The Relationship between Liquidity Risk and Stock Returns
Case Study: Oil Companies in Tehran Stock Exchange

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Abstract
According to the importance of relationship between risk and stock return, the effect of liquidity risk and risky factors; the size of company, market risk premium and book value ratio to market value on stock return of accepted oil companies in Tehran stock exchange were discussed in this research. Stock return as dependent variable and liquidity risk, size of company, market risk premium and book value to market value were considered as independent variables. The sample of research includes 6 oil companies that were active in 2011 to 2013 in Tehran stock exchange. Fama and French model was used in this research in order to investigating the relationship between dependent and independent variable and the lack of liquidity criterion Amihud as the liquidity risk client. Statistical analyses were done based on multi-choice regression and data are monthly and panel. The results of research show that the size of company doesn’t significant effect on oil companies stock return, as result from investor point of view, small and big companies are trustable the same but book value to market value, market risk premium and liquidity risk has significant effect on stock return of oil companies in Tehran stock exchange that represents the importance of these variables in studied companies stock return.

Key words: liquidity risk, return, Fama and French, Amihud and linear multi choice regression

Introduction
Investing as a financial decision is always with two components of risk and returns that exchanging them offer sinvesting different combinations. On one hand investors seek maximizing their revenue from investment and on the other hand they are faced with unreliability condition dominating financial markets that recent factor makes investment revenues achieving unreliable in another word all investing decisions are done based on the relationship between risk and return. Liquidity means conversion speed of investments or assets to cash with the least expense and in the least time and have an important effect in investing attraction, investors’ making decisions and accurate resource allocation. Most of investors prefer much liquidity stock to less liquidity stock that these factors in valuation of assets, caused by risk crystallization of lack of assets liquidity in buyer mind that can cause discourage investors from investing. In fact the lack of liquidity by the meaning of liquidity risk can affect stock return negatively. Since with risk increase, expected return will increase, checking liquidity risk as one of different kinds of risk and stock return is important. In current study the relationship between liquidity risk and monthly return of oil companies who are active in Tehran stock exchange is investigated.

Theoretical basis and background of study
Generally the lack of trust shows the risk content and means an uncertainty that person feels in relation to a possible result occurrence among possible results. We can consider unreliability as a function of the probability, the rate of occurrence or non-occurrence of any event is in swing between zero and one and they show it with percentage. Generally we can consider risk the possibility of realities deviation from what was expected. Deviation can happen in two directions of positive or negative. Risk may not be a negative phenomenon but there is risk with any opportunity and basically we can’t remove all risks because all opportunities will be removed, investors accept the higher level of risk only when gain more return. Obtained return because of risk tolerance, is usually called risk premium or risk award. The beginning of
researches related to liquidity risk refers to the mid-80s. This subject despite of being rooted is a part of new researches in financial management. Pontiff and D. Schall in 1998 tested the effect of book value ratio to market value on stock return, they used book value ratio to market value for predicting return because market value is the client of expected cash flow, therefor book value ratio to market value is representative of cash flow in current level, when discount rate changes price level will change and so this ratio will change too. The results show that there is a public positive relationship between book value ratio to stock market value and return. Marshal and Yang 2003 investigated the relationship between liquidity and stock return. Used liquidity criteria in this research are the gap between buying and selling proposed price and flow rate. In their model they used market return factors and size of company and concluded that the effect of company size on stock return is negative. Mohammad Sirani, Rezvan Hejazi and Malihe Keshavarz in 2010 studied the effect if liquidity risk and the other effective factors on sectional return in accepted companies in Tehran stock exchange that in that research considering the importance of relationship between risk and return, the effect of liquidity and effective factors on risk include market risk, company’s size, book value ratio to market value and also floating stock on sectional return considering FARM model. The results of mentioned research show that there is a significant relationship between market risk, company’s size and floating stock on return. But book value relationship to market value with stock and liquidity risk with return s not significant.

Methodology and hypotheses
The present study is functional in terms of goal, and correlation in terms of descriptive information collecting. In fact this research is quantitative that checks testing hypothesis through variables correlation analysis. Since this research data are checked simultaneously in sections and time series are panel data for data analysis panel regression methods is used that is one of econometric estimates method. The main question is that if there is significant relationship between liquidity risk and accepted oil companies’ stock return in Tehran stock exchange. Due to achieving research goals below hypothesis have been developed:

Studied hypotheses in current research are:
Main hypothesis
- There is a significant relationship between liquidity and stock return.
Sub-hypotheses
- There is a significant relationship company size and stock return.
- There is a significant relationship between market risk premium and stock return.
- There is a significant relationship book value to market value and stock return.

