment options in all over the world. Immediately after its development, researchers began to test this theory in order to assess its relevance to real life situations. A proxy for the theoretical market portfolio must be chosen to test the theory, as this portfolio is impossible to create and hold in reality. Mostly, a value weighted broad stock index is taken as a proxy to the market portfolio when testing CAPM. The results of the two earliest studies, conducted by Black, Jensen and Scholes (1972) and Fama and MacBeth (1973), supported the model. However, succeeding research contradicted the supportive results of the initial studies (Basu, 1977; Banz, 1981; Rosenberg *et al.,* 1985; Fama & French, 1992). After influential findings of Fama and French in 1992, it is realized that the standard CAPM can not be validated in its original form via tests conducted by the researchers until that time. To improve the predictive ability of their tests, many researchers tried to enrich the model by including other explanatory factors like firm size or book-to-market ratio beside the market risk premium (Fama & French, 1992; Davis, 1994). Some other researchers argued that risk and return have a conditional relationship and using a conditional asset pricing model CAPM can be validated (Jagannathan & Wang, 1996; Ang & Chen, 2007; Petkova & Zhang, 2005). Pettengill, Sundaram and Mathur (1995) used a modified version of the traditional Fama and MacBeth (1973) methodology which takes into account the market direction. They closely followed the Fama and MacBeth (1973) in forming portfolios and estimating betas of those portfolios but in the final step, they separated their cross-sectional data to up and down market periods based on the sign of the excess market return in each month. Then, the regression coefficients obtained from up and down market months are tested separately to assess whether there is any relationship between risk (beta) and return. Their findings support the existence of a highly significant conditional relationship between beta and returns for the full sample period and all three sub-periods. Their influential research is replicated by many researchers using data from various stock markets in order to see the generalizability of their results. Fletcher (1997), Hodoshima, Garza-Gomez, and Kunimura (2000), Elsas, El-Shaer & Theissen (2003), Fraser *et al.,* (2004); Theriou *et al.,* (2010) are among the researchers who examined the conditional relationship in various stock markets all around the world and reached similar results. However & Cooper (2009) claimed that Pettengill *et al.,* (1995)'s conditional methodology has a serious bias which causes it to provide supportive evidence for the conditional CAPM even if there is no relationship between beta and return. This bias arises from dividing research data based on ex-post market return information and using this to test ex-ante risk-return relationship. Returns of high beta stocks move up when market return goes up and move down when market return goes down. Thus, beta and returns will have a positive relationship in up markets. Using the same reasoning, it can be realized that their relationship will have a negative relationship during down market periods.

Some other researchers found that the conditional CAPM may not hold in one or both of the up and down markets for each test period. Al Refai (2009) tested the unconditional and conditional CAPM in the Amman Stock Exchange of Jordan using portfolios which are formed based on industries. He found a significant risk-return relationship in up markets but did not find any significant relationship in down markets for some of the portfolios. In contrast, Fletcher (2000) investigated the conditional relationship in international stock returns. He found significant risk return relationships in down market months for two sub-periods of his research, but documented an insignificant risk-return relationship for one of the up market periods. He concluded that since the risk-return relationship is significant during the up and down market periods of the full sample, there is still some support for the conditional CAPM. Fraser *et al.,* (2004) applied the conditional methodology using UK data and found that the risk-return relationship is insignificant for up markets while there is significance at 0,01 % level for down markets. Recently, Theriou et al. (2010) tested the unconditional and conditional CAPM approaches in Athens Stock Exchange. They found that the conditional model holds for only one of two sub periods while it is valid for the full sample. Verma (2011) also investigated the explanatory power of the conditional model using international stock returns from 18 countries for the period of 1970–1998. His findings are not supportive of the conditional CAPM. The results of the full sample and two sub-periods are all insignificant. Karacabey and Karatepe (2004) are the first researchers who tested the conditional CAPM approach in the ISE. Their findings were in accordance with the Pettengill *et al.*, (1995)'s and showed that there was a conditional risk-return relationship in this emerging stock market for their research period of 1990–2000. Gursoy and Rejepova (2007) found similar results for the period of 1995–2004 when they applied the same methodology in the ISE.

