

Testing the Validity of Standard and Zero Beta Capital Asset Pricing Model in Istanbul Stock Exchange

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Abstract

The objective of this study is to test the validity of Zero Beta Capital Asset Pricing Model (CAPM), developed by Black (1972), in another words testing validity of the CAPM in an environment with no risk-free asset and with Zero Beta capital asset, in Istanbul Stock Exchange (ISE). For this purpose, analyses have been done by using common stocks within ISE 100. Before doing the validity test of Zero Beta CAPM, test has been done in Standard CAPM. According to the results obtained in ISE test of Standard and Zero Beta CAPM, validity of both models has not been rejected. It is possible to state that both Standard CAPM and Zero Beta CAPM is proper for ISE; however it has been revealed that Zero Beta form is more valid. The result stating that Zero Beta CAPM is more valid is the same as the results of the study, done by Fama and MacBeth (1974). In both models; linearity relation between risk and return, provided by the models has been found valid for ISE.

Keywords: Validity, Zero Beta CAPM

1. Introduction

Capital Asset Pricing Model, revealing the risk and expected returns relations of common stocks, was generated by Sharpe (1964), Lintner (1965) and Mossin (1966) by use of diversification principles and there are many simplified assumptions lying behind it (Zhang, 2004, p. 113). However a large part of the assumptions of CAPM are based on conditions for which it is pretty hard to be valid in the real markets. The fact that the assumptions are not valid in real life required change or elimination of some assumptions. Other types of CAPM, which is named as “Standard Form”, are Zero Beta model, consumption-based model, multi-period model, multiple beta model and international CAPM model (Altay, 2004, s. 113). One of the said assumptions is presence of a risk-free interest rate on the basis of which investors can make limitless amount of investments and can borrow. Black (1972) suggested that this assumption is not a good approach in respect of many investors and the model will change if this assumption is not valid. Thereby the author developed Zero Beta CAPM.

If we have to define **Basic or Standard Form CAPM** shortly, it is a model, indicating that the required rate of return, expected by investors will be equal to the risk premium in case of risk-free interest rate and where risk reflects diversification. Equilibrium rates of expected return on all risky assets are a function of their covariance with the market portfolio. CAPM was formulated on the basis of the expectations. Beta and market return and consequently security return are future values.

Zero Beta CAPM Model: This model, developed by Black (1972) and relevant to the environment with no risk-free asset, is one of the most significant extensions of CAPM. Zero Beta CAPM was generated for loosening the assumption of a risk-free capital asset and the assumption that investors can borrow and lend on the basis of a risk-free interest rate. Because in real life, investors can make investments from an unlimited amount of risk-free assets; however they cannot borrow at the same amount limitlessly (Beaulieu, M. C., Dufour, J. M., & Khalaf, L., 2011, s-21).

Lending or making investment on a risk-free asset means obtainment of public bond and Treasury bill. Such types of investment instruments are always present and are the same for all investors. However, it is not possible for investors to borrow limitlessly on the basis of a risk-free rate (Elton, Gruber, Brown & Goetzmann, 2003, s.354).

Brennan (1971) changed this assumption saying that investors can borrow and lend limitlessly on the basis of a risk-free interest rate; however this is only possible with different interest rates. In the model, instead of risk-free rate, a portfolio, whose correlation with market portfolio returns is zero consequently whose beta is zero takes place. This means zero systematic risk or zero beta. Since the portfolio has some individual return variances, it is fully risk-free. Zero beta portfolios extend onto the efficient frontier, and have a minimum portfolio variance (Yörük, 2000, s.37). If the assumption of limitless borrowing or lending on the basis of a risk-free interest rate is eliminated and the assumption of non-borrowing or non-lending on the basis of a risk-free interest rate is implemented, Standard CAPM is as below:

$$E(R_i) = E(R_z) + [E(R_m) - E(R_z)] \beta_i \quad (1)$$

In this case, instead of risk-free rate of return in standard form, a risk-free asset, whose correlation with the market is zero is used ($E(R_z)$) (Altay, 2004, s.117).

