



The Asymmetric Effects of Stock Returns on Trading Volume in Tehran Stock Exchange

Roya Aleemran*, Siamak Shokouhifard

Department of Economics, Tabriz Branch, Islamic Azad University, Tabriz, Iran

Farzad Rahimzadeh

Assistant Professor and Faculty Member of University of Guilan

ABSTRACT

The relationship between returns and trading volume has interested financial economists and analysts for the last four decades. Theoretically, the effect of stock return on the trading volume is asymmetric, in the sense that, when the stock price increases, the reaction of investors is different from when the stock price is decreasing. Therefore, in this research, we empirically investigate the asymmetric effects of stock return shocks on trading volume of Tehran Stock Exchange during 2011-2016. Using the Johansson's Co-integration technique and Wald test, the results show both positive and negative asymmetric effects of stock return on stock trade quantities. The results further show that, in the our setting, the stock return includes two different growth means of 5.4 and 11.7 which contain the integration coefficients of 0.15 and 0.07 respectively, suggesting that the high stock return rate is not the sponsor of the capital market productivity.

Keywords: Trade volume, asymmetric effects, stock return

* Corresponding author: Assistant Professor of Economics, Email: Roya.aleemran@gmail.com
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1. Introduction

The stock is of paramount importance because minor capitals are inclined towards major movements and the money is guided so much that benefits the personal and national advantages. The capital provision, from the standpoint of economic schools and growth-related assumptions, has a particular significance for which the development of the capital market is one of the ways to increase the investment.

Trade volume provides important and valuable information about the current situation and the future outlook of the stock to the investors. High trade volume or, in other words, the increase in the quantity of the stock trade could be the impossibility of stock's purchase in the concept of stock's high liquidity capability and less risk. A trade volume is one of the important indices, the increase of which could be determinative of capital market's development. Trade volume in developed markets is comparatively immense and in inert markets is comparatively light.

Investors' motive to trade is solely dependent on their trading activity; it may be to speculate on market information or portfolios diversification for risk sharing, or else the need for liquidity. These different motives to trade are the result of processing different available information. In consequence, trade volume may originate from any of the investors who may have different information sets. As various studies reported, the information flow into the market is linked to the trading volume and volatility (Gallant, Rossi, and Tauchen, 1992). Thus, since the stock price changes when new information arrives, there exists a relationship between prices, volatility, and trading volumes (Lamoureux and Lastrapes, 1990 and Wang, 1994).

Moreover, numerous studies suggest that there are high correlations of returns across the international markets (Connolly and Wang, 2003). There are some overlapping trading periods and multiple listings of the same securities; thus, traders in one market draw inferences about the market simply by focusing on price movements in other markets (King and Wadhvani, 1990). Thus, it is logical to consider the fact that recent international financial markets process continuous trading and uninterrupted transmission of information in their day to day trading activity, which is reflected by returns, volume, and volatility (Lee and Rui, 2002).

One of the leading hypotheses to explain the price-volume relationship, the mixture of distribution hypothesis (Clark, 1973), suggests that price and volume are positively correlated. The central proposition of this hypothesis claims that price and volume change simultaneously in response to new information flow. The other popular hypothesis, sequential information arrival hypothesis (SIAH), states that there is a positive bi-directional causal relationship between the absolute values of price and trading volume. The model suggests a dynamic relationship whereby, due to the sequential arrival of information, lagged trading volume may have the chance to predict current absolute return and vice versa (Darrat et al., 2003).

In this paper, first, the theoretical principle and literature are presented. Then, after presenting the research model and explaining the variables, the data are extracted from the Rahavard Novin Software and the final model is estimated using the STAR model.

2. Theoretical issues

The research about the relationship between stock's return volatility and trades' volume has been commenced with Osborn's (1959) and since then various

researchers have suggested different views in this field. One view in this relation is the U-shape of the relationship between stock's return volatility and trades' volume offered by Kalev, Liu, Jarnecic and Pham (2002).

They revealed that the redundancy in trades' volume, price change, and in the market spread news at the beginning and end of the trades can be a reason for a positive relationship between these variables. Financial economists before Kalev, Liu, Jarnecic and Pham (2002) attempted to provide theoretical reasons for the presence of a positive relationship between the mentioned variables, most of them have expressed four theoretical reasons. The assumption of information continuous entry, distributions' aggregation model, properties pricing based upon rational anticipations and opinion disagreement are the four reasons for the existence of a relationship between stock return and trades' volume. Now in this section, the most significant practical studies are browsed about this topic inside and outside of the country. Abbasian et al. (2008) showed the long-term positive impact of exchange rate and trade balance securities and the negative effect of inflation, liquidity, and interest rates on the stock exchange market.