Data and Methodology

The research period for the study comprises 108 months from January 2003 to December 2011. It begins from the year 2003 in order to eliminate the effects of the 1994, 2000, and 2001 local financial crises on the ISE. The research period ends in 2011 due to data unavailability for the year 2012. Population data are the monthly returns of all common stocks traded on the ISE except investment trusts. For each research period, sample data include stocks which have return information for all months of this research period. Market returns are obtained from the ISE All Index which is taken as a proxy for the market portfolio. Three-month Government Debt Securities (GDS) Return Index is considered to be the risk free interest rate. Data are obtained from the ISE database.

The research period is divided into four six-year sub-periods just like Theriou *et al.*, (2010) did but with one overlapping year in each consecutive period in order to smooth out possible volatility of beta coefficients as suggested by Gursoy and Rejepova (2007). Each sub-period is further separated into three two-year time slices as portfolio formation, portfolio beta estimation and test periods in accordance with the traditional three-step test approach of Fama and Macbeth (1973). For each six-year test period only stocks which have return information for all months in that period are included in the test. In order to avoid survivorship bias, non-survival stocks are included in the research as well. Full research period is tested in the same way but with 36-month time slices for each test step. The beginning and ending dates of test periods and number of stocks in each period are given in Table 1 below.

Table 1

Test Periods and Number of Stocks in Each Period

	Full Period 2003–2010	**First Sub-Period 2003–2008**	**Second Sub-Period 2004–2009**	**Third Sub-Period 2005–2010**	**Fourth Sub-Period 2006–2011**
Portfolio Formation Period	January 2003–December 2005	January 2003–December 2004	January 2004–December 2005	January 2005–December 2006	January 2006–December 2007
Portfolio Beta Estimation Period	January 2006–December 2008	January 2005–December 2006	January 2006–December 2007	January 2007–December 2008	January 2008–December 2009
Testing Period	January 2009–December 2011	January 2007–December 2008	January 2008–December 2009	January 2009–December 2010	January 2010–December 2011
Number of Stocks in ISE All Index	372	296	304	310	372
Number of Stocks Included in the Study	225	228	235	236	264

In the portfolio formation period, time series of excess returns of individual stocks and the market portfolio are calculated by subtracting risk free rate from the raw returns for each month of this period. Then, excess returns of individual stocks are regressed on the monthly market risk premium in order to estimate beta of each individual stock for the formation period. At the end of this process, individual stocks are sorted in ascending order and the portfolio formation approach explained in Fama and MacBeth (1973) is applied to form portfolios.

20 equally sorted portfolios are constructed as follows. The number of available securities is denoted as N and the largest integer value smaller than or equal to N/20 as int(N/20). When individual stocks are sorted in ascending order by their betas, the first (lowest beta) portfolio and the last (highest beta) portfolio have int(N/20)+1/2[N-(20int(N/20)] securities if N is even. If N is odd the last portfolio has the additional one security. Each of the remaining 18 portfolios has int(N/20) securities. The number of stocks in each portfolio for each period is shown in Table 2 below.

Table 2

The Number of Stocks in Each Portfolio for Each Period

Test Period	**Total Number of Stocks**	**Number of Stocks in the First Portfolio**	**Number of Stocks in the Each One of the Middle 18 Portfolio**	**Number of Stocks in the Last Portfolio**
Full Sample	225	13	11	14
2003–2008	228	15	11	15
2004–2009	235	18	11	19
2005–2010	236	19	11	19
2006–2011	264	15	13	15

In order to avoid the regression phenomenon known as reversion to the mean, Fama and MacBeth (1973) suggested the formation of the portfolios from ranked betas computed using data from one time period and the estimation of the portfolio betas using data from the next time period. In the portfolio beta estimation period, beta of each individual stock is calculated by regressing the excess returns of the stock on the market risk premium using data from the second time-slice. Then betas of portfolios are estimated by averaging the betas of the individual stocks they contain. In the testing period, the excess returns of each portfolio are calculated by averaging the excess returns of the stocks they contain using the information from the third time-slice. Then, two different approaches are used to test the validity of CAPM in the ISE for the given time period. Firstly, traditional unconditional test procedure used by Fama and MacBeth (1973) is applied. The following regression equation is used;

$$R_{pt} - R_{ft} = \hat{\gamma}_{0t} + \hat{\gamma}_{1t}\beta_p + \varepsilon_{pt}$$
$$p = 1..............20$$
$$t = 1................T \qquad (1)$$

