

MARKETING EQUITY USING A FIVE-FACTOR ASSET PRICING MODEL IN ASEAN COUNTRIES



Shalini Pillay¹



Suganthi
Ramasamy²



Yuen Yee Yen^{3*}

^{1,2,3}Multimedia University Malaysia Jalan Ayer Keroh Lama, 75450 Bukit Beruang, Melaka, Malaysia.

¹Email: 1131200020@student.mmu.edu.my

²Email: suganthi.ramasamy@mmu.edu.my

³Email: yyuen@mmu.edu.my



(+ Corresponding author)

ABSTRACT

Article History

Received: 17 August 2022

Revised: 19 September 2022

Accepted: 4 October 2022

Published: 22 November 2022

Keywords

Asset pricing model
Book-to-market equity
Investment
Market premium
Profitability
Size
Stock return.

JEL Classification:

G11.

This research examines the impact of market risk premium, size, book-to-market equity, profitability, and investment as risk factors on stock return. Portfolios are formed to develop the left-hand side and right-hand side portfolios. The objective of this paper is to assess the performance of the equity market and to enhance the generalizability of the five-factor model. A statistical analysis is applied to estimate the asset pricing model to assess their performance in the Association of Southeast Asian Nations (ASEAN) equity market. The researchers found that there were value premiums in the average stock returns in all the countries except Malaysia. Traces of profitability premium can be observed in Malaysia, Thailand and Indonesia. However, there was no evidence of investment premiums in any of the countries. The study examines whether the asset pricing models capture the value, profitability and investment patterns in the capital market. The five-factor model performs better than the three-factor model in explaining the average excess returns of the size–BM (book-to-market) and size–profitability portfolios. However, the five-factor model fares poorly in explaining the average excess returns of the size–investment portfolios.

Contribution/Originality: The paper examines whether the five-factor model performs better than the three-factor model in explaining the average excess returns. The original contributions of the study center on how the Association of Southeast Asian Nations' value, profitability and investment returns vary with firm size.

1. INTRODUCTION

The center point of finance research is the relationship between risk and return, which traditionally revolves around classical decision theory, rationality and risk aversion. Based on a set of restrictive assumptions, scholars have developed finance models such as portfolio composition and asset pricing to supplement financial decisions. Markowitz (1952) established the Modern Portfolio Theory (MPT) in an attempt to explain the trade-off between the expected return and risk. In his paper "Portfolio Selection", Markowitz assumes that investors are risk-averse, and therefore they try to maximize returns as much as possible while minimizing the risk. This is achieved by forming portfolios of multiple assets to maximize return at any level of risk (Markowitz, 1952). The MPT led to the development of the very first asset pricing model, the Capital Asset Pricing Model (CAPM), by Sharpe (1964); Lintner (1969) and Mossin (1966), which focuses on the trade-off between risk and return. The CAPM has been successful in predicting expected returns using the market factor.

However, over the years, the CAPM has been largely criticized for being a one-factor model. Ross (1976) argued that there should be more factors considered in asset pricing, while Roll (1977) claimed the CAPM cannot be tested unless the true market portfolio's exact composition is known and employed in the sample to conduct the test. Further, Blume and Friend (1973) empirically rejected the CAPM as the model failed to explain the observed returns in all types of financial assets. This rejection stems from the assumptions that underlie the model: perfectly functioning short-selling, trading at a risk-free rate, and the tax advantage of bonds, which seem to be impractical in reality (Blume & Friend, 1973).

Motivated by the weaknesses in the CAPM, Arbitrage Pricing Theory (APT) was introduced by Stephen Ross in 1976 to substitute the former model. The introduction of APT acknowledges the existence factors other than the market factor in influencing the asset's observed returns. The new model defines asset returns as a function of a number of risk factors which are derived statistically. The model was developed under the assumption that investors take advantage of arbitrage opportunities that exist in the broader market (Ouma & Muriu, 2014). Therefore, the model defines the rate of return of an asset as a function of alternative investment return and other risk factors that are common in that class of asset. The key difference between the CAPM and APT is the meaning of β in each model. In the CAPM, β describes the statistical relationship between asset returns and the asset's total portfolio return. While on the other hand, APT defines β as the sensitivity of asset returns to a particular risk factor.

On the other hand, there was growing evidence of factors such as stock size and value effect in stock returns. For instance, Banz (1981) found that stocks with lower market capitalization (measure of stock size) are more likely to depict higher average returns compared to those with higher market capitalization. Besides that, there was a trend noticed by De Bondt and Thaler (1985) in value stocks, which have higher average returns compared to growth stocks. Taking this evidence into account, Fama and French (1992) developed a new model by augmenting the CAPM with market capitalization (proxy for equity size) and the book-to-market ratio (proxy for equity value). The model is known as the Fama and French three-factor model, which earned its authors a Nobel Prize. Later, the three-factor model was expanded by Carhart (1997) by adding momentum into the former multifactor model. This addition was motivated by Jegadeesh and Titman (1993), who found that stocks with good prior short-term returns will produce higher returns in the next 12 months from the date of portfolio formation compared to those with poor performance. However, in the long run, these excess returns reduce to half within the 24 months following the date of portfolio formation (Jegadeesh & Titman, 1993). Numerous studies, such as Titman, Wei, and Xie (2013); Novy-Marx (2013) found evidence of profitability and investment in explaining the average returns in multiple markets. Driven by these findings, Fama and French (2015) extended their three-factor model by including the profitability and investment factors in the attempt to explain the average returns of the equities in the United States market.

The objective of this study is to examine the performance of the five-factor model in the context of the Association of Southeast Asian Nations (ASEAN) equity market to provide out-of-sample evidence to promote the generalizability of the five-factor models. The ASEAN market is selected because it is much smaller compared to the United States and other developed equity markets; however, it is one of the fastest growing markets in the world, hence testing the model using different types of markets will provide a new perspective in the context of the ASEAN capital market. Another contribution of this study is the inclusion of all sizes of stock groups, including tiny stocks, since most of the prior studies focus on large stocks only. The model's performance is assessed based on the Gibson, Ross & Shanken F-statistic hypothesis that the regressions' intercepts are indistinguishable from zero.

2. LITERATURE REVIEW

Empirical studies on capital return patterns began with the development of the Capital Asset Pricing Model (CAPM), which has contributed significantly to explaining the relationship between risk and return. The model primarily uses beta to measure the systematic risk (risk that cannot be diversified), which is obtained through the

regression of stock returns against market returns and is commonly known as the single factor model. Evidence has emerged suggesting that a significant number of anomalies is still left unexplained by the CAPM. Major drawbacks of the CAPM are derived from the assumptions the model is being developed on. Empirical studies, such as Fama and French (1992), have rejected this model on the basis that the expected excess return of an asset is not rigorously proportionate to its beta.

Motivated by the weaknesses in the CAPM and growing evidence that the size (market capitalization) and value (book-to-market ratio) significantly affect the ability to explain the variation in the average excess returns, Fama and French extended the CAPM by including these two factors in order to bridge the gap left by the CAPM (Fama & French, 1992). Many empirical studies (such as Taneja (2010); Basiewicz and Auret (2010); Sattar (2017)) have found that the three-factor model has contributed remarkably in explaining the variations across stock returns compared to the single factor CAPM. Despite many empirical studies being in agreement that the three-factor model better explains the variation in the average excess returns compared to the CAPM, there are anomalies (i.e., other factors) that exist that are yet to be addressed by the existing models (Eraslan, 2013; Novy-Marx, 2013; Titman, Wei, & Xie, 2004). This is evident when there are still variations in the average excess returns that are left unexplained.

Encouraged by the empirical findings on the strong effect of profitability and investment on asset returns, Fama and French (2015) proposed an extended version of their previous three-factor model by including profitability and investment factors. The five-factor model was tested for its performance on the United States market using data from July 1963 to December 2013. Profitability is measured by net income divided by book equity value, while investment is measured by the growth in total assets. The measurement of these factors is further discussed in section 3.1. The empirical test suggests that the five-factor model outperforms the three-factor model as it is able to explain more anomalies (Chiah, Chai, Zhong, & Li, 2016). To test the applicability and robustness of the five-factor model, Fama and French (2015) examined the international markets for North America, Europe, Japan and Asia Pacific. They found that the five-factor model can explain most of the anomaly patterns in the average returns of these regions' capital markets.

The five-factor model was tested in the Chinese stock market by following the methodology described by Fama and French (2015). The stocks were grouped into portfolios and tested to determine the portfolio returns. Guo, Zhang, Zhang, and Zhang (2017) found a strong existence of size, value and profitability in the average returns. However, the investment factor did not contribute much to explaining the average returns.

