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Does the Carhart (1997) Four-Factor Model Still Applicable? Evidence from Stocks Listed on Bursa Malaysia

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ABSTRACT

Researchers and investors frequently use different financial models to explain stock returns. These models' applicability for evaluating various stock price anomalies is investigated across several markets. This research examines Carhart's (1997) four-factor model in Bursa Malaysia on four portfolios constructed according to their market value from 1 January 2011 to 1 January 2021. The results of the Robust Standard Errors and Ordinary least squares (OLS) regressions emphasised that the Carhart (1997) four-factor model has a strong return explanatory power in Bursa Malaysia. However, the results also asserted that the momentum effect does not exist in the four-sized portfolios in Bursa Malaysia.

Keywords: Carhart (1997), Momentum Effect, Bursa Malaysia
JEL Classifications: G11, G15, G41

1. INTRODUCTION

Capital allocation is essential for investors seeking to maximise the returns on their investments in the financial markets. To enable this objective, a range of models have been developed to estimate returns from securities according to their level of risk characteristics. One of the well-known models is the Capital Asset Pricing Model (CAPM), which was independently founded by Sharpe (1964), Lintner (1965), and Mossin (1966). Jensen (1968) argues that before the CAPM, a stock was evaluated individually based on its return, while there was no specific appropriate measure for evaluating portfolios. By using the beta as a sufficient measure of risk, investors can estimate the CAPM to determine an asset's risk-adjusted performance (Rohuma, 2022). It is worth mentioning that diversity was unable to reduce systematic risk, which is sensitivity to changes in the market portfolio. Investors, therefore, should be compensated for their portion of the systemic risk with an excess return. According to the CAPM, beta alone adequately explains the expected return on a portfolio. Equation 1 calculates the excess expected return for the portfolio x based on the CAPM.

$$E\,(r_x - r_f) = a_x + b_{x,m}.MRP + \varepsilon_x \quad (1)$$

Where, r_f is the return of risk-free; a_x is regression intercept; MRP is the return differential for market portfolio returns and a risk-free proxy; $b_{x,m}$ is the factor loading on the MRP; and ε_x is the error term.

Several questions have been raised about to what extent the CAPM can explain the returns from the anomalies in real-life markets. For instance, Black (1972) suggests that the CAPM equation should be modified with the absence of a risk-free return. Also, there are several anomalies that the CAPM could not explain. For example, Banz (1981) concluded that there is a reverse relationship between the average return of the firm and its size. Basu (1977) concluded that stocks with a low price to earnings ratio (P/E) achieved a higher return than the high P/E stocks. Likewise, CAPM did not consider the risk associated with the size and value of stocks. Thus, Fama and French combined these two factors into the three-factor model in 1993, expanding the systematic risk beyond the original market factor. Small-cap risk premium (referred to as SMB) is a size factor computed as the return differential for small-capitalisation and large-capitalisation portfolios. Value risk premium (referred to as HML) accounts for the value effect computed as the return differential for high book-to-market (BTMV) and low BTMV stocks. This factor offsets the predilection of value stocks to outperform growth stocks. SMB and HML together add to the explanatory power of the model in explaining variations of stock returns, induced by the size and value characteristics missed out by the traditional market beta. As a result, several researchers found the 3-FM useful for explaining the returns of the portfolio in various nations (Foye et al., 2013; Atodaria et al., 2021; Li and Duan, 2021; Rohuma, 2022; Irejeh and Aninoritse, 2024). However, Berk (1995) and Kirby (1998) argued that the size factor was not useful in explaining the stock returns as Fama and French suggested, while MacKinlay (1995) claimed that the 3-FM was affected by sample selection biases.

