The comparison of abnormal returns method on the Tehran Stock Exchange

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\textbf{ABSTRACT}

This study compares the expected return of the Tehran Stock Exchange and the main purpose is to compare the Fama and French three-factor method and the five factor model which includes the Fama and French three-factor model, the Momentum variable and the liquidity. In order to test hypotheses during 2002-2012, 99 companies in stock were selected and studied. To test the hypothesis, the least squares OLS method is used and by using Eviews software, first the data type was specified, then the test was performed and coefficients of determination were detected and by using F statistics and t statistics the research hypotheses were tested. The research results show that the five-factor model can explain more than Fama and French three-factor model. Also the hypotheses test result show that the factors of size, momentum and liquidity have significant relationship with abnormal stock returns and the ratio of book value to market value does not have a significant relationship with abnormal stock returns, also Both the Fama and French three-factor model, and the five-factor model has a significant relationship with abnormal stock returns.

\textbf{KEYWORD}

Fama and French three-factor model, momentum, liquidity

\textbf{INTRODUCTION}

Due to the increasing importance of capital markets to raise the individual small capital and equip to productive activities, it is important to identify the behavior of investors, and effective variables on the price and stock return on these markets. Without a doubt, investing in the stock market is an important part of the economy and without a doubt the greatest amount of capital would be exchanged through the stock markets around the world and the national economy is heavily influenced by the performance of the stock market. Also, this market is available for professional investors and the public as an investment tool. Return is the driving force on the investment process that motivate and is considered as a reward for investors. The total return refers to a set of the benefits that is accrued to share during the year.

Abnormal return is one of the most controversial topics which has been interested by researchers in the recent financial capital markets in emerging markets (Leldakys, 2004). This tends reason is due to a connection between price and return volatility, its impact on firm performance and the overall economic returns. The usefulness of the abnormal returns studying by investors is because that they consider abnormal return as a measure of risk, and also market policy makers can use this criterion as a tool to measure the vulnerability of the stock market. The results of carried out research during the past two decades in America, Japan and other developed countries suggest that there is a relationship between the company attributes such as size, the ratio of book value to market value, financial leverage, free cash flow and growth opportunities with non-return. Hence, the study of factors influencing abnormal returns can be useful in making many decisions of capital markets, and its result can be used to stock actives, including financial institutions, corporate executives and normal investors.

Identification of an asset pricing model has long been a problem in the financial economics literature. One of the models to predict the expected return on equity, is capital asset pricing model, the single-factor (CAPM) that was emerged by Sharp, Linz and Black as the first asset pricing theory on the Economic and Financial Sciences (Bagherzadeh, 2005).

Fama and French, using the capital asset pricing model in 1993, introduced a multiple regression equation for the introduction of the factors affecting the portfolio return. Actually they claim that except systematic risk (beta) shares, which plays a role in explaining differences between stock returns, some factors such as market risk, size and the ratio of book value to market value are also effective. The only anomaly that Fama and French three-factor model could
explain it, was the momentum strategy that Kerhart could provide that model. Kerhart added a variable called factor model of Fama and French to the momentum in 1997. He stated that his four-factor model are significantly decreasing the pricing error of Fama and French three-factor model and capital assets. Pastor and Estambaf made a five-factor model in 2003 by adding liquidity to the four-factor model, and Koobata and Takehara tested the five factor model for Japan’s data in 2010 and found that this model is superior to the three-factor model of Fama and French. In our study with the five-factor model were compared to Fama and French three-factor model for the data from the Tehran Stock Exchange.

A) Research History
Kubata and Takehara (2010) performed a study entitled "expected returns, liquidity risk and reverse strategy" for the Japan data. They compared Fama and French three-factor model with the five factor model and showed that the five factor model is superior to Fama and French three-factor model and has more explanatory power.

Kerhart (1997) compared Fama and French three-factor model with four-model and showed that the four-factor model is superior to Fama and French three-factor model and has more explanatory power and also the error pricing of four-factor model is lower than the Fama and French three-factor model.

some research in Fama and French three-factor model has been done in Iran that Bagherzadeh Research (2005), Mojtahedzadeh and Taremi (2006), Robat meili (2007), Noroozi (2010) and Abbasi and Ghazaljeh (2012) can be noted that their results has confirmed the model validity of Fama and French three-factor to the capital asset pricing model.

Also a research by Sadeghi, Telath and Askari (2013) entitled "momentum factor effect on Fama and French three-factor model explanatory power which showed that adding momentum to the Fama and French three-factor model leads to increase the explanatory power of the model.

