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Evaluate Multifactor Asset Pricing Models to Explain Market Anomalies Applicable Test in the Saudi Stock Market*

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Abstract

This paper compares and evaluates the performance of eight different multifactor asset-pricing models to identify and explain Anomalies in Saudi stock market (SSM). Data set of daily stock prices and returns are collected for all companies that issue shares (152 companies) which represent all sectors in the SSM during the period from 2009 to 2013. The 25 size-BE/ME portfolios are formed by the intersection of size and BE/ME quintiles (5x5 Size-BE/ME sorts). The empirical results show that each of capital asset pricing models CAPM, the Fama-French three-factor model, the Cahart model, the four factor model of Chan and Faff four factor model and the five -factor model (Adding liquidity to four factor model) have coefficients of the factors (B_p, S_p, h_p, w_p and L) to be significantly different from zero. Furthermore adjusted R^2s range from 29% to 78% but all of them produce an intercept that is significantly different from zero for 12-16 portfolios. However, by adding leverage and test the six-factor asset pricing model, the evidence confirms the significance of this model to explain return variation with adjusted R^2 ranges from 39% to 83% and the intercept are not significant for 17 portfolios out of 25. Moreover, the results of testing six-factor model by adding standard deviation of residual-provide supportive evidence to the six-factor model.

Keywords: Asset pricing, book-to-market ratio, Fama and French three-factor model**,** Cahart model, the four-factor model of Chan and Faff four factor model

Introduction

Many researchers have emphasized on analyzing asset-pricing behavior to explain the variance in expected return and their relevance to market risk. Sharpe (1964) and Lintner (1965) were the earlier researchers who presented Capital Asset Pricing Model and suggested that the expected returns of risky assets are determined by the covariance between assets returns and market portfolio's returns. One of the CAPM model’s assumptions is efficient market, since securities، prices reflect all available information at any point in time. However, other researchers’ empirical evidence indicates that the CAPM cannot explain different market anomalies that indicate market inefficiency or the asset-pricing model inadequacies. Banz (1981), who sorted stocks by their size (market capitalization); found that average returns on small stocks are higher predicted than by the CAPM. In addition, **Fama and French (1992)**

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found a strong cross-sectional relation between characteristics like size and book to-market and returns. Furthermore, Yalçın (2010) represented that market anomalies lead to abnormal returns more often than not. Therefore, anomalies indicate the semi-strong form and they are based on information in financial reports. In addition, they indicate that fundamental analysis does have some value for the individual investor. Therefore these Studies have shown that size and book to-market effect seem to be independent of the stock's beta, and therefore, independent of systematic risk.

Although many applicable evidences show that anomalies exist in stock markets, some researches show that anomalies occur once and disappear, while others occur repeatedly. For example, the evidence of **Schwert (2002)** shows that the size effect, the value effect, the weekend effect, and the dividend yield effect seem to have weakened or disappeared after the papers that highlighted them were published. The small-firm turn-of-the-year effect became weaker in the years after it was first documented in the academic literature. In addition, the activities of practitioners who implement strategies to take advantage of anomalous behavior can cause the anomalies to disappear (as research findings cause the market to become more efficient). For that reason, **List (2003)** found that market experience plays a significant role in eliminating the important market anomaly. These results illustrate the importance and the interest from study anomalies in the market.

Accordingly, the main purpose of our study is to identify the factors that affecting the expected return rather than market risk in the Saudi stock market (one of the emerging markets) that help investors either individuals or institutions to understand these factors that allow them to make effective capital investment decisions and financial decisions. Consequently, it reflects positively on raising the market efficiency especially the accurate and comprehensive information that can help investors deal with anomalies problems.

The structure of this paper is organized as follows: section 2 presents the literature review. Section 3 discusses the data and variables employed in the tests and the methodology of this study in details. Section 4 presents the empirical results. Section 5 is a summary and conclusion. Finally, future research directions.

Literature Review

Many researchers studied the logic of the CAPM and its empirical work about predictions of expected return. For example, Basu's evidence (1977) shows that future returns can be predicted on high E/P ratios better than by the CAPM model. Meanwhile, Statman (1980) confirmed that stocks with high B/M equity ratios have higher mean value of returns than others. Banz (1981) sorted stocks by their size (market capitalization). He found that average returns on small stocks are higher predicted than by the CAPM. In addition, for Japanese stocks Chan, et al. (1991) found a strong relationship between average return and (B /M equity). Capaul, et al. (1993) detect a similar (B/M) effect in many European stock markets and in Japan. This evidence suggests that E/P, debt-equity and B/M ratios play an important role in explaining both the variation in expected return and market anomalies. Fama and French (1992) proved that size, E/P, debt-equity and B / M ratios add to market beta that explain the expected stock returns. In addition, Fama and French (1993) show those higher returns on small stocks and high (B/M) stocks reflect unknown variables that produce undiversifiable risks that are not identified by the market return and are separately priced from market betas. For these reasons, Fama and French (2004) update and create results by using time-series regressions and found that market betas cannot completely explain the expected return. In addition, Shaker and Elgiziry (2013) used six portfolios, which sorted on size and book-to market ratio. They found that FF three-factor model leads to a remarkable enhancement over the CAPM and the four-factor model of Chan and Faff does not show a significant increase over the FF three-factor model in Egyptian stock market.

Also Brown and Cliff (2005) examined the effect of sentiment on size and (B/M) portfolios. They provide evidence that a negative relation between sentiment and mispricing of small stock. On the other side, Da and Warachka (2009) confirmed that a higher beta implies greater sensitivity to market wide revisions in expected cash flow. However, Fong (2012) tried to explain why large premium mainly occurs for small firms. He found that premium value is more obvious and low market values in firms with higher idiosyncratic volatility and in firms with tight short selling constraints. Peer, et al. (2011) confirmed that the CAPM model is not linearity but the linear model with Fama–French factors is able to explain the returns of US stock market correctly. However, Pin-Huang, et al. (2012) show that significant effect of the small firm occurs only for firms whose market capitalization and B/M ratio are smaller than their industry average. Furthermore, Erik and Petar (2012) show that equal weights portfolio of the single-characteristic strategies performs similar and sometimes better than the direct estimation approach. Moreover, Babalosa, et al. (2102) presented evidence against the notion of funds' mean-variance efficiency.

While the above-mentioned studies tested anomalies and mispricing by using portfolios, Avramov & Smith (2006) examined whether CAPM models with single securities can explain the size, value, and momentum anomalies. They found that with constant beta, none of these models could explain any of the market anomalies. In addition, Daniel & Titman (2011) noted that using models with portfolios rather than individual stocks has more advantages because they avoid an errors-in-variables problem and lower the dimensionality of the covariance matrix of returns.

Furthermore, there are previous studies that investigate the effect size and value on return. There are many studies that test anomalies through examining other factors that have explanatory power for the variation of return, for example, Yao, et al. (2011) found a negative relation between corporate asset growth and stock returns. This relation is weaker in markets where firms' asset growth rates are more alike, frequent and in firms that depend more on debt for growth. However, there is no effect of asset growth in the firms that have good corporate governance, investor protection, and legal origin. Bley and Saad (2012) examined the relationship between expected returns and lagged idiosyncratic volatility for individual stocks; they found this relation is significantly negative in Saudi Arabia and Qatar but none in Kuwait and Abu Dhabi. However, this relationship turns positive when they estimate conditional idiosyncratic volatility. Furthermore, the pricing of unsystematic risk is less evident in countries with higher governance and is not related to the degree of financial development.

Other researchers investigated the role of an illiquidity risk factor in asset pricing, such as Marx (2005) who found negative relationship between illiquidity and expected returns, so he argued that liquidity should have explanatory power in any asset-pricing model to be perfectly specified. In addition, Acharya and Pederse (2005) show that a required rate of return depends on its expected liquidity as well as on the covariance of its own return with the market return. Also, the results of Chordia, et al. (2008) indicate that private information is increased inclusion into prices when regimes are more liquid. Marcelo and Quiros (2006) found that illiquidity ratio is one of the common risk factors in the returns in the Spanish stock market over the 1994–2002 periods. In addition, Mahran (2011) showed that there was significant positive relationship between liquidity and stock prices in the Egyptian stock market. This effect was not seasonal but extended to cover the entire research period from 2004 until (2009); in addition, liquidity has ability to predict stock price with high significance. Moreover, the liquidity of the stock has a positive impact on the rate of trading in the market.

Some empirical literature gives evidence, which suggests that premium value is more likely to be statistically significant in high financial leverage and low credit quality. For example, Griffin and Lemmon (2002) report that firms with a higher likelihood of financial distress demonstrate higher value premium compared to other firms. In addition, they found that the firms with the highest distress risk were more premium than twice as large as that in other firms. Furthermore, Garlappi and Yan (2011) suggested that increases in the premium occur when the default risks probability increase.