Data, population and statistical sample
Used data in this research include daily return, daily volume, trading day’s number and deals price that are extracted by referring Tehran stock exchange website. In this research we investigate data using descriptive statistical methods such as mean and standard deviation that SPSS software is used in order to increasing tests accuracy and also Eviews software was used for analyzing data. The population included all accepted oil companies in Tehran stock exchange from the beginning of establishment of Stock Exchange up to now. Active oil companies in Tehran stock exchange in this research from 3/21/2011 to 3/20/2014 were selected considering below criteria as research sample:

1. Needed information including financial and non-financial will be available.
2. Because of comparison ability increase, their fiscal period will end to Esfand (March).
3. Considered companies will be traded at least 100 days of year and this condition is from important conditions that researchers such as Amihud emphasize on it.
Table 1 considered oil companies in sample

<table>
<thead>
<tr>
<th>No</th>
<th>Company sign</th>
<th>Name of company</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Sheneft</td>
<td>Pars oil</td>
</tr>
<tr>
<td>2</td>
<td>Shobehran</td>
<td>Behran oil</td>
</tr>
<tr>
<td>3</td>
<td>Vanaft</td>
<td>Oil Industry Investment</td>
</tr>
<tr>
<td>4</td>
<td>Shabandar</td>
<td>Bandar Abbas Oil Refining</td>
</tr>
<tr>
<td>5</td>
<td>Shabriz</td>
<td>Tabriz Oil Refining</td>
</tr>
<tr>
<td>6</td>
<td>Shepna</td>
<td>Isfahan Oil Refinery</td>
</tr>
</tbody>
</table>

Before anything we have to identify data in terms of panel or money. There are two possible moods here: our data are money one that must be estimated using the method of common effects or they are panel that must be estimated using one of two methods of fixed effects or random effects (Ezatollah Lotfi, 2012).

Panel data is the combination of cross-sectional and time-series data that is the relevant information to cross-sectional data are observed over time. These data have two aspects that one of them is related to different units in each special time section and the other one is related to time.

Considering that in money data companies are changed randomly annually, the current research’s data are panel because they are fixed over a year.

**Variables and research model**

Dependent variable is stock return and independent variable includes liquidity risk, company size and book value ratio to market value in this research.

**Fama and French model**

Fama and French model is used in this research for forming portfolio through measuring and book value to market value of each company but also market risk factor and the lack of liquidity factor will be added too.

There for schematic model of research is as follows:

\[
5-1 \quad r_t - r_f = \alpha + \beta^M \text{MKT}_t + \beta^S \text{SMB}_t + \beta^H \text{HML}_t + \beta^I \text{IMV}_t + \varepsilon_t
\]

- Based on equation 5-1 the first factor is (MKT) market risk premium that is very presented Beta model by CAPM that is called market risk premium. Market risk premium is the difference between market return and without risk return rate. Market return is calculated as end overall indexminus beginning overall index divided to beginning overall index and return index without risk is interest rates on government participation papers that in this research,Interest rates on Maskan bank participation papers are considered as without risk return.
- Based on equation 5-1 the second factor (SMB) the company size following the developed method of Fama and French considering the historical inflation of asset values, logarithm of the size of the company’s assets is calculated.
- Based on equation 5-1 the third factor (HML) is the book value ratio to stock market value that each share book value is calculated in this way that all debts will be deduced from the whole asset. Whatever is obtained is divided on the number of shares that the company has published and is available for people. In this research book value is calculated from the sum of stock holders’rights division on the number of shares. Market value is calculated from division the total daily trading value on the daily trading volume.
- Based on equation 5-1 the forth factor is (IMV) the lack of liquidity that in this research Amihud lack of liquidity is used. Because of below reasons we have used Amihud: first this criterion has strong theoretical attraction and secondly this criterion’s computational data are relatively available. The way of its calculation is as follows:
The Relationship between Liquidity Risk

\[ \text{ILLIQ}_{it} = \frac{1}{D_{it}} \sum_{d=1}^{D_{it}} \frac{|R_{idt}|}{V_{idt}} \]

ILLIQ: The lack of liquidity
\( D_{it} \): The number of days of trading on the stock \( i \) in month \( t \)
\( R_{idt} \): Returns \( i \) on day \( d \) in month \( t \)
\( V_{idt} \): Share \( i \) trading volume on day \( d \) in month \( t \)

**Research findings**

**Hausman test**
Hausman test has asymptotic chi-square distribution (chi) and the first assumption of this test shows that there is a significant difference in estimating coefficient of two fixed effects and random effects methods. In case of accepting the null hypothesis, random effects method is used and in case of accepting the one hypothesis, fixed effects are used.

