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THE RELATIONSHIP BETWEEN RUSSIA'S AND TURKEY'S SECTORAL STOCK MARKETS: THE EFFECTS OF THE RUSSIA-UKRAINE CONFLICT

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In this paper, the effects of the Russia-Ukraine conflict on the stock markets of Turkey (BIST), which has strong economic relations with both countries, and Russia (MOEX), one of the parties to the conflict, are investigated. The relationship between the stock indices for the overlapping sectors of both stock markets (namely the consumption, electricity, financial, oil and telecom sectors) are examined using the Fourier volatility spillover and Fourier-Granger causality tests. The findings of the paper indicate that there is a bidirectional causality relationship between both countries in the electricity sector, and a causality relationship between BIST and MOEX in the telecom sector. In addition, there is a bidirectional volatility spillover in the electricity, finance and oil sectors between the stock markets of the two countries. However, there is also a volatility spillover from MOEX to BIST in the food sector. The COVID-19 epidemic and the Russia-Ukraine war can be quoted as the reasons for this situation. This volatility spillover between the countries seems likely to harm the Turkish economy in the case of possible negative developments during the war. The results obtained in this study provide valuable information for portfolio diversification to the investors who will invest in these sectors as long as the war conditions continue.

Keywords: Ukraine-Russia conflict, Fourier volatility spillover, Fourier-Granger causality, MOEX, BIST

JEL Classification: E44, F51

INTRODUCTION

Globalization has increased the rapidly growing interplay between financial markets. The shocks of the financial market in one country cause such price changes in that country which can also influence foreign financial markets (Jebran & Iqbal, 2016; Afolabi, Olanrewaju & Adekunle, 2022). In addition to financial integration, an increase in electronic communication, the liberalization of capital controls, financial innovation and increased political and

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economic integration are also relevant (Berben & Jensen, 2005). This effect appears in the literature as a volatility spillover.

A volatility spillover is defined as the process which causes the volatility resulting from a shock in one market to potentially transfer onto another. This situation can also be expressed as a transfer of financial events from one market to another or the effect of financial variables in the economy on different variables (Darrat & Benkato, 2003). Factors such as the liberalization of capital movements, the internationalization of stock markets, direct and indirect (portfolio) investments make financial markets interdependent and increase volatility spillovers between such markets (Habiba, Peilong, Zhang & Hamid, 2020).

Making sense of the sources of volatility in financial markets is important in pricing domestic financial assets, implementing global hedging strategies, and making asset allocation decisions (Ng, 2000; Laborda & Olmo, 2021; Mensi, Al Rababa'a, Alomari, Vo & Kang, 2022; Vidal-Llana, Uribe & Guillén, 2023). For policymakers, a volatility spillover is important in terms of ensuring the continuity of financial institutions, the efficiency and functioning of financial markets (Mwambulu & Xianzhi, 2016).

Events such as wars, occupations and political conflicts between countries affect almost every country to different extents under the influence of globalization. However, the academic literature illustrates that the impact of these negative developments on financial institutions has received little attention. The occupation of Ukraine by Russia on February 24, 2022, which is the main subject matter of this paper, caused turmoil on stock markets. Early papers on the subject provided the evidence of how global financial institutions responded to the invasion (Beraich, Amzile, Laamire, Zirari & Fadali, 2022; Gaio, Stefanelli, Pimenta, Bonacim & Gatsios, 2022; Yousaf, Patel & Yarovaya, 2022; Ahmed, Hasan & Kamal, 2022; Lo, Marcelin, Bass`ene & S`ene, 2022). Moscow's MOEX index fell nearly 9 percent in the week following the conflict. Not only the Russian stock market (MOEX), but the important stock market indices such as the MSCI Word and S&P 500 as well recorded significant losses globally (Izzeldin, Muradoglu, Pappas, Petropoulou & Sivaprasad, 2023). It is expected that the conflict will have a deeper impact on the countries with strong commercial and financial ties, especially with Russia. In this context, this paper is focused on the volatility spillover between specific sectors in Russia and Turkey. Accordingly, the following research question is empirically examined:

> Is there a causality relationship between the Turkish and Russian stock markets for the consumption, electricity, finance, oil and telecom sectors during the observed period of the Russia-Ukraine conflict?