$R_{pt} - R_{ft}$ is the excess return of the portfolio *p* in month *t* and β_p is the beta of the portfolio *p* which is calculated in the previous time slice (portfolio beta estimation period). ε_{pt} is the error term with an expected value of zero. T is the number of months in the test period. Monthly regression coefficients $\hat{\gamma}_0$ and $\hat{\gamma}_1$ which are obtained from the regressions are averaged and the mean values $\overline{\gamma}_0$ and $\overline{\gamma}_1$ are used to test the following hypotheses using standard one sample t-test. The validity of the traditional CAPM will be accepted if these two null hypotheses are failed to be rejected.

$$H_0 : \overline{\gamma}_0 = 0$$
$$H_1 : \overline{\gamma}_0 \neq 0$$
$$H_0 : \overline{\gamma}_1 \neq 0$$
$$H_1 : \overline{\gamma}_1 \neq 0 \qquad (2)$$

Secondly, Pettengill *et al.,* (1995)'s conditional approach is used. Pettengill *et al.,* (1995) argue that risk and return relationship is conditional on the market risk premium of the test period. If market return is greater than the risk free rate, there is a positive relationship between betas and excess returns. On the other hand, if market return is lower than the risk free return, there is a negative risk-return relationship. To test the existence of this conditional relationship the following regression equation is used;

$$R_{pt} - R_{ft} = \hat{\gamma}_{0t} + \hat{\gamma}_{1t}\beta_p\delta + \hat{\gamma}_{2t}\beta_p(\delta - 1) + \varepsilon_{pt}$$
$$p = 1...............20$$
$$t = 1..................T \qquad (3)$$

δ is equal to 1 when the market risk premium in month t is positive $(R_{mt} - R_{ft} > 0)$ and it is equal to 0 when the market risk premium in month t is negative $(R_{mt} - R_{ft} < 0)$. As regression coefficient $\hat{\gamma}_1$ is calculated only when the market risk premium is positive, and as its expected value is the expected market risk premium $E(R_{mt} - R_{ft})$, its expected sign is positive. Because of the similar reasoning the expected sign of $\hat{\gamma}_2$ is negative. Lastly, following joint hypotheses are tested using the standard t-test.

$$H_0 : \overline{\gamma}_1 = 0$$
$$H_1 : \overline{\gamma}_1 > 0$$
$$H_0 : \overline{\gamma}_2 = 0$$
$$H_0 : \overline{\gamma}_2 < 0 \qquad (4)$$

Pettengill *et al.,* (1995) argue that if both of the null hypotheses are rejected in favor of the alternatives, then the conditional relationship between beta and returns is validated. They further explained that the existence of the conditional risk-return relationship does not guarantee positive risk-return tradeoff. It can exist, only if the average market risk premium is positive and the risk-return relationship is symmetrical between up and down market periods. The first condition is tested using standard one sample t-test. Pettengill *et al.,* (1995) used the following hypothesis and applied standard two-population t-test to test the symmetrical relationship;

$$H_0 : \overline{\gamma}_1 - \overline{\gamma}_2 = 0 \qquad (5)$$

The sign of $\overline{\gamma}_2$ should be reversed to test the symmetry using a two sample t-test (Pettengill *et al.,* 1995).

Results of the Unconditional CAPM Test

The results of the unconditional test are given in Table 3. $\overline{\gamma}_0$ is the mean of regression intercepts and $\overline{\gamma}_1$ is the mean of the regression slope. $s(\hat{\gamma}_0)$ and $s(\hat{\gamma}_1)$ are standard deviations of the coefficients and N is the number of observations (months) for the test period. $t(\overline{\gamma}_0), p(\overline{\gamma}_0), t(\overline{\gamma}_1)$ and $p(\overline{\gamma}_1)$ are t-statistics and p-values of the respective coefficient means. The test statistics show that no relation exists between betas and returns neither in the full sample nor in any one of the sub-periods.