Zero beta model indicates that a risk free interest rate is not necessary in order for CAPM to be valid. Investors keep different risky portfolios; however all such portfolios take place on the efficient frontier. Union of the portfolios at the frontier at the same time takes place at the frontier (Zhang, 2004, s.20). Linearity of the model is still valid and beta coefficient continues to be a measure of a systematic risk. However, one of the limitations of this model is the requirement that there is no restriction on the short sale. Since the correlation coefficients of many of the assets in the market are positive, it is almost not possible to establish a Zero Beta portfolio without short sale. On that account, in order for CAPM to be linear, it has to be either short sellable risk-free asset or there has to be no restriction on the short sale (Altay, 2004, s.117).

2.Literature Review

The initial different tests of CAPM were done by Black, Jensen, and Scholes (1972), Sharpe and Cooper (1972) and Fama and MacBeth (1974). The authors focused on the special estimation of Sharpe-Lintner version, modeling the returns on Zero Beta portfolios with expected return equal to risk-free interest rate and the relation between the beta and the expected return. Black, Jensen and Scholes (1972) tested CAPM in NYMEX stock exchange for the period of 1926-1966. They used monthly returns in their studies. They grouped all common stocks in 10 portfolios in order to minimize the errors in measurement of security betas. However, the authors realized as a result of their studies that the linear relation, provided by Standard CAPM is valid; but in the regression, established in the test of the model, the intercept point is a little bit different from zero. Thereby, the results, verifying Zero Beta CAPM were obtained rather than Standard CAPM.

Sharpe and Cooper (1972) created portfolios through arrangement according to calculated betas of NYSE shares in the years 1931-67. A direct proportion was found between the returns and the risks of the created portfolios. It was evident that 95 % of the variability in return could be explained with the change in beta. In the regression, established between the portfolio returns and the betas, constant (α_i) was found as 5.54 %. In the relevant period, r_f is 2 % and lower than 5.54 %. This result supports Zero Beta CAPM.

Fama and MacBeth (1974) revealed in their studies, comprising the years 1935-1968, that both Standard CAPM and Zero Beta CAPM was proper; however Zero Beta form was more valid.

Michailidiz, Tsooglou, Papanastasiou and Mariola (1998): They did research by use of the weekly returns of 100 companies in Athens Stock Exchange. They used quarterly T-bill returns of Greece by use of risk-free interest rate. As a result of the studies, they found out that the basic hypothesis of the theory on the fact that a higher risk is related to a higher return level is not supported. The results of the model, established in the study, indicate that CAPM equation supports the linear structure, explaining the stock exchange returns. The model, indicating the high value of correlation coefficient estimated between the intercept and the slope, can explain this relation. However, the fact that the intercept has a value of about of zero indicates that Zero Beta CAPM is not valid.

Hoyt and McCullough (1999) tested the assumption that Catastrophe Insurance Options¹, registered on the basis of Property Claims Services Office (PCS), are Zero Beta assets on account of the fact that PCS index is unrelated to the movements in the capital markets.

They calculated betas by use of CAPM standard market model for PCS Catastrophe Insurance Option data for the period of September 1995 and March 1997. For the market returns in the model, they used stock certificate index returns. They did research for two sub periods, April 1996-March 1997 and August 1996-March 1997, for putting forward option portfolios. According to the results of the researches of Hoyt and McCullough, contracts are Zero Beta assets and potential investors can make an effective diversification by use of the said contracts. Low correlation in the market and catastrophe options prices permits good diversification of the portfolio and reduction of risk (Hoyt & McCullough, 1999, s.149)

In the initial studies, done with regard to Zero Beta CAPM, suggested by Black, the estimated values derived after establishment of models were compared with the required values, and the results were obtained. For instance, if in the instance model, the intercept is found as 0.06 (6%); but the risk-free interest rate in that period is 0.02 (2%), the result on validity of Zero Beta CAPM instead of Standard CAPM is obtained. However, in the subsequent years, in the tests of these models, more different methods are used. For instance, if the alpha intercept has to be equal to zero and its equality to zero will be tested, its distribution around zero is tested. Some of these tests are GMM (Generalized method of moments), GRS (test, developed by Gibbons, Ross, Shanken), LRT (likelihood ratio test), WALD, Wald type GMM tests (Shanken, 1985). Chou and Lin (2002) tested validity of international Zero Beta CAPM for 16 OECD countries and Hong Kong with GRS, GMM, LRT and WALD tests in the periods 1980-1997. For international Zero Beta CAPM test, MSCI (Morgan Stanley Capital International) world index was taken as a basis instead of the world market portfolio. For portfolio of each country, securities market index of these countries was taken as a basis. Wald and GMM test results indicated that Zero Beta CAPM was valid in all the countries (Chou & Lin, 2002).

