Çankırı Karatekin Üniversitesi
İktisadi ve İdari Bilimler
Fakültesi Dergisi
Y. 2020, Cilt 10, Sayı 2, ss. 673-689

Cankırı Karatekin University
Journal of the Faculty of Economics
and Administrative Sciences
Y. 2020, Volume 10, Issue 2, pp. 673-689

Araştırma Makalesi

Testing Nonlinear Effect of Volume on Price: Evidence from Textile Sector Stocks in BIST

Gürkan BOZMA
Corresponding Author, Iğdır University, Faculty of Economics and Administrative Sciences, Department of Economics,
gurkan.bozma@igdir.edu.tr, ORCID: 0000-0003-4047-9012

Selim BAŞAR
Anadolu University, Faculty of Economics and Administration Sciences, Department of Economics,
selim@anadolu.edu.tr, ORCID: 0000-0002-7055-8240

Abstract:

This paper examines the nonlinear relationship between volume and price for Textile sector stocks trading in BIST over the period 2011-2016 using daily data. The reason for the selection of the textile sector is that it is a pioneering sector in the exports of Turkey in the post-1980 period. We use Nonlinear Autoregressive Distributed Lags (NARDL) model to test the asymmetric impact of volume on price. The result from the bound test indicates that the null of the cointegration hypothesis rejects for Ateks, Bossa, and Mndrs stocks. We find a significant long-run asymmetric effect of volume on the price for Ateks while not for other stocks. It is also found that volume affects price asymmetrically in the short-run for Ateks, Bossa, and Mndrs.

Keywords: Stock Market, Volume, Price, NARDL, Textile Sector
Jel Code: C01, F65, G17, G40

Hacmin Fiyat Üzerindeki Doğrusal Olmayan Etkisinin Test Edilmesi: BIST Tekstil Sektörü Hisse Senetleri Örneği

Özet:

Bu çalışma, 2011-2016 döneminde BİST'te işlem gören Tekstil sektörü hisse senetleri için hacim ve fiyat arasındaki doğrusal olmayan ilişkiyi günlük verileri kullanarak incelemektedir. Tekstil sektörünün seçilmesinin nedeni, 1980 sonrası dönemde Türkiye ihracatında öncü bir sektör olmasıdır. Hacmin fiyat üzerindeki asimetrik etkisini test etmek için Doğrusal Olmayan Gecikmesi Dağıtılmış Otoregresif (NARDL) modeli kullanılmıştır. Sınır testinden elde edilen sonuca göre, Ateks, Bossa ve Mndrs hisse senetleri için fiyat ve hacim arasında eşbütünleşik ilişki olduğu tespit edilmiştir. Diğer hisse senetleri için olmasa da, Ateks hisse senedinde hacmin fiyat üzerinde uzun dönemde asimetrik bir etkisi olduğunu görülmüştür. Ateks, Bossa ve Mndr hisse senetlerinde kısa dönemde hacmin fiyatı asimetrik olarak etkilediği ortaya koyulmuştur.

Anahtar Kelimeler: Hisse Senedi Piyasası, Hacim, Fiyat, NARDL, Tekstil Sektörü
Jel Kodları: C01, F65, G17, G40

Geliş Tarihi (Received): 27.03.2020, Kabul Edilme Tarihi (Accepted): 16.12.2020

Atıfta bulunmak için/Cite this paper:
Bozma, G. ve Başar, S. (2020). Testing nonlinear effect of volume on price: Evidence from textile sector stocks in BIST, *Çankırı Karatekin Üniversitesi İİBF Dergisi*, 10 (2), 673-689. Doi: 10.18074/ckuiibfd.710113

1. Introduction

The most important instrument of capital markets, which is one of the main financial and economic units for the world economies, undoubtedly stocks. They are financial instruments that create shareholding status between the issuer and the buyer and give the issuer the right to use the funds until the day of liquidation. Stock markets also have economic functions such as providing liquidity and movement to savings, creating a single price in the market, spreading ownership, securing investors, becoming an important indicator in the economy, giving mobility to the capital, and making structural changes in the industry.

In this study, the relationship between volumes and prices of textile sector shares traded in Borsa Istanbul (BIST) is discussed. The study is different from other studies as it is done for a single country and a single sector. The reason for the selection of the textile sector is that it is a pioneering sector in the exports of Turkey in the post-1980 period when the liberal economy began to be implemented. In the second part of the study, some theoretical and empirical studies about the determinants of stock prices are summarized. In this context, after explaining the discussions about some macro-economic factors such as inflation rate, interest rate, exchange rate, and money supply; the effect of the transaction volume, which is the main movement point of the study, on the price has been explained. In the last part, the relationship between volumes and prices of the stocks of the textile sector traded in BIST has been empirically analyzed. Various econometric methods have been used in this context and findings have been reported. The study concludes with results and evaluations made under the light of the application (analyses) results.

2. Determinants of Stock Prices

Several factors affect the formation of stock prices. Some of these are related to the commercial performance of the companies. Apart from this, the performances of countries and the world economy, as well as political factors and anticipations, can affect prices. Various studies have been carried out in the literature regarding the prices of stocks and their determinations.

As the findings on the effect of ***inflation*** on stocks have been investigated, it has been found that inflation has increased share stock returns (Abdullah and Hayworth, 1993; Boudoukh and Richardson, 1993; Fosback, 1992; Spyrou, 2004; Zügül and Şahin, 2009). On the other hand, some studies have been found inflation has decreased stock returns (Adrangi, Chatrath, and Raffiee, 1999; Chopin and Zhong, 2000; Fama, 1981; Geske and Roll, 1983; Mandelker and Tandon, 1985; Wongbangpo and Sharma, 2002).

Some studies have focused on the relationship between stock prices and the ***exchange rate***. Aggarwal (1981), Sadeghi (1992), Erdem, Arslan, and Sema

Erdem (2005), Kurihara (2006) have found a positive relationship between the exchange rate and stock prices. In contrast, Soenen and Hennigar (1988), Ajayi and Mougouė (1996), Maysami and Koh (2000), Hondroyiannis and Papapetrou (2001), Yurdakul and Akçoraoğlu (2006), Kim (2003), Dizdarlar and Derindere (2008), Albayrak, Öztürk, and Tüylüoğlu (2012) have found a negative relationship between the exchange rates and stock prices. Gay Jr (2008) argues that there is no relationship between exchange rates and prices for BRIC countries.

