SSRG International Journal of Economics and Management Studies
ISSN: 2393 – 9125 / https://doi.org/10.14445/23939125/IJEMS-V7I5P126

Volume 7 Issue 5, 172-177, May, 2020

Original Article

Empirical Test of the Capital Asset Pricing Model (CAPM): Evidence from Indonesia Capital Market

Agung Wibowo[1], Susetyo Darmanto[2]

[1] *Departement of Accounting, Fakultas EkonomikadanBisnis Universitas 17 Agustus 1945 Semarang, Indonesia*
[2] *Departement of Management, Fakultas Ekonomikadan Bisnis Universitas 17 Agustus 1945 Semarang, Indonesia*
Pawiyatan Luhur Bendan Dhuwur, Semarang, Indonesia

Received Date: 12 April 2020
Revised Date: 23 May 2020
Accepted Date: 28 May 2020

Abstract *- The Capital Asset Pricing Model is developed based on market conditions in a state of equilibrium, where the expected return of securities is determined only by the amount of systematic risk (β) of the security in question. Whereas in practice, the expected return of securities is influenced by many factors, so the question arises whether the Capital Asset Pricing Model has empirical validity in the Indonesian Capital Market? This study aims to find evidence of empirical validity of the enactment of the Capital Asset Pricing Model in the Indonesian Capital Market.*

The population used in this study is that securities that are always consistently listed in the LQ45 index from 2015 to 2019 are 33 securities. There are three analytical tools used, namely: first is Second-Pass Regression as used by Lintner (1965) and Douglas (1968), second is a regression through the origin point between security risk premium (E (Ri) - Rf) as the dependent variable with systematic securities (bi) as an independent variable, the third is the Paired Sample T-Test between the actual expected return of securities obtained from the Harry Max Markowitz method and the predicted expected return of securities obtained with the Capital Asset Pricing Model. The first test model showed that the coefficient of the Second – Pass Regression was different from the risk premium market [E (Rm) - Rf], which was negative and not significant. The second test model shows that the regression coefficient through the origin is also different from the risk premium market [E (Rm) - Rf], which is negative and not significant, the third test model shows that the actual expected return of securities is not significantly different from the expected return of securities. The three test models prove that the CAPM does not have valid empirical validity in the Indonesian Capital Market.

Keywords *- Expected Return, Systematic Risk, Securities Risk Premium, Market Risk Premium.*

I. INTRODUCTION

Investment is the current consumption delay to be allocated to assets that provide greater benefits in the future. Investments can be made in real assets or in financial assets. Investments in financial assets have several advantages compared to investments in real assets, namely: first, they have high flexibility for portfolio changes; second, they have a relatively greater expectation return; third require relatively fewer funds. Because of these advantages, investors are more likely to invest in financial assets.

Even though investment in financial assets has a greater return on expectations compared to investments in real assets, investment in financial assets has a higher risk than investing in real assets. Therefore in order to minimize risk, investors must make a diversion with how to form an optimal portfolio. The purpose of this optimal portfolio formation is to minimize risk with certainly expected returns. One theory of optimal portfolio formation that is still relevant is the Single Index Model. This Single Index Model will produce an optimal portfolio if investors are able to estimate the expected return of security.

One well-known return estimation theory of securities to date is the Capital Asset Pricing Model (CAPM) introduced by Jack Treynor (1961-1962)[1], William F. Sharpe (1964), John Lintner (1965a, b) and Jan Mossin (1966)[1]who developed Harry Markowitz's theory of diversification and portfolio theory. The Capital Asset Pricing Model is developed based on market conditions in a state of equilibrium, where the expected rate of return of securities is determined only by the amount of systematic risk (β) of the securities concerned[2]. Whereas in practice, the expected return of securities is influenced by many factors[3], so the question arises whether the Capital Asset Pricing Model has empirical validity in the Indonesian Capital Market? Several studies have indeed shown that systematic risk of securities does not have a significant positive effect on expected return of securities, meaning that CAPM does not have empirical validity[4].

