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An Empirical Investigation of Fama-French-Carhart Multifactor Model: UK Evidence

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Abstract: *The study employs Fama-French-Carhart Multifactor Model to investigate the significance of Firm Size, Book-to-Market ratio and Momentum in explaining variations in returns of stocks listed on the UK equity market using monthly stock data of 100 randomly selected UK stocks from January 1996 to December 2013 collected from DataStream 5.0. The empirical results from the Ordinary Least Square (OLS) regression analysis of the test of the multifactor model found firm size insignificant for three of the six portfolios formed; the value factor (book-to-market ratio) significant for all the six portfolios while the momentum factor is significant for the three portfolios with big market capitalization stocks. Overall, the empirical results indicate the presence of value effect among small-cap and big-cap stocks and momentum effect among big-cap stocks in the London Stock Exchange. Firm size is not found to be a reliable significant factor in explaining stock returns in the equity market.*

Keywords: *Beta, Fama-French-Carhart Multifactor Model, London Stock Exchange, Risk, Stock Returns*

I. Introduction

Starting from late 1970s, empirical studies began to challenge the explanatory strength of CAPM beta in capturing variations in stock returns. Their evidence suggests that major part of the total variations in expected return of stocks is unrelated to the systematic risk. Basu (1977) found beta insignificant in explaining the returns of portfolios formed based on price-earnings ratio (P/E) indicating that market portfolio might be inefficient. The study shows that stocks of firms with a low P/E ratio significantly offered higher returns than stocks of firms with a high P/E ratio which beta failed to explain in CAPM model. Stattman (1980) shows that stocks with high book-to-market equity ratio offer higher average excess returns than stocks of firms with low book-to-market ratio. The empirical analysis shows that the excess returns on stocks with high book-to-market equity ratio are not explained by their sensitivity to the systematic risk. Rosenberg et al. (1985) and Chan et al. (1991) confirmed Stattman (1980) findings respectively with regards to the US and Japanese equity markets. Banz (1981) shows that the return on stocks of firms with small market capitalization is higher than what CAPM predict. The study observed significant negative relationship between firm size and stock returns in the US equity market. Smaller firms offered significant higher risk-adjusted returns than larger firms indicating that the sensitivity of a firm to its market size is significantly stronger than its sensitivity to the systematic risk.

Fama and French (1992) implemented a three-factor explanation to variations in returns of stocks listed on the US equity markets. The empirical findings of the study show that firm size and book-to-market equity (BE/ME) ratio offer significant explanation to variations in stock returns than systematic risk beta. Fama and French (1995) explained the economic rationale for the significance of size and book-to-market ratio by relating the risk factor to earnings shock. They examined the fundamental features of value as well as growth stocks. Their explanation is that firms with a high book-to-market (BE/ME) ratio tend to be relatively distressed while firms with low book-to-market (BE/ME) ratio shows sustained growth. As a result low-BE/ME stocks then offer low average returns because their future earnings growth is weaker than the market expects, while high BE/ME stocks offer high average returns because future earnings growth is stronger than expected. This leads to the conclusion that returns on high book-to-market (BE/ME) ratio stocks compensate for holding relatively distressed (riskier) stocks.

Carhart (1997) working on the persistence in stock returns of mutual funds in the US equity markets from January 1962 to December 1993 included additional factor to the Fama and French (1992, 1996) model to form a four-factor model capturing Jegadeesh and Titman (1993) one-year momentum anomaly in stock pricing to show that Fama and French (1992, 1996) multifactor model augmented by momentum factor will significantly improve the explanation of the model to variations in stock returns. The momentum factor included in the model empirically revealed that stock returns tend to exhibit some form of positive autocorrelation in the short to medium term, such that investment strategies following a rule of buying past winners and selling past losers will generate abnormal returns in the short term. The difference between the winner and the loser portfolio representing the excess return offered by the momentum anomaly significantly explained variations in stock returns thereby improving the explanatory strength of the model.

This study employs Fama and French (1992) method augmented by Carhart (1997) momentum factor to investigate the significance of Firm Size, Book-to-Market ratio and Momentum in explaining variations in returns of stocks listed on the UK equity market. The results of this study will provide important insights into the explanatory strength of firm size, book-to-market equity (BE/ME) ratio and momentum factor in explaining variations in returns of stocks listed on the UK equity market. Such information will help investment analysts and researchers in formulating more accurate risk-return predictions. It will provide information that financial advisors need in advising their clients on the performance of stocks listed on the equity market.

II. Review of Empirical Studies

The findings of Fama and French (1992, 1995, 1996) and Carhart (1997) from the US equity markets establishing the significance of size, value and momentum effects in explaining variations in stock returns generated a lot of interest from various equity markets with empirical studies testing the general explanatory power of the model and the individual significance of these non-market factors in explaining stock returns better than systematic risk (beta).