3.Data and Methodology

3.1. Data

In this study, validity of Standard and Zero Beta CAPM was tested for the period of 2002:01-2006:12 in Istanbul Stock Exchange. Study commenced with 100 common stocks within ISE 100 as of the month of December of 2006; however the number of the examined companies decreased to 64 from 100 on account of the fact that the data of some common stocks were not available for the relevant period, and some common stocks did not provide the assumptions of the study. The companies to which the common stocks belonged, included in the analysis, are as in Appendix 1.

The monthly return series of the relevant period have been obtained by use of the closing prices of the last working day of each month. ISE100 index series has been used as the market indicator. All the returns have been calculated according to the simple return formula given below:

$$R_{it} = (P_{it} - P_{i,t-1})/P_{i,t-1} \quad (2)$$

In the formula, P_{it} indicates the closing price of i security in t period.

As the risk-free interest rate, the treasury discounted tenders' annual compound interest rates (weighted with the annual compound interest amount of the tenders, made within the month) have been taken from the official site of the treasury.

3.2. Methodology

Standard CAPM Test

Many correlation studies have been done with regard to the Standard CAPM, examining the positive relation between the risk and return. However, correlation analysis is not a sufficient method for estimating the significance of the relation between risk and return.

¹ The first series of Catastrophe Sigora Futures and Options were exported in 1992. These contracts were included in Insurance Services Offices (ISO) Catastrophe Index. Trading of these contracts is not so common (Hoyt, McCullough, 1999: 149).

Furthermore, in this method, measurement of beta, which is an independent variable in the test, can be misleading and beta of some common stocks can be estimated as excessive or low. Grouping the common stocks in the portfolio can eliminate these measurement errors. Errors in individual common stocks are cancelled since portfolio betas can be estimated better (Karabulut, 1995, s.34).

1. First-Pass Regression=Time Series Regression: For each security, the following regression is applied.

$$\begin{aligned} R_{it} &= \alpha_i + \beta_i R_{mt} + e_{it} \quad (\text{raw returns}) & (3) \\ R_{it}-R_{f_t} &= a_i + B_i (R_{mt}-R_{f_t}) + e_{it} \quad (\text{excess returns}) & (4) \end{aligned}$$

R_{it} = return rate of i capital asset in t period,

R_{mt} = return rate of market portfolio in t period,

R_{f_t} =risk-free interest rate,

$R_{it}-R_{f_t}, R_{mt}-R_{f_t}$ = excess returns of i capital asset and market

α_i and β_i : regression coefficients,

β_i = at the same time, beta, systematic risk indicator of the capital asset,

e_{it} = residuals.

2. Second-Pass Regression = Cross-Sectional Regression: Second-Pass regression is a simple regression of portfolio returns against the portfolio betas obtained by Equation 4 , testing CAPM.

$$R(\text{average}) = \gamma_0 + \gamma_1 \beta_i + u_i \quad (5)$$

$R(\text{average})$ = estimated value of the average return rate of portfolio

β_i =beta of portfolio obtained from the first regression.

γ_0 and γ_1 second regression coefficients

u_i residual terms.

When the second regression equation is compared with the CAPM formula $E(r_i) = r_f + [E(r_m) - r_f]\beta_i$, it is evident that coefficient γ_0 is an estimate of r_f value and γ_1 is an estimation of $[E(r_m) - r_f]$ value. On the other hand R_i and β_i values are estimates of uncertain real parameters of i capital asset (Polat, 1994, s.70). In this case; the fact that intercept γ_0 is not different from r_f statistically and γ_1 , expressing beta coefficient is equal to R_m-R_f statistically has to be tested.

