Does The 6-Factor Model Work Better in The Indonesian Capital Market

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Abstract. Researchers have made various efforts to discover the best relationship between systematic risk and portfolio returns, and one of these efforts is the Fama and French model. This research aimed to examine whether the latest version, the Fama and French 6-factor model, can outperform the previous version, the Fama and French 5-factor model, using the Kompas 100 Index as a proxy. The method used is a two-stage multiple regression with portfolio formation based on SMB, HML, RMW, CMA, and UMD criteria. The research results indicate that the Fama and French 6-factor model has not yet been able to outperform the Fama and French 5-factor model with the 2x3 portfolio construction. However, it can outperform the Fama and French 5-factor model with the 2x2 portfolio construction because adding one risk factor reduces the variation in risk concerning the variation in portfolio returns formed.

Keywords: *Excess Return, Market Risk Premium*

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1 Introduction

In investment, investors naturally create a stock portfolio with the primary objective of minimizing risk. This is because the capital market poses substantial risks (Sudiyatno & Irsyad, 2011). The decision to invest depends on the investor's profit expectations and risk tolerance, which are influenced by various factors (Acaravci & Karaomer, 2017). As a result, numerous researchers are diligently working to establish a model that links the expected returns on financial asset investments to the associated risks. Utilizing models is imperative for evaluating stock prices and aiding investors in making effective investment decisions. Modern portfolio theory, pioneered by Harry Markowitz in 1952, was a groundbreaking development in this field. Subsequently, the Capital Asset Pricing Model (CAPM) was introduced by Sharpe (1964), Lintner (1965) and Mossin (1966) to explain the relationship between systematic risk and the expected return demanded by investors, primarily represented by market risk (Yuki & Siyami, 2022). CAPM assesses risk through market beta, while non-systematic risk can be mitigated through diversification (Komara & Yulianti, 2019).

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After CAPM was introduced, it became a focal point for many researchers. Empirical studies conducted by researchers like Banz (1981), Roll (1981), Basu (1983), and Rosenberg & Reid (1985) highlighted the limitations of CAPM in explaining stock returns despite its widespread academic and empirical usage. CAPM relies solely on market beta to determine asset returns, overlooking other factors influencing returns. Consequently, researchers have strived to develop more advanced asset pricing models that offer superior, precise, and comprehensive insights. Over time, researchers conducted various tests to refine the CAPM model. Fama and French introduced the Fama and French 3 Factor Model, which combined CAPM and APT elements (Fama & French, 1992; Fama & French, 1993; Fama & French, 1996). They demonstrated that stock beta alone could not explain stock returns, whereas size and book-to-market ratio were effective (Sutrisno, 2016). After extensive experimentation, it was concluded that the Three Factor Model better explained variations in security returns compared to CAPM. Fama and French did not stop at the Three Factor Model; in 2012, they introduced the Fama-French Four Model (FF4F), which incorporated momentum factors. In 2014, they further extended their research to create the Fama-French Five-Factor Model (FF5F), incorporating FF3F and two mimicking factors related to profitability and investment. Tests showed that FF5F outperformed FF3F in explaining stock returns (Fama & French, 2015). Subsequently, researchers worldwide adopted FF5F, including studies in Pakistan (Zada et al., 2018), Brazil (Martins & Jr., 2015), Vietnam (Nguyen, 2015), and Australia (Heaney et al., 2016), all finding that FF5F provided better insights into average stock returns. Subsequently, researchers in the field of finance have extensively explored the Fama-French Five Factor Model (FF5F) in various geographical regions. For instance, (Zada et al., 2018) examined FF5F from 2004 to 2014 for Pakistan, Martins & Jr. (2015) scrutinized FF5F from 2002 to 2014 for Brazil, and (Nguyen, 2015) assessed FF5F from 2008 to 2015 for Vietnam. Their collective findings generally favoured FF5F over FF3F in explaining the average returns of stocks. Novy-Marx (2013) also conducted research, concluding that the Fama and French Five Factors Model provides a superior explanation of excess returns on stock portfolios in Indonesia compared to the Fama and French Three Factors Model.

