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The Nexus between Trading Volume and Stock Prices: Panel Evidence from OECD Countries

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Abstract: *In this study, the nexus between trading volume stock prices has been examined using panel causality test developed by Dumitrescu-Hurlin (2012) in OECD countries. As a result of a study which 12 countries are tested and monthly data of total 100 terms, it has stated that the causality from stock market index to trading volume. While this study shows that the positive or negative changes in the stock prices create trading volume on stock markets, it is clearly seen that trading volume doesn't affect the stock prices. In this situation, it can be said that positive feedback hypothesis is valid for markets in this analysis. According to these findings efficient market hypothesis is valid for these stock markets.*

Keywords: Stock Price, Trading Volume, Panel causality, Positive Feedback Hypothesis, OECD

JEL Classification: G12, G15

1. Introduction

Market price of stock reflects the present value of net cash inflows of investors expect to get changes that it may occurs in the dynamic markets and investors behavior led to change in expectations. This situation occurs to be happened by coming the new information to markets. The market price of stock is sensitive to the information too and price changes take place by the arrival of new information to the market and investors make investment decisions in the light of new informations (Rashid, 2007). Reaching new information to the investors changes their expectations to create trading volume and so leads to price movements (Çukur et al., 2012). This can be seen in three ways. First, it is tought that the information reaches the market creates trading volume and then the influence reflects to the stock price. But on the contrary, in accordance with the positive feedback hypothesis, investors will buy or sell floowing the rise or fall of the prices and this would cause an increase in the trading volume is considered as a secondary effect. İt is considered as third effect that there is a bidirectional relation between price and volume and the two variables act together (Elmas and Yıldırım, 2010).

Karpoff (1987) has stated that it is important to examine nexus between trading volume and price changes in many respects. Findings about this nexus is very important to be reference about issue such as information from financial markets, this information is distributed and how is reflected, market depth, size. On the other hand, this information helps understanding of empirical distribution of speculative prices (Badhani and Suyal, 2005). Investors can measure the variance changes on price process by considering the

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nexus between price-volume about distribution of speculative prices. This is important in terms of effectiveness of investment decisions. Finally, price-volume nexus is quite important for the futures markets. Variability on prices affects quietly the trading volume of future contracts. On the other hand, time for delivery of future contracts explains both trading volume and variability of rates (Badhani and Suyal, 2005).

The nexus between volatility of stock return and trading volume has been based on the models to reaching market of information and modeling distribution of stock prices (Çukur et al., 2012). These are sequential arrival information and mixed distribution hypothesis. Sequential arrival information hypothesis is put forward first time by Copel (1976) and then developed by Jennings and Starks et al. (1981). This hypothesis forecast a positive causality between the two variables because of containing information for explanation to current trading volume of past period prices and current trading prices of past period values on trading volume (Yılancı and Bozoklu, 2014). Model based on asymmetric information approach, all market participants weren't detected the informations simultaneously from new market. Moreover, this perception process refers to a sequential process that followed. Therefore, according to the successive information hypothesis, absolute lagged returns have the power to predict today's trading volume. On the other hand, the opposite situation may be possible. This situation has been developed by Mixed Distribution Hypothesis (Clark, 1973; Epps and Epps, 1976). The model also assumes that new information led to a change in the price reach simultaneously for market participants.

Because of change in price and trading volume are based on a common process it is considered that they are in a positive synchronous nexus. However there is also Boisterous Processors hypothesis developed by De Long et. al. (1990). They do not have the necessary information about the market and they are influenced from past positive returns and set going future prices by increasing their trading volumes. Therefore, there is a bidirectional positive causality between stock returns and trading volume resulting from behavioral finance (Umutlu, 2008).

2. Literature Review

Instead of focusing on stock price or trading volume as the only variable, establishment of nexus between the variables of trading volume and stock price is important in terms of getting more information about this nexus. Many studies about putting forward the nexus between price and volume focus on the existence of synchronous relationship between price and volume. In recent studies, it is compromised that price-volume relation has a dynamic structure and it is began to searching a causality even more the daily stock price and volume. To determine the direction of the nexus Granger causality tests are began to use (Bayrakdaroğlu and Nazlıoğlu, 2009).