Kubota and Takehara (2018) tested the five-factor model in Japan using data from January 1978 to December 2014 and found that both profitability and investment factors were unable to explain the cross-sectional variation of Japanese stocks, which raised questions over the validity of the profitability and investment factors construct. The authors established that the five-factor model is relatively inferior to the three-factor model in terms of Japanese data based on model simplicity and significance of the coefficients. Echoing this, Racicot and Rentz (2017) found weak empirical evidence in panel data to support the applicability of the new factors.

Prior empirical studies suggest that the performance of the five-factor model differs from region to region. While some studies, e.g., Chiah et al. (2016) and Guo et al. (2017), generally find evidence to support the five-factor model over its precedent three-factor model, there are a number of studies that rejected this model, e.g., Racicot and Rentz (2017); Kubota and Takehara (2018); Huynh (2018) and Dutta (2019). The empirical results are mixed and may be vulnerable to the exposure of market features. The continuous empirical studies on asset pricing over the years signal the importance of bridging the gaps that still prevail in the existing literature. Motivated by this, this study attempts to provide out-of-sample findings on the robustness of the five-factor model in the context of the ASEAN capital market by contributing to the comparative evidence across the international equity market. The central focus is to examine and evaluate the performance of the five-factor and three-factor models in pricing ASEAN equities. This study utilizes more than 90% of all listed ASEAN companies covering 216 months, from July

2000 to June 2018. This comprehensive sample aims to provide more convincing out-of-sample evidence to Fama & French's five-factor model, and it also contributes to the existing asset pricing literature. Further to this, the study aims to determine whether the five-factor model can explain more of the asset pricing anomalies compared to the three-factor model.

3. RESEARCH METHODOLOGY

3.1. Asset Pricing Factors Construction

For equity data, we use monthly closing price and accounting data that are primarily from Bloomberg and supplemented by the Central Bank websites. The sample period for this study is from July 2000 to June 2018 deriving 216 observations. Excess returns are calculated relative to the three-month Treasury Bill. The data set contains all the equity securities listed on Bursa Malaysia, the Singapore Exchange, the Stock Exchange of Thailand, the Indonesia Stock Exchange and the Philippines Stock Exchange. The test power is reduced due to the short sample size but this is mitigated by applying diversified left-hand side (Left-Hand Side henceforth) portfolios for the regression. The main objective of this study is to determine whether the five-factor asset pricing model can explain the variation in excess returns better than the three-factor model. This can be achieved by using diversified Left-Hand Side portfolios to enhance the estimation of the intercepts, which is the focal point for determining the performance of the asset pricing model.

Before sorting the data into portfolios, the data are filtered based on a few requirements to ensure its authenticity. Following the Fama and French method of filtering (Fama and French, 2015), the data without market equity is eliminated. Then the data with negative book-to-market ratios are removed. Securities with missing values are discarded from the sample. Once the filtering process is completed, the data are sorted based on 2x3 (for right-hand side) and 5x5 (for Left-Hand Side) to form size-book-to-market, size-profitability (Robust Minus Weak henceforth) and size-investment (Conservative Minus Aggressive henceforth) portfolios.

As mentioned above, the right-hand side is formed on 2x3 sorts on Size-Big/Medium, size-profitability and size-investment to construct the explanatory returns for the regressions. Due to huge differences between the large market cap stock values and the small market cap stock values, the stocks are sorted by size using the 90%-10% sorting to ensure that sufficient stocks are included in each portfolio. Another reason for sorting with this method is to provide a sufficient avenue for the evaluation of small stocks' performance in the model. This approach is motivated by the lack of precision in estimating small stocks' excess returns in previous studies.

Following Fama and French (2012) closely, all the portfolios are formed at the end of June year t . First, the stocks are sorted into big (top 90% of the market capitalization) and small (bottom 10% of the market capitalization) groups based on market capitalization. Then the portfolios are sorted independently based on book-to-market ratio using the 30th and 70th percentile breakpoints. The book-to-market ratio assumed here is as of December $t-1$, a 6-month lag from the date of portfolio formation to June year t to ensure that all accounting data are available. This minimum six-month gap is a common time frame to allow for all the audited accounting information to be released after the financial year end. The intersections between market capitalizations and book-to-market ratios produced six size-book-to-market portfolios: Big-High (BH), Big-Medium (BM), Big-Low (BL), Small-High (SH), Small-Medium (SM), and Small-Low (SL). Monthly value-weighted average returns for each portfolio are computed from July year t to June year $t+1$.

Size-profitability portfolios are sorted similar to the size-book-to-market portfolios, except the second sorting is done based on the stocks' profitability. The profitability of the stocks is derived by net income before tax (annual returns minus cost of goods sold, interest expense and selling, and general and administrative expenses) divided by book equity at the end of the fiscal year $t-1$. In each group size, the stocks are sorted into three main groups: Robust (top 30%), Medium (middle 40%), and Weak (bottom 30%) based on profitability. The intersections between market capitalization and profitability produced six size-profitability portfolios: Big-Robust (BR), Big-Medium (BM), Big-

Weak (BW), Small-Robust (SR), Small-Medium (SM), and Small-Weak (SW). Monthly value-weighted average returns for each portfolio are computed from July year t to June year $t+1$

Mirroring the size-book-to-market and size-profitability sorts, size-investment portfolios are also sorted by replacing the second sort with investment value as of the end of fiscal year $t-1$ for portfolios formed in June year t . The investment variable is measured by the growth of total assets as of the fiscal year end $t-1$ divided by total assets as of fiscal year end $t-2$. For each group size, the stocks are sorted into three groups: Conservative (bottom 30%), Medium (middle 40%), and Aggressive (top 30%) based on investment value. The intersections between the independent sorting of size and investment produced six portfolios: Big-Conservative (BC), Big-Medium (BM), Big-Aggressive (BA), Small-Conservative (SC), Small-Medium (SM), and Small-Aggressive (SA).

The sorting is summarized in Table 1, Table 2 and Table 3.

Table 1. Formation of size-book-to-market portfolios.

Size	Book-to-Market	Abbreviation Size-Book-To-Market
Big (B)	Value (V)	BV
	Neutral (N)	BN
	Growth (G)	BG
Small (S)	Value (V)	SV
	Neutral (N)	SN
	Growth (G)	SG

Table 2. Formation of size-robust minus weak portfolios.

Size	Robust-Minus-Weak	Abbreviation Size-Robust-Minus-Weak
Big (B)	Robust	BR
	Medium	BM
	Weak	BW
Small (S)	Robust	SR
	Medium	SM
	Weak	SW

Table 3. Formation of size-conservative minus aggressive portfolios.

Size	Conservative Minus Aggressive	Abbreviation Size-Conservative Minus Aggressive
Big (B)	Conservative (C)	BC
	Medium (M)	BM
	Aggressive (A)	BA
Small (S)	Conservative (C)	SC
	Medium (M)	SM
	Aggressive (A)	SA

Once the returns for each portfolio are calculated, the factor returns are computed. The Small Minus Big factor is the equal weighted average return of small stocks minus the equal weighted average return of big stocks. To have a clearer understanding on the effect of size we constructed the value-growth returns based on the big and small book-to-market portfolios, derived as $HML_S = SV - SG$ and $HML_B = BV - BG$, and finally the High Minus Low factor, High Minus Low = $\frac{1}{2} HML_S + \frac{1}{2} HML_B$. The robust-weak factor is calculated based on the difference between big and small size-op portfolios; $RMW_S = SR - SW$, $RMW_B = BR - BW$ and Robust Minus Weak = $\frac{1}{2}$

$RMW_S + \frac{1}{2}RMW_B$. The conservative–aggressive factor is calculated by deriving the differences between big and small size–investment portfolios.

A summary of these calculations is shown in Table 4.

Table 4. Summary of factor constructions.

