THE DYNAMIC RELATIONSHIP BETWEEN VOLATILITY INDEX AND ASYMMETRIC INFORMATION IN BORSA ISTANBUL*

VOLATİLİTE ENDEKSİ VE BORSA İSTANBUL'DAKİ ASİMETRİK BİLGİ ARASINDA DİNAMİK İLİŞKİLER

Araştırma Makalesi
Research Paper

Melih KUTLU**
Havvanur Feyza KAYA***

Abstract:

In this study, the causal relationships between asymmetric information in Borsa Istanbul and volatility index are investigated using daily data from 2003-2022. We first construct the asymmetric information series using the method of Llorente et al. (2002) and then apply the asymmetric causality test developed by Hatemi-J (2012) to investigate the causality between these variables. The approach captures nonlinear effects in the series by dividing them into positive and negative shocks. The results of the symmetric causality test indicate that there is no bidirectional causality between asymmetric information in Borsa İstanbul and volatility index. However, the results of the asymmetric causality test show that positive financial volatility shocks do cause positive asymmetric information shocks. An increase in financial volatility causes an increase in asymmetric information. Overall, this study highlights the asymmetric relationship between volatility index and asymmetric information in Borsa Istanbul, providing valuable insights for investors and policymakers in the Türkiye.

Keywords: Asymmetric Information, Volatility Index, Asymmetric Causality, Borsa İstanbul.

Öz:

Bu çalışmada Borsa İstanbul'daki asimetrik bilgi ile volatilite endeksi arasındaki nedensel ilişkiler 2003-2022 dönemine ait günlük veriler kullanılarak araştırılmaktadır. Bu çalışmada öncelikle Llorente vd.(2002) yöntemini kullanılarak asimetrik bilgi serisi oluşturulmuştur. Daha sonra bu değişkenler arasındaki nedenselliği araştırmak için Hatemi-J (2012) tarafından geliştirilen asimetrik nedensellik testi uygulanmıştır. Asimetrik nedensellik yaklaşımı, serideki doğrusal olmayan etkileri pozitif ve negatif şoklara bölerek yakalamaktadır. Simetrik nedensellik testi sonuçları, Borsa İstanbul'daki asimetrik bilgi ile volatilite endeksi arasında her iki yönde de bir nedensellik olmadığını göstermektedir. Ancak, asimetrik nedensellik testinin sonuçları, pozitif finansal volatilite şoklarının pozitif asimetrik bilgi şoklarına neden olduğunu göstermektedir. Öte yandan, finansal volatilitenin artması asimetrik bilginin artmasına neden olmaktadır. Genel olarak, bu çalışma, Borsa İstanbul'daki asimetrik bilgi ve volatilite endeksi arasındaki asimetrik ilişkiyi araştırarak Türkiye'deki yatırımcılar ve politika yapıcılar için değerli bilgiler sağlamaktadır.

Anahtar Kelimeler: Asimetrik Bilgi, Volatilite Endeksi, Asimetrik Nedensellik, Borsa İstanbul.

* Makale Geliş Tarihi: 2.10.2023
Makale Kabul Tarihi: 29.10.2023
** Dr. Öğr. Üyesi, Samsun Üniversitesi, melih.kutlu@samsun.edu.tr, https://orcid.org/0000-0002-8634-6330.
*** Doç. Dr., Samsun Üniversitesi, havvanur.kaya@samsun.edu.tr, https://orcid.org/0000-0002-3730-1793.

INTRODUCTION

Financial markets is significantly influenced by information and its dissemination. Markets also need complex information. Acquiring complex information has costs, and when this is high, markets can become inoperable. Financial development leads to new firm formation, increased competition, and adoption of technology. It creates profitable and productive investment opportunities. It becomes easier for the financial system to fulfill the tasks of allocating resources and increasing the efficiency of capital. Financial stability is necessary for the healthy functioning of the financial system. This requirement ensures the proper functioning of financial institutions and markets. Financial stability is crucial for the development and growth of financial markets. It ensures that the financial system operates smoothly and efficiently, which helps to allocate resources and promote economic growth. Without financial stability, markets can become volatile and unpredictable, which can deter investors and hinder the growth of businesses and the economy. Therefore, policymakers and regulators must prioritize maintaining financial stability to support the growth and development of financial markets.