Carhart (1997) argued that the 3-FM does not fully take stock price momentum into account. In the event study of Jegadeesh and Titman (1993), in contrast with range-bound investment strategies, momentum is the practice of embracing equities that have been performing well over a period ranging from 3 to 12 months while gradually selling equities that have not fared well. Therefore, in his research published in 1997, Carhart introduced the four-factor model (4-FM) of asset pricing after studying mutual funds' performance. Carhart (1997) added the momentum risk premium (WML) to the 3-FM factors. The WML is the return difference between the stocks that showed the best average prior 12-month returns (the winner) and the stocks that showed the worst average prior 12-month returns (the loser) of the portfolio. In recent years, momentum and the 4-FM have attracted considerable amounts of scholarly interest (see Zaremba and Shemer, 2018; Momani, 2021; Tabasam et al., 2022; Arnott et al., 2023; Cui and Li, 2024). However, Fama and French (2015) added two other factors to their previous model, the 3-FM. They included (1) the profitability factor, which is a new risk factor based on the differential return between firms with the maximum and the lowest return; and (2) the investment factor, which is based on the differential return to a low investment portfolio and a high investment portfolio.

The 4-FM proves itself as a good model for explaining stock returns in different markets (Bretschger and Lechthaler, 2012; Foye, 2016; Doğan et al., 2022; Munkhammar and Hampus, 2023; Pentsas et al., 2024). Therefore, in this research, the 4-FM is preferred over the 5-FM when considering stock performance within Bursa Malaysia. The most critical reason behind this choice is the existence of the momentum feature in the 4-FM. Integrating the momentum factor gives the 4-FM a more holistic view of what may drive the stock returns (Ma et al., 2024). It also improves the model's capacity to explain performance in short-term investment (Fama and French, 2015), which is often important to investors and portfolio managers. Moreover, existing studies show that momentum is one of the key variables affecting stock returns across different markets (Rehnby, 2016; Benali et al., 2023), and emerging markets such as Malaysia. Thus, as a result of high volatility and market inefficiencies in emerging markets, the momentum factor is more effective, as past price movements may have a more significant effect on future stock movements. Therefore, examining the 4-FM in Bursa Malaysia can be relevant for many reasons. Malaysia is a country that can be regarded as an emerging market, and the emerging markets are rather different from the developed ones. For instance, the size, value, or momentum effect may work differently in Bursa Malaysia than in a developed market. Furthermore, most of the literature concerning the 4-FM and other asset pricing models was based on developed regions, especially the U.S. and Europe. Hence, the results of this research indicate whether 4-FM works well in Malaysia as it works in developed countries.

The examination period of this research is 10 years, covering the period from 1 January 2011 to 1 January 2021. During this period, the financial market was generally turbulent. At the beginning of the period, it was the post-global financial crisis period. Then some Asian financial markets were shaken in 2015 and 2016 as a result of the turmoil in the Chinese market (Wanget al., 2019; Guo, 2021). Furthermore, at the end of the study, 2020, the world was exposed to the COVID-19 pandemic, which had a major impact on the financial market. Therefore, this research examines the 4-FM in Bursa Malaysia in a somewhat volatile period. The main objectives of this research are:

1. To examine the return explanatory power of the 4-FM in Bursa Malaysia
2. To investigate whether size, value, and momentum factors can explain efficiently portfolio returns
3. To explore whether the momentum factor exists in Bursa Malaysia.

2. LITERATURE REVIEW

Investors began using the CAPM to explain their portfolio returns over time. Researchers identified that the portfolio return is impacted by additional unsystematic risks that the CAPM failed to detect. For instance, Basu (1977) emphasised that lower P/E companies outperformed higher P/E stocks in terms of return and abnormal return after examining the association between a stock's P/E and performance on the NYSE between 1957 and 1971. Despite the evidence of its significance, according to Fama and French (2015), the 5-FM did not consider the momentum factor (WML) in their model. Fama and French (2015) gave several reasons: (1) the returns of momentum are more erratic and influenced by market regimes than the other five factors; (2) investors generally use behaviour finance to analyse momentum (Chui et al., 2010) while Fama and French favoured factors that could be explained by the market's inefficiency rather than by irrational stock behaviour; (3) the five factors may already impart some effects of momentum, and hence, momentum may not significantly increase the explanatory power of these five factors; and (5) unlike the other five factors, momentum appears primarily in short-term investments and may not be appropriate for long-term investments.