In contrast, Kubota and Takehara (2018) found that the FF five-factor model performed poorly in asset returns, with RMW profitability and CMA investment factors lacking statistical significance in GMM testing with Hansen-Jagannathan measurements. Before Fama and French embarked on their research journey, Carhart (1997) enhanced the Fama & French Four Factor model by introducing momentum as an additional factor. Initially introduced by Jegadeesh & Titman (1993), this momentum factor observed that stocks with positive momentum tended to continue performing well. Carhart believed that incorporating momentum helped reduce pricing errors in portfolio returns. Research (Candika, 2017) affirmed the strength of Carhart's Four Factor Excess Return model in influencing excess returns on Indonesian stocks, aiding in stock price assessment. The evolution of the Fama-French model continued with the refinement from the Four Factor Model (FF4F) to the Fama-French Five Factor Model (FF5F) in 2015. This

upgrade incorporated two new variables, probability and investment, driven by the dividend discount model and earlier empirical evidence suggesting their impact on asset returns (Fama & French, 2018). FF5F was shown to better explain the excess returns of stock portfolios in Indonesia compared to the Three Factors Model (FF3F).
Recognizing the need for more comprehensive models to gauge investment returns, researchers explored momentum factors. The Six Factor Fama and French Model (FF6F) emerged as an alternative to capture increasingly representative rates of return. Researchers like (Novak, 2021) tested FF6F for the German market, covering data from 1982 to 2021. Their analysis generally found FF6F to outperform FF5F in explaining average stock returns. Similar research in Indonesia (Munawaroh & Sunarsih, 2017) supported that FF6F provides a better explanation of excess returns on stock portfolios than FF5F. In summary, the Fama-French model has evolved, with FF5F and FF6F gaining prominence in explaining investment returns and portfolio performance alongside the traditional FF3F model.

THEORETICAL FOUNDATION

Development of Fama and French Model (5 Factor Model)

The Fama and French Three Factor Model (FF3FM) introduces systematic factors beyond the Capital Asset Pricing Model (CAPM) by incorporating the size of a company and the ratio of book value to market value, in addition to the market index value. These factors are considered proxies for systematic risk exposures not accounted for by CAPM's beta. Fama and French construct portfolios to track company size and book-to-market (B/M) ratios. They categorize companies based on market capitalization, dividing them into small (S) and large (B) groups. The small group (S) comprises companies with market capitalization below the median, while the large group (B) includes those above the median.

Furthermore, each year, companies are sorted into three groups based on their B/M ratios: 33.33% are categorized as having a low B/M ratio (Group L = Low), 33.33% as having a medium ratio (Group M = Medium), and 33.33% as having a high ratio (Group H = High). A high B/M ratio indicates that a company has good value if sold at a low book value. The intersection of these two size groups (S and B) and three value groups (L, M, and H) results in six distinct groups of companies (S/L, S/M, S/H, B/L, B/M, B/H). These groupings are formed annually throughout the observed period, resulting in a time series of 6 monthly returns spanning from 1929 to 1977. Annually, the size premium, denoted as SMB (Small Minus Big), is determined by calculating the difference in returns between small and large companies. This calculation involves forming two portfolios: one comprising long positions in three small companies and the other with long positions in three large companies. The returns from these portfolios are then compared, and the difference in returns represents the SMB factor. Notably, the returns from the portfolios of small and large companies are weighted equally, meaning that each company within these portfolios contributes equally to the calculation of the size premium. The formula is:

$SMB = \frac{1}{3}$ (S/L+S/M+S/H)-(B/L+B/M+B/H) $\frac{1}{3}$

In this case, the monthly return of the market portfolio is calculated concerning all stocks listed on the NYSE, AMEX and Nasdaq. Risk-free interest rates are monthly *T-bills*. So the equation of the 3-factor asset pricing model (Fama & French, 2004) is as follows:

$$E(r_i) - r_f = a_i + b_i\left[E(r_M) - r_f\right] + s_i E(SMB) + h_i(HML)$$

In this case, the coefficient represents the loading factor ($b_i s_i h_i$*Loading Factor*) of the three relevant factors. According to the APT intercept, it should be zero because a portfolio with a beta factor of zero on these three factors will have an expected return of zero. This equation was estimated in the first stage regression for 816 months from 1926 to 1997 using the following partial regression equation model: *ai.*

$E(r_i) - r_f = a_i + b_i\left[r_M - r_f\right] + s_i E(SMB) + h_i(HML) + e_i$

Thus, we conclude that small companies with a high book value to market value ratio have significantly higher returns. Furthermore, SMB and HML are positive, where portfolios of small companies (S) and value companies (H) will earn significantly higher average returns.