B) Defining the problem and research objectives
Identification of an asset pricing model has long been a problem in the financial economics literature.

This model not only explains the stock returns but also boost the ability to predict abnormal returns separately. (Koboota and Takhara 2010)

The goals of this research are as follows: first to find the correct form of asset pricing theory in Tehran Stock Exchange and the latter is to predict the abnormal stock returns due to the correct form of asset pricing model.

C) Theoretical principles
C, A) Returns
Total returns is a set of the benefits that is accrued to the share during the year. Expected returns, is an estimated return of an asset that investors expect to earn in the future. Expected return is associated with uncertainty and is likely to be met, or not met. Realized returns is a returns that has occurred and located. Abnormal returns, is the difference between realized returns and expected returns.

C, B) Capital Asset Pricing Model (CAPM)
With the capital asset pricing model (CAPM) first asset pricing theory in the field of economics and finance was emerged. (BagherZadeh, 2005)

With the capital asset pricing model (CAPM) first asset pricing theory in the field of economics and finance was emerged. (BagherZadeh, 2005)

The CAPM expressed equilibrium relationship between risk and expected return rate as follows:

In this relationship:

\[ E(R_i) = R_f + B_i (R_m - R_f) \]

\[ R_f : \text{Risk-free rate of return} \]

\[ B_i : \text{Systematic risk index of securities i} \ (\text{Coefficient of sensitivity}) \]

\[ E(R_m) : \text{expected return rate of the market portfolio}. \]

C, D) Fama and French three-factor model (F & F)

Fama and French, according to their findings in 1992 and using the CAPM model in 1993 designed the multivariate equation regression for affecting factors on the portfolios performance. They claim that except systematic risk (beta) shares, which describes the difference between stock returns.

Fama and French three-factor model is formulated as follows:

\[ R_i - R_f = b_1 (R_m - R_f) + S_1 \times SMB + B_2 \times HML \]

In this formula \( R_i - R_f \) is the additional return to the risk-free return, this return is due to three factors:

\( R_m - R_f \) : The difference between the risk-free return and the portfolio market return, which is called the market risk premium.

\( SMB \) : The difference between the mean of the portfolio returns of small companies, the portfolio returns of large companies that is called size factor.

\( HML \) : The difference between the mean of the portfolio stock returns of companies with a high ratio of book value to market value and the company’s portfolio with a lower market value to the book value that is called value factor.

\( b_1 \text{ and } S_1 \) these are market factors, size and value of the portfolio, respectively. (Regression coefficient)

\( \varepsilon_0 \) : Particular asset portfolio returns i with zero mean.

C, E) Momentum
Momentum means to buy and hold stocks with high returns and sell stocks with low returns.

Kerhart (1997) added the momentum factor of a year to Fama and French three-factor model, and used the resulting model to explain the performance of common investment funds. Kerhart four-factor model is as follows:

\[ R_{1i} - R_f = b_1 (R_m - R_f) + S_1 (SMB) + h_1 (HML) + w_1 (LMW) \]

Kerhart (1997) states that the four-factor model, decreases the error of Pricing Model CAPM and the Fama and French three-factor significantly. By using Kerhart &et al studies (1996) he estimated the pricing error by forming 27 portfolios on the basis of the market value of the shares, the ratio of book value to market value and momentum.

C, F) Liquidity and Five Factor Model

One of the good features of an asset is to quickly be converted to cash. Liquidity risk expresses the ease of becoming a pro or cash. As a pro will be converted (bonds) faster and closer to the real price to cash, its liquidity risk is lower and vice versa.

Pastor and Estmbaf (2003) by adding liquidity to the four-factor model, made a five factor model that showed the liquidity variable. Also Kubata and Takehara (2010), tested the five-factor model in Japan and found that the five factor model is serior to Fama and French three-factor model.