Economic cooperation between Russia and Turkey covers especially the trade, tourism, construction and energy sectors. The role of the two countries in both regional and global terms is important. Russia is the sixth largest economy in the world and Turkey is the 13th largest economy in the world (Masumova, 2018), Russia being a representative of the BRICS group and Turkey being a promising power close to this group. Compared to the 1990s, there is some degree of interdependence between the two countries. Among the reasons for the development of these relations, the general resemblance of the foreign policies of both countries with the 2000s comes to the fore (Öniş & Yılmaz, 2016).

On the other hand, speaking politically and financially, Turkey and Russia are among the leading countries in the world. Especially in recent years, economic and political processes in the Turkish-Russian relations have attracted attention. The foreign policies pursued by both countries in the last two decades have also been important. This common policy is also reflected in the volume of trade and finance between the countries.

The aim of this paper is to analyze the inter-dependencies between the stock market sector indices in this period of the great uncertainty created by the conflict. The global energy sector emerges as a potential shock multiplier due to the connection of oil prices with the other economic sectors (Laborda & Olmo, 2021). To the best of our knowledge, there is no research that investigates the effect of this conflict on

sectoral interdependence with Turkey, an important partner of Russia's. Considering the importance of both countries in the context of developing countries and that sectoral interdependence in stock markets is especially important for policymakers and portfolio managers. It will help portfolio managers to make effective decisions on portfolio diversification in this process. Links between economic sectors are known to affect portfolio distribution (Laborda & Olmo, 2021).

The main goal of the paper is to empirically examine whether there are a causal relationship and a volatility spillover among a broad set of sectors. Testing this relationship and its spread will be a reference that can be used by the policymakers and market actors of both countries. It is especially important for investors to know whether there is a causal relationship between which sectors or which volatility spillover comes from one market to another. On the other hand, considering the importance of the examined sectors not only for the two countries, but also for the world financial markets, the value of the findings increases even more.

The paper is organized in sections. In the second section, a literature review is provided, only to be followed by summarizing the data set and the methodology used in the third section. Finally, the findings obtained from the empirical analysis are presented in the conclusion.

PREVIOUS EMPIRICAL STUDIES

Studies testing volatility spillover are of great interest in the academic literature. In addition, the model group based on the ARCH/GARCH model has often been preferred in measuring volatility between variables. Multivariate GARCH models such as CCC-MGARCH, DCC-MGARCH, BEKK-MGARCH are used for the volatility dependence and spillover relationships between the time series of markets.

Previous studies mainly focused on the volatility spillover between the markets of two countries. Thus, it can be concluded that the studies conducted on the basis of country groups are limited. So far, studies on the subject have tried to understand international spillovers and market interconnectedness between markets. These studies used a very high level of clustering. Therefore, national and sectoral indices are seen to have come to the fore in those studies.

This research focuses on the global repercussions and interconnectedness among markets. Prior studies predominantly employed a sophisticated clustering approach. Consequently, the emphasis in these studies tends to shift towards national and sector-specific indices (Hammoudeha, Yuana & McAleer, 2009; Arouri, Jouini & Nguyen, 2012; Acemoglu, Carvalho, Ozdaglar & Tahbaz-Salehi, 2012; Wang & Wang, 2019; Laborda & Olmo, 2021; Mensi *et al*, 2022; Izzeldin *et al*, 2023; Vidal-Llana *et al*, 2023).

Prior studies are mainly related to developed markets. A. Rua and L. Nunes (2009) used Germany, Japan, the UK and the US as sample. T. C. Chiang, L. Lao and Q. Xue (2016) used China's, Hong Kong, Korean, Japanese and US stock markets. In addition to these papers, some papers used developed and emerging markets together. For example, K. Phylaktis and L. Xia (2009) investigated the regions of Europe, Asia, and Latin America. Similarly, R. Brooks and M. D. Negro (2006) used data for developed and emerging markets in 20 countries.

D. Acemoglu *et al* (2012) explored how sector-specific shocks can cause aggregate fluctuations in the presence of intersectoral input-output linkages. In this this paper, the energy (metals and mining, oil - gas), technology (telecom, software), bank and insurance, and cyclical sectors (retail) are analyzed. The volatility spillover among the five-sector index in the Russian (MOEX) and Turkish (BIST) stock markets are investigated. The sectors that stand out and are discussed in both countries' stock markets on the basis of the index are the consumption, electricity, financial, oil and telecom sectors.