The Robust Minus Weak (RMW) is one of the new variables out of two additional variables in the Five Factor Model by Fama-French. The RMW variable is closely related to a company's profitability factor. Profitability refers to a company's ability to generate profits at a certain level of sales, assets, and shareholder equity. Three ratios are commonly discussed: profit margin, return on assets (ROA), and return on equity (ROE). According to Hou et al. (2014) and Chiah et al. (2015), profitability in the Five Factor Model is proxied by ROE. Companies with high ROE values will fall into the robust category, while companies with low ROE values will fall into the weak category.

The following new variable in the Five Factor Model by Fama-French is Conservative Minus Aggressive (CMA), which is related to the investment factor. CMA represents the difference between a company's stock return with conservative investments and its stock return with aggressive investments. Based on Gray and Johnson (2011) and Chiah et al. (2015), the investment variable in the Fama-French Five Factor Model can be proxied by asset growth (AG). Therefore, companies with high AG values will fall into the aggressive category, while companies with low AG values will fall into the conservative category. Gray and Johnson (2011) explained in their research that asset growth (AG) is a strong predictor of abnormal returns in the future. Asset growth maintains forecasting ability even for large-cap stocks.

Development of Fama and French Model (6 Factor Model)

Fama and French introduced the *Six Factors Model* by adding a momentum variable or UMD (*Up Minus Down*). Momentum is also a phenomenon of stock movement where past stock prices influence the current stock price. This theory is in line with the theory of market efficiency in weak form (Ross *et al*., 2015).

Fama and French (2018) note that adding these six factors will result in much better accuracy than the *Five Factors Model.* Factors considered in the *Six Factors Model* are market excess return, size or SMB (*Small Minus Big), book-to-market* or HML (High

Minus Low) and adding profitability or RMW (Robust Minus Weak), *Investment* or CMA (*Conservative Minus Aggressive).*

Here is the *Six Factor* formula (Fama and French, 2018):

$$E\left(\frac{Rs}{p}\right) = R_r + \beta_m MKt + \beta_s SMB + \beta_R RMW + \beta_C CMA + \beta_u UMD + e$$

2 Method

The population of this study is all stocks listed in the Kompas 100 Index for the 2017-2021 period. So, the population is calculated as a whole during the period, not just 100 shares. Forty-six stocks have entered or are still part of the Kompas 100 Index from the 2017-2021 period.

In this study, the objects sampled were companies listed on the Kompas 100 Index. The technique used in determining the sample in this study is purposive sampling, a sample determination technique with certain considerations.

The criteria used in this study are:

1. Companies listed on the Kompas 100 Index during the period 2017-2021.
2. Inconsistent companies are included in the Kompas 100 Index during the 2017-2021.

Portofolios Formation Small Minus Big (SMB):

Table 1
Portfolio Group Information based on size-ME portfolio.

Sort 2x3 sort on	***Breakpoints***	**Faktor dan Komponen**
Size-BE/ME	30%, 40%, 30%	$SMB_{BE/ME}$ = (SL+SM+SH)/3-(BL+BM+BH)/3
Size-Op	30%, 40%, 30%	SMB_{Op} = (SR+SM+SW)/3-(BR+BM+BW)/3
Size-Invs	30%, 40%, 30%	SMB_{Invs} = (SC+SM+SA)/3-(BC+BM+BA)/3
SMB	-	SMB = $SMB_{BE/ME+}$ SMB_{Op+} SMB_{Invs}
Sort 2x2 sort on	***Breakpoints***	**Factors and Components**
Size-BE/ME	50%, 50%	SMB = (SH+SL+SR+SW+SC+SA)/6-(BH+BL+BR+BW+BC+BA)/6

Formation of High Minus Low (HML) Portfolio

Table 2
Portfolio Group Information based on size-BE/ME Portfolio

Sort 2x3 sort on	**Break-points**	**Factors and Compo-nents**
HML	30%, 40%, 30%	HML=(SH+BH)/2-(SL+BL)/2
Sort 2x2 sort on	**Break-points**	**Factors and Compo-nents**
HML	50%, 50%	HML=(SH+BH)/2-(SL+BL)/2

Portfolio Formation Robust Minus Weak (RMW):

Table 3
Portfolio Group Information based on Portfolio size-Profitability.