Liu et al. (1999) and Hon and Tonks (2003) reported the significance of momentum factor in explaining variations in returns of stocks listed on the London Stock Exchange. Liu et al. (1999) shows that over the period of 1977 to 1996 past winner stocks significantly offered future abnormal returns. The study shows that adjusting separately for systematic risk, size, book-to-market equity (BE/ME) ratio does not eliminate momentum abnormal returns. Hon and Tonks (2003) extended the data on UK returns back to 1955. The results of the study confirmed the presence of momentum effect in the UK equity market over the entire period of 1955 to 1996. However, the study noted that momentum cannot be regarded a general feature of the UK equity market over the whole sample period. The results show insignificant momentum effect for 1955 to 1976 sub-period and significant momentum effect for 1977 to 1996 sub-period. The study concluded that momentum effect is only apparent over certain time period in the UK equity market and as such cannot be regarded as a general feature of the equity market.

Dimson et al. (2003) tested for the presence of value effect in the London Stock Exchange for the period of 1955 to 2001 using monthly stock data from the London Share Price Database (LSPD) maintained at the London Business School. To investigate value effect in the equity market, six portfolios were formed based on the intersection of two size sorted groups and three book-to-market sorted groups. Controlling for size, the study examined the significance of the value premium (HML) among different groups of stocks in the equity market over the sample period. The results of the study revealed significant value premium among small market capitalization and big market capitalization stocks, indicating that stocks with high book-to-market ratio significantly explained the variations of excess returns of various groups of stocks in the equity market.

Malin and Veeraraghavan (2004) empirically investigated the multifactor model of Fama and French (1996) on three major European equity markets: France, Germany and the United Kingdom. Using monthly stock data and accounting data on market size and book value from 1991 to 2001 collected from DataStream, they formed six portfolios based on size and book-to-market equity ratio for each of the three European equity markets. The monthly returns of each of the six portfolios were regressed against three explanatory variables: R_m-R_f (excess market return), SMB (Small minus Big) for size effect and HML (High Minus Low) for value effect. In both France and Germany, the results of the study recorded positive and highly significant coefficient for only size effect (SMB) at 1% level of significance. For United Kingdom the result shows the coefficient of HML significant at 1% level of significance. The coefficients of big-size portfolios were significant, revealing a big firm effect in the London Stock Exchange during the sample period against the small-firm effect found by Fama and French (1992) study in US equity markets.

Morelli (2007) empirically examined the explanatory strength of beta, size and book to market value in explaining cross-sectional returns of 300 randomly selected UK stocks from July 1980 to June 2000. Using monthly adjusted stock data collected from the London Share Price Database (LSPD) and accounting data on book and market value of stocks taken from Datastream, 3-month UK Treasury Bill Rate as the risk free interest rate and a simple value weighted average of all the selected 300 firms as a proxy for the market portfolio, the study examined the role of beta(as predicted by CAPM), firm size and book to market value (as predicted by Fama and French Multifactor Model) in explaining expected UK stock returns during the period. The results of the study show that beta and firm size are not significant risk factors in explaining stock returns over the sample period. The book-to-market ratio was found by the study to be significant at 1% level of significance. This identifies book-to-market ratio as the major risk factor explaining stock returns in the London Stock Exchange from 1980 to 2000.

Bhatnagar and Ramlogan (2012) empirically compared the performance of the Capital Asset Pricing Model and the Fama and French three-factor model in explaining variations in returns of all stocks listed on the London Stock Exchange from April 2000 to June 2007 using monthly adjusted stock prices, market and book value of equity, 3-month UK Treasury bill rate as proxy for the risk free interest rate and value-weighted

portfolio of all stocks for the market portfolio. The empirical results of the Ordinary Least square regression analysis found beta to be statistically insignificant at 5% level of significance. The study found both size effect (SMB) and value effect (HML) statistically significant, providing evidence that the Fama and French three-factor model explains UK stock returns during the period.

Cakici and Tan (2014) examined size, value and momentum effects in UK and 22 other developed equity markets from January 1990 to March 2012. The study estimated the following four non-market factors for each of the 23 developed equity markets: the market portfolio, the SMB (size) portfolio, the HML (value) portfolio and the WML (momentum) portfolio following Fama and Frech (2012) methodology. The results of the study failed to establish significant size premia in any of the 23 developed equity markets, indicating that over the period covered by the study the size factor (SMB) offered insignificant explanation to variations in stock returns in all the 23 equity markets. The results for value premium (HML) confirm positive relationship between the variable and stock returns in all the 23 equity markets and highly significant in nine of the sixteen European equity markets, all Asian Pacific equity markets, Japan and Canada. For the momentum factor (WML), the results show nine out of sixteen European markets including UK equity market, returned significant momentum premia. In the Asia Pacific region and Japan, only two equity markets returned significant momentum premia. The results also show that the Canadian momentum factor is positive and significant

III. Data and Methodology

3.1 Data Description

This study uses historic monthly stock data of 100 randomly selected firms listed on the London Stock Exchange from January 1996 to December 2013 (216 months) taken from DataStream 5.0. Table 1 below presents the description of the data.