A stable financial system enhances economic performance and mitigates financial imbalances that may arise from unexpected and adverse events (Schinasi, 2004: 8). For financial stability, focused management strategies, regulatory and supervisory policies, effective monetary and fiscal policy and monitoring of credit trends are important in financial institutions (Watson, 2004: 100). Markets where debtors, creditors and issuers are fairly supported, and risk-free financial arbitrage opportunities are created are markets where financial stability is ensured. With the provision of financial stability, a structure that offers sustainable intermediation costs will emerge (Feldkamp and Whalen, 2014: 153). Financial stability is crucial for the overall health and performance of the economy. A stable financial system can effectively allocate resources and reduce the negative impact of adverse events, while promoting sustainable intermediation costs. To achieve financial stability, financial institutions need to implement focused management strategies, regulatory and supervisory policies, and effective monetary and fiscal policies. Additionally, fair support for debtors, creditors, and issuers in the markets can help create risk-free financial arbitrage opportunities, which further contributes to financial stability. Monitoring credit trends is also an essential component of financial stability. By ensuring financial stability, financial institutions can provide an environment that promotes economic growth and development.

To assess global financial stability, it is crucial to investigate the interplay between uncertainty in financial markets and asymmetric information (asinfo) dynamics. Investors use the Volatility Index (VIX) as an indicator to reflect future uncertainty for a given period. The VIX calculates anticipated volatility using options written on the S&P 500 Index. The VIX is commonly known as the "fear index" and serves as an indicator of market volatility or uncertainty. When investors are uncertain about the future direction of the market, they may be more likely to engage in asinfo behavior, such as insider trading or market manipulation.

Therefore, examining the relationship between the VIX and asinfo behavior is important for understanding the overall stability of financial markets.

In this study, the Hatemi-J (2012) asymmetric causality (ac) test is a statistical method used to examine causality between asinfo and financial volatility (finvol), while considering potential asymmetry in the relationship. The initial step in this investigation involves creating an asinfo series through the method established by Llorente et al. (2002), which is subsequently analyzed using Hatemi-J (2012) ac test to explore the causal relationship between the variables under scrutiny. In this instance, the test is utilized to examine whether finvol is causally linked to the degree of asinfo present in the BIST100 index.

Asymmetric information is when some investors know more information than other investors. This results in a lack of competition in terms of profit. The market becomes inefficient. The study aims to investigate how global uncertainty, such as geopolitical events or economic fluctuations, might impact the level of asinfo in the BIST100 index. By using the ac test, the study is able to capture any non-linear effects that might exist in the relationship between global uncertainty and asinfo. This method allows for a more detailed understanding of how the two variables interact, and whether there is a causal relationship between them. Overall, the study seeks to provide insights into how global uncertainty affects the level of asinfo in financial markets, and how this information can be incorporated into investment strategies.

1. VOLATILITY INDEX AND ASYMMETRIC INFORMATION: A THEORETICAL FRAMEWORK

Value management is important in finance. Value can be created not only by designing optimal portfolios or estimating cash flows, but also by examining price formation in the market and inferring information about its results (Bias et al., 2010: 1535).

In a market without random shocks, producers and consumers do not need any source of information other than their own preferences and production technology due to competitive prices. Expectation predictions can be challenging in a world that experiences shocks. Consequently, an efficient transfer of information from consumers, who possess some knowledge about their future demands, to producers who can take action, is critical for effective resource allocation (Grossman, 1981: 541). Sharing information in financial markets is necessary to increase competition for borrowers with proven reliability, reduce competition for new borrowers, and eliminate information barriers (Dell'Ariccia, 2001: 1973). Fair supervision and regulation are complementary to market discipline. Thus, financial intermediaries can continue their activities with sufficient capital.