Furthermore, since beta is the single factor that could explain the return of a risky asset, equality of coefficients of different factors, included in the analysis, and coefficient of β -square, included in the regression, since its return relation with beta is linear, to zero statistically is another factor, which has to be tested for indicating validity of CAPM.

Zero Beta CAPM Test

The stages in Zero Beta CAPM model are the same; the only difference is the fact that a portfolio return, whose correlation with the market is zero takes place instead of a risk-free asset return.

Since zero beta portfolio return is uncertain in this case, the second-pass regression equation is compared with CAPM, arranged as $E(r_i) = r_z (1-\beta_i) + E(r_m)\beta_i$. In this case, it is evident that γ_0 coefficient is an estimate of $r_z (1-\beta_i)$ value and γ_1 is an estimate of $[E(r_m)]$ value. On the other hand, R_i and β_i values are estimates of uncertain real parameters of i capital asset. Therefore, differing from Standard CAPM, it has to be $\gamma_0 = r_z (1-\beta_i)$. Then, it has to be equal to $\gamma_0/(1-\beta_i)=r_z$. Since R_z value is uncertain, the hypothesis, which has to be tested, is equality of all $\gamma_0/(1-\beta_i)$. Chou (2002) used Wald test statistic in testing of this hypothesis. In this study, Wald test has been used in testing the validity of Standard and Zero Beta CAPM

4. Findings

First-Pass Regression and Beta Coefficients

Initially, the study has focused on excess returns and beta coefficients had been calculated as in equation (4). As has been stated before, in this model, R_{mt} indicates the return of ISE100 index in t period, R_{it} return of each common stock, a_i regression constant coefficient, B_i beta coefficient, indicating sensitivity of i security returns to market index returns. In the studies, done in the literature, beta is in general estimated with monthly return estimates for the previous period of 60 months. e_{it} indicates error term; t the time interval in the course of which the returns are measured, $t = 1, 2, 3, \dots, T$.

As the risk-free interest rate, the annual compound interest rates of the treasury discounted tenders have been taken and then the betas have been estimated according to the model, indicated in equation (7). However, the risk-free interest rates, used in the research, are interest rates, comprising all the terms. Yet, in the literature, in such analyses, quarterly treasury bills have to be used. On that account, according to the model, indicated in equation (3), beta estimates have been obtained without deducting risk-free interest rate. (Appendix 2.)

Second-Pass Regression

According to betas, estimated with equations (3) and (4), returns of 64 common stocks have been arranged from the biggest to the smallest. 64 common stocks, arranged according to beta sizes, have been allocated to groups of 8 and portfolios have been created. Regression has been established between betas and returns of these portfolios, created.

Second-pass regression (equation (3)), established with the results of the model, taking the raw returns as a basis;

$$R_p = 0.020414 + \beta p 0.03844 \quad (6)$$

R-squared 0.567233

Second-pass regression (equation (4)), established with the results of the model, taking excess returns as a basis;

$$R_p = 0.005330 + B p 0.021393 \quad (7)$$

R-squared 0.858556

In the relevant period, the average R_f value has been calculated and it has been found as 0.022482. This value is very close to the alpha constant, which is 0.020414 in second-pass regression. On that account, it has been accepted that the risk-free interest rate taken as a basis is accurate and Standard CAPM test has been initiated.

As is mentioned in the literature section, in the initial studies on the issue, the empirical tests of Standard CAPM were done. However, subsequently, more different methods started to be used in testing of these models. In this study, Wald test, which is one of these methods, has been used. But, in the research, empirical results have been assessed primarily.

Equation (7) is the second pass regression equation of the model, taking excess returns as a basis; the alpha constant has to be equal to zero. It is evident that the alpha constant of the model, whose coefficients are found significant, is a low number, which is 0.00533. Furthermore, there is a linear relation, provided by CAPM. At the same time, since raw returns are taken as a basis in equation (6), the alpha constant has to be equal to r_f value. This value has been found as 0.020414; it is both higher than the value of 0.00533 and is a close value to 0.022482, which is the average r_f value of the relevant period.