Five factor model is as follows:

$$R_i - R_f = b_i(R_m - R_f) + S_i(SMB) + h_i(HML) + w_i(LMW) + i_i(IML) + \epsilon_i$$ (4)

R_i − R_f: Corporate excess returns to risk-free returns
R_m − R_f: Premium Market risk
SMB: Corporate symbol size
HML: Symbol of book value to market value
LMW: Momentum symbol
IML: symbol liquidity
b_i, S_i, h_i, w_i, i_i: Which are respectively the market, value, momentum and liquidity portfolios. (Regression coefficient)

C, G) The controlling method of variables and portfolio making method in the first model (three-factor model of Fama and French)

Fama and French three-factor model:

$$R_i - R_f = \beta_t^M(R_m,t - R_f,t) + \beta_t^{SMB} SMB + \beta_t^{HML} HML + \epsilon_t$$ (5)

Table 1: 4 portfolios formed on size and the ratio of book value to market value

<table>
<thead>
<tr>
<th>Portfolio number</th>
<th>The content of the portfolio</th>
<th>Icon portfolio</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Large enterprise / high book value to market value ratio</td>
<td>BH</td>
</tr>
<tr>
<td>2</td>
<td>Large company / low ratio of book value to market value</td>
<td>BL</td>
</tr>
<tr>
<td>3</td>
<td>Small company / high book value to market value ratio</td>
<td>SH</td>
</tr>
<tr>
<td>4</td>
<td>Small company / low ratio of book value to market value</td>
<td>SL</td>
</tr>
</tbody>
</table>

To avoid the influence of SMB and HML to each other, the portfolio method is used. The following table shows the 4 portfolio of variables SMB and HML.

$$SMB = \frac{1}{2} \times (SH - BH) + (SL - BL)$$ (6)

$$HML = \frac{1}{2} \times (SH - SL) + (BH - BL)$$ (7)

Five Factor Model:

$$R_i - R_f = \beta_t^M(R_m,t - R_f,t) + \beta_t^{SMB} SMB + \beta_t^{HML} HML + \beta_t^{LMW} LMW + \beta_t^{IML} IML + \epsilon_t$$ (8)

C, H) The controlling method of variables and portfolio making method in the second model (three-factor model of Fama and French)

Table 2: 16 portfolios composed on the basis of size, the ratio of book value to market value, momentum and liquidity

<table>
<thead>
<tr>
<th>Portfolio number</th>
<th>The content of the portfolio</th>
<th>Portfolio symbol</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Large enterprise / high book value to market value ratio / win / high liquidity</td>
<td>BHWL</td>
</tr>
<tr>
<td>2</td>
<td>Large enterprise / high book value to market value ratio / win / low liquidity</td>
<td>BHWI</td>
</tr>
<tr>
<td>3</td>
<td>Large enterprise / high book value to market value ratio / loser / high liquidity</td>
<td>BHL</td>
</tr>
<tr>
<td>4</td>
<td>Large enterprise / high book value to market value ratio / loser / low liquidity</td>
<td>BHL</td>
</tr>
<tr>
<td>5</td>
<td>Large company / low ratio of book value to market value / win / high liquidity</td>
<td>BLWL</td>
</tr>
<tr>
<td>6</td>
<td>Large company / low ratio of book value to market value / win / low liquidity</td>
<td>BLWI</td>
</tr>
</tbody>
</table>
To avoid the influence of variables SMB, HML, LMW and the IML on each other, the portfolio method is used:

\[
\text{SMB} = \frac{1}{8} \times (\text{SHWL} - \text{BHWL}) + (\text{SHWI} - \text{BHWI}) \\
\quad + (\text{SHLL} - \text{BHLI}) + (\text{SLLI} - \text{BHLI}) \\
\quad + (\text{SLWL} - \text{BLWL}) + (\text{SLWI} - \text{BLWI}) \\
\quad + (\text{SLLL} - \text{BLLL}) + (\text{SLLL} - \text{BLLL}) \\
\quad - \text{BLLI} \\
\quad - (9)
\]

\[
\text{HML} = \frac{1}{8} \times (\text{SHWL} - \text{SLWL}) + (\text{SHWI} - \text{SLWI}) \\
\quad + (\text{SHLL} - \text{SLLI}) + (\text{SHLI} - \text{SLLI}) \\
\quad + (\text{BHWL} - \text{BLWL}) + (\text{BHWI} - \text{BLWI}) \\
\quad + (\text{BHLI} - \text{BLLL}) \\
\quad + (\text{BLLI} - \text{BLLL}) \\
\quad \quad (10)
\]

\[
\text{LMW} = \frac{1}{8} (\text{SLLI} - \text{SLWI}) + (\text{SLLL} - \text{SLWL}) \\
\quad + (\text{SHLI} - \text{SHWI}) + (\text{SHLL} - \text{SHWL}) \\
\quad + (\text{BLLI} - \text{BHLL}) + (\text{BLLI} - \text{BLWL}) \\
\quad + (\text{BHLI} - \text{BHLL}) + (\text{BHLL} - \text{BHWL}) \quad \quad (11)
\]

\[
\text{IML} = \frac{1}{8} (\text{SLLI} - \text{SLLL}) + (\text{SLWI} - \text{SLWL}) \\
\quad + (\text{SHLI} - \text{SHLL}) + (\text{SHWI} - \text{SHWL}) \\
\quad + (\text{BLLI} - \text{BLLL}) + (\text{BLWI} - \text{BLWL}) \\
\quad + (\text{BHLI} - \text{BHLL}) + (\text{BHLL} - \text{BHWL}) \quad \quad (12)
\]