Considering the results of these studies, a conclusion can be drawn that the findings are different and the relationship at the sectoral level differs from one country to another. In addition, the sectors are found

not to have shown any structural change in general. S. B. Lee and K. J. Kim (1993) made an application using weekly stock market data in 12 major markets and found that there was a higher rate of contamination among the stock markets. The average weekly intermarket correlations rose from 0.23 to 0.39 before the crash of 1987. S. Calvo and C. Reinhart (1996) focus on the emerging markets during the 1994 Mexican peso crisis and find increased correlations between the stock prices and the Brady bonds. R. Kizys and C. Pierdzioch (2009) found the evidence of the increased international joint movement of stock returns since the mid-1990s among the leading developed countries.

Regarding the Russia-Ukraine conflict, M. Donadelli and A. Paradiso (2014) conducted a study for the Asian, Eastern European, and Latin American stock markets; E. Nivorozhkin and G. Castogneto-Gissey (2016) for the Russian Federation and global financial markets; M. Irandoust (2019) conducted a research study for the stock exchanges of the Russian Federation, Estonia, Latvia, Lithuania, Belarus and Ukraine, and R. Tajaddini and H. F. Gholipour (2023) did research in the stock markets of 83 selected countries.

O. Shnyrkov and O. Chugaiev (2023) carried out a study for the Ukrainian and EU stock markets; B. Bagchi and B. Paul (2023) did research in the G7 countries' stock markets; P. Pardal, R. T. Dias, N. Teixeira and N. R. Horta (2023) conducted a study on the stock markets of Germany, USA, France, England, Italy, the Russian Federation, Japan, Canada and China; M. Babar, H. Ahmad and I. Yousaf (2023) considered the stock markets of India, China, Indonesia, Argentina, Mexico, Malaysia and Korea. S. Ahmed, R. Assaf, M. R. Rahman and F. Tabassum (2023) conducted a research study on the stock markets of the 27 selected countries. The findings show that, after the Ukraine crisis of 2014, risk transfer was observed with dynamic integration between returns in the Russian stock market and the global stock markets. Additionally, there was a sharp decline in the stock exchange price index. If the efficient market hypothesis is weak, its prestige will increase for the Russian market, which is in equilibrium during the crisis. The stock markets of developing countries were also seen to be weaker than those of developed countries. The return and volatility spillover tends to increase. The integration process of global financial markets on a country and industry basis shows heterogeneity. This situation causes investors to diversify their portfolios, evaluate risk transmission opportunities, and in the case of uncertainty, suspend investments or redirect them to other markets in different periods. As a result, risk transfer between highly interconnected and dynamically distributed global financial markets is of great importance in terms of short-term interconnectedness. Additionally, geopolitical risk indirectly caused structural change in the stock markets after the war.

M. K. Alam, M. I. Tabash, M. Billah, S. Kumar and S. Anagreh (2022) conducted a study examining the relationship between the prices of the five commodities (namely oil, gas, platinum, gold and silver) in the stock markets of the G7 and BRIC countries. Due to the ongoing crisis, a strong dynamic and hyper-connectedness was perceived between all the commodities and the entire market, the connectedness being at a high level, which provides important footnotes for policymakers to ensure regional economic integration.

A. Pretorius (2023) shows that the stock markets of 11 developed and emerging market groups and the situation of individual countries affected by the Ukraine crisis are more vulnerable in the period of instability and uncertainty. K. Sohag, R. Vasilyeva, A. Urazbaeva and V. Voytenkov (2022) tried to measure the joint mobility between the stock market synchronization of the USA, China's and the Russian Federation's markets. The connectedness degree was found to be 26.15%. Simultaneously, the US-Chinese and US-Russian stock markets have negative reactions to the GPR. However, the degree of the connectedness between the Russian-Chinese stock markets is less sensitive to the GPR. G. Malhotra, M. P. Yadav, P. Tandon and N. Sinha (2023) investigated the dynamic connectedness of their financial markets in the short term for the 10 countries that import the largest number of agricultural commodities from Russia and Ukraine. He found a dynamic connection between Iraq's, Pakistan's and Tanzania's stock markets, based on which he found that it negatively affected

the agricultural products of Turkey, Bangladesh, Pakistan, Brazil and Iraq. However, he noticed a bigger spillover among the variables in the short run than in the medium run and in the long run.