Sort	Breakpoints	Factor Computations	
Size–BM	Top 30% Middle 40% Bottom 30%	SMB _{BM}	$= 1/3 [SV+SN+SG] - 1/3 [BV+BN+BG]$
		HML _S	$= 1/2 [SV+BV] - 1/2 [SG+BG]$
		HML _S	$= SV-SG$
		HML _B	$= BV-BG$
Size–Profitability		SMB _{RMW}	$= 1/3 [SR+SM+SW] - 1/3 [BR+BM+BW]$
		Robust Minus Weak	$= 1/2 [SR+BR] - 1/2 [SW+BW]$
		Size–Investment	SMB _{CMA}
CMA			$= 1/2 [SC+BC] - 1/2 [SA+BA]$
SMB			$= [SMB_{B/M} + SMB_{RMW} + SMB_{CMA}] / 3$

For the observed returns, Left-Hand Side portfolios are constructed in same way as right-hand side factors, except instead of 2x3 sorts, 5x5 sorts are used. Stocks are sorted for size and BM based on five quintile breakpoints. The independent sorts of size and BM produce 25 size–BM portfolios. A similar method is applied to size–momentum, size–profitability and size–investment sorts to produce 25 portfolios for each size combination. Once the portfolios are formed, equal-weighted portfolios’ monthly returns are calculated for each portfolio. The equal-weighted portfolios used are based on findings by Fama and French (1992); Fama and French (1993) and supported by Erdinç (2017), who state that equal-weighted returns perform better than value-weighted returns in describing the Fama and French three-factor model.

3.2. Gibson, Ross & Shanken F-Statistic

The widely used regression technique in estimating the performance of the empirical asset pricing model is the Gibson, Ross & Shanken F-Statistic test by Gibbons, Ross, and Shanken (1989). This statistic establishes that if a specific asset pricing model is able to completely explain the expected return, the intercept generated by the time series regression of the asset’s excess returns against the model’s explanatory returns must be indistinguishable from zero (Fama & French, 2015). The focus of the test is on the intercept value as it depicts the unexplained fraction of the asset’s excess return. In short, the intercept denotes the pricing error of the model (Gibbons et al., 1989).

Based on the portfolio formation described above, the sorting of the equities by each size combination will result in 25 portfolios (size–value, size–momentum, size–profitability, size–investment and size–liquidity), which are denoted as test assets (Left-Hand Side). The Gibson, Ross & Shanken test begins by running ordinary least squares (OLS) time-series regressions to estimate individual portfolios’ excess returns relationship with a set of factors as given by equation below:

$$R_{it} = \alpha_i + \beta_{i1} X_{1t} + \beta_{i2} X_{2t} + \dots + \beta_{i3} X_{nt} + \epsilon_{it}$$

where R_{it} is asset i 's excess return at time t , α is the unexplained portion of asset i 's excess return, β_i refers to the factor exposure relative to asset i 's return, X_{nt} is the explanatory factor at time t , and ε_{it} is the error term at time t .

To examine the performances of the explanatory factors in each test asset (Left-Hand Side), the 25 regressions for the size combinations are tested. The rule of thumb under Gibson, Ross & Shanken test is that, if the explanatory factor exposures depicted by beta, β , are able to capture all variations in expected returns, the intercept, α , is 0 for all securities and portfolio i (Fama & French, 2015). Hence, the hypotheses for this individual portfolio's OLS time series regression test are as follows:

3.3. Individual Portfolio Regression Hypotheses (Ordinary Least Squares Time Series Regression)

$$H_0: \hat{\alpha}_1 = \hat{\alpha}_2 = \hat{\alpha}_3 \dots \hat{\alpha}_{25} = 0 \text{ (the alpha is not significantly different from zero)}$$

$$H_1: \hat{\alpha}_1 = \hat{\alpha}_2 = \hat{\alpha}_3 \dots \hat{\alpha}_{25} \neq 0 \text{ (the regression alpha is significantly different from zero).}$$

Once the individual portfolios regressions are completed, the next step is to estimate whether the parameters in the individual regressions are jointly zero. With the assumption that the residuals are independent and normally distributed over time and homoscedastic and uncorrelated with the factors' returns, the intercepts, $\hat{\alpha}$, are normal and the residual covariance matrix, $\hat{\Sigma}$, is an independent Wishart (the multivariate version of X^2), the asymptotic joint distribution of the regression's intercepts establish the Gibson, Ross & Shanken test statistic as given by in equation below:

$$GRS \equiv \left(\frac{T-N-K}{N} \right) \left(1 + \hat{\mu}' \hat{\Omega}^{-1} \hat{\mu} \right)^{-1} \hat{\alpha}' \hat{\Sigma}^{-1} \hat{\alpha} \sim F(N, T-N-K)$$

Where:

T = number of observations.

N = number of portfolios (25 portfolios (5 x 5 sorts of size–book–to–market, size–momentum, size–profitability, size–investment, and size–liquidity).

K = number of factors (e.g., CAPM, $K=1$, F3FM, $K=3$, and so on).

$\hat{\mu}$ = sample mean.

$$\hat{\Omega} = \frac{1}{T} \sum_{t=1}^T [f_t - E_T(f)][f_t - E_T(f)]'$$

$\hat{\alpha}$ = vector of the estimated intercepts

$$\hat{\Sigma} = \text{residual covariance matrix, } \frac{1}{T} \sum_{t=1}^T \hat{\varepsilon}_t \hat{\varepsilon}_t'$$

One of the indicators of the asset pricing model's performance is when the alpha value is indistinguishable from zero. Hence, along with the Gibson, Ross & Shanken statistic, it is essential to also compute the test statistic to determine if all the alphas from the individual time series regressions are jointly equal to zero (Roy & Shijin, 2019). The proposed hypotheses to test the alphas' values of the asset pricing model are as follows:

$$H_0: \hat{\alpha}_1 = \hat{\alpha}_2 = \hat{\alpha}_3 \dots \hat{\alpha}_n = 0 \text{ (the regression alphas are jointly indistinguishable from zero)}$$

H1: $\widehat{\alpha}_1 = \widehat{\alpha}_2 = \widehat{\alpha}_3 \dots \widehat{\alpha}_n \neq 0$ (the regression alphas are jointly different from zero).

Not rejecting the null hypothesis denotes that the proposed asset pricing model is valid in explaining the stock prices (Fama & French, 2015).

The equation below explains the test statistic that is used to assess whether all 25 portfolios' alphas are jointly equal to zero. The normality of the error term is not required for this test. This alpha test statistic follows an asymptotic X^2 distribution with N degrees of freedom in the null hypothesis of zero alphas by assuming homoscedasticity. The following equation describes the test statistic's mathematical formula:

$$T \left(1 + \widehat{\mu}' \widehat{\Omega}^{-1} \widehat{\mu} \right)^{-1} \widehat{\alpha}' \widehat{\Sigma}^{-1} \widehat{\alpha}$$

4. EMPIRICAL ANALYSIS

4.1. Descriptive Analysis-Explanatory Returns

Table 5 exhibits the summary statistics for the explanatory factors between 2000 and 2018, with a total of 216 months of observations. Based on Table 4, equity premiums (depicted by Market Premium, which is the average difference between monthly value-weighted market returns and the one-month Treasury Bill) for all countries over the sample time frame are huge. Thailand recorded the highest equity premium at 0.76% followed by the Philippines (0.58%), Singapore (0.41%) and Malaysia (0.41%). Indonesia reported a negative equity premium of -6.80%. The estimates for the sample period of 216 months are below the traditional two-standard error bound in all countries except Indonesia.

There is a size premium in all countries except Malaysia. The Philippines has the highest size premium of 1.30% (t = 4.00), followed by Indonesia at 0.80% (t = 2.94), Thailand 0.72% (t = 3.00) and Singapore 0.36% (t = 1.43). Malaysia recorded a negative size of -0.16% (t = -0.06). Similarly, there are traces of value premiums (High Minus Low) in all the countries except Malaysia. The highest value premium is depicted by Thailand at 1.06% (t = 4.63), followed by Singapore at 0.79% (t = 4.33), Indonesia at 0.72% (t=2.70), and the Philippines at 0.10% (t = 2.75). Malaysia has a negative value premium of -0.72% (t = -0.46). All the value premium estimates are above the traditional two-standard error bound except for Malaysia. As in Fama and French (2012) and Roy and Shijin (2019), value premiums are larger in small stocks in Singapore, Thailand and Indonesia. On the other hand, value premiums are relatively larger in big stocks compared to smaller stocks in Malaysia and the Philippines. This finding is in consensus with Fama & French (2015) and provides new evidence on larger value premiums on big stocks contrary to the common accepted theory that value premiums exist largely in small stocks.

Table 5. Summary statistics for explanatory returns for the sample period (July 2000 to June 2018).