A number of recent papers has developed for consumption CAPM (CCAPM), such as Ammann, et al. (2012) which documented that the explanatory power of the alternative three-factor models is advanced to traditional CAPM according to stock market anomalies.

The empirical findings of Kim (2012) support and agree with the results of CCAPMs model, which can explain the cross-section of expected stock returns better than classic unconditional models. Furthermore, Kang et al. (2011) Show that value stocks are riskier than growth stocks in bad times. In addition, Fong (2012) re-examine the (B/M) effect. Neither the conditional (time series) nor unconditional (cross-sectional) tests provide firm evidence that the business risk can explain the premium. Cooper and Gubellini (2011) found that size, issuance, momentum, and asset growth portfolio are due to risk. Therefore, these evidences recommend that CAPM anomalies are not due to risk.

Data and Methodology

A. Data:

Daily stock returns are collected for all companies that are listed in the SSM over the period from January 2009 to 2013 with 823 observations for each portfolio. This is to avoid the effect of the Saudi stock market crash in 2006 and the financial crisis in 2008. During 2006, the SSM collapsed and the price index lost over 1300 points (65% of its top level).

Saudi Arabia's main stock market index, SASEIDX is used as a proxy for the market portfolio. The data are obtained from the SSM (Tadawul). The data set consists of 150 companies that issue shares that represent all sectors in the Saudi stock market.

The 3-month Treasury Bills rates collected from the Saudi Arabia Monetary Agency used as a proxy for risk-free rates of returns.

Firm size (ME) is measured by market capitalization or market value of equity. It is defined as the product of stock price and the number of shares outstanding at the end of June in year *t*.

The book-to-market equity (BE/ME) is computed as the ratio between a firm's book equity (BE) at the fiscal year-end in calendar year *t* – 1 and its market equity (ME) at the end of December of year *t* – 1.

Followed (1993), the 25 size-BE/ME portfolios are formed from independent sorts of stocks into five s*ize* groups and five *BE/ME* groups then the 25 size-BE/ME portfolios are formed by the intersection of size and BE/ME quintiles (5x5 *Size-BE/ME* sorts).

For calculating the two Fama-French (1993) factors (SMB and HML) stocks are sorted by size into two groups (Small (*S*) and Big (*B*)) based on their ME value. Then the same stocks sorted into three portfolios of B/M و Low (*L*), Medium (*M*), and High (*H*)) based on their BE/ME value. Six value-weighted portfolios (*S*/*L*, *S*/*M*, *S*/*H*, *B*/*L*, *B*/*M*, and *B*/*H*) are formed at the intersection of size and B/M and in a way of having approximately equal numbers of stocks.

SMB (small minus big) is the simple average of the returns on the small-stock portfolios minus the returns on the big-stock portfolios:

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

HML (high minus low) is the simple average of the returns on the high-B/M portfolios minus the returns on the low-B/M portfolios:

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

For calculating the Cahart (1997) factor (*WML*) the stocks sorted into three portfolios of return (winner, neutral, and loser). Winners (*W*) are the top 30% of the total stocks with the highest average return. Losers (*L*) are the bottom 30% of the total stocks with the lowest average return. Neutral are the remaining 40% of the stocks. Four value-weighted portfolios (*S*/*W*, *S*/*L*, *B*/*L*, and *B*/*W*) are formed at the intersection of size and performance. *WML* (winner minus loser) is the simple average of the returns on the winner-stock portfolios minus the returns on the loser-stock portfolios:

$$WML = [(S/W - S/L) + (B/L - B/W)] / 2 \tag{3}$$

For calculating the Liu (2006) factor the stocks sorted into three groups according to their liquidity (low, Medium and high liquidity). The illiquid are the total stocks with the low liquidity and the liquid (L) are the total stocks with high liquidity. IML is the simple average of the returns on illiquid portfolios stocks minus the returns on the liquid portfolio.

$$IML = R_{10\%}^{Illiquid} - R_{10\%}^{Liquid} \tag{4}$$

Illiquidity measured by Amihud Yakov(2006) who defined Stock illiquidity as the average ratio of the daily absolute return to the (dollar) trading volume on that day. This measure interpreted as the daily stock price reaction to a dollar of trading volume. So the illiquidity calculated by using daily data on returns and volume that are readily available over long periods for the Saudi stock market.

In addition, for calculating the leverage and test the six-factor asset pricing model (by adding liquidity and leverage to the Cahart four-factor model), the stocks are sorted into three group according to their leverage (low, Medium and high leverage).Then LMH leverage is the simple average of the returns on low leverage portfolios minus the returns on high leverage portfolios.

Leverage measured by McConnell and Servaes (1995) and Aggarwal and Zhao (2007) as follows:

- Market leverage (ML) is the ratio of total debt (debt in current liabilities + long-term debt) to market value of total assets in firm.
- Book leverage (BL) is the ratio of total debt (debt in current liabilities + long-term debt) to book value of total assets.

Lam (2002) use natural logs of both book and market leverage ratios for two reasons: First: the natural logs are a good function form for catching leverage effects in average returns (FF, 1992). Second: using natural logs permit to deduce the relation between leverage and book-to-market equity in average returns.

B. Methodology:

The study examines and checks the adequate of eight different models, which are discussed in previous literature, these models include:

1- CAPM: The capital asset pricing model indicates that the market beta is the only risk factor to explain cross section variation of expected stock returns.

2- Fama-French three-factor model: By adding two factors to CAPM (size and book-to-market factors). As Fama and French, observe that two classes of stocks have tended to do better than the market as a whole: (i) small caps and (ii) stocks with a high book-to-market ratio.

3- Cahart four-factor model: Is an extension of the Fama-French three-factor model including a momentum factor. Momentum in a stock is described as the tendency for the stock price to continue rising if it is going up and to continue declining if it is going down. Carhart (1997) subtracts the equal weighted average of the highest performing firms from the equal weighed average of the lowest performing firms, lagged one period.

4- Chan and Faff four-factor model: It is an augmenting asset-pricing model with a liquidity factor. Chan and Faff (2005) refer to the important role of liquidity in asset pricing. Therefore, in this model they add the liquidity factor to the Fama-French three-factor model.

5- Liu and CAPM: This model is a two-factor model (market and liquidity): This model was suggested by Liu (2006) who also addressed the role of liquidity risk on assets pricing and argue that his suggested two-factor model perform better than CAPM and Fama and French three-factor model in explaining the periodical return.

6- The Five-factor model: Augment model that is adding the Cahart four-factor model to the Chan and Faff four-factor where it includes market excess return, firm size, BE/ME ratio, liquidity and a “winner minus loser” factor to capture the momentum effect.

7- The Six-factor model: By adding liquidity and leverage to the Cahart four-factor model, where it includes market excess return, firm size, BE/ME ratio, “winner minus loser” factor to capture the momentum effect, liquidity and leverage.

8- After comparing the previous models, standard deviation (SD) of the portfolios residual will be added to the model. The purpose of this test is examining the explanatory power of portfolio residuals in this model; accordingly capture the model, which performs more explanatory power.

Cross-sectional regression is run for each of the 25 size-B/M portfolios. In addition, two tests are used to compare and check the adequacy of eight different models of assets pricing:

- First: The model is valid in the SSM stock market if the regression coefficients of the factors (B, S, H, L, W, and V) are significantly different from zero.
- Second: According to Merton (1973) and Lam et al. (2002), a well-specified asset-pricing model produces an intercept that is insignificantly different from zero. Hence, the intercept in an adequate model is expected to be not significantly different from zero. Thus, the pricing model is able to capture the variation of average returns.

Table (1) Summarizes the Models of the Study:

	Models	Formulas
1	CAPM model	$R_p - R_f = \alpha_p + \beta_p (R_m - R_f) + \varepsilon_p$ (5)
5	Liu and CAPM	$R_p - R_f = \alpha_p + \beta_p (R_m - R_f) + L(IML) + e(t)$ (6)
2	Fama-French three factor model	$R_p - R_f = \alpha_p + \beta_p (R_m - R_f) + s(SMB) + h(HML) + \varepsilon_p$ (7)
3	Cahart four-factor model	$R_p - R_f = \alpha_p + \beta_p (R_m - R_f) + s(SMB) + h(HML) + w(WML) + \varepsilon_p$ (8)
4	Chan and Faff four-factor model	$R_p - R_f = \alpha_p + \beta_p (R_m - R_f) + s(SMB) + h(HML) + L(IML) + e(t)$ (9)
6	Five factor model	$R_p - R_f = \alpha_p + \beta_p (R_m - R_f) + s(SMB) + h(HML) + w(WML) + L(IML) + e(t)$ (10)
7	The Six factor model (with Leverage)	$R_p - R_f = \alpha_p + \beta_p (R_m - R_f) + s(SMB) + h(HML) + L(IML + w(WML)) + lev (LMH) + e(t)$ (11)
8	The seven factor model with add б (e)	$R_p - R_f = \alpha_p + \beta_p (R_m - R_f) + s(SMB) + h(HML) + w(WML) + L(IML) + v (lev) + б(e) + e(t)$ (12)

Where:

R_p is the return on portfolio p,
R_f is the risk-free rate of return,
R_m is the return on market portfolio,
SMB is the size factor “small minus big”,
HML is the value factor “high minus low”,
WML is the momentum factor “winners minus losers”,
IML is the liquidity factor “illiquidity minus liquidity”
*(lev)*is the leverage factor "low mins high leverage".
βp is the slope coefficient for CAPM model,
α_p is coefficient of intercept (Jensen`s alpha or abnormal return),
S, h, L, W, V and SD are the premiums related to risk factors SMB, HML، IML, WML, *lev* and portfolio residuals *б* (*e*) respectively.

