

Full Length Research Paper

Relationship between stock liquidity and stock price changes rate

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Accepted 27 August, 2012

The relationship between stock liquidity and price change was researched in this paper by using data collected from Tehran Stock Exchange July to September 2010. Since this ratio could make a separation between the trading behaviors, it is important for the stock market authority to consider in assessing the market. Hypotheses were examined through correlation test about daily and monthly data. A correlation coefficient measures the strength and direction of a linear association between two variables. It ranges from -1 to +1. The results showed a significant relation between daily liquidity and price changes of stocks. In addition, significant relation was found between monthly liquidity and price changes of stocks. T student test showed positive but low correlation between liquidity and price change rates.

Key words: Stock liquidity, stock price changes, average value of ask/bid, average inter arrival rate.

INTRODUCTION

Stocks are evaluated based on future interests and confidence in the interests in Tehran Stock Exchange. The higher confidence in future interests, the less risk of losing investments. Some investors tend to evaluate probability of insolvency at any time, thus stocks with higher liquidity are more interesting. This is indeed the reason of many surveys on liquidity.

Transferable bonds can be turned into cash in stock market with reasonable price, though there is no guarantee of any loss. Money market is known as a tool which can replace with cash. Experienced investors apply liquidity factor along with other factors to discover real price and changes. Accumulated liquidity measurement may be used to predict directions in stock price changes (Subroto, 2007).

Rate of accumulated liquidity measurement was applied to determine market changes (Subroto, 2007). This is to say stocks with high liquidity attract more prices go up and thus liquidity becomes higher (as people investors. Also, in other side it might just as well be that show the stocks more interest). When this happens,

sellers grab their chance and ask higher. The vice versa is held true when liquidity of stock is low and consequently there is no tendency to bid higher, which means price goes down. However, there are other factors to affect price change. The hypotheses of this paper survey daily and monthly data. So with regard to the views of shareholders is useful to use dividends from stock price changes in the short term. Sometimes other reasons such as political or economical factors affects on these relations.

Research data includes first and second bids, first and second asks and agreed prices by Stock Market Technology Management. Correlation method was applied to test hypothesis by using data of a 6 months period in 2010 (July to December). The hypotheses are:

H₁: There is a significant relation between monthly liquidity changes percentage and monthly price changes percentage.

H₂: There is a significant relation between daily liquidity changes percentage and daily price changes percentage.

The object of this paper is to survey if there a significant relation between monthly (daily) liquidity changes percentage and monthly (daily) price changes percentage or not. Liquidity of assets is important for stock holders.

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To put it in simple way, liquidity is an index to attract purchasing and selling of assets. Prior study of Subroto (2007) measured liquidity of stocks by using sale and purchase value based on input rate at cut off point and utilized multinomial logistic method to plot market moves. The research, indeed, was about alternatives to measure liquidity of stocks by using average value of sale/purchase by input rate in Jakarta stock market. The survey made it clear that accumulated liquidity measurement rate may be used to plot stock market moves. The rate is also significant to find whether stock transaction is usual or not.

Population of the research is all companies in Tehran Stock Market since 21 April, 2010. Sample size was determined through Cochran's Relation. This relation is used for the determination of sample and is as follows:

$$n = \frac{z^2 pq}{d^2}$$

Ninety-six companies were adopted as participations classified based on their industry. Data has been from Tehran Securities Exchange Technology Management Co.

LITERATURE REVIEW

Subroto (2007) measured liquidity of stocks by using balanced sale and purchase value based on input rate at cut off point and utilized multinomial logistic method to plot market moves. The research was about alternatives to measure liquidity of stocks by using average value of balance sale/purchase by input rate in Jakarta stock market. The survey made it clear that accumulated liquidity measurement rate may be used to plot stock market moves. The rate is also significant to find whether stock transaction is natural or not. Results of the test in Indonesia and for the term of study showed that 30% of transaction is unusual, and stock price in Jakarta was growing and bided less by purchasers.