The relationship between the prices of stocks and the returns and the ***interest rates*** has also been the subject of various studies. Many of the studies suggest that stock prices are adversely affected by interest rates (Aydemir, Demirtaş, and Demirhan, 2009; Büyükşalvarcı, 2010; Cook and Hahn, 1988; Flannery and James, 1984; Hondroyiannis and Papapetrou, 2001; Kim, 2003; Mukherjee and Naka, 1995; Mumcu, 2005; Zügül and Şahin, 2009). On the other hand, there are some findings that there is no correlation between these variables (Dizdarlar and Derindere, 2008; Gençtürk, 2009; Kurihara, 2006; Laopodis, 2011).

The claim that the ***money supply*** will affect stock prices is also discussed in the literature. Sprinkel (1964) and Palmer (1970) reached findings confirming this claim. In some of these studies, it was concluded that the money supply in some cases negatively affects the stock prices (Altıntaş and Tombak, 2011; Sohail and Zakir, 2011; Zügül and Şahin, 2009) while some studies found a positive effect of this relationship (Atan, Boztosun, and Kayacan, 2005; Aydemir et al., 2009; Büyükşalvarcı, 2010; Gençtürk, 2009; Kaya, Çömlekçi, and Kara, 2013; Mukherjee and Naka, 1995; Omağ, 2009; Özer, Kaya, and Özer, 2013; Shiblee, 2009; Sohail and Hussain, 2012).

Recently, prices of stocks and the relationship between returns and volume are being discussed extensively. Granger and Morgenstern (1963) and Abdullahi, Kouhy, and Muhammad (2014) have suggested that there is no relationship between these variables. The relationship between volume and prices can be stated to be the forefront of causality analysis. Some of these studies have found that there is a two-way causality between transaction volume and stock prices (Akar, 2008; Başci, Özyildirim, and Aydoğan, 1996; Chen, Firth, and Rui, 2001; Lee and Rui, 2002; Moosa and Al-Loughani, 1995; Silvapulle and Choi, 1999; Yörük, Erdem, and Erdem, 2006).

However, there are also studies suggesting that volumes affect stock prices. Saatcioglu and Starks (1998) used data from the 1986-1995 period in their studies on stocks traded on Argentina, Brazil, Chile, Colombia, Mexico, and Venezuela stock exchange markets. According to the results of the study, there is a direct correlation between transaction volume and prices in Brazil, Colombia, Mexico, and Venezuela stock exchanges. Ahmed, Hassan, and Nasir (2005) have concluded that the volume is also influential on the volatility of stocks brought for the Kuala Lumpur Stock Exchange. Baklaci and Kasman (2006) estimated 25 stocks traded in BIST using the daily data for the period 1998-2005 and found that the volumes affect the return volatility of the corresponding stocks. Floros and Vougas (2007) have found in their work that on the Greek Stock Exchange, the volume is influenced by the prices of 20 stocks. Mahajan and Singh (2008) used daily data for the Mumbai Stock Exchange and concluded the increase in the volume of their stocks increased price volatility. Similar researches for India was carried out by Kumar, Singh, and Pandey (2009) and their finding was that the volume is affected by income. Chandrapala (2011) reached past period volume negatively affected existing prices in the study of 266 stocks traded in Colombo stock exchange. Başar (2014) applied a dynamic panel regression estimation on the stocks of logistics and civil aviation companies on BIST and reached the result that stock prices were negatively and significantly affected by the volume. Al Samman and Al-Jafari (2015) argued that the volume for the Omani stock exchange is the reason for stock returns. Findings related to the relationship between price and volumes have been obtained in studies conducted on BIST (Akar, 2008; Baklaci and Kasman, 2006; Başci et al., 1996; Kayalıdere, Kargın, and Aktaş, 2009; Umutlu, 2008; Yörük et al., 2006). Chaudhuri and Kumar (2015) stated that stock price is weakly exogenous only in the high volatility regime. Garcia et al. (2014) suggested that there is a bidirectional causal relation from volume to price returns not only in the mean but also in the variance. Carvalhal et al. (2013) indicated a positive and significant relation between stock price changes and high-volume trades. Moreover, Rashid (2007) suggested that the linear Granger causality from volume change to stock price change depends on the direction of the stock price movement. Wand et al. (2020) analyzed China’s stock market behavior and subsequent price–volume equation and they found that significant time-breaking effects exist and that the high-low volatility effects are substantial. Gebka and Wohar (2013) analyzed the causality between past trading volume and index returns in the Pacific Basin countries. They found that OLS results indicate no causal link between volume and returns. However, the quantile regression method reveals strong nonlinear causality: positive for high return quantiles and negative for low ones. Ozdemir (2020) analyzed that volatility spillover between stock prices and trading volume is examined within the framework of the mixed distributions hypothesis in Turkish capital markets. The results from the study indicated that the existence of bidirectional volatility spillovers between stock price and trading volume in the pre-and post-crisis periods. Moreover, there is a unidirectional volatility spillover from stock prices to trading volume in the crisis period. Zhang et al. (2017) found a strong relationship between stock price volatility and volume. Chen et.al (2018) found that the stock market volume information is helpful to the prediction of the volatility of the stock price.