The parameters are estimated by using ordinary least square method. The robustness of the models checked by R^2 determination coefficient, F-test for regression significance, *t*-test for parameters significance in a model.

Empirical Results

Table 2 presents the descriptive statistics for the 25 size-BE/ME portfolios in the Saudi stock market. The last column in panel A -titled ALL- shows an inverse relationship between return and size as the average of return show decreasing trend with the increasing in size. The average of return decreases from 0.0188 at the smallest size quintile to 0.0119 at the biggest size quintile. It is difficult to observe such relation when looking to the BE/ME, as shown in the last raw -titled ALL- in panel A.

The risk of the return measured with the standard deviation described in panel B. the standard deviation displays a strong decreasing trend with the increasing in size. The risk of return decreases from 0.0143 at the smallest size quintile to 0.0093 at the biggest size quintile. Similar to the return, it is difficult to observe such relation when looking to the BE/ME.

The average number of stocks in each of the 25 size- B/M portfolios presents Panel C. The number of stocks ranges from two to nine. These numbers considered low when compared to studies in developed markets but it is not uncommon with emerging markets (Keith et al., 2009).

Table (2) Descriptive Statistics for 25 Size-B/M Portfolios from 2009 to 2012

Size (ME)	Book-to-Market Equity (BE/ME)					
	Low	**2**	**3**	**4**	**High**	**ALL**
Panel A	**Averages of Return**					
Small	0.0199	0.0189	0.0197	0.0173	0.0184	0.0188
2	0.0199	0.0148	0.0178	0.0152	0.0192	0.0174
3	0.0178	0.0146	0.0134	0.0158	0.0126	0.0148
4	0.0150	0.0120	0.0113	0.0143	0.0119	0.0129
Big	0.0097	0.0110	0.0137	0.0101	0.0151	0.0119
ALL	0.0164	0.0143	0.0152	0.0146	0.0154	0.0152
Panel B	**Standard Deviation of Return**					
Small	0.0132	0.0147	0.0178	0.0122	0.0133	0.0143
2	0.0149	0.0120	0.0128	0.0132	0.0143	0.0134
3	0.0135	0.0127	0.0100	0.0102	0.0110	0.0115
4	0.0116	0.0081	0.0085	0.0104	0.0083	0.0094
Big	0.0076	0.0084	0.0121	0.0073	0.0111	0.0093
ALL	0.0122	0.0112	0.0121	0.0107	0.0116	0.0116
Panel C	**Numbers of Firms**					
Small	7	6	7	2	8	30
2	5	6	4	9	6	30
3	7	6	7	8	3	31
4	9	6	4	5	6	30
Big	3	5	8	6	7	29
ALL	31	29	30	30	30	150

The 25size-B/M portfolios are formed by the intersection of size and B/M

For checking multicollinearity of independent variables, table 3 reports the correlation coefficients for the independent variable. The results show that the correlation coefficients are mostly significant but very small it ranges from – 0.3 to 0.167. Therefore، it is reasonable to conclude that the model will not suffer from multicollinearity problem.

Table (3) the correlation coefficients for the independent variable.

	$R_m - R_f$	SMB	HML	WML	IML	б
$R_m - R_f$	1					
SMB	0.118**	1				
HML	0.124**	-0.194**	1			
WML	- 0.018	-0.009	-0.137**	1		
IML	- 0.300**	0.167**	0.132**	0.124**	1	
б	0.000	0.000	0.000	0.000	0.000	1

A. The Empirical Results of CAPM Model:

Table 4 presents the results of the CAPM model. The portfolios betas are positive and significant for all portfolios at the 1% level with highly t-values that range from the lowest of-11.37 to the highest of 49.8. It also observed betas that move in contrast with the size within the five B/M quintiles.

The coefficient of determination (R^2) is high and its values range from 29% to 70. This highest value of the R^2 matches with previous studies, for example Minović and Živković (2012) found that R^2 ranges from 78.97% to 80.15%. However, Petrović (2002) pointed out that R^2 test-statistics are not enough to check the adequacy of the model.

This is supported by the intercepts significance. The intercepts for 13 portfolios out of 25 are significantly different from zero at the 1% level (while10 portfolios are insignificant). Therefore, it is difficult to conclude that the market betas completely explain expected return and the CAPM does not hold.

Table (4) $Rp - R_f = \alpha_p + \beta_p (R_m - R_f) + \varepsilon_p$

The Regression Outputs From the CAPM						Ri – Rf = a + b(Rm – Rf) + e(t)				
	Low	**2**	**3**	**4**	**High**	**Low**	**2**	**3**	**4**	**High**
			a					**t(a)**		
Small	0.000	-.002**	-0.001	-.002**	-0.003**	.75	-2.79	-1.48	2.57	-4.98
2	-0.001	-0.000	-.002**	-.002**	-0.003**	-1.25	-.33	2.84	-5.23	-5.99
3	0.002*	0.001	0.003**	0.002**	0,001	2.60	1.83	4.61	-4.86	1.26
4	0.003**	0.002**	0.002**	0.004**	0.002**	3.98	4.7	3.74	3.73	3.11
Big	0.002**	0.001	0.000	-0.001	-0.000	3.37	1.168	0.177	-1.65	-0.82
			b					t(b)		
Small	1.24**	1.32**	1.195**	1.195**	1.46**	33.14	41.14	39.6	19.3	41.00
2	1.38**	1.17**	1.135**	1.335**	1.21**	34.1	27.4	29.01	49.8	40.03
3	0.810**	0.828**	0.815**	1.011**	0.80**	22.53	23.07	22.7	43.51	20.87
4	0.433**	0.64**	0.73**	0.575**	0.81**	11.37	24.04	21.6	18.1	38.5
Big	0.54**	0.957**	0.663**	0.93**	0.75**	21.04	29.2	33.2	25.12	31.97
			R^2					d-statistic		
Small	0.57	0.67	0.66	0.31	0.671	1.44	1.67	1.49	1.49	1.77
2	0.59	0.48	0.51	0.60	0.66	1.52	1.4	1.51	1.56	1.68
3	0.41	0.39	0.39	0.70	0.35	1.66	1.68	1.53	1.83	1.54
4	0.33	0.41	0.36	0.29	0.64	1.88	1.71	1.90	1.86	1.82
Big	0.35	0.51	0.57	0.33	0.55	1.72	1.42	1.4	1.38	1.54

B. The Empirical Results of Liu Model:-

Table (5) reports the results of the Liu model**.** The portfolios betas are positive and highly significant for all portfolios at the 1% level and move in contrast with size. This result is corresponding to the results of CAPM model. The Durbin Watson values show that the data set does not suffer from autocorrelation.

Although , R^2 is still high as its values range from 30% to 71% it is difficult to conclude that the Liu model completely explain expected return for two reasons: first: the liquid variable is significant for 15 portfolios out of 25 which represent 60% from the studied portfolios. Second: The intercepts for 14 portfolios are significantly different from zero at the 1% level (11 portfolios are insignificant).