Variable	Malaysia			Singapore			Thailand			Indonesia			Philippines		
	μ	σ	$t(\mu)$	μ	σ	$t(\mu)$	μ	σ	$t(\mu)$	μ	σ	$t(\mu)$	μ	σ	$t(\mu)$
Market Premium	0.409	4.002	1.500	0.410	5.125	1.175	0.759	6.190	1.802***	-6.795847	7.709911	-12.955*	0.577	5.662	1.499
SMB5	-0.161	37.184	-0.064	0.358	3.677	1.429	0.718	3.502	3.013**	0.800	3.995	2.942*	1.299	4.758	4.012*
High Minus Low	-0.716	23.074	-0.456	0.793	2.693	4.328*	1.062	3.369	4.632*	0.720	3.926	2.695*	0.100	5.341	2.751*
HML ₅	-0.488	20.460	-0.351	0.533	1.732	4.520*	0.911	2.189	6.118*	0.546	2.302	3.486*	0.346	4.254	1.195
HML ₃	0.071	1.569	-0.420	0.260	2.005	1.908***	0.150	2.072	1.065	0.174	2.615	0.977	0.654	2.933	3.277*
HML ₅₋₃	-0.559	20.788	-0.184	0.273	2.606	1.535	0.761	2.612	4.283*	0.372	2.977	1.837***	-0.308	4.986	-0.908
Robust Minus Weak	0.272	2.392	1.673***	-0.055	3.207	-0.251	0.274	3.168	1.274	0.488	3.655	1.962**	-0.530	4.933	-1.580
RMW ₅	-0.051	1.988	-0.378	-0.120	2.598	-0.678	-0.023	2.222	-0.151	0.014	2.463	0.083	-0.555	4.389	-1.857***
RMW ₃	0.323	1.240	3.830*	0.065	-1.837	0.521	0.298	1.684	2.598*	0.474	2.608	2.671*	0.024	2.286	0.155
RMW ₅₋₃	-0.374	2.295	-2.397	-0.185	3.156	-0.861	-0.321	2.346	-2.007**	-0.46	3.518	-1.921***	-0.579	4.964	-1.713***
Conservative Minus Aggressive	-0.256	2.039	-1.184***	-0.403	3.082	-1.922***	-0.449	2.529	-2.612*	-0.187	3.169	-0.868	-0.246	4.291	-0.842
CMA ₅	-0.345	1.485	-3.412*	-0.287	2.037	-2.068**	-0.303	1.790	-2.484*	-0.179	2.008	-1.310	-0.221	3.412	-0.952
CMA ₃	0.89	1.213	1.084	-0.116	2.195	-0.780	-0.147	1.486	-1.453	-0.008	2.329	-0.052	-0.025	2.512	-0.145
CMA ₅₋₃	-1.235	1.788	-3.574	-0.171	2.904	-0.862	-0.156	2.105	-1.087	-0.171	0.203	-0.843	-0.196	4.181	-0.690

Note: *** p < 0.01, ** p < 0.05, * p < 0.1.

Traces of profitability premiums (Robust Minus Weak) can be observed in Malaysia, Thailand and Indonesia. Indonesia has the highest profitability premium of 0.49% ($t = 1.96$), trailed by Thailand at 0.27% ($t = 1.27$), and Malaysia at 0.27 ($t = 1.67$). On the other hand, both Singapore and the Philippines recorded a negative profitability premium. Big stocks in all countries derived higher profitability premiums compared to smaller stocks. On the other hand, there is no evidence of investment premiums (Conservative Minus Aggressive) observed as negative returns reported by all the countries. This is in line with Guo et al. (2017), who found a weak relationship between investment and the average excess return.

4.2. Excess Returns for the 25 Size-BM, Size-Profitability and Size-Investment Portfolios

Panel A of Table 6 explains the patterns in the average returns during the sample period for 25 size-book-to-market portfolios. Small growth stocks generate high returns in all the countries except Indonesia. Apart from Indonesia, a standard size effect is observed in the extreme growth stocks (the left column of the 5 x 5 size-book-to-market matrices) as the small stocks' portfolios are prone to generating larger average returns compared to big stock portfolios' average returns. Value premiums are observed in Singapore, Thailand and the Philippines for all size groups where the average returns relatively increase from left to right. On the other hand, Malaysia shows a mixed pattern of value premiums, but the first two rows exhibit common value patterns where the average returns increase from left to right. Indonesia, however, exhibits a negative value premium for all size groups.

Panel B of Table 6 explains the average excess returns during the sample period for 25 size-profitability portfolios. By controlling profitability, the average returns generally decline as the size increases for all the countries except Indonesia. However, the decline pattern of the average returns in all size groups are inconsistent. Except Indonesia, all the countries' small stocks tend to generate higher average returns than big stocks, exhibiting a standard size effect. Panel B of Table 6 also exhibits the profitability effect acknowledged by Novy-Marx (2013), which was attested by Fama and French (2015). For Thailand, the profitability effect is apparent for all size groups, where the average returns increase from left to right. In other words, the returns for extremely high profitability portfolios generates higher returns than extremely low profitability portfolios. Malaysia and Singapore also exhibit profitability effects for all size groups except for the first row. Similarly, the Philippines also displays a profitability effect in all size groups except in the first two rows. However, Indonesia did not reflect any profitability effect since it recorded negative average returns for all the portfolios.

Panel C of Table 6 shows the average excess returns during the sample period for 25 size-investment portfolios. The average returns in all size groups can be seen in the Philippines, while Malaysia, Singapore and Thailand also recorded premiums in most of the size groups. Indonesia, yet again, reported a negative premium. Except for Thailand and Indonesia, a standard size effect is observed in these countries where the small stock portfolios have higher average returns than big stock portfolios. Thailand depicts a reverse size effect where the big stock portfolios average returns are higher than the small stock portfolio returns. The average returns pattern is inconsistent from left to right. A high average return for the lowest investment quantile compared to the highest investment quantile can be observed in the majority of rows in Malaysia, Singapore and the Philippines, while Thailand depicted an opposite effect where the highest investment quantile has higher average returns compared to the lowest investment quantile.

Table 6. Summary statistics for the 25 size–book-to-market (Panel A), size–profitability (Panel B), and size–investment (Panel D) portfolios.

Panel A: Monthly excess returns formed on size and BM										
	Mean					Standard Deviation				
	Low	2	3	4	High	Low	2	3	4	High
Malaysia										
Small	0.600	0.063	0.121	1.121	2.701	30.150	25.463	24.256	34.858	36.092
2	0.460	-0.426	-0.091	-0.030	1.220	30.733	25.547	20.158	21.897	29.846
3	-0.464	-0.243	-0.003	-0.190	-1.276	23.282	28.557	22.796	18.065	25.588
4	-0.634	-0.290	0.418	-0.326	-0.680	20.709	15.992	20.308	22.990	24.713
Big	-0.116	-0.350	-0.199	-0.309	-0.441	13.779	23.671	18.446	17.645	22.921
Singapore										
Small	2.376	1.606	1.879	1.908	2.767	13.793	10.419	9.854	9.139	10.334
2	0.307	0.101	0.234	0.905	1.433	8.652	7.160	7.407	7.879	8.970
3	-0.120	-0.331	0.038	0.157	0.577	8.488	8.511	8.113	7.208	7.518
4	-0.594	-0.114	0.055	0.191	0.560	8.678	8.097	7.367	6.474	6.859
Big	0.223	0.193	0.235	0.541	0.845	6.380	6.488	6.877	6.302	6.929
Thailand										
Small	0.616	1.310	0.686	2.460	4.635	6.058	6.233	6.303	9.305	14.811
2	0.268	0.469	0.412	0.563	1.806	5.734	5.197	5.504	5.283	12.832
3	-0.176	-0.283	0.294	0.364	1.057	4.829	4.697	4.883	5.093	6.350
4	-0.104	-0.093	0.156	0.236	0.599	4.294	3.642	4.316	4.353	5.147
Big	-0.047	0.107	0.151	-0.022	0.162	2.154	2.684	3.428	3.722	3.968
Indonesia										
Small	-4.540	-5.417	-5.298	-4.832	-5.047	11.869	9.145	9.334	10.573	11.683
2	-5.674	-6.134	-6.160	-5.934	-4.634	10.358	10.083	8.559	9.224	10.985
3	-7.270	-7.087	-6.385	-6.152	-5.866	8.040	8.776	8.189	9.469	10.266
4	-7.047	-7.413	-5.987	-5.458	-5.889	8.738	7.683	9.014	9.990	10.018
Big	-6.863	-6.429	-6.773	-6.399	-6.419	8.806	9.119	8.771	8.636	10.294
Philippines										
Small	5.767	5.172	3.060	2.501	6.278	27.787	25.445	11.317	11.879	22.755
2	1.801	1.618	1.428	1.515	3.066	12.061	10.963	9.346	9.016	13.702
3	1.543	1.067	0.852	0.975	1.115	13.115	9.422	7.841	6.581	8.695
4	0.798	0.314	0.371	1.926	1.090	8.717	8.215	8.123	11.562	8.945
Big	-0.014	0.432	1.040	0.867	1.682	5.728	6.373	5.848	7.053	9.417