Regulations that are too intrusive and poorly designed for market discipline create vulnerabilities (Arner, 2007: 196). Fragility, such as rising interest rates, uncertainties, asinfo, and banking sector problems, increases financial instability (Mishkin, 1999: 6). Asinfo is the potential for a financial intermediary to have specific information about the value

of a security relative to the stakeholders who trade the security. In extreme asymmetrical situations, trading may stop completely (Bodie et al., 2018: 295). Insider trading is another problem created by asinfo, which occurs when an officer of a company invests in company securities with more knowledge than outside investors (Fabozzi et al., 2014: 13). Asinfo influences the formation of financial crises (Mishkin, 1990: 34) and affects the firm's financial structure, net worth, and price fluctuations (Greenwald and Stiglitz, 1990: 11). In a speculative market with asinfo, the parties will try to use the information they have to make a profit. Asinfo also gives one side an advantage over the other.

Asinfo often gives rise to adverse selection and moral hazard in multiple markets (Stiglitz and Weiss, 1992: 186). Due to the asinfo between the parties, there may be a decrease in the average quality of the products traded (Akerlof, 1970: 488). In the market where products of varying quality (good and bad products) are bought and sold together, the problem of adverse selection arises because sellers better know the quality of the goods they sell (Wilson, 1989: 31). Adverse selection occurs when lenders cannot distinguish low-risk people from high-risk people before the transaction takes place (Bebzcuk, 2003: 7). Moral hazard is the term used to describe a situation in which an individual or institution can increase their risk-taking propensity without bearing the full cost of those risks. This can result in prioritizing individual benefits over the welfare of others (Kotowitz, 1989: 207). Moral hazard is the situation when the parties to the contract have different information from each other after the transaction has taken place.

2. A REVIEW OF THE EMPIRICAL LITERATURE ON VOLATILITY INDEX AND ASYMMETRIC INFORMATION

There are many studies investigating the effect of asinfo in financial markets from different perspectives. Bias et al. (2010) research the influence of asinfo between asset pricing and portfolio selection. Tests for asinfo have turned out to be complementary to traditional investment analysis (portfolio creation and cash flow forecasting). Drobets et al. (2010) concluded that accumulating high levels of liquidity would not be in the interests of shareholders in terms of firm value when there is a high level of asinfo. To assess the connection between asinfo and firm value, cash level and analysts' earnings per share estimates are multiplied to obtain the measure of asinfo. Gajewski and Li (2015) investigated whether the disclosure of financial information over the internet in the Euronext-Paris stock market affects the level of asymmetry knowledge. Thanks to user-friendly internet applications, it becomes normal to explain information over the internet. Internet-based disclosure enables the reduction of asinfo. Cui et al. (2018) states that corporate social responsibility reduces asinfo. Analysts' earnings per share estimates and price effect are used to measure asinfo. Managers of high-risk companies are increasingly working to build a good reputation, which is leading to a stronger relationship between corporate social responsibility and asinfo.

Zor et al. (2016) investigated the effect of asinfo level on the price-volume relationship in Borsa Istanbul with the Granger causality test. The month-end closing prices and trading

volumes of the BIST100 index for the January 1986 – May 2014 period and the BIST Second National (XIKIU) index for the January 1997 – May 2014 period are used as data. It has been determined that there is a one-way causality relationship from price change to transaction volume. Karaçayır and Afşar (2021) investigated the effect of asinfo on capital structure decisions in companies in the Borsa Istanbul Industrial Index using annual data and dynamic panel data method in the 2003-2017 period. It has been determined that when companies with high asymmetric knowledge level turn to debt financing, they will have difficulty in finding debt in times of crisis, and in this case, financing costs will increase. Nur and Korkmaz (2022) examined the relationship between asinfo and firm value in companies traded in the Food and Retail sector of Borsa Istanbul (BIST) and whether financial leverage influences this relationship. Panel data analysis is used with weekly data for the period of 10.06.2019-28.03.2022. It has been determined that the increase in the level of asinfo in the firms negatively affects the firm value. Financial leverage also influences the negative effect of asinfo on firm value. Koç (2016) investigated the relationship between dividend distribution and asinfo in companies included in the BIST 50 Index between 2009 and 2015 using panel data analysis method. In the presence of asinfo, it has been concluded that by increasing the dividend payments, the company managers want to inform the investor that their company evaluates the investment opportunities well and increases their investments, and that the company is in good condition as a result.

