The Effect of Liquidity Risk on the Pricing of Capital Assets in Companies Admitted to Tehran Stock Exchange

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Abstract: One of the risks associated with company stocks is stock liquidity. Stock companies with high liquidity are attractive for shareholders and investors and increase demand. Increasing the attractiveness and demand for company stocks makes it easy and inexpensive to finance and increase capital for company development. In addition, it reduces the expected returns of the shareholders. Therefore, the purpose of this study is to investigate the effect of liquidity risk on capital asset pricing in companies active in the stock market. In order to achieve this goal, a cross-sectional model has been used for the period of 2009-2014 annually and the effect of liquidity risk on two capital asset pricing models and a modified asset pricing model in 130 listed companies in Tehran Stock Exchange. The non-liquidity criterion has been used by amihud as a liquidity risk agent. Data were analyzed using combination of data and least squares regression. The diagnostic test in combined data (Chow & Hausman) suggests the use of a bound pattern for estimating the regression model. The results of regression model estimation showed that Liquidity risk does not have a significant effect on the pricing of capital assets, while a meaningful relationship was established with the pricing of adjusted capital assets.

Keywords: Capital Asset Pricing Model, Adjusted Model, Capital Asset Pricing, Stock Return, Non-Liquidity Ratio

Introduction

There is a steady principle in the investment culture that capital is risk averse and tends towards profitability. That's why refinners risk refusing to bring their capital to risk and risk or an uncertain horizons against their profits and capital. But can one find a place that does not risk investing in it? There is a risk and risk of giving up the principle of capital everywhere, some investments are high risk and some are low risk. Given the risk level and risk of investing, the investor has expectations of appropriate returns and returns. Typically, investors, by their financial analysis, are seeking returns proportional to the risks involved. In a conventional market where market agents have information, high returns will always have a higher risk. This leads to always making investment decisions based on the relationship between risk and returns and an investor always has two risk factors and returns in analyzing and managing his portfolio of investments. In other words, investment as a financial decision always has two components of risk and return that provides the exchange of these two different combinations of investment.

Theoretical Research

Variables and How to Measure it

Independent Variable: Liquidity Risk

How to Calculate Liquidity Risk: Equity Non-Cash Equity (Ci)

One of the new models used to calculate liquidity is the "Amiest Model." The amiest model that measures liquidity is the average ratio of the volume of the transaction to the absolute value of the return. However, given that the purpose of this study is to measure the lack of liquidity (and the risk of non-liquidity), the other (and even newer) criterion, called ILLIQ, will be used, which, in addition to being very similar to the American standard, most of the agents involved in the liquidity, namely the volume of the transaction, the supply and demand gap, and the number of days traded in the stock. ILLIQ, introduced in 2002 by Amihud, is calculated from the following formula:

\[ ILLIQ_t = \frac{1}{\text{Days}_t} \sum_{d=1}^{\text{Days}_t} \frac{R_{id}}{V_{td}} \]

In which \( R_{id} \) and \( V_{id} \) are equal to the yield and volume of the Rial (to millions) on day \( d \) from year \( t \), and \( \text{Day}_t \) is equal to the number of days traded in stock i in year t (Rahnamay Rudposhti & et al., 2009).
Market Insolvency ($C_m$)

In this research, the ambiguity method is used to obtain market liquidity, which is used by the following formula:

$$ILLIQ^m_t = \frac{1}{Days^m_t} \sum_{d=1}^{Days^m_t} \left( \frac{R^m_{td}}{V^m_{td}} \right)$$

Where $R_i$ and $V_i$ are equal to the yield and volume of the rial (in million) on day $d$ from year $t$, and $Days^m_t$ is equal to the number of days traded in stock $i$ in year $t$ (Rahnamay, Rudposhti & et al., 2009).

