THE CAUSAL RELATION BETWEEN STOCK PRICE AND TRADING VOLUME: EVIDENCE FROM THE HANOI STOCK TRADING CENTER

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ABSTRACT

This paper examines the causal relationship between stock prices and trading volume for the Hà Nội Stock Trading Center over the period from Feb. 6th 2006 to Feb. 27th 2009. To investigate the causal relations between stock prices and trade volume, the Granger causality test is applied in this study. Main results derived from the test reveal that there is the uni-directional causality between the daily market index and trading volume. In other words, changes in the market index lead to changes in market trading volume, but daily market trading volume does not cause the market index to change.

Key words: Hà Nội Stock Trading Center; Stock Price-Trading Volume Relationship; Granger Causality Tests.

1. Introduction

The relationship between stock prices (or returns) and trading volume has received a consideration attention from financial economists for years. It is observed that the earliest empirical studies on the price-volume relationship have primarily focused on the contemporaneous relationship between price changes and trading volume (see Karpoff, 1987 and Gallant et al., 1992). Empirically, most of these studies document the positive relation between stock returns and volume (Ying, 1966; Crouch, 1970; Wood et al., 1985; Harris and Gurel, 1986).

In recent years, the dynamic relation between stock returns and volume has been widely investigated in both developed and emerging stock markets by using the Granger causality and co-integration tests. Indeed, the bi-directional nonlinear Granger causality between stock returns and trading volume is found in the New York Stock Exchange during the period from 1915 to 1990 (Hiemstra and Jones, 1994). Additionally, Chen et al. (2001) and Lee and Rui (2002) document that bi-directional feedback between stock returns and trading volume exists in Switzerland, the Netherlands and Hong Kong while the uni-directional causality from returns to trading volume is observed in the U.S., Japan, the U.K., France and Italy. Another study conducted by Martikainen et al. (1994) in the Helsinki Stock Exchange shows the bi-directional causality between stock returns and trading volume for the period of 1983-1988.

In emerging stock markets, Moosa and Al-Loughani (1996) report that the bi-directional interaction between stock price and trading volume is present in Singapore and Thailand, and the uni-directional causality from trading volume to stock prices is observed in Malaysia, but no causal relation is found in the Philippines. Also in Asia, Lee and Rui (2000) find that changes in stock prices affect the trading volume in both Shanghai and Shenzhen Stock Exchanges. In Latin America region, Saatcioglu and Starks (1998) provide evidence that the bi-directional causality between returns and volume exists in Colombia and Venezuela while stock price changes lead to vol-

ume changes in Chile, and volume changes lead to stock price changes in Brazil and Mexico. In European emerging stock markets, Gunduz and Hatemi-J document that the bi-directional causality between stock prices and volume is observed in Hungary and Poland while stock prices lead to volume changes in Russia and Turkey, but no causal relation is found in the Czech Republic. Furthermore, Basci et al. (1996) employ the well-known co-integration technique to test for the long-run relationship between individual stock prices and trading volume in Turkey. Empirical results obtained from this study provide evidence of positive long-run relation between stock price and volume.

Although the relationship between stock prices and trading volume in both developed and emerging stock markets is extensively documented in the financial literature for the last decades, it is found no study that has focused on this issue for the HASTC. This study attempts to fill this gap in the literature by testing the causal relation between the market Index and trading volume of the HASTC. The remainder of this paper is structured as follows. Section 2 describes the data and methodology that are employed in this study. The empirical results are presented in Section 3. Finally, Section 4 concludes the paper.

2. Data and methodology

a. Data description

The data employed to test for the causal relation between stock prices and trading volume in this study includes daily series of the HASTC-Index and market trading volume. The data are primarily obtained over the period from Feb. 6th 2006 to Feb. 27th 2009 on the website of Ha Noi Stock Trading Center (www.hastc.org.vn). Then, a natural logarithmic transformation is performed for the primary data. To generate a time series of continuously compounded returns, daily returns are computed as follows:

$$r_t = \log(p_t) - \log(p_{t-1}) = \log(p_t/p_{t-1})$$

Where rt is change in the HASTC Index between two successive trading session while pt and pt-1 are the index at time t and t-1 respectively. Similarly, changes in trading volume are calculated in the same manner. Descriptive statistics for the daily Index and market trading volume are presented in Table 1.