Aksu et al. (2018) research the causality connection between financial stability and foreign direct investment with the Granger causality test between 2007 and 2015. There is a causality relationship from foreign direct capital inflows to financial stability. Gezer and Kılıç (2019) investigated the effects of financial stability on GDP and BIST100 index with ARDL test. Quarterly data is used for the period 2004 – 2017. The increase in financial stability in the short and long term affects the GDP and BIST100 index positively.

Sarwar (2012) analyzed the relationship between the USA and BRIC stock markets and the VIX in the 1993-2007 period. There is an asymmetric relationship between the USA, China and Russia stock markets and VIX. The VIX reacts to negative changes in stock returns much more effectively than it does to positive changes in returns of similar size. Wang (2019) used high-frequency data for volatility research in his study on thirteen developed country stock markets. In the study, in which the HAR-RV model is used, some elements present in financial series such as long memory and multiscaling behavior are included in the analysis. VIX has a significant impact on international stock markets.

Kaya and Coşkun (2015) sought an answer to the question of whether the VIX is a cause of securities markets. Investors investing in Borsa Istanbul can use the VIX as a leading indicator. Basarir (2018) found both short and long term one-direction causality link between VIX and BIST 100 index. Fear index shock has a negative effect on BIST-100 (Sarıtaş and Nazlıoğlu, 2019).

It is seen that asinfo is important for financial stability. The VIX, which is one of the important indicators of financial uncertainy, has an important position as a leading indicator in terms of securities markets. The investigation of the influence of the VIX on the asinfo in Borsa Istanbul contribute to the literature.

3. METHODOLOGY

The study's dataset consists of daily observations of finvol and asinfo for the period of 2003-2022, covering the Turkish economy. The method of LIorente et al. (2002) is employed in this study to construct the asinfo using Eq. (1) as a first step. In Eq. (1), AInf is the asymmetric information (trading volume), VOL is the daily volume, P is the stock price.

$$AInf_{it} = In\,(VOL_t * P_t) \tag{1}$$

Once the asinfo series is constructed using the method of LIorente et al. (2002) as described in Eq. (1), an ac test can be applied to examine the causality between the asinfo and finvol (BİST 100), where the latter is represented by VIX as a proxy. Both variables used in this study are obtained from Refinitiv Eikon database in Table 1.

Table 1. The Abbreviations and Descriptions of the Variables

Variables	Abbreviation	Description
Financial Volatility	VIX	Realized Volatility
Asymmetric Information	AInf	Trading Volume

Toda and Yamamoto (1995) test split the variables into positive and negative (p&n) disturbance to catch effects (nonlinear) and assumes that the cumulative sum of these shocks is linked to asymmetric behavior.[1]

In the first step, the p&n shocks of finvol and asinfo are separated. Step 2 of the econometric process involves computing the effects of p&n shocks of finvol and asinfo. In Step 3 of the analysis, a bootstrap test for causality research to the ac relationships between the variables. Table 2 presents the causality models and null hypotheses.

Table 2. The Null Hypotheses for the Causality Models

Models	(1)	(2)	(3)	(4)	(5)
H_0	$AInf_i \nRightarrow VIX_i$	$VIX_i \nRightarrow AInf_i$	$AInf_i^+ \nRightarrow VIX_i^+$	$VIX_i^+ \nRightarrow AInf_i^+$	$AInf_i^- \nRightarrow VIX_i^-$
Models	**(6)**	**(7)**	**(8)**	**(9)**	**(10)**
H_0	$VIX_i^- \nRightarrow AInf_i^-$	$AInf_i^+ \nRightarrow VIX_i^-$	$VIX_i^+ \nRightarrow AInf_i^-$	$AInf_i^- \nRightarrow VIX_i^+$	$VIX_i^- \nRightarrow AInf_i^+$

$AInf_i^+$:asinfo cumulative sums of positive changes, VIX_i^+: finvol cumulative sums of positive changes, $AInf_i^-$: asinfo cumulative sums of negative changes, VIX_i^-: finvol cumulative sums of negative changes

[1] Please refer to the following paper for a detailed explanation of the asymmetric causality method: Hatemi-J (2012).

