

Comparative Study of the Factors Affecting Stock Return in the Companies of Refinery and Petrochemical Listed in Tehran Stock Exchange

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Abstract

This study aims to present a comparative study of the factors affecting stock return in the refinery and petrochemical companies listed in Tehran Stock Exchange. Information of the return of the companies listed in the stock exchange is a major issue to form the stock portfolio. We need to identify the factors affecting the return to forecast returns. These factors have been studied in various studies at different times. This study sought to identify the factors affecting stock returns in Tehran Stock Exchange during 2004-2013. The study group consisted of refinery and petrochemical companies and the studied factors were systemic risk, the ratio of book value to market value and the size of the company. Panel data regression was used to analyze the data. The results of this analysis showed that there is a positive significant relationship between systemic risk and return. Moreover, there is a significant relationship between size and return. Other findings show no relation between the ratios of the market book value to returns.

Key words: stock return, systemic risk index, size of company, book value ratio to the market value, Tehran Stock Exchange.

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Introduction

One of the basic criteria for decisions on stock is the stock returns. Stock return is itself has information content and most actual or potential investors use it in financial analysis and predictions. If a relationship is observed between independent variables of the study (including, systemic risk index β , size and the ratio of book value to market value) and stock return, above factors can be considered as a criterion of return estimate and measurement of the shares return of companies. Information of the return of the companies listed in the stock exchange is a major issue to form the stock portfolio. We need to identify the factors affecting the return to forecast returns. These factors have been studied in various studies at different times. This study sought to identify the factors affecting stock returns in Tehran Stock Exchange during 2004-2013. For information on the performance of stocks of companies listed on the stock exchange is a major issue and that forecast returns be required to identify the factors affecting the performance. These various studies, have been studied at different times, including systematic risk factors include the ratio of book value to market value and the size of the company noted. The factors were systemic risk, the ratio of book value to market value and the size of the company. This study sought to identify the factors affecting stock returns in 1383 to 1392 the Tehran Stock Exchange. The study group included refinery and petrochemical companies; the effect of the factors on the stock return is same or different. Hence, the comparative study of the degree of the effective factors can contribute to investors in forming an optimum share portfolio. The study of the relationship between risk and return and identification of the factors affecting the return is something that has always attracted the attention of researchers of the financial area. Despite the ability of the Capital Asset Pricing Model (CAPM), recent empirical research has made this model a severe challenge. It seems that beta has shortcomings as the systemic risk index in describing the relationship between risk and return for long-term courses. However, other variables such as firm size and the ratio of book-to-market value are alternative competitors to the risk index. In this study, the factors affecting the return of refineries and petrochemical companies listed in the Stock Exchange will be examined. The results will show whether the factors affect the two sets of companies similarly or differently, which appear to have a lot of commonalities, or whether they can help investors in forming an optimum portfolio.

Review of the literature

Ziamba (2002) in Japan, Levis (1985) and Brown et al. in Australia found that stock of smaller companies had returns better than larger companies. Bndri (1988) found that financial leverage with the above two factors is effective in explaining the return. Fama and French (1992, 1996) presented a strong support to the size and ratio of book value to market value and stock returns. They did single and multiple tests and found a positive and significant relationship between the ratio of book value to market value and stock return and a negative relationship between size and the stock return. In fact, they questioned the sensitivity of beta in Capital Assets Pricing Model and found that differences in the stock returns are mainly explained by two factors of company size and the ratio of book value to market value. Ponif and Scull (2001) examined the effect of the ratio of book value to market value on the return. They used the book value to market value ratio to predict return because the market value represents the expected cash flow, so the ratio of book value to the market value represents cash flow at the current level, when the discount rate is changed, the price will change and so the ratio will change. The results show an overall positive relationship between the ratio of book value to market value and return, when other variables are considered as independent variables, the ability to predict the ratio does not have more statistical significance to explain return. Capital Asset Pricing Model (CAPM) of Sharpe (1964) and Black (1977) predicts that