Choi et al. (2012) found a positive relationship between trading volume and volatility suggesting that trading volume influences the flow of information to the market. This finding supports the validity of the mixture of the distribution hypothesis. Ravichandran and Bose (2012) found the evidence of leverage and asymmetric effect of trading volume in the stock market and indicated that bad news generates more impact on the volatility of the stock price in the market. Tapa and Hussin (2016) prove a significant positive contemporaneous relationship between stock return and trading volume. Also, the Malaysian ACE market is contradicted with the weak form of the efficient market hypothesis (EMH). Shanghari et al. (2017) found that there is a positive relationship between market-wide sentiment and returns but the relationship does not hold at the country level. For individual countries, they detect substantial country-to-country variations in the influence of market-wide sentiment on returns. The evidence also suggests that stock-specific sentiment may have a greater influence on returns than market specific sentiment. Furthermore, the effect of investor sentiment on stock returns in emerging Asian markets generally persists after accounting for macroeconomic factors. Naik et. al (2018) show that the Johannesburg Stock Exchange displays volatility asymmetry implying that the return volatility responds more to the bad news than to the good news. The relationship between trading volume and market volatility is found to be positive and contemporaneous supporting the MDH. This study also uncovers that the volatility persistence remains high even after the inclusion of trading volume as an explanatory variable in the volatility model. The above set of results also holds for the post-crisis sub-sample. Furthermore, the pairwise Granger causality tests indicate a feedback relationship between volume and volatility only in the case of the sub-sample. But for the full sample, a unidirectional causality between volume and volatility, with trading volume Granger, causes market volatility was observed.

3. Research methodology

In order to survey the positive and negative shocks, researchers use diverse methods. One of the common methods for analyzing the shocks is the use of meant equation's residual as shock. By this method the growth rate of meant parameter is decomposed into two components which are expectable or predicted impulses and unexpected impulses or unpredicted shocks and the residual variable of growth rate regression is used as unexpected impulses in surveying the asymmetrical effects of shocks whose

positive and negative quantities are used as positive and negative shocks, respectively. This method's problem is facing with measurement error of shocks. The utilization of proper appraisal methods and equation apt clarification has a significant importance. The equation clarification method leads to incorrect results in the relevant equation in inspection of shocks. The method of residual utilization is a model-dependent method.

Another way to calculate positive and negative impulses is the use of time process of time series. In this method process relinquishment of meant variable is regretted over time and real variable is compared with the mentioned process. It is possible to consider the magnitudes lower than the process as negative shocks and the magnitudes positioning over the process as positive shocks. Anyway, if the economy does not have a relative stability or, in other words, if it has structural alterations, this analysis could be incorrect.

One of the most common methods in gaining the positive and negative impulses is the Hodrick-Prescott's flattening filter (1998) which is obtained with minimizing the sum of variation square of time process variable. The proposed method in order to use the HP filter is that the amounts locating below the process are to be considered as negative shocks and above the process located amounts are to be considered as positive shocks. In spite of some advantages, HP filter utilization has altered the nature of some data.

The linear methods which are used for modeling economic variables extensively are incapable, due to the asymmetrical behavior of these variables, in accessing to asymmetrical changes and this inspires the researchers to reveal more flexibility in using the nonlinear models. The nonlinear models used to access considered goals include threshold models such as moderate transfer STAR (Terasvirta and Anderson, 1992) and Markov Switching (Hamilton (1998)) models.

In threshold models, the behavior of the time process variable over the time depends on the system's situation relative to threshold level and differs in various regimes. For better understanding of the topic, consider the simple model (TAR, 1) below:

$$y_t = \begin{cases} a_0 + a_1 y_{t-1} + \varepsilon_{1t} & y_{t-1} > \tau \\ a_0 + a_2 y_{t-1} + \varepsilon_{2t} & y_{t-1} < \tau \end{cases} \quad (1-3)$$

In model (1-3), y_t behavior differs in accordance with threshold level of τ . Generally, with the assumption of equal variation of interfering members, the TAR model's general state is as follows:

$$y_t = I_t \left[a_{10} + \sum_{i=1}^p a_{1i} y_{t-i} \right] + (1 - I_t) \left[a_{20} + \sum_{i=1}^p a_{2i} y_{t-i} \right] + \varepsilon_t \quad (2-3)$$