According to several studies (Foye, 2016; Doğan et al., 2022; Munkhammar and Hampus, 2023), the 4-FM is a useful model to explain stock returns in multiple markets. For instance, Rehnby

(2016) compares the CAPM, the 3-FM, and the 4-FM on the Swedish stock market to investigate which better model to explain the portfolio excess returns. The findings show that in a turbulent market, all models have little ability to explain portfolio excess returns. Besides, when compared to the CAPM, the 3-FM has better explanatory power for portfolio returns. However, when compared to the 4-FM, the explanatory power of the 3-FM is slightly lower. Several other studies concluded along similar lines, including Bello (2008) and Benali et al. (2023). In contrast, research by Chen and Fang (2009) found that the 3-FM performs better in the Pacific Basin markets than the CAPM. Furthermore, the authors concluded that there is no evidence to support the existence of the momentum impact of 4-FM. According to their findings, the 4-FM did not significantly outperform the 3-FM. Unlike the mutual funds that Carhart utilised in his 4-FM, stocks are employed in this research, which may account for why their 4-FM results are poor. Munkhammar and Hampus (2023) asserted that the 4-FM's ability to explain changes in risk-adjusted returns over time is not statistically certain and cannot be relied upon to outperform the CAPM in all market environments.

From 2004 to 2019, the KSE-100 Index was subjected to the investigation of the 3-FM and 4-FM in Pakistan by Shahid et al. (2024). The findings show that out of 25 portfolios, 15 were able to explain variations in stock returns. Unlike the value factor, the results show momentum is a significant factor in the Pakistani market. Also, the results imply that financial experts and analysts should include the momentum element when estimating stock prices. Momani (2021) examines how effectively the 3-FM and 4-FM apply in the Amman Stock Exchange (ASE) between 2002 and 2018. In contrast to Al-Mwalla's (2012) result, Momani (2021) recommends utilising the Carhart model in real-world applications when ASE equity market return estimation is necessary. The validity of the 4-FM and 3-FM in the Moroccoian stock market is also examined by Tazi et al. (2022) over 5 years (2013-2017). The results show that the momentum effect was insignificant, despite the size and value effects being found to partially hold. Furthermore, in comparison to the 3-FM, the 4-FM did not demonstrate a higher explanatory power. Given that both models only partially hold in the Casablanca Stock Exchange (CSE), it would seem that neither model can be completely trusted to anticipate cross-sections of return in the latter. After analysing 312 Malaysian funds from June 1998 to May 2015, Rahim et al. (2017) asserted that the 4-FM has a strong explaining power compared to the Q-factor.

The performance of the 4-FM and 3-FM on the Indonesian stock market is compared by Gumanti et al. (2017). The authors employ monthly time-series data from July 2005 to June 2015. The findings show that when it comes to explaining the portfolio excess returns in Indonesia, the 4-FM outperforms the 3-FM. The impact of the momentum component on the excess returns in the portfolio is negligible. Also, using data from 466 firms in Pakistani stock markets from 2009 to 2017, Khan et al. (2021) examined the impact of momentum strategies on stock returns using the 4-FM. The findings imply that momentum effects do not exist on the Pakistan Stock Exchange. The market and value premium and the return of portfolios have a positive and significant relationship, according to the 4-FM's results. On the other hand, the size and momentum element of a portfolio and its return have a negative and significant relationship. On the other hand, Tabasam et al. (2022) examine the momentum impacts by using a sample of 466 non-financial companies from the Pakistan Stock Exchange for the years from 2007 to 2017. The risk factors were also examined by using the CAPM and 4-FM. The results of the 4-FM show a strong correlation between systematic risk and returns, and the positive and statistically significant coefficient of SMB implies that a portfolio's returns are determined by the small stocks minus the large stocks. On the other hand, the WML and HML factors completely negatively explain the dependent variable, and the momentum effect is nearly nonexistent, according to the negative and highly significant coefficient of factors HML and WML.