Table (5) $R_p - R_f = \alpha_p + \beta_p (R_m - R_f) + L_p (IML) + e(t)$

	The Regression Outputs of the Liu Model									
	Low	**2**	**3**	**4**	**High**	**Low**	**2**	**3**	**4**	**5**
	a					**t(a)**				
Small	0.001	-.002**	-0.001	0.001	-0.003**	.85	-2.69	-1.53	1.61	-4.9
2	-0.001	0.000	-0.002*	-0.002**	-0.003**	-1.23	0.28	-2.76	-5.62	-5.91
3	-0.002*	0.001	0.003**	-.002**	0.001	2.86	1.31	4.75	-4. 7	1.36
4	0.003**	0.002**	0.002**	0.001**	0.001**	3.98	4.62	3.8	-3.8	-3.01
Big	0.001**	0.001	0.000	-0.001	-0.000	3.24	1.08	0.28	-1.91	-0.57
	b					t(b)				
Small	1.26**	1.34**	1.18**	1.20**	1.47**	33.2	41.6	38.7	19.1	40.6
2	1.38**	1.18**	1.15**	1.35**	1.23**	33.56	27.1	29.1	49.8	40.2
3	1.27**	0.73**	0.84**	1.02**	0.92**	22. 7	22.7	23.1	43.7	21.03
4	0.43**	0.63**	0.74**	0.59**	0.816**	11.23	23.3	21.52	18.34	38.4
Big	0.52**	0.94**	0.67**	0.878**	0.73**	20.1	28.43	33.3	18.99	33.85
	L					t(L)				
Small	-.15*	-0.16**	0.068	-0.075	-.075	-2.73	-3.12	1.50	-0.79	1.39
2	-0.03	-0.09	0.15*	-.122**	-0.16**	-0.48	-1.36	-2.5	-3.12	-3.38
3	-0.22	-0.005	-0.17**	-0.17**	-0.11**	-1.13	-.096	-3.2	-3.1	-2.61
4	-0.013	0.07	-0.08	-.123**	0.08*	-0.22	1.72	-1.63	-2.6	-2.4
Big	0.18**	0.12**	-0.14**	-0.26**	-0.43**	4.36	2.4	-2.99	6.2	-7.61
	R^2					d-statistic				
Small	0.58	0.68	0.66	0.31	0.67	1.44	1.68	1.49	1.5	1.78
2	0.59	0.48	0.51	0.65	0.68	1.53	1.41	1.61	1.36	1.60
3	0.39	0.393	0.40	0.71	0.35	1.68	1.68	1.54	1.83	1.54
4	0.35	0.42	0.36	0.36	0.36	1.88	1.72	1.87	1.8	1.74
Big	0.36	0.51	0.58	0.30	0.58	1.74	1.43	1.33	1.3	1.55

C. The Empirical Results of Fama-French Three-Factor Model

Table 6 reports the results of the Fama-French three-factor model which found that the market premium plays an important role in the three-factor model and captures the systematic risk. The market betas are positive and highly significant for all portfolios at the 1% level and the t-values ranging from the lowest of- 12.9 to the highest of 48.84. There is no observed moves of beta in contrast with size within the five B/M quintiles.

The coefficients of SMB (S) are confirming the effect of size on excess returns of portfolios especially; they are significant for all portfolios at 1% level except three, which is not significant. The S coefficients are positive with small size within the first and the second size quintiles. However, the coefficients S are negative with the medium and big size quintiles (in the third, fourth and fifth size quintiles).The significant t-values ranging from the lowest of- 2.5 to the highest of 11.7.

The coefficients of HML (*h*) are significant in 18 portfolios at 1% level. In addition, they are significant at 5% level in 3 portfolios but not significant in 3 portfolios. The value of the coefficients *h* is negative at the lowest B/M quintiles and increased to be positive for the highest B/M quintiles within each of the size quintiles. In addition, the Durbin Watson (D- Statistics) values show that the data set does not suffer from autocorrelation.

The previous results on the market premium(β_p), SMB (S) and HML (*h*) are similar to that shown by Shum & Tang (2005) and Drew & Veeraraghavan's (2003) who examine the application of the FF three-factor model in the Hong Kong, Singaporean, and Taiwanese markets and find evidence similar to FF model 1993. However, the coefficient of determination R^2s is high and its values range from 33% to 74%. Consequently, the R^2s increased in the Fama-French model from both the CAPM and the Liu models but the intercepts for 12 portfolios are insignificantly different from zero at the 1% level. Therefore, Fama-French three-factor model in this case cannot completely explain the excess of portfolios returns and some other factors should be added into this model.

Table (6) $R_p - R_f = \alpha_p + \beta_p (R_m - R_f) + s_p (SMB) + h_p (HML) + \varepsilon_p$

	Low	2	3	4	High	Low	2	3	4	High
	a					t(a)				
Small	-0.001	-.003**	-0.002**	0.000	-.004**	-1.45	-5.46	-4.39	0.24	-6.46
2	-0.003**	-0.001	-0.003**	-.003**	-.003***	-4.74	-1.4	-3.6	-5.98	-5.55
3	-0.001	0.001	0.003**	-0.001	0.001	-1.55	1.55	5.23	-1.15	1.41
4	0.002**	0.003**	0.003**	.003**	0.000	4.35	5.87	4.91	5.76	-0.97
Big	0.002**	0.0011	0.001	0.001	0.001	5.44	1.12	1.18	1.07	1.4
	b					t(b)				
Small	1.33**	1.27**	1.17**	1.07**	1.3**	34.1	41.4	40.3	18.3	40.31
2	1.41**	1.30**	1.07**	1.24**	1.05**	37.1	29.3	27.9	48.8	42.67
3	1.25**	0.88**	0.82**	.97**	0.76**	24.6	23.4	26.1	46.3	19.82
4	0.55**	0,75**	0.81**	0.73**	0.80**	12.9	25. 5	21.2	21.4	34.5
Big	0.65**	0.76**	0.79**	0.67**	0.75**	25.8	32.6	35.1	17.1	29.76
	s					t(s)				
Small	0.268**	0.48**	0.45**	0.56**	0.46**	4.3	8.87	9.05	5.2	7.8
2	0.60**	0.04	0.25**	0.25**	0.131**	9.15	0.58	3.70	5.33	2.64
3	0.27**	-0.30**	-0.154	-0.26**	0.16**	-2.79	-5.7	-2. 5	-6.89	2.17
4	-0.25**	-0.30**	-0.32**	-0.60**	-0.21**	-3.8	-6.7	-5.4	-9.5	-5.77
Big	-0.44	-0.39**	-0.38**	-.50**	-0.35**	-10.5	-7.22	-11.7	-6.6	-9.1
	h					t (h)				
Small	-0.87**	-0.108	-0.24*	0.18	0.63**	-8.04	-1.16	-2.71	1.49	6.08
2	-0. 77**	-0.98**	0.174	0.39**	0.93**	-6.8	-7.1	1.47	4.94	10..8
3	-0.29*	-0.72**	0.097	0.49**	0.80**	-1.8	-7.9	0.90	7.30	6.20
4	-0.56**	-0.43**	-0.21**	0.55**	0.23**	-4.87	-5. 5	-2.04	6.01	3.5
Big	-0.62**	-0.85**	-0.25*	0.96**	0.37**	-8.55	-9.14	-2.69	7.20	5.46
	R^2					d-statistic				
Small	0.62	0.70	0.69	0.33	0.70	1.47	1.65	1.56	1.51	1.76
2	0.65	0.51	0.57	0.67	0.71	1.64	1.44	1.61	1.40	1.69
3	0.40	0.45	0.39	0.74	0.37	1.63	1.73	1.53	1.91	1.55
4	0.33	0.46	0.38	0.37	0.66	1.88	1.68	1.88	1.87	1.83
Big	0.40	0.57	0.63	0.41	0.61	1.79	1.47	1.41	1.38	1.61

D. The Empirical Results of Cahart Four-Factor Model:

From Table (7) the results of Cahart four-factor model show that the coefficients on market betas (b_p) are still positive and highly significant in all portfolios at 1% level except one portfolio that is not significant. The t-values of the coefficients on market betas ranging from the lowest of- 3.4 to the highest of 29.7, which is lower than the results of the CAPM model. In addition, there is no observed moves of beta in contrast to size within the five B/M quintiles that is on the opposite of the CAPM model results.

The coefficients (S_p) of the size effect are positive with small size within the first and the second size quintiles and within the five B/M quintiles. However, the coefficients S are negative sometimes with the medium and constantly with the big size quintiles. In addition, the S coefficients are significant at 1% level in 13 portfolios and 3 portfolios are significant at 5% level while 9 portfolios are not significant.

The coefficients on HML (h_p) are significant in 20 portfolios at 1% level, furthermore four portfolios are significant at 5% level where (h_p) are not significant at all in one portfolio. The value of the coefficients h is negative at the lowest B/M quintiles and increased to be positive for the highest B/M quintiles within each of the size quintiles.

The relationship between momentum factor and the 25 size-B/M portfolios is confirmed because the coefficients of WML (w_p) are significantly different from zero at the 1% significance level in 17 size-B/M portfolios, while two portfolios are significant at the %5 level but (w_p) are not significant in 6 portfolios. The range of t-values on WML (w) is ranging from 2.5 to 16.28. The coefficients of momentum (w_p) are negative and significant in 11 portfolios out of 25, which appear in the smallest size quintiles, while the positive coefficients mainly appear in the largest size quintiles.

The previous results are in agreement with the empirical evidence of Grundy and Martin 2001, Fong et al. 2005 and Lam et al. (2009) who provide that betas, size, B/M and WML momentum risk are significant and have the ability to explain the underperformance in returns in some Asian markets. Also L'Her et al. (2004) found that the four-factor pricing model is significant in the Canadian stock market.