Panel B: Monthly excess returns formed on size and profitability										
	Mean					Standard Deviation				
	Low	2	3	4	High	Low	2	3	4	High
Malaysia										
Small	1.775	2.369	1.040	0.490	1.246	9.076	16.633	7.897	6.623	6.796
2	0.439	-0.190	0.077	0.345	0.624	8.030	5.729	5.307	5.460	6.041
3	-0.267	-0.168	-0.031	0.056	0.574	7.040	5.263	5.145	5.294	5.778
4	-0.264	-0.131	-0.093	0.355	0.508	7.120	5.308	5.536	5.958	5.752
Big	-0.235	-0.073	0.050	0.786	0.643	5.589	4.785	4.927	6.139	4.471
Singapore										
Small	2.908	3.241	1.443	1.536	2.137	15.085	15.121	8.709	7.496	9.912
2	0.493	0.265	0.370	0.504	1.084	10.822	7.969	7.707	6.815	7.363
3	-0.538	-0.387	0.055	0.439	1.030	9.809	7.831	6.579	7.097	8.535
4	-0.492	-0.479	0.308	-0.029	0.459	8.654	6.873	7.758	7.454	7.558
Big	0.359	0.238	0.132	0.764	0.614	6.340	7.612	6.594	6.149	5.883
Thailand										
Small	2.301	1.118	1.598	1.150	3.255	10.502	7.362	12.279	6.625	15.994
2	0.733	0.058	0.474	0.612	1.244	7.135	5.138	5.968	5.271	10.326
3	-0.351	0.281	0.172	0.094	0.691	5.144	4.787	4.942	5.200	5.898
4	-0.212	-0.485	-0.224	0.288	0.664	4.621	3.902	4.292	4.161	4.387
Big	-0.212	-0.392	0.192	0.164	0.303	3.855	3.278	2.750	2.775	2.604
Indonesia										
Small	-4.540	-5.131	-5.245	-4.883	-4.365	15.088	10.951	11.081	9.702	10.169
2	-5.826	-5.456	-6.250	-5.971	-4.724	9.785	10.159	9.568	9.344	10.899
3	-6.832	-7.357	-6.495	-6.449	-5.527	9.308	8.402	8.592	8.484	9.349
4	-7.343	-7.172	-6.587	-5.790	-4.980	8.850	8.357	9.420	9.254	9.949
Big	-7.010	-6.849	-6.704	-6.399	-6.019	9.971	9.891	8.882	9.074	7.868
Philippines										
Small	4.524	5.818	3.487	3.749	4.466	23.175	33.112	13.769	12.713	16.993
2	2.700	1.042	2.007	1.482	2.469	18.261	10.420	11.799	9.190	11.796
3	1.003	-0.006	1.605	1.164	1.800	11.756	7.971	9.977	7.121	11.328
4	0.709	0.314	0.743	1.240	1.190	11.033	8.132	8.266	7.898	8.068
Big	0.876	0.692	0.787	0.602	1.061	6.748	5.877	6.440	8.077	6.955

Panel C: Monthly excess returns formed on size and investment										
	Mean					Standard Deviation				
	Low	2	3	4	High	Low	2	3	4	High
Malaysia										
Small	1.962	1.674	1.556	1.280	1.345	9.521	8.205	7.863	6.950	8.167
2	0.408	0.369	0.522	0.265	-0.056	7.567	6.362	5.761	5.842	6.069
3	0.003	0.160	0.211	0.055	-0.271	6.506	5.977	5.232	5.197	5.868
4	-0.214	0.019	0.137	0.294	-0.135	6.903	5.301	5.355	5.497	6.120
Big	0.043	0.038	0.307	0.048	0.171	5.222	4.683	4.437	4.558	5.654
Singapore										
Small	3.295	3.149	1.885	2.121	2.472	14.642	14.611	9.354	11.809	10.886
2	0.622	0.296	1.197	0.629	0.600	9.956	7.810	8.014	7.671	7.661
3	-0.197	0.313	0.337	0.434	-0.381	9.302	7.372	7.646	7.970	8.387
4	-0.467	0.152	0.145	0.011	-0.046	7.744	7.043	6.223	7.986	9.299
Big	0.585	0.485	0.466	0.128	0.313	5.695	6.183	6.262	6.378	8.401
Thailand										
Small	-0.220	0.241	-0.111	0.097	0.083	3.271	3.014	2.478	2.622	3.171
2	-0.121	-0.215	-0.139	0.004	0.219	4.608	4.288	4.027	4.517	4.102
3	0.194	-0.211	0.217	0.473	0.412	5.823	4.451	4.937	4.852	5.207
4	0.060	0.144	0.733	0.959	0.846	5.620	5.388	6.220	5.978	6.245
Big	3.316	2.830	1.620	1.108	2.514	13.500	12.946	8.649	6.809	11.459
Indonesia										
Small	-4.149	-5.000	-3.753	-4.524	-4.316	14.818	10.844	19.127	10.023	11.060
2	-6.006	-5.744	-5.646	-5.495	-5.655	9.278	9.750	9.746	9.879	9.293
3	-6.818	-6.263	-6.504	-6.290	-6.467	9.139	9.702	8.680	9.424	8.593
4	-6.523	-5.838	-6.268	-6.264	-6.687	9.325	9.079	9.882	8.656	9.140
Big	-6.479	-6.530	-6.557	-6.777	-6.588	9.843	8.366	8.401	8.985	10.096
Philippines										
Small	4.133	3.758	6.500	2.956	5.820	20.196	16.165	28.423	14.770	25.846
2	2.154	1.845	1.623	2.460	1.043	11.582	12.253	10.695	11.251	8.476
3	1.399	1.858	1.044	0.638	1.071	10.188	12.866	7.720	6.833	9.429
4	0.724	0.933	0.639	0.976	0.803	8.582	10.076	8.488	7.340	9.006
Big	1.096	0.889	0.879	0.492	0.708	7.236	7.771	6.302	6.279	7.216

5. RESULT

This section addresses the main focus of this study, using the Gibson, Ross & Shanken F-statistics (Gibbons et al., 1989) to assess the performance of the five-factor model in explaining the variation in the average excess returns. The rule of thumb of the Gibbons et al. (1989) F-test is that, if the model is able to completely capture the variation in the excess returns, the intercept should be indistinguishable from zero (Lin, 2017). In addition to the Gibson, Ross & Shanken test statistic, the summary statistics of the average absolute values of the 25 intercepts of each set of regressions ($|a|$), the average of the standard errors of the intercepts ($s(a)$), and the average of the 25 regressions R^2 are discussed. To further elaborate the findings, the Sharpe ratio ($SR(a)$), which is the core of the Gibson, Ross & Shanken statistics, is also included.

The asset pricing Gibson, Ross & Shanken F-statistic test is conducted on the average excess returns of the sorted size–book-to-market ratio, size–profitability and size–investment portfolios. Since this study assesses the performance of the five-factor model, the portfolio average excess returns that will be assessed are the portfolios resulting from the sorting of the model's factors.

5.1. Asset Pricing Test for Size BM Portfolios

Table 7 illustrates the Gibson, Ross & Shanken F-statistics, the summary of the absolute values of intercepts, the average standard errors, and the R² and Sharpe ratio regressions which the Gibson, Ross & Shanken test are based on.

For Malaysia, the Gibson, Ross & Shanken F-statistic for the three-factor and five-factor models are 2.53 and 2.48, respectively, which rejects the null hypothesis of zero alpha (see Table 7). The average absolute intercepts have improved in the five-factor model where it has decreased from 0.18% (three-factor) to 0.15% (five-factor), but the figures are still far from zero. The addition of the profitability and investment factors to the three-factor model fail to enhance the average R², which remains unchanged at 0.81. Five-factor model's Sharpe ratio for the intercepts (the smaller the better), Fama and French (2012) witnessed a slight increase from 0.58 to 0.60, further enhancing its inability to capture the excess returns of the size-book-to-market portfolios in Malaysia. In short, relying on the mild improvement in the average absolute intercept and model's five-factor model performed slightly better in explaining the average excess returns on the Malaysian size-book-to-market portfolios compared to the three-factor model.

