International Journal of Business and Management; Vol. 17, No. 7; 2022
ISSN 1833-3850 E-ISSN 1833-8119
Published by Canadian Center of Science and Education

Fama and French (1993) Three-Factor Model: Evidence from Conventional and *Shariah*-Compliant Portfolios in Bursa Malaysia

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Received: April 29, 2022 Accepted: May 24, 2022 Online Published: June 25, 2022
doi:10.5539/ijbm.v17n7p66 URL: https://doi.org/10.5539/ijbm.v17n7p66

Abstract

The main objective of this research is to test whether the style factors employed by the Fama and French (1993) three-factor model adequately explain the performance of four conventional sub-portfolios sorted by book value-to-market value (BVTMV) and their *Shariah*-compliant counterparts in Bursa Malaysia over the examination period from 1 December 2005 to 28 February 2018. To ensure the regression results of this research are unbiased estimations, tests for unit root, heteroskedasticity and autocorrelation bias were conducted on the regression variables. The regression test was conducted by regressing the monthly excess returns of the conventional and *Shariah* sub-portfolios on the monthly returns of the three factors of Fama and French (1993), which are the market risk premium, the small-cap risk premium, and the value risk premium. The results of this research revealed that the Fama and French (1993) three-factor model can significantly explain the performance of the four conventional sub-portfolios sorted by BVTMV and the four *Shariah*-compliant sub-portfolios sorted by BVTMV in Bursa Malaysia.

Keywords: Fama and French (1993), Bursa Malaysia, *Shariah*, conventional, portfolio

Abbreviations

BVTMV: Book Value-to-Market Value Ratio.

CAPM: Capital Asset Pricing Model.

CP: Conventional Portfolio.

FF3F: Fama and French (1993) three-factor model.

FF5F: Fama and French (2015) five-factor model.

HML: High BVTMV return minus Low BVTMV return.

MRP: Market return minus Risk-free return.

MV: Market Value.

SCP: *Shariah*-Compliant Portfolio.

SMB: Small-cap return minus Large-cap return.

1. Introduction

The capital asset pricing model (CAPM), which was separately pioneered by Sharpe (1964), Lintner (1965), and Mossin (1966), is one of the most well-known models in the financial field. The CAPM is estimated by investors to determine the risk-adjusted return of an asset by applying the beta coefficient as an adequate risk measure. Investors should concentrate on the risk and return of portfolios as a whole rather than on the risk and return of individual stocks because the impact of a stock's risk is significantly reduced once it is included in a portfolio (Markowitz, 1959). As a result, constructing a well-diversified portfolio can eliminate that part of the risk associated with stocks (unsystematic risk), whereas the sensitivity to market portfolio movements (systematic risk) cannot be mitigated by diversification, and thus investors deserve an excess return for the part of the systematic risk. The CAPM indicates that (1) there is a linear relationship between beta and expected return; and (2) beta is a sufficient factor in explaining the portfolio's expected return. The CAPM, on the other hand, has been criticized. For example, Fama and MacBeth (1973) and Reinganum (1981) claim that there is no correlation between beta and expected stock return, indicating that a higher beta does not always imply a higher return. The dividend yield, according to Brennan (1970), should be included in the CAPM formulation. Also, Fama and French (1992) revealed that the beta alone was insufficient to explain the stock returns.

In 1993, Fama and French presented their three-factor model. When the CAPM was tested and deployed, Fama and French argued that it did not have much success in explaining stock returns. They emphasise that size and value anomalies are potential risks in portfolios and that investors should compensate for investing in size and value stocks. Therefore, Fama and French (1993) construct and add two factors mimicking portfolios that represent the size and value effects to the CAPM factor (market risk premium, MRP). These two factors are (1) the small-cap risk premium (SMB), which is a mimicking portfolio of the risk factor that is related to the size and represents the difference in return between small-cap stocks and large-cap stocks; and (2) the value risk premium (HML), which is a mimicking portfolio of the risk factor that is related to the value and represents the difference in return between stocks with high book value-to-market value BVTMV (value stocks) and stocks with low BVTMV (growth stocks). It is worth mentioning that the return of small-cap stocks is generally higher than the return of large-cap stocks (Banz, 1981; Arnaya & Purbawangsa, 2020), while the return of the value stocks is also generally higher compared to the return of the growth stocks (Fama & French, 1993; Black, Mao & McMillan, 2009; Cao, Chen & Datar, 2017).