3. An Application on the Relations Between Transaction Prices and Prices of Stocks of the Textile Sector Traded in Stock Exchange Istanbul

3.1. Methodology

The NARDL (Non-Linear Autoregressive Distributed Lags) method proposed by Shin, Yu, and Greenwood-Nimmo (2014) is used to determine the existence of an asymmetric relationship between price and volume in the stock market. The NARDL model is often used in recent empirical studies as a useful method for determining the asymmetric relationship. The following equation (1) is used to reveal that asymmetric relationship.

$$y_t = \beta^+ x_t^+ + \beta^- x_t^- + u_t \qquad \text{and} \qquad x_t = x_0 + x_t^+ + x_t^- \tag{1}$$

where the *y* and *x* dependent and independent variables are stationary I(1) level respectively and x_t^+ and x_t^- indicate the sum of the positive and negative residuals of *x*. Positive and negative residuals are obtained as in the following equation (2).

$$x_t^+ = \sum_{j=1}^{t} \Delta x_t^+ = \sum_{j=1}^{t} \max(\Delta x_j, 0)\,, x_t^- = \sum_{j=1}^{t} \Delta x_t^- = \sum_{j=1}^{t} \min(\Delta x_j, 0) \tag{2}$$

The NARDL model is similar to the ARDL model developed by Pesaran et al. (2001). Therefore, the series should also be stationary at I (0) or I (1) levels. The NARDL model adapted to equation (3) is given below.

$$\Delta Lnp_{i,t} = \alpha_0 + \beta Lnp_{i,t-1} + \theta^+ Lnv_{i,t-1}^+ + \theta^- Lnv_{i,t-1}^- + \sum_{i=1}^{p-1} \varphi_i \Delta Lnp_{i,t-i} + \sum_{i=0}^{q-1} \pi_i^- \Delta Lnv_{i,t-i}^- + \sum_{i=0}^{q-1} \pi_i^+ \Delta Lnv_{i,t-i}^+ + \varepsilon_t \tag{3}$$

Equation (3) shows *Lnv* and *Lnp* the volume and price of i stock respectively and ε is error terms without autocorrelation. The information criterion (Akaike, Schwarz, Hannan-Quinn, FPE) could be used in the NARDL model as well as in the ARDL model, besides the general to the specific approach. General to the specific approach, starts from the maximum lag length, and the model is estimated again by discarding statistically insignificant variables. This process continues until there is no meaningful variable in the model and thus the optimal model is tried to be obtained. Following the determination of the optimal model, null hypotheses are tested for whether the series are cointegrated or not $t_{BDM} : \beta = 0$ and $F_{PSS}: \beta = \theta^+ = \theta^- = 0$. The test statistics obtained from the tests are compared with the table values given in Pesaran, Shin, and Smith (2001) to determine whether the series are cointegrated. The hypothesis $W_{LR}: -\frac{\theta^+}{\beta} = -\frac{\theta^-}{\beta}$ is tested for the existence of a long-run symmetrical relationship. At the same time, the hypothesis $W_{SR}: \sum_{i=0}^{q} \pi_i^- = \sum_{i=0}^{q} \pi_i^+$ is tested for a short-run symmetrical relationship.

3.2. Data Set

10 Textile stocks (Arsan, Ateks, Bilici, Bossa, Dagi, Kords, Mndrs, Sktas, Yatas, and Yunsa) traded at BIST to test the existence of an asymmetric relationship between the price of the stock market and the volume using the daily data set for the period 2011-2016 is discussed. The data of 10 Textile stocks prices are taken from www.investing.com. Estimates were made by taking the natural logarithm of the data sets used in the study. Table 1 presents descriptive statistics for the series.

Table 1: Descriptive Statistics

Statistics		Mean	Median	Max.	Min.	Std. Dev.	Skew.	Kurto.	JB	Obs.
Arsan	Lnv	13.445	13.437	17.229	10.504	1.024	0.205	3.052	10.875*	1517
	Lnp	0.578	0.548	1.241	0.131	0.222	0.263	2.131	65.210*	1517
Ateks	Lnv	11.46	11.374	14.746	8.588	1.083	0.3	2.878	22.931*	1461
	Lnp	1.746	1.7439	2.496	1.169	0.306	0.149	2.299	35.277*	1461
Bilici	Lnv	12.481	12.461	16.031	9.242	1.107	0.158	3.097	6.242*	1364
	Lnp	0.433	0.255	1.430	-0.051	0.369	0.829	2.335	181.294*	1364
Bossa	Lnv	12.89	12.807	17.255	9.254	1.123	0.41	3.299	46.598*	1461
	Lnp	0.76	0.751	1.536	0.398	0.186	0.742	3.859	179.196*	1461
Dagi	Lnv	12.79	12.741	16.532	8.835	1.181	0.12	3.206	5.716**	1357
	Lnp	0.39	0.357	1.308	-0.415	0.389	0.3	2.665	26.716*	1357
Kords	Lnv	12.296	12.103	17.449	7.8716	1.549	0.195	2.541	22.061*	1461
	Lnp	1.419	1.383	2.021	1.004	0.205	0.636	3.181	100.737*	1461
Mndrs	Lnv	14.815	14.815	18.275	11.780	0.978	0.079	2.953	1.665	1461
	Lnp	-0.430	-0.494	0.166	-0.942	0.260	0.369	2.141	78.114*	1461
Sktas	Lnv	11.391	11.319	15.452	8.397	1.076	0.402	3.437	51.028	1461
	Lnp	1.318	1.151	2.868	0.631	0.544	1.062	3.384	283.690	1461
Yatas	Lnv	13.194	13.223	16.853	7.879	1.162	-0.093	3.144	3.373	1461
	Lnp	0.434	0.278	1.475	-0.261	0.453	0.465	1.877	129.358*	1461
Yunsa	Lnv	11.424	11.377	14.883	7.688	1.336	0.002	2.451	18.326	1461
	Lnp	1.388	1.435	1.911	0.718	0.293	-0.356	1.910	103.114	1461

Note: * ,** and *** indicate null hypothesis rejected at a significance level of 1%, 5%, and 10%, respectively.

As seen in Table 1, on average, Mndrs has the highest volume in the stocks (14.815). This stock is followed by Arsan (13.445) and Yatas (13.194), respectively. The lowest volume belongs to Sktas stock. When we look at stock prices, Ateks appears as the highest bid (1.746). Yunsa (1.388) and Sktas (1.318) follow Ateks respectively. If we look at the standard deviation, which is a decent indicator, the price is the highest for Sktas (0.544) and the lowest for Bossa (0.186). When we look at the kurtosis coefficients, it is expressed that the coefficients have a distribution of fat tail when the coefficients are larger than 0. The Jarque-Bera coefficients show that the volume of Mndrs stock, the volume and price of Sktas stock, and all the series except Yatas and Yunsa's volume are not normally distributed. Other statistics of the series can be seen in Table 1. On the other hand, when we see over at the stationary of the series (Table 2), the volumes of all stocks are at 1% significance level (I (0)) and the price series are at the 1% significance level (I (1)).