In Singapore, the Gibson, Ross & Shanken statistic for the three-factor and five factor models are 2.22 and 2.63, respectively, which also rejects the null-hypothesis of zero alpha. Unlike Malaysia, the average absolute intercepts are much closer to zero for both the three-factor and five-factor models, with a slight improvement in the five-factor model where the value decreased from 0.08% to 0.01%. Adding the profitability and investment factors into the three-factor model has enhanced the model's power from 0.34 to 0.69, which resulted in a shrink in its alpha value by 0.07%. Despite having improved the intercept and R² values, the five-factor model fails to improve the Sharpe ratio, which has increased from 0.57 to 0.63. Judging from the improvement in the average absolute intercepts and model's power, it can be deduced that the five-factor model performed better than the three-factor model in explaining the average excess return of the size-BM ratio.

Table 7. Summary statistics of regressions to describe monthly excess returns on portfolios on the basis of size and BM (July 2000 to June 2018).

Factor model	Gibson, Ross & Shanken	Absolute Alpha Value $ \alpha $	Regression Power (R ²)	Standard Error [s(a)]	Sharpe Ratio [SR(a)]
Malaysia					
3-Factor	2.527	0.184	0.808	0.304	0.583
5-Factor	2.481	0.147	0.814	0.713	0.600
Singapore					
3-Factor	2.220	0.078	0.343	0.343	0.571
5-Factor	2.628	0.005	0.687	0.331	0.628
Thailand					
3-Factor	1.076	0.082	0.315	0.335	0.408
5-Factor	1.030	0.007	1.030	0.337	0.411
Indonesia					
3-Factor	3.752	1.705	0.436	0.657	0.957
5-Factor	3.611	1.490	0.454	0.654	0.954
Philippines					
3-Factor	1.025	0.184	0.411	0.631	0.392
5-Factor	1.357	0.101	0.437	0.614	0.454

Note: α refers to the alpha value.

A different outcome is observed in Thailand where the three-factor model and five-factor models' Gibson, Ross & Shanken statistics are among the lowest within the five ASEAN countries. Adding the profitability and investment factors into the three-factor model have been proven to improve the performance of the asset pricing

model in explaining the excess returns of the size–book-to-market portfolios. It witnesses a decline in the Gibson, Ross & Shanken statistic from 1.08 to 1.03 with a shrink in the average absolute intercept value from 0.08 (three-factor) to 0.01 (five-factor), which is much closer to zero. Both of the models' regressions did not reject the null hypothesis of zero alpha. The R^2 has improved significantly from 0.32 to 1.03 after the addition of the profitability and investment factors. Nevertheless, the Sharpe ratio remained unchanged at 0.41. The five-factor model seems to capture more of the variation in average excess returns of the size–BM portfolios in Thailand compared to the three-factor model.

Indonesia's Gibson, Ross & Shanken F-statistics for the three-factor and five factor models are the highest among the five Association of Southeast Asian Nations countries, at 3.75 and 3.61, respectively. Even though the Gibson, Ross & Shanken statistic improved by adding the profitability and investment factors, it still rejected the null hypothesis of zero alpha. The Gibson, Ross & Shanken test did not see much improvement in the average absolute intercepts, which are still farther from zero, although it decreased from 1.71 to 1.49 after the addition of the two new factors, with a mild increase in R^2 from 0.44 to 0.45 and a slight decrease in the Sharpe ratio from 0.96 to 0.95, which is the highest among the five countries. The empirical results suggest that the five-factor model is able to explain more of the variation in the average excess return of the size–BM portfolios in Indonesia.

Mirroring the performance in Thailand, the Philippines depicts much smaller Gibson, Ross & Shanken F-statistics. However, the addition of profitability and investment did not improve the Gibson, Ross & Shanken F-statistic where it increased from 1.03 (three-factor) to 1.36 (five-factor). Both models fail to reject the null hypothesis of zero alpha. The average absolute alpha decreased through the addition of the two factors, from 0.18 to 0.10, yet it is still farther from zero. The R^2 slightly improved through the addition of the two factors, from 0.41 to 0.44. However, the Sharpe ratio increased from 0.39 to 0.45 in the five-factor model. By focusing on the average absolute alpha, the five-factor model mildly enhanced the performance of the three-factor model in explaining the variation in the average excess returns of the size–BM portfolios in the Philippines.

In short, the inclusion of the additional factors (profitability and investment) resulted in a poor performance in capturing the variation in the average excess returns of the size–BM portfolios in all the countries except for Thailand. This is evident from the high Sharpe ratio with the additional factors, and the average absolute alphas are still far from zero. However, the five-factor model performed better in Thailand as it is able to capture more patterns in the average excess returns of the size–BM portfolios.

Table 8. Summary statistics of regressions to describe monthly excess returns on portfolios on the basis of size and profitability (July 2000 to June 2018).

Model	Gibson, Ross & Shanken	Absolute Alpha Value $ \alpha $	Regression Power (R^2)	Standard Error [s(a)]	Sharpe Ratio [SR(a)]
Malaysia					
3-Factor	3.948	0.005	0.464	0.333	0.729
5-Factor	3.556	0.219	0.559	0.311	0.718
Singapore					
3-Factor	3.379	0.033	0.646	0.360	0.705
5-Factor	3.373	0.047	0.684	0.339	0.712
Thailand					
3-Factor	2.496	0.216	0.319	0.359	0.621
5-Factor	2.077	0.089	0.390	0.346	0.583
Indonesia					
3-Factor	3.373	1.617	0.414	0.688	0.907
5-Factor	3.305	1.376	0.444	0.675	0.912
Philippines					
3-Factor	1.137	0.178	0.361	0.673	0.412
5-Factor	1.085	0.105	0.404	0.641	0.406

Note: α refers to the alpha value.

5.2. Asset Pricing Test for Size–Profitability Portfolios

Table 8 illustrates the Gibson, Ross & Shanken F-statistics of the absolute value of intercepts, average standard errors, regressions R^2 and Sharpe ratios.

The Gibson, Ross & Shanken F-statistic for the five-factor model in Malaysia decreased from 3.95 to 3.56 with the addition of the profitability and investment factors in the three-factor model, and both models rejected the null hypothesis of zero alpha. This is supported by the fact that the value of the average absolute intercepts did not improve with the addition of the two new factors, instead departing further from zero. Despite the poor performance in the Gibson, Ross & Shanken F-statistics and the average absolute intercept value, the R^2 has improved tremendously in the five-factor model, where it increased from 0.46 to 0.56. There is a mild decrease in standard error with the enhanced model, where it shrinks from 0.33 to 0.31. There is a slight improvement in the Sharpe ratio, where it reduces from 0.73 to 0.72 with the addition of the two new factors. In short, the five-factor model is unable to improve the performance of the three-factor model in explaining the average excess returns of the size–profitability portfolios in Malaysia.

There is only a slight improvement in the Gibson, Ross & Shanken F-statistic for Singapore with the extension of profitability and investment factors into the three-factor model, where the Gibson, Ross & Shanken statistic for the three-factor is 3.38, while the five-factor model records a value of 3.37. Both models rejected the null hypothesis of zero alpha. Even though the average absolute intercepts are closer to zero, with the addition of the two new factors into the three-factor model, the value moves from 0.03 to 0.05. The R^2 for the three-factor model is 0.65, and is 0.68 in the five-factor model, a mild increase with the addition of the two new factors. The standard error in the three-factor model is 0.36, which decreases in the five factor to 0.34. The Sharpe ratio provides further evidence of the poor performance of the models where it remains at 0.71. The five-factor model performs on a par with the three-factor model in explaining the average excess returns in the size–profitability portfolios in Singapore.

Thailand depicts a different outcome where both of the models did not reject the null hypothesis of zero alpha. In fact, the five-factor model's Gibson, Ross & Shanken statistic largely improved where it decreased to 2.08 compared to the three-factor model, which was at 2.50. This is supported by a lower average absolute intercept in the five-factor model, which is much closer to zero (0.09) compared to the three-factor model which was at 0.22. The R^2 mildly improved in the five-factor model to 0.39 from 0.32 in the three-factor model. The decline in the standard error from 0.36 to 0.35 further enhance the performance of the five-factor model. The Sharpe ratio has also improved accordingly, where it decreases to 0.58 in the five-factor model from 0.62 in the three-factor model. The five-factor model is better at describing the average excess returns of the size–profitability portfolios in Thailand.

