Empirical Test of Fama and French Three-Factor Model in Amman Stock Exchange

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Abstract

This study aims to empirically test the ability of Fama and French (1993) Three-Factor Model (FF3F) in predicting monthly excess rates of returns of stocks traded in Amman Stock Exchange (ASE) during the period (2001 - 2010). The study uses similar methodology of FF3F. Stocks in the sample have sorted according to the size (market value) and value (book-to-market ratio, B/M) in order to form portfolios and measuring the dependent and independent variables. To estimate the FF3F parameters, a time series regression ran using the ordinary least square method.
The study documents positive value effect in ASE. Portfolios with high B/M outperformed those of low B/M. Also, the study finds small size effect, but not in a like-manner as in the U.S or other developed markets. The study finds that multi factor asset pricing model works better than the single factor model, i.e. the CAPM. Therefore, it is recommended that participants in ASE should exploit size and value effect in investment strategy and replace the CAPM by FF3F in various asset pricing applications.

Keywords: Asset Pricing Models, Fama and French Three-Factor Model, Size Effect, Value Effect, Amman Stock Exchange

Introduction

Asset evaluation is a crucial process in investment decisions, whether financial or real assets. Fama and French (FF) (1992) studied the effect of each of the following: market capitalization (i.e. firm size), earnings/price (E/P) ratio, debt/equity ratio, and book/market ratio (B/M) in an attempt to explain variations in the rates of returns between the stocks in the cross-sectional regression approach. In light of this, they have found that the market beta alone doesn't have any explanatory power, while size, E/P, leverage and B/M ratio each alone has a power in explaining the cross-sectional variations in the average rate of returns. But when they are used jointly, the size and B/M ratio have a significant power in explaining the average rate of returns and they seem to absorb the ability of leverage and E/P ratio in explaining the cross-section variations in the average rate of returns.

Accordingly, FF(1993) proposed a new alternative model to the CAPM. The FF new model (FF3F) contains three factors: (i) market excess rate of return, (ii) size related factor, and (iii) B/M equity related factor. They found that the market factor alone can not explain all variations in the rate of returns; and that the two additional factors enhanced the explanatory power of the CAPM in capturing the variations in the rate of returns. In the light of these results, they recommended the use of their FF3F instead of the traditional CAPM.

In Jordan, a small number of studies (e.g. Ajlouni et al. (2013) and AL-Khazali (2001)) tested the ability of the CAPM to predict variations in the rate of returns of stock and found that the CAPM is not able to explain a sufficient amount of variations in the rates of returns. Furthermore, a number of international studies tested the ability of the market beta in predicting the rate of returns in Amman Stock Exchange (ASE) and did not find any relationship between the market and the rate of returns of stocks; see for example Calessens et al. (1995) and Serra (2002).

This study aims to answer questions about the FF3F’s significant power in explaining common variations in the average rates of returns of stock and its superiority to the CAPM in predicting the rates of return in Jordanian capital market. This will provide investors with satisfactory tools to analyze and predict stocks prices and make accurate decisions. Therefore, the main objective of this study is to test the validity of the FF3F in ASE and sought to find if this model is better than the CAPM in explaining the variations in the rate of return in ASE. This study is expected to provide information about systematic factors that expected to have an influence on the rates of return of stocks, to provide participants in ASE with useful information, which leads to improve their decisions, to provide investors in ASE with important information about some profitable investment strategy. In addition, this study contributes to the literature in the field of asset pricing studies in general, and the FF3F in particular. However, the study exposed to some limitations, such as shortness of the testing period (July 2001 to April 2010), while most studies used long testing period extend between 30 and 80 years. Also, small sample size used in this study (200 stocks), compared with thousands of stocks used in USA studies. Small size of sample might have an effect on the results of analysis, as well.

Theoretical Background:

Evolution of Asset Pricing Models:

In the early beginnings, evaluation of an asset depends on the expected value of its outcomes without considering the range of possibility of these outcomes. Such insufficient evaluation remained in use until Daniel Bernoulli introduced new concepts to finance in 1954: expected utility and risk. These two concepts represent the basis of all modern asset pricing theories and models, in which rational pricing depends on the expected return-risk tradeoff concept. Markowitz (1952) developed a way to build an investment frontier and put criteria within which the investors can choose their investment. Then, Sharpe (1964), Lintnir (1965) and Mossin (1966) simultaneously developed the first asset pricing theory that was later called the CAPM. The theory assumes that the rate of returns on a financial asset has a linear relationship with the asset market beta. According to the number of risk factors that determine asset prices, asset pricing theories are divided into two types: single factor model and multi factor model. The best known example of the single factor model is the CAPM. On the other hand, there are various examples of multi-factor model, such as Arbitrage Pricing Theory (APT) and Inter-temporal CAPM (ICAPM).

Since its introduction, researchers, such as Black et al. (1972) and Fama and Macbeth (1973), have strive to examine the CAPM validity in predicting the rate of returns on assets. It did not take a long time before some researchers suggested modifications of the classical form of the CAPM. Some of these modifications did not get away from the basic spirit of the theory, such as Black (1972) who modified the classical CAPM assumption about lending and borrowing at the risk of free rate to introduce a less restricted CAPM form that was called the zero-beta CAPM (Z-B CAPM). Merton (1973) developed a new form of asset pricing model with a continuous time horizon and multi risk factors called ICAPM. Ross (1976) developed the APT, as an arbitraging process rather than an equilibrium condition. A number of studies have found that the CAPM has failed to explain the variations in the rate of returns between stocks, resulted from "anomalies". The most famous anomalies are, the size-effect (Banz, 1981), earnings/ price ratio (Basu, 1983), return-leverage relation (Bhandari, 1988), and value-effect (Rosenberg et al. 1985). However, the CAPM is still the main asset pricing model which has been used in the financial community.

The macroeconomic variable approach has been used by many researchers to investigate the impact of multi variables other than market beta on securities returns, but they differ in terms of what variables are used in the analysis, since they used microeconomic variables other than macro ones. In other words, they used characteristics of securities as common variables in predicting securities returns and to infer if securities pricing process is a multi-factor one, then to suggest what types of factors that misspecified by the well established asset pricing models, especially the CAPM.

Through using this approach, many researchers have found that there are additional factors besides the market beta. The most important evidence about effect of such variables was documented by studies such as Basu (1977) who found that stocks with high earning to price ratio (E/P) gain a higher risk-adjusted rate of return (adjusted in the sense of the CAPM) than stocks with low E/P ratio. Rozeff and William R. Kinney (1976) documented the widely known stock markets phenomena that called January Effect, in that the USA stock market earns substantially higher rates of return in January than any other month. The same evidence was also found by Keim (1983).