R. Dias, C. Revez, N. Horta, P. Alexandre and P. Heliodoro (2022) examine capital markets and financial contagion, showing that capital markets have mostly increased correlations. It is anticipated that investors will have difficulty in diversifying risks in this market during the periods of uncertainty in the global economy. This situation is becoming an important guide for financial markets for correct and efficient policies of achieving a sustainable economy and in-market regulations.

Regarding the Russia-Ukraine conflict, Beraich *et al* (2022) conducted a study on the US, European, and Chinese stock markets; I. Yousaf, R. Patel and L. Yarovaya (2022) carried out a research study on the G20 and the other selected stock exchanges; S. Ahmed *et al* (2022) did research in the European stock market; H. A. Mahran (2023) conducted a study on the Egyptian stock market. Additionally, Lo *et al* (2022) analyzed 73 countries dependent on Russian goods.

Considering sector-based studies, Mensi *et al* (2022) evaluated 10 sectors (information technology, energy, financial, industrial, utilities, communication services, consumer staples, healthcare, materials, and consumer discretionary) for the S&P 500. H. A. Mahran (2023) discussed education, banks, healthcare, food, information technology, real estate, industry, resources, transportation and travel. R. Laborda and J. Olmo (2021) used energy, healthcare, biotechnology, banking and insurance, pharmaceuticals, the cyclical sector, and technology. X. Wang and Y. Wang (2019) used stock indices for 11 sectors: real estate, consumer discretionary, telecommunications services, industrial, utilities, energy, finance, consumer staples, information technology, healthcare, and Chinese stock market materials.

Unlike all these studies, this study focuses on the MOEX and BIST exchanges. Considering the importance of the examined sectors in terms of countries' economies and stock markets, this study offers a novel insight into policymakers and investors.

DATA AND METHODOLOGY

The data used in the paper consist of the daily data made up of 976 observations for the period from 2nd January 2019 to 24th November 2022. The data set of the research study covers both the COVID-19 pandemic period and the Russia-Ukraine conflict period. In this regard, the considered data originate from the consumption, electricity, financial, oil and telecom sectors. These sectors' data are compatible with each other in terms of the content in both BIST and MOEX. In other words, no exact equivalents of some indices in BIST seem to be included in MOEX, whereas some other indices in MOEX are not included

Table 1 The descriptive statistics

	BIST SECTORS					MOEX SECTORS				
	Electric	Consumer	Finance	Oil	Telecom	Electric	Consumer	Finance	Oil	Telecom
Mean	149	4252	2030	3742	1233	7292	1775	9479	7617	1893
Median	108	3720	1745	3167	1238	7462	1820	10801	8184	1906
Maximum	479	8006	4844	10600	2441	9596	2296	14638	10024	2434
Minimum	75	2963	1171	1825	808	4499	1136	5124	5117	1261
Std. Dev.	89	1347	862	1881	313	1758	372	3500	1469	344
Skewness	1.83	1.364	1.30	1.456	1.26	-0.10	-0.02	-0.04	-0.14	-0.07
Kurtosis	5.83	3.725	3.74	4.924	5.19	1.27	1.33	1.21	1.41	1.53

Source: Authors

in BIST. The sectoral data for both stock markets were obtained from the Refinitiv Eikon Database (www.eikon.refinitiv.com). In order to eliminate possible purchasing power parity effects, all the data obtained were expressed in dollars. The descriptive statistics of the data used in the paper are presented in Table 1.

In time series analysis, regime change over time is effective on the results. Therefore, the model should be preferred considering the regime changes in the series for more reliable results. This paper uses the Fourier models that consider both smooth and sharp regime changes to account for regime changes in the series. Accordingly, the Fourier-Granger causality and Fourier volatility spillover tests were used, which is one of the methods that take into account structural breaks.

