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ASSET PRICING MODEL: EMPIRICAL STUDY IN INDONESIA'S CAPITAL MARKET

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Abstract

Asset pricing model have been researched since 1950 and revealed four models, namely the Capital Asset Pricing Model (CAPM), Arbitrage Pricing Theory (APT), Fama and French Three Factor Model (FF3FM) and Fama and French Five Factor Model (FF5FM). Testing the validity of this model has been carried out in recent years and the results are still debatable. The purpose of this study is to test the validity of the four models in the Indonesian Capital Market. The method used to test the validity of the model are F test, t test and paired different test. The validity of model when it fulfills several criteria such as the value of the intercept is equal to 0 and is not significant, the independent variable significantly and consistently influences to dependent variable both through the F test and t test. The results showed that the CAPM Model is a valid model in terms of explaining the relationship of risk and return in the Indonesian Capital Market, meanwhile The APT, FF3FM and FF5FM models are invalid models. The CAPM model is still superior compared to other models

Keywords: Risk and return, CAPM, APT, FF3FM, FF5FM

INTRODUCTION

The capital market is a market that is available to facilitate market players to trade financial instruments, one of which is stock. Investing in stock does not always get return because there is a risk that must be compensated by investors because stock returns are not match with

expectations (expected return). The relationship between risk and stock return is explained in the *Asset Pricing Model* theory. Early research on the Asset Pricing Model began with the emergence of *Capital Asset Pricing Model* (CAPM) Sharpe (1964). CAPM is an asset pricing model that explains beta (as a measure of asset sensitivity to systematic risk) that can influence the return of an asset, or known as a single factor model (Nyangara *et al*., 2016). In 1976, Stephen Ross introduced a model called *Arbitrage Pricing Theory* (APT). This model found that, stock returns can not only be explained by systematic risk (beta), but also able to be explained by macroeconomic variables (Kisman and Restiyanita, 2015). The next model is the *Fama and French Three Factor Model* (FF3FM) is a development of the CAPM model by adding two new variables namely, market capitalization / size (SMB) and book to market ratio (HML) (Fama and French, 1993). In 2015, the FF3FM model was developed into the Fama and French Five Factor Model (FF5FM) by adding two additional variables namely profitability (RMW) and investment (CMA) (Fama and French, 2015).

Empirical research of the four models have been conducted in the last five years. Research conducted by Bajpai and Sharma (2015) found that CAPM was valid to explain stock returns in the Indian Capital Market in 2004 - 2013, while research conducted by Chaudhary (2016) found that CAPM was not valid to explain stock returns in the Indian and USA capital markets in the period 2001-2015. Kisman and Restiyanita (2015) found that CAPM and APT are valid to explain the stock returns in the Indonesian capital market in 2008 – 2010 significantly. The fundamental difference from APT and CAPM is CAPM uses the concept of a single factor model (using only one factor, namely the market risk premium) while APT developed a CAPM model that called it a multifactor model, because many macroeconomic factors affect stock returns. Research conducted by French (2017) found that, macroeconomic variables such as industrial production and risk premium have a significant influence on stock returns on the US capital market and 5 ASEAN countries, exceptions to Indonesia and Malaysia. The advantage of APT over CAPM is that it uses multi-factors which are ignored by CAPM. The APT model illustrates the actual state of reality compared to CAPM, this is confirmed in research conducted by Kisman and Restiyanita (2015) who found that the APT model is better than the CAPM because it has a coefficient of determination (R2) which is better than the CAPM. Research conducted by Karp and Vuuren (2017), found that FF3FM was unable to explain stock returns on the South African capital market. Balakrishnan et al. (2018) conducted a research on the FF3FM and FF5FM models in the Indian capital market with the research period 1999 - 2015. The results found that the FF3FM model was able to explain portfolio returns, but the FF5FM model was also able to explain portfolio returns and more complete than FF3FM because there were two additional factors are investment and profitability. Acaravci and Karaomer (2017)

found that FF5FM was able to explain stock returns on the Turkish capital market, this contradicts with research conducted by Kubota and Takehara (2018) that revealed FF5FM was unable to explain stock returns in the Japanese capital market, due to two additional factors namely profitability and investment no significant effect on stock returns.