Table 1: Summary statistics on the Index and trading volume (Feb. 6, 2006 – Feb. 27, 2009)

Measures	Obs.	Max.	Mean	Min.	SD*
Trading volume (1,000 shares)	727	22,057	3,073	4	3,506
Changes in trading volume (%)	726	114.3	0.3	-122.3	21.9
HASTC-Index	727	459.4	222.9	78.1	92.5
Changes in HASTC-Index (%)	726	4.2	0	-5.6	1.2

*** SD: Standard deviation**

b. Methodology

To investigate the causal relations between stock prices and trade volume, the Granger causality test is applied in this study. It is worth noting here that the Granger test requires all variables to be stationary and have the same number of lags. Therefore, before conducting the test, a unit root test is necessarily used in order to examine whether the series are stationary. Additionally, Akaike information criterion (AIC) technique is conducted to determine the appropriate lag lengths in the model.

- Unit root test

The unit root test is an approach that is developed to determine whether the time series is stationary or non-stationary. To test for the presence of unit root in time series, several approaches are available, e.g. the Dickey-Fuller (DF), Augmented Dickey Fuller (ADF) and Phillips-Person (PP) tests. In this study, the widely used ADF test is used to examine whether the HASTC indexes and volume series are stationary. The ADF test is based on estimating the following equation:

$$\Delta y_t = \alpha_0 + \beta y_{t-1} + \sum_{j=1}^{k} \phi_j \Delta y_{t-j} + \varepsilon_t$$

where Δ is first-difference operator and y_t is the series under consideration. Because the ADF test results are sensitive to the choice of the lag length (k), the Akaike Information Criterion (AIC) is applied for selecting the optimal k of the ADF regression (k should be large enough to achieve a white noise structure in ε_t). Moreover, the null hypothesis in the ADF test is the existence of a unit root (β=0), and it is rejected if the ADF test sta-

tistic is larger than the critical value. Since the distribution of ADF test statistic is not standard, the critical values tabulated by MacKinnon (1991) is used in drawing inferences for the stock returns series used in the study.

- Granger causality tests

Granger causality test is a commonly used approach that is designed to answer a simple question of whether changes in X cause changes in Y and vice versa. Specifically, the approach is modeled to measure how much of the current Y can be explained by past values of itself and lag values of X. The Granger causality tests can be expressed as the following regression equations:

$$Y_t = \alpha_0 + \sum_{l=1}^{k} \beta_l Y_{t-1} + \sum_{l=1}^{k} \delta_l X_{t-l} + \varepsilon_t$$

$$X_t = \alpha_1 + \sum_{l=1}^{k} \phi_l X_{t-l} + \sum_{l=1}^{k} \rho_l Y_{t-l} + \nu_t$$

In the above equations, if δ_l is statistically significant different from zero, but is insignificant, it is concluded that X Granger causes Y. Conversely, if ρ_l is statistically significant, but δ_l is insignificant, X is said to be Granger caused by Y. Both of the two cases can be called by the term of "uni-directional causality". Moreover, if either δ_l or ρ_l are found significantly, then it could be said that "bi-directional causality" or "bi-directional feedback" exists between Y_t and X_t (Brooks, 2002). However, if neither δ_l nor ρ_l are statistically significant, it would indicate that Y_t and X_t are temporally independent.

It is noted that the term "causality" does not necessarily mean that movements in a particular variable cause movements in another variable, but it just means that the current value of one variable is caused by the past values of the other. It is clear that some predictions can be made on the basis of Granger causality tests. As mentioned in the literature, prediction is a very important element in testing the hypothesis of market efficiency. Taking all into account it can be concluded that the Granger causality approach is very useful in detecting the efficient market hypothesis.

3. Empirical results

As mentioned above, before the Granger tests are conducted, the unit root test should be employed as a pre-test in order to measure the level of integration of the observed series. Results of the ADF unit root test with and without time trend for the data in level and first difference (changes in the index and trading volume) are reported in Table 2.

The results indicate that the null hypothesis of a unit root cannot be rejected at the conventional significant level (5 percent) for the market index series because the t-statistics are smaller than their corresponding critical values (MacKinnon's critical value). However, when the first differences are taken and tested for a unit root, the null hypothesis is significantly rejected for the series, indicating that it is stationary. With the evidence, it is concluded that the daily HASTC-Index series is integrated of order 1, denoted as I(1). Moreover, Table 2 reveals that the null hypothesis of a unit root is significantly rejected at 5- percent level for the daily trading volume series. Since the series is stationary at the level, they are certainly stationary at the first difference. In other word, it can be said that the daily trading volume series is integrated to the order zero or I(0).