Deuskar (2006) introduced a model to survey liquidity and volatility of stock price and argued that high volatility brings in high risk revenue and with low return rate of riskless assets resulted from low return rate of current assets as market liquidity is low. He also concluded that low liquidity foster supply shock. Dey (2005) surveyed effect of global market growth on liquidity and concluded, using combined regression method, that year, size, type of transaction, competition and growth rate are of important factors of liquidity. Therefore, investors expect higher return from markets with high stock turnover.

Another capital asset pricing model was introduced by Pedersen and Acharya (2005), which survey relation between expected return and liquidity of stock. They concluded that simultaneous effect of liquidity on stock return is trivial in short run and the effect grows in long

run. Omar et al. (2004) surveyed effect of liquidity on stock return in Tunisia and doing this they applied stage regression and monthly data. The result showed a negative relation between liquidity and stock return.

Marshall and Young (2003) studied relation between liquidity and stock return. Liquidity standards used by the researcher was price gap between bid and ask and turnover rate. The model also used market return and size factors and finally obtained negative effect of size factor. Chan and Faff (2003) used effect of liquidity of assets in Australia market by using stock turnover standard for assets pricing in stages. They used monthly data and controlling factors such as book value to market rate, size of company and surplus of market return. The authors used stage regression frame surveyed effect of liquidity (based on stock price turnover rate) on asset pricing in Australia market using monthly data and controlling factors such as book value to market value rate and surplus of market return.

Fallah et al. (2011) measured the relationship between liquidity risk and stock price. The results show that liquidity risk and firm size have statistically significant impacts on the stock price at the Tehran Stock Exchange, and P/E ratio (book value to market value) of companies have statistically insignificant effect on prices and further indicate the importance of liquidity and risk variables as compared to P/E and BM in pricing Tehran Stock Exchange. Salehi et al. (2011) tested the relationship between stock returns and its liquidity ability in companies listed in Tehran Stock Exchange. The findings show there is negative correlation between variables. Izadinia et al. (2011) surveyed relation between stock features of stock transactions with different indices of liquidity in Tehran stock market. Liquidity indices applied in this research are stock turnover; Amihud (1986) showed that features of stock transaction are the main factors of liquidity.

Relation between stock turnover, as liquidity standard, and stocks return in Tehran Stock Market was surveyed in a research (Yahya et al., 2010). Results of the research hinted positive and significant relation between coefficient of variable turnover rate and stock return. Mehrani and Rasaian (2009) surveyed relation between annual return of stock and liquidity factors. Results of the tests showed absence of any significant relation between stocks return and bid and ask difference, stock turnover, value of transaction, frequency and number of days of transaction. Results also showed an inconsiderable significant relation between annual return of stocks and number of days of transactions. Another survey showed companies prefer policies toward more liquidity, as it increases turnover and value of company (Mendelson and Amihud, 1986) and even affects stock price.

METHODS AND VARIABLES

First, the monthly and daily liquidity rate changes are calculated,

Table 1. Central tendency and variability of variables.

Variable	Sample	Mean	Std deviation	Skewness	Kurtpsis	Median
Monthly liquidity changes percentage	434	-1.34331	30.995432	-0.440	1.318	-0.510
Monthly price changes percentage	434	1.99530	14.319465	0.713	1.510	-0.114
Daily price changes percentage	11264	0.10249	1.622916	0.318	1.339	0.000
Daily liquidity changes percentage	11264	4.818	38.715965	0.911	1.817	0.000

after which the monthly and daily price changes are calculated. The relationship between daily liquidity changes and price changes as well as the relationship between monthly liquidity changes and monthly price changes are calculated by using the correlation.