**D) The statically population and sample**

The statically population of the study consisted of all companies listed on the Stock Exchange of Tehran.

Statically sample with regard to the realm of time and space have been conducted. Therefore, the sample of this research is those firms listed on Tehran stock exchange that meet the following conditions:

1) The fiscal year to March.

2) Until the year 2002 and the end of 2001 were listed in Tehran Stock Exchange.

3) Financial statements and required data are available for study.

4) During the years 2002 to 2012 have an active presence in Tehran Stock Exchange and during the period of investigation are not out of stock.

5) Companies are productive companies.

The statically sample using an omitting sampling method and with regard to the above-mentioned cases is consisted of 99 companies from 18 industries.

**E) Data analysis**

**E, A) first-analytical theory**

\( H_0 \): pricing model is not more than five- factor model.

\( H_1 \): the prediction power of Fama and French three-factor pricing model is more than five- factor model.(table3)

Based on the presented results in the above table and F statistics Fisher, adjusted coefficient of determination and the significance level of the Fama and French three-factor model coefficients and the five-factor model, it can be said that the Fama and French three-factor model predictions power will be increased with the addition of two factors: LMW and the IML. Thus the five-factor model explains more than the three-factor model.

\( H_0 \): Fama and French three-factor model does not have a significant relationship with the abnormal stock returns.

\( H_1 \): Fama and French three-factor model has a significant relationship with the abnormal stock returns.(table4)
Table 3: the analysis of the independent variables in the hypotheses of study

<table>
<thead>
<tr>
<th>Explanatory variables</th>
<th>Fama and French three-factor model</th>
<th>Five Factor Model</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>coefficient</td>
<td>Statistics t</td>
</tr>
<tr>
<td>c</td>
<td>0.031</td>
<td>7.250</td>
</tr>
<tr>
<td>β (Rm-Rf)</td>
<td>0.027</td>
<td>4.087</td>
</tr>
<tr>
<td>SMB</td>
<td>0.370</td>
<td>3.186</td>
</tr>
<tr>
<td>HML</td>
<td>-0.394</td>
<td>3.183</td>
</tr>
<tr>
<td>LMW</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>IML</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>Adjusted coefficient of determination</td>
<td>0.64</td>
<td></td>
</tr>
<tr>
<td>Statistics F</td>
<td>49.37</td>
<td></td>
</tr>
<tr>
<td>Significance level</td>
<td>0.000</td>
<td></td>
</tr>
<tr>
<td>Watson statistic camera</td>
<td>1.998</td>
<td></td>
</tr>
<tr>
<td>F Lymr</td>
<td>0.0831</td>
<td></td>
</tr>
<tr>
<td>VIF</td>
<td>2.192</td>
<td></td>
</tr>
</tbody>
</table>

Table 4: the analysis of the independent variables coefficient in the study hypotheses

<table>
<thead>
<tr>
<th>Explanatory variables</th>
<th>coefficient</th>
<th>Statistics t</th>
<th>Significance level</th>
</tr>
</thead>
<tbody>
<tr>
<td>c</td>
<td>0.183</td>
<td>3.309</td>
<td>0.0006</td>
</tr>
<tr>
<td>FAMA</td>
<td>0.067</td>
<td>3.508</td>
<td>0.0037</td>
</tr>
</tbody>
</table>

**E, B) Second hypothesis analyze**

Given the significant level of hypothesis, the Fama and French three-factor model has a significant positive relationship with the abnormal returns.

$H_0$: Five Factor Model does not have a significant relationship with the abnormal stock returns.