This study tries to prove the empirical validity of the Capital Asset Pricing Model in the Indonesian Capital Market by using the same approach carried out by the

Lintner (1965) and Douglas (1968) approach. In addition, this study also tries to approach by comparing the actual expected return of securities obtained from the Harry Max Markowitz method with the predicted expected return of securities obtained with the Capital Asset Pricing Model.

A. Hypothesis Development

In order to form an optimal portfolio, the ability of investors to estimate the minimum expected return required from individual securities is very important. One model that can be used to estimate the minimum expected return is the Capital Asset Pricing Model (CAPM)[2]. The Capital Asset Pricing Model (CAPM) is a model that can be used to estimate the expected return of security on the market in equilibrium conditions. The aim is to determine the required minimum expected rate of return of a security[5]. Based on the assumptions of investor behaviour that is anti-risk and prefers high returns, CAPM can be used to estimate the expected return of security in a market that is in equilibrium. In a market in a state of equilibrium, the required rate of return of an individual security will be influenced by systematic risk as measured by beta (β)[6].

The Capital Asset Pricing Model was first proposed by Sharpe (1964), Lintner (1965), and Mossin (1969). The Capital Asset Pricing Model is formed based on the functional relationship between the expected return of individual security with the systematic risk contained therein, based on a number of key assumptions of the capital market, namely [2]: (1) There are risk-free assets so that all investors can lending or borrowing with the amount not limited to a risk-free interest rate; (2) No inflation occurs, so the economy is in a stable condition; (3) There is no personal income tax, so investors have the same choice between getting dividends or capital gains; (4) The capital market is in equilibrium conditions; (5) Short sale is permitted, and investors can makethe short sale whatever they want. The implication of this assumption is that all investors will choose a market portfolio, which is a portfolio that contains all assets in the market, and this market portfolio is an efficient portfolio, which is in the efficient frontier, according to Markowitz.

The CAPM assumptions, as mentioned above, are very unrealistic because they are difficult to find in the real world. However, CAPM is a model that can be used to help investors predict expected returns. As a market-based model in equilibrium, CAPM can help investors simplify the picture in the real world of complexity regarding the expected return and systematic risk relationship. In equilibrium market conditions, all investors are in an optimal position, so it is not possible to get an abnormal return. All only get the expected return. The Capital Asset Pricing Model is a model that links the expected return of an asset with systematic risk in a very simple linear equation, namely E (Ri) = Rf + bi * [E (Rm) - Rf][7].

Research on the linear relationship between expected return with systematic risk has provided evidence that there is a linear relationship between expected return and systematic risk[8910]. The results of previous studies also prove that the coefficient and residuals of the regression between expected return and systematic risk are consistent with an efficient capital market[9], so the following hypothesis can be proposed.

Ha: systematic risk of securities has a significant positive effect on the expected return of securities in the Indonesian Capital Market, meaning that the Capital Asset Pricing Model applies to the Indonesian Capital Market.

II. RESEARCH METHODS

A. Population

The population of this study is the company's securities which are consistently listed in the LQ45 index from 2015 to 2019 as many as 33 securities. The use of securities that are levelled on the LQ45 index is based on the consideration that these securities are the most liquid securities, and their trading volume is relatively large so that they are expected to reflect the actual conditions of the Indonesian Capital Market.

B. Data

The data used in this study are secondary data, which includes:

- Monthly securities price data from 33 securities that are consistently listed in the LQ45 index from January 2015 to December 2019. This data was obtained from Yahoo! Finance with the address https://finance.yahoo.com/quote/DIS/history?p=DIS
- Market index data used is the monthly Composite Stock Price Index (CSPI) for January 2015 to December 2019. This data was obtained from the Indonesia Stock Exchange website at https://www.idx.co.id/data -market / trade-summary / index-summary /
- The risk-free rate data used is the monthly interest rate of Bank Indonesia Certificates (SBI) from January 2015 to March 2016, while from April 2016 to December 2019, BI 7-day (Reverse) Repo Rate is used. , obtained from the Bank Indonesia website at https://www.bi.go.id/en/moneter/bi-7day-RR/data/Contents/Default.aspx

C. Analysis Method

The analytical procedures used in this study are as follows.

a) Prepare basic data, including

1) Calculates the monthly return of each security.
The monthly return for each security is calculated by the percentage change in the closing market price in each month with the following formula:

$R_i = (P_t – P_{t-1}) / P_{t-1}$
Where:
R_i = return of securities i
P_t = security price I at time t
P_{t-1} = price of securities I at time t-1

2) Calculates the expected return of each security.
The expected return of each security is calculated using the arithmetic average of monthly returns during the study period using the following formula:

$$E(R_i) = \frac{\sum R_i}{n}$$

Where:
$E(R_i)$ = expected return sekuritas i.