In fact, the Fourier functions in time series models are based on the work of W. Enders and J. Lee (2012). These methods were subsequently used to finalize the Fourier ADF test. Regarding the subject matter, many unit root tests have been developed in the literature, one of which is the conventional ADF unit root test. Moreover, E. Zivot and D. W. K. Andrews (1992) developed structural breaks, which this test included, and this model only considers one structural break. Later on, J. Lee and M. C. Strazicich's (2003) and J. L. Carrion-i-Silvestre's, D. Kim and P. Perron (2009) models were developed, respectively. These are the models that consider two and five structural breaks. In the following years, the Fourier ADF test, which takes into account both sharp and smooth transitional structural breaks, was proposed by W. Enders and J. Lee (2012). They claimed that these methods, in which structural breaks are determined *a priori*, were insufficient. The statistics for the Fourier ADF unit root test are calculated as follows:

$$y_t = y_0 + y_1 sin\left(\frac{2\pi kt}{T}\right) + y_2 cos\left(\frac{2\pi kt}{T}\right) + v_t \quad (1)$$

In addition to that, it was used in the cointegration and causality tests of Fourier functions (Tsong, Lee, Tsai & Hu, 2016). The Fourier-based cointegration test and the Fourier-based causality test are among the studies brought to the literature by W. Enders and P. Jones (2016). In the above calculation, y_t is the dependent variable, y_1 and y_2 are the independent variables, T is the time dimension, sin is the sine function, cos is the cosine function, *k* is the lag length, and v_t is the error term.

In this paper, the version of the volatility spillover test developed by J. Li and W. Enders (2018) was used to account for structural breaks, which was first developed by C. M. Hafner and H. Herwartz (2006). While investigating causality in variance in their paper, J. Li and W. Enders (2018) took into account both smooth and sharp structural breaks with trigonometric functions using sines and cosines. The Lagrange multiplier (LM), which can also be used in larger-size samples, was used to perform the analysis in question. This method is based on the GARCH (1, 1) model, and C. M. Hafner and H. Herwartz (2006) estimate the model as follows:

$$\varepsilon = \xi_{it}\sqrt{\sigma^2(1 + z'_{jt}\pi)}, z_{jt} = (\varepsilon^2_{jt-1}, \sigma^2_{jt-1}) \quad (2)$$

According to this method, structural changes are not taken into account in volatility spillovers. Moreover, σ^2_{jt-1} indicates conditional variance, ξ_{it} shows the GARCH model's standardized residual values. According to the GARCH (1, 1) model, if there is a long-term structural break between the series which cannot be taken into account by the model, then there is a possibility that the results obtained will be incorrect. In this context, J. Li and W. Enders (2018) added structural breaks to the model in question and established the structural break volatility spillover model as follows:

$$\sigma^2_{it} = \omega_{0i} + \sum_{k=1}^{n} \omega_{1i,k} + sin\left(\frac{2\pi k_i t}{T}\right) +$$

$$+ \sum_{k=1}^{n} \omega_{2i,k} cos\left(\frac{2\pi k_i t}{T}\right) + \alpha_i \varepsilon^2_{it-1} + \beta_i \sigma^2_{it-1} \quad (3)$$

where, *T* is the time dimension, *sin* is the sine function, *cos* is the cosine function, *k* is the lag length, v_t is the error term, π is 3.14, and ω is weight. The findings obtained owing to this model can account for not only severe structural breaks in the series, but also those with smooth transition structural breaks.

On the other hand, the Fourier Granger causality test was developed by W. Enders and P. Jones (2016). The reason for the development of this test is that the traditional Granger causality test performed with the vector autoregressive (VAR) model developed by C. A. Sims (1980) neglects regime changes and is often insufficient. In this test, unobservable regime change movements are determined by including A. R. Gallant's (1981) Fourier functions in the VAR model.

$$\gamma_t = \beta_0 + \gamma_{1k} sin\left(\frac{2\pi kt}{T}\right) + \gamma_{2k} cos\left(\frac{2\pi kt}{T}\right) + \\ + \vartheta_1 \gamma_{t-1} + ... + \vartheta_u \gamma_{t-u} \quad (4)$$

The equation created for the test is as above. T is the time dimension, *sin* is the sine function, *cos* is the cosine function, k is the lag length, v_t is the error term, y_t is the dependent variable, y_1 and y_2 are the independent variables. The basic hypothesis of the Fourier-Granger causality test reads as follows, "There is no causal relationship between the series." (H0: ϑ=0).

EMPIRICAL FINDINGS

At the first stage of the analysis, the stationarity levels of the series are dealt with using the Fourier-based ADF unit root test developed by W. Enders and J. Lee (2012). All the examined series have unit roots in their level values and have a stationary structure after the first difference.