Table 3

Results of the Unconditional Test

Test Period	$\overline{\gamma}_0$	$s(\hat{\gamma}_0)$	$t(\overline{\gamma}_0)$	$p(\overline{\gamma}_0)$	N	$\overline{\gamma}_1$	$s(\hat{\gamma}_1)$	$t(\overline{\gamma}_1)$	$p(\overline{\gamma}_1)$
Full Sample	3,299	9,486	2,087	0,044	36	-0,639	5,250	0,730	0,470
2003–2008	-1,922	9,913	0,950	0,352	24	-0,828	5,663	0,716	0,481
2004–2009	-0,413	10,385	0,195	0,847	24	1,040	5,666	0,899	0,378
2005–2010	2,184	9,143	1,170	0,254	24	3,610	10,771	1,642	0,114
2006–2011	-1,417	14,858	-0,467	0,645	24	1,702	21,094	0,395	0,696

According to CAPM, $\bar{\gamma}_1$ should be greater than zero and $\bar{\gamma}_0$ should be equal to zero. According to the results of the unconditional test, $\bar{\gamma}_0$ is not found different from zero in any one of the test periods except the full period. However, $\bar{\gamma}_1$ is never significantly different from zero and it has a negative sign for the full period and for 2003-2008 sub-period. In conclusion, validity of the unconditional CAPM in the ISE during the test period is rejected. These results are consistent with the findings of many of the earlier researchers including Fama and French (1992).

Results of the Conditional CAPM Test

The results of the conditional Pettengill test are presented in Tables 4 and 5. The coefficient mean $\bar{\gamma}_1$ has the expected sign in all sub-periods and in the full sample. In up market periods (when market risk premium is positive) portfolios with higher betas have higher returns and in down market periods (when market risk premium is negative) the same high beta portfolios have lower returns. This situation implies that there is a relationship between betas and returns. However, a statistically significant conditional relationship between betas and returns for both up and down market periods is only found in 2005–2010 and 2006–2011 sub-periods. For the full period, the relationship is insignificant during both up and down market cases. For 2003–2008 sub-period, the relationships are significant only in down market months. Similarly, there is a significant conditional relationship between betas and returns in up market months of the 2004–2009 sub-period, but unlike any of the other test sub-periods, there is no significant relationship in down market months for the same sub-period. To sum up, the results show that there is a statistically significant conditional relationship between betas and returns in the 2005–2010 and 2006–2011 sub-periods. The relationship is significant either only for up or only for down market months in other test periods. These results are not perfectly consistent with the two previous studies conducted in the ISE by Gursoy & Rejepova, (2007) and Karacabey and Karatepe (2003) who found strong conditional relationships for both up and down markets for all test periods of their research studies.

Table 4

Results of the Conditional Test (Up Market)

Test Period	$\bar{\gamma}_0$	$s(\hat{\gamma}_0)$	$t(\bar{\gamma}_0)$	$p(\bar{\gamma}_0)$	**N**	$\bar{\gamma}_1$	$s(\hat{\gamma}_1)$	$t(\bar{\gamma}_1)$	$p(\bar{\gamma}_1)$
Full Sample	7,3223	8,5177	4,211	0,000	24	0,0949	5,8984	0,079	0,938
2003–2008	2,5342	8,3496	1,0942	0,2953	14	1,1146	6,1686	0,6517	0,5269
2004–2009	6,2928	6,6060	3,3000	0,0071	12	3,9430	5,4153	2,5223	0,0284
2005–2010	3,0001	9,9829	1,2021	0,2480	16	7,3275	11,1409	2,6310	0,0189
2006–2011	-9,1890	11,7276	-2,932	0,012	14	13,6480	15,9927	3,193	0,007

Table 5

Results of the Conditional Test (Down Market)