Table 2: ADF Unit Root Test Results

Variables	Lnv_t	ΔLnv_t	Lnp_t	ΔLnp_t
Arsan	-10,330(2)*	-	-2.794 (0)	-36.795 (0)*
Ateks	-10.017(3)*	-	-2.655(0)	-38.011(0)*
Bilici	-7.466(4)*	-	-2.185(0)	-34.893(0)*
Bossa	-7.843(1)**	-	-3.095(1)	-35.361(0)*
Dagi	-11.139(2)*	-	-1.440(1)	-32.073(0)*
Kords	-4.916(6)*	-	-1.848(0)	-36.858(0)*
Mndrs	-6.093(7)*	-	-2.116(1)	-41.388(0)*
Sktas	-8.813(4)*	-	-2.522(0)	-35.983(0)*
Yatas	-5.831(5)*	-	-1.291(0)	-36.867(0)*
Yunsa	-4.523(6)*	-	-1.602(0)	-35.813(0)*

Note: * ,**, and *** respectively 1%, 5%, and 10% the null hypothesis at the level of significance is rejected.

Normally, there are 12 textile stocks in BIST. These are excluded from the study because the volume and price series values of Derim and Hateks are stationary at the level I(0). Since none of the listed series is at level I (2), the NARDL method can be used to determine the asymmetric relationship between volume and price in stocks.

3.3. Estimation Results

As a result of the ADF unit root test, short and long-term asymmetric relations between the prices and volumes of stocks are examined by the NARDL method followed by Shin et al. (2014) because none of the series is stationary at I (2) level. To determine the optimal lag length, general to specific approach is used and the NARDL model is tried to be constructed starting by lag lengths p = 12 and q = 12. As seen in Table 3, only a long-run period of asymmetric relationship exists between prices and stocks in Ateks, Bossa, and Mndrs (F_{PSS}> I (1)). On the other hand, it can be said that there is no cointegrated relationship between the asymmetric structure of volume and price for 7 stocks. In this context, between the volumes and prices of stocks, Saatcioglu and Starks (1998), Moosa and Al-Loughani (1995), Başci et al. (1996), Silvapulle and Choi (1999) and Yörük et al. (2006) suggest symmetrical relations may exist.

Table 3: NARDL Model Results

Arsan		**Ateks**		**Bilici**		**Bossa**		**Dagi**	
Constant	0.000 (0.035)	*Constant*	0.016 (2.714)	*Constant*	0.003 (0.792)	*Constant*	0.004 (1.203)	*Constant*	0.002 (0.727)
$\boldsymbol{lnp_{t-1}}$	-0.009 (-1.816)	lnp_{t-1}	-0.012 (-3.518)	lnp_{t-1}	-0.006 (-1.321)	lnp_{t-1}	-0.011 (-2.121)	lnp_{t-1}	-0.003 (-1.699)
$\boldsymbol{lnv^{+}_{t-1}}$	-0.001 (-1.075)	lnv^{+}_{t-1}	0.002 (2.661)	lnv^{+}_{t-1}	0.000 (0.333)	lnv^{+}_{t-1}	0.002 (2.028)	lnv^{+}_{t-1}	0.000 (0.870)
$\boldsymbol{lnv^{-}_{t-1}}$	-0.001 (-1.074)	lnv^{-}_{t-1}	0.002 (2.652)	lnv^{-}_{t-1}	0.000 (0.346)	lnv^{-}_{t-1}	0.002 (2.025)	lnv^{-}_{t-1}	0.000 (0.869)
$\boldsymbol{\Delta lnv^{+}}$	0.015 (7.432)	Δlnp_{t-3}	0.076* (2.781)	Δlnp_{t-1}	0.061 (0.888)	Δlnv^{+}	0.019* (11.264)	Δlnp_{t-1}	0.131* (2.391)
$\boldsymbol{\Delta lnv^{+}_{t-2}}$	0.005* (3.274)	Δlnv^{+}	0.022* (7.838)	Δlnp_{t-12}	0.081 (1.549)	Δlnv^{+}_{t-2}	0.003** (2.207)	Δlnp_{t-3}	0.084*** (1.880)
$\boldsymbol{\Delta lnv^{+}_{t-3}}$	-0.004** (-2.220)	Δlnv^{+}_{t-2}	0.004* (2.437)	Δlnv^{+}	0.012 (1.549)	Δlnv^{+}_{t-10}	-0.003**** (-1.726)	Δlnp_{t-10}	0.058* (2.276)
$\boldsymbol{\Delta lnv^{-}_{t-1}}$	0.004* (3.073)	Δlnv^{+}_{t-10}	0.003* (2.543)	Δlnv^{-}_{t-1}	0.004* (2.815)	Δlnv^{-}	0.004* (2.590)	Δlnv^{+}	0.009* (4.288)
$\boldsymbol{\Delta lnv^{-}_{t-2}}$	-0.004** (-2.338)	Δlnv^{-}	0.005* (3.281)			Δlnv^{-}_{t-1}	0.006* (3.625)	Δlnv^{-}	0.002*** (1.853)
$\boldsymbol{\Delta lnv^{-}_{t-3}}$	0.006* (3.114)	Δlnv^{-}_{t-1}	0.005* (2.727)					Δlnv^{-}_{t-1}	0.005* (3.438)
		Δlnv^{-}_{t-3}	0.004* (2.694)						
$\boldsymbol{L^{+}_{rkur}}$	-0.135 (-1.274)		0.216* (3.479)		0.057 0.314)		0.188 (1.252)		0.284 (0.851)
$\boldsymbol{L^{-}_{rkur}}$	-0.135 (-1.271)		0.214* (3.454)		0.059 (0.325)		0.187 (1.250)		0.282 (0.849)
χ^2_{SC}	1.233 [0.26]		0.001 [0.96]		0.014 [0.90]		2.00 [0.15]		0.231 [0.63]
χ^2_{HET}	329.124 [0.00]		319.08 [0.07]		125.01 [0.00]		270.93 [0.00]		320.17 [0.00]
χ^2_{FF}	1.080 [0.298]		57.977 [0.00]		7.38 [0.00]		13.032 [0.00]		1.215 [0.270]
$\boldsymbol{W_{LR}}$	0.610 [0.43]		16.022 [0.00]		7.737 [0.00]		1.147 [0.28]		22.462 [0.00]
$\boldsymbol{W_{SR}}$	4.949 [0.02]		9.491 [0.00]		7.54 [0.00]		7.542 [0.00]		107.087 [0.000]
F_{PSS}	3.24		4.21***		0.70		4.63***		1.06
t_{BDM}	-1.81		-3.51***		-1.32		-2.12		-1.69