4. FINDINGS

Table 3 displays the findings of the unit root tests statistics. Table 3 shows that the series are stationary[2].

Table 3. The Results of Unit Root Tests

Variables	ADF		PP	
	Const.	Const.-Trnd.	Const.	Const.-Trnd.
AInf	-1.5050	-5.1850***	-5.9091***	-19.3765***
VIX	-5.7786***	-5.7822***	-6.3302***	-6.3328***

Note: *** is significance level of 1%, ** is significance level of 5% and * is significance level of 10%.

The predicted values in the symmetric model are 3.14 and 2.64 in Table 4. Since the predicted values are smaller than the critical values, the null hypothesis cannot be rejected. There is no bidirectional symmetric causality between asinfo and finvol in the Turkish financial system.

In Model 3, positive cumulative asinfo does not cause positive finvol. However, the result of Model 4 reveals that positive finvol does cause positive asinfo. Furthermore, the estimated test values are 13.623 and 28.854 for Models 5 and 6, respectively. These statistics are greater than the 5% significance level, indicating that there is an asymmetric bidirectional causality between negative cumulative asinfo and negative cumulative finvol.The findings of asymmetric models are presented in Table 4. Except for Model 3, asymmetric causality findings are found in other models.

Asymmetric information is affected by all types of news (p&n). Asymmetric information weakens competition. As of the period examined, the weakening of this competition causes the liquidity in the market to decrease. Decreasing liquidity reduces the amount of information that creates prices. This situation, which affects investors, increases the cost of capital. In addition to the cost of capital, serious problems also arise from corporate governance. The soundness of the information provided to internal and external stakeholders reduces the level of asymmetric information. The flow of information will not be healthy in a market that is constantly affected by the shocks created by the global uncertainty environment.

[2] Dickey and Fuller (1981), Phillips and Perron (1988).

Table 4. Symmetric and Asymmetric Causality Tests Results

Symmet. Causal. Test		
Models	**H_0**	**Est.Test Value**
(1)	$AInf_i \nRightarrow VIX_i$	3.14
(2)	$VIX_i \nRightarrow AInf_i$	2.64
Asymm. Causal. Test		
Models	**H_0**	**Est. Test Value**
(3)	$AInf_i^+ \nRightarrow VIX_i^+$	9.425
(4)	$VIX_i^+ \nRightarrow AInf_i^+$	17.309**
(5)	$AInf_i^- \nRightarrow VIX_i^-$	13.623**
(6)	$VIX_i^- \nRightarrow AInf_i^-$	28.854***
(7)	$AInf_i^+ \nRightarrow VIX_i^-$	29.416***
(8)	$VIX_i^+ \nRightarrow AInf_i^-$	19.801**
(9)	$AInf_i^- \nRightarrow VIX_i^+$	18.791**
(10)	$VIX_i^- \nRightarrow AInf_i^+$	27.013***

Note: *** is significance level of 1%, ** is significance level of 5% and * is significance level of 10%.

CONCLUSIONS

This study is to analyze the relationships between asinfo and finvol in the Turkish financial system from 2003 to 2022 daily. The study utilizes trade volume as a measure of asinfo and VIX as a measure of finvol. Asinfo is constructed using the methodology outlined in LIorente et al. (2002). To investigate the probable causal relationships between asinfo and finvol, ac tests were study, and the ac connection between the two are investigate using a bootstrap ac test.

The results of the symmetric causality test indicate that in the Turkish financial system, there is no bidirectional causality between asinfo and finvol, symmetrically. However, the results of the ac tests suggest that positive finvol disturbances do cause positive asinfo disturbances, whereas positive asinfo disturbances do not cause positive finvol disturbances. This implies that an increase in finvol sources an increase in asinfo. Moreover, there is an asymmetric bidirectional causality between negative asinfo disturbances and negative finvol disturbances.

Additionally, there is an ac connection from positive asinfo disturbances to negative finvol disturbances, indicating that rise asinfo causes a reduce in finvol. Conversely, positive finvol disturbances lead to negative asinfo, implying that an increase in finvol causes a

decrease in asinfo. Negative asinfo disturbances cause positive finvol disturbances, while negative finvol disturbances cause positive asinfo disturbances.