Yılancı and Bozoklu (2014) have used the time-varying asymmetric causality test in the study that examined the nexus of causality between stock prices and trading volume. In this study, it is found that there is one-way causality from trading volume to stock price and this nexus has changed depending on time. Time varying asymmetric causality test is more developed technique. In this context, the most important advantage of this test is to identify causality in time zones instead of presenting absolute judgments about series beyond the conventional tests.

Kamath (2008) has identified the presence of meaningful and asymmetrical nexus from stock return to trading volume for Chilean Stock Market. Toraman et al., (2007) used the Toda Yamamoto causality test via İstanbul Stock Exchange (ISE-100) index and he total trading volume data between 1990 and 2007. As a result of the study, while founding the causality from price to volume, it has been reached findings about not being a causality from volume to price. Gökçe (2002) has stated causality from stock return to trading volume when he has examined ISE. As a support to finding, Gündüz and Hatemi (2005) has examined the nexus between price and process by using Toda-Yamamoto causality test in their study based on 5 European Countries including Turkey. In the study in which weekly data discussed, while founding a one-way causality from price to trading volume for Russia and Turkey, there is no causality for Czech Republic, Poland and Hungary. Martikainen and Puttonen (1996) have addressed Finnish market in their studies and they have drawn a conlusion that there is causality from stock price to trading volume.

Hiemstra and Jones (1994) has identified a bidirectional nexus between stock return and trading volume when they have examined the dynamic relation between stock return and trading volume by using linear and nonlinear Granger causality tests. Bayrakdaroğlu and Nazlıoğlu (2009) have examined relation between trading volume and stock price about 2003-2006 periods in the study based on ten bank addressed on ISE. They have used linear and nonlinear Granger causality tests. As a result of Granger causality tests, it is found that there is no nexus between volume and price for banks. Elmas and Yıldırım (2010) have used observation of sessions instead of montly data for investigating the dynamic relation in their study based on the same variables. As a result of selected investigation, found that there is causality from price to volume in 2001, 2006 and 2008. As a support of these findings, Kayalıdere and Aktaş (2009) have found that ISE has influence on changes of trading volume and transaction number of monthly returns. As a result of Chen et. al. (2001) nonlinear causality test based on U.S., Japan, U.K., France, Canada, Italy, Switzerland, Netherlands and Hong Kong stock markets, found that there is causality from stock price to trading volume.

Smirlock and Starks (1988) have found a causality relation between absolute stock price changes and volume when they have examined the nexus between them by using Granger causality test. Griffin et al. (2007) has found strong positive nexus between trading volume and past returns in many markets in the study for testing dynamic nexus between return and trading volume. Saatcioğlu and Starks (1998) have stated that there is causality from price to volume in advanced markets but in emerging markets the causality is from trading volume to price in their study based on identification about different reactions of advanced and emerging markets. Lam et al. (1990) have examined the nexus between absolute value of price changes and trading volume additionally the nexus between stock price changes and trading volume in the study about Hong Kong markets. They have found a strong positive nexus between trading volume and absolute value of price changes by using data of stock and market index. In addition, it is emphasized that price changes on Hong Kong markets are cause of trading volume but there is no significant data for trading volume's influence on price changes. Silvapulle and Choi (1999) have stated that there is linear and nonlinear bidirectional causality between price and trading volume by using linear and nonlinear Granger causality test about daily index closing price and trading volume in Korean markets.

Çukur et al. (2012) have stated one-way causality from stock return to trading volume and they have tested mixed distribution hypothesis by using GARCH model and they have found that this hypothesis is not valid in Turkey. In another study in which GARCH and TGARCH model are used, Kıran (2010) Sequential arrival information and Mixed Distributions Hypothesis are not valid in ISE. In another study conducted in 1997-2009, sequential arrival information and Mixed Distributions Hypothesis's volatility in ISE are analysed and get significant information for not being valid of this hypothesis. Additionally, stated that there is long term negative nexus from trading volume to volatility and study findings have stated a Granger causality relation between return volatility and trading volume (Boyacıoğlu et al. 2010). Baklacı and Kasman (2006) have stated significant findings about invalid of Mixed Distributions Hypothesis in their study based on the same variables.