Fama and French (1993) three-factor model (FF3F) has improved the explanation of stock returns compared to the CAPM in various studies conducted in different markets, such as the USA, Asia, and Europe. Hence, it was considered useful to test the FF3F in Malaysia, one of the countries among emerging markets that have exhibited rapid economic growth. The small firm effect and value effect are well-documented market anomalies in the capital market. Active managers generally follow different investment styles that are classified by firm size and/or fundamental book value-to-market value ratio (BVTMV). Therefore the main objective of this research is to investigate whether the style factors employed by FF3F adequately explain the performance of the excess returns of conventional sub-portfolios (CPs) sorted by BVTMV and their *Shariah*-compliant counterparts (SCPs) on Bursa Malaysia over an extensive examination period, from 1 December 2005 to 28 February 2018. The other objective of this research is to examine the investment style attribution that drives the performance of both kinds of portfolios by applying FF3F over the same examination period. Thus, the research questions are

1. Do the style factors employed by the FF3F adequately explain the performance of the CPs and SCPs sorted by BVTMV in Bursa Malaysia over the examination period?

2. What is the investment style attribution that drives the performance of CPs and SCPs sorted by BVTMV by applying FF3F in Bursa Malaysia over the examination period?

Concerning the *Shariah*-compliant portfolio, it differs from the conventional portfolio in that it must comply with Islamic law named *Shariah*. The *Shariah*-compliant portfolio (whether the investors are Muslim or not) may not include investments in companies that trade in or produce against *Shariah* such as liquor, pork, tobacco, pornography and gambling, or investments in financial products that have fixed interests such as bonds, preferred stocks and options, or any other practice deemed immoral. However, *Shariah*-compliant portfolios do not operate in the same favourable conditions as conventional portfolios since they may have suffered from poor diversification, as their managers may face a challenge with stock allocation, which by definition has to be *Shariah*-compliant. Besides the disadvantages of smaller size and restricted investment choices, *Shariah*-compliant portfolios have unique additional operational costs since they must appoint *Shariah* scholars to monitor and ensure that their investments are in line with *Shariah*. Furthermore, the size of the *Shariah*-compliant financial services industry remains negligible when compared to the global financial services industry, as it only represents around 1% of the global financial market (Montgomery & Masson, 2016. p, 76). However, despite its small size in the global financial services industry, the high growth of the *Shariah*-compliant financial services industry shows there is considerable potential for this industry to grow globally. The World Bank (2015) and Alam et al. (2020) indicate that the Islamic financial services industry has been growing by 10–12% annually in the last two decades. Furthermore, according to Ernst and Young (2018), the *Shariah*-compliant financial services industry is one of the fastest-growing global financial services industries.

The motivation for choosing Bursa Malaysia in this study is because it consists of conventional and Islamic capital markets working in parallel, and it is a well-regulated market that offers a wide range of financial and investment facilities with data availability. Bursa Malaysia is also a well-known market for *Shariah*-compliant since the majority of stocks listed on it are *Shariah*-compliant. According to the *Shariah* Advisory Council of the Securities Commission Malaysia, in its report on 26 November 2021, there are 751 Islamic stocks out of 948 stocks listed in Bursa Malaysia. Thus, around 79% of stocks in Bursa Malaysia are *Shariah*-compliant (SC, 2021). The market capitalisation of the Islamic capital market at the end of February 2022 was RM2,313.3 billion, which represents around 65% of the Malaysian capital market SC (2022). Furthermore, choosing one country to conduct the analyses helps to reduce the bias that derives from the variety of national characteristics present if the study used different countries.

2. Literature Review

Over time, the CAPM was employed by investors to explain the returns of their portfolios. However, researchers found that other unsystematic risks are affecting the portfolio return that the CAPM did not recognise. For example, after studying the impact of the P/E of stocks on their performance on the NYSE between 1957 and 1971, Basu (1977) concluded that the lower P/E stocks achieved a superior return and abnormal return accompanied by a lower beta coefficient than the high P/E stocks. Also, after analysing stocks on the NYSE from 1936 to 1975, Banz (1981) asserted the presence of the size effect on expected returns. According to the author, when firms are divided based on their market capitalisation, companies with small market capitalisations have higher average returns than companies with large market capitalisations.

Fama and French published their valuable paper in 1992, which has been one of the most influential studies published on asset pricing (Faff, 2003, p. 311). Their study aimed to find what additional factors affected stock returns over the 1963-1990 examination period. They examined the beta, size, BVTMV, leverage and P/E in the USA markets (AMEX, NASDAQ and NYSE). Fama and French (1992) found that the beta alone was unable adequately to explain the returns of the stocks, and the size and BVTMV factors played a significant role in explaining the cross-section of stock return compared to leverage and the P/E. Nevertheless, Black (1993) claimed that Fama and French's (1992) paper was affected by data mining. In a similar vein, Kothari, Shanken and Sloan (1995) stated that Fama and French (1992) was affected by survivorship and selection biases, the authors also concluded that the relationship between the return and the BVTMV is not strong as Fama and French claimed.