Banz (1981) introduced one of the most important contradictory evidence against the CAPM. He found that stocks with lower market capitalization generated higher rates of return than ones with higher market capitalization, and when he added market capitalization to the CAPM, it improved the explanatory power of the model. This evidence is what has become to be known as the Size Effect. In turn, De Bondt and Thaler (1985) found a reversal pattern (from 3 to 5 years) in the long-term rate of return. They argued that stocks with past poor performance tend to earn higher rates of return than stocks that well performed as will as the market. Opposite to this long term reversal pattern, Jegadeesh and Titman (1993) found a continuous short-term pattern (from 6 to 12 months) in the rate of return, in which higher rate of return is still earned by past winner stocks over loser ones.

Finally, Rosenberg et al. (1985) examined the effect of B/M. They found that stocks with high B/M have higher rate of return than stocks with low B/M. Such evidence has raised doubts about the ability of the CAPM to predict asset returns. Also these evidence and many others are regarded as the basis for most trading strategies that have been widely used in financial markets.

In addition, APT has used to test the ability of capturing some evidences of the CAPM shortcomings. An example of such investigation is the study of Reinganum (1981), which empirically investigated the ability of the APT to capture differences in the rate of return between small market capitalization stocks and large market capitalization stocks (size-effect). The results showed contrary conclusion to the APT. Small market capitalization portfolio earns 20% of the yearly excess rate of return over large market capitalization portfolio. Therefore, the APT fails to capture the size-effect. In addition to this evidence, Cho and Taylor (1987) found that the January

Effect still exist even after controlling for the APT risk. The same results confirmed by Gultekin and Gultekin (1987).

Emergence of the Fama and French Three-Factor Model (FF3F):

Since CAPM and APT have failed to capture some differences in the rate of return from securities that appear to be occur from differences in characteristics of firms, academics and practitioners considered these evidences and variables as anomalies and puzzles. Thus, a new model should at least be able to capture the existing shocking anomalies and be significant economically and statistically in predicting securities prices. FF (1992) have developed a new model that strongly captures the cross-sectional variations in the excess rates of return associated with size, B/M, E/P and leverage variables. In their second study (FF, 1993), they exploited this conclusion to build a new multi-factor model, which has become known as the FF3F because it assumes that securities returns are affected by three factors only, namely:

(i) Market risk premium rate of return, which is measured by the difference between the market return and the risk-free rate.

(ii) Equity market value, which is measured by the number of shares outstanding multiplied by the market price per share.

(iii) Book-to-market equity, which is measured by the book value of equity divided by the market value of equity.

They used Black et al. (1972) methodology. In the first stage, they sorted stocks according to their market value and B/M, and then divided each sort to five equal parts (5 quintiles) to form five equal portfolios according to market value and another five portfolios according to B/M. After that, they constructed a twenty-five portfolio by the intersection of five market value portfolios with the B/M five portfolios, and then the rates of return were calculated to be used as dependent variable in the test. They also constructed the factors that were supposed to be proxies for risk factors that affected rate of return. In the second stage, a time-series regression was conducted to test the relationship between the mentioned three factors and the rate of return on 25 portfolios. Finally, they concluded that common variation in stock returns can be predicted by the following formula:

$$R_p - R_f = a_0 + b_p\,[E\,(R_{mkt}) - R_f] + S_p\,SMB + h_p\,HML + \varepsilon_p \qquad (1)$$

Where:

R_p - R_f: is the difference between the rate of return of portfolio and the risk-free rate (portfolio risk premium)

$E(R_{mkt})$ - R_f: is the market risk premium.

SMB: is the difference between the rate of return on the small market value portfolio and the rate of return on big market value portfolio.

HML: is the difference between the rate of return on the high book-to-market portfolio and rate of return on the low book-to-market portfolio.

b_p, s_p, h_p: are the factor loadings or slopes in the time-series regression.

FF have argued that the FF3F is statistically and practically better than the CAPM in predicting the price of a stock and can be used in an other applications of pricing model, such as evaluating portfolios performance, selecting securities, measuring abnormal rate of return in event studies, and estimating the cost of capital. They pointed out to a strong evidence of robustness of FF3F, its ability to predict rates of return of portfolios that are constructed according to some anomalies, such as E/P and dividend yield, in addition to its ability to capture the January Effect.

Since it is development, FF3F has represented a compelling argument and an altering point against the CAPM in the financial markets community. FF3F argument is consistent with APT and ICAPM.

However, FF3F should be exposed to many tests. Therefore, many researchers have directed their efforts to examine this model from different perspectives. Some of them investigated a theoretical explanation for a multi prediction process that was proposed by the FF3F, especially the predictive power associated with SMB and HML factors of risk. Others examined whether FF3F holds with periods and samples other than the one used by FF. All these efforts have produced a large amount of evidence around the FF3F, some of which accept the model predictions as risk factor-based and others have refuted this story and refused the model.

Literature Review

This section presents the empirical evidence of FF3F robustness. In responses to FF’s argument about the ability of their FF3F to predict the rate of return of stocks and its superiority over the widely used classical CAPM, many studies aimed to explore if the model is holding, is able to predict a stock’s returns and is useful in different asset pricing applications, in many countries, with different periods and statistical tests techniques.

A large number of these studies have used a two-stage methodology similar to that used in FF to develop the FF3F. For example, FF (1995) found results that confirmed the FF3F. An example of them is FF (1996), who tested the ability of FF3F to capture differences in the rate of return that appear in accordance to some anomalies, such as, long-term reversal pattern in rates of returns on stocks, short-term continuation pattern in rates of returns, earnings/price ratio, cash flow/ price ratio and sales growth, that still shocked the CAPM. By using data from the U.S markets through the period of 1963 to 1993, they found that, except for the short-term momentum, the

FF3F performed well in explaining all the previous investigated anomalies. In response, they argued that the FF3F is just a model and it is natural to be unable to explain all variations in rates of returns of stocks. Drew and Veeraraghavan (2003) examined if the FF3F has more ability over the CAPM in Hong Kong, Korea, Malaysia, and the Philippines through the period (1991-1999). They found that the FF3F has a more explanatory power over the CAPM in all these countries. The same result was found by studies, such as Gaunt (2004) for Australian market, Drew et al. (2005) for Chinese market, Lajili (2007) for French market, Rogers and Securato (2009) for Brazilian market, Homsud et al. (2009) for Thailand market, and Connor and Sehgal (2001) in the Indian capital market.

But, FF3F has been faced by a sharp controversy and a broad discussion. Kothari et al. (1995) showed evidence that in contradiction with FF3F evidence about B/M ratio effect. Moreover, Lakonishok et al. (1994) argued that high returns are associated with high B/M ratio and both are generated by an overreaction of investor to past performance.

In addition to the previous studies, other studies used the Fama and Macbeth (1973) cross-sectional methodology, besides the time-series regression. However, they found that the FF3F is better than the CAPM. For example, Lawrernce et al. (2007) found a better explanatory power for the FF3F over the Three-Moment CAPM and the traditional CAPM, and GÖKGÖZ (2007) found the same preference for the FF3F in the Turkish market.

