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

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Abstract

This paper evaluates and compares different asset pricing models to examine anomalies in Saudi stock market (SSM). Daily stock returns and data set were collected for all companies that issue shares (152 companies) and representative all sectors in the SSM during 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 (Bp, Sp, hp, wp and L) to be significantly different from zero. Furthermore adjusted R2s 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 significant of this model to explain return variation with adjusted R2s range 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, three factor Fama and French 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 describe the variant in expected return and their related to market risk. Sharpe (1964) and Lintner (1965) were the earlier researchers who presented that the expected returns are determined by the covariance between assist's returns and market portfolio's returns. One of the CAPM model's assumptions is efficient market, since securities prices are reflect all available information at any point in time. However other researcher's empirical evidence indicates that the CAPM cannot explain different market Anomalies that indicate to market inefficiency or the asset-pricing model is inadequacies. Fama and French (1992) found that size and book to-market affect stock return. Moreover, Yalçın (2010) represented that market anomalies lead to abnormal returns more than ever. Therefore, anomalies indicates to the semi-strong form and the investors care about fundamental analysis. Therefore, the previous studies have shown that book to-market and size effect looks to be independent from market risk.

Although many applicable evidence show that anomalies exist in stock markets, some researches show that anomalies occur once and disappear, while others occur repeatedly. For example, Schwert (2002) shows that the investors who implement good strategies can cause the anomalies to disappear. For that reason, List

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(2003) found that market experience plays a significant role in eliminating market anomaly. These results illustrate the importance of study market Anomalies.

Accordingly, the main goal of our study is to recognize the variables that affecting the expected return rather than market risk in the Saudi stock market that help investors either individuals or institutions to understand these variables that allow them for making effective capital investment decisions and financial decisions. Consequently, it reflect positively on raising the market efficiency specially the accurate and comprehensive information can help investors to encounter with market Anomalies.

This paper is organized as follows: section 2 deals with literature review. Section 3: the methodology of this study. Section 4 discus the empirical results. Section 5 deals with summary and conclusion. Finally, Recommendations for future studies.

Literature Review

Many researchers studied the empirical work about the CAPM, such as Basu's evidence (1977) who shown that future returns can be predicted by E/P ratios better than CAPM model. Meanwhile, Statman (1980) confirmed that stocks with highest B/M equity ratios have returns more than others. In addition, Banz (1981) found that return of small stocks' are more predicted than by the CAPM. Chan, et al. (1991) shown a strong relationship between (B /M equity) and return. Also Capaul, et al. (1993) detect a similar effect of (B/M) in many European stock markets and in Japan. This evidence suggests that E/P, debt-equity and B/M ratios are important to explain both the difference 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 stock returns. In addition, Fama and French (1993) show that small stocks and high (B/M) stocks reflect unknown variables that produce undiversifiable risks which are separately priced from market risk. For that reasons Fama and French (2004) update and create results by using time-series regressions and found that market risk cannot completely clarify the predictable return. In addition, Shaker and Elgiziry found that FF three factor model leads to a remarkable enhancement over the sharp model.

Also Brown and Cliff (2005) examined the effect of sentiment on size and (B / M) portfolios. They provide evidence that the relation between sentiment and mispricing of small stock is inverse. On the other side, Fong (2012) try to clarify why large premium is mainly occurs for small firms .He found that the value premium is more obvious and low market values in small firms Peer, et al. (2011) confirmed that the CAPM model is not linearity but with Fama and French simple linear model the returns of US stock market correctly explained. However, Pin-Huang, et al. (2012) shows that significant effect of the small firm is occur only for firms whose B-to M ratio are smaller than their industry average.

Studies that mentioned above tested anomalies and mispricing by using portfolios, while Avramov & Smith (2006) examined whether CAPM models could be clarify the effect of size, value, and market anomalies. He found that, none of these models could explain any of the market anomalies. Daniel & Titman (2011) noted that using portfolios model can reduce the covariance matrix of returns.

Furthermore previous studies that investigate the effect size and value on return, there are many studies that test anomalies through examine other factors that have explanatory power for the variation of return for example, Yao, et al. (2011) found an inverse relation between growth rate of assets and stock returns. Bley and Saad (2012) examined the stocks; they found significant negative relationship between expected returns and volatility for individual in Saudi Arabia and Qatar but none in Kuwait and Abu Dhabi. Furthermore, the pricing of unsystematic risk is less evident in country with higher governance and not related to the level of financial development.