After establishing a fact that the stationarity levels are at the same level, uni- or bidirectional causality relationships between the sectors were investigated using the conventional Granger causality and Fourier-Granger causality test developed by W. Enders and P. Jones (2016). According to the results presented in Table 3 (the traditional method), no causality was found for any sector. On the other hand, the Fourier-Granger causality test demonstrates that no causality findings were found in the consumer, finance and oil sectors, and one-way causality was detected in the telecom sector from BIST to MOEX. Moreover, there is the two-way causality detected in the electricity sector between the two indices. This situation is thought to be as is due to the intensity of the strong commercial relationships between Russia and Turkey. In this context, the possible structural breaks caused by the COVID-19 pandemic and the Russia-Ukraine war, which are included in the data subjected to the analysis carried out in the paper, were considered. Especially in the energy sector, there was an increase in energy prices due to dependence on the energy resources coming from the geographies where the conflict started. This situation changed investors' risk perception by affecting the companies operating in the energy sector on global markets. Moreover, there is causality from BIST to MOEX in the communication sector, where there are intense commercial negotiations due to the fact that these are neighboring countries.

Table 2 The Fourier ADF unit root test results

	Level	First Diff.
BIST Consumer	-3.11 (1)	-12.31 (4) ***
BIST Electric	-0.34 (1)	-15.50 (1) ***
BIST Finance	-3.45 (1)	-15.22 (4) ***
BIST Oil	-1.67 (1)	-13.63 (1) ***
BIST Telecom	-0.17 (1)	-11.49 (1) ***
MOEX Consumer	-3.27 (1)	-11.93 (1) ***
MOEX Electric	-2.84 (1)	-12.08 (3) ***
MOEX Finance	-3.14 (1)	-12.24 (1) ***
MOEX Oil	-3.11 (1)	-13.54 (5) ***
MOEX Telecom	-2.71 (4)	-22.41 (3) ***

Note: *** indicates significance with 99% confidence. The values in parentheses indicate the Fourier number.

Source: Authors

Following the causality test, the effect of the volatility spillover was investigated between the Turkish and Russian markets on a sectoral basis. Accordingly, the method that was applied was first developed by C. M. Hafner and H. Herwartz (2006) and does not take into account structural breaks in variance. Following this, the Fourier-based method was used, which can consider smooth transition structural breaks in volatility using the trigonometric functions

Table 3 The conventional Granger causality and Fourier-Granger causality test results

	Conventional Granger Causality		Fourier-Granger Causality	
Sector	BIST → MOEX	MOEX → BIST	BIST → MOEX	MOEX → BIST
Consumer	0.08 (0.76)	0.65 (0.41)	2.374 (0.125)	0.243 (0.637)
Electricity	0.01 (0.97)	0.01 (0.96)	5.199 (0.039)**	5.551 (0.074)*
Financial	0.03 (0.87)	1.22 (0.27)	0.131 (0.695)	0.461 (0.501)
Oil	2.06 (0.15)	0.05 (0.88)	1.291 (0.449)	1.564 (0.445)
Telecom	0.47 (0.49)	1.40 (0.23)	3.425 (0.084)*	0.417 (0.509)

Note: ** and * indicate significance with 95% and 90% confidence, respectively. The values in parentheses indicate significance.

Source: Authors

Table 4 The results of the conventional volatility spillover and Fourier volatility spillover tests

	Conventional Volatility Spillover		Fourier Volatility Spillover	
Sector	BIST → MOEX	MOEX → BIST	BIST → MOEX	MOEX → BIST
Consumer	0.313 (0.85)	1.198 (0.55)	3.77 (0.15)	8. 703 (0.012)**
Electricity	0.776 (0.67)	1.247 (0.54)	10.736 (0.00)***	9.699 (0.00)***
Financial	6.995 (0.03)**	1.418 (0.49)	30.812 (0.00)***	11.826 (0.00)***
Oil	0.584 (0.75)	1.971 (0.37)	8.574 (0.013)**	4.683 (0.09)*
Telecom	0.334 (0.84)	1.576 (0.45)	4.356 (0.11)	4.246 (0.11)

Notes: ***, ** and * indicate significance with 99%, 95% and 90% confidence, respectively. The values in parentheses indicate significance.