In model (2-3) the threshold level depends on variable behavior of y_{t-d} in which $d \in \{1, 2, \dots, P\}$ and the indicator function I_t is defined as:

$$I_t = \begin{cases} 1 & \text{if } y_{t-d} > \tau \\ 0 & \text{if } y_{t-d} \leq \tau \end{cases}$$

Another important assorting in threshold models is how to equalize the variable about the threshold level. Some models of TAR become shifted from one regime to another moderately (such as STAR models) and some become shifted fast such as Markov-Switching models. The diagrams below reveal two types of shifting:

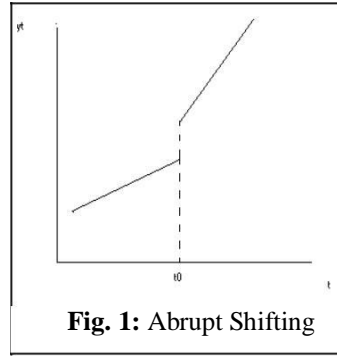


Fig. 1: Abrupt Shifting

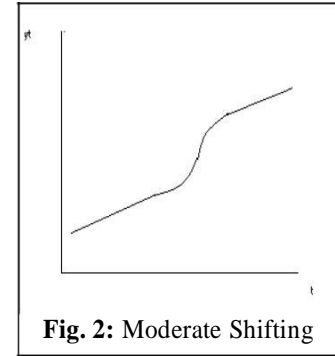


Fig. 2: Moderate Shifting

Markov-Switching models have been recommended by Quandt` (1972) and Goldfeld (1973) and developed by Hamilton (1989) for the extraction of trade drives. In order to conceive the Markov-Switching model better, consider the static variable of y_t which is defined for the first regime as $S_t = 1$ by following an autoregressive process:

$$y_t = \alpha_1 + \beta_1 y_{t-1} + \varepsilon_{1t}, \quad \varepsilon_{1t} \rightarrow N(0, \sigma_1^2) \quad (3-3)$$

Now, imagine that the variable y_t for the second regime $S_t = 2$ is determined by a different autoregressive model as follows:

$$y_t = \alpha_2 + \beta_2 y_{t-1} + \varepsilon_{2t}, \quad \varepsilon_{2t} \rightarrow N(0, \sigma_2^2) \quad (3-4)$$

If the error term component in model (3-3) and (3-4) is the same, the process of changes in variable y_t can be obtained as a unit model by the use of an imaginary variable.¹

$$y_t = \alpha_1 + \beta_1 y_{t-1} + \delta D + \gamma D y_{t-1} + \varepsilon_t \quad (4-3)$$

In model (4-3), the imaginary variable D for the time is zero when the system is in the first regime ($S_t = 1$) and one, when the system is in the second regime ($S_t = 2$). Since the variable y_t is modeled using an autoregressive process of p order and regime m $[MS(m)-AR(p)]$, we will have:

$$y_t = \sum_{i=1}^m (\sum_{j=1}^p \beta_{ij} y_{t-j}) + u_{it} I_i(S_{t-1}) \quad (5-3)$$

$$I_i(S_{t-1}) = \begin{cases} S_t = i \rightarrow 1 \\ S_t \neq i \rightarrow 0 \end{cases}$$

In model (6-3), the probability of situation transfer from one regime to another in terms of conditional probabilities will be calculable. For example in model (7-3), p_{ij} which indicates regime i to regime j is defined as follows:

$$P_{ij} = \Pr(S_{t+1} = j | S_t = i); \sum_{j=1}^m P_{ij} = 1, \forall i, j \in \{1, 2, \dots, m\} \quad (6-3)$$

¹ It must be noticed that in Markov model there is no need for interference components of model (8-4) and (9-4) to be the same and it would be possible that two models contain different interference components, in this case, it is not possible to propose the model (10-4)

The Markov's transfer model $MS(m) - AR(p)$ can be categorized in accordance with the fact that which part of the autoregressive model depends on the regime and can be transferred under its effect. The one which is more noticeable in economic studies, includes four models of Markov-Switching in mean (MSM), intersection (MSI), autoregressive parameters and Heteroscedasticity (MSH).¹

After extraction of stock return volatilities by Markov-Switching method, the relation of long-term effect of these volatilities in trades' volume will be estimated. For which the Johanson method is applied, before evaluating this relation, the stability of variables will be inspected by the use of the augmented Dickey-Fullertest.