Average value of the ask (AVA): where "Pb" is bid price and "Volb_t" is volume of transaction expressed as following equation. "n" as denominator in equations 1 and 2 is the average of orders volume (subroto, 2007):

$$\frac{\sum_{t=1}^n Pb_t - Volb_t}{n} \quad (1)$$

Average value of the bid (AVB): where "Ps" is the price preferred by the seller and "Vols_t" is volume of price obtained as follows:

$$\frac{\sum_{t=1}^n Ps_t - Vols_t}{n} \quad (2)$$

Adjusted inter-arrival rate (purchase): where "Xb" is the time it takes to place a bid order in transaction system, "n" is number of transaction. Difference between purchase orders is considered as effective factor on liquidity. Equation (3) justifies Equation (1) (n in Equations 3 and 4 is number of transactions).

$$\frac{\sum_{t=1}^n Xb_t - Xb_{t-1}}{n} \quad (3)$$

Adjusted inter-arrival rate (sale): where "Xs" is the time it takes to place an ask order in transaction system. Difference between purchase orders is considered as effective factor on liquidity. The following Equation justifies Equation (1).

$$\frac{\sum_{t=1}^n Xs_t - Xs_{t-1}}{n} \quad (4)$$

Liquidity rate is shown with inter-arrival rate: the averages obtained from Equations 1 and 2 are combined with Equations 3 and 4 and adjusted liquidity rate for each stock will be Equation 5 that is liquidity rate:

$$\frac{\frac{\sum_{t=1}^n Pb_t - Volb_t}{n}}{\frac{\sum_{t=1}^n Ps_t - Vols_t}{n}} \times \frac{\max\left(\frac{\sum_{t=1}^n Xs_t - Xs_{t-1}}{n}, \frac{\sum_{t=1}^n Xb_t - Xb_{t-1}}{n}\right)}{\min\left(\frac{\sum_{t=1}^n Xs_t - Xs_{t-1}}{n}, \frac{\sum_{t=1}^n Xb_t - Xb_{t-1}}{n}\right)} \quad (5)$$

Daily liquidity changes percentage: having daily liquidity for each share calculated, Equations (6) gives the daily liquidity changes percentage:

$$\text{Daily liquidity changes percentage} = \{(DLQ_n - DLQ_{n-1})/DLQ_{n-1}\} * 100 \quad (6)$$

where DLQ_n is liquidity of nth day and "DLQ_{n-1} is liquidity of n-1th day. The liquidity rate is obtained from Equation 5.

Monthly liquidity changes percentage: having monthly liquidity for each share calculated, Equation (7) gives the daily liquidity changes percentage:

$$\text{Monthly liquidity changes percentage} = \{(DP_n - DP_{n-1})/DP_{n-1}\} * 100 \quad (7)$$

Where MLQ_n is liquidity of nth day and "MLQ_{n-1} is liquidity of n-1th day.

Daily price change: opening and closing price of the day for each stock was applied to calculate price change:

$$\text{Daily price change percentage} = \{(DP_n - DP_{n-1})/DP_{n-1}\} * 100 \quad (8)$$

Where DP_n is closing price of nth day; DP_{n-1} is closing price of n-1th day.

Monthly price change: opening and closing price of the month for each stock was applied to calculate price change:

$$\text{Monthly price change percentage} = \{(DP_n - DP_{n-1})/DP_{n-1}\} * 100 \quad (9)$$

Where DP_n is closing price of nth month; DP_{n-1} is closing price of n-1th month.

RESULTS

Statistic test

Tables 1 list obtained descriptive statistics including average, mid, standard deviation, skewness and tension. Having the average bigger than midpoint implies that there are some big peaks in the data—peaks affect on average value. In these cases, skew tends to right. In contrary, mode the skew tends to left, and for some variables average value move close to the midpoint, which implies symmetrical distribution of variables. There is relative symmetry for almost all variables, which is shown as the study proceeds. In addition, tension of all variables except for dependent variable exceeds normal tension (Skewness and tension of zero normal distribution). Noticeable is that trivial divergence of normality causes no serious issue ahead of analysis and in practice many cases of trivial divergence in data distribution is commonly observed.