The results of previous studies have differed regarding the ability of the 4-FM to explain stock returns. Differences in the research methodology, the study period, or the market conditions at the time of the study could account for the differences in the results. Moreover, most of the earlier research did not account for heteroskedasticity, autocorrelation, or unit root biases; as a result, the reliability of their findings may have been affected. Examinations for unit root, autocorrelation, and heteroskedasticity bias were performed to guarantee that the results of this study are unbiased estimations. If any biases were found, the relevant corrections were used.

3. DATA AND METHODOLOGY

This research adapted secondary data over the period from 1 January 2011 to 1 January 2021 from different sources such as the Taiwan Economy Journal, Bank Negara Malaysia, and Bursa Malaysia. From stocks listed in Bursa Malaysia, the researchers chose monthly data over weekly or daily data since it has less volatility. This study also uses the Winsorization approach introduced by Van Rensburg and Robertson (2003) to correct for data outliers. Specifically, 0.5% outliers at the top and bottom are deleted and replaced with the 99.5th and 0.5th percentiles, respectively. These remedies help to reduce the effect of excessive values on the outcomes. Moreover, to examine the effect of the 4-FM on different portfolio sizes in terms of their market capitalisation, this research constructs four equally weighted quarterly portfolios according to their market capitalisation (P_1, P_2, P_3, and P_4). The P_1 is a portfolio with the lowest market capitalisation quarterly portfolio, while the P_4 is a portfolio with the highest capitalisation quarterly portfolio. These portfolios are rebalanced every 6 months, on the 1st of January and the 1st of July.

In terms of SMB and HML factors, this research tracks the method explained by Fama and French (1993). Accordingly, the stocks in the sample would be hierarchized according to the market capitalisation. This creates two groups of stocks: Small (S): These are the stocks that make up the bottom, 50% of the sample, and Big (B): These are the stocks that are situated in the uppermost, 50% of the sample. Then the stocks are also ordered according to BTMV which is taken as book value over market value. The stocks are classified into three partitions: High (H): The top 30% of BTMV which should be value stocks, Medium (M): The middle 40%

of BTMV, and Low (L): The bottom 30% which may be growth stocks. The balance of these portfolios is also on the 1st of January and the 1st of July every year. There are also six portfolios based on applying the size and BTMV classification in combination: S/H: Small, high BTMV stocks, S/M: Small, medium BTMV stocks, S/L: Small, low BTMV stocks, B/H: Big, high BTMV stocks, B/M: Big, medium BTMV stocks, and B/L: Big, low BTMV stocks.

The study calculates monthly returns for the six portfolios determined as a weighted average of the stock returns in each portfolio. The SMB factor can be computed as shown in Equation 2:

$$SMB = \frac{1}{3}\left(\left(\mathrm{S/H} + \mathrm{S/M} + \mathrm{S/L}\right) - \left(\mathrm{B/H} + \mathrm{B/M} + \mathrm{B/L}\right)\right) \quad (2)$$

The HML is the average returns of all the high BTMV portfolios subtracted by the average returns of the low BTMV portfolios as shown in Equation 3:

$$HML = \frac{1}{2}\left(\left(\mathrm{B/H} + \mathrm{S/H}\right) - \left(\mathrm{B/L} + \mathrm{S/L}\right)\right) \quad (3)$$