Table 1: Data description.

Data Description	DataStream 5.0 Code
Monthly adjusted closing prices of all the firms selected	P
Monthly closing value of FTSE ALL SHARE Index	FTALLSH(PI)
91-day (3-month) UK Treasury Bill Rate	UKOIR077R
Market Capitalisation of all the selected firms	MV
Book value of equities of all the selected firms	WC03501
Market to Book value of all the selected firms	MTBV

Source: Author generated

Even though asset pricing models do not specify time frequency for data, empirical findings have shown that beta values are sensitive to the time frequency used. Bartholdy and Peare (2005) tested the Capital Asset Pricing Model and the Fama-French Three Factor Model using different time frames, data frequencies and indexes and found that the use of monthly stock data provides the best estimate. Their findings show that the use of daily and weekly data increases the level of noise in the beta value. Hence, to minimize the level of noise in the beta values, this study uses monthly data in conducting the empirical study. The monthly closing value of the FTSE All Share Index of the London Stock Exchange is used as the proxy for the market portfolio. The 91-day (3-month) Treasury Bill Rate is taken as the proxy for the risk free interest rate. The Market Capitalisation is defined as the share price multiplied by the number of ordinary shares in issue. The book value of shareholders equity is defined as the equity share capital and reserves of the firm.

To be considered in the sample frame, a firm must be a constituent of FTSE All Share Index and must have been listed on the London Stock Exchange on or before 1995. Firms that have gone bankrupt or have been delisted from the London Stock Exchange were excluded from the sample frame. Firms with negative book value of equity were not considered part of the sample frame since it will not be possible to estimate the book-to-market ratio required for the empirical analysis. A sample of 100 firm were randomly selected from the list of all companies in the sample frame to represent all subcomponents of the FTSE All Share Index, consisting of firms from the FTSE 100, FTSE 250 and FTSE Small Cap indices. The spreading of the sample distribution captures the various components of the London Stock Exchange with small-capitalised (small), mid-capitalised (medium) and highly-capitalised (big) firms represented. The FTSE Small Cap consisting of stocks with small market capitalization contains 47% of the sample. The FTSE 250 which comprises mid-capitalised firms has 37% of the sample distribution while FTSE 100 comprising of the most highly capitalized firms in the London Stock Exchange has 16% of the sample distribution. The sample captures various classes of stocks in the UK stock market to give a representation of the market.

3.2 Model Specification

Fama and French (1992, 1996) proposed a three-factor model to explain the variations in average stock returns associated with size and value effects. Carhart (1997) added momentum factor to the three-factor model

giving a four-factor model. This empirical study will test the Four-Factor Model giving in equation 1 below to explain stock returns in the London Stock Exchange.

$$R_p - R_{ft} = \beta_0 + \beta_{im}(R_{mt} - R_{ft}) + \beta_{is}(SMB) + \beta_{ih}(HML) + \beta_{imt}(WML) + e_{it} \quad (1)$$

Where $R_p - R_{ft}$ is the monthly excess portfolio returns, $R_{mt} - R_{ft}$ is the market premium, representing the excess return of the market over the risk-free interest rate. The return on 91-day (3-month) UK Treasury Bill rate is used as the risk-free rate in this study. SMB is the monthly equally weighted average of the returns on the small stock portfolios (portfolios with small market cap stocks) minus the returns on the big stock portfolios (portfolios with big market cap stocks). It represents the size premium. HML is the equally weighted average of the returns on the high book-to-market ratio stock portfolios minus the returns on the low book-to-market ratio stock portfolios. It represents the Value premium. WML is the equally weighted average of the returns on Winner portfolios (portfolio of stocks with highest prior returns) minus the returns on the loser portfolios (portfolio of stocks with lowest prior returns). It represents the earning premium (momentum factor). β_{im}, β_{is}, β_{ih} and β_{imt} are the slopes of the time-series regression representing the risk-factor sensitivities. β_0 is the intercept of the model and e_{it} is the stochastic error term.