Although the coefficient of determination R^2s is high and its values range from 33% to 77% the intercepts for 12 portfolios are insignificantly different from zero at the 1% level. Consequently, some other factors should be added into the Cahart four-factor model.

Table (7) $R_p - R_f = \alpha_p + \beta_p (R_m - R_f) + s_p (SMB) + h_p (HML) + w_p (WML) + \varepsilon_p$

	The Regression Outputs of the Cahart Four-Factor Model Ri – Rf = a + b(Rm – Rf) + s(SMB) + h(HML) + w(WML) + e(t)									
	Low	**2**	**3**	**4**	**High**	**Low**	**2**	**3**	**4**	**High**
	a					**t(a)**				
Small	0.001	-0.002**	-0.002**	0,001	-0.003**	-0.77	-5.14	-3. 5	0.69	-5.42
2	-.003**	0.000	-.003**	0.002**	-0.002**	-5.61	-1.29	-3.14	-5.2	-5.12
3	.000	0.000	0.003**	-0.001	0.001	0.58	0.54	5.99	-1.05	1.66
4	-0.001	-0.002**	0.003**	0.002**	-0.001**	2.63	4.89	3.96	7.95	5.20
Big	0.001**	0.001	0.001	-0.001	0.0000	4.42	0.504	1.88	1.65	1.20
	b					t(b)				
Small	1.51**	1.55**	1.34**	1.29**	1.70**	19.1	22.9	21.03	9.4	23.1
2	1.63**	1.68**	0.92**	1.66**	1.36**	19.73	18.26	10.59	29.7	22.01
3	1.21**	0.55**	0.77**	0.91**	0.96**	9.86	8.30	9.61	18.65	10.18
4	0.028	0.11**	0.83**	0.34**	0.49**	0.35	11.05	5.26	5.20	11.13
Big	0.147**	1.23**	0.23**	0.29**	0.56**	3.10	17.9	6.29	3. 4	11.54

Table (7) $R_p – R_f = \alpha_p + \beta_p (R_m – R_f) + s_p (SMB) + h_p (HML) + w_p (WML) + \varepsilon_p$

	The Regression Outputs of the Cahart Four-Factor Model ri – rf = a + b(rm – rf) + s(smb) + h(hml) + w(wml) + e(t)									
	low	**2**	**3**	**4**	**high**	**low**	**2**	**3**	**4**	**high**
	s					t(s)				
Small	0.21*	0.34**	0.37**	0.46**	0.27**	2.6	5.65	6.54	3.74	4.04
2	0.49**	0.124	0.326**	0.038	0.023	6.60	1.75	4.21	0.77	-0. 42
3	0.29*	-0.24*	-0.127	-0.23**	0.061	2.64	-2.31	-1.78	-5.27	0.73
4	0.036	0.013	-0.32**	-0.30**	-0.051	0.501	0.29	-4.86	-5.28	-1.30
Big	-.16**	-0.43**	-0.13**	-0.06	-0.26**	-3.83	-7.04	-4.02	-0.82	-5.96
	h					t (h)				
Small	-0.89**	-0.04	-0.26**	0.25*	0.59**	-8.4	-0.55	-2.96	2.27	4.23
2	-0.80**	-0.95**	0.193**	0.34**	0.89**	-9.31	-9.07	3.14	4.9	11.67
3	-0.29**	-0.68**	0.104*	0.49**	0.77**	-6.23	-7.18	2.02	7.4	5.90
4	-.49**	-.35**	-0.10*	0.50**	0.26**	-9.04	-5,8	-2.05	5.60	5.95
Big	-0.55**	-0.86**	-0.11*	0.32**	0.39**	-6.96	-9,28	-2.73	4.48	7.30
	w					t(w)				
Small	-0.25*	-0.39**	0. 24**	0.30	0.57**	-2.6	-4.77	-3.1	-1.81	-6.3
2	0.32**	-0.54**	-0.22*	-0.59**	-0.44**	-3.15	-4.78	2.08	-8.73	-5.88
3	0.058	0.47**	0.079	0.095	-0.29**	0.386	5.88	0.82	1.61	-2.50
4	0.822**	0.91**	-0.024	0.55**	0.45**	8.39	14.48	-0.27	6.95	8.43
Big	0.78**	-0.12	0.73**	1.63**	0.26**	13.36	-1.43	16.28	15.5	4.46
	R^2					d-statistic				
Small	0.62	0.71	0.70	0.34	0.72	1.46	1.68	1.56	1.50	1.78
2	0.65	0.52	0.51	0.77	0.72	1.55	1.47	1.61	1.47	1.75
3	0.40	0.47	0.40	0.74	0.38	1.63	1.70	1.54	1.89	1.56
4	0.34	0.57	0.38	0.41	0.69	1.90	1.77	1.88	1.91	1.88
Big	0.55	0.57	0.73	0.54	0.62	1.94	1.47	1.61	1.40	1.62

E. The Empirical Results of Chan and Faff Four-Factor Model:

The results of Chan and Faff four-factor model shown in table (8) indicate that the coefficients on market betas (*b*) are positive and highly significant in all portfolios at 1% level. The t-values of the coefficients of market betas ranging from the lowest of 12.6 to the highest of 41.9, which are more than the results of the Chan and Faff four-factor model. In addition, there is no observed moves of beta in contrast with size within the five B/M quintiles.

The S coefficients of the size effect are significant at 1% level in 24 portfolios but not significant in one portfolio. In addition, the coefficients on HML (*h*) are significant in 20 portfolios at 1% level, furthermore one portfolio is significant at 5% level but (*h*) is not significant at all in three portfolios. The value of the coefficients *h* is still negative at the lowest B/M quintiles and increased to be positive for the highest B/M quintiles within each of the size quintiles.

The coefficients of IML are the simple average of returns on illiquid portfolios stocks minus the returns on the very liquid portfolio. The coefficients of IML are significantly different from zero at the 1% significance level in 16 size-B/M portfolios, while one is significant at the 5% level but the coefficients of IML are not significant in eight portfolios. The range of the coefficients on IML is from -1.9 to -8.68. The coefficients are negative for all portfolios except three out of 25 are positive which appear in the biggest size quintiles. So negative relationship between the illiquidity factor and the average returns of 25 size-B/M portfolios is founded. This result on IML is similar to that shown by Amihud Yakov (2006) who found that illiquidity has a negative and significant effect on stock return.

The Durbin Watson (D- Statistics) values show the data set does not suffer from autocorrelation. In addition, the coefficient of determination R^2s is high and its values range from 31% to 77%.Then the R^2s in the Chan four-factor model is lower than the Cahart model. However, the intercepts for 13 portfolios are insignificantly different from zero at the 1% level. Therefore, the Chan and Faff four-factor model cannot completely explain the excess of portfolios returns and some other factors should be added into this model.

Table (8) $R_p - R_f = \alpha_p + \beta_p (R_m - R_f) + s_p (SMB) + h_p (HML)) + L_p (IML) + e(t)$