Other researchers investigated the effect of an illiquidity risk on the price of asset. Such as Marx (2005) who found negative relationship between illiquidity and expected returns, In addition, Acharya and Pederse (2005) show that a required rate of return depends on its expected liquidity. 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 risk affect stock returns in the Spanish market during period1994–2002. In addition, Mahran (2011) found that there is significant direct relationship between liquidity and stock prices in the Egyptian stock market. This effect was not seasonal but extended to cover the entire research period (2004 to mid (2009) and not based on specific period, in addition liquidity has ability to predict stock price with high significant. As well as the liquidity of the stock had a positive impact on the rate of trading in the market.

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

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

The empirical findings of Kim (2012) support and agree with the results of CCAPMs model, because he found CCAPMs better than classic unconditional models. Furthermore, Cooper and Gubellini (2011) found that size, issuance, momentum, and asset growth portfolio are due to risk. Therefore, these evidences recommend that CAPM anomalies be not due to risk.

Data &Methodology

Data

Daily stock returns are collected for all companies 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).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 and representative all sectors in the Saudi stock market. Also the 3-months Treasury Bills rates used as measurement of risk-free rates.

Firm size (ME) is measured by market value of equity.. The book-to-market equity (BE/ME) is computed as the ratio between a firm's book equity (BE) and its market equity (ME).

Followed (1993), the 25 size-BE/ME portfolios are classes into five size groups and five BE/ME group then the 25 size-BE/ME portfolios are formed by the intersection of size and BE/ME quintiles (5x5 Size-BE/ME sorts).

Stocks are classes in Fama-French (1993) by size into two groups (Small (S) and Big (B)) based on their ME value. Then the same stocks classes into three portfolios of B/M (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 nearly equal numbers of stocks.

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

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

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:

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

For calculating the Cahart model (1997). Stocks classes into 3 portfolios (winner, neutral, and losers).

(W) Winners are the top 30% of the total stocks with the highest average return.

(L)Losers 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 cross section interacting between size and performance.

WML (winner minus loser) is subtracting the returns on the loser-stock portfolios from the average of the returns on the winner-stock portfolios:

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

For calculating the Liu (2006) factor the stocks sorted into three group 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 subtracting the returns on the liquid portfolio from the average of the returns on illiquid portfolios. Illiquidity measured by Amihud Yakov(2006) who defined Stock illiquidity as the average ratio of daily absolute return to the trading volume on that day.

$$IML = R_{10\%}^{Illiquid} - R_{10\%}^{Liquid} \qquad (4)$$

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 sorted into three group according to their leverage (low, Medium and high leverage).Then LMH leverage is subtract returns on high leverage portfolios from average of the returns on low leverage portfolios.

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

- Market leverage (ML) = current liabilities + long-term debt / market value of total assets
- Book leverage (BL) = (current liabilities + long-term debt) /book value of total assets.

Lam (2002) use natural logs of both book and market leverage because using natural logs deduce the relation between leverage and book-to-market equity in average returns.

Methodology

The study examine and check the adequate of eight different models, which discussed in previous literature, this 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 model: thy found that small firm and stocks with a high book-to-market ratio tended to do better than the whole market.

3- Carhart (1997) subtract 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 (2005) refer to the importance role of liquidity in asset pricing. Therefore, in this model they add the liquidity factor to the Fama-French model

5- Liu and CAPM, this model is a two-factor model (market and liquidity). This model was suggested by Liu (2006) who consider the effect of liquidity risk on assets pricing model.

6- The Five factor model, augment model which include market excess return, firm size, BE/ME ratio, liquidity and a "winner - loser" factor to clarify the momentum effect.