Testing of Standard CAPM with Wald Test Statistic

Regressions have been established between the returns of the portfolios, created according to betas, calculated with excess returns and excess returns of the market. 8 regression equations have been obtained in total.

$$\begin{aligned} R_{p1} &= 0.01014634782 + 0.0801890217 * R_M \\ R_{p2} &= 0.00491869851 + 0.1652607213 * R_M \\ R_{p3} &= 0.01180940926 + 0.1602890912 * R_M \\ R_{p4} &= 0.009106504966 + 0.020227468 * R_M \\ R_{p5} &= 0.01147803166 + 0.1156245581 * R_M \\ R_{p6} &= 0.007809864488 + 0.085823938 * R_M \\ R_{p7} &= 0.01311482571 + 0.2927549215 * R_M \\ R_{p8} &= -0.07228782624 + 0.34664330730 * R_M \end{aligned}$$

In the obtained regression equations, alpha constants have to be equal to zero. In this case, if CAPM is valid, this null hypothesis will be accepted;

$$H_0: \alpha = 0$$

However, since the fact that alpha constants of individual equations are equal to zero will not indicate that Standard CAPM is valid throughout ISE, collective equality to zero has to be tested. On that account, 7 regression equations obtained have been tested within the system. Hypothesis for all the portfolios created;

$$\begin{aligned} H_0: \alpha_1 = \alpha_2 = \alpha_3 = \alpha_4 = \dots \alpha_8 = 0 \\ H_1: \text{is established as at least one } \alpha \neq 0. \end{aligned}$$

From the regressions of all portfolios, created for testing collective equality of alphas to zero, a collective estimate model has been developed and estimates of coefficients have been obtained. In the collective model, each equation has been defined as below.

$$\begin{aligned}
 R_{P1} &= C_{(11)} + C_{(12)} * R_M \\
 R_{P2} &= C_{(21)} + C_{(22)} * R_M \\
 R_{P3} &= C_{(31)} + C_{(32)} * R_M \\
 R_{P4} &= C_{(41)} + C_{(42)} * R_M \\
 R_{P5} &= C_{(51)} + C_{(52)} * R_M \\
 R_{P6} &= C_{(61)} + C_{(62)} * R_M \\
 R_{P7} &= C_{(71)} + C_{(72)} * R_M \\
 R_{P8} &= C_{(81)} + C_{(82)} * R_M
 \end{aligned}$$

Coefficient estimates of the collective model are as below:

$$\begin{aligned}
 R_{P1} &= 0.010146 + 0.080189 * R_M \\
 R_{P2} &= 0.004919 + 0.165261 * R_M \\
 R_{P3} &= 0.011809 + 0.160289 * R_M \\
 R_{P4} &= 0.009107 + -0.002023 * R_M \\
 R_{P5} &= 0.011478 + 0.148221 * R_M \\
 R_{P6} &= 0.007810 + 0.085824 * R_M \\
 R_{P7} &= 0.013115 + 0.017536 * R_M \\
 R_{P8} &= 0.346643 + 0.712136 * R_M
 \end{aligned}$$

After obtainment of estimates of coefficients collectively, Wald Test has been done for equality of alphas to zero collectively in this system. The tested hypothesis within the system is as below.

$$H_0 : C_{(11)} = C_{(21)} = C_{(31)} = C_{(41)} = C_{(51)} = C_{(61)} = C_{(71)} = C_{(81)} = 0$$

H₁ : at least one of them is not equal zero.

Wald test statistic result is as below.

Table 1. Standard CAPM Validity Testing Wald Test

Walt Test (System)		Df	Probability
Chi-square	7.581980	8	0.4753

Since the probability value of the calculated test statistic is 0.4753 > 0.05, it is accepted as H₀. In other words, the alpha constants of all the portfolios, created, are equal to zero collectively.

Testing of Zero CAPM with Wald Test Statistic

It has been mentioned that the model is as below in an environment with no risk-free capital asset but with a capital asset with Zero Beta instead of risk-free capital asset;

$$R_i = R_z + (R_m - R_z) \beta_i$$

While doing the Standard CAPM test, the excess returns of the portfolios, created according to their risks, had been used. On the other hand, in Zero Beta CAPM test, study was done with raw returns on account of the fact that there is no assumption of limitless borrowing and lending on the basis of risk-free interest rate.