The results showed that the four asset pricing models were still in terms of being debated for their validity, so this research was very important to be carried out related to testing the validity of the four models and the comparison between the four models. This research was conducted in the Indonesian Capital Market due to the limitations of comprehensive asset pricing model research in countries with developing economies (emerging markets) such as Indonesia. This research is focused on KOMPAS100 index in the Indonesia Stock Exchange, because this index have high liquidity and large market capitalization and are supported by good financial fundamentals. The KOMPAS100 index was chosen because it is related to one of the asset pricing model assumptions that securities must have high liquidity.

LITERATURE REVIEW

CAPM

The basis for forming the CAPM model is to use the *mean-variance-efficient* concept introduced by Harry Markowitz, meaning that investors choose the portfolio that has the highest expected return of all portfolios with the same level of risk or portfolios that have a low level of risk of the entire portfolio with a level of return the same (Fama and French, 2004). CAPM is a model that explains that beta variables (as a measure of security sensitivity to systematic risk or market risk) are able to predict the return of a security, which is usually called a single factor model (Nyangara *et al*., 2016).

Research related to the validity of the CAPM model has been conducted over the past five years. Bajpai and Sharma (2015) and Lee *et al*. (2016) found that the CAPM model is valid, this is different from research conducted by Chaudhary (2016) and Nyangara *et al*., (2016) found that the CAPM model is invalid. The hypotheses in CAPM testing are:

H1: The CAPM model is valid in terms of explaining the relationship of risk and return of securities in the Indonesia Capital Market.

APT

The fundamental difference from APT and CAPM is that CAPM uses the concept of a single factor model (using only one factor, namely market premium) while APT develops a CAPM model that calls it a multifactor model, because many macroeconomic factors affect stock returns (Bodie *et al.*, 2014). The advantage of APT compared to CAPM is that APT uses multi-

factors which are ignored by CAPM, so these multi-factors illustrate the actual state of reality (Bodie *et al*., 2014). The limitation in the APT model is that it does not explain specifically which macroeconomic variables are included in calculation of this model and how many economic variables are used (Bodie *et a*l., 2014). Based on the results of previous empirical studies, in this study the authors use four macroeconomic variables (inflation, interest rate, foreign exchange rate and economic growth) as factors which affects stock returns for the purpose of testing the model APT (Amtiran *et al*., 2017).

Research on the validity of the APT model has been carried out over the past five years. Kisman and Restiyanita (2017) find that the APT model is valid, this is different from research conducted by Amtiran *et al*. (2017) found that the APT model is invalid. The hypotheses in testing the APT model are:

H2: The APT model is valid in terms of explaining the relationship of risk and return of securities in the Indonesia Capital Market.

FF3FM

The FF3FM model appears to answer the weaknesses of the CAPM model, namely there are other factors (multi-factors) besides stock beta that affect stock returns (Fama and French, 1993). FF3FM is a development of the CAPM model by adding two new variables namely, market capitalization / size (SMB) and book to market ratio (HML). Fama and French have argued that small scale companies (market capitalization) have greater risks than large scale businesses so that the company's shares will produce a greater return than large-scale companies (Fama and French, 1993). The book to market ratio (B / M) variable is measured by the book value of equity (BVE) divided by the market value of equity (MVE). If the MVE value is higher than the BVE, it indicates that investors are optimistic about the company's future. While the value of BVE is higher than that of MVE, it indicates that investors are pessimistic about the company's future and this is a risk that the company may experience financial distress due to a decline in the company's value. In other words, companies that have high B / M tend to be more risky, so the company's shares will produce a greater return than companies that have a low B / M value (Fama and French, 1993).

Research on the validity of the FF3FM model has been carried out over the past five years. Chaudhary (2017) and Boamah (2015) found that the FF3FM model was valid, this was different from the research conducted by Chandra (2015) and Sreeenu (2016) found that the FF3FM model was invalid. Therefore the hypotheses in testing the FF3FM model were:

H3: The FF3FM model is valid in terms of explaining the relationship of risk and return on securities in the Indonesia Capital Market.