Test Period	$\bar{\gamma}_0$	$s(\hat{\gamma}_0)$	$t(\bar{\gamma}_0)$	$p(\bar{\gamma}_0)$	**N**	$\bar{\gamma}_1$	$s(\hat{\gamma}_1)$	$t(\bar{\gamma}_1)$	$p(\bar{\gamma}_1)$
Full Sample	-4,4746	5,3587	-3,067	0,011	12	-2,1062	3,3793	-2,159	0,054
2003–2008	-7,1888	9,2761	2,5704	0,0279	11	-3,1232	4,1703	2,3245	0,0424
2004–2009	-7,1197	9,1496	2,6957	0,0208	12	-1,8622	4,4063	1,4638	0,1712
2005–2010	0,5520	7,5201	0,2076	0,8414	8	-3,8263	4,5167	2,3959	0,0478
2006–2011	9,4645	11,8309	2,530	0,032	10	-15,0237	15,3238	-3,100	0,013

The existence of a significant risk-return relationship in periods of 2005–2010 and 2006–2011 does not guarantee positive risk-return trade off. It can be accepted only if average excess market returns are positive and the risk premiums in up and down markets are symmetrical (Pettengill *et al.*, 1995). It can be seen in Table 6 that the average market risk premium is positive for both periods of 2005–2010 and 2006–2011. However, the risk premium in up and down markets is not found symmetrical for any of the test periods. This result is consistent with Fletcher (1997)'s findings and inconsistent with Pettengill *et al.*,'s. Table 7 shows the results of symmetry test for all periods.

Table 6

Average market Excess Returns

	Test period	**Number of Months**	**Mean Risk Premiums**	**t-stat**	**p-value**
Full period	**Full Sample**	36	2,11	1,53	0,13
	2003–2008	24	-1,40	0,69	0,50
	2004–2009	24	0,19	0,08	0,94
	2005–2010	24	3,41	2,17	0,04
	2006–2011	24	0,42	0,33	0,74
Up Market	**Full Sample**	24	6,98	6,97	0,00
	2003–2008	13	5,84	3,59	0,00
	2004–2009	12	9,83	4,99	0,00
	2005–2010	16	8,07	6,28	0,00
	2006–2011	14	4,58	4,91	0,00

	Test period	Number of Months	Mean Risk Premiums	t-stat	p-value
Down Market	**Full Sample**	12	-7,64	-8,09	0,00
	2003–2008	11	-9,95	5,48	0,00
	2004–2009	12	-9,45	5,53	0,00
	2005–2010	8	-5,13	4,95	0,00
	2006–2011	10	-5,39	-3,85	0,00

Table 7

Statistics for Symmetry Test

Test Period	Full Sample	2003–2008	2004–2009	2005–2010	2006–2011
$\overline{\gamma}_1$ ***(up)***	6,982	5,843	9,833	8,068	4,583
$\overline{\gamma}_2$ ***(down)***	-7,638	-9,954	-9,453	-5,133	-5,389
t-stat	0,417	1,690	0,146	1,488	0,499
p-value	0,679	0,105	0,886	0,151	0,622

Conclusions

In this study, two different test approaches are used to test the validity of CAPM in the ISE between January 2003 and December 2011.

Firstly, the unconditional test procedure developed by Fama and MacBeth (1973) is applied and no statistically significant risk-return relationship is found in any of the test periods. This result is consistent with the previous findings in the literature.

Secondly, Pettengill *et al.*, (1995)'s conditional test procedure is applied. Although a positive risk-return relationship during up market periods and a negative risk return relationship during down market periods are observed, the results are not statistically significant for all periods of research. For the full test period, results are insignificant for both up and down market tests. For 2003–2008 sub-period, down market results indicate a significant negative relationship between risk and return. In contrast, for 2004–2009 sub-period, there is a positive risk return relationship in the up market months but relationship is not significant in the down market months. For 2005–2010 and 2006–2011 sub-period, both up and down market tests give statistically significant results. Nevertheless, as the risk premiums in up and down markets are not symmetrical, the existence of a positive risk-return tradeoff cannot be validated for any of these two sub-periods.

The test results obtained from the application of the conditional approach are inconsistent with the previous studies conducted in the ISE which use the same methodology. The main reason of this may be the usage of different test periods and proxies for the market portfolio and for risk free rate. As beta calculations are usually exceedingly sensitive to the time intervals of the observations and to the proxies used for the market portfolio and the risk free rate, the difference of the results should not be surprising. Besides, there are some studies in other stock markets that have results similar to those obtained by the authors of this paper (Al Raif, 2009; Fraser *et al.,* 2004; Verma, 2011).