In order to test Zero Beta CAPM, regressions have been established between the average returns of the portfolios and market returns. The regression results are as below:

In this case, in an environment, where Zero Beta CAPM is equal, the regression results have to express the following equation:

$$\begin{aligned}
 R_i &= \underline{R_z(1 - \beta_i)} + \beta_i(R_{mt}) \\
 R_{it} &= a_i + B_i R_{mt} + e_{it} \quad (\text{regression result})
 \end{aligned}$$

If Zero Beta CAPM is valid in this case, this null hypothesis won't be rejected.

$$H_0: \alpha_i = R_z(1 - \beta_i) \quad \alpha_i / (1 - \beta_i) = R_z \quad i=1,2,3,\dots,N \text{ since } R_z \text{ value is uncertain here.}$$

$$H_0: \frac{\alpha_1}{(1-\beta_1)} = \frac{\alpha_2}{(1-\beta_2)} = \dots = \frac{\alpha_8}{(1-\beta_8)} \text{ is tested.}$$

If we have to summarize, here a study has been done with raw returns. More clearly, R_f has not been deducted from portfolio and market return. 8 portfolios have been created according to the betas, arranged from the smallest to the biggest. In the estimates, obtained from the created portfolios, Wald test has been used again in order to test that $\alpha / 1-\beta$ is equal to each other. However since Standard CAPM is valid, $\alpha / 1-\beta$ are again equal to r_f may have been tested. In order to avoid this problem, equality to the average risk-free interest rate and higher rates have been tested in the relevant period. So that whether r_f or a higher rate than r_f ; that is equality to R_z is in question has been separately examined. 8 regression equations obtained are as below.

A collective estimate model has been developed from the regressions of all the portfolios, created to test equality of Alpha/1-Beta to zero collectively, and estimates of the coefficients have been obtained.

$$\begin{aligned} R_{p1} &= 0.02724287236 + 0.2178901981 * R_M \\ R_{p2} &= 0.01857460734 + 0.3593147809 * R_M \\ R_{p3} &= 0.0228018271 + 0.4641715641 * R_M \\ R_{p4} &= 0.02219732061 + 0.3707080686 * R_M \\ R_{p5} &= 0.02161161421 + 0.4951707749 * R_M \\ R_{p6} &= 0.01777307937 + 0.4999528563 * R_M \\ R_{p7} &= 0.01824026035 + 0.7045079693 * R_M \\ R_{p8} &= 0.01680608053 + 0.7580611547 * R_M \end{aligned}$$

The hypothesis, which has to be tested in the established system, is as below:

$$H_0: c_{(11)}/(1-c_{(12)}) = c_{(21)}/(1-c_{(22)}) = c_{(31)}/(1-c_{(32)}) = c_{(41)}/(1-c_{(42)}) = c_{(51)}/(1-c_{(52)}) = c_{(61)}/(1-c_{(62)}) = c_{(71)}/(1-c_{(72)}) = c_{(81)}/(1-c_{(82)})$$

Table 2. Zero Beta CAPM Validity Testing Wald Test

Walt Test (System)	Value	df	Probability
Chi-square	0.770098	7	0.9977

Since the probability value of wald test statistic is $0.9977 > 0.05$, it is not rejected as the null hypothesis, and the conclusion that Alpha/1-Beta are equal to each other is drawn. Normally, if in the regression equations of Standard CAPM test, taking excess returns as a basis, the intercepts were not accepted as equal to zero, the hypothesis here would be accepted as a return rate, different from r_f would be accepted, and Zero Beta CAPM's validity could be verified. However, here equality of Alpha/1-Beta here does not mean that they are not equal to R_f . On that account, the average R_f value of the period within which alternative work has been conducted for solution of such a problem, has been calculated and equality to this value has been tested. The average R_f value of the relevant period is 0.022482. The tested hypothesis is as below:

$$H_0: c_{(11)}/(1-c_{(12)}) = c_{(21)}/(1-c_{(22)}) = c_{(31)}/(1-c_{(32)}) = c_{(41)}/(1-c_{(42)}) = c_{(51)}/(1-c_{(52)}) = c_{(61)}/(1-c_{(62)}) = c_{(71)}/(1-c_{(72)}) = c_{(81)}/(1-c_{(82)}) = 0.022482$$