FF5FM

FF5FM is a development of the FF3FM model. Fama and French (2015) add two additional factors, namely profitability and investment. The FF5FM theory is based on the dividend discount model theory (Fama and French, 2015). This theory states that a company that has a high B / M value will have a high expected return, a company that has a high profitability value will have a high return value and a company that has a high growth value of current book equity has a low return value (Fama and French, 2015). FF5FM is able to explain better in terms of predicting stock returns compared to FF3FM, in other words the additional two factors in FF5FM strengthen the existing FF3FM model (Fama and French, 2015).

Research on the validity of the FF5FM model has been carried out for the past five years. Acaravci1 and Karaomer (2017) and Chiah (2016) found that the FF5FM model was valid, this was different from the research conducted by Jiao and Lilti (2017) and Kubota and Takehara (2018) found that the FF5FM model was invalid. Therefore the hypothesis in FF5FM model testing is:

H4: The FF5FM model is valid in terms of explaining the relationship of risk and return on securities in the Indonesia Capital Market.

RESEARCH METHODOLOGY

The population in this study is all public companies included in the KOMPAS100 index on the Indonesia Stock Exchange in 2014-2018 who are the subjects in this study.

This study does use a purposive sampling method, uses several criteria to make a selection of elements of the population in order to achieve the objectives of this study. The criteria for selecting the population element is that public companies must be listed in the KOMPAS100 index for 5 consecutive years (2014-2018) and public companies do not do a stock split in 5 consecutive years (2014-2018).

The validity of each model was tested by using regression analysis. A valid model must meet several criteria, namely the intercept value must be equal to 0 and not significant and the independent variable must have a significant effect both simultaneously and partially.

RESULTS AND DISCUSSION

Portfolio Construction

This study uses a research sample of 51 stocks which are divided into five portfolios. The formation of a portfolio based on the value of size, B / M, investment and profitability of each security. Each security is sorted by size, B / M, investment and profitability from the largest to

the smallest. The formation of a portfolio based on the company's financial fundamentals is intended to divide the research sample into three categories namely big, medium and small.

Classical Assumption Test

The purpose of making a regression model is to estimate parameters. The multiple linear regression model can be called a good model if it meets the BLUE (Best Linear Unlock Estimator) criteria (Ghozali, 2012). BLUE can be achieved if it has fulfilled the classical assumptions, namely multicollinearity test, autocorrelation, heteroscedasticity test and normality test. The test results show that the CAPM, APT, FF3FM and FF5M models pass the classic assumption test.

CAPM Validity Test

Validation of the CAPM is carried out on all five portfolios. The CAPM model valid when the validity testing meet the criteria and consistently valid in each portfolio. The Regression equation of CAPM is described as below.

$[E(R_p) – R_f] = \alpha_p + \beta_p . [E(R_m) - R_f] + e$

The following will describe the results of the CAPM model testing analysis in each portfolio:

Table 1 Test Results for CAPM Model Validity

Portfolio	CAPM				
	Intercept	sig intercept	β (Beta)	sig beta	Rsquare
A	0.003	0.389	0.993	0.000	67.10%
B	-0.003	0.529	0.996	0.000	69.60%
C	0.003	0.577	0.996	0.000	66.30%
D	-0.001	0.874	1.004	0.000	47.30%
E	-0.006	0.351	0.997	0.000	35.40%

The results of data analysis through linear regression of the five portfolios indicate that the value of the beta coefficient of the stock is significantly positive with an error rate of 5%. The value of the alpha (intercept) is equal to 0 and not significant. This proves that the CAPM model is consistently valid in testing the five portfolios. The results of this study are in accordance with the theory explained by Sharpe (1964) and supported by research by Bajpai and Sharma (2015) and Lee *et al*. (2016) which states that CAPM is a model that explains that beta variables (as a measure of security sensitivity to systematic risk or market risk) are able to predict the return of

the securities. The novelty in this research is the CAPM is valid each portfolio category (small, medium and big) that previous study not yet captured this.