Actually, the history of test results of the conditional approach of Pettengill et al.'s methodology is somewhat similar to the unconditional CAPM. Early test results are supportive while later research findings have some contradictory evidence.

Test results show that neither the standard CAPM nor its conditional version can perfectly estimate the risk-return relationship in the ISE during the sample period. However, the conditional version seems to be a much more promising alternative to the standard CAPM as a simple method for stock valuation. Further empirical studies of CAPM in the ISE would be beneficial to confirm this inference. Empirically testing the conditional model with using different market portfolio and risk free return proxies and for different time intervals may be helpful in understanding its usefulness. The significance of the relationship for the 2005–2010 and 2006–2011 sub-periods is also promising for its predictive ability in subsequent years.

Finally, the results of this study support the argument that there is a need for asset pricing models which both cover the shortcomings of CAPM and has as a strong theoretical background as it has.

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Rumeysa Bilgin, Eyup Bastı

Papildomi kapitalinių aktyvų įkainojimo modelio pagrįstumo požymiai: pritaikymas Stambulo fondų biržoje

Santrauka

Kapitalinių aktyvų įkainojimo modelyje (KAĮM) teigiama, kad kapitalo grąžos normą nulemia vienui vienas veiksnys. Tai kapitalo reagavimas į rinkos portfelį, kuris yra vadinamas *kapitalo beta*. Pagal šį modelį laukiama kapitalo grąžos norma turi teigiamą santykį su savo *beta*. Tačiau modelio, *vieno veiksnio* metodas, labai supaprastina aktyvų įkainojimo procesą. Kaip ir daugelis kitų „teorinių“ modelių, KAĮM sumoka dėl jų paprastumo kelioms nerealioms prielaidoms. Tačiau dauguma tų prielaidų neišsilaiko realaus pasaulio kapitalo rinkose. Taigi dėl šios priežasties modelio pagrįstumas turėtų būti įvertintas realiomis sąlygomis. Nuo pat jo sukūrimo pradžios (septintojo dešimtmečio), KAĮM yra nuolat pakartotinai tikrinamas įvairiose viso pasaulio kapitalo rinkose. Tačiau testavimo rezultatai yra negalutiniai, nes KAĮM testavimas yra gan sudėtingas procesas. Norint išbandyti modelį kapitalo rinkose, turėtų būti naudojami dviejų modelio variantų (t. y. *grąžos normos* rinkos portfeliui ir *nerizikingos grąžos* normos) „pakaitalai“. Be to, turi būti pasirinktas laiko intervalas tarp stebėjimų, skirtas regresijos analizėms atlikti. „Pakaitalai“ ir laiko parinkimo pasirinkimas yra įvairus, todėl testavimo rezultatai labai priklauso nuo tų pasirinkimų. Tokiu būdu, toje pačioje kapitalo rinkoje, tuo pačiu metu atliktų testų duomenys gali pateikti skirtingus rezultatus, jei tuo metu yra naudojamasi skirtingais „pakaitalais“ ir/arba laiko intervalais. Dėl šios priežasties, kai KAĮM yra atsisakoma tik remiantis vieno testo rezultatais, galima būtų daryti prielaidą, kad šiuos rezultatus lėmė netinkamas, netikslus „pakaitalo“ parinkimas arba tam tikros to laikotarpio sąlygos. Tačiau KAĮM pagrįstumo įvertinimas realaus pasaulio kapitalo rinkose, atrodo, yra nepasiekiamas dėl anksčiau paminėtų priežasčių; empirinis modelio testavimas įvairiose kapitalo rinkose skirtingų laikotarpių, leidžia geriau suprasti apie rizikos grąžos santykį jose. Šio *darbo tikslas* yra papildyti teorinę literatūrą apie KAĮM, prieš tai pateikiant daugiau įžvalgų, atsirandančią analizuojant kylančią kapitalo rinką.

Šio *tyrimo tikslas* yra įvertinti KAĮM galimybes, kurios leistų numatyti kapitalo grąžą *Stambulo fondų biržoje* (SFB). Kaip greitai besivystanti rinka, kuria vis labiau domisi užsienio investitoriai, SFB suteikia gerą galimybę suprasti *rizikos-grąžos* santykį besivystančiose kapitalo fondų biržose.