Based on their results in 1992, Fama and French (1993) introduced their three-factor model (FF3F) after studying the AMEX, NASDAQ and NYSE from 1963 to 1991. They argued that including the size and value factors along with the beta factor explains portfolio performance much better than using the beta alone. Compared with the CAPM, the *R*-squared of the portfolios' regressions in the FF3F, was between 0.83 and 0.97, where 21 of the *R*-squared are bigger than 0.90, while it was between 0.61 and 0.92 in the CAPM, but only two of the *R*-squared are bigger than 0.90. Thus, the FF3F has a higher ability to explain portfolio performance compared to the CAPM. Sutrisno and Nasri (2018) came to the same result, claiming that the Fama-French three-factor model is better than CAPM in explaining excess returns on stock portfolios in Indonesia. Even though the Fama-French three-factor model beats the CAPM, Sutrino and Nasri (2018) suggest that other factors should be taken into account when creating asset pricing models that better reflect stock return variability in the Indonesian stock market. Therefore, the FF3F became desirable to many researchers to explain portfolio return in different countries, such as O'Brien (2007) in Australia; Lawrence, Geppert and Prakash (2007) in the USA; Su and Taltavull (2021) in Spain; Atodaria, Shah and Nandaniya (2021) in India; Al-Mwalla and Karasneh (2011) in Jordan; Allen and Cleary (1998), Drew and Veeraraghavan (2002), Lai and Lau (2010), and Shaharuddin, Lau and Ahmad (2017) and Bakar and Rosbi (2019) in Malaysia.

On the other hand, the FF3F could not explain some anomalies related to profitability and investment. Hence, in response to this critique, Fama and French (2015) added two additional factors that reflect profitability and investment in their FF3F. The new two factors are the profitability factor (RMW), which is the difference in return between the most profitable companies and the least profitable, and the investment factor (CMA), which is the difference in return between a low-investment portfolio and a high-investment portfolio. Therefore, the five factors are the MRP, the SMB, the HML, the RMW and the CMA. The FF5F proved that small, profitable and value stocks with no significant growth prospects are expected to have the highest return. Yet, despite the criticisms of the FF3F, Hodrick and Zhang (2001:329) state that it became "*the workhorse for risk adjustment in academic circles*".

To compare different asset pricing models, Foye (2018) conducted a study in 18 countries to investigate whether the FF5F would have a better return explanation power than the FF3F for stocks listed in different markets from December 1996 to June 2016. The study applied the standard regression approach. While the FF5F offered a better return explanation in Eastern Europe and Latin America, the evidence revealed that the FF5F did not offer a better return explanation in Asia where the FF3F was a better option. Su and Taltavull (2021) tested the FF3F in the real estate investment trusts in Spain from Q3-2007 to Q2-2017 by applying the autoregressive distributed lag model. Based on the study's results, the researchers concluded that FF3F is an adequate model to explain the performance of the real estate investment trusts in Spain compared to the Carhart four-factor model and CAPM. Also, Atodaria, Shah and Nandaniya (2021) aimed to analysis the CAPM and FF3F for the NIFTY 50 companies - Nifty 50 is one of the two main stock indices used in India- in the equity market of India - over the period from April 2014 to March 2019. The authors found that CAPM is less performance than the FF3F in explaining the performance of the companies.

From January 2015 to December 2020, the monthly return data of 270 Chinese A-share funds are selected by Liu and Shi (2022). The main objective of this paper is to examine the explanatory power of FF3F, Carhart's (1997) four-factor model and FF5F in the stock market of China. It is evident from the results that the FF5F has a better explanation power for stock's excess return than the FF3F and Carhart's four-factor model. In a recent study also during the COVID-19 period over the examination period from January 2020 to September 2021, a study was conducted by Wang (2022) to test the applicability of the FF3F and FF5F on three American biopharmaceutical industry funds. By employing the multiple regression analysis, the results indicate that both FF3F and FF5F have great application to the stocks of the American biopharmaceutical business over the study period. This indicates that all 5 variables have a good capacity to explain changes in this industry's stock returns. However, for the three funds, the five-factor model shows a stronger positive correlation and fitting degree.