the market portfolio is efficient in terms of Mean-variance. Therefore, this hypothesis should be tested to empirically test CAPM: the market portfolio is on the "working boundary". CAPM initial test studied characteristics of SLM rather than to test the efficiency of the market portfolio. Fama and Macbeth's (1973) study is one of the researches, which tested features of SLM empirically. Using two-stage regression, the beta of each stock or portfolio is estimated based on regression between stock returns and market portfolio and then, the relationship between beta and the average return is estimated based on cross-sectional regression and the best fit line is seen as an estimate of the share market line. Finally, the results of this estimate are compared with CAPM. Despite the results of Block et al. (1972) and Fama and Macbeth (1973) showing that there is a positive linear relationship between systematic risk and stock returns, the results of studies in the past two decades suggests that in addition to systemic risk, other factors play a role in explaining the average stock return. For example, Benz and Ringanom (1981) reported that after controlling systemic risk, small company stocks create greater returns compared with large companies. In particular, Benz's research suggests that mean difference explains greater stock returns. Statman (1980) and Rosenberg et al. (1985) reported that there is a positive relationship between the average rate of stock return and the ratio of book value to market price in America capital market. Results of Davis, Fama and French's (2000) study confirmed findings reported by Statman and Rosenberg et al. In total, the results of this study and other similar studies suggest that the average rate of stock return has a significant relationship with variables such as firm size, the ratio of book value to market value, and so forth. The theory that these variables are not irrelevant in the context of the CAPM framework, most of these variables are known as "Exceptions of the stock market". However, the empirical evidence of the exceptions is added daily, their interpretation is still uncertain. For example, Fama and French studied the relationship between beta, size of company and the ratio of book value to market value with the expected return of shares in America's capital market by summarizing previous empirical studies and Fama and Macbeth's cross-sectional regression method, and concluded that systemic risk cannot explain the difference between stock returns during the study period (1963-1990), and variables of firm size and book-to-market value ratio are able to better explain the average difference of stock returns. Empirical findings of Fama and French (1992) clearly shows that by controlling the size of company and beta, there is a significant relationship between beta and return on stock and average stock returns explain the combining variables of firm size and book-to-the market value ratio. Fama and French (1992) believe that the poor performance of beta in explaining stock returns can be attributed to two probable factors of systemic risk. According to Fama and French (1992), the size of the company and the ratio of book value to market value are related to the systematic pattern of growth and relative profitability that could potentially be major sources of risk in their returns. The results of Chan et al.'s (1991) study also show that the ratio of book value to market value could explain the expected return of Japanese companies. Based on these findings, Fama and French proposed a model consisting of three factors in contrast to the CAPM, and claimed that all factors except for systemic risk shares play a role in explaining differences in stock returns that can be summarized in the following three factors:

1. The return surplus expected from the market portfolio to the risk-free return rate;
2. The difference between the return on a portfolio composed of stocks of small companies and a portfolio composed of stocks of large companies;
3. The difference between the return on a portfolio composed of stocks with a high ratio of book value to market value and the portfolio composed of small stock ratio of book value to market value. .Accordingly, the three-factor model of Fama and French (1993, 1996) states that the difference between the expected return of a typical portfolio and a risk-free return can be attributed to three factors mentioned above. According to Fama and French, the three-factor model is able to explain most empirical exceptions in the literature of capital asset pricing. Thus, results of hierarchical studies of Fama and French result in serious challenges for CAMP and created many disputes between financial thinkers. For example, Black and McKinlay (1995) criticized the results of Fama and French (1992, 1993, 1996) and believed that these models, in particular mere use of the ratio of book value to market price arise from certain conditions typical in America capital market and these patterns cannot be observed outside the sample (outside America capital market). Kothari, Shanken and Sloan (1995) argue that the results of Fama and French have been affected by excluding some items from the final sample. In an experimental study, Chan Choi (2003) concluded that systemic risk and size of company have a weaker role in explaining stock returns but the book value to market value ratio has the greater explanatory power. Daniel and Titman (1997) criticized the interpretation of the findings of Fama and French (1992, 1993, 1996) and argued that the effect of size and the ratio of book value to market price are not considered the index for non-diversifiable risk factors; however, firm size and the ratio of book value to market value are highly correlated with stock returns that can be attributed to the return features rather than covariance structure of returns that can explain cross-sectional changes of returns. Daniel and Titman (1997) attributed the ratio of book value to market value to the characteristics of the company and have provided a model that is in contrast to the three-factor model of Fama and French (1993, 1996). The proposed model of Daniel and Titman (1997) challenged the study findings of Fama and French (1992, 1993, 1995, 1996). Fama and French (1998) found that the ratio of capital market in America that challenge CAPM seriously also has a similar effect in 12 non-US capital markets and emerging markets. Daniel, Titman and Wei (2000) used data from the stock market in Japan to re-test their proposed model, and rejected Fama and French's three-factor model (1993, 1996). Akdeniz's (2000) studied the relationship between risk and return on stock in Istanbul stock exchange and showed that there was not a significant relationship between beta and return on stock in 1988 to 1992 and the two variables of firm size and book-to-market ratio are able to explain the difference between stock returns. At the same time, there was no significant relationship between the ratio of profit to the price and stock return. Lam (2002) studied the effect of beta, firm size and the ratio of book value to market value variables on stock returns in Hong Kong stock exchange and found that beta cannot explain stock returns in Hong Kong stock exchange but the variables of firm size and ratio of book value to the market

value are related to stock returns. Thus, the empirical evidence suggests that violations of the CAPM cannot be attributed to certain sample, environment or capital market.

Hypotheses

1. There is a significant relationship between systemic risk index and stock returns of petrochemical companies.
2. There is a significant relationship between the size of the company and stock returns of petrochemical companies.
3. There is a significant relationship between the ratio of book value to market value and stock returns of petrochemical companies.
4. There is a significant relationship between the systemic risk and stock return of the refinery companies.
5. There is a significant relationship between the company size and stock return of the refinery company.
6. There is a significant relationship between ratio of book value to market value and stock returns in the refining companies.

Minor hypotheses of the study

1. The effect of systematic risk index on stock returns is the same in both refinery and petrochemical companies.
2. The effect of firm size on stock returns is the same in both refinery and petrochemical companies.
3. The effect of book value to market value ratio on stock returns is the same in both refinery and petrochemical companies.

Objectives

1. Study of the relationship between systematic risk index and stock returns in petrochemical companies
2. Study of the relationship between firm size index and stock returns in petrochemical companies
3. Study of the relationship between the ratio of book value to market value and stock returns in petrochemical companies
4. Study of the relationship between systematic risk index and stock returns in refinery companies
5. Study of the relationship between firm size index and stock returns in refinery companies
6. Study of the relationship between the ratio of book value to market value and stock returns in refinery companies.

Methodology

Hypothesis-testing includes the significance of the relationship between the independent variables such as the systemic risk index, size and the ratio of book value to market value and dependent variable of return on stock based on the multiple regression. The following steps are taken for comparative study of the factors affecting stock returns for refinery and petrochemical companies:

1. First, panel regression was carried out for each refinery and petrochemical companies separately; that is, the data on refinery and petrochemical companies was collected for the period under study in the form of independent variables (systemic risk, size and the ratio of book value to market value) and the dependent variable; that is, stock returns and the panel model was estimated by integrating time series for longitudinal and cross-sectional courses, namely companies of both industries. This estimation is done using Eviews software.
2. For each of the panel models of the companies, significance of the regression coefficients for each of the independent variables as factors affecting stock returns are separately examined using tests such as t-test.
3. Standardized coefficients of regression equations are used to compare equal or unequal effect of each of the independent variables (affecting stock returns).

Data collection methods

Collection method include documentation that contains information published on the stock exchange and the financial statements of refinery and petrochemical companies listed in Tehran Stock Exchange, statistical data, literature research, library studies, and internet resources including books, domestic and international articles and dissertations and case studies.