7- The Six factor model by adding liquidity and leverage to Cahart four-factor model,

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

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 model	$R_p - R_f = \alpha_p + \beta_p (R_m - R_f) + s(SMB) + h(HML) + \varepsilon_p$ (7)
3	Cahart 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 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 Lever-age)	$R_p - R_f = \alpha_p + \beta_p (R_m - R_f) + s(SMB) + h(HML) + L(IML + w(WML)) + lev (LMH) + e(t)$ (11)
8	The seven factor model with add $\sigma(e)$	$R_p - R_f = \alpha_p + \beta_p (R_m - R_f) + s(SMB) + h(HML) + w(WML) + L(IML) + v (lev) + \sigma(e) + e(t)$ (12)

Where:

- R_p is the portfolio return p,
- R_f is the risk-free rate.
- R_m is the on market return.
- SMB is the size factor "small - big",
- HML is the value factor "high - low",
- WML is the momentum "winners - losers",
- IML is the liquidity factor "illiquidity -liquidity"
- (lev)is the leverage factor "low - high leverage" .
- βp is the slope coefficient for CAPM model,
- α_p is 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 σ (e) respectively.

The parameters are estimated using ordinary least square method. The robustness of the models checked by R^2, F-test for regression significance, and t-test.

Empirical Results

Table 2 presents the descriptive statistics for the 25 portfolios according to size and BE/ME in the Saudi stock market. The last column in panel A -titled ALL- shows negative 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 to 0.0119 at the biggest size. 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 display a strong decreasing trend with the increasing in size. Risk decreases from 0.0143 at the smallest size to 0.0093 at the biggest size. Similar to the return it is to 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 present Panel C. the number of stocks range from two to nine.

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

Table (3) present the checking multicollinearity of independent variables, The results show that the correlation coefficients are mostly significant but very small it rang from – 0.3 to 0.167. So 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

The empirical results of CAPM model:-

Table (4) show that betas are positive and significant for all portfolios at the 1%. they ranging from the lowest of- 11.37 to the highest of 49.8. Also observed betas that move inversely with the size within the five B/M quintiles.

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

This is support by the intercepts significance. The intercepts for 13 portfolios from of 25 are significantly different from zero at the 1% (10 portfolios are insignificant). Therefore, it is difficult to conclude that the market beta s completely explain expected return and the CAPM does not hold.

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

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

The empirical results of Liu model

Table (5) reports the results of the Liu model**.** The portfolios betas are positive with 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 the data set does not suffer from autocorrelation.

Although , R^2 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 are represent 60% from the studied portfolios. Second: The intercepts for 14 portfolios are significantly differ from zero at the 1% (11 portfolios are insignificantly).

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

The empirical results of Fama-French (three-factor model)

Table 6 reports the results of the Fama-French three-factor model that found the market premium plays an important effect in the three-factor model and 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 coefficients of HML (h) are significant in 18 portfolios at 1% level. In addition, they significant at 5% in 3 portfolios but not significant in 3 portfolios. 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 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). They examine FF three-factor model in the Hong Kong, Singaporean, and Taiwanese markets and found 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, some other factors should be added to Fama-French three-factor model to describe the excess of portfolios returns.

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)		
Smal	-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)		
Smal	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)		
Smal	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)		
Smal	-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		
Smal	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

The empirical results of Cahart model:-

Table (7) present the results of Cahart four-factor model. The coefficients on market betas (b_p) are still positive and highly significant in all portfolios at 1% except one portfolio is not significant. The t-values of the coefficients on market betas ranging from the lowest of- 3.4 to the highest of 29.7which is lower than the results of the CAPM model. Also there is no observed moves of beta in contrast with size within the five B/M portfolios which is 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 within the five B/M. 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% 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% where (h_p) are not significant at all in one portfolios. 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 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 portfolio out of 25, which are appear in the smallest size portfolios .while the positive mainly appear in the largest size portfolios.

The previous results are 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 four-factors 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) $R_p - R_f = \alpha_p + \beta_p (R_m - R_f) + s_p (SMB) + h_p (HML) + w_p (WML) + \varepsilon_p$

	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
			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

	low	2	3	4	high	low	2	3	4	high
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

The empirical results of Chan and Faff four-factor model: -

The results of Chan and Faff four-factor model shown in table (8) and found that the coefficients on market betas (b) are positive and highly significant in all portfolios at 1% The t-values of the coefficients of market betas ranging from the lowest of12.6 to the highest of 41.9, which is more than the results of the Chan and Faff four-factor model. Also there is no observed s of beta did not move negatively with size within the five B/M portfolios.