Dependent Variables

Stock Returns

Calculating Stock Returns: In this research, we use the following methods to calculate stock returns:

Calculating returns using capital asset pricing model

William Sharp has proposed the following relationship to calculate returns in the form of capital asset pricing model:

$$E(r_i) = r_f + \beta (r_m - r_f)$$

The variables in the above relationship are:

- $E(r_i)$: asset return $i$
- $r_f$: risk-free return rate
- $r_m$: market returns
- $\beta$: Systematic Risk Measurement

Calculation of returns using the adjusted capital asset pricing model

Given the new relationship noted in the beta calculation in this paper, the calculation of return on capital asset pricing model is subject to change, in this sense, since this paper intends to examine the effect of liquidity risk on capital asset pricing model, therefore, we should introduce this risk into some kind of model and see its result on the model.

Acharya and Pedersen achieved the new model by adding non-liquidity costs ($C_i$) to the aforementioned model. By deducting the cost of non-liquidity from the obtained and expected returns, we will look at a model similar to the one below. If $\lambda = r_m - r_f$, we will have:

$$E(r_i) = r_f + E_t(C_i) + \frac{\lambda \cdot \text{cov}(r_i, r_m)}{\text{Var}(r_m - c_m)}$$

In the above equation, relationships are:

- $C_i$: Lack of stock liquidity; $i$
- $C_m$: Lack of market liquidity
- $E_t(C_i)$: The average non-liquidity of stock $i$ in year $t$
- Other variables are similar to those of capital asset pricing models.

Systematic Risk Coefficient Calculator (Beta)

Systematic risk factor (beta) is the risk of a financial asset or a set of financial assets that is derived from the market risk of the market. To calculate the systematic risk, the beta index is used, which is the result of the covariance of $i$ and market return on market variance (Kapalan, 2007). The traditional beta is calculated on the Tehran Stock Exchange, but the moderation beta must be obtained by considering the liquidity risk.

The beta is calculated by the formula:

$$\beta = \frac{\text{cov}(r_i, r_m)}{\text{Var}(r_m)}$$

One of the drawbacks to the traditional beta (standard) is that it does not take into account liquidity. The beta modifier is the only difference with the standard beta that this beta also includes liquidity risk. According to the above, the beta is calculated as follows:

$$\text{Adj} - \beta = \frac{\text{cov}(r_i, r_m)}{\text{Var}(r_m)}$$
Control Variables
SIZE: The logarithm of the company's stock market value in year t. This variable controls the size of small and large companies in the sample.

The ratio of book value to market value (B / M): is the logarithm of a plus book value to the market value of the firm in year t. This variable is included in the model to control the effect of growth companies on non-growth companies.

Leverage (LEV): Equal to total debt to total assets.

Background Research
Fallah Shams & et al. (2014), investigated the relationship between liquidity risk and market risk with abnormal returns in the Fama and French Factor model in Tehran Stock Exchange. In this study, we eliminated the stock returns affected by SMB and HML in the Fama and French three-factor model. Also, characteristics of the company and market are considered as market risk variables and liquidity risk. The results of the research show that the model has acceptable fit.

Yahya Zade Far & et al. (2010), examined the relationship between liquidity and stock returns in Tehran Stock Exchange. In this research, the relationship between stock exchange rate as a liquidity criterion and return on equity in Tehran Stock Exchange during the period from 2002 to 2008 has been investigated. The time series data are collected annually through a combination of data (panel) and analyzed by Eviews software. In this regard, after testing the relationship between the two variables, the size and book value variables into the market value as the control variables entered into the model. This may be due to an increase in the attractiveness of the cash-settled stock and an increase in demand for such stocks.

Bidgoli and Sarang (2007), research on porcelain selection using three criteria of average return, standard deviation of return and liquidity in Tehran Stock Exchange. The two tried to integrate the liquidity criterion as one of the most important criteria for investors in the portfolio creation process. In this regard, they used two liquidity filtering approaches and liquidity constraints to integrate liquidity. The research has shown that in many cases, even simple forms of liquidity-based portfolio optimization can have great benefits in reducing the risk of liquidity of a portfolio of investors (and without losing a significant amount of expected returns per unit of risk). The comparison between these two approaches showed that, overall, the results of the liquidity limitation approach are much more attractive and better than liquidity filtering approach. In other words, high-level liquidity is effective on investor decisions and thus affects the boundaries of work.