The population of this research includes companies operating in the petrochemical and refinery companies in Tehran Stock Exchange.

Data analysis and hypothesis-testing methods

Data collection and study data include: documents, books, websites and databases of stock exchange organization, reported data of companies on their performance, database software of the stock market to achieve comprehensive and accurate data. Since the data used for the study are both time series and company for the period under study, the data analysis Panel is used. One study in Tehran Stock Exchange of the factors affecting the return is Bagherzade (2005) that was conducted on the factors affecting the expected stock returns of companies listed in Tehran Stock Exchange. His studies showed that there is a significant linear relationship between market risk (measured by beta), firm size and book-to-market value ratio. In addition, the results of his conclusions found no significant relationship between the profit to price ratio and average return. Sadeghi Sharif (2003) studied the design of capital assets pricing model (CAPM) in Tehran Stock Exchange according to risk factor, the relationship between risk and return expected of shareholders and localization of CAPM and provided a good model to show the relationship between risk and return in all courses even the periods when the market risk premium is negative. The results of this study suggest that the capital assets pricing model can explain return behavior and its relationship to beta in the absence of positive market direction (negative market risk premium), and in cases where the market direction is positive and upwards, the relationship between risk and return is positive (consistent). Fama and French (1992, 1996) presented a strong support for the relationship between size and the ratio of book value to market value and stock returns. Ponif and Scull (2001) examined the effect of the ratio of book value to market value on the return. They used the book value to market value ratio to predict return because the market value represents the expected cash flow, so the ratio of book value to the market value represents cash flow at the current level, when the discount rate is changed, the price will change and so the ratio will change.

Introduction to model

According to the study hypotheses, significance of the relationship between the independent variables, including the systemic risk index, size and the ratio of book value to market value of stock returns with dependent variable was examined. Multiple regression was used to test the relationship of all variables with dependent variable. A regression analysis will find that to what extent the changes in each independent variable affect the dependent variable.

The regression equation is as follows:

$$RETURN = \beta_0 + \beta_1 BVMR + \beta_2 BETA + \beta_3 SIZE + \varepsilon_{ij}$$

where

RETURN= stock return

BVMR= book to market value ratio

BETA = Systemic risk

SIZE= firm size

ε_{ij} = error Term

According to the mentioned model, sample of the study contain refinery and petrochemical companies in the Tehran Stock Exchange for a time period from the beginning of the fiscal year 2004 to the end of the fiscal year 2013. The model is estimated by panel data model. Data was collected from Tehran Stock Exchange website. Panel model is used to examine Hausman test. Significance or insignificance of the above model can be expressed by the following statistical hypotheses.

$$\begin{cases} H_0 : \beta_i = \beta_j = 0 \\ H_1 : \beta_i \neq \beta_j, \forall i \neq j \end{cases}$$

In other words,

H0: Above regression model is not significant at 5% level of error.

H1: Above regression model is significant at 5% level of error.

Hausman test

Hausman test is one of the major tests in panel studies and it can be considered in all sections or periods, including separate intercept. The researcher should estimate random group or time effects; that is, the pattern of fixed group or time effects and then make decisions on the fixed effects or random effects pattern. The underlying assumption in the fixed effects model is that the error can be correlated with explanatory variables, of course it does not change with the time in varying; for example, gender or skin color over time but the random effects model assumes that there is no correlation between errors and explanatory variables. Hausman test uses chi-square. If the test probability is more than 5%, we can prefer random effects over fixed effects at 95% of confidence level; otherwise, the fixed effects are selected.

Hausman test of refinery companies

Hausman test of refinery companies

| Result | Sig. | Statistic | Test |
|-------------------------------|-------|-----------|----------------|
| Random effects are confirmed. | 0.009 | 6.856 | Hausman |

With regard to the data of refinery companies, it could be seen that as significance level is less than 5%, random effects are confirmed.

