Evaluating the Effect of Stock Liquidity and Limitation of Orders on Future Fluctuations Case Study: Petrochemical Companies Admitted to Tehran Stock Exchange

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DOI: https://doi.org/10.62343/cjss.2024.250

ABSTRACT

Fluctuations in stock prices are commonly observed in all stock exchanges and are considered a natural aspect of market dynamics. These fluctuations are influenced by various factors both within and outside of organizations. When these factors are identified, shareholders can make informed decisions by evaluating their holdings as well as those of others in the market. This enables them to take appropriate actions such as maintaining, selling, or replacing their shares as needed. This research examines the impact of stock liquidity and order restrictions on the future fluctuations of petrochemical companies listed on the Tehran Stock Exchange over a five-year period. Utilizing a panel data approach, monthly time series data obtained from the Stock Exchange is analyzed. The hypotheses are tested using panel data econometric methods and the EViews7 software. The findings reveal a significant relationship between relative liquidity and future stock price fluctuations, as well as a significant relationship between sales order limits and future fluctuations. Consequently, it is recommended that regulatory authorities implement effective policies regarding stock liquidity and sales order limits to manage and mitigate sudden fluctuations in the Stock Exchange.

Keywords: *Stock liquidity; price fluctuation; transaction rates; purchase and sales; proposed price variances*

INTRODUCTION

A stock market is always affected by various vicissitudes that can cause fluctuations in its stock prices. Every country battles a range of such fluctuations as per its specific economic and political conditions. The Iran Stock Exchange is no exception and its fluctuations commonly affect the performance of the listed companies.

Stock liquidity is one of the most essential subjects for investors. When it comes to short-term investments, most investors prefer highly liquidated stocks. Investors with long-term aims are sensitive to stock prices and their changes. In fact, changes in share prices are vital sources of information when evaluating a company's financial situation, conducting a comparative analysis, and, most importantly, making decisions about stock transactions.

Understanding the effect of stock liquidity on market volatility can lead to the issuance of limiting regulations and decisions that are instrumental in controlling fluctuations. Simply put, information related to fluctuations and changes in transaction concepts are some of the most important criteria for evaluating investing deposits and other securities and for pricing derivatives.

Limitations regarding clause 10 of the executive instruction of online securities transactions in the Tehran Stock Exchange and Iran Forward Market include limitations on the type of orders, rate of orders, transaction time, and specific supplies and ordered prices. These limitations are explained below:

A. Limitations on the type of orders
   Permissible orders for online customers (regarding order prices). Time limits with no limitations (including days, dates and open dates)
B. Limitations on the amount of orders
   At present, there are no limitations on the amount of orders over and above the ordinary limits on main transactions
C. Limitations on the time of transactions
   i. Entering order time – this starts at the beginning of the transaction system's permitted order entering hour to 12:30PM
   ii. Immediately post 12.30PM, orders through the daily credit of online customers must be eliminated
D. Limitations on specific supplies
   i. Online customers can enter their orders at the time of opening discount symbols, while observing the price limits of these orders
   ii. The Stock Exchange or Forward Market should determine separate quo-

tas in all the primary supplies for each online customer. Online transaction customers can make purchases from primary supplies, keeping in mind the permissible amount of online transactions for the determined rate of shares.

iii. Online customers have no right to competitive action or dominant transaction

E. Price limits on orders

i. The rate of permissible difference between the order price and the market price is applied at the opening discount and primary supply, as follows:
   - A customer's order purchase price in an online transaction cannot be more than the best market-quoted price
   - A customer's order selling price in an online transaction cannot be less than the best market-quoted price
   - At the time of entering the orders, if there are no purchase or sell orders, the aforementioned limitation is not applicable

ii. Some factors surrounding the percentage of permissible difference between the order price and the latest transaction price are:
   - In case the value of the order is less than or equal to one million Rials, the difference between the purchase/sales order prices and the latest transaction price can be a maximum of 2%. This limitation is applicable from 9:00AM to 12:30PM
   - If a transaction is not executed in the current day, the base price of the latest transaction would be the final price of the previous day

