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 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 döneme 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 sonuçta 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垴ımlaştırılmıştır. Ateks, Bossa ve Mndrs hisse senetlerinde kısa dönemde hacmin fiyat etkisi asimetrik olarak etkilediği ortaya koyulmuştur.

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

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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 İstanbul (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 Mougoué (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 relation ship 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; Başcı, Özyıldırım, 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; Başç et al., 1996; Kayalider, Kargin, 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.

\[ y_t = \beta^+ x^+_t + \beta^- x^-_t + u_t \quad \text{and} \quad x_t = x_0 + x^+_t + x^-_t \] (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).

\[ x^+_t = \sum_{j=1}^{t} \Delta x^+_j = \sum_{j=1}^{t} \max(\Delta x_j, 0) \quad \text{and} \quad x^-_t = \sum_{j=1}^{t} \Delta x^-_j = \sum_{j=1}^{t} \min(\Delta x_j, 0) \] (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.

\[ \Delta Ln p_{i,t} = \alpha_0 + \beta Ln v_{i,t-1} + \theta^+ Ln v^+_{i,t-1} + \theta^- Ln v^-_{i,t-1} + \sum_{i=1}^{p-1} \phi_{i} \Delta Ln p_{i,t-i} + \sum_{i=0}^{q-1} \pi_{i} \Delta Ln v^+_{i,t-i} + \sum_{i=0}^{q-1} \pi_{i} \Delta Ln v^-_{i,t-i} + \varepsilon_t \] (3)

Equation (3) shows \( Ln v \) and \( Ln p \) the volume and price of \( i \) stock respectively and \( \varepsilon \) 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| 0.205     | 0.116 | -0.033 | 10.875*| 1517 |
| Lnp        | 0.578 | 0.548 | 1.241 | 0.131 | 0.222     | 0.149 | 2.131  | 65.210*| 1517 |
| Ateks Lnv  | 11.46 | 11.374 | 14.746| 8.588 | 0.833     | 0.158 | 1.797  | 6.242* | 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 | 0.107     | 0.079 | 2.335  | 181.294*| 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 | 0.123     | 0.149 | 2.335  | 46.598*| 1461 |
| Lnp        | 0.76  | 0.751 | 1.536 | 0.398 | 0.186     | 0.742 | 2.335  | 35.277*| 1461 |
| Dagi Lnv   | 12.79 | 12.741| 16.532| 8.835 | 0.12      | 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| 0.195     | 2.541 | 22.061*| 100.737*| 1461 |
| Lnp        | 1.419 | 1.383 | 2.021 | 1.004 | 0.205     | 0.636 | 3.181  | 78.114*| 1461 |
| Mndrs Lnv  | 14.815| 14.815| 18.275| 11.780| 0.079     | 0.293 | 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 | 0.107     | 0.402 | 3.347  | 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 | \(Ln v_t\) | \(\Delta Ln v_t\) | \(Ln p_t\) | \(\Delta Ln p_t\) |
|-----------|-------------|------------------|-------------|------------------|
| Arsan     | -10.330(2)* | -2.794 (0)       | -36.795 (0)*|                   |
| Ateks     | -10.017(3)* | -2.655(0)        | -38.011(0)* |                   |
| Biliçi    | -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)* |                   |
| Sktus     | -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.
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 ($W_{LR} = 16.02 [0.00]$) 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 ($W_{SR} = 9.49 [0.00]$), increases and decreases in volume affect the price differently. Ateks stock price increases in the