Table 3. Validity Test of Zero Beta CAPM Wald Test 2

Walt Test (System)	Value	df	Probability
Chi-square	4.152692	8	0.8431

As is evident, there is equality to R_f . The portfolio return with no market relation according to Zero Beta CAPM has to be $r_z > r_f$. On that account, the aforementioned tests continued to be applied with the coefficients above the calculated average r_f value. As a result of the relevant tests, it has been found out that the $\alpha/1-\beta$ values ranged between **0.0074** and **0.06403** statistically. This result verifies the ideas, supported by Brennan, occupied in Zero Beta portfolio after Black. According to Brennan, investors can borrow and lend on the basis of risk-free interest rate; however this has to be done with different interest rates.

Furthermore, Fama and MacBeth (1974) suggested in their studies, comprising the years 1935-1968 that both Standard CAPM and Zero Beta CAPM were proper; however Zero Beta form was more valid.

5. Conclusions

According to the results, obtained from test of standard and Zero Beta CAPM in ISE, validity of both models has not been rejected. It is possible to say that both Standard CAPM and Zero Beta CAPM are valid for ISE; but it has been suggested that Zero Beta form is more valid. This result has been reached on account of two grounds. The first reason is the fact that wald test statistic probability values have been found higher in Zero Beta CAPM tests. The second reason is the fact that in the estimated models, alpha constants are equal to a single value; that is r_f in the test period if Standard CAPM is valid. However, instead it has been found out that it is equal to values in the range between 0.0074 and 0.06403. This result verifies the ideas, supported by Brennan. According to Brennan, investors can borrow and lend on the basis of a risk-free interest rate; however this will be done with different interest rates.

The result on the fact that Zero Beta CAPM is more valid is the same as the result of the study, Fama and MacBeth (1974). In both models, linearity relation between risk-return, provided by the models, has been found valid for ISE.

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Appendix 1. Companies, Included in ISE 100 Analysis

1	ADANC	ADANA ÇİMENTO C	33	GSDHO	GSD HOLDING AŞ
2	AKBNK	AKBANK	34	GLYHO	GLOBAL YATIRIM ORTAKLIĞI
3	AKCNS	AKÇANSA	35	GRGYO	GARANTİ GMYO
4	ALARK	ALARKO HOLDING	36	HURGZ	HÜRRİYET GAZETECİLİK
5	AKGRT	AKSİGORTA	37	ISCTR	İŞ BANKASI C
6	ANSGRT	ANADOLU SİGORTA	38	IZMDC	İZMİR DEMİRÇELİK
7	ARCLK	ARÇELİK	39	IAGYO	İŞ GAYRİMENKUL Y.O.
8	ASLSN	ASELSAN	40	KARTN	KARTON SANAYİ
9	AYGAZ	AYGAZ	41	KCHOL	KOÇ HOLDİNG
10	BOSSA	BOSSA Tic. ve San.	42	KRDMD	KARABÜK DEMİR ÇELİK
11	BEKO	BEKO	43	MAMAR	MARMARİS MARTI
12	BOYNR	BOYNER Mağazacılık	44	MGROS	MİGROS
13	CELEBİ	ÇELEBİ HAVA SERVİSİ	45	NETRZ	NET TURİZM
14	CIMSA	CİMSA	46	NETAŞ	NETAŞ TELEKOM
15	DMSAS	DEMİRSAŞ DÖKÜM	47	OTKAR	OTOKAR
16	DEVA	DEVA HOLDİNG	48	PRKTE	PARK ELEKTRİK MADEN
17	DGZTE	DOĞAN GAZETECİLİK	49	PETKM	PETKİM
18	DYHOL	DOĞAN YAYIN HOLDİNG	50	PTOFS	PETROL OFİSİ
19	DOHOL	DOĞAN HOLDİNG	51	PINSU	PINAR SU
20	DKTAS	DÖKTAŞ	52	SAHOL	SABANCI HOLDİNG
21	ECILC	ECZACIBAŞI İLAÇ	53	SARKY	SARKUYSAN
22	ECZYT	ECZACIBAŞI YATIRIM	54	SISE	ŞİŞE CAM
23	ERDMR	EREĞLİ DEMİRÇELİK	55	SKBNK	ŞEKERBANK
24	ECYAP	ECZACI YAPI	56	TATKS	TAT KONSERVE
25	EGIYM	EGS EGESER GIYIM	57	TEKSTL	TEKSTİL BANK
26	ENKAI	ENKA İNŞAAT	58	TRKYC	TRAKYA CAM
27	FINBN	FİNANSBANK	59	THYOL	TÜRK HAVA YOLLARI A.Ş.
28	FROTO	FORDOTOSAN	60	TOASO	TOFAŞ OTOMOBİL FAB
29	FORTS	FORTIS BANK	61	TSKB	T.SINAI KALKINMA B.
30	GARAN	GARANTİ BANKASI	62	UÇAK	USAŞ
31	GOLDS	GOLDAŞ KUYUMCULUK	63	UZEL	UZEL MAKİNA
32	GOODY	GOODYEAR	64	VSTEL	VESTEL