However, it should be noted that supply and demand are the only determining factors when it comes to property. One of the most critical objectives of stock exchange bureaus is creating regulated and transparent strategies for confronting the supply and demand criteria when determining the price of financial properties. Generally, strategists and legislators always try to eliminate the existing factors that cause a supply-demand imbalance. Laws and regulations that prevent any contrast between supply and demand are significant in newly emerged markets. To cushion the market against fluctuations and financial crises, legislators establish rules and limitations in financial markets for input or output investments, supply and demand of shares, determination of stock prices, stock selling rate, etc. Excessively fluctuating stock prices in new markets are mainly caused by speculation or a supply-demand imbalance. Prices in such markets are determined based on buy and sell orders

(supply and demand) of securities. All the transaction orders of securities are sent to the Stock Exchange from all over the country and stock prices are determined. Moreover, some stock exchange bureaus, like the Tehran Stock Exchange, do not have any market specialists or brokers due to easy transactions. As a result, price fluctuations are more intense. So far, the range of fluctuations has been determined by trial and error. Therefore, the current study aims to understand the effects of stock liquidity on future fluctuations of stock prices by analyzing the data from petrochemical companies listed on the Tehran Stock Exchange. The following hypotheses were determined when working toward the research objective:

A) Main hypothesis:
   There is a significant relation between relative liquidity and future fluctuations in stock prices.
B) Subordinate hypotheses:
   There is a significant relation between the limitations on purchase orders and future fluctuations.
   There is a significant relation between the limitations on selling orders and future fluctuations.

HISTORY OF RESEARCH

The facilitation of property transactions is considered on the basis of liquidity (Taqavi & Biabani, 2003). In the absence of exclusive definitions, measuring and capturing liquidity is difficult. Some studies define *liquidity* as 'the possibility of transforming any form of property into another form in the short-term, without causing loss to its real value.' In other words, the term 'liquidity' is used when there are no changes in the original price (Benic & Feranic, 2008). Kyle (1985) stated that since brokers cannot distinguish between the orders created by aware brokers and those created by the ones looking for liquidity, they determine the prices as functions of imbalanced conditions in the order, which means uninformed and unaware people determine the transactions. This creates a positive relation between the rate of orders, transaction volumes, and price change. This is generally referred to as the price effect. Some researchers, like Elyk (1985), have studied the cross-sectional effects of liquidity on the expected yield of stocks.

Amihud and Mendelson (1991) stated that companies are inclined toward increasing their stock liquidity policies since liquidity can potentially improve the company's yielding efficiency and value. Furthermore, they also observed that company managers often try to increase the liquidity of their securities by conversion of their

companies into public joint stock entities, voluntary disclosure of information, and stock distribution among more shareholders (i.e., increasing the number of shareholders for the free-floating shares of the company).

Chan and Faff (2003) studied the cross-sectional effect of liquidity in the Australian market by applying the stock turnover rate when pricing assets. They used monthly data and control factors, such as the ratio of the book value to the market, company size, and excessive market yields, and observed the effect of liquidity on the pricing of assets by using cross-sectional regression. They found a negative relation between the turnover and yield. The proposed price and yield were also found to be negatively related, showing a positive liquidity premium on one side and a negative liquidity premium in the Australian Stock Market on the other side.

Martinez, Nieto, and Tapia (2005) analyzed three crucial factors of liquidity and yield average in the Australian market. They used various liquidity criteria in their research. The first liquidity criterion was the Pastor et al. criterion (2003), based on the inverse relation between price fluctuations and ordering flows. The stock yields of dividend paying companies show less sensitivity as compared to liquidity. This indicates that investors focus on dividends and market liquidity when evaluating a company (Pastor et al., 2003). The second criterion was a market function, which is defined as the yield sensitivity to proposed transaction price changes. Efficient financial markets facilitate the fluent transfer of money from people with savings to people having profitable investment opportunities. Such markets indicate a high level of transactions and high market participation. Investors feel more secure in such markets and, hence, readily make transactions (Marshall & Young, 2003). As presented by Amihud, the final criterion was the absolute ratio of stock yield to the rate of transactions (in Euros). Results from this empirical study showed that the criterion reported by Amihud significantly improved the pricing model of assets.