The findings suggest that with the increase in volatility, firm evaluations become challenging due to the different levels of information obtained by investors. The decrease in the efficiency of investment choices due to the increase in volatility can further increase asinfo, leading to adverse selection and moral hazard. This may result in managers manipulating the market based on the share value to align with their personal interests. Thus, investors must consider the increase in asinfo while creating a portfolio during periods of increased volatility. In such a market, in addition to traditional portfolio construction methods (fundamental and technical analysis), it will be useful to investigate the reasons for price formations.

Araştırma ve Yayın Etiği Beyanı

Makalenin yayın süreçlerinde Karadeniz Teknik Üniversitesi Sosyal Bilimler Enstitüsü Sosyal Bilimler Dergisi'nin "*Etik Kurallara Uygunluk*" başlığı altında belirtilen esaslara uygun olarak hareket edilmiştir. Çalışmanın araştırma kısmında etik kurul izni gerektirecek bir husus bulunmamaktadır.

Araştırmacıların Katkı Beyanı

Çalışmanın giriş ve literatür bölümü Melih KUTLU tarafından, verilerin toplanması ve ampirik uygulamanın gerçekleştirilmesi Havvanur Feyza KAYA tarafından, sonuç bölümü ise her iki yazar tarafından üretilmiştir.

Çıkar Çatışması Beyanı

Makalede yazarlar tarafından beyan edilmiş herhangi bir olası çıkar çatışması bulunmamaktadır.

REFERENCES

Akerlof, G. A. (1970). The market for "Lemons": quality uncertainty and the market mechanism, *The Quarterly Journal of Economics*, 84 (3), 488-500.

Aksu, M., Sakarya, Ş. & Aksu, S. (2018). Analysis of the relationship between financial stability and foreign direct inflows: an analysis on the economy of Turkey, *Journal of Social Sciences of Mus Alparslan University Anemon,* 6, 195-200.

Arner, D. W. (2007). *Financial stability, economic growth, and the role of law*, Cambridge: Cambridge Press.

Başarır, Ç. (2018). Korku endeksi (VIX) İle BIST 100 arasındaki ilişki: frekans alanı nedensellik Analizi, *İşletme Fakültesi Dergisi*, 19(2), 177-191.

Bebzcuk, R. N. (2003). *Asymmetric information in financial markets introduction and applications*, Cambridge: Cambridge University Press.

Bias, B., Bossaerts, P. & Spatt, C. (2010). Equilibrium asset pricing and portfolio choice under asymmetric information, *The Review of Financial Studies*, 23 (4), 1503–1543.

Bodie, Z., Kane, A. & Marcus, A. J. (2018). *Invesments* (11. Edition). New York: McGraw-Hill Education.

Cui, Jinhua, Jo, Hoje & Na, Haejung (2018). Does corporate social responsibility affect information asymmetry?, *J. Bus. Ethics*, 148, 549–572.

Çonkır, D., Meriç E & Esen E. (2021). Korku endeksi (VIX) ile gelişmekte olan ülke borsaları arasındaki ilişkinin analizi: yatırımcı duyarlılığı üzerine bir çalışma. *İnsan ve Toplum Bilimleri Araştırmaları Dergisi,* 10(1)109-132.

Dell'Ariccia, G. (2001). Asymmetric information and the structure of the banking industry. *European Economic Review*, 45, 1957-1980.

Dickey, D. A., & Fuller, W. A. (1981). Likelihood Ratio Statistics for Autoregressive Time Series with a Unit Root. Econometrica, 49(4): 1057- 1072.

Drobetz, W., Grüninger, M. C., & Hirschvogl, S. (2010). Information asymmetry and the value of cash. *Journal of banking & finance*, *34*(9), 2168-2184.

Fabozzi, F. J., Modigliani, F., Jones, F. J. (2014). *Foundations of Financial Markets and Institutions*, Essex: Pearson Education Limited

Feldkamp, F. L. & Whalen, R.C. (2014). *Financial Stability*, New Jersey: Wiley.