Regarding the WML factor, following the method of Benali et al. (2023), stocks are categorised into three primary groups according to the average return they generated in the preceding 6 months. These groups are (1) losers (Ls), which include stocks falling from 0% to 30% of the average return; (2) medium (Md), which include stocks falling from 40% to 70% of the average return; and (3) winners (Wi), which include stocks falling from 70% to 100% of the average return. The intersection of the two MV portfolios and the three average return portfolios creates six additional portfolios. These portfolios are (1) the S/Wi portfolio: Small and Wi portfolio; (2) the S/Md portfolio: Small and Md portfolios; (3) the S/Ls portfolio: Small and Ls portfolio; (4) the B/Wi portfolio: Big and Wi portfolio; (5) the B/Md portfolio: Big and Md portfolio; and (6) B/Ls portfolio: Big and Ls portfolio. The WML is the difference in the return between winner and loser portfolios, and it is computed in Equation 4 as follows:

$$\mathrm{W}M\mathrm{L} = \frac{\mathrm{S/Wi} + \mathrm{S/Wi}}{2} - \frac{\mathrm{B/Ls} + \mathrm{B/Ls}}{2} \quad (4)$$

The 4-FM is also employed to investigate the existence of the momentum factor in Bursa Malaysia, where the momentum effect is shown by positive factor loading on the WML.

The statistical analysis program STATA 12 is used to examine the performance attribution analysis. Each portfolio (P_1, P_2, P_3, and P_4) excess returns are regressed on the average returns of the 4-FM. Hence, the 4-FM formula is shown in Equation 5:

$$(r_{p,t} - r_{f,t}) = a_x + b_{p,m}.MRP_t + b_{p,s}.SMB_t + b_{p,v}.HML_t + + b_{p,m}.WML_t + \varepsilon_{p,t} \quad (5)$$

Where: $b_{p,s,}$ $b_{p,v}$ and $b_{p,v}$ are the factor loading for the SMB, HML, and WML factors, respectively.

According to Hsieh and Hodnett (2011), to fairly assess portfolios built from the same pool of sample stocks, developing a market proxy using the available sample stocks is necessary. Thus, the portfolio that contains all stocks in this study is considered a market proxy. At the same time, the return of the 3-month Treasury bills issued by Bank Negara Malaysia is considered a risk-free proxy. It is worth mentioning that all values are lagged by 6 months before the return of the portfolio is calculated. Using a 6-month lag is popular in the financial literature (Fama and French, 1992; Werner, 2010; Bektic et al., 2019). Furthermore, before running the regression, all variables are logged to decrease time series variation (DeFusco et al. 2015). Besides, examinations for unit root, autocorrelation, and heteroskedasticity bias were performed on the variables using the Augmented Dickey and Fuller (1981), Durbin's Alternative, and Breusch-Pagan tests, respectively. This is to ensure that the findings of this research are reliable. However, if any biases were found, the relevant corrections were used. The researchers also ran a correlation test for the four factors (MRP, SMB, HML, and WML). This helps to assess the degree and direction of association among these variables. For instance, when two or more independent variables are highly correlated, then it is known as multicollinearity and can lead to negative impacts in a regression model (Daoud, 2017). This might include difficulty in assessing the effect of each variable separately from the others. On the other hand, if there is no or low multicollinearity of the independent variable, it leads to the successful interpretation of the findings.

4. RESULTS

Table 1 consists of two panels. Panel (a) presents the outcomes of the unit root test as investigated by ADF. In detail, this panel presents the ADF results (1) with intercept only; (2) intercept and trend; and (3) no intercept and no trend. The critical value is significant at the 0.05 level. Panel (b) displays the outcomes of the autocorrelation as well as heteroskedasticity bias by employing Durbin's Alternative and the Breusch-Pagan tests, respectively. The significant value is also at a 0.05 level.

The outcomes clearly show that all absolute values of the ADF test for all portfolios and factors in Panel (a) exceed their critical values at a 0.05. Accordingly, the time series is stationary, and there is no unit root bias. Furthermore, as long as all P-values of Durbin's Alternative test are larger than 0.05. Thus, the residuals are not serially correlated. Regarding the Breusch-Pagan test, the findings emphasise that all portfolios' $P < 0.05$, except the P_4. Therefore, the residuals of the P_1, P_2, and P_3 are heteroscedastic. In contrast, the P-value of the P_4 is bigger than 0.05. Hence, the null hypothesis is accepted, and its residual is not heteroskedastic.