Table 1 summarizes some of the previous empirical studies. As can be seen in literature review, despite of examining the nexus between trading volume and stock price in Stock Market by many time series technique which is conventional Granger causality test, Toda Yamamoto Granger causality test and Non-Linear causality test. These tests have many advantages. For example, Toda Yamamoto causality test can get over the different stationary level problematic of series. Non-linear causality test can take into account financial time series' non-linear stracture. On the other hand, panel data methods hasn't used on examination of this nexus. In order to fill the lackness in literature and reach more valuable precise information about OECD countries, trading volume-stock price nexus has examined with panel causality test developed by Dumitrescu and Hurlin (2012) in this paper.

Table 1. Summary of Previous Empirical Studies on the Nexus between Trading Volume and Stock Market

Study	Data	Methodology	Stock Market	Findings
Hiemstra and Jones (1994)	No information	Linear and Non-Linear Causality	New York Stock Exchange	Two-way causality between stock market and trading volume
Martikainen and Puttonen (1996)	1988-1992 (monthly)	Granger Causality	Finnish Stock Market	Causality from stock price to trading volume
Saatcioğlu and Starks (1998)	1986-1995 (monthly)	Granger Causality	25 Latin American Stock Markets	While there is causality from price to volume in advanced markets, it is from trading volume to price in emerging markets
Silvapulle and Choi (1999)	No information	Linear and Non-Linear Causality	Korean Stock Market	Causality from stock price to trading volume
Chen et. al. (2001)	1973-2000 (daily)	Non-Linear Causality	9 OECD Countries	Causality from stock price to trading volume
Gökçe (2002)	1988-2001 (daily)	Granger Causality	ISE-100	Causality from stock return to trading volume
Gündüz and Hatemi (2005)	No information	Toda-Yamamoto Causality	Czech Republic, Hungary, Poland, Russia, Turkey	Causality from price to trading volume
Toraman et. al. (2007)	1990-2007 (daily)	Toda-Yamamoto Causality	ISE-100	Causality from price to trading volume
Bayrakdaroğlu and Nazlıoğlu (2009)	2003-2006 (daily)	Linear and Non-Linear Causality	ISE (only banking index firms)	No causality between trading volume and price.
Yılancı and Bozoklu (2014)	1990-2012 (daily)	Time Varying Asymmetric Causality	ISE-100	Causality from trading volume to stock price and this nexus has changed depending on time.

3. Econometric Methodology

There are some advantages of choosing panel data analysis instead of time series in econometric research. Some of them are making evaluation by using less data and making collective statement about countries and companies more than one. When Table 1 is reviewed, it is demonstrated that there isn't definitive judgment about the relationship between these two variables. The findings may vary according to tested countries and time period.

Another of the basic advantages of using panel data analysis are that data has both cross sectional and time dimension. In this context, when it is considering both take into account cross section dependency and in terms of the present collective judgment, the usage of panel data analysis has been found suitable.

It is possible to state that there is some causality tests used in literature about panel causality. While generalized method of moments (GMM) is used in case of cross sectional is bigger than time dimension, Dumitrescu-Hurlin (2012) and Emirmahmutoğlu-Köse (2011) tests used for occasions on the contrary. In our study, because of that cross sectional is bigger than time dimension, usage of Dumitrescu-Hurlin (2012) or Emirmahmutoğlu-Köse (2011) tests is more convenient. The difference between these two tests is identical with the situation between conventional Granger causality test and Toda-Yamamoto causality test. While Dumitrescu-Hurlin (2012) test has been used in situation that all series are stable at the same level in panel, Emirmahmutoğlu-Köse (2011) test has been used in situations that all series are stable at the different level. As seen in application section, Dumitrescu-Hurlin (2012) panel causality test has been used for panels in which all series are stable at the same level, time dimension is bigger than cross sectional and take into account cross sectional dependency is used in this study.