Gajewski, J-F. & Li, L. (2015). Can internet-based disclosure reduce information asymmetry? *Advances in Accounting, incorporating Advances in International Accounting*, 31, 115-124.

Gezer, M. A. & Kılıç, R. (2020). The impact of financial stability on real economy in Turkey: based on linear and non-linear ARDL models, *Sosyoekonomi*, 28(46), 117-140.

Greenwald, B. C. & Stiglitz, Joseph E. (1990). Asymmetric information and the new theory of the firm: financial constraints and risk behavior, *NBER Working Paper*, No: 3359.

Grossman, S. J. (1981). An introduction to the theory of rational expectations under asymmetric information, *The Review of Economic Studies*, 48(4). 541-559.

Hatemi-J, A. (2012). Asymmetric causality tests with an application, *Empirical Economics*, 43, 447–456.

Kaya, A., & Coşkun, A. (2015). VIX endeksi menkul kıymet piyasalarının bir nedeni midir? Borsa İstanbul örneği, *C.Ü. İktisadi ve İdari Bilimler Dergisi*, 16(1), 175-186.

Karaçayır, E. & Afşar, A. (2021). Capital structure decisions and the effect of asymmetric information in Borsa İstanbul, *Journal of Süleyman Demirel University Institute of Social Sciences*, 41, 133-154.

Koç, İ. Ö. (2016). Dividend payout of corporations considered as signals by the investors under asymmetric information, *Finans Politik & Ekonomik Yorumlar*, 53(613), 33-43.

Eatwell, J., Milgate, M., & Newman, P. (Eds.). (1989). *Allocation, information and markets*. Springer.

Llorente, G., Michaely, R., Saar, G., & Wang, J. (2002). Dynamic volume-return relation of individual stocks. *The Review of Financial Studies*, 15(1), 1005–1047.

Mishkin, F. S. (1998). Asymmetric information and financial crises: a historical perspective, *NBER Working Paper*, 3400, 1-38.

Mishkin, F. S. (1998). Global financial instability: framework, events, issues, *Journal of Economic Perspectives*, 13(4), 3-20.

Nur, T. & Korkmaz, T. (2022). Moderator role of financial leverage in the relationship of asymmetric information and firm value: an application on BIST, *Business and Economics Research Journal*, 13(3), 449-463.

Phillips, P. C., & Perron, P. (1988). Testing for a unit root in time series regression. *Biometrica*, 75(2), 335-346.

Sarıtaş, H., & Nazlıoğlu, E. H. (2019). Fear index, stock market and exchange rates nexus: an empirical analysis for Turkey, *Academic Review of Economics and Administrative Sciences*, 12(4), 542-551.

Sarwar, G. (2012). Is VIX an investor fear gauge in BRIC equity markets?, *Journal of Multinational Financial Management*, 22, 55-65.

Schinasi, G. J. (2004). Defining financial stability, *IMF Working Paper*, 04/187.

Stiglitz, J. E., & Weiss, A. (1992). Asymmetric information in credit markets and its implications for macro-economics. *Oxford Economic Papers*, *44*(4), 694-724.

Şahin, C. (2018). Korku endeksi hisse senedi piyasaları üzerinde etkili midir? Borsa İstanbul üzerine bir uygulama, *TURAN-SAM: TURAN Stratejik Araştırmalar Merkezi*, 10(37).

Wang, H. (2019). VIX and volatility forecasting: A new insight, *Physica A*, 533, 1-15.

Watson, C. M. (2004). Financial-sector efficiency: The impact of policy and the road ahead. In *Financial Markets in Central and Eastern Europe* (pp. 117-150). Routledge.

Wilson, C. (1989). *Adverse selection, allocation, information and markets*. Ed. (J. Eatwell vd.), Palgrave Macmillan.

Toda, H. Y., & Yamamoto, T. (1995). Statistical inference in vector autoregressions with possibly integrated processes. *Journal of Econometrics, 66*, 225-250.

Zor, İ., Bozkurt, İ. & Öksüz, S. (2016). The impact of asymmetric information level on the relationship price and trading volume: evidence from BIST. *Anadolu University Journal of Social Sciences*, 16(1), 119-136.