4. Model estimation and analysis of finding

In this study, variables are defined as follows:

L_{st} : the logarithm of amount of stock trade

L_{sr} : Logarithm of stock price return

L_{gdp} : Logarithm of real gross domestic product

Variable	Without intersection and process	With intersection	With intersection and process
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The investigation of variables in level

L_{st}	2.8	-0.68	3.94
L_{sr}	1.48	-1.93	-2.11
L_{gdp}			

Variables with one order differentiation

dL_{st}	-3.8***	-9.1***	-9.04***
dL_{sr}	-10.71***	-10.93***	-10.96***
dL_{gdp}	-10.72***	-12.01***	-11.09***

Table 1.
Stability of variables

The results of ADF tests reported in Table above show that the variables of L_{st}, L_{sr}, L_{gdp} are not in static level and become static with one time differentiating and they are the evaluation terms from the accumulation grade of 1, therefore, we can use Johanson Co-integration technique for investigating the integration relationship between the evaluated variables.

For determining the autoregressive optimum lag, the model will be estimated with the use of Markov-switching method for six evaluation lags and by the use of optimum model selection criteria of Akaike (AIC), Schwarz Bayesian (SBC), and Hannan Queen and the optimum lag is selected. The amounts of achieved optimum model criteria are presented in Table (2).

	1	2	3	4	5	6
AIC	3.99	3.94	3.98	4.04	4.01	4.13
SIC	4.07	4.38	4.09	4.17	4.23	4.28
HIC	4.18	4.17	4.25	4.35	4.43	4.51

Table 2.
Amounts of
AIC, SIC,
HIC

¹ MS-VAR models too are exactly the same as MS-AR and classified

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The presented amounts in Table (2) reveal that the autoregressive optimum lag is two. Hence, the model $MSM(2) - AR(2)$ is used for the extraction of positive and negative shocks of stock returns. By the utilization of $MSM(2) - AR(2)$ model the growth rate of stock return is distinguished by two regimes with average high growth and average low growth in which the regime with the average low growth and high growth are considered as negative and positive shocks, respectively.

LR test results reveal that the assumption of $H_0: \mu_1 = \mu_2$ in level of 1% is rejected and the average growth rate of two regimes are different from each other meaningfully, in which the mean is a function of regime. The results of LR test are presented in Table (3).

Table 3.
LR test
Results

$\chi^2(1)$	prob
35.81	0.00

The estimations of $MSM(2) - AR(2)$ model parameters, which are presented in Table (4) and (5) reveal that growth rate of stock return can be distinguished by two regimes with the average growth of 5.45 (negative return shocks regime) and 11.73 (positive return shock regime). The negative and positive regimes with the stability probability of 0.92 and 0.95 benefit from a high stability, respectively. Moreover, the probability of transferring from the negative regime to positive and vice versa is 0.08 and 0.05, respectively. The consequences of probability show that the positive stock return regime relative to negative stock return regime is comprised of more stability.

Table 4.
Parameter
Estimation of
MSM(2)-AR
(2) model

	coefficient	variance	Statistic t
μ_1	5.45	1.99	2.74
μ_2	11.73	2.16	5.43
gLba(-1)	0.38	0.08	5.04
gLba(-2)	0.28	0.07	4.05

Table 5.

The probabilities of transfer between regimes

	p_1	p_2
p_1	0.92	0.08
p_2	0.05	0.95

The results of Markov-Switching model presented in Table (6) indicate that the months when positive and negative stock return shocks observed in Iran.

Table 6.

Period of extracted positive and negative shocks of Markov-Switching method

Shock type of stock return	month		
Negative shock	1391:5- 1393:4		1395:4- 1395:4
Positive shock	1386:5-1386:10	1390:1- 1391:4	1393:5- 1395:3

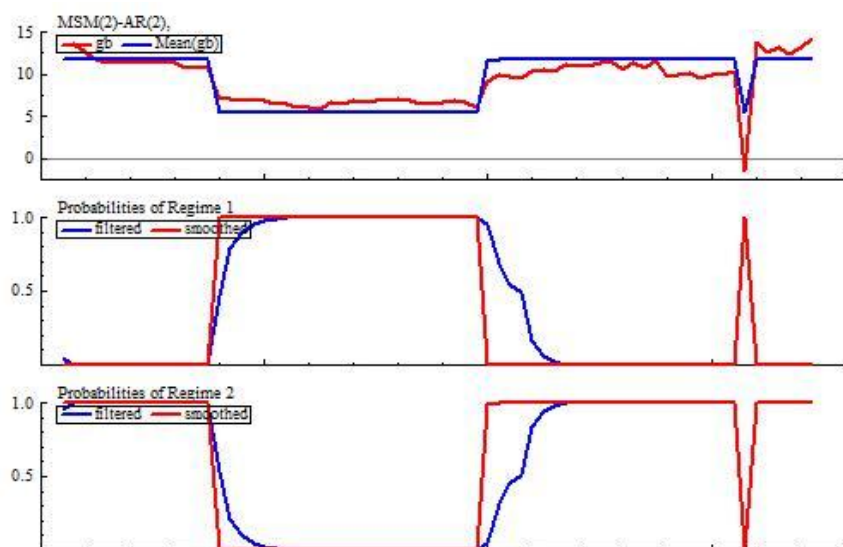


Fig. 3.
The situation
of two stock
return
regimes.
Positive and
negative
situation of
stock return's