	The Regression Outputs of the Chan the Four Factor Model									
	Low	**2**	**3**	**4**	**High**	**Low**	**2**	**3**	**4**	**5**
	a					**t(a)**				
Small	0.001	-.003**	-.002**	-.000	-.004**	1.37	-5.37	-4.4	0.26	-6.42
2	-.003**	-0.001	0.002**	-.003**	-.003**	-4.70	-1.32	-3.35	-5.90	-5.5
3	-.001	0.000	0.003**	-0.001	0.001	1.48	1.5	5.35	-1.97	1.50
4	0.003**	0.003**	0.002**	0.003**	0.000	4.35	5.82	4.96	5.85	-0.90
Big	0.002**	0.001	0.001**	0.001	0.001	5.36	1.05	3.3	0.89	1.74
	b					t(b)				
Small	1.35**	1.29**	1.16**	1.08**	1.31**	33.09	36.70	35.32	15.3	33.44
2	1.41**	1.31**	1.10**	1. 3**	1.07**	32.83	27.25	24.4	41.9	32.9
3	1.28**	0.88**	0.84**	0.99**	0.78**	20.2	25.3	20.6	30.5	15.97
4	0.55**	0.72**	0.82**	0.74**	0.81**	12.76	24.90	21.2	12.6	34, 6
Big	0.68**	1.13**	0.75**	0.804**	0.77**	25.15	31.9	35.2	16.33	31.79
	s					t(s)				
Small	0.27**	0.48**	0.45**	0.56**	0.47**	4.38	8.99	9.02	5.23	7.83
2	0.60**	0.04	0.25**	0.25**	0.135**	9.12	0.60	3.7	5.43	2.73
3	0.27**	-0.30**	-0.15**	-0.12**	-0.17**	2.85	-5.67	-2.42	-6.8	-2..3
4	-0.25**	-.303**	-0.31**	-0.49**	-0.21**	-3.79	-6.7	-5.35	-9.5	-5.74
Big	-0.44**	-0.39**	-0.38**	-0.51**	-0.34**	-10.7	-7.3	-11.7	-6.86	-9.27
	h					t (h)				
Small	-0.86**	-0.107	-0.24**	0.28	0.63**	-8.02	-1.15	-2.72	1.50	6.10
2	-0.77**	-0.90**	0.176	0.39**	0.93**	-6.82	-7.10	1.49	4.98	7.20
3	-0.29*	0.72**	0.099	0.49**	0.80**	-1.8	-7.89	0.92	7.04	6.23
4	-0.56**	0.43**	-0.21**	0.54**	0.219**	-4.87	-5.5	-2.04	6.24	3.54
Big	-0.62**	-0.86**	-0.15**	0.96**	0.37**	-8.7	-9.20	-2.68	7.38	5.7
	L					t(L)				
Small	-0.16**	-0.19**	-0.06	-0.03	-0.08	-2.93	-3.44	-1.40	-0.90	1.60
2	-0.04	-0.09	-0.15**	-0.17**	-0.19**	-0.68	-1. 4	-2.6	-3.2	-3.7
3	-0.22**	-0.001	-. 17**	-.109**	-.176**	-2.63	-0.03	-3.17	-3.30	-2.75
4	0.008	0.076*	-0.07	-0.12**	-0.17**	-0.14	1. 90	-1.55	-2. 5	-2.39
Big	0.178**	0.13**	-0.09**	0.43**	-0.26**	5.01	2.7	-3.01	6.68	-8.04
	R^2					d-statistic				
Small	0.62	0.71	0.69	0.34	0.70	1.46	1.65	1.57	1.49	1.77
2	0.65	0.51	0.52	0.77	0.71	1.54	1.45	1.61	1.38	1.68
3	0.40	0.45	0.40	0.74	0.38	1.65	1.73	1.55	1.91	1.55
4	0.31	0.46	0.39	0.38	0.67	1.88	1.70	1.88	1.87	1.81
Big	0.47	0.58	0.64	0.44	0.64	1.82	1.45	1.41	1.37	1.64

F. The Empirical Results of Five−Factor Model:

Table (9) reports the results of Five factor model that examine the effect of market betas, SMB, HML, IML and WML factors on excess returns of portfolios. The empirical evidence shows that there are significant premiums for the Five-factor model with high explanatory power. The coefficient of determination R^2s is high and its values range from 33% to 78%. However, the intercepts for 13 portfolios are still insignificantly different from zero at the 1% level therefore this model cannot completely explain the excess of portfolios returns and some other factors should be added into this model.

Table (9) $R_p - R_f = \alpha_p + \beta_p\ (R_m - R_f) + s_p\ (SMB) + h_p\ (HML) + w_p\ (WML) + L_p\ (IML) + e(t)$

	Low	2	3	4	High	Low	2	3	4	High
	a					t(a)				
Small	-0.000	-.002**	-.002**	0.000	-.003**	-0.89	-3.98	-3.37	0.59	-4.86
2	-.003**	0.000	0.001	-.002**	0.002**–	-3.69	-0.29	-0.97	-3.81	-4.05
3	-.002**	0.001	0.001	-0.001	0.001	-2.46	1.23	1.9	-1.33	1.2
4	-.002**	0.001	0.002**	-.002**	-0.002**	2.4	1.9	4.37	4.03	-3.3
Big	-.001	0.001	0.001	0.002**	0.001	1.44	1.14	-1.04	-2.71	1.3
	b					t(b)				
Small	1.49**	1.53**	1.34**	1.25**	1.69**	18.84	22.78	21.04	9.17	22.8
2	1.63**	1.68**	0.917**	1.66**	1,36**	19.6	18.2	10.58	29.6	22.01
3	1.19**	0.55**	0.75**	0.89**	0.95**	9.71	8.3	9.4	18.5	10.13
4	-0.03	0.112*	0.82**	0.33**	0.48**	-0.34	2.18	10.9	5.2	11.03
Big	0.16**	1.23**	0.21**	-0.27**	0.55**	3.35	18.1	6.04	-3.2	11.7
	s					t(s)				
Small	0.199**	0.34**	0.36**	0.45**	0.27**	2.8	5.62	6.22	3.70	6.4
2	0.48**	-0.124	0.35**	0.045	-0.004	6.4	-1.5	4.44	0.89	-0.07
3	0.30**	-.147**	-0.12	-0.22**	0.06	2.70	-2.5	-1.62	-5.09	0.73
4	0.04	0.01	-.313**	-0.29**	-0.03	0.53	0.12	-4.6	-5.03	-0.83
Big	-0.17**	-0.43**	-0.11**	0.03	0.23**	-3.95	-7.1	-3.4	0.39	-5.5
	h					t (h)				
Small	-0.87**	-0.133	-0.26**	0.19	0.58**	-8.04	-1.45	-3.01	1.6	5.7
2	-0.79**	-0.95**	0.19	0.34**	0.39**	-6.99	-7.59	1.6	4.5	10.47
3	-0.28	-0.69**	0.124	0.501**	0.77**	-1.65	-7.6	1.14	7.57	6.02
4	-0.49**	-0.36**	-0.21*	-0.49**	0. 26**	-4.45	-5.07	-2.01	-5.6	4.38
Big	-0.56**	-0.86**	-0.07	1.09**	0.39**	-8.6	-9.2	-1.56	9.38	6.21
	L									
Small	-0.15**	-0.14**	-0.08	-0.09	-0.04	-2.77	-3.00	1.80	-1.0	-0.82
2	-0.02**	-0.04	-0.17**	-0.15**	-0.18**	-0.38	-0.68	-2.77	-2.17	-2.8
3	-0.24**	-0.04	-0.19**	-0.12**	-0.16**	-2.79	-0.79	-3.51	-3.65	-2.44
4	-0.07	0.008	0.079	-0.16**	-0.108**	-1.22	0.23	-1.5	-3.6	-3.61
Big	0.23**	0.13**	-0.35**	.32**	-0.38**	3.87	2.83	-6.12	5.45	-8.81
	w					t(w)				
Small	-0.22**	-0.35**	-0.25**	-0.30**	-0.56**	-2.26	-4.27	-3.25	-2.8	-6.15
2	-0.31**	-0.53**	0.265**	-0.57**	-0.41**	-3.03	-4.7	2.5	-8.32	-5.4
3	0.12	.49**	0.122	0.126*	-0.23*	0.8	6.08	1.25	2.13	-2.04
4	0.85**	0.909**	-0.008	0.59**	0.47**	8.55	14.4	-0.09	7.4	8.81
Big	1.75**	-0.17	1.75**	1.6**	0.33**	12.8	-2.01	17.7	14.9	5.85
	R^2					d-statistic				
Small	0.62	0.71	0.69	0.35	0.72	1.47	1.68	1.56	1.51	1.78
2	0.65	0.70	0.72	0.78	0.72	1.56	1.47	1.61	1.46	1.74
3	0.40	047	0.40	0.74	0.39	1.65	1.69	1.56	1.89	1.55
4	0.35	0.57	0.39	0.42	0.70	1.95	1.78	1.85	1.90	1.86
Big	0.56	0.58	0.75	0.56	0.66	1.90	1.44	1.71	1.46	1.68

G. The Empirical Results of Six-Factor Model:

Table (10) illustrates the regression outputs of the six-factor model (by adding liquidity and leverage to the Cahart four-factor model). The empirical evidence shows that there are significant premiums for the six-factor model (including market betas (*b*), SMB, HML, IML, WML and lev). Furthermore, both book and market leverage variables show significant explanatory power on excess return of portfolio with explanatory power R^2 value ranging from 39% to 83%. Furthermore, the intercepts for 17 portfolios are insignificantly different from zero at the 1% level. Consequently, this model can explain the excess returns of portfolios. These results similar to that shown by Lam (2002) who deduced the relation between leverage and book-to-market equity in average returns.

In addition the coefficients of leverage factor (lev) (the simple average of the returns on low leverage portfolios minus the returns on high leverage portfolios) are significantly different from zero at the 1% significance level in 10 size-B/M portfolios, while six are significant at the 5% level but the coefficients of (lev) are not significant in 9 portfolios. The coefficients are negative for 13 portfolios out of 16 significant portfolios. So negative relationship between the leverage factor and the average returns of 25 size-B/M portfolios is founded. This result on (lev) is similar to that shown by Mahran (2015) who found that in spite of the difference among firms in growth opportunities or in operating efficiency, the leverage (book or market) have a significant negative effect on both the firm value and the difference between firm value and the industry value in the Saudi stock market.