Source: Authors

developed by J. Li and W. Enders (2018). The obtained findings are given in Table 4; according to the C. M. Hafner and H. Herwartz (2006) method, the volatility spillover from BIST to MOEX was determined only in the financial sector. In the results obtained according to the Fourier volatility spillover method of J. Li and W. Enders (2018), causality was found in bidirectional volatility in the electricity, financial, and oil sectors. The findings show that causality in the variance could not be determined in the conventional C. M. Hafner and H. Herwartz (2006) method, since structural breaks are not taken into account. Thus, performing the analysis by taking into consideration the structural breaks revealed the fact that there were significant differences in the results obtained. In terms of the causality tests, the relationships that are not very strong are seen as in the volatility spillover test. The COVID-19 epidemic and the Russia-Ukraine war can be quoted as the reasons for this situation. The fact that there are causal relationships in the electricity and financial sectors, and especially in the oil sector, where Russia distributes gas and where there are strong ties between Russia and Turkey, meets the expectations. This volatility spillover between the countries seems likely to harm the Turkish economy in the case of a possible negative development regarding the war.

CONCLUSION

Since the 1980s, liberalization movements in the world and innovations in financial systems have significantly been influencing national economies. The fact that information is accessible more easily and at a lower cost, along with technological progress, has enabled the use of information more effectively, and many financial products have developed with respect to risk and return expectations. The diversity of financial products has broadened risk preferences

on the one hand, whereas, on the other, the number of participants has increased and that has led to market growth. Thus, the financial systems of all countries have become interconnected. This situation has necessitated not being independent from the financial dynamics in other countries' markets while making investment decisions for the country's economy on financial markets. In addition to that, not only economic but also the war and natural disasters that the world is being faced with today affect all global markets. Considering many different sectors of all financial markets, sectoral impact shocks will also be different. In general, this situation can be understood on the examples of raw materials and energy provided from the countries where the war broke out.

The recent conflict between Russia and Ukraine is one of these examples. The events that were effective on the global markets had an impact on both energy prices and the prices of financial assets considered as safe havens. This situation also found a response in the academic literature, and current studies have been carried out in the field. This paper is focused on how the war interacted with different sectors. Accordingly, the effects of the war crisis on the stock market subsectors were analyzed as well.

According to the findings obtained in the paper, bidirectional causality relationships were found between the two countries in the electricity sector and a causality relationship was found from BIST to MOEX in the telecom sector. In addition, there is a mutual volatility spillover between the stock markets of the two countries in the electricity, financial and oil sectors. In the food sector, a volatility spillover from MOEX to BIST was detected. Finally, strong relationships were found between the two countries by both the Fourier-Granger causality and Fourier volatility spillover tests. This situation is thought to be as is due to the intensity of the commercial relationships between Russia and Turkey. However, the use of the Fourier-functional methods enabled the smooth transition structural breaks to be taken into account in the paper. In this context, the possible structural breaks caused by the COVID-19 pandemic and the Russia-Ukraine war, which are included in the data analyzed in the paper, were considered. Additionally, the Russia-Ukraine war has led to a number of sectoral impacts. Especially so in the energy sector, there has been an increase in energy prices due to dependence on the energy resources coming from the geographies where the conflict started. This situation has changed investors' risk perception by affecting the companies operating in the energy sector on global markets. On the other hand, the financial sector has been exposed to such influences as fluctuating exchange rates and increased demand for safe haven assets due to geopolitical uncertainty. In addition, there have been supply problems and price fluctuations in the food sector and the other basic material sectors in the countries trading with the regions where the war broke out. These sectoral effects have affected global economic balances, causing investors to re-evaluate their portfolio strategies.

The findings of our paper coincide with the findings of a number of the studies (Mahran, 2023; Beraich *et al*, 2023; Vidal-Llana *et al*, 2023) conducted on the basis of the Russia-Ukraine conflict, dealing with different markets and sectors. Similarly, the studies in question revealed the fact that the paper increased the interaction and risk shocks between financial markets and certain sectors (such as energy, electricity).

Finally, the fact that the research study conducted in this paper was carried out taking into consideration the sector indices traded on the stock market is worthy of notice.

The limitations of this paper include the use of only the sector indices on the stock market. However, it is recommended that more comprehensive studies taking into account different sectoral data should be carried out. It is estimated that the other sectors will also be affected in the times of war and that foreign trade balances with the countries closely bordering with the regions where the war broke out will be dynamic. In this regard, it is thought that another paper containing different sectoral data will contribute to evaluating the issue from a broader point of view and will be promising. It will open the door to more comprehensive findings.

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