Following Fama and French (199, 1996) methodology, at the end of June of each year (t) all the selected sample stocks are sorted into two groups based on their market capitalisation. Small firm(S) group consist of all firms with 50% lowest market capitalization while the big firm (B) group contains the remaining 50% with the highest market capitalization. All the firms are also sorted independently based on book-to-market ratio. Low BE/ME group (L) contains stocks with 30% lowest BE/ME ratio, medium BE/ME group (M) contains stocks with 40% medium BE/ME ratio and high BE/ME group (H) having stocks with 30% highest BE/ME ratio. The intersections of the two size groups with the three book-to-market ratio groups results in six portfolios: S/L, S/M, S/H, B/L, B/M, and B/H. The SMB portfolio is the difference between the average monthly returns on the three small stocks portfolio (S/L, S/M and S/H) and the average monthly returns on the three big stocks portfolio (B/L, B/M, and B/H).

$$SMB = \frac{[S/H + S/M + S/L]}{3} - \frac{[B/H + B/M + B/L]}{3} \quad (2)$$

The HML is the difference between the average monthly returns on the two high book-to-market ratio stocks portfolio (S/H and B/H) and the average monthly returns of the two low book-to-market ratio stocks portfolio (S/L and B/L).

$$HML = \frac{[S/H + B/H]}{2} - \frac{[S/L + B/L]}{2} \quad (3)$$

Monthly returns for the portfolios are calculated for 12 months from July of year t to June of year t+1. All the portfolios are then rebalanced after 12 months. To estimate the WML (Winner minus Loser) variable for each month from July of year t-1 to June of year t, stocks are ranked based on size and prior performance. The Winner Portfolio (W) contains 30% of stocks with the highest past returns while Loser portfolio (L) contains 30% of the stocks with lowest past returns. From the intersection of the Winner (W) and loser (L) portfolio with size portfolios (Small and Big):

$$WML = \frac{[S/W + B/W]}{2} - \frac{[S/L + B/L]}{2} \quad (4)$$

IV. Data Evaluation

4.1 Size and Book-to-Market Ratio Sorted Portfolios

The descriptive statistics for SMB and HML portfolios are presented in table 2 and 3 respectively.

Table 2: Monthly returns of size sorted portfolios.

Portfolios	Mean Return %	Std. Dev	Minimum	Maximum
SMALL	0.9364	4.2217	-11.1736	19.4361
BIG	0.8581	3.8522	-11.4310	14.6803
SMB	0.0783	4.1782	-12.4264	10.2796
R_m-R_f	0.1032	4.1739	-13.7900	9.4727

Source: Author's SPSS Output

From table 2, the Small stocks (S) portfolio with mean monthly return of 0.9364% offered higher return than the Big stocks (B) portfolio which returned 0.8581%. The Small stocks (S) portfolio also recorded the lowest monthly return (-11.1736) and the highest monthly return (19.4361) over the period. The difference between the monthly return of Small stocks (S) and the Big stocks (B) portfolio gives SMB (Small minus Big) portfolio. The mean monthly return of SMB is 0.0783% indicating the excess return for investing in small stocks over the period. Comparing the monthly returns of the SMB portfolio with the monthly excess returns of the market portfolio (R_m-R_f) the market portfolio with mean monthly excess return of 0.1032% offered higher return with relatively lower total risk than the SMB portfolio. The SMB consist of small firms which are more

sensitive to various risk factors. The risk premium offered by the portfolio is smaller than the market risk premium indicating that the risk of investing in small market capitalisation stocks in the London Stock Exchange over the sample period were not rewarded adequately.

Table 3: Monthly returns of book-to-market ratio sorted portfolios.

Portfolios	Mean Return %	Std. Deviation	Minimum	Maximum
HIGH	1.1865	5.2619	-18.3912	25.2243
LOW	0.7062	4.1615	-16.5883	17.0038
HML	0.4803	7.0458	-26.5251	26.9365
R_m-R_f	0.1032	4.1739	-13.7900	9.4727

Source: Author's SPSS Output

From table 3, the High book-to-market ratio (H) portfolio with mean monthly return of 1.1865% offered higher return than the Low book-to-market ratio (L) portfolio which returned 0.7062%. The High book-to-market ratio (H) also recorded the highest monthly return (25.2243) over the period. The difference between the monthly return of High book-to-market ratio (H) portfolio and the Low book-to-market ratio (L) portfolio gives HML (High minus Low) portfolio. The table shows a strong volatility in the monthly returns of the HML portfolio suggesting a high level of total risk (7.0458).The mean monthly return of HML is 0.4803% indicating the excess return for investing in stocks of firms with high book-to-market ratio over the period. With mean monthly return of 0.4803%, the HML portfolio offered higher return than the market portfolio which offered mean monthly excess return of 0.1032% over the same period. The risk premium offered by the portfolio is higher than the market risk premium indicating that the risk of investing in high book-to-market ratio stocks in the London Stock Exchange over the sample period was rewarded.

4.2 Momentum Sorted Portfolios

Using past returns, all the stocks were sorted into two portfolios to estimate the effectiveness of the momentum factor in explaining variations in stock returns over the sample period. Table 4 presents the descriptive statistics for portfolios formed based on momentum.

Table 4: Monthly returns of momentum sorted portfolio.