The Gibson, Ross & Shanken test for Indonesia has similar patterns to Malaysia and Singapore, where it rejects the null hypothesis of zero alpha. Nevertheless, there is an improvement in the five-factor's Gibson, Ross & Shanken F-statistic value when it drops to 3.31 from 3.37 in the three-factor model. The average absolute intercept also improves where the five-factor's value is much lower at 1.38 compared to the three-factor, which was at 1.62. The R^2 in the three-factor model is 0.41, while there is a mild improvement in the five-factor where the R^2 is 0.44. There is also a decrease in the standard error with the addition of the two new factors, where it declined from 0.69 to 0.68. However, there is no change in the Sharpe ratio with the addition of the new factors. The five-factor performed on a par with the three-factor in explaining the average excess returns in the size–profitability portfolios in Indonesia.

Among the five countries in this study, the Philippines reported the lowest Gibson, Ross & Shanken F-statistic, where both models fail to reject the null hypothesis of zero alpha. The three-factor Gibson, Ross & Shanken F-statistic is 1.14, which decreased with the addition of the two new factors of profitability and investment to 1.09. In light of that, the average absolute intercepts shrink from 0.18 to 0.11 with the two additional factors. The R^2 value also improved with the additional two factors, where it increased from 0.36 to 0.40. Despite improvement in the Gibson, Ross & Shanken statistic, average absolute intercept, model's power and standard error, the Sharpe ratio

remained unchanged. Nonetheless, the Gibson, Ross & Shanken test outcome suggest that the five-factor model supersedes in explaining the average excess returns in the size–profitability portfolios in the Philippines.

5.3. Asset Pricing Test for Size–Investment Portfolios

Table 9 illustrates the Gibson, Ross & Shanken F-statistics, a summary of the absolute value of intercepts, average standard errors, R^2 regressions, and Sharpe ratios.

The Gibson, Ross & Shanken statistics for the three-factor and five-factor models in Malaysia reject the null hypothesis of zero alpha for the regressions against size–investment portfolios. There is an improvement in the five-factor Gibson, Ross & Shanken statistic, which decreased to 3.23 from 3.30 in the three-factor model. The three-factor model has average absolute intercepts closer to zero, which become worse after adding profitability and investment, where the intercept moves further from zero to 0.27. There is an increase in the R^2 where the addition of two new factors increased the R^2 to 0.58 from 0.48 (in the three-factor), while the standard error shows a mild decline from 0.31 to 0.29 with the addition of the profitability and investment factors. The Sharpe ratio worsened with the new addition, where it increases from 0.67 to 0.68. The five-factor model fares poorly compared to the three-factor model in explaining the anomalies in the average excess returns of the size–investment portfolios.

The addition of the new factors to the three-factor model did not improve the model's performance in Singapore, where the Gibson, Ross & Shanken statistic increases from 2.18 to 2.29, which rejects the null hypothesis of zero alpha. It also did not improve the average absolute intercept, where the factor expansion moves the intercept even further from zero. Nonetheless, the R^2 and standard error improved in the five-factor model. However, the Sharpe ratio worsened in the five-factor compared to the three-factor, where it increased to 0.59 from 0.57. This is expected as both the Gibson, Ross & Shanken statistic and the average absolute intercept fare poorly. Although both models are rejected by the Gibson, Ross & Shanken test, the three-factor model performed better in explaining the average excess returns in the size–investment portfolios in Singapore.

Table 9. Summary statistics of regressions to describe monthly excess returns on portfolios on the basis of size and investment (July 2000 to June 2018).

Model	Gibson, Ross & Shanken	Absolute Alpha Value $ \alpha $	Regression Power (R^2)	Standard Error [s(a)]	Sharpe Ratio [SR(a)]
Malaysia					
3-Factor	3.304	0.002	0.478	0.310	0.667
5-Factor	3.231	0.268	0.582	0.286	0.684
Singapore					
3-Factor	2.178	0.038	0.625	0.384	0.565
5-Factor	2.278	0.089	0.660	0.366	0.585
Thailand					
3-Factor	1.487	0.214	0.312	0.346	0.479
5-Factor	1.325	0.103	0.370	0.336	0.466
Indonesia					
3-Factor	2.457	1.470	0.412	0.718	0.774
5-Factor	2.516	1.222	0.442	0.706	0.796
Philippines					
3-Factor	0.661	0.065	0.393	0.657	0.317
5-Factor	1.038	0.116	0.435	0.623	0.397

Note: α refers to the alpha value.

In contrast to Malaysia and Singapore, the Gibson, Ross & Shanken statistic for Thailand improved in the five-factor model compared to the three-factor model, where it decreased from 1.49 to 1.33. Both models' Gibson, Ross & Shanken statistic tests did not reject the null hypothesis of zero alpha. The additional factors (profitability and investment) have been proven to empirically improve the average absolute intercept to 0.10 compared to the three-

factor value of 0.21. The addition of new factors improved the model's power, as the R^2 improved from 0.31 to 0.37, and the standard error reduced from 0.35 to 0.34. The Sharpe ratio also improved with the additional factors, where it decreased from 0.48 to 0.47. Though all the improvements are mild, it can be said that the five-factor model performed better than the three-factor model in explaining the anomalies in the average excess returns in the size–investment portfolios in Thailand.

Echoing the patterns in Singapore, Indonesia's five-factor model did not improve the three-factor model, as the Gibson, Ross & Shanken statistic is much higher for the enhanced model and increased from 2.46 to 2.52, with both models rejecting the null hypothesis of zero alpha. However, the average absolute intercept improved, where it decreased from 1.47 to 1.22, while the R^2 increased slightly from 0.41 to 0.44, and the standard error improved where it decreased from 0.72 to 0.71 with the factor expansion. However, the Sharpe ratio worsened with the factor expansion. The five-factor model failed to improve the performance of the three-factor model in explaining the anomalies in the average excess returns of the size–investment portfolios.

Yet again, the Philippines' three-factor and five-factor models displayed the lowest Gibson, Ross & Shanken statistic values of 0.66 and 1.04, respectively. Both of these models did not reject the null hypothesis of zero alpha. The five-factor model's Gibson, Ross & Shanken statistic is much higher than that of the three-factor model. In addition to that, the empirical results suggest that the five-factor model's average absolute intercepts are much higher compared to those of the three-factor model, moving farther from zero to 0.12. However, the addition of the two factors improves the model's power from 0.39 to 0.44, with a decline in standard deviation from 0.66 to 0.62. Further, profitability and investment are unable to improve the Sharpe ratio. Three-factor model precedes the five-factor model in explaining the average excess returns in the size–investment portfolios in the Philippines.

6. SUMMARY AND CONCLUSION

This study examines the Association of Southeast Asian Nations' stock returns with two goals. The first is to examine the size, value, profitability and investment patterns in average returns in Malaysia, Singapore, Thailand, Indonesia and the Philippines. Attesting to findings by Fama and French (2012), value premiums were found in the average stock returns in Singapore, Thailand, Indonesia and the Philippines. Traces of profitability and investment premiums were observed in the average returns for all countries except Indonesia. The contribution of the study centers on how the value, profitability and investment returns in the Association of Southeast Asian Nations vary with firm size. The value premiums were large for smaller stocks in all the countries, depicting a standard size effect. Echoing Roy and Shijin (2019), profitability premiums were found to be larger in smaller stocks compared to larger stocks in all the countries. Similarly, investment premiums were found to be larger in small stocks in all countries except Singapore and Thailand.

The second goal of this study is to run the Gibson, Ross & Shanken F-statistic test to examine whether the empirical asset pricing three-factor and five-factor models are able to capture the value, profitability and investment variations in the average returns. The Gibson, Ross & Shanken test suggests that the three- and five-factor models rejected the null hypothesis of zero alphas in their regression against the portfolios' average excess returns in Malaysia, Singapore and Indonesia. Following Fama and French (2015), the main concern of this study is to determine the best asset pricing model (though flawed) to explain the variation across the average returns on the portfolios, while less emphasis was put on whether the competing models are rejected relative to their performance, which is determined through the Gibson, Ross & Shanken statistics test.

The addition of the profitability and investment factors into the three-factor model has improved the performance of the model in explaining the anomalies in the average excess returns of the size–BM portfolios in all the countries. This is judged based on the mild to extreme improvement in the average absolute intercepts (a decline of between 15% and 93% compared to the three-factor model) and the model's power (an increase between 0.7% and 226% compared to the three-factor model). It can be deduced that the addition of profitability and

investment into the model improves its ability to capture the pattern in average excess returns in the size–BM portfolios for all the countries.