Some researchers argued that it is difficult to apply the FF3F with the previous two-stage methodology. Therefore, they used existing indexes to construct the SML and HML factors and established market industries in place of the portfolios that were constructed based to size or other anomalies. An example is Faff (2001) who tested the model by using Australian data for (1991-1999). He found that the model is priced by investors. Similarly, Pham (2007) conducted the same simple methodology on Japanese market through the period (1984-2004) and found the same result.

In addition, some researchers tested the ability of FF3F in various applications of asset pricing models. Hu (2003) compared the use of FF3F and CAPM in capital budgeting and found that, in the short term, FF3F has performed better than the CAPM. Naceur and Ghazouani (2007) argued that FF3F is more useful than the CAPM in estimating cost of capital within the Tunisian banking sector. In addition, Chahine (2008) and Clement et al. (2009) used the FF3F in evaluating investment strategies in the Euro Zone markets and reached the same conclusion.

Hypotheses of the Study

The study hypotheses are:

H1: there is relationship between book-to market ratio and the rates of return of stock traded in ASE.

H2: there is relationship between market value and the rates of return of stock traded in ASE.

H3: the Fama and French Three-Factor Model is better than the CAPM in predicting stock rates of returns in ASE.

Data of the Study

The sample of the data of stocks (such as book value, market value and closing price) that used in this study to perform empirical test of FF3F contains stocks that are traded in ASE and which achieved the set of chosen criteria to generate the dependent and independent variables. The set of criteria, as used by FF (1992, 1993), are:

(i) A stock should be traded at June of year t and at June of year t-1. Also, it should have disclosed book value of equity for December of year t-1. Market value of a stock in June of year t is matched with its book value at December of year t-1, which investors consider this data in generating asset return for period t to t+1.

(ii) Each stock with negative book value was excluded from the sample. Only two firms were excluded according to this criterion.

(iii) Each stock without a trading record for more than two consecutive months was excluded from the sample.

(v) Each stock with turnover ratio less than 0.2% monthly was also excluded from the sample. The third and fourth criteria are used to reduce the impact of a stock with thin trading. Turnover ratio limit is chosen arbitrarily in a way to reduce the negative impact of thinly traded stock and to maintain an appropriate size of the sample.

The rate of return for each stock in the sample contains capital gain and dividends yield calculated on a monthly basis. As a proxy for market rate of return, the current study used monthly changes in the value-weighted index of ASE. This index used 1991 as a basic year and represents 90% of ASE market capitalization. Rate of return on the Three-month treasury bills was used as a proxy for the risk free rate. Application of these criteria during the period (December 2000-June 2009) gives a list of stocks qualified for the purpose of constructing mimicking portfolios. Table (1) shows average data statistics of the sample in ASE from July 2001 to April 2010.

Table (1) Yearly Averages of the Sample Data

Year	No. of Firms	CAP (Size)	B/M Ratio	ASE Index
2001-2002	76	33	1.60	1672
2002-2003	93	44	1.53	1772

2003-2004	96	50	1.65	2574
2004-2005	105	73	0.86	4753
2005-2006	131	168	0.68	7724
2006-2007	125	157	0.68	5991
2007-2008	175	122	0.68	7590
2008-2009	168	226	0.67	6937
2009-2010	161	117	0.99	5555
Average	126	110	1.04	4952

Notes: CAP, is the market value of sample in million of Jordanian dinar
B/M Ratio: the book-to-market ratio measured at Dec t-1
ASE Index: the value weighted index of ASE.

Methodology of the Study

Portfolio Aggregation Procedures

To generate the dependent and independent variables, the study builds two sets of portfolios: In the first set, 6 portfolios constructed in order to generate the independent variables, specifically the SMB and HML. First, stocks in the sample sorted into two groups according to their market value at June of year t, then the sample, independently, resorted into three groups according to their B/M ratio at December of year t-1. Then, by intersection of the two groups, six portfolios are generated and from these six portfolios the SMB and HML will generated: SL, SM, SH, BL, BM, and BH.

In the second set, the dependent variable is generated. 16 portfolios were formed by sorting the stocks sample into four groups according to their market value (MC1, MC2, MC3 and MC4). For example, stocks within the lowest 25% of market capitalization ranking go into portfolio MC1, and so on. Then each one of the four market value groups resorted into another four sub groups according to their B/M ratio. These sorting procedures create 16 portfolios: MC11, MC12, MC13, MC14, MC21, and so on). For clarification, stocks that make up portfolio MC1 and also fall within the group of lowest B/M ratio within the same market capitalization group go into portfolio MC11. Finally, the value-weighted rate of return computed on a monthly basis for these 16 portfolios for the period of July 2001 to April 2010.

Time-Series Linear Regression Model

To test the ability of the FF3F to predict stock rate of return in ASE, the current study follows FF(1993) and uses the time-series regression like the one introduced by Black et al. (1972), as follows:

$$R_{pt}-R_{ft} = a_0 + \beta_1 (R_{mt}-R_{ft}) + \beta_2 (SMB_t) + \beta_3 (HML_t) + \varepsilon_{pi} \qquad (2)$$

Where

R_{pt} : is the rate of return portfolio at month t.

R_{ft} : is the risk free rate of return at month t.

R_{mt}: is the rate of return on the market portfolio at month t.

SMB_t: is the market capitalization mimicking factor at month t.
HML_t: is the book-to-market mimicking factor at month t.
ε_i: is the error term.
a_0: is the intercept.
β_1, β_2, β_3: sensitivity associated with each corresponding factor.

In addition to the above three factor regression, this study also runs another three regressions. The first one is with a single market factor (Rmt-Rft), and the other two regressions include two factors: the first is market factor and the second is either a market capitalization factor (SMB) or a book-to-market factor (HML). The purpose for running these three additional regressions is comparing predictive power of the FF3F with CAPM, as well as to detect the additional explanatory power from each factor (SMB and HML) individually.

Therefore, the input variables needed to run the time-series regressions to test the FF3F are as follows:

The Dependent Variable

(i) Portfolio monthly excess rate of return (Rpt-Rft) is the monthly excess rate of return for the portfolios, which is measured as the rate of return on a portfolio at month t minus risk-free rate (rate of return on one month treasury bills).

The Explanatory Factors

(i) Market Factor or Market Risk Premium (Rmt-Rft) is the monthly changes in the ASE value-weighted index (proxy for Rm), subtracted from it the rate of return of the one month treasury bills (Risk free rate of return).

(ii) Size Risk Premium (SMB) represents the premium required by investors as compensation for carrying the size risk, which is the difference in the rate of return between a small market capitalization companies and large market capitalization ones. As in FF (1993), the SMB risk factor is measured monthly as:

$$SMB = ((SL + SM + SH) - (BL + BM + BH))/3 \qquad (3)$$

(iii) Value Risk Premium (HML) is risk price required by investors as a compensation for exposure to value risk, which is the difference in the rate of return between the high B/M ratio stock (Value stock) and low B/M ratio stock (Glamour stock). The HML is measured monthly as:

$$HML = ((BH + SH) - (BL + SL))/2 \qquad (4)$$

Statistical Description of the Portfolios

This section aims to give an overview of the statistical description of portfolios and input variables of the time-series regression. Table (2) shows the number of stocks in each of the 6 portfolios that constructed for the purpose of generating independent factors in the time-series regression in ASE from July 2001 to April 2010.