Shaharuddin et al. (2017) tested the explanatory power of the FF3F in respect of the returns of *Shariah*-compliant stocks on Bursa Malaysia from May 2006 to May 2011. The sample included all *Shariah*-compliant stocks listed on the FTSE Bursa Malaysia KLSE. The results confirmed that the model adequately explained the performance of the *Shariah*-compliant stocks on Bursa Malaysia. On the contrary, Bakar and Rosbi (2019) studied a sample of 16 *Shariah*-compliant initial public offering stocks listed on Bursa Malaysia between January 2016 and December 2018, to evaluate the performance of stocks using the FF3F. After applying the regression analysis, the results showed a negative abnormal return (-3.399), and hence, the portfolio performed worse than the market, while the MRP, SMB and HML could only explain 46.67% of the portfolio's excess returns. Accordingly, other factors better accounted for the returns of the *Shariah*-compliant initial public offering listed on Bursa Malaysia.

Most of the previous studies, however, did not test for the unit root, heteroskedasticity and autocorrelation biases, therefore, their results might be unreliable. To ensure that the regression results of this study are unbiased estimations, tests for unit root, heteroskedasticity, and autocorrelation bias were conducted on the regression variables with appropriate corrections employed if any biases were detected. Other differences between this research and previous studies lie in the size and number of the hypothetical portfolios, and the examination period, since over an extensive period from 1 December 2005 to 28 February 2018, this research employs a large number of hypothetical portfolios where each portfolio includes a relatively large number of stocks.

3. Methodology

This study is based on secondary data that has been published. The data was mostly collected from the Taiwan Economic Journal's database (TEJ), which was accessed through a subscription. The study uses monthly data rather than daily or weekly data because it avoids large market fluctuations over the study period. The return on investment (ROI) is derived directly from the TEJ database and used to estimate a stock's return. Moreover, this study uses the *Shariah*-compliant securities list report issued by Malaysia's security commission (SC) to determine if a stock is *Shariah*-compliant or not. Any firm that is included in this list is considered *Shariah*-compliant, while any company that is not listed is considered non-*Shariah* compliant. This report was published at the end of May and November during the study period of 1 December 2005 to 28 February 2018, except for 2006, when it was published at the end of April and October. To construct the sub-portfolios, each conventional and *Shariah*-compliant stock is ranked according to BVTMV on the portfolio rebalancing dates, which are on 1 June and 1 December immediately after the *Shariah*-compliant lists were released. Four equally weighted quarterly portfolios within both kinds of stocks are constructed. The Q1 represents stocks in the bottom quarterly portfolio with the lowest BVTMV, while the Q4 represents stocks in the high quarterly portfolio with the highest BVTMV. Table 1 displays the number of stocks in each sub-portfolio sorted by BVTMV. Table 1 displays the starting and ending number of stocks in the conventional sub-portfolios sorted by BVTMV and their *Shariah*-compliant counterparts over the examination period.

Table 1. Number of Stocks in the Sub-portfolios Sorted by BVTMV

Sub-portfolios Sorted by BVTMV					
	Start Des 05'	**End Feb 18'**		**Start Des 05'**	**End Feb 18'**
CPs:			**SCPs:**		
Q1(Low)	96	165	**Q1(Low)**	84	125
Q2	95	165	**Q2**	84	124
Q3	95	165	**Q3**	84	125
Q4 (High)	95	165	**Q4 (High)**	84	124

To construct the Fama and French factors, the stocks are divided into two groups according to their market value (MV), whereby the small portfolio (S) consists of the smallest 50% of stocks with respect to MV; and the big portfolio (B) consists of the biggest 50% of stocks with respect to MV. At the same time, stocks are divided into three categories according to their book value-to-market value ratio (BVTMV) as follows: (1) the low portfolio (L), which consists of the lowest 30% of the stocks with regards to BVTMV; (2) the medium portfolio (M), which consists of the middle 30%–70% of the stocks in respect of BVTMV; and (3) the high portfolio (H), which consists of the highest 30% of the stocks with regards to BVTMV. According to Fama and French (1993), the reason for separating MV into two portfolios and BVTMV into three portfolios is because BVTMV better explains the portfolio return compared to MV. The rebalanced of these hypothetical portfolios is also semi-annually, at the end of May and November over the research examination period. Afterward, the six-factor benchmarks required to calculate the small-cap risk premium (SMB) and the value risk premium (HML) samples are constructed by intersecting the two MV portfolios with the three BVTMV portfolios.

Hence, the six portfolios constructed are: (1) B&H contains stocks that are simultaneously grouped in the big MV and the high BVTMV portfolios; (2) B&M contains stocks that are simultaneously grouped in the big MV and the medium BVTMV portfolios; (3) B&L contains stocks that are simultaneously grouped in the big MV and the low BVTMV portfolios; (4) S&H contains stocks that are simultaneously grouped in the small MV and the high BVTMV portfolios; (5) S&M contains stocks that are simultaneously grouped in the small MV and the medium BVTMV portfolios; and (6) S&L contains stocks that are simultaneously grouped in the small MV and the low BVTMV portfolios.