Note: * ,**, and *** respectively 1%, 5%, and 10% the null hypothesis at the level of significance is rejected. The first difference of Δ symbol variables; Figure in the parentheses are the t-statistics and the brackets are probability values. χ^2_{SC}, $\chi^2_{HET,}$ and χ^2_{FF} indicate the LM, White, and Ramsey-Reset tests respectively. Newey-West standard error correction has been used because the models have heteroscedasticity and autocorrelation problem.

The Wald test was used to determine long-run and short-run asymmetric relationships for the stocks and obtained results are presented in Table 3. According to the findings ($\boldsymbol{W_{LR} = 16.02\ [0.00]}$) in the long term, only the volume of Ateks affects the price asymmetrically. Accordingly, an increase or a decrease in the volume of the stock causes differences in the price. A positive 1% increase in volume for Ateks will increase the stock price by 0.216%, while a 1% decrease in volume will decrease the price by 0.214%. This result indicates that the price of the stock is more sensitive to positive volume increases. When we look at short-term asymmetric results ($\boldsymbol{W_{SR} = 9.49\ [0.00]}$), increases and decreases in volume affect the price differently. Ateks stock price increases in the short term are caused by volume increases. In this context, it can be stated that the volume increases in Ateks stock are in the direction of buying and therefore raising the prices.

Table 3 (Continued)

Kords		**Mndrs**		**Sktas**		**Yatas**		**Yunsa**	
Constant	0.014 (2.291)	*Constant*	-0.002 (-1.291)	*Constant*	0.014 (1.186)	*Constant*	-0.005 (-2.608)	*Constant*	0.003 (1.114)
$\boldsymbol{lnp_{t-1}}$	-0.010 (-2.599)	lnp_{t-1}	-0.009 (-2.672)	lnp_{t-1}	-0.006 (-1.134)	lnp_{t-1}	-0.002 (-1.201)	lnp_{t-1}	-0.002 (-0.925)
$\boldsymbol{lnv^{+}_{t-1}}$	0.001 (2.595)	lnv^{+}_{t-1}	0.002 (2.732)	lnv^{+}_{t-1}	0.002 (2.430)	lnv^{+}_{t-1}	0.001 (2.586)	lnv^{+}_{t-1}	0.000 (0.671)
$\boldsymbol{lnv^{-}_{t-1}}$	0.001 (2.586)	lnv^{-}_{t-1}	0.002 (2.736)	lnv^{-}_{t-1}	0.002 (2.443)	lnv^{-}_{t-1}	0.001 (2.576)	lnv^{-}_{t-1}	0.000 (0.682)
$\boldsymbol{\Delta lnp_{t-3}}$	0.061*** (1.770)	Δlnp_{t-1}	-0.085* (-2.487)	Δlnp_{t-8}	0.075*** (1.695)	Δlnv^{+}	0.011* (5.185)	Δlnp_{t-1}	0.080*** (1.766)
$\boldsymbol{\Delta lnp_{t-9}}$	-0.070* (-2.836)	Δlnp_{t-3}	0.060** (2.054)	Δlnv^{+}	0.013* (7.633)	Δlnv^{+}_{t-8}	0.002** (2.255)	Δlnp_{t-5}	-0.050 (-1.559)
$\boldsymbol{\Delta lnv^{+}}$	0.010* (4.663)	Δlnp_{t-9}	-0.057*** (-1.759)	Δlnv^{+}_{t-5}	-0.004** (-2.143)	Δlnv^{-}	0.003* (2.729)	Δlnp^{+}	0.011* (5.263)
$\boldsymbol{\Delta lnv^{+}_{t-2}}$	0.002* (2.436)	Δlnv^{+}	0.009* (3.167)	Δlnv^{+}_{t-6}	-0.005* (-3.546)	Δlnv^{-}_{t-1}	0.004* (2.885)	Δlnp^{+}_{t-1}	-0.002** (-2.066)
$\boldsymbol{\Delta lnv^{-}}$	0.004* (3.787)	Δlnv^{-}_{t-10}	0.003* (2.758)	Δlnv^{+}_{t-8}	-0.005** (-2.293)			Δlnp^{+}_{t-2}	0.003* (2.458)
$\boldsymbol{\Delta lnv^{-}_{t-1}}$	0.005* (3.986)			Δlnp^{-}_{t-7}	-0.004*** (-1.908)			Δlnp^{-}_{t-1}	0.005* (3.452)
$\boldsymbol{L^{+}_{rkur}}$	0.154* (2.941)		0.277*** (1.986)		0.358 (1.043)		0.827 (1.388)		0.172 (0.428)
$\boldsymbol{L^{-}_{rkur}}$	0.154* (2.928)		0.278*** (1.992)		0.360 (1.049)		0.819 (1.384)		0.175 (0.432)
χ^2_{SC}	0.197 [0.65]		4.556 [0.03]		4.057 [0.04]		0.635 [0.425]		0.567 [0.451]
χ^2_{HET}	261.56 [0.00]		380.69 [0.00]		150.53 [0.00]		100.89 [0.00]		367.85 [0.00]
χ^2_{FF}	16.262 [0.00]		22.868 [0.00]		40.977 [0.00]		32.226 [0.00]		52.980 [0.00]
$\boldsymbol{W_{LR}}$	0.011 [0.91]		0.948 [0.33]		8.425 [0.02]		2.466 [0.11]		0.629 [0.42]
$\boldsymbol{W_{SR}}$	0.985 [0.32]		3.495 [0.06]		0.427 [0.51]		4.298 [0.03]		4.285 [0.03]
F_{PSS}	3.05		4.83**		2.352		3.09		1.95
t_{BDM}	-2.59		-2.67		-1.13		-1.20		-0.92

Note: *, ** and *** respectively 1%, 5%, and 10% the null hypothesis at the level of significance is rejected. The first difference of Δ symbol variables; the figure in the parentheses are the t-statistics and the brackets are probability values. χ^2_{SC}, $\chi^2_{HET,}$ and χ^2_{FF} indicate the LM, White, and Ramsey-Reset tests respectively. Newey-West standard error correction has been used because the models have heteroscedasticity and autocorrelation problem.