3) Calculatemarketreturnsusing the formula:
$R_m = (IHSG_t – IHSG_{t-1}) / IHSG_{t-1}$
Where:
$IHSG_t$= composite stock price index at time t.

$IHSG_{t-1}$ = composite stock price index at time t-1.

4) Calculating the expected market return.
Expected market returns are calculated using the arithmetic average of monthly market returns during the study period using the following formula:

$$E(R_m) = \frac{\sum R_m}{n}$$

Where:
E (Rm) = expected market return.

5) Calculates the interest rate for a monthly risk-free asset.
The interest rate for monthly risk-free assets is calculated by dividing by the number 12 of the interest rate of SBI and BI 7-day (Reverse) Repo Rate.

After the basic data is obtained, an analysis is carried out with the following model.

1) The First Testing Model

This first test model is in accordance with the approach used by Lintner (1965)[11] and Douglas (1968)[12], who had tested the Capital Asset Pricing Model (CAPM) in the 1960s. The analysis was carried out through two stages of the regression process, namely first-pass regression and second-pass regression.

a) First–pass regression.
First-pass regression is used to obtain beta and residual variants from each security. The model used is similar to the model used by Lintner, namely:
$R_{it} = a_i + b_i*R_{mt} + e_{it}$
Where:
R_{it} = return of securities I in period t.
R_{mt} = market return in period t
a_i = intercept of the security return line I with the returned model.
b_i = systematic risk of a security i
e_{it} = residual of the regression line

b) Second–Pass Regression
Second, pass regression or also known as cross-sectional regression, is intended to see whether beta (b) of each security influences the expected return as predicted by the Capital Asset Pricing Model (CAPM). The formulation used is as follows.
$E(R_i) = a_1 + [a_2*b_i] + [a_3*\sigma^2 e_i] + e_i$
Where:
$E(R_i)$ = expected return securities- i
a_1 = interception of the regression line
a_2 = slope of the regression line
a_3 = coefficient of variance from the first regression
$\sigma^2 e_i$ = residual variants of the first regression

If the CAPM applies to the Indonesian Capital Market, then the estimation of the regression coefficient should meet the following conditions:

1) The value of a_1 will approach the average value of risk-free return assets (R_f).

2) The value of a_2 will approach the average market risk premium [$E(R_m) – R_f$)].

3) The value of a_3 will be zero.

2) The Second Testing Model

The second test model is performed using the basic Equity Asset Pricing Model (CAPM) where E(Ri)–Rf = [E(Rm)–Rf] * bi.

Where:
$E(R_i)–R_f$ = security risk premium.
$[E(R_m)–R_f]$ = market risk premium.
B_i = systematic risk of each security.

Then a regression is performed through the origin point between the security risk premium [E(Ri)–Rf] as the dependent variable with systematic securities (bi) as the independent variable, so a regression coefficient of β is obtained. If CAPM applies in the Indonesian Capital Market, the magnitude of the coefficient β should be the same as the average market risk premium or [E(Rm)–Rf].

3) Third Model Testing

The most basic thing of the CAPM is a statement about the relationship between the security risk premium of individual securities with systematic risk[6]. Jack Treynor, William Sharpe, and John Lintner around the 1960s formulated the CAPM as:

$E(R_i) – R_f = b_i*[E(R_m) – R_f]$
Also often written as:
$E(R_i) = R_f + b_i*[E(R_m) – R_f]$

Where:
$E(R_i)$ = expected return of securities- i.
$E(R_m)$ = expected return of the market.
R_f = risk-free return of assets.
B_i = systematic risk of securities i.