Portfolios	Mean Return %	Std. Deviation	Minimum	Maximum
WINNER	1.2863	5.7694	-21.2282	31.1766
LOSER	0.9079	5.3887	-25.3190	14.8198
WML	0.3783	2.8738	-8.0662	16.3568
R_m-R_f	0.1032	4.1739	-13.7900	9.4727

Source: Author's SPSS Output

The results in table 4 highlights the effectiveness of the momentum factor in explaining stock returns in the London Stock Exchange over the sample period. The Winner portfolio which contains stocks with highest past returns offered the highest mean return of 1.2863% with total risk of 5.7694. The Loser portfolio offered 0.90797% with standard deviation of 5.3887. The WML (Winner minus Loser) portfolio shows the gain offered by the momentum strategy over the sample period. Investors implementing the momentum strategy over the sample period will earn mean return of 0.3783%. With mean monthly return of 0.3783%, the WML portfolio offered higher return than the market portfolio which offered mean monthly excess return of 0.1032% over the same period. The risk premium offered by the portfolio is higher than the market risk premium indicating that the risk of investing in stocks with highest past returns in the London Stock Exchange over the sample period were rewarded.

4.3 Correlation Between the four Risk Factors

Table 5 below presents the correlation between the monthly returns of R_m-R_f, SMB, HML and WML portfolios over the sample period.

Table 5: Correlation between the four factors monthly returns.

	CORRELATION BETWEEN FACTORS			
Portfolios	**R_m-R_f**	**SMB**	**HML**	**WML**
R_m-R_f	1.0000	0.1490	0.0990	-0.0620
SMB	0.1490	1.0000	0.4960	0.1210
HML	0.0990	0.4960	1.0000	0.1300
WML	-0.0620	0.1210	0.1300	1.0000

Source: Author's SPSS Output

The highest correlation coefficient in table 5 is 49.6% between the two Fama and French (1993) portfolios SMB and HML. The momentum (WML) portfolio shows inverse (negative) association with the market portfolio (R_m-R_f), which indicates that the combination of the WML and the market portfolio (R_m-R_f) could yield diversification effect. Generally, the correlation coefficients are weak indicating that the degree of association between the four factors is influenced by different factors.

V. Empirical Results and Analysis

The empirical analysis is based on a multivariate OLS regression of equation 1. The model assumes that the intercept and the market risk premium should not be statistically different from zero and that the coefficients of SMB, HML and WML should be statistically significant. The coefficient of SMB is expected to be significantly positive for all small size portfolios (S/L, S/M and S/H) and significantly negative for all big stock portfolios (B/L, B/M and B/H). For the value premium (HML), the model expects the coefficient to be significantly negative for portfolios with low book-to-market ratio (S/L and B/L) and significantly positive for portfolios with high book-to-market ratio stocks (S/H and B/H). Table 6 summarises the empirical results.

Table 6: Fama-French-Carhart Four-Factor Model regression results.

$R_p - R_{ft} = \beta_0 + \beta_{im}(R_{mt} - R_{ft}) + \beta_{is}(SMB) + \beta_{ih}(HML) + \beta_{imt}(WML) + e_{it}$

		β_0	β_{im}	β_{is}	β_{ih}	β_{imt}	**Adjusted R^2**
S/L	Coeffients	0.442	0.042	0.800	-0.229	-0.014	0.402
	Std. Error	0.245	0.059	0.068	0.040	0.086	**F-stat**
	t-statistics	1.803	0.713	11.805 *	-5.726 *	-0.162	36.100 *
	p-value	0.073	0.477	0.000	0.000	0.872	Sig: 0.000
		β_0	β_{im}	β_{is}	β_{ih}	β_{imt}	**Adjusted R^2**
S/M	Coeffients	0.372	-0.058	-0.116	0.570	0.163	0.493
	Std. Error	0.263	0.063	0.073	0.043	0.092	**F-stat**
	t-statistics	1.415	-0.920	-1.596	13.321 *	-1.768	51.877 *
	p-value	0.158	0.359	0.122	0.000	0.790	Sig: 0.000
		β_0	β_{im}	β_{is}	β_{ih}	β_{imt}	**Adjusted R^2**
S/H	Coeffients	0.459	-0.101	0.043	0.472	-0.110	0.421
	Std. Error	0.272	0.066	0.075	0.044	0.095	**F-stat**
	t-statistics	1.687	-1.541	0.571	10.654 *	-1.155	38.967 *
	p-value	0.093	0.125	0.569	0.000	0.249	Sig: 0.000
		β_0	β_{im}	β_{is}	β_{ih}	β_{imt}	**Adjusted R^2**
B/L	Coeffients	0.411	-0.055	-1.222	-0.222	0.304	0.512
	Std. Error	0.407	0.098	0.112	0.066	0.142	**F-stat**
	t-statistics	1.011	-0.563	-10.894 *	-3.360 *	2.135 **	55.847 *
	p-value	0.313	0.574	0.000	0.001	0.034	Sig: 0.000
		β_0	β_{im}	β_{is}	β_{ih}	β_{imt}	**Adjusted R^2**
B/M	Coeffients	-0.010	0.026	0.046	0.740	0.195	0.684
	Std. Error	0.256	0.062	0.071	0.042	0.090	**F-stat**
	t-statistics	-0.040	0.419	0.656	17.759 *	2.172 **	114.210 *
	p-value	0.968	0.676	0.513	0.000	0.031	Sig: 0.000
		β_0	β_{im}	β_{is}	β_{ih}	β_{imt}	**Adjusted R^2**
B/H	Coeffients	0.206	0.093	-0.607	0.851	0.183	0.678
	Std. Error	0.255	0.062	0.070	0.042	0.089	**F-stat**
	t-statistics	0.809	1.513	-8.617 *	20.510 *	2.045 **	110.943 *
	p-value	0.419	0.132	0.000	0.000	0.042	Sig: 0.000