On the other hand, although there is a long-run relationship between volume and prices in Bossa ($\boldsymbol{W_{LR} = 1.14\ [0.28]}$) and Mndrs ($\boldsymbol{W_{LR} = 0.94\ [0.33]}$), increases and decreases in the volume have similar effects on price. This may be due to the long-term symmetrical relationship between volume and price, not asymmetric, as Moosa and Al-Loughani (1995), Başci et al. (1996), and Silvapulle and Choi (1999) suggest. On the other hand, the positive and negative increases in volume for Bossa ($\boldsymbol{W_{SR} = 7.54\ [0.00]}$) and Mndrs ($\boldsymbol{W_{SR} = 3.49\ [0.06]}$) affect the price difference. In the short term, the rise in volume for

Bossa increases the price of the stock. In this context, it can be said that the volume increase for Bossa is in the direction of buying, while it is in the direction of selling for Mndrs.

4. Conclusion

It is of great importance for investors that the stock prices are affected by which variables and at what level. Because a high amount of investment requires a high amount of information. Particularly after the 2008 financial crisis, researchers tried to intensely determine the determinants of stock prices. The studies focused mainly on symmetrical models. Asymmetric models have been used in recent years (Fujihara and Mougou, 1997; Hiemstra and Jones, 1994; Silvapulle and Choi, 1999; Lee and Rui, 2002; Rashid, 2007). Asymmetric relations between volume and price have been identified, and bidirectional asymmetric relationships have been found throughout the studies. These results obtained from the studies show that the volume will have an asymmetrical effect on the price and it should be measured. In this study, the existence of an asymmetrical relationship between the volume and price of the stock was tried to be determined by applying the NARDL method to 10 textile stocks traded in BIST in the 2011-2016 period. As a result of the findings obtained from the empirical method, only in the long term in Ateks stock, the volume affects the price of the stock asymmetrically. In the short term, the volumes of Ateks, Bossa, and Mndrs stocks have an asymmetrical effect on their prices. These results are considered to be of great importance for the investor. BIST stands out among the developing country stock market with its high transaction volume. Investors buy stocks in sectors with high-profit maximization. Therefore, investors who buy and sell stocks use some financial indicators, and investments can be made by looking at the stock volume. If this situation is compared with the findings obtained from the study, it obliges investors to consider the volume of stocks both in the long and short term. Moreover, the findings show that investors are advised to maximize profit for stocks such as Ateks, Bossa and Mndrs, and to examine the volume of the stock, such as financial statement analysis (price-earnings, current ratio, acid-test ratio, etc.) that affect the stock. On the other hand, the focus of the study on the mean equation reveals the necessity of examining the price-volume relationship in case of uncertainty (analysis of variance). Finally, in future studies, it is suggested to the researchers to examine the asymmetric effect of the price on the volume.

References

Abdullah, D. A., and Hayworth, S. C. (1993). Macroeconometrics of stock price fluctuations. *Quarterly Journal of Business and Economics, 32*(1), 50-67. Retrieved from http://www.jstor.org/stable/40473075

Abdullahi, S. A., Kouhy, R., and Muhammad, Z. (2014). Trading volume and return relationship in the crude oil futures markets. *Studies in Economics and Finance, 31*(4), 426-438. doi:doi:10.1108/SEF-08-2012-0092

Adrangi, B., Chatrath, A., and Raffiee, K. (1999). Inflation, output, and stock prices: Evidence from two major emerging markets. *Journal of Economics and Finance, 23*(3), 266-278. doi:10.1007/bf02757711

Aggarwal, R. (1981). Exchange Rates and Stock Prices: A study of U. S. capital market under floating exchange rates. *Akron Business and Economic Review, 12,* 7-12.

Ahmed, H. J. A., Hassan, A., and Nasir, A. M. (2005). The relationship between trading volume, volatility and stock market returns: A test of Mixed Distribution Hypothesis for a Pre and Post crisis on Kuala Lumpur Stock Exchange. *Investment Management and Financial Innovations, 3*(3), 146-158.

Ajayi, R. A., and Mougouė, M. (1996). On the dynamic relation between stock prices and exchange rates. *Journal of Financial Research, 19*(2), 193-207. doi:10.1111/j.1475-6803.1996.tb00593.x

Akar, C. (2008). Hisse senedi fiyatlariyla yabanci islem hacmi arasinda nedensellik: Toda-Yamamoto Yaklasimi. *Muhasebe ve Finansman Dergisi*(37).

Al Samman, H., and Al-Jafari, M. K. (2015). Trading volume and stock returns volatility: evidence from industrial firms of Oman. *Asian Social Science, 11*(24), 139.

Albayrak, A. S., Öztürk, N., and Tüylüoğlu, Ş. (2012). Makroekonomik değişkenler ile sermaye hareketlerinin İMKB-100 endeksi üzerindeki etkisinin incelenmesi. *AİBÜ-İİBF Ekonomik ve Sosyal Araştırmalar Dergisi*.

Altıntaş, H., and Tombak, F. (2011). Türkiye'de hisse senedi fiyatları ve makro ekonomik değişkenler arasındaki ilişkinin ekonometrik analizi: 1987-2008. *Anadolu Üniversitesi Ekonomi Kongresi II*, 1-21.

Atan, M., Boztosun, D., and Kayacan, M. (2005). Arbitraj fiyatlama modeli yaklaşımın İMKB'de test edilmesi. *9. Ulusal Finans Sempozyumu Stratejik Finans*.