Table (10) $R_p - R_f = \alpha_p + \beta_p (R_m - R_f) + s_p (SMB) + h_p (HML) + w_p (WML) + L_p (IML) + lev_p (LMH))$

	Low	**2**	**3**	**4**	**High**	**Low**	**2**	**3**	**4**	**High**
			a					t(a)		
Small	-0.001	-.002*	-0.001	0.001	-.003**	-1.7	-2.19	-1.30	0.52	-4.7
2	-.000	0.000	=0.003**	-.002**	0.002**–	1.69	-0.14	-3.9	-3.71	-4.03
3	-.001	0.001	0.003**	-0.001	0.001	-1.66	1.02	4.9	-1.63	1.8
4	-.001	0.001	0.003**	.002**	-0.001	1.61	1.76	4.8	4.14	-1.07
Big	0.001	0.001	0.000	-0.001	0.000	1.41	1.64	-0.67	-1.6	1.3
			b					t(b)		
Small	1.5**	1.54**	1.4**	1.20**	1.74****	18.3	22.06	20.93	8.33	22.85
2	1.67**	1.66**	0.89**	1.63**	1.36**	19.5	17.5	10.01	28.5	21.34
3	1.36**	0.59**	0.76**	0.87**	1.01**	21.34	8.49	9.04	19.4	10.23
4	0.14	0.200**	0.82**	0.37**	0.47**	0.16	3. 8	10.51	5.5	10.17
Big	0.14**	0.98**	1.57**	-0.26**	0.52**	2.74	14.8	4.32	-2.92	10.54
			s					t(s)		
Small	0.199**	0.34**	0.36**	0.45**	0.27**	2.8	5.62	6.22	3.70	6.4
2	0.48**	-0.20	0.35**	0.051	-0.01	6.4	-1.6	4.44	1.03	-0.18
3	-0.01	-.147**	-0.12	-0.22**	0.06	-0.19	-2.5	-1.62	-5.09	0.73
4	0.04	0.01	-.313**	-0.29**	-0.03	0.53	0.12	-4.6	-5.03	-0.83
Big	-0.17**	-0.43**	-0.11**	0.03	0.23**	-3.95	-7.1	-3.4	0.39	-5.5

Table (10) $R_p - R_f = \alpha_p + \beta_p (R_m - R_f) + s_p (SMB) + h_p (HML) + w_p (WML) + L_p (IML) + lev_p (LMH))$

	Low	2	3	4	High	Low	2	3	4	High
	h					**t (h)**				
Small	-0.87**	-0.18*	-0.26**	0.19	0.58**	-8.04	-1.9	-3.01	1.6	5.7
2	-0.79**	-0.95**	0.21	0.34**	0.89**	-6.99	-7.59	1.7	4.5	10.55
3	-0.28	-0.69**	0.124	0.501**	0.77**	-1.65	-7.6	1.14	7.57	6.02
4	-0.49**	-0.36**	-0.21*	-0.49**	0. 26**	-4.45	-5.07	-2.01	-5.6	4.38
Big	-0.56**	-0.86**	-0.07	1.09**	0.39**	-8.6	-9.2	-1.56	9.38	6.21
	L									
Small	-0.15**	-0.14**	-0.08	-0.09	-0.04	-2.77	-3.00	1.80	-1.0	-0.82
2	-0.02	-0.05	-0.17**	-0.08*	-0.12**	-0.38	-0.78	-2.92	-2.2	-2.8
3	-0.24**	-0.04	-0.19**	-0.12**	-0.16**	-2.79	-0.79	-3.51	-3.65	-2.44
4	-0.07	0.008	0.079	-0.16**	-0.108**	-1.22	0.23	-1.5	-3.6	-3.61
Big	0.13**	0.13**	-0.15**	.32**	-0.28**	3.87	2.83	-6.12	5.45	-8.81
	w					t(w)				
Small	-0.22**	-0.35**	-0.25**	-0.30**	-0.56**	-2.26	-4.27	-3.25	-2.8	-6.15
2	-0.31**	-0.50**	0.29**	-0.55**	-0.41**	-3.03	-4.2	2.6	-7.7	-5.4
3	0.12	.49**	0.122	0.126*	0.23*	0.8	6.08	1.25	2.13	-2.04
4	0.85**	0.909**	-0.008	0.59**	0.47**	8.55	14.4	-0.09	7.4	8.81
Big	0.75**	0.17*	0.75**	1.6**	0.33**	12.8	2.01	17.7	14.9	5.85
	Lev					t(v)				
Small	0.20**	0.09**	-0.04*	-.096**	-0.18**	10.04	2.7	-1.9	-2.6	-9.6
2	-.087**	0.001	-0.002	-0.02	-0.016	-4.4	0.04	0.08	-1.17	-0.83
3	-.103**	-.103**	0.001	-0.005	-0.05*	-3.4	-3.05	1.28	-0.01	-2.2
4	-0.02	-.037**	-0.02	0.04*	0.05*	-1.6	-2.3	-1.00	2.2	2.2
Big	-0.08**	0.06*	0.002	-.165**	-0.04*	-2.7	2.3	0.18	-3.12	-2.3
	R^2					d-statistic				
Small	0.66	0.72	0.70	0.39	0.81	1.47	1.68	1.56	1.51	1.78
2	0.41	0.70	0.72	0.78	0.73	1.65	1.47	1.61	1.46	1.74
3	0.40	047	0.40	0.74	0.39	1.65	1.69	1.56	1.89	1.55
4	0.45	0.57	0.41	0.42	0.83	1.95	1.78	1.85	1.90	1.86
Big	0.56	0.58	0.75	0.56	0.66	1.90	1.44	1.71	1.46	1.68

H. The Empirical Results of Six-Factor Model with Adding the Standard Deviation of the Portfolio Residuals:

The complementary test to check the strength of the six-factor model can be achieved by adding the standard deviation of the portfolio residuals that is obtained from Eq. (11) in six-factor model. The purpose of this test is examining the explanatory power of the portfolio residuals in this model.

The residual is the difference between the actual portfolio return and the expected one, which is obtained from the regression outputs of the six-factor model for each portfolio. The standard deviation of residual is then computed by using the portfolio residuals of the 825 days.

Table (11) shows the results after adding the residual standard deviation to six-factor model. The results of tables (10 & 11) are close and there is no change from the results of six-factor model. Most coefficients on the six-risk factor (bp, sp, hp, Lp, W_P and Lev) remain significant and the market betas are still all significantly positive at the 0.01 significance level.

The result also suggests that the variable of residual standard deviation may have no statistical impact on the six-factor model. Only six out of the 25 coefficients on the residual standard deviation are significantly different from zero at the 0.1 significance level. Further, the explanatory power R^2 value ranges from 0.35 to 0.75, which is even lower than that of the six-factor model in Table 10. Therefore, the six-factor model, MP, SMB, HML, and WML, *(IML) and lev* may be sufficient to capture common variation of average returns.

Table (11) $R_p - R_f = \alpha_p + \beta_p (R_m - R_f) + s(SMB) + h(HML) + w(WML) + L(IML) + lev(LMH) + v\,бe + e(t)$