APT Validity Test

APT validity testing is carried out on all five portfolios. The APT model is valid when the the validity testing meet the criteria and consistently valid in each portfolio. Regression equation of APT is described as below.

$R_{it} = \alpha + \beta_1 GDP_{it} + \beta_2 INF_{it} + \beta_3 IR_{it} + \beta_4 EXRATE_{it} + e$

The following will describe the results of the analysis of the APT model testing in each portfolio.

Table 2 APT Model Validity Test Results - Test F and R^2

Portfolio	APT		
	F value	sig uji F	Rsquare
A	0.687	0.604	4.80%
B	0.608	0.658	4.20%
C	0.596	0.667	4.20%
D	1.493	0.217	9.80%
E	1.316	0.276	8.70%

Table 3 APT Model Validity Test Results - Test t

Variable	Portfolio A		Portfolio B		Portfolio C	
	β (beta)	sig beta	β (beta)	sig beta	beta	sig beta
Intercept	0.017	0.144	0.006	0.673	0.018	0.201
Inflation	0.644	0.606	0.869	0.428	0.570	0.668
Interest Rate	-0.610	0.957	1.033	0.337	1.206	0.758
Forex	0.461	0.793	-8.515	0.771	-15.463	0.798
GDP	0.881	0.204	0.798	0.481	1.000	0.195
Variable	**Portfolio D**		**Portfolio E**			
	β (beta)	sig beta	β (beta)	sig beta		
Intercept	0.009	0.531	0.009	0.508		
Inflation	0.842	0.177	0.702	0.453		
Interest Rate	0.642	0.755	0.511	0.808		
Forex	0.663	0.496	0.616	0.497		
GDP	0.725	0.199	0.815	0.123		

The results of data analysis through linear regression from the five portfolios show that the coefficient values of all independent variables (risk factor) of the APT model do not significantly influence the independent variable (return) either through the F test and t test. The alpha value (intercept) is equal to 0 and not significant This proves that the APT model is not consistently valid in testing the five portfolios. The results of this study are supported by previous research which states that the variable GDP, interest rate, foreign exchange rate and inflation have no significant effect on stock returns (Tursoy *et al.*, 2008; Amtiran *et al*., 2017). The results of this study refute the APT theory which states that macroeconomic variables as a proxy of systematic risk are able to influence stock returns specifically for inflation, GDP, interest rate and foreign exchange rates.

FF3FM Validity Test

Validation of FF3FM was conducted on all five portfolios. The FF3FM model is valid when the validity testing meet the criteria and consistently valid in each portfolio. Regression equation of FF3FM is described as below.

$R_i - R_f = \alpha + \beta_1 (R_m - R_f) + \beta_2 SMB + \beta_3 HML + e$

The following will describe the results of the FF3FM model testing analysis in each portfolio.

Table 4 Test Results for FF3FM Model Validity - Test F and R2

Portfolio	FF3FM		
	F value	sig uji F	Rsquare
A	104.488	0.000	84.80%
B	75.174	0.000	80.10%
C	51.954	0.000	73.60%
D	20.613	0.000	52.50%
E	77.102	0.000	80.50%

Table 5 Test Results for FF3FM Model Validity - t Test

Variable	Portfolio A		Portfolio B		Portfolio C	
	β (beta)	sig beta	β (beta)	sig beta	β (beta)	sig beta
Intercept	0.004	0.109	-0.004	0.243	-0.002	0.686
MKT	0.780	0.000	0.984	0.000	0.831	0.000
SMB	0.602	0.000	1.107	0.004	0.486	0.000
HML	0.191	0.256	0.676	0.000	0.505	0.614

Variable	Portfolio D		Portfolio E	
	β (beta)	sig beta	β (beta)	sig beta
Intercept	0.000	0.991	0.000	0.905
MKT	0.896	0.000	0.491	0.000
SMB	0.324	0.798	0.834	0.000
HML	0.556	0.017	0.747	0.000

The results of data analysis through linear regression from the five portfolios show that the coefficient values of all the independent variables (risk factors) of the FF3FM model have a significant effect on the independent variables (return) through the F test. The alpha value (intercept) is equal to 0 and not significant. Whereas for the t test SMB and HML independent variables are not consistently have a significant effect on the excess return variable. This proves that the FF3FM model is not consistently valid in testing the five portfolios. The results of this study are supported by previous research which states that the SMB and HML variables have no significant effect on excess returns (Gabriel, 2014; Karp and Vuuren, 2017). The results of this study refute the FF3FM theory which states that the SMB and HML variables are able to influence stock returns.