The SMB factor is the difference in the average return between the three small-cap portfolios (S&H, S&M and S&L) and the three big-cap portfolios (B&H, B&M and B&L), as follows in Equation 1:

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

On the other hand, the HML factor is the difference in the average return between the two high BVTMV portfolios (B&H and S&H) and the two low BVTMV portfolios (B&L and S&L), as follows in Equation 2:

$$HML = \frac{B\&H+S\&H}{2} - \frac{B\&L+S\&L}{2} \quad (2)$$

The performance attribution analysis is carried out by using the STATA 12 statistical analysis software. The test is conducted by regressing the monthly excess returns of each portfolio on the monthly returns of the MRP, the SMB and the HML factors. The test formula is as follows in Equation 3:

$$(r_{x,t} - r_{f,t}) = a_x + b_{x,m}.MRP_t + b_{x,s}.SMB_t + b_{x,v}.HML_t + \varepsilon_{x,t} \quad (3)$$

Where:

$(r_{x,t} - r_{f,t})$: is the excess return of a portfolio x in month *t;*

MRP_t : is the market risk premium, which is the market return minus risk-free return in month *t*;

$b_{x,m}$: is the factor loading on the MRP, measures the sensitivity of the portfolio *x* excess return to the movement in the MRP;

SMB_t : is the small-cap risk premium in month *t*;

$b_{x,s}$: is the factor loading on the SMB, measures the sensitivity of the portfolio *x* excess return to the movement in the SMB;

HML_t : is the value risk premium in month t; and

$b_{x,v}$: is the factor loading on the HML, measures the sensitivity of the portfolio x excess return to the movement in the HML.

A positive factor loading on the SMB indicates a small-cap bias, while a negative factor indicates a large-cap bias. Likewise, a positive factor loading on the HML represents a value bias, while a negative factor denotes a growth bias. To ensure that this research is free from the look-ahead bias, which is the mismatch between the time of constructing the portfolio and the availability of some data, the values of the attributes used to construct the portfolios are lagged by six months before the portfolio returns are computed. Employing a lag of six months is conservative and agrees with Fama and French's (1992) argument. Moreover, to ensure the decrement in the time-series variation, all attributes used to construct the variables in the model are logged before conducting the regression. Also, the following tests were conducted before running the regressions, to ensure that the results of this research are unbiased:

1. **The unit root**: if the time-series has unit roots, the time-series is not covariance stationary (DeFusco et al., 2015, p.516). To test whether the time series has a unit root or not, this research applies the Augmented Dickey-Fuller (1981) test (ADF). The *STATA 12* statistical analysis software presents three kinds of ADF test (1) the ADF with intercept (constant) and trend; (2) the ADF with intercept (constant) only; and (3) the ADF with no intercept (constant) and no trend. The null hypothesis for this test is H_0: the time series has a unit root, whereas the alternative hypothesis of the ADF test is H_1: the time-series has no unit root. Only variables that are statistically significant under the ADF test at a 5% level are accepted in the regression analysis.

2. **The heteroskedasticity**: DeFusco et al. (2015, p.445) clarify that heteroskedasticity bias occurs once the variance of the error terms changes through the observations. Thus, heteroskedasticity appears when the residuals of the regression in general, grow much larger with each increase in the independent variables' size. Heteroskedasticity could exhibit a statistically significant relationship between variables where there is no relation. To test whether the residuals are heteroskedastic or not, this research applied the Breusch-Pagan (1979) test. The significance of this test is at a 10% level, where the null hypothesis is H_0: the residuals of the regression are not heteroskedastic against the alternative hypothesis of H_1: the residuals of the regression are heteroskedastic.

3. **The autocorrelation (serially correlated):** The autocorrelation bias occurs when the residuals of the regression are correlated through observations, and it might cause a wrong standard error of the regression (DeFusco et al., 2015, p.450). The autocorrelation bias in this research is examined by applying Durbin's alternative test (Durbin, 1970). The significance of this test is at a 10% level, where the null hypothesis is H_0: the residuals of the regression are not serially correlated, while the alternative hypothesis is H_1: the residuals of the regression are serially correlated.

Since all the above tests indicate that there is no autocorrelation bias. Hence, the regressions that are employed are: (1) the OLS regression if the sub-portfolios have no heteroskedastic; and, (2) the robust standard errors regression for the sub-portfolios that only have a heteroskedastic bias. It is worth mentioning that the adjusted *R*-squared for the robust standard errors regression is derived from the OLS regression.