Introducing the model and extracting the long term relation:
For the investigation of positive and negative shocks' effects the following model is used:

$$L_{t+1} = f(lgdp, lba)$$

$$L_{t+1} = \alpha_0 + \alpha_1 DM^+ L_{t+1} + \alpha_2 DM^- L_{t+1} + \alpha_4 L_{t+1}$$

Where:

The logarithm of amount of traded stock in stock

market L_{t+1} : The logarithm of stock price return

L_{t+1} : The logarithm of real gross domestic product

DM^+ : Imaginary variable for stock return positive shocks

: Imaginary variable for stock return negative shocks

For the extraction of a long-term relation, Johanson Co-integration technique is used and the correction of vector error is checked by applying the VECM and the assumption of equal effects of positive and negative stock return shocks will be analyzed. The extraction of long term relation and zero assumption tests during following steps will be executed:

VAR delay	AIC	SIC	HIC
1	5.1	5.77*	5.37
2	4.57	5.78	5.06*
3	4.44*	6.2	5.13
4	4.67	6.97	5.58

Table 7.
Optimum order
determination
of model VAR

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According to results of criteria of Akaike (AIC), Schwarz Bayesian (SBC) and Hanan Queen the optimum lags are three, two and, one, respectively. Since the criteria of Hannan Queen considers the intermediate of delay amount which leads to more obvious co-integration vectors, both delay values are selected.

In meaning level of 5% two tests λ_{+max} and λ_{-max} show an integration relation, therefore, due to the tests' results one integrated vector is extractable. Integration vector extracted using the Johanson Co-integration technique is presented in table (8). This vector is normalized relative to variable L_{2t} .

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Table 8.

Accumulation vector between variables

Variable	coefficient	variance	Statistic t
L_{co}	1	-	-
$DM^p L_{ba}$	0.15	0.06	2.4
$DM^n L_{ba}$	0.07	0.06	1.1
Lgdp	4.7	0.37	12.7

As depicted in Table (8), the elasticity of trade values to positive shocks of stock return is equal to 0.07, while this elasticity for negative shocks is 0.15. Additionally, the elasticity of trade values to real product is 4.42, as well.

For the zero assumed tests, based on equal positive and negative shocks' coefficients ($H_0: \alpha_1 = \alpha_2$) the Wald test can be utilized. Wald test has been executed on the basis of LR statistic evaluated for estimating equation, the results of which are presented in Table (9). The consequences of test show that adequate proofs for rejecting the zero assumption are available and the difference between positive and negative shocks of stock return is meaningful.

Table 9.

Results of LR test

$\chi^2(1)$	Prob
10.12	0.001

Therefore, in Iran's economy, the effects of positive and negative shocks of stock return on stock trade values are asymmetric during the period of the study.

The results of vector error correction model are presented in Table (10):

Table 10.

Error correction situation in model VECM

Variable's name	coefficient	Variance	statistic t
$ecm(-1)$	-0.71	0.17	-3.95

The estimation results of VECM model show that the short-term errors become flattened in upper integration relation because the ECM coefficient is -0.71 which shows that in each period the amount 0.71 of short-term errors is flattened.

5. Conclusion

The results of the study show that the effects of stock return on trade volume in Iran are asymmetric so that, the stock return effects stock trade volume when stock return

is in a regime with low growth rate, are more than when the stock return is in a regime dominated by a high growth rate. Based on the consequences, the politicians can use the policies to increase the stock return moderately and in a stable manner in order to develop the stock trades.

Since the stock return shocks' effects on trade volume are asymmetric, politicians of the country's capital market must consider the asymmetry magnitude and apply this asymmetry in adopting the policies. Based on the research results, it can be expressed that in the capital market, stock return plays a small role in developing this section and other marginal causes resulting chiefly from other economic and politic sections have a significant role. It is recommended to study the effects of stock return shocks' effects in stock trade volume in accordance with regimes depending on other variables.

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