Test Validity of FF5FM

Validation of FF5FM was conducted on all five portfolios. The FF5FM model is said to be valid when the FF5FM validity is valid and consistent in each portfolio. Regression equation of FF5FM is described as below.

$R_i - R_f = \alpha + \beta_1 (R_m - R_f) + \beta_2 SMB + \beta_3 HML + \beta_4 RMW + \beta_5 CMA + e$

The following will describe the results of the FF5FM model testing analysis in each portfolio.

Table 6 Test Results for FF5FM Model Validity - Test F and R^2

Portfolio	FF5FM		
	F value	sig uji F	Rsquare
A	69.800	0.000	86.60%
B	68.063	0.000	86.30%
C	32.586	0.000	75.10%
D	15.367	0.000	58.70%
E	45.234	0.000	80.70%

Table 7 Test Results for FF5FM Model Validity - t Test

Variable	Portfolio A		Portoflio B		Portoflio C	
	β (beta)	sig beta	β (beta)	sig beta	β (beta)	sig beta
Intercept	0.004	0.117	-0.002	0.450	-0.002	0.603
MKT	0.800	0.000	0.937	0.000	0.828	0.000
SMB	0.659	0.000	1.231	0.000	0.535	0.000
HML	0.624	0.069	1.013	0.004	0.290	0.870
CMA	4.292	0.002	0.523	0.013	0.054	0.940
RMW	-0.335	0.251	-0.938	0.062	-0.958	0.478
Variabel	**Portoflio D**			**Portoflio E**		
	β (beta)	sig beta		β (beta)	sig beta	
Intercept	0.001	0.901		-0.001	0.871	
MKT	0.896	0.000		0.512	0.000	
SMB	0.490	0.481		0.758	0.000	
HML	0.665	0.005		0.840	0.001	
CMA	1.694	0.009		0.593	0.188	
RMW	1.185	0.818		0.299	0.101	

The results of data analysis through linear regression from the five portfolios show that the coefficient values of all the independent variables (risk factors) of the FF5FM model have a significant effect on the independent variables (return) through the F test. The alpha value (intercept) is equal to 0 and not significant. Whereas for the t test, SMB; HML; CMA and RMW are not consistent to influence the excess return variable. This proves that the FF5FM model is not consistently valid in testing the five portfolios. The results of this study are supported by previous research which states that the SMB, HML, CMA and RMW variables have no significant effect on excess returns (Gabriel, 2014; Karp and Vuuren, 2017; Kubo and Takehara, 2018). The results of this study refute the FF5FM theory which states that the SMB, HML, CMA and RMW variables are able to influence stock returns.

Comparison among The Models

Testing the validity of the asset pricing model must meet several conditions indicators, such as the intercept value must be 0 and not significant and the independent variable (risk factor) must have a significant effect on stock return both simultaneously and partially. Only the CAPM model is valid because it meets all the valid criteria for a model. While the APT, FF3FM and FF5FM models are invalid because they do not meet several criteria. The APT model did not pass the F test and t test because all independent variables did not significantly influence the

dependent variable even though the intercept value of this model was 0. The APT model did not pass the F test and the t test was supported with a relatively low R^2 value below 10%. FF3FM and FF5FM models pass the F test. This indicates that the model can be used to explain stock returns or independent variables in this model have a significant effect on the dependent variable simultaneously. This is supported by high R^2 values above 50%. One of the criteria that makes the FF3FM and FF5FM models invalid is that the independent variables SMB, HML, CMA and RMW do not consistently affect the dependent variable significantly. This indicates that the SMB, HML, CMA and RMW variables are doubtful contributing to the variable excess return.