Table 2 presents the return correlation analysis of the four Carhart factors. The test is conducted by applying the Pearson analysis test.

Since their values are between +0.4 and +0.29, the findings in the table show that all positive correlation coefficients are weak. On the other hand, the negative correlation coefficients are between −0.25 and −0.59. Therefore, except for the correlation between MRP and WML, all correlation coefficients of the four factors are weak, either positive or negative. However, the correlation

Table 1: Results of unit root, heteroskedasticity, and autocorrelation tests

Panel (a)	ADF tests					
	Intercept only		Intercept and trend		No intercept and no trend	
	Critical value	ADF test stat.	Critical value	ADF test stat.	Critical value	ADF test stat.
Portfolios and factors:						
P_1 (Small)	−2.889	−9.322	−3.447	−9.283	−1.950	−9.320
P_2	−2.889	−10.278	−3.447	−10.246	−1.950	−10.304
P_3	−2.889	−9.915	−3.447	−9.875	−1.950	−9.953
P_4 (Large)	−2.889	−9.096	−3.447	−9.061	−1.950	−9.135
MRP	−2.889	−9.588	−3.447	−9.556	−1.950	−9.610
SMB	−2.889	−9.387	−3.447	−9.408	−1.950	−9.424
HML	−2.889	−10.036	−3.447	−10.454	−1.950	−9.291
WML	−2.889	−14.611	−3.447	−14.972	−1.950	−13.792
Panel (b)	**Durbin's alternative test**		**Breusch-Pagan Test**			
	Chi-square	**P-values**	**Chi-square**		**P-values**	
Portfolios						
P_1 (Small)	2.460	0.116	24.01		0.000*	
P_2	1.293	0.255	9.80		0.001*	
P_3	0.496	0.481	4.34		0.037*	
P_4 (Large)	1.029	0.310	1.15		0.283	

Table 2: Results of the correlation test of the four factors of Carhart (1997)

Factors	MRP	SMB	HML	WML
MRP	1.00			
SMB	−0.31	1.00		
HML	0.40	−0.39	1.00	
WML	−0.59	0.29	−0.25	1.00

coefficient between MRP and WML is −0.59; thus, the correlation here is considered moderate. Generally speaking, as the correlation coefficients are weak, it can be concluded there is no or low multicollinearity of the 4-FM variables; hence, it is expected that the regression results can be successfully interpreted.

Table 3 presents the regression results of the monthly excess returns of each portfolio (P_1, P_2, P_3, and P_4) on the average monthly returns of the MRP, SMB, HML, and WML. It is worth mentioning that since P_1, P_2, and P_3 only have a heteroskedastic bias, the regression that was conducted for them is the Robust Standard Errors. It is worth noting that the adjusted R-square for Robust Standard Errors regression is calculated using the OLS. The OLS was used for the P_4, which has neither autocorrelation nor heteroskedastic biases.

The Table 3 results demonstrate that the R-square values for all portfolios are between 0.949 and 0.982 with P = 0.05. Thus, at a 0.05 level, the variation in the 4-FM (MRP, SMB, HML, and WML) can explain at least 94.9% of the portfolio's return. Furthermore, the values of the adjusted R^2 are similar or highly near to the R^2 values, showing that there is no overloading and that the regressions are reliable. Hence, it can be concluded that size, value, and momentum factors can efficiently explain the portfolio returns. Concerning the abnormal return, it is noted that only P_3 has a mildly negative abnormal return (statistically insignificant), while other portfolios (P_1, P_2, and P_4) do not have an abnormal return. Thus, the abnormal return does not differ from 0.000. Therefore, the portfolio's return is mostly explained by the MRP, SML, HML, and WML, hence, the excess return is