Table (2) Number of Stocks in each Portfolios formed by Size and Value

Date	SL	SM	SH	BL	BM	BH	Total
2001-2002	7	13	18	16	17	5	76
2002-2003	5	19	23	23	18	5	93
2003-2004	5	24	19	23	15	10	96
2004-2005	5	23	25	26	19	7	105
2005-2006	4	28	34	35	24	6	131
2006-2007	5	25	32	33	25	5	125
2007-2008	18	33	36	34	37	17	175
2008-2009	18	34	32	32	34	18	168
2009-2010	18	30	33	30	35	15	161
Total	85	229	252	252	224	88	
Average	9.4	25.4	28	28	24.9	9.8	125.6

Source: Calculated by the researchers.

Notes:

SL: Portfolio of stock with small market capitalization and low B/M ratio

SM: Portfolio of stock with small market capitalization and medium B/M ratio.

SH: Portfolio of stock with small market capitalization and high B/M ratio.

BL: Portfolio of stock with big market capitalization and low B/M ratio.

BM: Portfolio of stock with big market capitalization and medium B/M ratio.

BH: Portfolio of stock with big market capitalization and high B/M ratio.

It can be seen from table (2) that the small stocks are concentrated in the portfolios with a high B/M ratio, and big portfolios concentrated in the portfolios with a low B/M ratio, which may gives an indication that the small stocks are distressed because it's low earnings generating capability in the future. On the contrary, the big capitalization of stocks gives the sign of high earning capability in the future

Table (3) shows statistical description of the excess rates of returns for the two sets of portfolios in ASE from July 2001 to April 2010. Recall that 6 portfolios had been constructed for the purpose of generating independent variables, and 16 portfolios had been constructed for generating dependent variables. Also with each table there is a chart in order to facilitate review of the results reported in the table.

Table (3) The Mean of the Monthly Excess Rate of Return and Standard Deviation of the 6 portfolios

Value / Size	Mean			Standard Deviation			Sharpe Ratio		
	L	M	H	L	M	H	L	M	H
S	0.62	1.60	2.18	6.15	6.75	7.21	0.10	0.24	0.30
B	1.13	1.89	1.75	6.99	7.36	9.35	0.16	0.26	0.19

Source: Calculated by the researchers.

Note: Each cell represents the intersection of size and value measures.

Table (4) shows that, in general, the small portfolios tend to have higher return than big portfolios. Thus, there is superiority for high B/M portfolios over low B/M portfolios. This is in contradiction with the results in table (3), and somehow consistent with FF(1993). This may occurs because the aggregation procedures and method of calculating rate of returns of the 16 portfolios different from the ones used in the 6 portfolios that reported in the table (3). In fact, both sets of portfolios (tables 3 and 4) with high B/M portfolios have higher excess rate of return than low B/M portfolios, with except of some cases. Also, the differences in excess rate of return between high and low portfolios are broader than differences between small and big portfolios.

Table (4) The Mean of the Monthly Excess Rate of Return and Standard Deviation of the 16 portfolios

Value / Size	Mean				Standard Deviation				Sharpe Ratio			
	L1	2	3	H4	L1	2	3	H4	L1	2	3	H4
MC1	1.48	2.20	2.45	3.65	7.2	8.9	7.1	12.4	0.20	0.25	0.34	0.29
MC2	0.74	1.88	1.10	2.21	6.6	8.2	9.1	9.1	0.11	0.23	0.12	0.24
MC3	0.77	1.25	1.42	1.78	6.0	6.8	8.5	8.4	0.13	0.18	0.17	0.21
MC4	1.44	1.77	1.30	3.00	8.3	6.8	7.2	10.1	0.17	0.26	0.18	0.30

Source: Calculated by the researcher.

As a measure of risk, standard deviation does not reflect an increase or a decrease in the excess rates of return of stocks in most of cases. That may occur because one of two reasons: (i) investors are irrational in pricing stocks and their behavior in investment does not reflect the risk in market, or (ii) because the standard deviation is a measure of total risk, so it doesn't reflect the actual risk that investors consider when pricing stocks. In summary, we find that standard deviations for small portfolios and high B/M portfolios are higher than big and low B/M portfolios. This means that these portfolios have higher total risk.

In measuring the performance of different portfolios, the current study uses Sharpe measure ((Rp-Rf)/standard deviation). On average, small and high portfolios have a higher performance than big and low portfolios. Therefore, the investors should invest in small-high or big-high portfolios, since these portfolios yield the highest monthly excess rate of return, equal to 3.65% (43.8%) yearly and 3% (36%) yearly in SH and BH respectively. Also investor can generate superior rate of return if he invests in small portfolio. The difference in the excess rate of return between 4 smallest portfolios and 4 biggest portfolios is about 6.8% yearly.

Table (5) represents statistical description of the monthly average and standard deviation of the excess rate of return for explanatory variables market; HML and SMB risk premiums in ASE from July 2001 to April 2010.

Table (5) Independent Variables: Mean of the Monthly Value of the Market, HML, and SMB Risk Premiums

Risk premium	Mean	Standard Deviation
R_m-R_f Premium	1.16	6.87
HML Premium	1.04	5.60
SMB Premium	- 0.13	4.64

Source: calculated by the researchers.

Note: HML: is the difference in the rates of return between high B/M portfolios and low B/M portfolios,

SMB: is the difference in the rates of return between small size portfolios and big size portfolios .

The above table reports that market risk premium has the highest average monthly excess rate of return and standard deviation, followed by HML, and SMB. The high standard deviation of the excess rate returns for these three explanatory variables will strengthen their power in explaining the excess rates of returns of portfolios.

Table (6) details the mean for each independent variable in each year in ASE from July 2001 to April 2010, rather than on the overall period as in the table (5) .

Table (6) Independent Variables: Mean of the Monthly Value of the Market, HML and SMB Risk Premiums

Year	SMB	HML	R_m- R_f
2001-2002	-3.15	2.60	2.04
2002-2003	1.45	1.29	0.48
2003-2004	0.35	1.12	2.70
2004-2005	-2.42	3.52	8.44
2005-2006	1.74	-1.70	-1.85
2006-2007	1.02	1.19	-0.81
2007-2008	-2.99	0.13	4.81
2008-2009	1.58	-0.35	-4.65
2009-2010	-0.76	1.62	-1.12

Source: calculated by the researcher

Interestingly, the average monthly excess rate of returns for SMB is increased when the market premium is decreased. This may indicates that when the market is poor the small size premium appears strongly, but when the market is strong and in rally, the big portfolios premium appears. Also, SMB is highly fluctuating from year to year. The HML premium is more consistent than the SMB premium, and generally higher.

The following table (7) shows the correlation coefficients between independent variables.