According to this test, basic hypothesis has stated absence of homogeneous causality in panel and alternative hypothesis has stated prensence of heterogeneous causality at least in one cross sectional. What is important here while basic hypothesis has been examining prensence of homogeneous nexus, alternative hypothesis has examined prensence of heterogeneous nexus.

In addition, another quality of this technique is that it performs highly in unbalanced panel data models and models have few data. In this analysis, test technique used for testing basic hypothesis is average of individual Wald statistics (Bozoklu and Yılancı, 2013). Namely;

$$W_{N,T}^{Hnc} = \frac{1}{N}\sum_{i=1}^{N} W_{i,t}$$

$W_{i,t}$ in here shows the Wald test statistics used for testing causality in country.

Because of the fact that individual Wald statistics for small value of T don't converge to chi-square distribution, Dumitrescu and Hurlin (2012) have suggested using approximate standardized statistics for $W_{N,T}^{Hnc}$ by using guess values for average and variance of this unknown distribution. This statistic is calculated specified below;

$$Z_{N,T}^{HNC} = \frac{\sqrt{N}\,[W_{N,T}^{Hnc} - \sum_{i=1}^{N} E(W_{i,t}]}{\sqrt{\sum_{i=1}^{N} Var(W_{i,t})}}$$

In this equation; i symbol point outs total country number, W symbol point outs Wald statistics, T symbol point outs period number. We didn't give information about Cross section dependency test and Hadri Kurozumi panel causality test (2012) owing to these tests awareness by readers. Moreover, there are more detailed econometric information about this model in Dumitrescu-Hurlin (2012) and Bozoklu-Yılancı (2013)'s papers.

4. Data and empirical findings

In this study, Trading volume and monthly average closing price data about basic indexes of America (S&P), Austria (ATX), Belgium (BEL-20), France (CAC-40), England (FTSE), Ireland (ISEQ), Switzerland (SMI), Japan (NIKKEI-225), South Korea (KOSPI), Mexico (BOLSA), New Zealand (NXZ-50) and Turkey (BIST-100) markets is used. Total 100 monthly data between October-2004 and January-2013 are discussed in this study. All of these data have been get from www.uk.finance.yahoo.com and Eviews, Gauss and Matlab programmes have been used at the analysis.

It should be noted that despite the usage of daily data in several papers, monthly data is used in this paper. The cause of this usage is different in the holidays in different countries. Therefore, panel data analysis can't use with these daily data. On the other hand, monthly data can be obtained with simultaneously for each coutries. Moreover, papers using the monthly frequency is seen in literature (Martikainen and Puttonen, 1996; Saatcioglu and Starks, 1998).

Before examining causality between trading volume and stock market index, there are some pre-analyses for determining type of causality test. One of these is examining cross sectional dependence of series. Because, convenient unit root and causality test will be used according to presence cross sectional dependence or not.

Results of CDLM (Cross-Section Depedency, Lagrange Multiplier) formed by Breusch Pagan and adjusted CDLM test formed by Pesaran et. al. (2008) are focus point of our study because of enormity of time dimension than cross sectional. According to these two tests, it is seen that there is cross sectional dependence in panels about both trading volume and stock market index. These results are stated in Table 2. In such a case, it is convenient using unit root and panel causality test taking into account cross sectional dependency.

Table 2. Cross Section Dependency Test Results

	Trading Volume		Stock Market Index	
	Test Statistic	**Prob.**	**Test Statistic**	**Prob.**
CD LM (Breusch-Pagan, 1980)	233.35*	0.00	178.05*	0.00
$CDLM_{adj}$ (Pesaran, 2008)	4.64*	0.00	16.68*	0.00

Note: * item point outs significance %1, level.

Cross sectional dependency test results aren't enough individually for determining usage of which panel causality test. Additionally to cross sectional dependency test, Stationarity levels must be determined. Hadri-Kurozumi (2012) panel unit root test results based on cross sectional dependency are presented at this part of our study.