Lashoski and Veronkova (2012), examined whether stock liquidity along with company size and value was one of the important factors influencing stock returns. The results of their studies show that, unlike what is expected, stock liquidity is not significantly affected by stock returns compared to stock value and size of the company.

Sadka (2011), examined the relationship between stock liquidity and accounting information in the New York Stock Exchange. In his research, he showed that by reducing the risks associated with accounting information through increased quality and reliance on accounting information, the company's shares are reliant and attractive, and ultimately lead to increased stock liquidity.

Narayan and Zheng (2010), have conducted research as the market liquidity risk factor and financial market anomalies. The results indicate that the Fama and French models are not only able to capture the efficiency of the past four of the four factors.

Gopalan & et al. (2009), also suggested a positive relationship between the liquidity of a company's assets and its stock liquidity. They argued that this relationship depended on market expectations regarding the arrangement of the company's liquid assets. In their research, it was assumed that stock liquidity is relevant to managerial decisions such as investment and finance that change the liquidity of company assets. Their criteria for stock liquidity were Amihud's benchmark, the price gap for buying and selling, the average price gap for buying and selling, and zero returns. For asset liquidity, the combination of assets is given in terms of liquidity rating from zero to one, and their weighting is calculated and used as asset liquidity criterion. They concluded that an increase in one unit in assets would increase the firm's liquidity by 14.5%.

Martinezento and Taipa (2005), examined the pricing of assets and the risk of systematic liquidity in the Spanish market that systematic liquidity has an effective impact on the behavior of financial market factors. They examine three important criteria for liquidity (Pastur and Stambagh (2003) criteria) The return on the bid price changes and the benchmark provided by Amihud significantly improves the model of asset fluctuation and is preferred to other liquidity criteria.

Langstof (2005), explores the role of the lack of liquidity in asset pricing. In this research, it has been stated that a liquid asset can be worth 25% more than a non-recapital asset. Equity cash flow shows that the expected returns and the price volatility of an asset could significantly increase the liquidity of the asset.
Research Method

The research methodology is a set of authoritative (reliable) and systematic rules, tools and paths for investigating facts, identifying uncertainties and finding solutions to problems. Based on the nature and method, scientific research can be divided into five groups of historical research, descriptive, correlation or consistency, (post-event) and experimental (experimental) (Hafeznia, 2006). The methodology of this research is as follows:

Research method from the perspective of the target

This research is, in terms of purpose, of applied research. Applied research is an attempt to find an answer to solve a problem and practical problem that exists in the real world. In fact, it is a research applied research, which is real information, and various statistical methods are used to reject or not reject the hypotheses and are in the field of theoretical theory. And its results can be useful for different groups of accountants and experts and users of financial statements. The data are analytical and quasi-experimental-post-event. Because it analyzes the actual data. The data of this research is of a quantitative nature because of the financial statements published in the Stock Exchange database. This research is based on the deductive-inductive arithmetic (induction from partial to total reach) the present study is a time-series cross-sectional study. Because sample companies are being investigated at different times.

Society, Statistical Sample and Sampling Method

The statistical population of this research is composed of all companies accepted in Tehran Stock Exchange in the period from March 2009 to March 29, 2015. The total number of these companies was 495 companies. In this research, the sample of companies was selected by systematic elimination method of 130 companies.

Research Hypotheses

First Hypothesis: Liquidity risk affects shareholders’ purchases.

Second Hypothesis: Liquidity risk affects stock returns.

Test of Research Hypotheses

First Hypothesis: Liquidity risk influences capital asset pricing.