The coefficients of the size effect are significant at 1% in 24portfolios but not significant in one portfolios. In addition, the coefficients on HML (h) are significant in 20 portfolios at 1% level, furthermore one portfolios are significant at 5% level but (h) are not significant at all in 3 portfolios. The value of the coefficients h are still negative at the lowest B/M portfolios and increased to be positive for the highest B/M portfolios within each of the size portfolios.

The coefficients of IML are significantly different from zero at the 1% in 16 size-B/M portfolios, while one is significant at the %5 but the coefficients of IML are not significant in 8 portfolios. The range of the coefficients on IML is from -1.9 to -8.68. The coefficients are negative for all portfolio except three out of 25 are positive which are appear in the biggest size portfolios. 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 negatively effect on stock return.

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 33% to 77% .Then the R^2s in the Chan model is lower than Cahart model. However, the intercepts for 13 portfolios are insignificantly different from zero at the 1%. 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

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 shown that there are significant premiums for the Five-factor model with high explanatory power. The coefficient R^2s is high and its values range 33% to 78%. However, the intercepts for 13 portfolios are still insignificantly differ from zero at the 1%. Therefore this model cannot completely explain the excess of portfolios return 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)		

	low	2	3	4	high	low	2	3	4	high
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	0.25	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

The empirical results of six factor model

Table (10) illustrate the regression outputs of six factor model (by adding liquidity and leverage to the Cahart model). The empirical evidence shown 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 range 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 was deduced the relation between leverage and book-to-market equity in average returns.

In addition, coefficients of leverage factor (lev) (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 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, firm 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

	low	2	3	4	high	low	2	3	4	high
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
			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

The empirical results of six-factor model with adding the standard deviation of the portfolio residuals

To check the strength of the six-factor model can be achieved by adding the standard deviation of the portfolio residuals which is obtained from Eq. (11)in six factor model. The propose 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, which is obtained from the regression outputs of six factor model. For each portfolio during 825 days. Then residual is computed by using 825 days.

The following table (11) show the results after adding of the residual standard deviation to six-factor model. Both the results of table 10 & 11 are much closed and there is no change from the results of six factors model. Coefficients on the six risk factors (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 6 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 range from .35 to 0.75.Therefore, the six factors, MP, SMB, HML, and WML, (IML) and lev may be sufficient to capture common variation of average returns.

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

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

the regression outputs of the six factor model with adding the portfolio residuals										
	low	**2**	**3**	**4**	**high**	**low**	**2**	**3**	**4**	**high**
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
		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
			Vσe					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 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 test and check 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".

The following table (12) summary for the explanatory power and coefficients of the asset pricing models, which represent significant according to the results of this study in the Saudi stock market:

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

The S coefficients are positive with small size within the first and the second size of five B/ portfolios. However, the coefficients S are negative with the medium and the biggest size portfolios. 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%. 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 of the size quintiles.

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 negative relationship between the leverage factor and the average returns of 25 size-B/M portfolios is founded.

The empirical evidence shown 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 range from 39% to 83% . Furthermore, the intercepts for 17 portfolios are insignificantly different from zero at the 1%. Moreover, the results of testing six-factor model -by adding standard deviation of residual-provide supportive evidence to the six -factor model because only 6 out of the 25 coefficients on the Residual standard deviation are significantly different from zero at the 1%. Further, also adjusted R^2 is 0.75 which is lower than occur in the six-factor model

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	$v\sigma e$	R^2
CAPM model (Table3)	10 insig	25 sig							.29-.70
Liu and CAPM (Table4)	11insig	All sig				15sig			.30-.71
Fama-French three factor model (Table5)	12 insig	All sig	(21) sig	21 sig.					.33-.74

MODEL	α_p	β_p	s(SMB)	h(HML)	w(WML)	L(IML)	Lev	ν бe	R^2
Cahart four-factor model (Table6)	12 insig	24 sig	16 sig	24 sig	(19) sig				.34-.77
Chan and Faff four-factor model (Table7)	11 insig	All sig	24 Sig	21 sig		15 sig			.31-.77
Five factor model (Table8)	13 insig	All sig	24 sig	22sig	21 sig	17 sig			.35-.78
The Six factor model (with Leverage) (Table9)	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

The recommendations for future researches: first, investigate new factors such as agency cost, earning to price ratio, and dividend. Second re- examines the asset-pricing models with the effect of up-and down-market conditions and seasonal behavior.

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