In terms of choosing the market proxy, Hsieh and Hodnett (2011) argue that constructing a market proxy from available sample stocks is essential to conduct a fair evaluation of portfolios that are constructed from the same pool of sample stocks. Therefore, the return of the equally weighted portfolio of all conventional stocks in the database is employed as a market proxy for all conventional sub-portfolios, while the return of the equally weighted portfolio of all *Shariah*-compliant stocks in the database is employed as a market proxy for all *Shariah*-compliant sub-portfolios. At the same time, the 3-month Bank Negara Treasury bills rate and the 3-month Islamic interbank rates are employed as risk-free proxies for all conventional sub-portfolios and *Shariah*-compliant sub-portfolios, respectively.

4. Results: Performance Attribution for Sub-portfolios Sorted by BVTMV

4.1 Unit Root, Heteroskedastic and Autocorrelation Tests

Panel (a) in Table 1 shows the results of the three kinds of ADF test for the excess returns of conventional sub-portfolios sorted by BVTMV and their *Shariah*-compliant counterparts during the whole examination period. While Panel (b) displays the results of the Breusch-Pagan (1979) test and Durbin's alternative test for the same sub-portfolios. Where the p-values of the Breusch-Pagan (1979) test are significant at a 10% level, they are highlighted in bold in the table.

Table 2. Unit root, Heteroskedastic and autocorrelation test results for sub-portfolios sorted by BVTMV

Panel (a)	**ADF Tests**					
	Intercept only		**Intercept and Trend**		**No Intercept and No Trend**	
The excess return of BVTMV Sub-portfolios	**Critical Value 5%**	**ADF Test Stat.**	**Critical Value 5%**	**ADF Test Stat.**	**Critical Value 5%**	**ADF Test Stat.**
CP:						
Q1(Low)	-2.887	-10.984	-3.444	-10.788	-1.950	-10.813
Q2	-2.887	-11.885	-3.444	-11.794	-1.950	-11.883
Q3	-2.887	-10.994	-3.444	-11.509	-1.950	-10.930
Q4 (High)	-2.887	-11.206	-3.444	-11.337	-1.950	-10.955
SCP:						
Q1(Low)	-2.887	-10.909	-3.444	-10.783	-1.950	-10.815
Q2	-2.887	-11.891	-3.444	-11.885	-1.950	-11.911
Q3	-2.887	-10.970	-3.444	-11.113	-1.950	-10.955
Q4 (High)	-2.887	-11.080	-3.444	-11.196	-1.950	-10.836

Panel (b)	**Breusch-Pagan (1979) Test**		**Durbin's Alternative Test**	
The Excess return of BVTMV Sub-portfolios	**Chi^2**	**Probability**	**Chi^2**	**Probability**
CP:				
Q1(Low)	**5.210**	**0.024***	0.265	0.617
Q2	0.040	0.857	0.001	0.979
Q3	1.630	0.262	1.283	0.277
Q4 (High)	**9.220**	**0.003***	0.004	0.941
SCP:				
Q1(low)	**8.840**	**0.004***	0.000	0.998
Q2	1.420	0.283	0.284	0.597
Q3	**5.760**	**0.017***	0.000	0.989
Q4 (High)	**12.090**	**0.001***	0.359	0.569

Note. * significant at 10%.

The results from Panel (a) indicate that the ADF absolute values for all sub-portfolios are bigger than their corresponding critical values at a 5% level. Therefore, the alternative hypothesis is accepted which stated that the data has no unit root, and the time series is stationary. In terms of the Breusch-Pagan (1979) test in Panel (b), the conventional Q2 and Q3 sub-portfolios, as well as the *Shariah*-compliant Q2 sub-portfolio, have p-values bigger than 10%, while other sub-portfolios' p-values are less than 10%. Hence, only the conventional Q2 and Q3 sub-portfolios, as well as the Shariah-compliant Q2 sub-portfolio, accept the null hypothesis and their residuals are not heteroskedastic, while other sub-portfolios accept the alternative hypothesis and their residuals are heteroskedastic. On the other hand, it is revealed from the results of Durbin's alternative test in the same panel that the p-values of all sub-portfolios are bigger than 10%. Therefore, the null hypothesis cannot be rejected, which means that the residuals for both types of sub-portfolios sorted by BVTMV are not serially correlated.

4.2 Portfolio Performance Attribution

Table 2 shows the regression results of the conventional sub-portfolios sorted by BVTMV and their *Shariah*-compliant counterparts. Following the results in Table 1, the regressions that are employed in this research are: (1) the OLS regression for the conventional Q2 and Q3 sub-portfolios, as well as the

Shariah-compliant Q2 sub-portfolio since these sub-portfolios have no heteroskedastic or autocorrelation biases; and (2) the robust standard errors regression for the other sub-portfolios, since these sub-portfolios only have a heteroskedastic bias.