Appendix 2. Beta Estimates of the Companies

Company	With Raw Returns	With Excess Returns
	Calculated Betas	Calculated Betas
Vestel	0.853508277	0.829278497
Usaş	0.954197989	0.964190263
Uzel	0.786630445	0.812461132
Tskb	1.196678019	1.246592532
Trakyacam	0.586485408	0.559518929
Tofaş	0.985540797	0.998041921
Thy	1.072451482	1.052023405
Tekstil	1.213604317	1.240905982
Tat Knsrve	0.792303145	0.754038275
Şişecam	1.085783978	1.058183611
Şekerbnk	1.42873324	1.488648415
Sarkuysan	0.552353539	0.558003419
Sabancı	1.161625809	1.12724622
Pınar	0.863129409	0.880608597
Petrol	0.90235829	0.858542803
Petkim	1.008728241	0.982888306
Parkelektrik	1.166200374	1.257105818
Otokar	0.787275674	0.74779392
Net Truzim	1.001090973	0.984426153
Nets	1.095459714	1.072950169
Migros	0.726822372	0.698863477
Marmaris	1.531949734	1.473635871
Koç	1.018532371	0.99462645
Kartonsan	0.412951483	0.364466949
Kardemir	1.23103988	1.196380211
Izmirdemir	0.966644108	0.899327388
Isgym	1.23587235	1.221865682
Isbank	1.356295726	1.364415197
Hurriyet	0.950515056	0.970200692
Gsd	1.289120329	1.26550803
Goodyear	0.654447348	0.613612819
Goldas	1.043833418	1.072513573
Globalyatr	1.568504264	1.59318721
Garntigmy	1.238833474	1.197691885
Garntibank	1.250606625	1.279173069
Fortisbank	1.079062654	1.097210066
Fordotosan	0.691070661	0.773587745
Finansbank	1.11330327	1.049546228
eregli	0.955750979	0.972791833
Enka	0.407422936	0.425488948
Egeser	0.732188032	0.692552539
Eczacyatr	0.883427389	0.861325221
Eczciyapi	1.079062654	1.097210066
Eczaciilac	0.864088795	0.832472785
Doktas	1.001050776	0.986228169
Dognyayn	1.050197437	1.008045527
Dognholdg	1.397280589	1.396906572
Dogngazet	1.211758999	1.137262963
Devahlding	0.173139975	0.099380283
Demirdok	1.025171829	0.986885404
Cimsa	1.097170922	1.072713923
Celebi	0.599602124	0.624414215
Boyner	1.248130102	1.228487089
Bossa	0.610631458	0.61939623
Beko	0.954412106	0.946560835
Adanacim	1.281860096	1.295293296
Akcansa	1.155931201	1.13658168
Aksigorta	1.233951283	1.205213134
Alarkohol	1.145842965	1.141300082
Anadlsigrt	1.289259435	1.268827154
arçelik.	0.98127571	0.923218646
Akbank	0.877408475	0.835443093
Aselsan	0.671858968	0.709009174
Aygaz	0.947419085	0.914359903