Hadri-Kurozumi test works inverse logic unlike other panel unit root test is the key point when results are being evaluated. While basic hypothesis of other studies states panel have unit root. However, zero hypothesis of this test assumes that panel has a stationarity. According to Hadri-Kurozumi (2012) panel unit root based on reached cross sectional dependency of panels in Table 3 levels are stable in two panels. Because test statistics are lower than critical values for these two panels and this shows that zero hypothesis is accepted but alternative hypothesis is declined.

Table 3. Hadri-Kurozumi Panel Unit Root Test Results

Trading Volume		Stock Market Index	
Test Statistic	**Prob.**	**Test Statistic**	**Prob.**
-2.28	0.98	0.25	0.39

In such a case that both cross sectional dependency and panels have stationarity at same level Dumitrescu-Hurlin (2012) panel causality test is supportive to obtain accurate results. If panels were stationarity at different levels, it would be more convenient preferring Emirmahmutoğlu-Köse (2011) panel causality test.

Table 4. Dumitrescu-Hurlin Panel Causality Test Results

From Trading Volume to Stock Market Index			
Number of Lag	$Z_{N,T}^{HNC}$	**Prob.**	**Results**
1	-0.5078	0.6116	No Causality
2	1.13	0.2584	No Causality
3	0.31	0.75	No Causality
From Stock Market Index to Trading Volume			
Number of Lag	$Z_{N,T}^{HNC}$	**Prob.**	**Results**
1	1.8117***	0.0700	Causality
2	3.6529*	0.0003	Causality
3	2.4066**	0.0161	Causality

Note: *, **, *** items point out significance respectively %1, 5 and 10 levels.

When panel causality test results are examined in Table 4, it is stated that there is no causality from trading volume to stock market index for all lags. However, it is stated that there is causality from stock market index closing price to trading volume for 1, 2 and 3 lags. Because probability values is above 0.10 in causality results of from Trading Volume to Stock Market Index. On the other hand, this values below 0.10 in opposite causality results. It means that rising and declining on prices generates good or bad perception on investors. Depending on this perception, investors create trading volume by buy or sell. Moreover, although number of lag keeps changing, there is no change on results. Therefore, reached findings is very certain. On the other hand, Instead of using daily data, the usage of monthly data doesn't change common belief that the direction of causality is from stock market to trading volume.

5. Concluding Remarks

Nexus between stock prices and trading volumes is important in terms of giving information about general structure of markets and opening way for investors improving positions. In 12 OECD countries examined study, Dumitrescu and Hurlin (2012) panel causality test take into account cross sectional dependency and convenient for heterogeneous structure is used.

As a result of analyses, it is stated that there is causality from stock market index to trading volume. However, there is no evidence of causality from trading volume to stock market index. This shows that positive or negative changes on stock prices cause investors' buy or sell shares. So, this situation creates trading volume. In other words, positive feedback hypothesis is valid in these markets. But rising of trading volume isn't valid on stock prices. This situation shows that investors react differently to different information because of asymmetric information in markets and for this reason arrival information doesn't reflect to stock prices. In addition, Finding about that trading volume isn't cause of stock prices shows us that arrival info doesn't reflect to prices and correspondingly hard to forecast the stock prices. This finding is an indicator for validity of efficiency markets hypothesis for all indexes in this study.

All these results get along with many studies via time series analysis in past literature. Some of these studies are Gökçe (2002), Gündüz and Hatemi (2005), Toraman et al., (2007), Kayalıdere and Aktaş (2009), Elmas and Yıldırım (2010). In this study, validity of findings has been strengthened by using panel data analysis.

The one of important constraint in this paper is leave out of account volatility and non-linear structure in trading volume and share prices. Therefore, taking into account both volatility and non-linear structure in data can allow to obtain developed results in future researchs. Moreover, the usage of unbalanced panel data methods may provide more useful findings in order to use daily data and assure time compliance among data. On the other hand, the different results can be obtained with use of sequential panel selection method (SPSM) for each country.

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