Table (7) The Correlation Coefficient between Independent Variables

Variable	**SMB**	**HML**	**R_m-R_f**
SMB	1		
HML	-0.20	1	
R_m-R_f	-0.52	0.04	1

The table shows that SMB premium and market risk premium (Rm-Rf) is highly negatively correlated (ρ=-0.52). So, it is expected that the variation in the SMB variable have an impact on the market beta estimation. This finding is in line with FF (1993) but positively not negatively. Also, the same result for a correlation between the HML and SMB premiums but less severe (ρ = -0.20) and that inconsistent with the FF(1993) which found more less correlation between the SMB and HML (ρ = -0.08). Finally, there is a thin positive correlation between the HML and market risk premiums.

The Time-Series Regression Results

Time-series regression conducted to test the FF3F ability to predict the excess rate of return for stocks that traded in ASE. For the significance level, the study used α = 5% for rejection of null hypothesis. The analysis of the FF3F will come in three sections: (1) the time-series regression run by using the three factors (Rm-Rf, HML and SMB) as regressors and the excess rate of returns on the 16 portfolios as dependent variables (2) the same three factors will be regressed on the excess rate of return on the 6 portfolios (SL, SM, SH, BL, BM, BH) that formed to generate the two factors (SMB and HML), and (3) the three factors will be regressed on the average of monthly excess rate of return of 16 portfolios, and once again on average of monthly excess rate of return of 6 portfolios.

Estimating the Excess Return of the 16 Portfolios

Table (8) reports the results of the time-series regression on the three factors, namely the market factor (Rm-Rf), HML and SMB. The dependent variable in this regression is the monthly excess rates of return on 16 portfolios in ASE during the period (July 2001 - April 2010).

Table (8) Three Factor Model Test: Three Factors are Regressors and the Excess Rates of Return of the 16 Portfolios are Dependent Variables

R_p-R_f = a_0 + β_1 (R_m-R_f) + β_2 SMB + β_3 HML + e								
Portfolio	Book-to-Market Ratio				Book-to-Market Ratio			
	L 1	2	3	H 4	L 1	2	3	H 4
Constant	a_0				t-statistic			
MC1	0.94	0.94	1.38	1.61	1.44	1.22	2.33	1.66
MC2	-0.26	0.45	-0.75	0.30	-0.57	0.75	-1.38	0.50
MC3	-0.25	0.03	-0.41	0.16	-0.52	0.07	-0.81	0.31
MC4	0.50	0.88	0.08	1.19	0.86	1.92	0.20	1.87
(R_m-R_f)	β_1				t-statistic			
MC1	0.59	0.69	0.64	1.24	5.50	5.44	6.47	7.71
MC2	0.80	0.9	1.05	0.90	10.6	9.20	11.70	9.10
MC3	0.50	0.72	0.97	0.83	6.30	8.60	11.70	9.70
MC4	0.85	0.69	0.75	0.96	8.60	9.10	10.70	9.12
SMB	β_2				t-statistic			
MC1	0.38	0.75	0.59	1.15	2.30	3.90	4.00	4.80
MC2	0.94	0.96	1.35	0.82	8.30	6.44	9.90	5.50
MC3	0.30	0.56	0.52	0.04	2.50	4.50	4.10	0.30
MC4	-0.04	-0.16	-0.2	-0.13	-0.30	-1.40	-1.90	-0.81
HML	β_3				t-statistic			
MC1	-0.08	0.55	0.40	0.74	-0.69	4.04	3.81	4.29
MC2	0.21	0.50	0.8	0.94	2.56	4.80	8.30	9.00
MC3	0.47	0.43	0.73	0.63	5.50	4.80	8.25	6.90
MC4	-0.06	0.07	0.30	0.63	-0.53	0.85	4.00	5.60
Determination	R^2				s(e)			
MC1	0.24	0.30	0.34	0.42	6.45	7.62	5.89	9.63
MC2	0.55	0.50	0.66	0.60	4.50	5.9	5.40	5.90
MC3	0.41	0.48	0.67	0.64	4.70	5.03	5.00	5.12
MC4	0.51	0.57	0.68	0.62	5.90	4.5	4.20	6.33

Source: calculated by the researcher

Note: Intersection of MC1 with L1 indicates to portfolio MC1.1, MC1 with L2 indicates to portfolio MC1.2, and so on.

Table (8) documents the results of the time series test conducted to examine the ability of the FF3F in predicting the monthly excess rate of return in ASE. The market risk premium coefficients, except high book-to-market group, aren't able to explain all variation in the excess rates of returns between small and big portfolios. Exception for (MC4.1, MC4.2, MC4.3, MC4.4 and MC3.4), the SMB coefficients are significant in all portfolios. Also the same thing is true for the HML but more strongly and systematically in reflecting variation in the rates of return. When we move from portfolio with low B/M portfolio into high ones, the coefficient of the HML becomes higher. Also, the HML coefficients are significant in 14 out of 16 portfolios. This evidence is consistent with other results in Jordan (Claessens et al., 1995). Also, the result of HML and SMB is in some degree consistent with FF(1993) and Aksu and Onder (2007) in Turkish market. The better performance of the HML over the SMB is consistent with the results reported in tables (3) and (4) above regarding a strong and consistent value effect than the size effect in ASE. Despite, that the three factors are jointly significant in capturing the variation in the excess of rates of return between different portfolios. The FF3F can't explain enough variation in the excess of rates of return, specifically, the four smallest portfolios, where the FF3F explains only 0.24% and 0.30% of the variation in of the rates of return of MC1.1 and MC1.2 respectively.

Table (9) reports the result of the time series regression test of the CAPM, i.e. the market factor (Rm-Rf).

Table (9) CAPM Test: The Market Risk Premium is the Regressor and the Excess Rates of Return of the 16 Portfolios are the Dependent Variables

R_p-R_f = a_0 + β (R_m-R_f) + e								
Portfolio	Book-to-Market ratio				Book-to-Market ratio			
	L 1	2	3	H 4	L 1	2	3	H 4
Constant	a_0				t-statistic			
MC1	0.95	1.69	1.94	2.65	1.47	2.02	3.22	2.45
MC2	0.19	1.20	0.40	1.47	0.33	1.68	0.49	1.83
MC3	0.30	0.62	0.47	0.81	0.57	1.08	0.74	1.34
MC4	0.45	0.91	0.34	1.80	0.77	2.02	0.75	2.50
(R_m-R_f)	β_1				t-statistic			
MC1	0.46	0.45	0.44	0.86	4.85	3.73	4.79	5.49
MC2	0.47	0.58	0.60	0.64	5.76	5.66	5.16	5.53
MC3	0.41	0.54	0.82	0.84	5.35	6.57	8.86	9.56
MC4	0.86	0.74	0.82	1.03	10.34	11.50	12.60	9.96
Determination	R^2				s(e)			
MC1	0.19	0.12	0.18	0.23	6.60	8.50	6.50	11.0
MC2	0.24	0.24	0.20	0.23	5.77	7.20	8.20	8.10
MC3	0.22	0.29	0.43	0.47	5.37	5.80	6.50	6.20
MC4	0.51	0.56	0.60	0.49	5.86	4.60	4.60	7.30

Source: calculated by the researcher.