Normality of data distribution-validity of correlation tests is one of the main assumptions in correlation study. Normality of variable distribution through Kolmogorov Smirnov is under concern in what follows. In doing so,

Table 2. One-sample Kolmogorov-Smirnov test.

Variable	Sample	Kolmogrov Smirnov test	Asymp. Sig	Result of test
Monthly liquidity changes percentage	434	0.872	0.433	Test distribution is normal
Monthly price changes percentage	434	0.826	0.503	Test distribution is normal

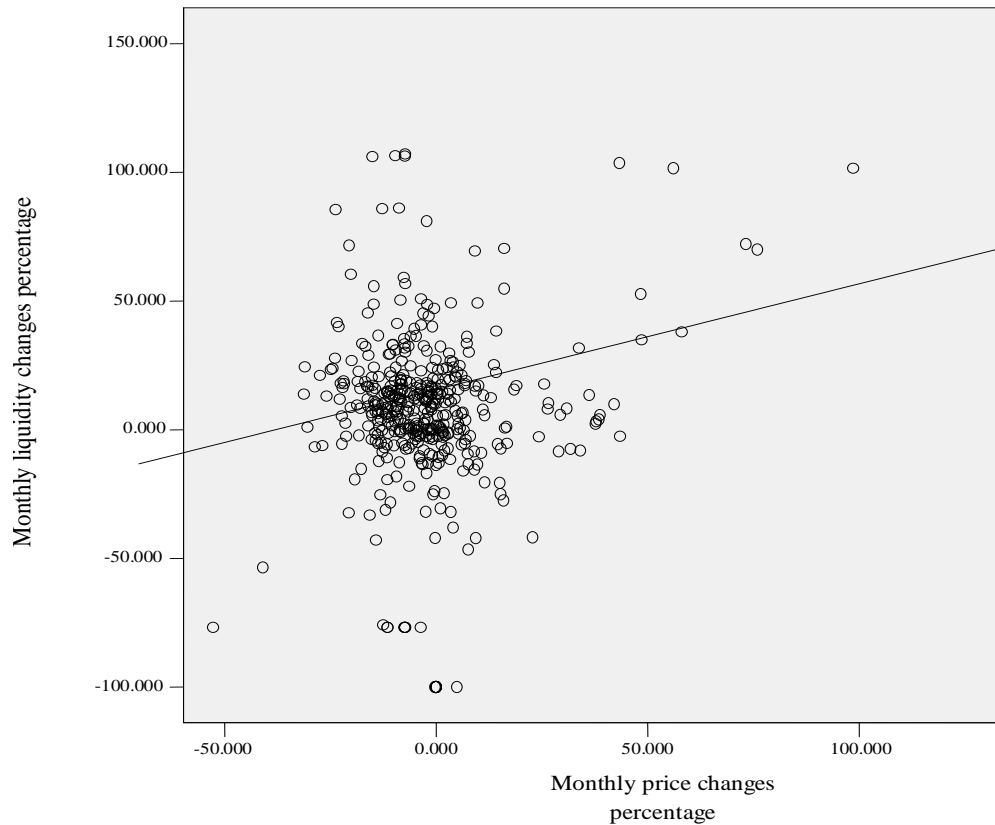


Figure 1. Scatter diagram for monthly changes.

normality of variables needs to be ensured.

H₀: Data conforms to normal distribution for depended variable.

H₁: Data does not conform to normal distribution for depended variable.

Level of significance for monthly liquidity changes percentage and monthly price change percentages were 0.433 and 0.503, respectively (>0.05). That is H₀ is confirmed and variable distribution is normal. Results of Kolmogorov Smirnov test are shown in Table 2.

Linear relation between scatter diagrams

A positive and considerable relation between the two variables is observed in Figure 1. Scatter diagram for

daily price changes percentage and daily liquidity changes percentages to total number of companies in sample group was obtained.