The accuracy of a model to predict returns is also tested in this study. Testing the ability of the model to predict returns is done for the CAPM. FF3FM and FF5FM models. The CAPM model is a valid model because it meets all the test criteria. The FF3FM and FF5FM models pass the F test and the high R^2 value exceeds the CAPM R^2 value even though the SMB, HML, CMA and RMW variables are doubtful contributing to the variable excess return due to inconsistency problems. The test results show that the CAPM model is able to predict actual returns well as shown in the table below that the difference between the average actual return and predictive return has the lowest variance difference when compared with FF3FM and FF5FM.

Table 8 Comparison Among The Models - Return Prediction Ability

Portfolio	**CAPM**		**FF3FM**		**FF5FM**	
	Actual Return	*Predictive Return*	*Actual Return*	*Predictive Return*	*Actual Return*	*Predictive Return*
A	0.566%	-0.148%	0.566%	-0.373%	0.566%	-0.691%
B	-0.037%	-0.267%	-0.037%	-0.047%	-0.037%	0.167%
C	0.166%	-0.317%	0.166%	1.674%	0.166%	3.249%
D	-0.587%	-0.223%	-0.587%	-0.517%	-0.587%	-0.483%
E	-0.735%	-0.107%	-0.735%	-0.659%	-0.735%	-0.232%
Average	**-0.125%**	**-0.212%**	**-0.125%**	**0.016%**	**-0.125%**	**0.402%**
Selisih	**0.087%**		**-0.141%**		**-0.527%**	

The ability of the CAPM model to predict actual returns is also well tested through statistical testing of the Different Test (*Levene Test*). The following will be presented the results of testing the difference test statistics (*Levene Test*).

Table 9 *Levene Test* Results

Portfolio	CAPM
	Sig *Levene Test*
A	0.143
B	0.245
C	0.598
D	0.360
E	0.497

The test results show that the CAPM model is able to predict actual returns well. This is shown that the average difference between actual return and predictive return there is no statistical difference with an error of 5%. Because the significance value is greater than 0.05 (5%).

The results prove that investors' decisions are still based on security sensitivity to market returns compared to other variables such as macroeconomic variables, size, B / M, investment and profitability. This is indicated by the beta coefficient value of each portfolio close to 1, which means portfolio sensitivity it is perfectly close to market risk. The invalidity of the other three models indicates that investors in the Indonesia Capital Market still rely on the phenomenon of market risk as the basis for decision makers. Market risk is a reflection of systematic risk that is more effective and efficient in explaining stock returns than macroeconomic variables. The results of this study refute the argument which states that macroeconomic variables are multi-factors that are more real than market risk. Meanwhile. the fundamental variables have not been able to contribute to portfolio return. If it is related to the condition of the capital market in Indonesia, which is still developing. It is reflected that the investment decisions of investors are still very simple, which still relying on one factor that is market risk. Because market risk includes all information available in the Indonesia capital market.

CONCLUSIONS AND SUGGESTIONS

The purpose of this study is to test the validity of the CAPM, APT, FF3FM and FF5FM models in the Indonesian Capital Market in the 2014-2018 periods. The results showed that:

a. The CAPM model is a valid model in terms of explaining the relationship of risk and return in the Indonesia Capital Market.
b. The APT model is an invalid model in terms of explaining the relationship of risk and return in the Indonesia Capital Market.
c. The FF3FM model is an invalid model in terms of explaining the relationship of risk and return in the Indonesia Capital Market.

d. The FF5FM model is an invalid model in terms of explaining the relationship of risk and return in the Indonesia Capital Market.

The CAPM model is still superior compared to the APT, FF3FM and FF5FM models. This indicates that the variation of securities returns in the Indonesia Capital Market is still strongly explained by variations in market risk that reflect systematic risk.

Suggestions for investors (practical) is to better to use CAPM model as a basis for investment decisions because the CAPM model is still superior compared to other models. Suggestions for further research (empirical) related to asset pricing models shall include variables such as information, liquidity and other macroeconomic variables to find a better asset pricing model.

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