Table 3: Performance attribution of the fout factor of carhart

Regression summary	P_1 (Small)	P_2	P_3	P_4 (Big)
Prob>F	0.000	0.000	0.000	0.000
R^2	0.949	0.960	0.977	0.982
Adj -R^2	0.948	0.959	0.976	0.981
Intercept	0.000	0.000	−0.001	0.000
t-Stat	−0.67	−0.530	−1.780	0.170
P.value	0.502	0.596	0.077	0.867
b_{MRP}	0.977	0.956	1.010	0.976
t-Stat	25.21	28.09	36.09	50.74
P. value	0.000**	0.000**	0.000**	0.000**
b_{SMB}	0.730	0.144	−0.223	−0.803
t-Stat	8.890	2.180	−5.020	−22.61
P. value	0.000**	0.031**	0.000**	0.000**
b_{HML}	0.400	−0.007	−0.015	−0.333
t-Stat	5.160	−0.130	−0.410	−10.43
P. value	0.000**	0.900	0.686	0.000**
b_{WML}	0.015	−0.022	−0.013	0.000
t-Stat	0.920	−1.490	−1.280	0.120
P-value	0.361	0.138	0.205	0.908

**Significant at 5%.

not systematically different from what the model predicts. This strongly supports that the 4-FM has a strong return explanatory power in Bursa Malaysia.

All four sub-portfolios have a significant and near equal-to-one coefficient in MRP. That makes the MRP an important determinant of the return of all four portfolios and confirms that the MRP is one of the key drivers of portfolio return by supporting the hypothesis given by the 4-FM. The P_1 (smallest portfolio) and P_4 (biggest portfolio) have almost similar MRP coefficients at 0.977 and 0.976, respectively. This may indicate that size does not seem to be a significant determinant of the sensitivity of portfolio returns to market risk. P_3, barely above 1 at 1.010, shows this portfolio to be relatively highly sensitive to market risks, which could well be due to sectoral or asset-specific characteristics. Hence, the MRP factor is quite significant for all the portfolios, which indicates that the part of the 4-FM derived from the CAPM is strong.

The SMB factors are statistically significant for all portfolios. Where P_1 showed a considerable slope of 0.730. This indicates that the smallest portfolio has strong positive exposure to the SMB factor. P_2 has also a positive slope but at 0.144, which is still significant. This demonstrated a reduced but still positive sensitivity to the SMB factor. As per the theoretical expectations, smaller firms are expected to be more sensitive to the SMB. On the other hand, large firm's total exposure to the SMB factor is weaker than their smaller peers which explains P_3's inverse coefficient of −0.223. Firms with a size factor P_4 report a significant coefficient of −0.803. Large firms, according to this reasoning, show decreased sensitivity to the SMB. These findings support the view that the SMB factor has a dimension for the deciphered size dissimilarity across portfolios. Starting from the smallest portfolio (P_1), a gradual decrement is noted towards P_4 indicating the fact that smaller firms earn higher returns. This is in line with the implications of the theoretical framework of the Fama and French model where smaller firms have better chances of return due to their size premium being higher.

The positive result and its significance in the smallest portfolio (P_1) in regards to the 0.400 coefficient can be viewed to suggest that smaller firms will have more positive exposure to the value premium. This aligns with the expectations that smaller firms generally gain from the value characteristics, especially the smaller firm's pool. Concerning the P_2 and P_3 (Intermediate Portfolios), the coefficients for these portfolios (−0.007 and −0.015, respectively) are negative but not statistically significant. This implies that medium-sized firms in these portfolios do not seem, and to some extent, do not focus on the HML factor. For the largest portfolio (P_4), the −0.333 coefficient can be viewed as negative and also significant ($P = 0.000$), suggesting that larger firms have a negative relation with the HML factor. They are least likely to have value characteristics businesses. The significant coefficients for P_1 and P_4 also infer that there is a pattern regarding the HML. There are tendencies of P_1 being the highest when it comes to dealing with the HML factor, while P_4 depicts the opposite. Although P_2 and P_3 do not have significant influences on the intermediate portfolios, one can infer that the impact of the HML factor is somewhat less for mid-sized firms. These results illustrate the empirical argument that the relationship between firm size and value premium exposure, as measured by the HML factor, is complex. Variability brings in the need to pay attention to the size and value characteristics factors in a study of returns for firms.