Mixed outcomes were obtained regarding the performance of the five-factor model against the three-factor model in explaining the average excess returns of the size–profitability portfolios. While Singapore and Indonesia depicted the five-factor model as performing on a par with the three-factor model in explaining the variation in the average excess returns of the size–profitability portfolios, the five-factor model fared poorly against the three-factor model in Malaysia. On the other hand, the five-factor model performed better in Thailand and the Philippines by capturing more anomalies in the average excess returns of the size–profitability portfolios.

In contrast to the outcome of the five-factor model in the size–BM and size–profitability portfolios, the additional factors failed to improve the performance of the model in capturing the patterns in the average excess returns of the size–investment portfolios in all countries except Thailand. The three-factor model seems to perform better in Malaysia, Singapore, Indonesia and the Philippines. However, the five-factor model performed better in capturing the variation in the average excess returns of the size–investment portfolios in Thailand.

The high Sharpe ratios depicted by the models, which are influenced by the precision of the intercepts and the magnitude of the average R^2 and average standard error, suggest that there are anomalies out there that are yet to be priced by the existing asset pricing models. Therefore, the search for a better asset pricing models will continue.

Finally, the Left-Hand Side portfolios are limited to the portfolios formed on the basis of size–book-to-market, size–profitability and size–investment. Hence, the asset pricing models used in this study may produce different outcomes if the portfolios are formed in a different manner.

Funding: This study received no specific financial support.

Competing Interests: The authors declare that they have no competing interests.

Authors' Contributions: All authors contributed equally to the conception and design of the study.

REFERENCES

- Banz, R. W. (1981). The relationship between return and market value of common stocks. *Journal of Financial Economics*, 9(1), 3-18. Available at: [https://doi.org/10.1016/0304-405x\(81\)90018-0](https://doi.org/10.1016/0304-405x(81)90018-0).
- Basiewicz, P., & Auret, C. (2010). Feasibility of the Fama and French three factor model in explaining returns on the JSE. *Investment Analysts Journal*, 39(71), 13-25. Available at: <https://doi.org/10.1080/10293523.2010.11082516>.
- Blume, M. E., & Friend, I. (1973). A new look at the capital asset pricing model. *The Journal of Finance*, 28(1), 19-33.
- Carhart, M. M. (1997). On persistence in mutual fund performance. *The Journal of Finance*, 52(1), 57-82.
- Chiah, M., Chai, D., Zhong, A., & Li, S. (2016). A better model? An empirical investigation of the Fama–French five-factor model in Australia. *International Review of Finance*, 16(4), 595-638. Available at: <https://doi.org/10.1111/irfi.12099>.
- De Bondt, W. F., & Thaler, R. (1985). Does the stock market overreact? *The Journal of Finance*, 40(3), 793-805. Available at: <https://doi.org/10.1111/j.1540-6261.1985.tb05004.x>.
- Dutta, A. (2019). Does the fivefactor asset pricing model have sufficient power? *Global Business Review*, 20(3), 684-691. Available at: <https://doi.org/10.1177/0972150919837060>.
- Eraslan, V. (2013). Fama and French three-factor model: Evidence from Istanbul stock exchange. *Business and Economics Research Journal*, 4(2), 1-11.
- Erdinç, Y. (2017). Comparison of CAPM, three-factor Fama-French model and five-factor Fama-French model for the Turkish stock market. *Financial Management from an Emerging Market Perspective*, 69, 92.
- Fama, E. F., & French, K. R. (1992). The cross-section of expected stock returns. *The Journal of Finance*, 47(2), 427-465.
- Fama, E. F., & French, K. R. (1993). Common risk factors in the returns on stocks and bonds. *Journal of Financial Economics*, 33(1), 3-56. Available at: [https://doi.org/10.1016/0304-405x\(93\)90023-5](https://doi.org/10.1016/0304-405x(93)90023-5).
- Fama, E. F., & French, K. R. (2012). Size, value, and momentum in international stock returns. *Journal of Financial Economics*, 105(3), 457-472. Available at: <https://doi.org/10.1016/j.jfineco.2012.05.011>.

- Fama, E. F., & French, K. R. (2015). A five-factor asset pricing model. *Journal of Financial Economics*, 116(1), 1-22. Available at: <https://doi.org/10.1016/j.jfineco.2014.10.010>.
- Gibbons, M. R., Ross, S., & Shanken, J. (1989). A test of the efficiency of a given Portfolio. *Econometrica*, 57(5), 1121-1152. Available at: <https://doi.org/10.2307/1913625>.
- Guo, B., Zhang, W., Zhang, Y., & Zhang, H. (2017). The five-factor asset pricing model tests for the Chinese stock market. *Pacific-Basin Finance Journal*, 43, 84-106. Available at: <https://doi.org/10.1016/j.pacfin.2017.02.001>.
- Huynh, T. D. (2018). Explaining anomalies in Australia with a five-factor asset pricing model. *International Review of Finance*, 18(1), 123-135. Available at: <https://doi.org/10.1111/irfi.12125>.
- Jegadeesh, N., & Titman, S. (1993). Returns to buying winners and selling losers: Implications for stock market efficiency. *The Journal of Finance*, 48(1), 65-91. Available at: <https://doi.org/10.1111/j.1540-6261.1993.tb04702.x>.
- Kubota, K., & Takehara, H. (2018). Does the Fama and French five-factor model work well in Japan? *International Review of Finance*, 18(1), 137-146. Available at: <https://doi.org/10.1111/irfi.12126>.
- Lin, Q. (2017). Noisy prices and the Fama-French five-factor asset pricing model in China. *Emerging Markets Review*, 31, 141-163. Available at: <https://doi.org/10.1016/j.ememar.2017.04.002>.
- Lintner, J. (1969). The valuation of risk assets and the selection of risky Investments in stock portfolios and capital budgets. *The Review of Economics and Statistics*, 47(1), 222-224.
- Markowitz, H. (1952). Portfolio selection. *The Journal of Finance*, 7(1), 77-91.
- Mossin, J. (1966). Equilibrium in a capital asset market. *Econometrica*, 34(4), 768-783.
- Novy-Marx, R. (2013). The other side of value: The gross profitability premium. *Journal of Financial Economics*, 108(1), 1-28.
- Ouma, W. N., & Muriu, P. (2014). The impact of macroeconomic variables on stock market returns in Kenya. *International Journal of Business and Commerce*, 3(11), 1-31.
- Racicot, F.-E., & Rentz, W. F. (2017). A panel data robust instrumental variable approach: A test of the new Fama-French five-factor model. *Applied Economics Letters*, 24(6), 410-416. Available at: <https://doi.org/10.1080/13504851.2016.1197361>.
- Roll, R. (1977). A critique of the asset pricing theory's tests Part I: On past and potential testability of the theory. *Journal of Financial Economics*, 4(2), 129-176. Available at: [https://doi.org/10.1016/0304-405x\(77\)90009-5](https://doi.org/10.1016/0304-405x(77)90009-5).
- Ross, S. A. (1976). Options and efficiency. *The Quarterly Journal of Economics*, 90(1), 75-89.
- Roy, R., & Shijin, S. (2019). The nexus of anomalies-stock returns-asset pricing models: The international evidence. *Borsa Istanbul Review*, 19(1), 1-14.
- Sattar, M. (2017). CAPM Vs Fama-French three-factor model: An evaluation of effectiveness in explaining excess return in Dhaka stock exchange. *International Journal of Business and Management*, 12(5), 119. Available at: <https://doi.org/10.5539/ijbm.v12n5p119>.
- Sharpe, W. F. (1964). Capital asset prices: A theory of market equilibrium under conditions of risk. *The Journal of Finance*, 19(3), 425-442. Available at: <https://doi.org/10.2307/2977928>.
- Taneja, Y. P. (2010). Revisiting fama french three-factor model in Indian stock market. *Vision: The Journal of Business Perspective*, 14(4), 267-274. Available at: <https://doi.org/10.1177/097226291001400403>.
- Titman, S., Wei, K. J., & Xie, F. (2004). Capital investments and stock returns. *Journal of Financial and Quantitative Analysis*, 39(4), 677-700.
- Titman, S., Wei, K. J., & Xie, F. (2013). Market development and the asset growth effect: International evidence. *Journal of Financial and Quantitative Analysis*, 48(5), 1405-1432. Available at: <https://doi.org/10.1017/s0022109013000495>.

Views and opinions expressed in this article are the views and opinions of the author(s). The Asian Economic and Financial Review shall not be responsible or answerable for any loss, damage or liability, etc., caused in relation to/arising from the use of the content.