$H_1$: Five Factor Model has a significant relationship with the abnormal stock returns. (table 5)

Table 5: the analysis of the independent variables coefficient for studying the hypotheses

<table>
<thead>
<tr>
<th>Explanatory variables</th>
<th>coefficient</th>
<th>Statistics t</th>
<th>Significance level</th>
</tr>
</thead>
<tbody>
<tr>
<td>c</td>
<td>0.261</td>
<td>5.449</td>
<td>0.0000</td>
</tr>
<tr>
<td>FIVE</td>
<td>0.119</td>
<td>3.001</td>
<td>0.00609</td>
</tr>
</tbody>
</table>

**E, C) The third hypothesis analyze**

Given the significant level of hypothesis, the five-factor model has a significant positive relationship with the abnormal returns.

$H_0$: the size factor does not have a significant relationship with the abnormal stock returns.

$H_1$: the size factor has a significant relationship with the abnormal stock returns. (table 6)
Table 6: the analysis of the independent variables coefficient for studying the hypotheses

<table>
<thead>
<tr>
<th>Explanatory variables</th>
<th>coefficient</th>
<th>Statistics t</th>
<th>Significance level</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>0.216</td>
<td>3.211</td>
<td>0.0014</td>
</tr>
<tr>
<td>SMB</td>
<td>0.0503</td>
<td>2.446</td>
<td>0.0148</td>
</tr>
</tbody>
</table>

**E, D) Fourth hypothesis analyze**

Given the significant level of hypothesis, the size factor has a significant positive relationship with the abnormal returns.

H0: the ratio of book value to market value does not have a significant relationship with the abnormal stock returns.

H1: The ratio of book value to market value has a significant relationship with the abnormal stock returns. (Table7)

Table 7: the analysis of the independent variables coefficient for studying the hypotheses

<table>
<thead>
<tr>
<th>Explanatory variables</th>
<th>coefficient</th>
<th>Statistics t</th>
<th>Significance level</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>0.128</td>
<td>3.199</td>
<td>0.0006</td>
</tr>
<tr>
<td>HML</td>
<td>0.031</td>
<td>1.468</td>
<td>0.1638</td>
</tr>
</tbody>
</table>

**E, E) Fifth hypothesis analyze**

Given the significant level of hypothesis, the ratio of book value to market value does not have a significant positive relationship with the abnormal returns.

H0: the momentum does not have a significant relationship with the abnormal stock returns.

H1: the momentum has a significant relationship with the abnormal stock returns. (Table8)

Table 8: the analysis of the independent variables coefficient for studying the hypotheses

<table>
<thead>
<tr>
<th>Explanatory variables</th>
<th>coefficient</th>
<th>Statistics t</th>
<th>Significance level</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>0.223</td>
<td>3.168</td>
<td>0.0016</td>
</tr>
<tr>
<td>LMW</td>
<td>0.017</td>
<td>3.001</td>
<td>0.0227</td>
</tr>
</tbody>
</table>

**E, F) Sixth hypothesis analyze**

Given the significant level of hypothesis, the momentum factor has a significant positive relationship with the abnormal returns.

H0: the liquidity does not have a significant relationship with the abnormal stock returns.

H1: the liquidity has a significant relationship with the abnormal stock returns. (table 9)

Table 9: the analysis of the independent variables coefficient for studying the hypotheses

<table>
<thead>
<tr>
<th>Explanatory variables</th>
<th>coefficient</th>
<th>Statistics t</th>
<th>Significance level</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>0.038</td>
<td>5.364</td>
<td>0.0000</td>
</tr>
<tr>
<td>IML</td>
<td>0.022</td>
<td>3.289</td>
<td>0.0197</td>
</tr>
</tbody>
</table>
E, F) Seventh hypothesis analyze

Given the significant level of hypothesis, the liquidity factor has a significant positive relationship with the abnormal returns.

CONCLUSION

The result of the first hypothesis testing showed that the predicting power and explanatory power of five-factor model is more the Fama and French three factor which is similar to the Pastor and Estambaf (2003) and Kubata and Takehara results

The results of the second and third hypotheses showed that Fama and French three-factor model has a significant relationship between the five-factor model and the abnormal return

the results of the fourth, the sixth and seventh hypothesis illustrates that there is a significant relationship between the variables of size, momentum and liquidity with the abnormal return. The result of the fifth hypothesis also indicates that there is not a significant relationship between the ratios of book value to market value.

Due to the favorable results of the five factor model to explain the expected returns and abnormal returns, investors and managers of investment companies are advised to use the base five factor model to assess the portfolios performance since the results showed that the five-factor model has more explanatory power than Fama and French three-factor model. In any case, these result can increase the understanding and knowledge of capital market investors and researchers.

REFERENCES