Marshall (2006) perceived the liquidity criteria according to the transactions, such as turnover rate and purchase or sales proposed prices. He observed the contradictions between traditional and contemporary liquidity criteria. Drawing from previous studies, he considered a new criterion for liquidity, calling it 'VOW – the value of order weight.' Marshall found that the order-weighted coefficient was statistically significant even after controlling the beta variables with regard to the ratio of the book value to the market value and yields of the stockholder's income (Marshall, 2003).

Deuskar (2006) presented a model for analyzing the behavior between liquidity and the likely fluctuations of stock prices. He believed that the risk premium increases

during high fluctuations. On the other hand, when the current yield of assets is low, the rate of non-risk asset yield is also likely to be low. Lack of liquidity has the potential to improve the supply shock.

Fujimoto and Masahiro (2006) drew a positive relation between the lack of liquidity and stock yield fluctuations. Their research sample included 100 of the most significant shares from the New York Stock Exchange and 100 close index shares by the end of the year 2000. The liquidity criteria used in their study included stock turnover and the relative price difference between stock purchases and sales. The resultant variable for 75% of the examined shares indicated a greater lack of liquidity by increased stock return fluctuations.

METHODS

The present study is applied research. It has considered the effects of stock liquidity and order limitations on future fluctuations by using data analysis, inferential statistics, such as Pearson correlation, regression estimation tests, and analysis of the regression model hypotheses by "sweivE" software.
This study calculates liquidity using the following three factors:

1- Proposed stock transaction differences (purchasing and selling) indicating the difference between the highest and the lowest prices
2- Variable of the ratio of number of transacted shares to the total shares in the company. These numbers were collected primarily by the Rahavard Novin software. The values of the variable were then calculated using Excel
3- The variable ratio of the company's transacting days to the total number of days when the Stock Exchange reported transactional activities, was calculated by Rahavard Novin and Excel software packages

The present study focuses on ordering limitations by considering purchase and sell order limitations as variables. The period considered for this research was from March 2010 to March 2014 (on a monthly basis). Statistical research samples included 12 active petrochemical companies, such as Persian Gulf, Iranian, Pardis, Shazand, Zagros, Maroun, Shiraz, Bandar Imam, Abadan, Jam, Urumieh, and Esfahan.

RESULTS

This research used a regression model, as indicated in relation (1):

$$\sigma_{\tau+1}^{\mathrm{M}} = a_0 + a_1\sigma_{\tau}^{\mathrm{M}} + a_2 RLIQ_{\tau}^{buy} + a_3 RLIQ_{\tau}^{sell} + \sum_{j=1}^{11} b_j D_{j,\tau} + control + \varepsilon_{\tau+1}$$

Relation 1: Regression model of the project

The variable of stock fluctuations in the above model was calculated by relation (2):

$$\sigma_{\tau}^{\mathrm{M}} = \sqrt{\frac{1}{K}\sum_{k=1}^{K}\left[MQ, MQ\right]_{\tau}^{sparse,k} - \frac{1}{K}\left[MQ, MQ\right]_{\tau}^{all}}$$

Relation 2: Variable equation for the stock fluctuations

3.2 Significance Test of Variables and the Model

T-test was used to analyse the significance of the independent variables in each model. The null hypothesis in the t-test was as follows:

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

Relation 3

Its verification was analysed by the following relation:

$$T = \frac{\hat{\beta}_1 - \beta_1}{SE\left(\hat{\beta}_1\right)} \sim t_{\frac{\alpha}{2},N-k}$$

Relation 4

The obtained T-statistic was compared with t in the table (calculated with N-K degree of freedom in 95% confidence level). If the absolute value of the calculated T were to be greater than that of t in the table, the numerical value of the test function would have been in the critical area, and the null hypothesis would have to be rejected. In this situation, the considered coefficient (β1) was significant, with a 95% confidence coefficient, indicating the relationship between dependent and independent variables.