The t-test is employed to test the significance of variables in the model. The ρ-values indicate the t-test level of significance. ρ-value below 0.01 and 0.05 indicates that the relationship between dependent and explanatory variables is significant at 1% and 5% significance level respectively. ρ-value above 0.05 indicates that at 5% level of significance, no statistical significant relationship exist between the dependent and explanatory variables. The adjusted $\mathbf{R^2}$ measures the proportion of variation in stock returns that can be attributed to the explanatory variables. The F-test gives the overall significance of each of the model.

Source: Author's SPSS Output

* Significant at 1%, ** Significant at 5%

The empirical results from Table 6 show that the intercept $\boldsymbol{\beta_{0\ and}}$ the market risk premium ($R_{mt} - R_{ft}$) for all the six portfolios are statistically insignificant at 5% level of significance, which is consistent with the assumptions of the multifactor model. The adjusted $\mathbf{R^2}$ shows that the lowest explanation offered by the model is 40% for portfolio S/L. The model offered approximately 68% explanation to variations in returns of both B/M and B/H portfolios. The F-statistics indicates that the explanatory power of the Fama-French-Carhart multifactor model is statistically significant at 1% level of significance for all the six portfolios.

5.1 Size Effect

At 5% level of significance the size factor (SMB) significantly explained the variations in monthly returns of S/L, B/L and B/H portfolios with positive coefficient for portfolio S/L and negative coefficients for

B/L and B/H portfolios. The t-test indicates the presence of significant small firm effect for stocks in these three portfolios. However, the SMB variable failed to offer significant explanation to variations in monthly returns of S/M, S/H and B/M. The inability of the size factor to offer significant explanation to variations in returns of stocks in these three portfolios indicates that the variable is not significantly a reliable factor in explaining variations in returns of stocks listed on the London Stock Exchange over the sample period. Malin and Veeraraghavan (2004) documented a big firm effect for the UK equity market using a sample period of 1991 to 2001. However the insignificance of the size effect (SMB) variable in explaining variations in UK stock returns reported in this empirical study is consistent with findings of Cakici and Tan (2014) recent empirical study.

5.2 Value Effect

This empirical study found the value effect (HML) statistically significant in explaining variations in UK stock returns over the sample period thereby supporting the Fama and French (1992, 1996) empirical studies from the US equity market. The coefficient of the HML variable is found significant at 1% level of significance with the expected relationship for all the six portfolios (S/L, S/M, S/H, B/L, B/M and B/H). This shows that on average, stocks of firms with high book-to-market ratio offered higher returns than stocks of firms with low book-to-market ratio over the sample period. The study shows that the value premium exists among small-capitalisation and big-capitalisation stocks in the UK equity market over the sample period. The result of this empirical study is consistent with the findings of Dimson et al. (2003) and Morelli (2007) studies from the London Stock Exchange. However, Malin and Veeraraghavan (2004) empirical study documented a growth effect in the UK equity market.

5.3 Momentum Effect

For the momentum factor (WML) no statistical significant relationship exist between the factor and the excess returns on portfolios with small stocks (S/L, S/M and S/H) showing that the momentum factor is insignificant in explaining returns of stocks with small market capitalisation in the UK equity market over the sample period. However, the WML variable is positive and statistically significant in explaining returns of all the three portfolios with big market capitalisation stocks (B/L, B/M and B/H), indicating that big market capitalisation stocks with past highest returns significantly offered future returns in the equity market over the sample period. The empirical result supports the findings of Liu et al. (1999), Hon and Tonks (2003) and Cakici and Tan (2014) from the UK equity market and Carhart (1997) studies from the US equity markets. Hon and Tonks (2003) implemented the momentum strategy on UK stocks from 1955 to 1996. The findings of the study shows that the momentum anomaly is significant in explaining the returns of stocks in the equity market in the 1977 to 1996 sub-sample period in the study, confirming Liu et al. (1999) empirical result. Cakici and Tan (2014) study covering the period of January 1990 to March 2012 confirmed significant momentum premia for the UK equity market. However, the result of this study shows that the momentum factor significantly explains the returns of big market capitalisation stocks in the UK equity market over the sample period. Stocks of firms with small market capitalisation were not able to earn significant future returns through the momentum anomaly.