Table (9) shows that market coefficients for small portfolios groups (MC1 and MC2) are lower than those estimated by the three factors. This decrease in the market risk premium coefficient occurs due to the exit of the SMB from the regression. FF(1993) suggested that the market premium coefficients are collapsed toward one in the FF3F as a result of the high correlation between the SMB and the market risk premium (ρ = - .52). According to the CAPM test, the market risk premium definitely could not be able to explain the higher excess of rates of return of small portfolios over big portfolios. The market premium estimated coefficients indicate that big portfolios are more risky than small portfolios at the same level of the B/M ratio. Thus, the market factor coefficients are not reflecting higher rate of return for the small portfolios that reported in the table (4). This evidence is consistent with studies of FF (1992, 1993), Davis et al. (2000), Aksu and Onder (2007) and Connor and Sehgal (2001). Comparing with the FF3F, CAPM is less satisfactory in explaining the variation in the excess of rates of return between portfolios sorted according to the market capitalization and B/M ratio. Most of R2 in CAPM are lower than those in the FF3F.

Table (10) reports the results of testing the CAPM with the SMB alone. The purpose is to examine the additional explanatory power of adding SMB to the CAPM.

Table (10) The CAPM with SMB: The Market Risk Premium and the SMB are Regressors and the Excess Rates of Return of the 16 Portfolios are the Dependent Variables

R_p-R_f = a_0 + β_1 (R_m-R_f) + β_2 SMB + e								
Portfolio	Book-to-Market ratio				Book-to-Market ratio			
	L 1	2	3	H 4	L 1	2	3	H 4
Constant	a_0				t-statistic			
MC1	0.85	1.54	1.82	2.42	1.34	1.91	2.94	2.35
MC2	-0.03	1.00	0.12	1.33	-0.07	0.12	0.18	0.09
MC3	0.26	0.51	0.40	0.85	0.49	0.93	0.63	1.40
MC4	0.45	0.95	0.41	1.88	0.77	2.13	0.93	2.64
(R_m-R_f)	β_1				t-statistic			
MC1	0.60	0.66	0.61	1.19	5.58	4.82	5.84	6.86
MC2	0.78	0.87	1.00	0.83	10.17	8.02	8.59	6.35
MC3	0.47	0.70	0.92	0.79	5.21	7.52	8.68	7.67
MC4	0.85	0.68	0.73	0.92	8.70	9.06	9.71	7.68
SMB	β_2				t-statistic			
MC1	0.40	0.59	0.47	0.94	2.55	2.92	3.05	3.66
MC2	0.88	0.81	1.11	0.52	7.72	5.07	6.50	2.83
MC3	0.16	0.44	0.31	-0.14	1.21	3.21	1.94	-0.95
MC4	-0.03	-0.18	-0.28	-0.31	-0.17	-1.62	-2.60	-1.76
Determination	R^2				s(e)			
MC1	0.23	0.19	0.25	0.31	6.43	8.17	6.26	10.40
MC2	0.52	0.39	0.44	0.28	4.62	6.50	6.95	7.48
MC3	0.23	0.36	0.45	0.47	5.35	5.55	6.40	6.16
MC4	0.51	0.57	0.63	0.50	5.90	4.50	4.48	7.20

Source: calculated by the researcher.

Note from the regression results in the table (10) that the SMB adds to the explanatory power for the CAPM in explaining variation in the excess rates of return. But, this additional explanatory power for the SMB appeared clearly, only in the two small groups of portfolios (MC1 and MC2). Also, the coefficient of determination (R2) is increased; the errors term is decreased as well as the intercept for some portfolios.

Table (11) reports the test of the explanatory power added by the HML to enhance the explanatory power of the CAPM in explaining the excess rate of return.

Table (11) The CAPM with HML: The Market Risk Premium and the HML are Regressors and the Excess Rates of Return of the 16 Portfolios are the Dependent Variables

R_p-R_f = a_0 + β_1 (R_m-R_f) + β_2 HML + e								
Portfolio	Book-to-Market ratio				Book-to-Market ratio			
	L 1	2	3	H 4	L 1	2	3	H 4
Constant	a_0				t-statistic			
MC1	1.09	1.24	1.62	2.07	1.65	1.51	2.56	1.95
MC2	0.12	0.83	-0.21	0.63	0.21	1.19	-0.28	0.93
MC3	-0.13	0.26	-0.20	0.18	-0.27	0.48	-0.37	0.34
MC4	0.50	0.81	0.00	1.14	0.84	1.79	0.01	1.80
(R_m-R_f)	β_1				t-statistic			
MC1	0.46	0.43	0.43	0.84	4.91	3.74	4.83	5.57
MC2	0.47	0.57	0.58	0.61	5.71	5.75	5.44	6.40
MC3	0.39	0.53	0.80	0.82	5.72	6.79	10.43	11.27
MC4	0.86	0.74	0.81	1.01	10.3	11.45	13.48	11.21
HML	β_2				t-statistic			
MC1	-0.14	0.44	0.32	0.57	-1.17	3.10	2.86	3.08
MC2	0.07	0.36	0.60	0.82	0.68	2.99	4.58	7.05
MC3	0.42	0.35	0.66	0.62	4.99	3.67	7.03	7.02
MC4	-0.05	0.09	0.33	0.65	-0.48	1.16	4.43	5.88
Determination	R^2				s(e)			
MC1	0.20	0.19	0.24	0.29	6.59	8.13	6.30	10.60
MC2	0.25	0.3	0.34	0.48	5.78	6.97	7.53	6.69
MC3	0.37	0.38	0.62	0.64	4.84	5.47	5.35	5.09
MC4	0.51	0.57	0.67	0.62	5.88	4.55	4.24	6.30

Source: calculated by the researcher.

As shown in the table, the HML enhance the power of the CAPM in predicting the excess rates of return of portfolios, especially for high B/M portfolios with big size. It is noted from the results table (11) that when move from portfolios of low B/M ratio to portfolios with higher ratio, the goodness of fit criteria (R2, α0, and s(e)) all become better.

Estimating the Excess Return of the 6 Portfolios

The additional sets of regressions reported here are the same ones that reported above, but with one difference. Here the excess rates of returns on the 6 portfolios (SL, SM, SH, BL, BM, BH) that constructed to generate regressors (SMB and HML) are used as a dependent variable in the regression. Table (12) reports the results of the time series test of the FF3F in estimation the excess rate of return of the 6 portfolios.