Monthly liquidity and price changes percentage

Correlation test (Pierson’s correlation rate) was applied to survey linearity of the relation—the test measures linear correlation between the two variables (Karen, 1996). Following correlation matrix calculates Pierson’s correlation level for dependent and independent variables. Correlation level of variables is rewritten in form of H₀ and H₁ as follows:

$$\begin{cases} H_0 : \rho_{XY} = 0 \\ H_1 : \rho_{XY} \neq 0 \end{cases}$$

Table 3. Correlation between monthly liquidity and price changes percentage.

Hypothesis	Sample	Level of significance	Correlation	Result of test
There is a significant relation between monthly liquidity and price changes percentages.	434	0	0.219	H ₁ is accepted

Table 4. Correlation between daily liquidity and price changes percentage.

Hypothesis	Sample	Correlation test	Level of significance	Result of test
There is a significant relation between daily liquidity and price changes percentages	11264	0.085	0	H ₁ is accepted

Table 5. ANOVA (monthly).

Model	Sum of squares	df	Mean Square	F	sig
1 Regression	4239.591	1	4239.591	21.663	0.000
Residual	84545.791	432	195.708		
Total	88785.382	133			

a. P dependent variable: monthly stock price changes percentage redictors: (Constant) monthly stock liquidity changes percentage.

H₀: There is no significant relation between monthly liquidity and price changes percentages.

H₁: There is a significant relation between monthly liquidity and price changes percentages.

Pierson's correlation result was showed in Table 3. Probability of significance for monthly liquidity and price variations was obtained equal to 0.000 (<0.05). There fore, H₀ is rejected at 95% probability, and the correlation between the two variables is 0.22; thus, there is a positive correlation between the two variables which is significant at 95%, though the significance is not strong.

Daily liquidity and price changes percentage

Correlation level of variables is rewritten in form of H₀ and H₁ as follows:

$$\begin{cases} H_0 : \rho_{XY} = 0 \\ H_1 : \rho_{XY} \neq 0 \end{cases}$$

H₀: There is no significant relation between daily liquidity and price changes percentages.

H₁: There is a significant relation between daily liquidity and price changes percentages.

Pierson's correlation results are shown in Table 4. Probability of significance for daily liquidity and price variations was obtained equally as 0.000 (<0.05). Therefore, H₀ is rejected at 95% probability, and

correlation between the two variables is 0.085 (positive and not strong).

Regression analyses

After computing the relations, we want to see whether liquidity changes percentage has effect on price changes percentage or not. The model is given as follows:

$$Y_{i,t} = \beta_0 + \beta_1 X_{it} + \varepsilon_{i,t}$$

Zero hypothesis and opposite hypothesis in this model are as follows:

$$\begin{cases} H_0 : \beta_1 = 0 \\ H_1 : \beta_1 \neq 0 \end{cases}$$

H₀: The stock liquidity changes percentage has effect on price changes percentage.

H₁: The stock liquidity changes percentage has effect on price changes percentage.

We tested the previous hypothesis in two categories: monthly and daily.

Monthly: Regression analysis for monthly variable is given in Table 5. Significant of F value is equal to 0.000 in this table. This amount is less than 0.05, thus, at the 95% confidence level there is a significant model and we can calculate regression model.

Table 6. Model summary (monthly).

Model	R	R square	Adjusted R square	Std. error of the estimate	Durbin-Watson
1	0.219 ^a	0.048	0.046	13.98956	1.725

a. Predictors: (constant), monthly stock liquidity changes percentage. Dependent variable: monthly stock price changes percentage.

Table 7. Coefficients (monthly).

Model	Unstandardized coefficient		Standardized coefficient	t	Sig.
	B	Std. error	Beta		
1 (Constant)	2.131	0.672		3.170	0.002
Monthly stock liquidity changes percentage	0.101	0.022	0.219	4.654	0.000

a. Dependent variable: monthly price changes percentage.

Table 8. ANOVA (daily).

Model	Sum of squares	df	Mean Square	F	sig
1 Regression	215.578	1	215.578	82.441	0.000
Residual	29449.530	11262	2.615		
Total	29665.107	11263			

a. Predictors: (constant), daily liquidity changes percentage. Dependent variable: daily price changes percentage.