Null hypothesis: there isn't significant difference in two methods' estimating coefficient.
One hypothesis: there is significant difference in two methods' estimating coefficient.

Table 2- the results of hausman test for choosing random or fixed effects

<table>
<thead>
<tr>
<th>p-value</th>
<th>Freedom degree(chi-sq)</th>
<th>The value of the test statistic(\chi^2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.477</td>
<td>4</td>
<td>3.504</td>
</tr>
</tbody>
</table>

According to table 6-1, the level of test significance is 0.477. This value is less than \( \alpha \) in error level of 5% as result Hausman statistics implies that the most suitable method for estimating model in random method panel data.

**Model estimation and review research hypotheses**

**Estimation using random-effects model**
One of regression assumptions is errors’ independency from each other. In order to checking errors' independency Watson Durbin test is used. If the statistics of Watson Durbin is not placed in distance of 1.5 to 2.5 there will be correlation among errors. Therefore regression analysis is not reliable for data. In the case of autocorrelation we can use one or a combination of below methods for removing autocorrelation.

1- We obtain Independent variable lag and use them instead of previous independent auto variables in regression.
2- Obtain dependent variable lag and use it as previous dependent auto variable besides other dependent variables.
3- Use the first difference of variables that is \( \Delta X_i = X_i - X_{i-1} \)

It is noticeable that the meaning of Lag is a function that set the value of variable in one period equal to previous period or periods.

First model estimation was done based on dependent and independent variables in this research and considering lack of exposure within acceptable parameters Watson Durbin, method 1 and 2 were used in combination in order to remove current autocorrelation.
Table 3: The results of model estimation with random effects method

<table>
<thead>
<tr>
<th>Variables and Intercepts</th>
<th>Lag</th>
<th>Coefficients</th>
<th>T statistics</th>
<th>P-value</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept α</td>
<td>0</td>
<td>-1.344</td>
<td>-0.037</td>
<td>0.97</td>
<td>Disapproval</td>
</tr>
<tr>
<td>Company size β^s</td>
<td>0</td>
<td>0.009</td>
<td>0.003</td>
<td>0.996</td>
<td>Disapproval</td>
</tr>
<tr>
<td>Book value to market value β^h</td>
<td>-2</td>
<td>4.357</td>
<td>2.079</td>
<td>0.039</td>
<td>Confirm</td>
</tr>
<tr>
<td>Market risk premium β^m</td>
<td>0</td>
<td>85.267</td>
<td>6.222</td>
<td>0.00</td>
<td>Confirm</td>
</tr>
<tr>
<td>The lack of liquidity β^l</td>
<td>-1</td>
<td>-145.156</td>
<td>-7.787</td>
<td>0.00</td>
<td>Confirm</td>
</tr>
<tr>
<td>Return y</td>
<td>-1</td>
<td>0.137</td>
<td>2.058</td>
<td>0.04</td>
<td>Confirm</td>
</tr>
</tbody>
</table>

R^2 = 0.20, R^2 = 0.18  
prob = 0.000001, F = 8.62

DW = 1.99

According to above picture the value of R^2 determiner coefficient shows that 20% of dependent changes are explained by independent variables. Statistics F and p-value show the lack of enough evidences for rejecting the linear relationship between dependent and independent variables in error level of 5% and as result the significance of the model. The value of Watson Durbin of this test is 1.99 shows that model are placed in lack of autocorrelation area.

The main hypothesis of research

Null hypothesis: the effect of the lack of liquidity variable coefficient is not significant in model.
One hypothesis: the effect of the lack of liquidity variable coefficient is significant in model.

According to table 3 the significance level of the lack of liquidity is 0.00 previous month. Considering this value is less than α in error level of 5% therefor null hypothesis is rejected and one hypothesis based on that the effect of the lack of liquidity variable coefficient is significant in model is accepted.

The first sub-hypothesis

Null hypothesis: the effect of company size variable coefficient is not significant in model.
One hypothesis: the effect of company size variable coefficient is significant in model.

According to table 3 the significance level of the company size is 0.996. Considering this value is more than α in error level of 5% therefor null hypothesis and one hypothesis based on that the effect of company size variable coefficient is not significant in model, are accepted.

The second sub-hypothesis

Null hypothesis: the effect of book value to market value variable coefficient is not significant in model.
One hypothesis: the effect of book value to market value variable coefficient is significant in model.