Hausman test of petrochemical companies

Hausman test of petrochemical companies

| Result | Sig. | Statistic | Test |
|-------------------------------|-------|-----------|----------------|
| Random effects are confirmed. | 0.031 | 8.838 | Hausman |

With regard to the data of petrochemical companies, it could be seen that as significance level is less than 5%, random effects are confirmed. Therefore, both models are estimated based on random effects for companies.

Testing auto-correlation of the model: Durbin-Watson test

In regression analysis, especially when variables are studied during a time interval, changes may follow a specific pattern over time. Durbin-Watson is used to detect this pattern. The concept of independence means that the result of an observation does not affect the result of other observations. In regression, when the behavior of the dependent variable is studied at an interval, it is possible to face with the problem of lack of independence of error. Such relationship in data is called autocorrelation. If there is a correlation in the errors, linear regression cannot be used. In this study, Durbin-Watson's statistic was equal to 1.982 in the refinery companies in the last row of Table. Since the lack of autocorrelation is accepted, it is possible to provide significance test of regression coefficients. In this study, Durbin-Watson's statistic was equal to 1.711 and close to 2 in the petrochemical companies in the last row of Table. Since the lack of autocorrelation is accepted, it is possible to provide significance test of regression coefficients.

Estimation of the research model for refinery and petrochemical companies

I. Hypothesis testing for petrochemical companies

a) Petrochemical companies

With regard to the confirmation of random effects model, the following results were obtained for petrochemical companies:

of the model of petrochemical companies

| Variable | Coefficient | SD | t-test | Sig. |
|--|-------------|-----------|--------|-------|
| Intercept | -4343.425 | -2883.421 | -3.411 | 0.001 |
| Firm size | 0.083 | 0.007 | 11.840 | 0.000 |
| Systemic risk | 0.305 | 0.052 | 5.824 | 0.000 |
| Book to market value ratio | -2883.421 | 2415.716 | -1.049 | 0.605 |
| Coefficient of determination | 0.653 | | | |
| Adjusted coefficient of determination | 0.640 | | | |
| Durbin-Watson | 1.711 | | | |

H1: there is a significant relationship between systemic risk index and stock return in petrochemical companies. T-test is equal to 5.824 for systemic risk index at significance level of 0.000 in petrochemical companies. In other words, the effect of systemic risk index on stock return is significantly positive and stock return increases by 5.824 with the one unit increase in systemic risk of stock return.

H2: there is a significant relationship between firm size and stock return in petrochemical companies. T-test is equal to 11.840 for firm size at significance level of 0.000 in petrochemical companies. In other words, the effect of firm size on stock return is significantly positive and stock return increases by 11.840 with the one unit increase in firm size.

H3: there is a significant relationship between book to market value ratio and stock return in petrochemical companies. T-test is equal to -1.049 for book to market value ratio at significance level of 0.6056 in petrochemical companies. In other words, the value does not significantly affect the stock return at 5% level of significance.

II. Hypothesis testing for petrochemical companies

b) Petrochemical companies

With regard to the confirmation of random effects model, the following results were obtained for petrochemical companies:

Estimation of the model of petrochemical companies

| Variable | Coefficient | SD | t-test | Sig. |
|--|-------------|----------|--------|-------|
| Intercept | -7159.738 | 2900.011 | -2.468 | 0.021 |
| Firm size | 0.090 | 0.007 | 3.587 | 0.001 |
| Systemic risk | 76.617 | 30.966 | 2.474 | 0.020 |
| Book to market value ratio | 93.240 | 836.862 | 0.111 | 0.912 |
| Coefficient of determination | 0.730 | | | |
| Adjusted coefficient of determination | 0.673 | | | |
| Durbin-Watson | 1.982 | | | |

H4: there is a significant relationship between systemic risk and stock return in petrochemical companies. T-test is equal to 2.474 for book to market value ratio at significance level of 0.020 in petrochemical companies. In other words, the effect of systemic risk index on the stock return is significantly positive and stock return increases by 11.840 with the one unit increase in firm size.