5.4 Investment Implications of the Empirical Results

The implementation of the Fama-French-Carhart Multifactor Model offered some investment implications for investors and fund managers targeting stocks listed on the UK equity market. First, investment decisions and strategies relying on firm size to explain stock returns in the UK equity market cannot be considered reliable based on the findings of this study. Investment decisions targeting stocks based on their market size may fail to offer significant explanation to stock returns in the equity market.

Second, investment decisions and strategies targeting stocks with high book-to-market ratio will offer significant positive return. The value effect is significantly present in both small and big market capitalisation stocks. The study shows that stocks with high book-to-market ratio significantly offer higher returns than stocks with low book-to-market ratio. This indicates that book-to-market ratio is the main significant factor that explained stock returns in the UK equity market over the sample period covered in this study.

Third, the significance of the momentum factor in explaining variations in returns of the three portfolios with big market capitalisation stocks show that by implementing the WML (Winner minus Loser) portfolio investors could outperform the market to earn excess return. The difference between the return on winner portfolio and the return on loser portfolio is found to be positive and significant for big market capitalisation stocks in the equity market. The empirical result on the explanatory power of the momentum factor also indicates that investors cannot outperform the market through implementing the momentum strategy on stocks with small market capitalisation. The momentum factor shows insignificant relationship with the returns of portfolios with small market capitalisation stocks, only stocks with big market capitalisation offered significant return through the momentum strategy over the period covered in this study.

VI. Conclusion and Recommendation

This study documents a strong significant presence of the value effect in the UK equity market over the period covered. Using HML (High Minus Low) to capture the excess return for investing in stocks with high book-to-market equity (BE/ME) ratio (value premium), the study found significant value premium in all the six portfolios formed. The findings of the study also establish a significant presence of momentum effect among big market capitalisation stocks in London Stock Exchange. The empirical tests show that the momentum factor WML (Winner Minus Loser) capturing the excess return for investing in stocks with one-year prior higher returns is positive and significant for all the three portfolios with big market capitalisation stocks. However, the results of the study could not establish a significant reliable size effect in the equity market.

The study recommends that investors in the UK equity market should consider non-market (firm-specific) factors in their investment decisions and strategies. Investment decision and strategy based on book-to-market ratio of stocks listed on the equity market could offer significant return above the market return.

References

[1]. BANZ, R.W., 1981. The relationship between return and market value of common stocks. Journal of Financial Economics, 9(1), pp. 3-18.

[2]. BARTHOLDY, J. and PEARE, P., 2005. Estimation of expected return: CAPM vs Fama and French. International Review of Financial Analysis, 14, pp. 407-427.

[3]. BASU, S., 1977. Investment Performance of Common Stocks in Relation to their Price-Earnings Ratios: a Test of the Efficient Market Hypothesis. Journal of Finance, 32(3), pp. 663-682.

[4]. BHATNAGAR, C.,SHEKHAR and RAMLOGAN, R., 2012. The Capital Asset Pricing Model Versus The Three Factor Model: A United Kingdom Perspective. International Journal of Business and Social Research, 2(1), pp. 51-65.

[5]. CAKICI, N. and TAN, S., 2014. Size, value, and momentum in developed country equity returns: Macroeconomic and liquidity exposures. Journal of International Money & Finance, 44, pp. 179-209.

[6]. CARHART, M.M., 1997. On Persistence in Mutual Fund Performance. Journal of Finance, 52(1), pp. 57-82.

[7]. CHAN, L.K.C., HAMAO, Y. and LAKONISHOK, J., 1991. Fundamentals and Stock Returns in Japan. Journal of Finance, 46(5), pp. 1739-1764.

[8]. DIMSON, E., NAGEL, S. and QUIGLEY, G., 2003. Capturing the Value Premium in the United Kingdom. Financial Analysts Journal, 59(6), pp. 35-45.

[9]. FAMA, E.F. and FRENCH, K.F., 1995. Size and Book-to-Market Factors in Earnings and Returns. Journal of Finance, 50(1), pp. 131-155.

[10]. FAMA, E.F. and FRENCH, K.R., 1996. Multifactor Explanations of Asset Pricing Anomalies. Journal of Finance, 51(1), pp. 55-84.

[11]. FAMA, E.F. and FRENCH, K.R., 1992. The cross-section of expected stock returns. Journal of Finance, 47(2), pp. 427-465.