Šiame tyrime testuojami du skirtingi KAĮM metodai SFB sistemoje, kad būtų nustatytas *rizikos-grąžos* santykis. Testo laikas - devyneri metai (nuo 2003 metų sausio iki 2011 metų gruodžio mėnesio). Pavyzdyje yra pateikiama informacija apie visų fondų, kuriais prekiaujama SFB, mėnesio grąžos norma. Fondai, apie kurių kapitalo grąžą informacijos visiems, bet kurio *sub*-laikotarpio mėnesiams nėra, toliau *sub*-laikotarpio pavyzdyje neanalizuojami. SBF visi indeksai yra naudojami kaip „pakaitalai“ rinkos portfeliui. Trijų mėnesių *Vyriausybės skolos vertybinių popierių* (VSVP) grąžos indeksas yra laikomas nerizikinga pelno norma.

Pirmojoje tyrimo dalyje, tradicinis nesąlyginis KAĮM metodas testuojamas naudojant gerai žinomą metodiką, kurią 1973 metais sukūrė Fama ir MacBeth. Testo, devynerių metų laikotarpis, yra padalinamas į tokius keturis *sub*-laikotarpius (po šešerius metus): 2003–2008, 2004–2009, 2005–2010, ir 2006–2011. Kiekvienas *sub*-laikotarpis ir visas laikotarpis, per kurį atliekamas testas, yra toliau dalinami į tris, dviejų metų laikotarpius (remiantis Fama ir MacBeth (1973) trijų etapų testo metodu). Pirmajame etape, kapitalo *beta* yra apskaičiuojama regresuojant perviršinę kapitalo grąžą rinkos premijai, tam panaudojant duomenis iš pirmųjų dviejų metų laikotarpių. Vertybiniai popieriai yra sugrupuojami į portfelius pagal jų apskaičiuotą *betą*. Antrajame etape kapitalo *beta* yra pakartotinai apskaičiuojama panaudojant duomenis iš antro, dviejų metų laikotarpio. Taip pat, norint apskaičiuoti portfelio *betą*, paimamas vidurkis iš ankstesniame etape suformuoto kiekvieno portfelio vertybinių popierių *betų*. Paskutiniame etape, portfelio grąža, kuri yra apskaičiuota panaudojant paskutinio, dviejų metų laikotarpio duomenis, yra regresuojama į portfelio *betą,* kuri yra apskaičiuota antrajame etape. Pagal KAĮM, šios regresijos linijos nuolydis turėtų būti lygus rinkos rizikos premijai, o perėmimas turėtų būti lygus nuliui. Koeficientai yra tikrinami naudojant standartinius vieno pavyzdžio t-testus, norint pamatyti ar išlaiko KAĮM. Ši testavimo procedūra taikoma visam pavyzdžiui ir kiekvienam iš keturių tyrimo *sub*-laikotarpių. Nesąlyginio testo rezultatai nepateikia jokių įrodymų, kad nagrinėjamu laikotarpiu SFB-oje egzistuotų koks nors svarbesnis *rizikos-grąžos* santykis. Šie rezultatai atitinka ankstesnių, nesąlyginių KAĮM tyrimų, atliktų SFB-oje ir daugelyje užsienio fondų biržose, rezultatus. Tokiu būdu, kaip ir buvo tikėtasi, KAĮM neišlaiko savo nesąlyginės formos SFB.