Table 3. Performance attribution for sub-portfolios sorted by BVTMV

Panel (a) Conventional Sub-portfolios

	Q1 (Low)	Q2	Q3	Q4 (High)
Prob > F	0.000	0.000	0.000	0.000
R^2	0.982	0.973	0.977	0.979
Adj-R^2	0.981	0.973	0.976	0.978
Intercept	0.000	0.000	**-0.002**	0.000
t-Stat	-0.640	-0.190	**-2.560**	0.300
P. Value	0.521	0.848	**0.013**	0.761
b_MRP	0.965	0.995	1.000	1.005
t-Stat	71.43	64.61	58.43	40.16
P. Value	0.000***	0.000***	0.000***	0.000***
b_SMB	-0.346	-0.131	0.024	0.309
t-Stat	-11.32	-3.700	0.610	5.230
P. Value	0.000***	0.000***	0.547	0.000***
b_HML	-0.413	-0.279	0.137	0.525
t-Stat	-15.44	-8.100	3.580	9.000
P. Value	0.000***	0.000***	0.000***	0.000***

Panel (b) *Shariah*-compliant Sub-portfolios

	Q1 (Low)	Q2	Q3	Q4 (High)
Prob > F	0.000	0.000	0.000	0.000
R^2	0.978	0.966	0.962	0.957
Adj-R^2	0.977	0.965	0.961	0.956
Intercept	-0.001	0.000	**-0.002**	0.001
t-Stat	-1.280	-0.670	**-2.370**	0.700
P. Value	0.203	0.506	**0.020**	0.487
b_MRP	0.985	0.983	0.987	1.000
t-Stat	52.78	57.07	50.19	36.67
P. Value	0.000***	0.000***	0.000***	0.000***
b_SMB	-0.376	-0.121	-0.007	0.279
t-Stat	-11.14	-3.050	-0.130	4.350
P. Value	0.000***	0.003***	0.894	0.000***
b_HML	-0.418	-0.272	0.132	0.489
t-Stat	-12.79	-7.070	2.300	7.340
P. Value	0.000***	0.000***	0.024**	0.000***

Notes. *** Factor loading significantly at 1%, and ** factor loading significantly at 5%.

The results of the table clarify that the lowest *R*-squared of the conventional and *Shariah*-compliant sub-portfolios is 0.957 with all sub-portfolios having p-values equal to 0. Therefore, at least 95.7% of the variation in the excess returns of conventional and *Shariah*-compliant sub-portfolios sorted by BVTMV can be explained significantly at a 1% level by the variation in the three risk factors (MRP, SMB, and HML). The adjusted *R*-squared values are identical or very close to the *R*-squared values, hence, there are no overloading problems and the regressions are sound. In terms of the abnormal return (alpha coefficient), only the Q3 conventional and *Shariah*-compliant sub-portfolios have significantly negative abnormal returns, where their p-values are 0.013 and 0.020, respectively. Therefore, for both kinds of sub-portfolios, the market only outperforms the Q3 sub-portfolio significantly at a 5% level in a consistent manner. However, the conventional Q1, Q2, and Q4 sub-portfolios, as well as the *Shariah*-compliant Q2 sub-portfolio, have no abnormal returns. On the other hand, the *Shariah*-compliant Q4 sub-portfolio has a positive abnormal return that is not significant, with a p-value equal to 0.487. While the *Shariah*-compliant Q1 sub-portfolio has a negative abnormal return that is also not significant, with a p-value equal to 0.203.

With regards to the MRP factor, it is evident that the beta coefficients of all conventional and *Shariah*-compliant sub-portfolios are equal or close to 1, with p-values equal to 0. Consequently, all sub-portfolios move in tandem with the market. In detail, the beta coefficient for the conventional Q3 sub-portfolio and *Shariah*-compliant Q4 sub-portfolio is equal to 1, while the conventional Q4 sub-portfolio is the only sub-portfolio that has a beta coefficient bigger than 1. Thus, only the conventional Q4 sub-portfolio has a higher systematic risk than the market while, with a beta coefficient of less than one, the majority of the sub-portfolios have less systematic risk compared to the market. Thus, the results indicate that the MRP is a crucial factor that drives the performance of conventional sub-portfolios sorted with BVTMV and their *Shariah*-compliant counterparts.