It can be seen that, across all portfolios, the WML factor hardly contributed. Its coefficients were marginally different across the portfolios, but always statistically insignificant. Where P_1's coefficient is 0.015, which indicates very weak positive exposure to the momentum factor, though insignificant. While the coefficient of P_2 is −0.022 reflects a small negative association with the momentum factor; this is also an insignificant result. The −0.013 coefficient of P_3 reflects a weak negative relationship with the momentum factor, although that is not statistically significant. For the P_4, the coefficient is effectively zero (0.000), with no relationship to the WML factor. Because the WML factor is insignificant for all size portfolios, it is indicative that momentum is of little explanatory power in explaining the variations in return for the analysed sample in Bursa Malaysia. This could probably mean that the momentum effects are weak or indistinguishable. All these results then converge to consistency with some empirical pieces of research that found the significance of the WML factor to vary with respect to the market, the time period, and portfolio construction criteria. Lack of significance also challenges the applicability of the momentum factor in certain contexts and hints at further research, which could explore market-specific dynamics and conditions under which such momentum effects can be more relevant.

The lack of momentum in this study could be attributed to several reasons, including but not limited to (1) Post-2008 Global Financial Crisis (GFC) recovery: The early part of this research (2011-2015) includes a regression period after the GFC of 2008. In this period, low consumption was directly correlated with those policies in the economic climate and indeed some policies did restrain consumption and saved the markets (quantitative easing, low interest rates); (2) Global market instability (2015-2016): This period included events like the slowdown in China's economy (Wang et al., 2019; Guo, 2021), and global market volatility leading to short-term momentum trend breakout with a loss of some concentration on momentum strategies across the four portfolios constructed in this research; (3) COVID-19 Pandemic (2020-2021): The last part of this study concerns the disruption caused by the COVID-19 pandemic which, as nobody has any doubt, is significant in the economy and stocks market. The upheaval in 2020 followed by a strong recovery of the market supported by stimulus and hope could have altered the normal patterns of occurrence of momentum. At the time, stocks exhibited volatility and fast but rather unpredictable Tempo making it very difficult for momentum to exist which proclivity aided in the poor results that existed in most of the particulars studied herein.

5. CONCLUSION

This research investigated whether the 4-FM is a pioneer model in explaining the excess return of four different-size portfolios. Also, to examine whether the momentum effect exists in Bursa Malaysia from 1 January 2010 to 1 January 2021. With R-squares between 0.949 and 0.982, accompanied by $P < 0.05$, variation in the 4-FM (MRP, SMB, HML, and WML) can explain a high percentage of the portfolio's return. This is also supported by the lack of any significant abnormal return for all four sub-portfolios. Therefore, the 4-FM is considered an applicable model in Bursa Malaysia. Moreover, the results asserted that investment in the smallest portfolio (P_1) is subject to small-cap and value risks. Besides, investment in the small portfolio (P_2) is only subject to small-cap risk. On the contrary, investment in the large portfolio (P_3) is only subject to big-cap risk. Finally, investment in the largest portfolio (P_4) is subject to large-cap and growth risks.

Lastly, the study found that the momentum effect does not exist in Bursa Malaysia. Moving on when institutional and algorithm trading became rampant, there was heightened interest in the momentum strategies from 2011 through to 2021. Markets might have become more efficient in pricing momentum feed-in effects with the rise of institutional investors and algorithmic trading hence slumping returns to momentum strategies. This mass adoption could have explained the diminished impact of the WML factor in the results. Consequently, the normal sequence where stocks that performed well in the past will continue performing well in future appears not to have applied during this study period.

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