Antra, Pettengill ir kt. (1995) sukurtas sąlyginis KAĮM metodas buvo panaudotas norint ištirti sąlyginį santykį tarp rizikos ir grąžos. Pagal sąlyginį KAĮM metodą, kapitalo *beta* turi sąlyginį ryšį su jo grąža. Kitaip tariant, *rizikos-grąžos* santykis tampa teigiamas, kai rinkos rizikos premija yra teigiama, ir neigiamas, kai rinkos rizikos premija yra neigiama. Pirmoje dalyje panaudota trijų etapų metodika yra naudojama modifikavus paskutinį sąlyginio KAĮM testavimo etapą. Nors pirmieji du etapai yra identiški nesąlyginio metodo etapams, paskutiniame etape kylantys ir smunkantys rinkos laikotarpiai yra testuojami atskirai. Sąlyginio testo rezultatai skiriasi skirtingiems tyrimo *sub*-laikotarpiams. Lyginant visą pavyzdį, testo rezultatai yra nereikšmingi ir kylantiems, ir smunkantiems rinkos laikotarpiams. Pirmojo *sub*-laikotarpio atveju, egzistuoja žymus ir neigiamas santykis tarp rizikos ir grąžos, kai rinkos rizikos premija yra neigiama. Kai rinkos rizikos premija yra teigiama, rizikos-grąžos santykis tampa teigiamu, bet nesvarbiu. Antrojo *sub*-laikotarpio atveju priešingai, egzistuoja žymus rizikos-grąžos santykis, kai rinkos rizikos premija yra teigiama, bet santykis yra nesvarbus, kai rinkos rizikos premija yra neigiama. Tik trečiojo ir ketvirtojo *sub*-laikotarpių atvejais testų rezultatai buvo statistiškai svarbūs abiem rinkos rizikos premijos atvejais. Nepaisant to, teigiamo rizikos-grąžos suderinamumo nėra nė vienam pavyzdžio laikotarpiui. Taigi, kaip ir gauti nesąlyginio KAĮM rezultatai, sąlyginės versijos rezultatai nepatvirtina rizikos-grąžos santykio egzistavimo ta prasme, kokią KAĮM numatė SFB.

Šie rezultatai nesutampa su dviem, anksčiau atliktais sąlyginio KAĮM tyrimais, kurie buvo atlikti SFB. Šiuose tyrimuose buvo dokumentuotas svarbus ir sąlyginis rizikos grąžos santykis per visus testo laikotarpius. Labiausiai tikėtina priežastis dėl šio nesuderinamumo yra laikotarpio ir testo rezultatų pakaitalo specifiškumas. Regresijos rezultatai taip pat yra labai jautrūs testo duomenų dažnumui, net jei naudojamas tas pats laiko intervalas. Antra vertus, yra atlikta keletas tyrimų kitose kapitalo biržose, kurių rezultatai yra panašūs į šio tyrimo rezultatus.

Šio tyrimo rezultatai parodo, kad nei standartinis KAĮM, nei sąlyginė jo versija negali būti naudingi numatant kapitalo grąžą SFB tiriamuoju laikotarpiu. Nepaisant to, sąlyginę versiją galima laikyti daug sėkmingesniu modeliu nei standartinį KAĮM (prognozavimo sugebėjimų prasme), nors jos pritaikymas yra beveik toks pat paprastas kaip ir nesąlyginės versijos. Būsimieji empiriniai KAĮM tyrimai SFB-oje būtų naudingi patvirtinant šią išvadą. Empirinis, sąlyginio modelio testavimas, naudojant skirtingus rinkos portfelius ir nerizikingus grąžos „pakaitalus“ ir skirtingais laiko intervalais gali padėti suprasti jo naudingumą. Santykio svarba 2005–2010 ir 2006–2011 *sub*-laikotarpiais taip pat teikia vilčių dėl savo sugebėjimo prognozuoti tolesniais metais.

Per pastaruosius dešimtmečius, finansų srities mokslininkai dėjo daug pastangų, kad būtų pagerinti KAĮM. Šio proceso rezultatas toks, kad buvo sukurta daugybė standartinio KAĮM sprendimų ir du atskiri aktyvų įkainojimo modeliai. Tačiau standartinis KAĮM vis dar yra populiarus verslo pasaulyje dėl jo pritaikymo paprastumo ir todėl, kad kitų modelių empiriniai rezultatai nėra geresni. Šio tyrimo rezultatai dar kartą parodo būtinybę kurti naujus aktyvų įkainojimo modelius, kurie galėtų padengti KAĮM trūkumus, taip pat turėtų tokį stiprų pagrindą kaip ir KAĮM.

Raktažodžiai: *aktyvų įkainojimas, rizikos-grąžos santykis, standartinis KAĮM, sąlyginis KAĮM, Stanbulo fondų birža*.

The article has been reviewed.

Received in June, 2012; accepted in February, 2014.