### Table 3: NARDL Model Results

|                      | Arsan | Ateks | Bilici | Bossa | Dagi |
|----------------------|-------|-------|--------|-------|------|
| Constant             | 0.000 | 0.016 | 0.003  | 0.004 | 0.002|
| (0.035)              | (2.714)|       | (0.792)| (1.203)| (0.727)|
| $\ln p_{t-1}$       | -0.009| -0.012| -0.006 | -0.011| -0.003|
| (-1.816)             | (-3.518)|     | (-1.321)| (-2.121)| (-1.699)|
| $\ln v^a_{t-1}$     | -0.001| 0.002 | 0.000  | 0.002 | 0.000 |
| (-1.075)             | (2.661)|  | (0.333)| (2.028)  | (0.870) |
| $\ln v^c_{t-1}$     | -0.001| 0.002 | 0.000  | 0.002 | 0.000 |
| (-1.074)             | (2.652)|  | (0.346)| (2.025)  | (0.869) |
| $\Delta \ln v^t$    | 0.015 | 0.076*| 0.061  | 0.019*| 0.131*|
| (7.432)              | (2.781)|  | (0.888)| (11.264)| (2.391)|
| $\Delta \ln p_{t-3}$| 0.005*| 0.022*| 0.081  | 0.003**| 0.084***|
| (7.838)              | (2.707)|  | (1.549)| (2.207)  | (1.980) |
| $\Delta \ln v^a_{t-2}$| -0.044**| 0.004*| 0.012  | 0.033**| 0.058*|
| (-2.220)             | (2.437)|  | (1.549)| (1.726)  | (2.276) |
| $\Delta \ln v^c_{t-10}$| 0.003*| 0.004*| 0.004* | 0.004*| 0.009*|
| (3.073)              | (2.543)|  | (2.815)| (2.590)  | (4.288) |
| $\Delta \ln v^c_{t-2}$| -0.004**| 0.005*| 0.006* | 0.006*| 0.002***|
| (-2.338)             | (3.281)|  | (3.625)| (1.853)  |       |
| $\Delta \ln v^c_{t-3}$| 0.006*| 0.005*| 0.005* | 0.005*|       |
| (3.114)              | (2.727)|  | (3.438)|       |       |

| $L_{Rkur}$           | -0.135| 0.216*| 0.057  | 0.188 | 0.284 |
| (-1.274)             | (3.479)|  | (3.144)| (1.252) | (0.851) |
| $L_{Rkur}$           | -0.135| 0.214*| 0.059  | 0.187 | 0.282 |
| (-1.271)             | (3.454)|  | (3.325)| (1.250) | (0.849) |
| $\chi^2_{SC}$        | 1.233 | 0.001 | 0.014  | 2.00  | 0.231 |
| [0.26]               | [0.96] | [0.90] | [0.15] |       | [0.63] |
| $\chi^2_{HET}$       | 329.124| 319.08 | 125.01 | 270.93| 520.17 |
| [0.00]               | [0.07] | [0.00] | [0.00] |       | [0.00] |
| $\chi^2_{SR}$        | 1.080 | 57.977| 7.38   | 13.02 | 1.215 |
| [0.298]              | [0.00] | [0.00] | [0.00] |       | [0.270] |
| $W_{LR}$             | 0.610 | 16.022| 7.737  | 1.147 | 22.462 |
| [0.43]               | [0.00] | [0.00] | [0.28] | [0.09] | [0.00] |
| $W_{SR}$             | 4.949 | 9.891 | 7.54   | 7.542 | 107.087|
| [0.02]               | [0.00] | [0.00] | [0.00] |       | [0.00] |
| $F_{SR}$             | 5.24  | 4.21***| 0.70   | 4.63***| 1.06  |
| -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 $A$ symbol variables; Figure in the parentheses are the $t$-statistics and the brackets are probability values. $\chi^2_{SC}$, $\chi^2_{HET}$, and $\chi^2_{FF}$ 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.
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.