In terms of the factor loading on SMB, it is observed that the slopes for the conventional and *Shariah*-compliant Q1 and Q2 sub-portfolios are negative with p-values almost equal to 0. Hence, the performance of these sub-portfolios is statistically significant at a 1% level towards the performance of large-cap stocks. However, the *Shariah*-compliant Q3 sub-portfolio also has a negative slope, but with a p-value equal to 0.894. Thus, the performance of the *Shariah*-compliant Q3 sub-portfolio is mildly (statistically insignificant) to the performance of the large-cap stocks. By contrast, the slopes for the conventional Q3 and Q4 sub-portfolios, as well as the *Shariah*-compliant Q4 sub-portfolio, are positive. Thus, the performance of these sub-portfolios is toward the performance of the value stocks, but only statistically significant at a 1% level for conventional and *Shariah*-compliant Q4 sub-portfolios (p-values = 0), while not significant for the conventional Q3 sub-portfolio (p-value = 0.547). Thus, the SMB is also considered a crucial factor in explaining the performance of the conventional sub-portfolios and their *Shariah*-compliant portfolios sorted with BVTMV.

Lastly, regarding the factor loading on HML, the slopes for the conventional and *Shariah*-compliant Q1 and Q2 sub-portfolios are negative with p-values equal to 0. Thus, the performance of these sub-portfolios is statistically significant at a 1% level with regards to the performance of the growth stocks, since these sub-portfolios are characterised by a low BVTMV. On the other hand, the slopes for the conventional and *Shariah*-compliant Q3 and Q4 sub-portfolios are positive, where the p-values of the conventional Q3 and Q4 sub-portfolios, as well as the *Shariah*-compliant Q4 sub-portfolio, are equal to 0, while the p-value for the *Shariah*-compliant Q3 sub-portfolio is 0.024. Thus, for both types of sub-portfolios, the performance of the Q3 and the Q4 sub-portfolios is strong with regards to the performance of the value stocks but statistically significant at a 1% level for the conventional Q3 and Q4 sub-portfolios, as well as for the *Shariah*-compliant Q4 sub-portfolio, but statistically significant at a 5% level for the *Shariah*-compliant Q3 sub-portfolio. This is expected since the Q3 and Q4 sub-portfolios represent the high BVTMV portfolios. Therefore, the HML is further considered a crucial factor in explaining the performance of the conventional sub-portfolios sorted with BVTMV and their *Shariah*-compliant counterparts.

The results of this section are in line with what Fama and French (1993) found in terms of the insignificance of the abnormal return for the majority of the sub-portfolios. Also, when taking into account the *R*-squared as well as the adjusted *R*-squared, it is evident that the FF3F properly explains the performance of the conventional sub-portfolios sorted by BVTMV and their *Shariah*-compliant counterparts. Furthermore, it is also evident from the results that (1) the investments in the conventional and *Shariah*-compliant Q1 and Q2 sub-portfolios are exposed to the large-cap and growth risks; (2) the investments in the conventional and *Shariah*-compliant Q3 sub-portfolios are only exposed to the value risks; and (3) the investments in the conventional and *Shariah*-compliant Q4 sub-portfolios are exposed to the small-cap and value risks.

5. Conclusion

This research aimed (1) to investigate whether the style factors employed by the Fama and French (1993) three-factor model adequately explain the performance of the *Shariah*-compliant portfolios (SCPs) and conventional portfolios (CPs) over the examination period from 1 December 2005 to 28 February 2018; and (2) to examine the investment style attribution that drives the performance of *Shariah*-compliant portfolios and conventional portfolios by applying the Fama and French (1993) three-factor model over the same examination period. The test was conducted by regressing the monthly excess returns of different kinds of portfolios on the monthly returns of the Fama and French (1993) factors (MRP, SMB, and HML). The results emphasise that the FF3F is sufficient in explaining the performance of the conventional sub-portfolios sorted by BVTMV and their

Shariah-compliant counterparts. Where there are no significant abnormal returns for most of the regressions. Also, the results indicate that (1) the performance of the conventional Q1 and Q2 sub-portfolios and their *Shariah*-compliant counterpart is driven by the performance of the large-cap and growth stocks; (2) the performance of the conventional Q3 sub-portfolio and its *Shariah*-compliant counterpart is only driven by the performance of the value stocks; and (3) the performance of the conventional Q4 sub-portfolio and its *Shariah*-compliant counterpart is driven by the performance of the small-cap and value stocks. Therefore, the FF3F is considered a favourable model to explain the portfolio performance for different kinds of portfolios in Bursa Malaysia. These results agree with the results obtained by Allen and Cleary (1998), Drew and Veeraraghavan (2002), Lai and Lau (2010), Shaharuddin, Lau and Ahmad (2017) and Wang (2022). The results also may give strong evidence that the performance of the conventional portfolios is similar to the performance of *Shariah*-compliant portfolios in Bursa Malaysia during the study period.

Acknowledgments

Professor Heng-Hsing Hsieh (Andy) deserves special thanks for the study proposal, as well as his encouragement and support in carrying it out, particularly his guidance and assistance in selecting the right methodology.

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