Another task in the pre-test is to examine the appropriate lag length for the variables in the model. The optimal lag length (k) is determined by using the AIC technique with eight lags to be included. The optimal lag, which generates the lowest AIC value, is found for the Granger causality model between the Index and trading volume is five.

Table 2: ADF unit root test results for the HASTC-Index and market trading volume

Variables	Constant without trend	Constant with trend
Levels		
HASTC-Index (1)	-1.15	-2.00
Trading volume (5)	-2.37	-3.42[b]
First differences (changes)		
HASTC-Index (1)	-20.79[a]	-21.1[a]
Trading volume (4)	-23.82[a]	-23.80[a]

[a], [b]: Significant at the 1% and 5% levels, respectively.

Based on the results of the ADF and AIC tests, the Granger tests are conducted to determine whether the causal relations are present between stock prices and trading volume of the market. Findings of the tests are presented in Table 3.

Null hypothesis	F-statistic	Lag length	Decision
Trading volume does not Granger cause the Index	0.51	5	Accept
The Index does not Granger cause trading volume	3.03[b]	5	Reject

Table 3: Results of Granger causality tests

[b]: Significant at the 5% level

As can be readily seen in Table 3, the null hypothesis that the market index does not Granger cause market trading volume is rejected at the five- percent level. The rejection of the null hypothesis indicates that trading volume can be forecasted on the basis of current market index. However, in the opposite direction, the results derived from the tests reveals that the market index is not Granger caused by the market trading volume. Taking all evidence into account, it can be concluded that the uni-directional causality between daily stock prices (measured by the market index) and trading volume exists in the HASTC.

Based on the results derived from Granger causality test, the regression analysis is conducted in order to examine the effects of stock returns on trading volume with different lag time (k=5). The regression model used in this study takes the following form:

$$V_t = \alpha + \sum_{k=1}^{2} \beta_k V_{t-k} + \sum_{k=1}^{5} \delta_k R_{t-k} + \varepsilon_t$$

where:

V_t: market trading volume at time t

R_t: stock returns at time t

k: the lag length of time

Table 4: Results of regression analysis

Variables	Coefficient and t-statistic
Constant	0.006
	(-0.83)
V_{t-1}	-0.382
	(-10.41)[a]
V_{t-2}	-0.255
	(-6.95)[a]
R_{t-1}	0.859
	(-1,34)
R_{t-2}	1.258
	(1.90)[c]
R_{t-3}	-0.936
	(-1.43)
R_{t-4}	1.056
	-1.61
R_{t-5}	-0.680
	(-1.07)
Number of observations	727
Adjusted R^2	0.15
F-statistic	18.67[a]

[a], [c]: Significant at the 1% and 10% levels, respectively. t-values in parenthesis.

Empirical results presented in table 4 indicate that an increase in market trading volume at the present will lead to decreases in trading volume in the next two trading sessions. Statistically, these relations are significant at the one- percent level. In addition, the regression analysis shows a significant positive relation between trading volume at time t and stock returns at t-2. This finding implies that an increase in the HASTC today leads to an increase in market trading volume in the day after tomorrow.

4. Conclusion

This paper investigates the dynamic relation between stock prices and trading volume for the HASTC. Using the daily HASTC-Index and market trading volume data, empirical results derived from the Granger causality tests reveal that daily market index leads to daily market trading volume. Effects of the HASTC-Index on the trading volume, however, don't take place immediately and there is certain time lag. In the opposite direction, evidence gathered from this survey is contrary to the supply- demand law and results of previous studies on the stock exchanges in some countries when it proves that the trading volume has no effect on the market index. In other words, it is concluded that the uni-directional causality between daily stock prices and trading volume ex-

ists in the HASTC.

Findings of this survey have important meanings to market managing authority, investors and researchers. As for market managers, this survey helps them to work out appropriate policies to regulate better the market. Investors (mostly the small ones with limited knowledge of the stock exchange) can draw from this survey some practical knowledge that helps them understand better working laws in the Vietnamese stock exchange and they can deal more reasonably with changes in the market. This could be considered as an important basis for better efficiency of the Vietnamese stock exchange. In other words, this is a basis that allows the stock exchange to develop in a more sustainable manner and avoid dangers of collapse caused by the investors' lack of necessary knowledg■

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