Aydemir, O., Demirtaş, G., and Demirhan, B. (2009). Hisse senedi piyasasının gelişiminde makro ekonomik değişkenlerin rolü: panel veri analizi. *13. Ulusal Finans Sempozyumu*.

Baklaci, H., and Kasman, A. (2006). An empirical analysis of trading volume and return volatility relationship in the Turkish Stock Market. *Ege Academic Review, 6*(2), 115-125.

Başar, S. İ. (2014). Hisse Senetlerinin fiyatları ile işlem hacimleri arasındaki ilişki: lojistik ve sivil havacılık sektörleri üzerine bir uygulama. *Kafkas Üniversitesi, Sosyal bilimler Enstitüsü, Yüksek Lisans Tezi*.

Başci, E., Özyildirim, S., and Aydoğan, K. (1996). A note on price-volume dynamics in an emerging stock market. *Journal of Banking & Finance, 20*(2), 389-400.

Boudoukh, J., and Richardson, M. (1993). Stock returns and inflation: A long-horizon perspective. *The American economic review, 83*(5), 1346-1355.

Büyükşalvarcı, A. (2010). The Effects of Macroeconomics Variables on Stock Returns: Evidence from Turkey. *European Journal of Social Sciences, 14*(3/4), 404.

Carvalhal, A., Martins, C., & Figueiredo, O. (2013). High volume trades and stock price changes in Brazil. *Corporate Ownership & Control, 11(1),* 92-101. http://dx.doi.org/10.22495/cocv11i1art8

Chandrapala, P. (2011). The relationship between trading volume and stock returns. *Journal of Competitiveness, 3*(3).

Chaudhuri, K., & Kumar, A. (2015). A Markov-switching model for Indian stock price and volume. *Journal of Emerging Market Finance, 14(3),* 239-257.

Chen, G. m., Firth, M., and Rui, O. M. (2001). The dynamic relation between stock returns, trading volume, and volatility. *Financial Review, 36*(3), 153-174.

Chen, S., Sun, Y. L., & Liu, Y. (2018). Forecast of stock price fluctuation based on the perspective of volume information in stock and exchange market. *China Finance Review International*.

Chopin, M., and Zhong, M. (2000). Stock returns, inflation and macroeconomy: the long-and short-run dynamics.

Cook, T., and Hahn, T. (1988). The information content of discount rate announcements and their effect on market interest rates. *Journal of Money, Credit and Banking, 20*(2), 167-180.

Dizdarlar, H. I., and Derindere, S. (2008). Hisse senedi endeksini etkileyen faktörler: İMKB 100 Endeksini etkileyen makroekonomik göstergeler üzerine bir araştırma. *Yönetim Dergisi, 19*(61), 113-124.

Erdem, C., Arslan, C. K., and Sema Erdem, M. (2005). Effects of macroeconomic variables on Istanbul stock exchange indexes. *Applied Financial Economics, 15*(14), 987-994.

Fama, E. F. (1981). Stock returns, real activity, inflation, and money. *The American economic review, 71*(4), 545-565.

Flannery, M. J., and James, C. M. (1984). The effect of interest rate changes on the common stock returns of financial institutions. *The Journal of finance, 39*(4), 1141-1153.

Floros, C., and Vougas, D. (2007). Trading volume and returns relationship in Greek stock index futures market: GARCH vs. GMM. *International Research Journal of Finance and Economics*(12), 98-115.

Fosback, N. G. (1992). Stock market logic.

Fujihara, R. A., and Mougoué, M. (1997). An examination of linear and nonlinear causal relationships between price variability and volume in petroleum futures markets. *Journal of Futures Markets, 17*(4), 385-416.

Gay Jr, R. D. (2008). *Effect of macroeconomic variables on stock market returns for four emerging economies: A vector regression model for Brazil, Russia, India, and China*: Nova Southeastern University.

Gebka, B., & Wohar, M. E. (2013). Causality between trading volume and returns: Evidence from quantile regressions. *International Review of Economics & Finance, 27*, 144-159.

Gençtürk, M. (2009). finansal kriz dönemlerinde makroekonomik faktörlerin hisse senedi fiyatlarina etkisi. *Suleyman Demirel University Journal of Faculty of Economics & Administrative Sciences, 14*(1).

Geske, R., and Roll, R. (1983). The fiscal and monetary linkage between stock returns and inflation. *The Journal of finance, 38*(1), 1-33.

Granger, C. W., and Morgenstern, O. (1963). Spectral analysis of New York stock market prices. *Kyklos, 16*(1), 1-27.

Hiemstra, C., and Jones, J. D. (1994). Testing for linear and nonlinear granger causality in the stock price- volume relation. *The Journal of finance, 49*(5), 1639-1664. doi:10.2307/2329266

Hondroyiannis, G., and Papapetrou, E. (2001). Macroeconomic influences on the stock market. *Journal of Economics and Finance, 25*(1), 33-49.

Kaya, V., Çömlekçi, İ., and Kara, O. (2013). Hisse senedi getirilerini etkileyen makroekonomik değişkenler 2002-2012 Türkiye Örneği. *Dumlupınar Üniversitesi Sosyal Bilimler Dergisi, 35*, 167-176.

Kayalıdere, K., Kargın, S., and Aktaş, R. (2009). İMKB'de fiyat ve hacim arasındaki nedensellik ilişkisi. *Celal Bayar Üniversitesi SBE Sosyal Bilimler Dergisi, 7*, 115-124.

Kim, K.-h. (2003). Dollar exchange rate and stock price: evidence from multivariate cointegration and error correction model. *Review of Financial Economics, 12*(3), 301-313.

Kumar, B., Singh, P., and Pandey, A. (2009). The dynamic relationship between price and trading volume: Evidence from Indian stock market.

Kurihara, Y. (2006). The relationship between exchange rate and stock prices during the quantitative easing policy in Japan. *International Journal of Business, 11*(4), 375.

Laopodis, N. T. (2011). Equity prices and macroeconomic fundamentals: International evidence. *Journal of International Financial Markets, Institutions and Money, 21*(2), 247-276.