H5: there is a significant relationship between the firm size and stock return in refinery companies. T-test is equal to 3.587 for the firm size at significance level of 0.001. In other words, the effect of firm size on the stock return is significantly positive and stock return increases by 3.587 with the one unit increase in firm size.

H6: there is a significant relationship between book to market value ratio and stock return in refinery companies. T-test is equal to 0.11 for the book to market value ratio at significance level of 0.912. In other words, the variable does not have a significant effect on the stock return variable at 5% level of significance. Testing the major hypotheses mentioned in the first chapter was conducted to estimate the model. According to the results, the minor hypotheses are tested and hypotheses of refinery and petrochemical companies are compared.

b. Interpretation of the adjusted coefficient of determination for each equation

Adjusted coefficient of determination reported in the Table is equal to 0.640 for petrochemical companies; that is, independent variables explain 0.640% of the changes in dependent variable.

Adjusted coefficient of determination reported in the Table is equal to 0.673 for refinery companies; that is, independent variables explain 0.673% of the changes in dependent variable.

c. Testing minor hypotheses of refinery and petrochemical companies

Equality of the coefficients obtained in two refinery and petrochemical companies is compared and examined whether there is a significant difference between coefficients and effects of the independent variables on the dependent variables.

| Variable | Coefficient | SD | t-test | Sig. |
|-----------------------------------|-------------|----------|------------|-------|
| Firm size | 0.083 | 0.007 | 11.84 | 0.000 |
| Systemic risk | 0.305 | 0.052 | 5.824 | 0.000 |
| Book to market value ratio | -2883.421 | 2415.761 | - 1.193 | 0.605 |

Standardized coefficients of regression model for refinery companies

| Variable | Coefficient | SD | t-test | Sig. |
|-----------------------------------|-------------|---------|--------|-------|
| Firm size | 0.090 | 0.007 | 11.41 | 0.001 |
| Systemic risk | 76.617 | 30.966 | 2.474 | 0.020 |
| Book to market value ratio | 93.240 | 836.862 | 0.111 | 0.912 |

II. The first minor hypothesis

The effect of systemic risk index on the stock return is the same in both refinery and petrochemical companies. With regard to the standard coefficient reported for the firm size in the model of petrochemical companies in the second row of Table 5 that is equal 5.824 and 2.474 for refinery companies, it is concluded that the effect of systemic risk on the stock return in the petrochemical companies is greater than that of refinery companies. In other words, the variable of stock return in petrochemical companies has greater senility and effect than systemic risk of refinery companies.

II. The second minor hypothesis

The effect of firm size index on the stock return is the same in both refinery and petrochemical companies. With regard to the standard coefficient reported for the firm size in the model of petrochemical companies in the first row of Table that is equal 11.84 and 11.41 for refinery companies, it is concluded that the effect of firm size on the stock return in the petrochemical companies is greater than that of refinery companies. In other words, the variable of stock return in petrochemical companies has greater senility and effect than the size of refinery companies.

III. The third minor hypothesis

The effect of book to market value ratio on the stock return is the same in both refinery and petrochemical companies. Due to insignificance of the coefficient of the book to market value ratio in both refinery and petrochemical companies, we conclude that there is no significant relationship between the book to market value ratio and the stock return in both refinery and petrochemical companies.

Conclusion

This study aims to present a comparative study of the factors affecting stock return in the refinery and petrochemical companies listed in Tehran Stock Exchange. Information of the return of the companies listed in the stock exchange is a major issue to form the stock portfolio. This study sought to identify the factors affecting stock returns in Tehran Stock Exchange during 2004-2013. The study group consisted of refinery and petrochemical companies and the studied factors were systemic risk, the ratio of book value to market value and the size of the company. Panel data regression was used to analyze the data. The results of this analysis showed that there is a positive significant relationship between systemic risk and return. Moreover, there is a significant relationship between size and return. Other findings show no relation between the ratio of the market book value to returns.

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