[12]. HON, M.T. and TONKS, I., 2003. Momentum in the UK stock market. Journal of Multinational Financial Management, 13(1), pp. 43-70.

[13]. JEGADEESH, N. and TITMAN, S., 1993. Returns to Buying Winners and Selling Loser: Implications for Stock Market Efficiency. Journal of Finance, 48(1), pp. 65-91.

[14]. LIU, W., STRONG, N. and XU, X., 1999. The Profitability of Momentum Investing. Journal of Business Finance & Accounting, 26(9), pp. 1043-1091.

[15]. MALIN, M. and VEERARAGHAVAN, M., 2004. On the Robustness of the Fama and French Multifactor Model: Evidence from France, Germany, and the United Kingdom. International Journal of Business and Economics, 3(2), pp. 155-176.

[16]. MORELLI, D., 2007. Beta, size, book-to-market equity and returns: A study based on UK data. Journal of Multinational Financial Management, 17, pp. 257-272.

[17]. ROSENBERG, B., REID, K. and LANSTEIN, R., 1985. Persuasive evidence of market inefficiency. Journal of Portfolio Management, 11(3), pp. 9-16.

[18]. STATTMAN, D., 1980. Book Values and Stock Returns. The Chicago MBA: A Journal of selected papers, 4, pp. 25-45.

APPENDIX I: 100 Randomly Selected Constituents of the FTSE All Share Index

COMPANY	DataStream Code	COMPANY	DataStream Code
4IMPRINT GROUP	901095	RANK GROUP	900918
ABERDEEN UK TRACKER	904947	BTG	139996
AGA RANGEMASTER GROUP	900737	CRODA INTERNATIONAL	900476
ANGLO PACIFIC GROUP	991221	ALLIANCE TRUST	901526
BLOOMSBURY PBL.	135750	MARSTON'S	900274
BOOT (HENRY)	926525	DCC	135588
BRAMMER	901815	COBHAM	904313
BRITISH ASSETS	901531	RATHBONE BROTHERS	901773
BRITISH POLYTHENE INDS.	910663	WORLDWIDE HLTHCR.TST	960639
CANDOVER INVS.	904708	BERENDSEN	900954
CAPE	900294	DIPLOMA	910264
CAPITAL & REGIONAL	917191	INTERSERVE	900346
CAPITAL GEARING TST.	926841	RENISHAW	917076
CARPETRIGHT	319752	HOMESERVE	928782
CHEMRING GROUP	914073	GO-AHEAD GROUP	135565
CLARKSON	940015	LAIRD	901107
COMMUNISIS	135860	DERWENT LONDON	926373
DEVRO	319802	RESTAURANT GROUP	912000
DIALIGHT	312742	BROWN (N) GROUP	914327
FINSBURY GW.& INC.TST.	910876	CAIRN ENERGY	910146

GREGGS	952780	ROTORK	910649
HEADLAM GROUP	910395	NORTHGATE	910540
HILL & SMITH	911998	MERCANTILE IT.	901556
INVESCO ASIA TRUST	960673	BODYCOTE	910119
JKX OIL & GAS	139998	BBA AVIATION	900293
JOHNSTON PRESS	943610	SYNTHOMER	905310
JPMORGAN CLAVERHOUSE	901537	CLOSE BROTHERS GROUP	905313
KEYSTONE IT.	910833	DIXONS RETAIL	900906
MCBRIDE	134982	GREENE KING	900250
MONTANARO EUR.SMCOS.T	988915	ITE GROUP	907765
MOTHERCARE	905308	BLACKROCK WORLD MNG.	953113
MUCKLOW (A & J) GROUP	900340	GRAINGER	931261
NEW CITY HIGH YIELD FD.	955875	ELEMENTIS	901023
PANTHEON INTL.PARTS.	965471	IMAGINATION TECHN.	135869
PHOTO-ME INTL.	900917	SEVERN TRENT	904373
PORVAIR	940860	REED ELSEVIER	901080
RENOLD	900580	ASSOCIATED BRIT.FOODS	900825
S & U	901178	CAPITA	953830
SCHRODER UK MID CAP.FD.	901964	ASTRAZENECA	319608
SHIRES INCOME	926252	BP	900995
SPEEDY HIRE	953866	INTU PROPERTIES	507516
ST.IVES	931202	JOHNSON MATTHEY	901152
TOWN CENTRE SECURITIES	904127	MEGGITT	910509
UK MAIL GROUP	319875	SMITHS GROUP	900943
UNITED UTILITIES GROUP	904367	WOLSELEY	900764
VITEC GROUP	926712	RIO TINTO	901714
VOLEX	900528	AVIVA	901503
PENNON GROUP	904391	PRUDENTIAL	901521
SAVILLS	943918	ANGLO AMERICAN	903076
OXFORD INSTRUMENTS	940013	ASHTEAD GROUP	906045

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