F-statistic was used to analyze the significance of the regression model. The null hypothesis was as follows:

$$\begin{cases} H_0 : \beta_1 = \beta_2 = ... = \beta_k = 0 \\ H_1 : \beta_1 \neq \beta_2 \neq .... \neq \beta_k \neq 0 \end{cases}$$

Relation 5

The verification was considered by the following statistic:

$$F = \frac{ESS/(K-1)}{RSS/(N-k)} \qquad \text{Relation 6}$$

The obtained F-statistic was compared with the F values in the Table with K-1 and N-K degrees of freedom in error level (α) of calculated 5%. If the calculated F were to be greater than F in the Table, the numerical value of the test function would have been in the critical area, and the null hypothesis (H0) would have to be rejected. The model was significant in this situation, with a 95% confidence coefficient. If the calculated F were to be less than F in the Table, H0 (null hypothesis) would have to be accepted, and the significance of the model in a 95% confidence level would be rejected. In this study, the regression model verification was approved with regard to the F statistic.

ANALYSIS

This section looks at the data analysis made in this study using descriptive and inductive statistical values.

The 'central value' in the distributive study of a statistical population is the representative value by which the surrounding measures are distributed. The numerical criterion introducing the center of the data set is called the 'measure of central tendency.' Mean and average are among the most common centripetal criteria. In most cases, the average is near the mean value in Table (1). This indicates a normal distribution of variables.

Standard deviation is another dispersion index, showing the distance of the data from the average value. If the standard deviation is near zero, it indicates that the data is near the average value and has little dispersion. On the other hand, a large standard deviation indicates substantial data dispersion. The standard deviation is equal to the second root of the variance. The approximation of standard deviation is of the same dimension as the data. In all cases (Table 1), the standard deviation of the data is small, indicating appropriate data distribution.

Skewness is equal to the third normalized moment. It is a criterion for the distribution function's existence or lack of symmetry. Skewness for a fully symmetrical distribution is equal to zero, positive for an asymmetrical distribution extending to higher values, and negative for an asymmetrical distribution extending to lower

values (Johnson et al., 2001). Table 1 shows the rate of skewness of variables. Apart from the leverage ratio, all other variables in this study are positively skewed. In most cases, low skewness indicates normal distribution of the variables.

Elongation is equal to the fourth normalized moment. In other words, elongation is a criterion that refers to the sharpness of the curve at the maximum point (Hassanipak, 2007). The rate of elongation for normal distribution is equal to 3. The daily virtual variable (D) is not placed under 'descriptive statistics' since it is a combination of 0 and 1.

Table 1: Descriptive statistics for the research variables

Distribution form criteria		Dispersion criteria	Concentration criteria		Variable type	Abbreviation	Variable
Exten-si-on	Skew-ness	Standard deviation	Mean	Average			
3.67	0.9	20617.8	25225.5	29178.96	indepen-dent	RLIQBUY	Relative liquidity towards purchasing
3.24	0.83	22405.4	27419.3	31195.3	indepen-dent	RLIQSELL	Relative liquidity towards selling
23.24	3.05	27.31	19.30	29.84	dependent	SIGMAT	Stock price fluctuations
10.24	2.35	103.25	1161.39	1556.63	control	NT	No. of transactions
57.66	5.98	1030.6	478.02	715.11	control	AQ	Volume of transactions
142.04	9.34	0.0002	$8/28*e^{-6}$	$3/89*e^{-5}$	control	AMR	Lack of liquidity variable

4.2 Pearson Correlation Test

Table 2 shows the correlation rate and significance levels in lines 1 and 2, respectively. The considered correlation is statistically significant if the significance is less than 0.05. As can be seen, the correlations are significant in some cases. For example, transaction volume (AQ) significantly correlates with all the variables, whereas the other variables have significant correlations with each other in some cases. However, the intensity of correlations is less than the value, with the possibility of co-linearity in the model.