	The Regression Outputs of the Six Factor Model with Adding the Portfolio Residuals									
	Low	**2**	**3**	**4**	**High**	**Low**	**2**	**3**	**4**	**High**
	a					**t(a)**				
Small	-0.000	-.002**	-.000	0.000	-.003**	-.38	-4.2	-1.36	0.66	-5.7
2	-.001	0.000	0.002*	-.002**	0.002**–	1.33	-.028	-2.1	-2.81	-3.03
3	-.001	0.001	0.003**	-0.001	0.001	-1.7	0.97	5.01	-1.4	1.11
4	-.001	0.001	0.003**	.002**	-0.001	1.67	1.76	5.17	4.14	-1.08
Big	0.001	0.001	0.000	-.001	0.000	1.13	1.60	-0.49	-1.5	1.5
	b					t(b)				
Small	1.64**	1.50**	1.37**	1.23**	1.5**	20. 4	21.8	20.8	8.8	22.01
2	1.5**	1.7**	0.87**	1.7**	1.4**	18.04	18.18	9.7	28.9	21.9
3	1.36**	0.55**	0.802**	0.904**	0.97	21.34	8.18	7.7	18.4	9.95
4	0.25	0.200**	0.92**	0.37**	0.534**	3.2	3. 8	11.9	5.5	12.0
Big	0.34**	1.26**	.24**	-0.17**	0.6**	8. 4	18.0	6.6.	-1.96	12.4
	s					t(s)				
Small	0.35**	0.34**	0.37**	0.45**	0.24**	3.37	5.8	6.5	3.70	3.9
2	0.48**	-0.123	0.33**	0.052	-0.01	6.4	-1.5	4.3	1.04	-0.02
3	-0.29**	-.132*	-0.095	-0.21**	0.081	-2.7	-2.2	-1.3	-4.95	0.97
4	0.018	0.012	-.313**	-0.29**	-0.025	0.26	0.25	-4.6	-5.03	-0.65
Big	-0.13**	-0.44**	-0.106**	0.055	0.22**	-3.4	-7.14	-3.4	0.74	-5.2
	h					t (h)				
Small	-0.78**	-0.18*	-0.24**	0.16	0.40**	-7.3	-1.9	-2.8	0.86	4.3
2	-0.89**	-0.91**	0.18	0.36**	0.93**	-7.9	-7.2	7.2	4.7	10.9
3	-0.38	-0.66**	0.144	0.502**	0.81**	-2.3	-7.3	1.3	7.50	6.24
4	-0.6**	-0.35**	-0.139*	-0.14**	0. 30**	-5.8	-4.8	-1.36	-5.6	5.1
Big	-0.45**	-0.87**	-0.07	1.18**	0.43**	-7.8	-9.2	-1.45	10.2	6.8
	L									
Small	-0.18**	-0.13**	-0.071	-0.063	-0.014	-3.3	-3.00	1.60	-0.67	-0.31
2	-0.008	-0.07	-0.16**	-0.08*	-0.14**	-0.14	-0.12	-2.7	-2.3	-3.23
3	-0.21**	-0.04	-0.19**	-0.12**	-0.158**	-2.5	-0.72	-3.51	-3.65	-2.4
4	-0.002	0.01	0.004	-0.11**	-0.12**	-0.01	0.27	-1.4	-3.5	-4.2
Big	0.064*	0.124**	-0.15**	.29**	-0.3**	2.3	2.7	-6.2	5.01	-9.3
	w					t(w)				
Small	-0.34**	-0.35**	-0.30**	-0.29	-0.47**	-3.5	-4.22	-3.7	-1.7	-5. 5
2	-0.23*	-0.59**	0.30**	-0.59**	-0.45**	-2.3	-5.1	2.8	-8.4	-5.8
3	0.17	.49**	0.077	0.121*	0.25*	1.13	5.9	1.77	2.10	-2.1
4	11**	0.913**	-0.10	0.48**	0.66**	11.6	14.5	-0.12	5.9	7.7
Big	0.53**	0.21*	0.74**	1.45**	0.29**	10.4	2.4	16.2	13.7	5.00

Table (11) $R_p - R_f = \alpha_p + \beta_p (R_m - R_f) + s(SMB) + h(HML) + w(WML) + L(IML) + lev(LMH) + v\,бe + e(t)$

	The Regression Outputs of the Six Factor Model with Adding the Portfolio Residuals									
	low	**2**	**3**	**4**	**high**	**low**	**2**	**3**	**4**	**high**
		leverage						t(v)		
Small	-0.11**	0.051**	-0.005*	0.16**	-0.21**	-3.06	2.7	-2.55	4.8	-12.7
2	0.084**	0.003	-0.001	-0.014	-0.012	-4.2	0.14	0.013	-1.17	-0.17
3	0.106**	-0.03**	0.018	-0.005	-0.05*	3.4	-3.05	0.93	-0.41	-2.2
4	-0.02	-.020**	-0.35*	0.04*	00.23*	-1.6	-1.5	-1.9	2.2	2.2
Big	-0.010	0.09*	0.001	-.11**	-0.024*	-1.05	2.4	0.081	-3.00	-2.1
		Vбe						t(v)		
Small	0.14**	0.007	0.041	0.029	-.016	5.4	0.312	1.94	0.63	-1.39
2	-0.08	0.075	-0.045	000.017	0.041	-1.9	2.4	-1.5	0.93	1.8
3	-0.059	-0.14	0.049	0.003	0.005	-1.4	-0.65	1.8	0.173	0.87
4	-0.02	-0.013	0.1**	0.117**	0.005	-1.6	-0.75	4.06	5.6	0.82
Big	0.24	0.062**	0.021*	0.100**	0.047	17.3	2.7	2.5	3.6	1.1
		R^2						d-statistic		
Small	0.64	0.72	0.70	0.35	0.70	1.47	1.68	1.56	1.49	1.76
2	0.41	0.52	0.52	0.75	0.72	1.55	1.5	1.61	1.45	1.74
3	0.40	048	0.40	0.74	0.39	1.65	1.69	1.55	1.89	1.55
w	0.45	0.57	0.41	0.42	0.70	1.95	1.78	1.85	1.90	1.86
Big	0.68	0.58	0.74	0.56	0.66	1.90	1.44	1.67	1.46	1.68

Summary and Conclusion

This paper comprehensively examines the asset-pricing models in Saudi stock market during the period from 2009 to 2013. The 25 size-BE/ME portfolios are formed by the intersection of size and BE/ME quintiles (5x5 Size-BE/ME sorts). Therefore, this study tests and checks the adequate of eight different models. These models include market factor MP (excess market return), size factor SMB (small minus big in terms of size), HML (high minus low in terms of B/M), momentum factor WML (winners minus losers in terms of return), IML (illiquid minus the liquid portfolio) and *(lev)* which is the leverage factor "low minus high leverage".

Table (12) “Summary for the explanatory power and coefficients of the asset pricing models” represents the significant results of this study in the Saudi stock market:

The market premium plays an important role in all models and captures the systematic risk. The market betas are positive and highly significant for almost all portfolios (24 -25 portfolio) at the 1% level. The portfolios betas are moved in contrast to the size within the five B/M quintiles in the empirical results of CAPM model. However, there are no observed moves of beta in contrast to size within the five B/M quintiles in the other pricing models.

The S coefficients are positive with small size within the first and the second size within the five B/M quintiles. However, the coefficients S are negative with the medium and the biggest size quintiles. In addition, the S coefficients are significant at 1% level for range 16-24 portfolios.

The coefficients of HML (*h*) are significant in range 19-24 portfolios at 1% level. Furthermore, the value of the coefficients *h* are negative at the lowest B/M quintiles and increased to be positive for the highest B/M quintiles within each quintile.

The relationship between momentum factor and the 25 size-B/M portfolios is founded because the coefficients of WML (w_p) are significantly different from zero at the 1% significance level in range 16-21 size-B/M portfolios. The coefficients of momentum (w_p) are negative and significant in the smallest size quintiles while the positive coefficients mainly appear in the largest size quintiles.

The coefficients of IML (illiquid minus very liquid portfolio) are significantly different from zero at the 1% significance level in range 15-22 size-B/M portfolios. The negative relationship between the illiquidity factor and the average returns of 25 size-B/M portfolios is founded.

The coefficients of leverage factor (lev) are significantly different from zero at the 1% significance level in 10 size-B/M portfolios, while six are significant at the 5% level but 9 portfolios are not significant. The coefficients are negative for 13 portfolios out of 16 significant portfolios. So a negative relationship between the leverage factor and the average returns of 25 size-B/M portfolios is founded.

The empirical evidence shows that there are significant premiums for the six-factor model (market betas (*b*), SMB, HML, IML, WML and lev). In addition, the explanatory power R^2 value ranges from 39% to 83%. Furthermore, the intercepts for 17 portfolios are insignificantly different from zero at the 1% level. Moreover, the results of testing the six-factor model -by adding standard deviation of residual - provide supportive evidence to the six-factor model because only six out of the 25 coefficients on the Residual standard deviation are significantly different from zero at the 0.1 significance level. Further, the average adjusted R2 value is 0.75, which is even lower than that of the six-factor model.

The recommendations for future researches are: First, investigate new factors such as agency cost, earning to price ratio, and dividend. Second re- examine the asset-pricing models for two effects up-and down-market conditions and seasonal behavior.

Table (12) Summary for the Explanatory Power and Coefficients of the Asset Pricing Models

Model	α_p	β_p	s(SMB)	h(HML)	w(WML)	L(IML)	Lev	vбe	R^2
CAPM model (Table 4)	10 insig	25 sig							.29-.70
Liu and CAPM (Table 5)	11insig	All sig				15sig			.30-.71
Fama-French three factor model (Table 6)	12 insig	All sig	(22) sig	21 sig.					.33-.74
Cahart four-factor model (Table 7)	12 insig	24 sig	16 sig	24 sig	(19) sig				.34-.77
Chan and Faff four-factor model (Table8)	11 insig	All sig	24 Sig	21 sig		15 sig			.31-.77
Five-factor model (Table9)	13 insig	All Sig	24 sig	22sig	21 sig	17 sig			.35-.78
The Six-factor model (with Leverage) (Table10)	17 insig	24 sig	15 sig	20 sig	16 sig	22 sig	16 sig		.39-.83
The Six-factor model (with SD	17 insig	24 sig	15 sig	20 sig	16 sig	21 sig	16 sig	(6) sig	.35-.75

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