The formulation above says that the expected return of securities [E(Ri)] is equal to the rate of return on risk–free assets (R_f) plus risk premium [bi*(Rm–Rf)]. The greater the systematic risk of securities (b), the higher the expected risk premium of the security, thus the higher the expected return of securities. By entering the values of [E(Rm)–Rf] and b_i into the equation then adding the value of R_f, the predicted expected return value will be obtained. Then do a statistical comparison using the Paired Sample T-Test between the predicted expected return of the results of the CAPM or E(Ri) = Rf + bi * [E(Rm)–Rf] with the actual expected return or $E(R_i)=\frac{\sum R_i}{n}$. If the test results do not show statistically significant differences, then this indicates that the CAPM does not apply in the Indonesian Capital Market, because in theory, the expected return of the CAPM is the ideal expected return, which has calculated the amount of systematic risk of each security, whereas the actual expected return is the expected return which is not necessarily ideal, because it does not take into account the amount of systematic risk of each share, so that if the expected return of the CAPM results does not differ from the actual expected return, it means that the CAPM is unable to produce an ideal expected return.

III. RESULT AND DISCUSSION

From the results of monthly data collection for the period of 2015 to 2019, which includes interest rates on Bank Indonesia Certificates (SBI) and BI 7-day (Reverse) Repo Rate, monthly return of securities, and by using first-pass regression, an average value is obtained average expected market return, and beta securities presented in table no. 1 as follows.

Table 1. BI 7-Day Average (Reverse) Repo Rate, Expected Return Market, and Beta Securities during the period of 2015 to 2019

	Minimum	Maximum	Mean	Std. Deviation
BI 7-day Repo Rate	0.0035	0.0050	0.0042	0.0005
E(Rm)	-0.0619	0.0678	0.0053	0.0279
Beta	0.0300	3.6850	1.4849	0.8117

From table no. 1 is obtained an average of E(Rm) = 0.0053 and an average of R_f = 0.0042 to obtain an average market risk premium of [E(Rm)–Rf] = 0.0011. The average market risk premium is relatively very small because each beta addition of one percent will only get a risk premium of 0.0011 percent. Considering that the average beta is already quite high (1.4849), which is already higher than the Beta market (βm = 1), the market risk premium does not motivate investors to invest in risk assets, so investors prefer to invest in risk-free assets. . This is an oddity that occurs in the Indonesian Capital Market.

Furthermore, based on the second-pass regression equation $E(Ri) = a_1 + [a_2 * b_i] + [a_3 * \sigma^2 e_i] + e_i$, the results are presented in Table no 2 as follows.

Table 2. Second-Pass Regression Results in the First Model Testing

	Unstandardized Coefficients	Std. Error	t	Sig	Criteria	Results
Constant (a_1)	0.005	0.004	1.081	0.288	R_f = 0.0042	Too high
Beta (a_2)	-0.001	0.004	-0.305	0.763	$[E(R_m-R_f]$ = 0.0053	Too low and negative
VarRes (a_3)	-0.068	0.447	-0.152	0.880	= 0	Negatively marked, not significant.

Dependent Variable: E(Ri)

From the second-pass regression seen in table no 2 obtained:
1) Value a_1 = 0.005, this value is higher when compared with R_f = 0.004.
2) Value a_2 = –0.001 with a significance of 0.763 (not significant). This value is too low and is negative compared to [E(Rm)–Rf] = 0.0054.
3) Value a_3 = - 0.068 with a significance of 0.880, this value does not differ significantly from zero.

Because the value of a_2 = – 0.001 is not significant at α = 0.05, empirically, beta does not have a significant effect on expected return security. Thus the results of this test do not support the empirical validity that the Capital Asset Pricing Model (CAPM) applies to the Indonesian Capital Market.

The second test model is performed using the basic Equity Asset Pricing Model (CAPM) where E (Ri)–Rf = [E(Rm)–Rf] * bi. Then a regression is performed through the origin point between E(Ri)–Rf as the dependent variable and bi as the independent variable. The regression results through the origin are presented in Table 3 as follows.