According to Table 6, coefficient of determination equals 0.048, it means about 5% of the dependent variable is explained by independent variable. Durbin-Watson statistic is equal to the 1.73.

According to Table 7, t-statistics for the percentage changes in monthly stock liquidity amount is equal to 4.65 (positive). The t statistic for intercept is equal to 3.17 thus at the 95% confidence level, there is a significant model. The model is estimated as follows:

$$Y_{i,t} = 2/13 + 0/101X_{it}$$

Daily: The previous steps are done for daily data. Regression analysis is given in Table 8. In this table, significant of F value is equal to 0.000. This amount is less than 0.05, thus, at the 95% confidence level there is a significant model and we can calculate regression model.

According to Table 9, coefficient of determination equals 0.007, it means about 1% of the dependent variable is explained by independent variable. Durbin-Watson statistic is equal to the 2.205.

According to table 10 T-statistics for the percentage changes in daily liquidity amount is equal to 9.08 (positive). The t statistic for intercept is equal to 12.66 thus at the 95% confidence level is a significant model. The model is estimated as follows:

$$Y_{i,t} = 0.085 + 0.004X_{it}$$

According to regression analyses liquidity changes percentage has weak effect on price changes percentage.

DISCUSSION

Monthly liquidity and price change percentage, daily liquidity and price change percentages were calculated in EXCEL software. Afterward relations mentioned in hypotheses were examined through correlation test in SPSS software. Outputs implied the following results:

1. There is a significant relation between monthly liquidity and price changes of stocks.
2. There is a significant relation between daily liquidity and price changes of stocks.

The results are according Acharya and Pederson (2005). They concluded that the effect of liquidity on stocks turnover is low in short run and high for long term investments. According to regression analyses, liquidity changes percentage has effect on price changes percentage. Of course this effect is not so high and we should find other factors that change stock prices. Our results are similar to Marsha and Young's (2003) results

Table 9. Model summary (daily).

Model	R	R square	Adjusted R square	Std. error of the estimate	Durbin- Watson
1	0.085 ^a	0.007	0.007	1.617080	2.205

a. Predictors: (Constant), daily price changes percentage. Dependent variable: daily price changes percentage.

Table 10. Coefficients (daily).

Model	Unstandardized coefficients		Standardized coefficients		t	Sig.
	B	Std. error	Beta			
1 (Constant)	0.085	0.015			5.554	0.000
Daily stock liquidity changes percentage	0.004	0.000	0.085		9.080	0.000

Dependent variable: daily price changes percentage.

to some extent. They explored the relation between liquidity and stock turnover. The model applied in their study uses market turnover and size; afterward positive effects of turnover and negative effect of size were measured.

Results of this study are not consistent with that of Omri et al. (2004) (they concluded a negative relation between liquidity and stock turnover). In conclusion, with increase/decrease of liquidity, stock prices increases/decreases in same direction. The results may be helpful for investors for making better decisions. Noticeable is that liquidity is considered as an important factor for thriving stocks market. The results are useful to decisions and choices for the share exchange to investors and activists. Investors can calculate the percentage changes in liquidity on a daily basis for short-term share returns. Also, calculating the percentage changes in liquidity for long-term returns, a monthly contribution must be chosen. As a suggestion, other researchers can carry out their researches in longer periods of time, but their results must be similar to those of this research, though other factors may affect the result and relations.

We need new ways for measuring. The use of inter arrival average rate of order book sell and buy as a factor of this value is considered to represent one of the dimensions of the liquidity which is in trading time. The high level of the advent of selling and buying for certain assets reflects the expectation of investors about assets' liquidity. If a stock is sold and bought frequently, it implies that the stock will have more liquidity. Also, we can suggest traditional liquidity measures for future studies. The results are useful for decision making and investors can calculate the percentage changes in liquidity on a daily and monthly basis for short-term share returns.

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