Table 2: Correlation between the model variables

	SIGMAT	RLIQSELL	RLIQBUY	NT	DT	AQ	AMR
SIGMAT	1.000000	----	----	----	----	----	----
RLIQSELL	0.023759 0.5250	1.000000	----	----	----	----	----
RLIQBUY	0.052180 0.1625	0.017029 0.6487	1.000000	----	----	----	----
NT	0.047807 0.2007	0.148525 0.0001	0.246328 0.0000	1.000000	----	----	----
DT	0.026915 0.4715	0.056815 0.1283	0.165505 0.0000	0.028587 0.4444	1.000000	----	----
AQ	0.092668 0.0130	0.158210 0.0000	0.117512 0.0016	0.342990 0.0000	-0.074497 0.0460	1.000000	----
AMR	-0.037630 0.3140	-0.007881 0.8330	-0.033722 0.3669	-0.067044 0.0726	0.151259 0.0000	-0.097005 0.0093	1.000000

Tests for Determination of Regression Estimation Method and Results of Regression Model Fitness

Chow test is used to determine which method is more efficient for estimating the regression model: panel or combined data.

As seen in Table 3, the significance level of the Chow test in the considered equation is less than α=0.05. Therefore, appraisal of the model is approved with a 95% confidence level by using the panel method. Since null hypothesis of Chow test was rejected on the basis of y-intercepts, Hausman test is used for identifying the existence of fixed or random effects.

Table 3: Results of Chow test for regression models

Regression model (1)	Test statistic	Degree of freedom	Significance level	Result
Chow test	1.86	(687 & 11)	0.04	Using panel model
Hausman test	0.000	7	1.000	Not known

According to Table 3, the significance level of the Hausman test is prob-1.000. Thus, it can be concluded that the Hausman test cannot distinguish between fixed and random effects. This implies the need for a different criterion. Therefore, the regression model is estimated to have random effects. Then, the potential of random effects is measured when expressing the relations between the model variables. The

estimation results show that the expressed random effect with Rho rate equals 0.000, and the non-expressed random effect with Rho rate equals 1.00. These results indicate that random effects cannot express 100% of the model changes. Hence, fixed effects should be used for model estimation. The estimations with fixed effects are indicated in Table 4.

Table 4: Results of regression model fitness

Response variable=Fluctuations of future stock prices			
Independent variables	**Regression coefficients**	**t-test statistic**	**Significance level**
Equation (α) constant	27.79	22.65	0.000
Fluctuations of present stock prices	0.03	2.18	0.02
Relative liquidity towards purchasing	-1.95	-0.59	0.55
Relative liquidity towards sales	0.0001	2.82	0.004
Daily virtual variable	-0.47	-0.35	0.71
No. of performed transactions	-0.0002	-0.51	0.60
Transaction volume	-0.001	-3.62	0.000
Variable for lack of liquidity	2464.09	0.50	0.61
F-test statistic: 3.52	Significance level: 0.000		
	Determinant coefficient: 0.26		Durbin-Watson statistic: 1.90

DISCUSSION

Durbin-Watson statistic is considered for analysing regression hypotheses. It includes statistical values between 0-4. If the value of this statistic is closer to '2', then the likelihood of serial self-correlation in the model is low. According to the obtained Durbin-Watson statistic of 1.9, there is no possibility of serial self-correlation in the considered regression model (using the Durbin-Watson table).

4.4.2 Jarque-Bera Normality Test

Jarque-Bera test and histogram analysis are used to understand the normality conditions of fitted model residues. According to Table 5, the significance level of Jarque-Bera is less than α=0.05 and equal to zero. Thus, the distribution of residues is not normal with 95% confidence level.