Table 3: Regression Results Through the Origin Point between Risk Premium Security and Systematic Risk

		B	Std. Error	t	Sig.
1	Beta (β)	-0.001	0.001	-1.026	0.312

a. Dependent Variable: [E(Ri) - Rf]
b. Linear Regression through the Origin

From table No. 3, it is known that beta (β) does not significantly affect the security risk premium, and Beta (β) = –0.001 is smaller than the average market risk premium [E(Rm)–Rf] = 0.0053, so it can be concluded that, with using regression through the origin point, the results of this test do not support the empirical validity that the Capital Asset Pricing Model (CAPM) applies to the Indonesian Capital Market.

The third model was tested statistically using the Independent Sample t-Test between the actual expected return [E(Ri)] and the predicted expected return [E(Ri)] obtained from the Capital Asset Pricing Model (CAPM) equation. The results of this comparison are presented in table no. 4 as follows.

Table 4a. Results of Paired Sample t-Test between Predicted Expected Return [E (Ri)] and Actual Expected Return [E (Ri)].

		Mean	Std. Deviation	Std. Error Mean
Expected Return	Actual	0.0025	0.0117	0.0020
	Predicted	0.0059	0.0009	0.0002

Table 4b. Paired Samples Test

		Paired Differences		t	Sig. (2-Tailed)
		Mean	Std. Deviation		
Pair 1	Predicted Expected Return - Actual Expected Return	0.0034	0.0118	1.662	0.106

From table no 4, it is known that the mean of actual expected return is 0.0025, while the mean of predicted expected return is 0.0059, so there is a mean difference of 0.0034 with a significance of 0.106 (not significant). Because the predicted expected return of the CAPM results is the same or not different from the actual expected returns, it means that the CAPM is not able to produce an ideal expected return, so it can be concluded that the results of this test do not support the empirical validity that the Capital Asset Pricing Model (CAPM) applies to the Indonesian Capital Market.

The first test model, with second-pass regression, is presented in table no. 2; it can be seen that the value of the Constanta coefficient (a_1) = 0.005 with a significance of 0.288, meaning that it is not statistically different from zero. In fact, if the CAPM is valid, the Constanta coefficient (a_1) = 0.005 should be significantly different from zero, and the value is the same as Rf = 0.004.

The coefficient value of beta (a_2) = –0.001 has a significance of 0.763, meaning that it is statistically not different from zero. This shows that the systematic risk of securities does not significantly affect the expected return of securities. In fact, if the CAPM applies, the beta coefficient (a_2) should have a significance of less than 0.05 or significant so that it is significantly different from zero and the value is equal to [E(Rm)–Rf] = 0.0054. The empirical test results actually show that the beta coefficient (a_2) is negative,

meaning that the greater the systematic risk of securities, the lower the expected return of securities. This clearly shows that the CAPM does not apply to the Indonesian Capital Market.

Value of the residual variance coefficient (a_3) = –0.068 with a significance of 0.880, meaning that it does not differ significantly from zero. This result is in accordance with the theory. However, in general, it can be concluded that based on the results of testing with second-pass regression do not support the empirical validity that the CAPM applies in the Indonesian Capital Market. The results of this study support the results of research conducted by Fama and French (1992), who found that beta cannot explain cross-sectional differences in stock returns[13]. CAPM testing with second-pass regression proves that CAPM also does not apply in the Indonesian Capital Market [4].

The second test model, carried out using regression through the origin point between the securities risk premium [E(Ri)–Rf] as the dependent variable and systematic risk (bi) as the independent variable. Empirical results indicate that the systematic risk (b_i) regression coefficient is –0.001 with a significance of 0.312, meaning that systematic risk does not significantly affect securities risk premium [E(Ri)–Rf]. The

results of the second test model are in line with the results of the first test model, thereby strengthening the evidence that the CAPM does not apply in the Indonesian Capital Market

A third test model using Paired Sample t-Test between actual expected return [E(Ri)] with the predicted expected return [E(Ri)] obtained from the CAPM equation. Empirical test results showed that there is no significant difference between actual expected return and predicted expected return obtained from the CAPM equation. This is evident from table no. 4 that the magnitude of the mean difference = 0.0034 with a significance of 0.106, which means that the difference is not real.