Table (12) Three-Factor Model: Three Factors are Regressors and the Excess Rates of Return of the 6 Portfolios are Dependent Variables

R_p-R_f = $a_0 + \beta_1 (R_m$-$R_f) + \beta_2$ SMB + β_3 HML + e						
Portfolio	Book-to-Market ratio			Book-to-Market ratio		
	Low	Medium	High	Low	Medium	High
Constant	a_0			t-statistic		
Small	-0.03	0.24	-0.43	-0.07	0.59	1.45
Big	-0.20	0.48	-0.19	0.79	1.20	-0.44
(Rm-Rf)	β1			t-statistic		
Small	0.76	0.83	0.88	11.18	12.34	18.15
Big	0.90	0.85	0.77	21.28	12.78	10.54
SMB	β2			t-statistic		
Small	0.79	0.91	0.87	7.70	9.04	11.8
Big	-0.13	0.06	-0.23	-2.07	0.57	-2.12
HML	β3			t-statistic		
Small	-0.10	0.51	0.82	-1.42	7.17	15.8
Big	-0.13	0.40	0.96	-2.91	5.64	12.30
Determination	R^2			s(e)		
Small	0.57	0.66	0.84	4.08	4.01	2.91
Big	0.87	0.71	0.78	2.54	3.99	4.38

Source: calculated by the researcher.

By comparing reported results in the table above with table (8), it is obvious that FF3F is able to explain the excess rate of return of the 6 portfolios better than that for the 16 portfolios. R2s are higher than those reported in the table (8). Also, the intercepts and the errors term are less in case of the 6 portfolios. In except for portfolio of big size and medium B/M ratio, all coefficients of the SMB are statistically significant. The same result is found for the HML coefficients, but its coefficient is insignificant for the portfolio of small size and low B/M ratio.

Table (13) reports the results of the CAPM ability in predicting the monthly excess rates of return of the 6 portfolios.

Table (13) The CAPM: The Market Risk Premium is the Regressor and the Excess Rates of Return of the 6 Portfolios are the Dependent Variables

R_p-R_f = a_0 + β (R_m-R_f) + e						
Portfolio	Book-to-Market ratio			Book-to-Market ratio		
	Low	Medium	High	Low	Medium	High
Constant	a_0			t-statistic		
Small	0.06	0.99	1.48	0.12	1.75	2.54
Big	0.04	0.91	0.73	0.13	2.03	1.04
(Rm-Rf)	β			t-statistic		
Small	0.48	0.52	0.61	6.50	6.41	7.20
Big	0.94	0.85	0.89	25.00	13.11	8.73
Determination	R^2			s(e)		
Small	0.29	0.28	0.33	5.21	5.74	5.91
Big	0.86	0.62	0.42	2.64	4.50	7.13

Source: calculated by the researcher.

Table (13) shows the same results of market risk premium failure in capturing differences in the rate of returns between portfolios. The market risk premium is highly loaded on the big portfolios, specifically, big portfolio with low B/M ratio (BL) despite that this portfolio generated lowest rate of return between the big size portfolios. This bias of the market factor in estimating risk of BL portfolio may be a result of composition of this portfolio. Where BL portfolio includes biggest size stocks in ASE and those stocks account for most weight of the value-weighted index. In short, the market risk premium alone is unable to predict the variation in the rate of returns.

Table (14) reports the results of two sets of regressions. The first one consists of market risk premium and SMB as regressors and the second one consists of market risk premium and HML.

Table (14) CAPM with each of SMB and HML: The Market Risk Premium and SMB or HML are Regressors and the Excess Rates of Return of the 6 Portfolios are the Dependent Variables

R_p-R_f = a_0 + β_1 (R_m-R_f) + β_2 SMB + e						
Portfolio	Book-to-Market ratio			Book-to-Market ratio		
	Low	Medium	High	Low	Medium	High
Constant	a_0			t-statistic		
Small	-0.14	0.80	1.33	-0.35	1.66	2.50
Big	0.05	0.92	0.86	0.22	2.06	1.27
(Rm-Rf)	B1			t-statistic		
Small	0.77	0.79	0.80	11.3	9.72	9.20
Big	0.91	0.81	0.71	20.80	10.90	6.20
SMB	B2			t-statistic		
Small	0.82	0.76	0.63	8.10	6.30	4.73
Big	0.09	-0.06	-0.51	-1.45	-0.54	-3.03
Determination	R^2			s(e)		
Small	0.57	0.48	0.45	4.10	4.90	5.40
Big	0.86	0.62	0.47	2.63	4.60	6.87
Rp-Rf = a0 + β1 (Rm-Rf) + β2 HML + e						
Portfolio	Book-to-Market ratio			Book-to-Market ratio		
	Low	Medium	High	Low	Medium	
Constant	a_0			t-statistic		
Small	0.29	0.60	0.77	0.56	1.13	1.73
Big	0.15	0.51	-0.29	0.58	1.30	-0.65
(Rm-Rf)	B1			t-statistic		
Small	0.49	0.51	0.58	6.74	6.70	9.17
Big	0.95	0.86	0.85	25.80	14.70	13.44
HML	B2			t-statistic		
Small	-0.22	0.38	0.70	-2.46	4.06	8.90
Big	-0.11	0.40	1.00	-2.50	5.66	12.80
Determination	R^2			s(e)		
Small	0.33	0.38	0.62	5.10	5.40	4.50
Big	0.87	0.73	0.78	2.60	3.98	4.50

Source: calculated by the researcher.

It can be seen from table (14) that adding the SMB enhanced ability of CAPM in predicting monthly excess rates of return for the small portfolios, which is highly loaded on the small portfolios, while big portfolios coefficients are insignificant. It seems that the SMB leaves this task for the market risk premium. These results are consistent with those reported in table (11) about additional explanatory power the HML contributes to the CAPM, per which HML did a well job in explaining the excess rates of return for the high book-to-market portfolios over low book-to-market portfolios, its coefficients increase monotonically from low-negative for low book-to-market portfolios to high positive for high book-to-market portfolios. Also, the result reported in table (14) support the results earlier in this study about the stronger power for the HML over the SMB in enhancing the ability of the CAPM in predicting the monthly excess rate of return in ASE

Estimating the Average Monthly Excess Returns of Portfolios

It has been argued that sorting stocks in the sample according to some empirical regulatory might potentially reduce the errors in variable issue and lead to exaggerate the relation with such empirical regulatory, such as size, and influence the results of the pricing model test (Lo and Mackinaly, 1990). In order to deal with this problem, the study runs a test with three factors and one factor models to examine the ability to predict the monthly average excess rates of return of 6 and 16 portfolios. Table (15) reports the results.