On the other hand, although there is a long-run relationship between volume and prices in Bossa ($W_{LR} = 1.14 [0.28]$) and Mndrs ($W_{LR} = 0.94 [0.33]$), 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 ($W_{SR} = 7.54 [0.00]$) and Mndrs ($W_{SR} = 3.49 [0.06]$) affect the price difference. In the short term, the rise in volume for

### Table 3 (Continued)

| Kords | Mndrs | Sktas | Yatas | Yunsa |
|-------|-------|-------|-------|-------|
| Constant | 0.014 | -0.002 | 0.014 | -0.003 |
| (2.291) | (-1.291) | (1.186) | (-2.608) | (1.114) |
| $lnp_{t-1}$ | -0.010 | -0.009 | -0.006 | -0.002 |
| (-2.599) | (-6.272) | (-1.134) | (-2.201) | (-0.925) |
| $lnv_{t-1}^+$ | 0.001 | 0.002 | 0.002 | 0.000 |
| (2.595) | (2.732) | (2.430) | (2.576) | (0.671) |
| $lnv_{t-1}^{-}$ | 0.001 | 0.002 | 0.002 | 0.000 |
| (2.586) | (2.736) | (2.443) | (2.576) | (0.682) |
| $\Delta lp_{t-1}$ | 0.061*** | 0.061*** | 0.057*** | 0.060*** |
| (1.770) | (1.770) | (1.695) | (1.695) | (1.766) |
| $\Delta ln_{t-9}$ | -0.070* | -0.060** | 0.013* | 0.022** |
| (-2.836) | (-2.054) | (7.633) | (2.555) | (-1.559) |
| $\Delta ln_{t-5}$ | -0.057*** | -0.044** | 0.004** | 0.005** |
| (-1.759) | (-1.243) | (2.729) | (2.729) | (5.263) |
| $\Delta ln_{t-10}$ | 0.002* | 0.009* | -0.005* | 0.004* |
| (2.436) | (3.167) | (3.546) | (2.885) | (2.966) |
| $\Delta ln_{t-8}$ | 0.004* | 0.003* | -0.005** | 0.004* |
| (3.787) | (2.758) | (2.293) | (2.885) | (2.458) |
| $\Delta ln_{t-7}$ | 0.005* | 0.004*** | -0.004** | 0.005* |
| (3.966) | (-1.908) | (1.908) | (1.908) | (3.452) |
| $L_{khr}$ | 0.154* | 0.277*** | 0.358 | 0.827 |
| (2.941) | (1.986) | (1.043) | (1.388) | (0.428) |
| $L_{khr}$ | 0.154* | 0.278*** | 0.360 | 0.819 |
| (2.928) | (1.992) | (1.049) | (1.384) | (0.432) |
| $\chi^2_{SC}$ | 0.197 | 4.556 | 4.057 | 0.635 |
| (0.65) | (0.03) | (0.04) | (0.425) | (0.451) |
| $\chi^2_{HET}$ | 261.56 | 380.69 | 150.53 | 100.89 |
| [0.00] | [0.00] | [0.00] | [0.00] | [0.00] |
| $\chi^2_{FF}$ | 16.262 | 22.868 | 40.977 | 32.226 |
| [0.00] | [0.00] | [0.00] | [0.00] | [0.00] |
| $W_{LR}$ | 0.011 | 0.948 | 8.425 | 2.466 |
| (0.91) | (0.33) | (0.02) | (0.11) | (0.42) |
| $W_{SR}$ | 0.985 | 3.495 | 4.277 | 4.298 |
| (0.32) | (0.06) | (0.51) | (0.03) | (0.03) |
| $F_{ras}$ | 3.05 | 4.83** | 2.352 | 3.09 |
| -2.13 | -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 $\Delta$ symbol variables; the figure in the parentheses are the t-statistics and the brackets are probability values. $\chi^2_{SC}$, $\chi^2_{HET}$, and $\chi^2_{FF}$ 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 ($W_{LR} = 1.14 [0.28]$) and Mndrs ($W_{LR} = 0.94 [0.33]$), 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 ($W_{SR} = 7.54 [0.00]$) and Mndrs ($W_{SR} = 3.49 [0.06]$) 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.
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