In theory, the expected return obtained from the CAPM equation shows the ideal expected return, which corresponds to the systematic risk of each security, while the actual expected return does not yet reflect the ideal expected return because it does not take into account a linear relationship with a systematic risk of securities. Because the results of empirical testing prove that the actual expected return does not differ significantly from the predicted expected return obtained from the CAPM equation, it can be concluded that the CAPM does not apply in the Indonesian Capital Market. The results of this third testing model support the results of the first testing model and the results of the second testing model, so it can be concluded in general that the CAPM does not apply in the Indonesian Capital Market.

There are various reasons that allow the failure of empirical CAPM testing, which is caused by the assumptions of the application of CAPM that cannot be fulfilled in the Indonesian Capital Market, including: first, in Indonesia, there is a profit tax both for capital gains and for dividends; second, there are differences in interest rates on deposits and loans; third, no assets are truly risk-free; fourth, there is inflation in Indonesia; fifth, a short sale is not permitted; sixth, there is an empirical fact that the average market risk premium of [E (Rm)–Rf] = 0.0011 which is much smaller compared to the average level of risk-free asset rates of Rf = 0.0042 causes the beta to be negative, namely beta = –0.001, so that beta negatively influences the security risk premium, so that the CAPM does not apply to the Indonesian Capital Market.

IV. CONCLUSION

Based on the results of testing on empirical data using three test models that have been done, it can be concluded that the CAPM does not have empirical validity applicable in the Indonesian Capital Market. This is because there are several assumptions underlying the CAPM that are not fulfilled in the Indonesian Capital Market, including that in Indonesia, there is a profit tax for capital gains and dividends; there are differences in interest rates on deposits and loans; no assets are truly risk-free; inflation in Indonesia; short sale not permitted.

REFERENCES

[1] French, C. W., The Treynor Capital Asset Pricing Model. Journal of Investment Management.,1 (2003) 60-72.

[2] Jones, C. P. Investments Principles and Concepts. (11th ed. International Student Version. Asia: John Wiley & Sons, Inc., (2010).

[3] Ross, S., The Arbitrage Theory of Capital Asset Pricing, Journal of Economic Theory.,13 (1976).

[4] Simangunsong, Y. M. & Wirama, D. G., Pengujian Validitas Empiris Capital Asset Pricing Model Di Pasar Modal Indonesia, Jurnal Ilmiah Akuntansi dan Bisnis, 9 (2014) 57-64.

[5] Hartono, J. Teori Portofolio dan Analisis Investasi. (BPFE, (2010).

[6] Elton, Edwin J., M. Gruber, S. Brown, and W. G. Modern Portfolio Theory and Investment Analysis. (New York: John Wiley and Sons, (2003).

[7] Adcock, C.J. dan Clark, E. A. Beta Lives – Some Statistical Perspectives on the Capital Asset Pricing Model. European Journal of Finance., 5 (1999) 213-224.

[8] Black, Jensen, F. & Scholes, M. C. The Capital Asset Pricing Model: Some Empirical Tests. Studies in the Theory of Capital Markets (M. C. Jensen Edition, Praeger Publishers, (1972).

[9] Fama, E. F. dan MacBeth, J. D. Risk, Return and Equilibrium: Empirical Tests. Journal of Political Economy. 81 (1973) 607-636.

[10] Brave, A., Leavy, R. & Michaely, R. Using Expectations to Test Asset Pricing Models. Financial Management, 34(3) (2005) 5-37.

[11] Litner, J. The Valuation of Risk Assets and the Selection of Risky Investment in Stock Portfolio and Capital Budget. Review of Economics and Statistics, 47(1) 13-37 (1965).

[12] Douglas, G. W. Risk in the Equity Markets: An Empirical Appraisal of Market Efficiency. Ann Arbor, Michigan: University Microfilms, Inc. (168AD).

[13] Fama, E. F. & French, K. R. The Cross-Section of Expected Stock Returns. Journal of Finance, 47(2) (1992) 427-465.