Table (15) Time-Series Regression of Three Factors (and Single Factor) as Regressors and the Monthly Average Excess Rates of Return on the 16 and 6 Portfolios are the Dependent Variables

Panel A: FF Three-Factor Model and 16 Portfolios						
$R_p\text{-}R_f = a_0 + \beta_1 (R_m\text{-}R_f) + \beta_2\, SMB + \beta_3\, HML + e$						
	a_0	β_1	β_2	β_3		
Coefficient	.004	0.82	0.50	0.45		
t-statistic	2.32	26.90	10.70	13.90	R^2 = 90%	s(e) =1.80
Panel B: FF Three-Factor Model and 6 Portfolios						
$R_p\text{-}R_f = a_0 + \beta_1 (R_m\text{-}R_f) + \beta_2\, SMB + \beta_3\, HML + e$						
	a_0	β_1	β_2	β_3		
Coefficient	.002	0.83	0.38	0.41		
t-statistic	1.10	28.10	8.48	12.9	R^2 = 91%	s(e) = 1.78
Panel C: Single Factor Model (CAPM) and 16 Portfolios						
$R_p\text{-}R_f = a_0 + \beta (R_m\text{-}R_f) + e$						
	a_0	β				
Coefficient	0.01	0.66				
t-statistic	3.30	13.70			R^2 = 64%	s(e) = 3.40
Panel D: Single Factor Model (CAPM) and 6 Portfolios						
$R_p\text{-}R_f = a_0 + \beta (R_m\text{-}R_f) + e$						
	a_0	β				
Coefficient	.007	0.71				
t-statistic	2.34	16.50			R^2 = 72%	s(e) = 3.04

Source: calculated by the researcher.

Table (15) reveals that FF3F is more powerful than CAPM in predicting variations in average excess rates of returns of both 16 and 6 portfolios. The result is in contrast with Berk (2000) argument that sorting of stock according to the some anomalies reduce the errors in the variables. The explanatory power of three factors in explaining average monthly variations in the excess rates of returns is stronger than those for the individual portfolios. Panel A and panel B of table (15) shows that FF3F is able to explain 90% of the variations in the both average excess rates of returns. Also, the error in estimation is below 2. On the other hand, panel C and D document low power of market risk premium in explaining the variations in the excess rates of returns. The market factor has a lower coefficient of variation and higher estimation errors and intercept than those reported in the FF3F model.

Conclusion

This study aimed at investigating the validity of FF3F in predicting monthly excess rates of returns of stocks traded in ASE during the period (July 2001- April 2010), and to examine the effect of size and value in ASE.

The empirical results of the study shows that there is a strong value effect in the ASE within the sample period, and the excess rate of returns in most of cases is higher in portfolios with higher book-to-market ratio than in portfolios with lower ratio. These results are consistent with other studies conducted in emerging and small markets, such as Chui and Wei (1998) that find similar value effects in each of Thailand, Korea, Malaysia and Hong Kong, and Gaunt (2004) who finds strong value effects in the Australia market. While Homsud et al. (2009) find a reverse value effects in Thailand. Fama and French (1992, 1993, and 1995) find similar value effects in the U.S markets and argue that the excess rates of returns in the high book-to-market portfolio is a case of a higher risk, so they suggested that high book-to-market ratio is a sign of distress situations expected by the investors. Lakonishok et al. (1994) suggest that as a result of mispricing by the investors and the slow price corrections, value stocks are overpriced while glamour stocks are underpriced.

In addition, this study finds that size effects in the ASE are less consistent and weaker than value effects, as well as the pattern of size-return relations in ASE is different from the one documented by previous studies conducted in the U.S. The analysis reveals that the smallest size portfolios group (MC1) always earns a higher rate of returns than other portfolios. The second small size group of portfolios (MC2.1, MC2.2, MC2.3 and MC2.4) three out of four portfolios tend to earn higher rate of returns than corresponding ones in the higher size group of portfolios (MC3.1, MC3.2, MC3.3 and MC3.4). But in case of the biggest size group of portfolios (MC4.1, MC4.2, MC4.3 and MC4.4), the evidence indicates that these portfolios tend to earn higher rates of return than the two smaller size groups of portfolios (MC2 and MC3). These results are consistent with other studies, such as AL-Khazali (2001) in ASE during the period (1980 to 2000) and Drew et al. (2005) in China market. Some researchers argue that excess rate of returns of small stocks over big stocks is a compensation for higher risk associated with small size. For example, Fama and French (1995) argue that small size firms tended to be less profitable than big firms, so investors required higher rates of returns for higher risk that is associated with investment in these firms. Others, such as Bhardwaj and Brooks (1992) and Stoll and Whaley (1983) suggest that the higher rate of returns of small stocks is a matter of increase in the cost of investing in these stocks.

Moreover, consistently with Fama and French (1993), the study finds that the CAPM is unable to predict the differences in the rates of returns between portfolios sorted according to size (market value) or value (book-to-market ratio). Although the big portfolios earn lower rate of returns than small portfolios, it appears from the regression results that the market factor coefficients are always highly loaded on the big portfolios. The same thing is true for book-to-market sorting, but here the market factor does a better job than in size sorting portfolios. The interpretations of these results are one of three reasons: (i) Jordanian investors are irrational and do not reflect the risk inherent in the stocks in their investment decisions; (ii) the CAPM assumptions are violated in ASE's environment, specifically, allowing short selling, this investment activity had been prohibited in the legislation of the Jordanian capital market; (iii) the CAPM is invalid, there are multiple pervasive factors instead of one single factor as the CAPM assumes. Most recent studies agree with the first and third interpretation. AL-Khazali (2001) examined the CAPM's ability to predict the rates of returns in ASE and find that the CAPM does not capture the differential rates of returns for small portfolios over big portfolios, and argued that the inability of the CAPM might be the result of the irrationality of Jordanian investors and of less diversified portfolios held by those investors.

Furthermore, in comparing between size and value, the results exhibits that the latter factor (the HML) has stronger and a more meaningful ability to explain the variation in the monthly excess rates of returns. This may be due to the consistent and the strong value effect in ASE. In addition, the HML has a very low correlation with the market risk premium, in contrast to the SMB which has a strong negative correlation with market risk premium. So, the HML is able to capture many variations in the rates of returns that are unexplained by the market risk premium as well as the SMB.

Finally, FF3F is better than the CAPM in explaining the variations in the rates of returns in ASE. The results of this study indicate that the additional of two factors, namely the SMB and HML, enhances the explanatory power of the CAPM. This evidence is consistent with the FF(1993) in U.S market, Connor and Sehgal (2001) in Indian market, Drew and Veeraraghavan (2003) in Hong Kong, Korea, Malaysia and the Philippines markets.

However, the three factor model is still unsatisfactory in some cases. The results of this study show that an economically significant amount of variations in the excess rate of returns is still unexplained by the FF3F; specifically, the smallest size group portfolios (MC1).

Recommendations

According to the results found, the study recommends the following:

(i) According to the evidence found about the size and value effects in ASE, the study recommends that traders in ASE should exploit these effects in their investment strategy, by investing in portfolios with smaller market value and portfolios with higher book-to-market ratio.

(ii) In the light of results about inferiority of the CAPM and superiority of the FF3F, the study recommended the practitioners in ASE to utilize FF3F instead of CAPM in the various applications of the asset pricing models.

(iii) The study recommends the investors in ASE to take the size and value into consideration when making investment decisions.

(iv) The study recommends that investors in ASE may be able to improve their investment performance by transferring their investment from big stock to small stock when the market expected to go poorer and from small to big when the market expected to go higher.

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