4.4.3 Multi Co-linearity

When estimating least-square parameters, variance inflation in linear regression models is one of the most essential elements. However, a challenge in using this method is the existence of 'co-linearity'. One way to identify multi co-linearity is using variance inflation factor. This factor shows how inflated the estimated coefficient of variance is compared to the estimated variables that do not have linear correlation.

Table 5 shows the variance inflation coefficients for the regression model under consideration. According to the results of this test, it can be concluded that no multi co-linearity exists for the variance inflation model.

Table 5: Tests of regression hypotheses for the considered regression equation

Test	Amount	Results
Durbin-Watson statistic	1.90	Lack of serial self-correlation probability in the model
Jarque-Bera test	133.26	Non-normal distribution of model residue (1)
Variance inflation statistic	1.14	Confirming the lack of multi co-linearity in the regression model

ANALYSIS OF THE RESEARCH HYPOTHESES, DISCUSSION AND CONCLUSION

The research hypotheses are analysed in this section. Important relations for approving or rejecting the hypotheses are considered in Table 6.

Table 6: Important considered relations

Considered effect	Amount	Significance
Relation between purchase order limitations and future fluctuations	-1.95	---
Relation between selling order limitations and future fluctuations	0.0001	***

***Significant with over 99% confidence

The obtained F-statistic for the estimated regression model in Table (4) equals 3.52, which is quite significant. Thus, it can be concluded that there is a significant relation between relative liquidity and future fluctuations in stock prices.

Table (6) shows that although the coefficient of relation between purchasing order limitation and future fluctuations is -1.95, this effect is not statistically significant.

Therefore, we can state that there is no significant relation between purchasing order limitation and future fluctuations. Hence, the first subordinate hypothesis is rejected.

Furthermore, the results in Table (6) also show that the coefficient of relation between the selling order limitation and future fluctuations equals 0.0001. This implies a substantial statistical significance. Thus, it can be concluded that there is a significant relationship between the limitation of selling orders and future fluctuations. Hence, the first subordinate hypothesis is approved.

The results of this study showed a significant relation between liquidity and selling order limitation and future fluctuations. These factors can cause a great deal of future fluctuations in the Stock Exchange, and controlling these variables can greatly help the stock market progress.

As it was stated in the history of research, existing limitations in the stock exchange have caused serious problems in the market liquidity for investors. Cases such as a lack of brokers for a stock, the formation of sales queues, and the reluctance of buyers to purchase stocks with sales queues are among the reasons that stock liquidity has been overlooked for a long time. On the other hand, stockholders have to wait for the liquidation of their stock to justify the ESP or formation of assemblies. Experience has shown that in addition to the elimination of liquidity, an extension of this process causes the selling price of such stocks to be much lower than their inherent values. Consequently, the stock market experiences intensive fluctuations. It has been observed that long purchasing queues for a stock can encourage the public to purchase it.

One way to eliminate stock market fluctuations could be: if the capacity of the selling queue reaches a definite percentage of the total distributed stock (e.g., 1%), the fluctuation limits should be taken away from the mentioned stock symbol; the buyers in the buying queue should be allowed to propose their premium rates relative to the existing price or the sellers in the selling queue should be permitted to announce their discounts. Percentage determination could cause longer purchasing and selling queues. However, once the limitations are taken away, non-committed buyers and sellers are likely to withdraw. This could also encourage genuine buyers and sellers to execute their transactions. Moreover, this strategy could allow the existing supervision and penalty protocols in the stock exchange to reduce unreal stock transaction queues, thereby controlling future fluctuations.

CONCLUSION

In addition to accessing limitations to the data for orders, the lack of research in the area of order limitations is a matter of concern. It is recommended that future researchers use the subject of this research in other industries when analyzing variables in the long run. Future researchers are also advised to use variables from those used in this study.

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