According to table 3 the significance level of book value to market value is 0.039 two months ago. Considering this value is less than α in error level of 5% therefor null hypothesis is rejected and one hypothesis based on that the effect of the book value to market value variable coefficient is significant in model, is accepted.

The third sub-hypothesis

Null hypothesis: the effect of market risk premium variable coefficient is not significant in model.
One hypothesis: the effect of market risk premium variable coefficient is significant in model.

According to table 3 the significance level of market risk premium is 0.000. Considering this value is less than α in error level of 5% therefor null hypothesis is rejected and one hypothesis based on that the effect of the market risk premium variable coefficient is significant in model, is accepted.

Considering the level of confidence, intercept variables and the size of these two variables are ineffective in model.
Therefor the final fitted regression model will be as follows through random effects method:

\[ R_{t} - R_f = \frac{1}{344} + 0.009 \text{SMB} + 4.35 \text{HML} + 85.267 \text{MKT} - 145.156 \text{IMV} + \epsilon_t \]

As you can see in fitted table the coefficients of market risk premium, book value to market value are positive and show the direct and significant relationship among these variables and stock return. Also there is an inverse relationship between the lack of liquidity and stock return.

**Normality of residual sentences test**

Studied hypothesis for testing normality of variables for the time period of 2011 to 2013 is done using statistics test Jarque-Bera:

Null hypothesis: errors distribution is normal.
One hypothesis: errors distribution isn't normal.

<table>
<thead>
<tr>
<th>Skewness</th>
<th>Kurtosis</th>
<th>Jarque-Bera</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.275</td>
<td>3.4900</td>
<td>3.777</td>
<td>0.151</td>
</tr>
</tbody>
</table>

According to table 6-6 the level of confidence is 0.151. This value is more than \( \alpha \) in error level of 5%. So null hypothesis based on that errors distribution is normal won’t be rejected and errors distribution will be normal.

**Conclusion**

**Research main hypothesis**

The effect of the lack of liquidity is significant in model. According to table 6-2, statistics f value and p-value show the significance of the lack of liquidity coefficient in model. The obtained results of data analysis show the significant relationship between liquidity risk and return. In spite of research default that was based on direct relationship between risk and return, negative coefficients of lack of liquidity in model represents the inverse relationship between these two variables. The reasons of this inverse relationship can be:

1. Studied period of this research is 2011 to 2013 that in this time exchange Organization’s attempt in order to Install Internet and online transactions have caused a number of countless investors’ entry to this field. Investors, who have entered this field because of the lack of needed training with getting return from shares’ prices changes intention, invaded to shares with high liquidity and violate more return for more risk rule.
2. Since stock return of each period has formed from two sections (price increase and cash earnings at the end of each period), so based on mentioned reasons in case 1, the most return section of each share will be at the end of relevant period to price changes that as mentioned before because of increasing the number of traders is fluctuating.

In this part sub-hypotheses of research are discussed and compared with similar studies:

The first sub-hypothesis: the effect of company size variable coefficient is significant in model. According to table 3 statistics f and p-value represent the lack of significant relationship between company size and stock return. This means that economic scale of companies is big or small is not effective on stock return and from investor’s point of view big and small companies are trustable equally. This equation studied by Fama and French in 1996 as well. During their experiments they concluded that there is a negative relationship between size and stock return. Marshal and Yung in 2003 investigated the relationship between liquidity and stock return and the used company size in their model and concluded that the effect of company size on stock return has been negative.

The second sub-hypothesis: the effect of book value to market value variable coefficient is significant in model. According to table 3 statistics f and p-value represent the significant coefficient of book value to market value in model. Therefor there is a positive significant relationship between book value ratio to market value and stock return. This represents the significance of book value to market value in stock return.

The third hypothesis: the effect of market risk premium variable coefficient is significant in model. According to table 3 statistics f and p-value represents the significance of
market risk premium in model. Therefore there is a positive significant relationship between market risk premium and stock return. This shows the importance of market risk premium in stock return.

Policy implications
- The result of researches such as this one because of the importance of making optimal decisions and assets pricing can be used in efficient allocation of financial resources in banks, institutions and financial organizations and investing.
- According to first hypothesis in present study the company size isn’t effective on stock return. So investors are recommended to pay attention factors such as book value to market value and market risk premium that their significant relationship with return in sub-hypotheses 3 and 4 in order to invest in high-yield companies.
- The existence of knowledge and investing experience of investors cause their better understanding from risk and return relationship and make more accurate decisions. So they are recommended to be trained efficiently before entering stock for investing in this field.

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