Lee, B.-S., and Rui, O. M. (2002). The dynamic relationship between stock returns and trading volume: Domestic and cross-country evidence. *Journal of Banking & Finance, 26*(1), 51-78.

Mahajan, S., and Singh, B. (2008). An empirical analysis of stock price-volume relationship in Indian stock market. *Vision: The Journal of Business Perspective, 12*(3), 1-13.

Mandelker, G., and Tandon, K. (1985). Common stock returns, real activity, money, and inflation: Some international evidence. *Journal of International Money and Finance, 4*(2), 267-286.

Matilla-García, M., Marín, M. R., & Dore, M. I. (2014). A permutation entropy based test for causality: The volume–stock price relation. *Physica A: Statistical Mechanics and its Applications, 398*, 280-288.

Maysami, R. C., and Koh, T. S. (2000). A vector error correction model of the Singapore stock market. *International Review of Economics & Finance, 9*(1), 79-96.

Moosa, I. A., and Al-Loughani, N. E. (1995). Testing the price-volume relation in emerging Asian stock markets. *Journal of Asian Economics, 6*(3), 407-422.

Mukherjee, T. K., and Naka, A. (1995). Dynamic relations between macroeconomic variables and the Japanese stock market: an application of a vector error correction model. *Journal of Financial Research, 18*(2), 223-237.

Mumcu, F. (2005). Hisse senedi fiyatlarını etkileyen makroekonomik faktörler: İmkb üzerine bir uygulama. *Süleyman Demirel Üniversitesi Sosyal Bilimler Enstitüsü, Yayımlanmamış Yüksek Lisans Tezi*.

Omağ, A. (2009). Türkiye'de 1991-2006 döneminde makroekonomik değişkenlerin hisse senedi fiyatlarına etkisi. *Öneri Dergisi, 8*(32), 283-288.

Ozdemir, L. (2019). Volatility spillover between stock prices and trading volume: evidence from the pre-, in-and post global financial crisis periods. *Frontiers in Applied Mathematics and Statistics*, 5, 65.

Özer, A., Kaya, A., and Özer, N. (2013). Hisse senedi fiyatlari ile makroekonomik değişkenlerin etkileşimi. *Dokuz Eylül Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi, 26*(1).

Palmer, M. (1970). Money supply, portfolio adjustments and stock prices. *Financial Analysts Journal*, 19-22.

Pesaran, M. H., Shin, Y., and Smith, R. J. (2001). Bounds testing approaches to the analysis of level relationships. *Journal of Applied Econometrics, 16*(3), 289-326. doi:10.1002/jae.616

Rashid, A. (2007). Stock prices and trading volume: An assessment for linear and nonlinear Granger causality. *Journal of Asian Economics, 18*(4), 595-612.

Rashid, A. (2007). Stock prices and trading volume: An assessment for linear and nonlinear Granger causality. *Journal of Asian Economics, 18(4),* 595-612.

Saatcioglu, K., and Starks, L. T. (1998). The stock price–volume relationship in emerging stock markets: the case of Latin America. *International Journal of forecasting, 14*(2), 215-225.

Sadeghi, M. (1992). Stock market response to unexpected macroeconomic news: the Australian evidence.

Shiblee, L. S. (2009). The Impact of Inflation, GDP, Unemployment, and Money Supply on Stock Prices.

Shin, Y., Yu, B., and Greenwood-Nimmo, M. (2014). Modelling asymmetric cointegration and dynamic multipliers in a nonlinear ARDL framework. In *Festschrift in Honor of Peter Schmidt* (pp. 281-314): Springer.

Silvapulle, P., and Choi, J.-S. (1999). Testing for linear and nonlinear Granger causality in the stock price-volume relation: Korean evidence. *The Quarterly Review of Economics and Finance, 39*(1), 59-76.

Soenen, L. A., and Hennigar, E. S. (1988). An analysis of exchange-rates and stock-prices-the united-states experience between 1980 and 1986. *Akron Business and Economic Review, 19*(4), 7-16.

Sohail, N., and Hussain, Z. (2012). Macroeconomic policies and stock returns in Pakistan: a comparative analysis of three stock exchanges. *Interdisciplinary Journal of Contemporary Research in Business, 3*(10), 905-918.

Sohail, N., and Zakir, H. (2011). The Macroeconomic variables and stock returns in Pakistan: The case of Kse100 Index. *Journal of Applied Research in Finance Bi-Annually, 3*(1), 76-84.

Sprinkel, B. W. (1964). *Money and stock prices*: Homewood, Ill: RD Irwin.

Spyrou, S. I. (2004). Are stocks a good hedge against inflation? Evidence from emerging markets. *Applied Economics, 36*(1), 41-48.

Umutlu, G. (2008). İşlem hacmi ve fiyat değişimleri arasındaki nedensellik ve dinamik ilişkiler: İMKB'de bir ampirik inceleme. *Gazi Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi, 10*(1), 231-246.

Wang, P., Ho, T., & Li, Y. (2020). The price-volume relationship of the shanghai stock index: structural change and the threshold effect of volatility. *Sustainability, 12(8),* 3322.

Wongbangpo, P., and Sharma, S. C. (2002). Stock market and macroeconomic fundamental dynamic interactions: ASEAN-5 countries. *Journal of Asian Economics, 13*(1), 27-51.

Yörük, N., Erdem, C., and Erdem, M. S. (2006). Testing for linear and nonlinear Granger Causality in the stock price–volume relation: Turkish banking firms' evidence. *Applied Financial Economics Letters, 2*(3), 165-171.

Yurdakul, F., and Akçoraoğlu, A. (2006). Global factors stock returns: empirical evidence from the Turkish economy. *Ise Review, 6*(21), 1-18.

Zhang, W., Bi, Z.Z. and Shen, D.H. (2017). Investor structure and the price–volume relationship in a continuous double auction market: an agent-based modeling perspective. *Physica A: Statistical Mechanics and its Applications*, 467, 345-355.

Zügül, M., and Şahin, C. (2009). İmkb 100 endeksi ile bazı makroekonomik değişkenler arasındaki ilişkiyi incelemeye yönelik bir uygulama. *Akademik Bakış, 16*, 1-16.