Sort 2x3 sort on	**Break-points**	**Factors and Com-ponents**
RMW	30%, 40%, 30%	RMW=(SR+BR)/2-(SW+BW)/2
Sort 2x2 sort on	**Break-points**	**Factors and Com-ponents**
RMW	50%, 50%	RMW=(SR+BR)/2-(SW+BW)/2

Portfolio Formation Conservative Minus Aggresive (CMA):

Table 4
Portfolio Group Information based on size-BE/ME Portfolio

Sort 2x3 sort on	**Break-points**	**Factors and Compo-nents**
CMA	30%, 40%, 30 %	CMA=(SC+BC)/2-(SA+BA)/2
Sort 2x2 sort on	**Break-points**	**Factors and Compo-nents**
CMA	50%, 50%	CMA=(SC+BC)/2-(SA+BA)/2

Portfolio Formation based on Up Minus Down (UMD) : (for Fama and French 6 Factors Model)

Table 5
Up Minus Down (UMD) Portfolio Grouping

Sort 2x3 sort on	***Breakpoint***	**Factors and Components**
UMD	30%, 40%, 30%	CMA= (SC+BU)/2-(SD+BD)/2

Data analysis using regression, where regression is initially performed for the Fama 5-factor model and then followed by regression for the Fama 6-factor model
The regression model for Fama and French 5-factor model used in this research is :

$$E\left(\frac{Rs}{p}\right) = R_r + \beta_m MKt + \beta_s SMB + \beta_R RMW + \beta_C CMA + e$$

Meanwhile, the regression model for Fama and French 6-factor model used in this research is :

$$E\left(\frac{Rs}{p}\right) = R_r + \beta_m MKt + \beta_s SMB + \beta_R RMW + \beta_C CMA + \beta_u UMD + e$$

3 Results & discussions

Table 5
The results of the Fama and French 5-factor model regression of Portfolio 2x2

Variable	Coef	Std. Error	t-Statistic	Prob.		
MKT	1.119216	0.061985	18.05630	0.0000	F	8.759715
SMB	0.254393	0.033585	7.574702	0.0000	Prob>F	0.000004
HML	0.126180	0.044331	2.846325	0.0062	R-squared	0.447845
RMW	-0.024271	0.012033	-2.017063	0.0487	Adjusted R-squared	0.396719
CMA	0.013496	0.028657	0.470947	0.6396		
C	0.003501	0.002258	1.550369	0.1269		

Table 6
The results of the Fama and French 5-factor model regression of Portfolio 2x3

Variable	Coef	Std. Error	t-Statistic	Prob.
MKT	0.643166	0.157214	4.091036	0.0001
SMB	0.345684	0.145276	2.379501	0.0209
HML	0.392906	0.105961	3.708026	0.0005
RMW	-0.079251	0.183212	-0.432561	0.6671
CMA	0.317016	0.199317	1.590511	0.1176
C	-0.012687	0.007485	-1.695082	0.0958

F	101.3360
Prob>F	0.000000
R-squared	0.903688
Adjusted R-squared	0.894771

Table 7
The results of the Fama and French 5-factor model regression of Portfolio 2x3

Variable	Coeffi-cient	Std. Error	t-Statistic	Prob.
C	234.1798	483.0884	0.484756	0.6298
MRP	-2.639478	0.825217	-3.198526	0.0023
SMB	0.300585	0.156142	1.925071	0.0596
HML	5.850394	1.058707	5.525982	0.0000
RMW	-0.772127	0.606316	-1.273474	0.2084
CMA	-0.404588	0.124449	-3.251030	0.0020
UMD	0.213280	0.095045	2.243977	0.0290

R-squared	0.753297
Adjusted R-squared	0.725368
S.E. of regression	3393.907
Sum squared resid	6.10E+08
Log-likelihood	-569.1990
F-statistic	26.97216
Prob(F-statistic)	0.000000

The table above indicates that the coefficient of determination (Adjusted R2) test results for the 2x3 portfolio in the Fama and French 5-factor model are better compared to both the 2x2 portfolio in the Fama and French 5-factor model and the portfolio in the Fama and French 6-factor model. This means that the construction of the 2x3 portfolio in the Fama and French 5-factor model can effectively explain the influence of Market Excess Return (MKT), Small Minus Big (SMB), High Minus Low (HML), Robust Minus Weak (RMW), Conservative Minus Aggressive (CMA) on the Excess Return of the stock portfolio when compared to the construction of the 2x2 portfolio. However, the Fama and French 6-factor model is still superior in predicting portfolio returns compared to the Fama and French 5-factor model with the 2x2 portfolio construction.

4 Conclusion

The research results found that the Fama and French 5-factor model with the 2x3 portfolio construction is still superior compared to both the Fama and French 6-factor model and the Fama and French 5-factor model with the 2x2 portfolio construction. Furthermore, the Fama and French 6-factor model is still superior in explaining portfolio returns compared to the Fama and French 5-factor model with the 2x2 portfolio construction.

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