Sub-Hypothesis 1-1: Liquidity risk affects the pricing of capital assets based on the stock returns model of capm method.

\[ \text{CAPM}_{i,t} = \alpha_0 + \beta_1 \text{ILLIQ}_{i,t} + \beta_2 \text{SIZE}_{i,t} + \beta_3 \text{B/M}_{i,t} + \beta_4 \text{LEV}_{i,t} \]

Sub-hypothesis 1-2: Liquidity risk affects the pricing of capital assets based on the return on equity model by the Adj-Capm method.

\[ \text{ADJ-CAPM}_{i,t} = \alpha_0 + \beta_1 \text{ILLIQ}_{i,t} + \beta_2 \text{SIZE}_{i,t} + \beta_3 \text{B/M}_{i,t} + \beta_4 \text{LEV}_{i,t} \]

Table 1. Results of the regression test using fixed effects method

<table>
<thead>
<tr>
<th>Sig.</th>
<th>T</th>
<th>The standard error</th>
<th>Coefficient</th>
<th>Variable</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.794</td>
<td>0.260</td>
<td>0.039</td>
<td>0.00086</td>
<td>ILLIQ</td>
</tr>
<tr>
<td>0.0011</td>
<td>3.27</td>
<td>0.094</td>
<td>0.308</td>
<td>SIZE</td>
</tr>
<tr>
<td>0.00</td>
<td>-50.76</td>
<td>0.079</td>
<td>-0.455</td>
<td>B/M</td>
</tr>
<tr>
<td>0.00</td>
<td>-13.74</td>
<td>0.034</td>
<td>-0.478</td>
<td>LEV</td>
</tr>
<tr>
<td>0.192</td>
<td>-1.304</td>
<td>0.236</td>
<td>-0.308</td>
<td>C</td>
</tr>
<tr>
<td>0.764</td>
<td></td>
<td></td>
<td></td>
<td>The coefficient of determination</td>
</tr>
<tr>
<td>0.716</td>
<td></td>
<td></td>
<td></td>
<td>Adjusted coefficient</td>
</tr>
<tr>
<td>(0.00)/1574</td>
<td></td>
<td></td>
<td></td>
<td>F statistics (F-statistic)</td>
</tr>
<tr>
<td>1.94</td>
<td></td>
<td></td>
<td></td>
<td>Watson Camera Test</td>
</tr>
</tbody>
</table>

The results of Table (1-2) show that in this hypothesis, the data has been sorted in a composite method. Also, the results of the Hausman test have been used to estimate the model of this hypothesis using a fixed cross-sectional method.

The results of the Watson camera (1.94) indicate that the errors of the variables are independent of each other. In this table, we see that the value of the coefficient of determination is 0.764, which suggests that the model is based on independent variables of 76%. On the other hand, the significance level of the Fisher test shows that the model in general is meaningful in this hypothesis. It is seen in this table that the t-test for the liquidity risk variable is greater than 0.05 (0.794), which indicates that the dependent variable (returns) is not affected. Therefore, the assumption H0 is confirmed and the assumption of H1 is rejected. As a result, it can be said that the liquidity risk on capital asset pricing is not affected by the CAPM method based on stock returns model.

Sub-hypothesis 1-2: Liquidity risk affects the pricing of capital assets based on the return on equity model by the Adj-Capm method.
Table 2. The results of regression test using constant effects method

<table>
<thead>
<tr>
<th>Sig.</th>
<th>T</th>
<th>The standard error</th>
<th>Coefficient</th>
<th>Variable</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.00</td>
<td>13.84</td>
<td>0.0160</td>
<td>0.222</td>
<td>ILLIQ</td>
</tr>
<tr>
<td>0.00</td>
<td>5.5</td>
<td>0.444</td>
<td>2.44</td>
<td>SIZE</td>
</tr>
<tr>
<td>0.00</td>
<td>-5.12</td>
<td>0.373</td>
<td>-1.91</td>
<td>B/M</td>
</tr>
<tr>
<td>0.037</td>
<td>-2.088</td>
<td>0.164</td>
<td>-0.343</td>
<td>LEV</td>
</tr>
<tr>
<td>0.094</td>
<td>-1.67</td>
<td>1.118</td>
<td>-1.87</td>
<td>C</td>
</tr>
<tr>
<td>0.394</td>
<td></td>
<td></td>
<td>The coefficient of determination</td>
<td>0.394</td>
</tr>
<tr>
<td>(0.00)3.15</td>
<td></td>
<td></td>
<td>Adjusted coefficient statistics (F-statistic)</td>
<td>0.269</td>
</tr>
<tr>
<td>2.2</td>
<td></td>
<td></td>
<td>Watson Camera Test</td>
<td>(1.86)</td>
</tr>
</tbody>
</table>

The results of table 1 showing that in this hypothesis, as in the previous hypothesis, the data has been sorted in combination. Also, the results of the Hausman test have been used to estimate the model of this hypothesis using a fixed cross-sectional method.

The results of the Watson camera (2/2) indicate that the errors of the variables are independent of each other. In this table we see that the value of the coefficient of determination is 0.394, which indicates that the model is preferred by independent variables of 39%. On the other hand, the significance level of the Fisher test shows that the model in general is meaningful in this hypothesis. It is seen in this table that the t-test for the liquidity risk variable is less than 0.05 (0.00), which indicates that the dependent variable (returns) is affected, so the assumption H0 is rejected and the assumption H1 is confirmed. As a result, liquidity risk affects the pricing of capital assets based on the return on equity model by Adj-Capm method.

Relationship (1) Estimated model of sub hypothesis 1-2
ADJ-CAPM_{t,i} = -1/87+0/222 ILLIQ_{i,t}+ 2/44 SIZE_{i,t} 1/91 B/M_{i,t}-0/343 LEV_{i,t}

The Second Main Hypothesis: Liquidity risk affects stock purchasing.
SOLD STOCK_{i,t} = \alpha + \beta_1 ILLIQ_{i,t}+\beta_2 SIZE_{i,t}+\beta_3 B/M_{i,t}+ \beta_4 LEV_{i,t}

Table 3. The results of the regression test using fixed effects method

<table>
<thead>
<tr>
<th>Sig.</th>
<th>T</th>
<th>The standard error</th>
<th>Coefficient</th>
<th>Variable</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.00</td>
<td>-14.28</td>
<td>0.053</td>
<td>-0.758</td>
<td>ILLIQ</td>
</tr>
<tr>
<td>0.00</td>
<td>11.87</td>
<td>1.46</td>
<td>17.44</td>
<td>SIZE</td>
</tr>
<tr>
<td>0.00</td>
<td>-3.92</td>
<td>1.23</td>
<td>-4.85</td>
<td>B/M</td>
</tr>
<tr>
<td>0.00</td>
<td>-3.59</td>
<td>0.543</td>
<td>-1.95</td>
<td>LEV</td>
</tr>
<tr>
<td>0.00</td>
<td>-6.56</td>
<td>3.69</td>
<td>-24.26</td>
<td>C</td>
</tr>
<tr>
<td>0.831</td>
<td></td>
<td></td>
<td>The coefficient of determination</td>
<td>0.831</td>
</tr>
<tr>
<td>(0.00)23.96</td>
<td></td>
<td></td>
<td>Adjusted coefficient statistics (F-statistic)</td>
<td>0.796</td>
</tr>
<tr>
<td>1.86</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The results of Table 2 show that in this hypothesis, as in the previous hypothesis, the data has been sorted in combination. Also, the results of the Hausman test have been used to estimate the model of this hypothesis using a fixed cross-sectional method.

The results of the Watson camera (1.86) indicate that the errors of the variables are independent of each other. In this table we see that the coefficient of determination is equal to 0.831, which indicates that the model is preferred by independent variables of 83%. On the other hand, the significance level of the Fisher test shows that the model in general is meaningful in this hypothesis. It is seen in this table that the t-test for the liquidity risk variable is less than 0.05 (0.00), which indicates that the dependent variable (stock purchasing volume) has been affected. Therefore, the assumption H0 is rejected and the assumption H1 is verified. As a result, liquidity risk affects the shareholder's purchasing power.
Relationship (2): Estimated model of the second main hypothesis

\[ \text{SOLD STOCK}_{i,t} = -0.758 + 17.44 \text{ILIQ}_{i,t} + 17.44 \text{SIZE}_{i,t} - 4.85 \text{B/M}_{i,t} - 1.95 \beta_4 \text{LEV}_{i,t} \]

The third main hypothesis: Liquidity risk influences stock returns.

Table 4. Summary of hypothesis testing results

<table>
<thead>
<tr>
<th>Hypothesis</th>
<th>Result</th>
<th>Phrase</th>
<th>Hypothesis</th>
</tr>
</thead>
<tbody>
<tr>
<td>First sub-hypothesis</td>
<td>Reject</td>
<td>Liquidity risk affects the pricing of capital assets based on the equity returns model of the Capm method.</td>
<td>First sub-hypothesis</td>
</tr>
<tr>
<td>Second sub-hypothesis</td>
<td>Confirmation</td>
<td>The liquidity risk affects the pricing of capital assets based on the return on equity model by the Adj-Capm method.</td>
<td>Second sub-hypothesis</td>
</tr>
<tr>
<td>The main hypothesis</td>
<td>Confirmation</td>
<td>Liquidity risk affects shareholder purchases.</td>
<td>The main hypothesis</td>
</tr>
</tbody>
</table>

Analysis of test results of hypotheses

In this research, before testing the hypotheses, first, the status of normal, consistency of variance and data sorting method were tested. The results showed that the data are not normal distribution. And the variables are stable and there is no inconsistency of variance. The panel method was tested by constant assumptions.

To estimate the sub-hypothesis model, which states that liquidity risk affects the pricing of capital assets based on the capm model, based on the stock returns model, Considering the meaningfulness of the Lermer test and the lack of significance of the Hausman test, the panel method with fixed effects of this hypothesis model is estimated. Table 1 shows that liquidity risk was not able to influence the pricing of capital assets based on the capm model of stock returns. So the results of this hypothesis showed that the liquidity risk could not be linked to the pricing of capital assets. As a result, liquidity risk on capital asset pricing is not affected by capm model based on stock returns model.

To estimate the sub-second hypothesis model, which states that liquidity risk affects the pricing of capital assets based on the stock returns model, Adj-Capm method. Considering the meaningfulness of the Lermer test and the lack of significance of the Hausman test, the panel method with fixed effects of this hypothesis model is estimated. In Table 2 liquidity risk was able to influence the pricing of capital assets based on the return on equity model by the Adj-Capm method. The results of this hypothesis showed that the liquidity risk could be correlated with the pricing of capital assets based on the return on equity model of the Adj-Capm method.

Table 5. Comparison of the results of the research with similar research

<table>
<thead>
<tr>
<th>Hypothesis</th>
<th>Result</th>
<th>Phrase</th>
<th>Hypothesis</th>
</tr>
</thead>
<tbody>
<tr>
<td>The main hypothesis</td>
<td>Reject</td>
<td>Sub-hypothesis 1-1: Liquidity risk affects the pricing of capital assets based on the equity return model of the Capm method.</td>
<td>The main hypothesis</td>
</tr>
<tr>
<td>The second main hypothesis</td>
<td>Confirmation</td>
<td>Hypothesis 2-1: Liquidity risk affects the pricing of capital assets based on the return on equity model by the Adj-Capm method.</td>
<td>The second main hypothesis</td>
</tr>
</tbody>
</table>
Total Resulting

With regard to all the materials mentioned and the tests conducted on the main hypothesis of this research that the effect of liquidity risk on the pricing of capital assets can be concluded that this assumption was assured with a confidence of 95%. That is, liquidity risk affects the pricing of capital assets. Meanwhile, the results of the tests with 95% indicate that the performance of the adjusted capital asset pricing model in which the lack of liquidity of the assets is taken into account. In other words, the Adjusted-CAPM model has a higher predictive power compared to the CAPM model. According to the tests, liquidity risk has a negative and significant relationship with shareholder purchases. That is, with the increase in the liquidity risk of stock, the amount of stock trading decreases. Also, according to the results of liquidity risk, there is a direct relationship with the expected return on equity. This means that a higher real non-liquidity leads to higher expected returns, which in turn increases the expected return rate. Stock liquidity creates a high degree of information efficiency, shareholders are moving into markets that have high market liquidity and are motivated to buy stocks of companies with a high share of their free float. These two characteristics of the market help attract investors and increase their satisfaction, as a result of market growth and development. Therefore, one of the criteria for deciding on investing in general securities is the liquidity of those bonds, with the tangible significance of this criterion increasing the value of dealing with it.

References

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