EURASIAN RESEARCH JOURNAL
ERJ, Vol. 5, No. 1, pp. 59-71, Winter 2023

https://doi.org/10.53277/2519-2442-2023.1-04
ISSN 2519-2442, KAZAKHSTAN
Research Article

ANALYSIS OF THE GLOBAL FOOD CRISIS IN INTERNATIONAL MARKETS BY THE ASYMMETRIC TVP-VAR METHOD

Oznur TASDOKEN [1]
[1] Dokuz Eylul University, 00035, Izmir, Türkiye; oz.nur35@hotmail.com
ORCID: 0000-0001-7381-4361

Hakan KAHYAOGLU [2]
[2] Dokuz Eylul University, 00035, Izmir, Türkiye; hakan.kahyaoglu@deu.edu.tr
ORCID: 0000-0002-6031-7494
Corresponding Author: Hakan KAHYAOGLU

ABSTRACT

It is the expenditure on consumption that constitutes the basic share of the expenditures of the households that supply labor as a factor of production in an economy. These expenditures have an indirect effect on the input costs of the companies that demand labor as a production factor. The change in food prices determines both the relative price structure of the economy and the inflationary trend in the economy for the future, depending on the changes in labor and goods markets. For this reason, households that make the consumption decisions of companies as a producer decision unit in the economy are highly sensitive to changes in food commodity prices. A continuous and permanent change in food commodity prices has a direct impact on consumption expenditures and investment decisions. This effect causes supply shocks that may arise as a result of food and commodity prices to turn into demand shocks at the same time. From this point of view, this study investigates the distribution of volatility in global commodity prices, food commodity prices, Baltic dry indices, and crude oil prices, which are the indicators of price trends of basic inputs in international markets. Thus, the mechanism of spillover of a possible supply shock is revealed at the international level under the restrictions of the asymmetric TVP-VAR approach.

Keywords: Asymmetric TVP-VAR, Global inflation rate, Food commodity prices, Connectedness approach, Diebold-Yilmaz methodology.

Eurasian
Research
Journal
Winter 2023
Vol. 5, No. 1

INTRODUCTION

The rise in the price of oil, which is an economically basic input, is the most important reason for the increase in the costs of biomass energy production, foodstuffs, and other materials, depending on the direct energy costs and its use in other fields and its share in the input (Hanson et al., 1993). In this respect, changes in oil prices have both supply and demand effects on commodity prices. On the supply side, the increase in oil prices increases fertilizer, transportation costs, and overall costs (Pindyck, 2004). This situation leads to a decrease in food commodities, which represents all foodstuffs, and causes an increase in their prices. On the demand side, the biomass energy production of energy products that can be a substitute for oil causes an increase in energy production. This situation increases the demand for foodstuffs such as corn and soybean used for biomass production, especially considering the waste for circular economy and environmental protection.

According to the business cycles in the economy, the diffusion effect through oil prices and commodity prices also differs (Khalfaoui et al., 2023). However, the diffusion effect through crude oil prices and commodity prices differs according to commodity types (Cao & Cheng, 2021; Hanif et al., 2021; Balcilar et al., 2021). Therefore, the dynamic linkage of dynamic aggregate return and volatility in crude oil price and food commodity markets changes over time, and asymmetrical effects on volatility increase in times of economic crisis (Umar et al., 2021). In addition, the addiction effect among oil price and food commodity prices also demonstrates that there is an asymmetrical relationship in different market conditions. In other words, it shows that there are risk spillover effects among the global crude oil market and commodities (Meng et al., 2020; Dahl et al., 2020).

In general, the volume of basic logistics maritime trade in international trade also shows the global demand for industrial goods and end products. Therefore, this index not only measures the amount of international commodities flows but also their associated costs (Bildirici et al., 2015:416). The increase in transportation and logistics costs causes changes in other economic indicators related to exchange rates, depending on its effect on the exchange rate of internationally traded goods (Sun et al., 2020). The effects that occur when changes in commodity prices spread to the freight market lead to an interaction that will again lead to the spread of commodity prices to their own prices. This process also applies to the relationship between oil, freight and commodity prices.

In this respect, the analysis of alteration in oil prices, which will be defined as a supply shock, can be analyzed from the said supply shock itself and the spillover effect due to other effects. This will be analyzed with the approach used in this study. However, the spread between oil, Baltic dry price (freight) and different commodities can be asymmetrical (Bandyopadhyay & Rajib, 2021).

Changes in the prices of input factors in the economy affect inflation expectations depending on their supply-side effects. Inflation expectations cause changes in economic preferences and behaviors of households to maintain their welfare level. The reason for this is that the effect of the food commodity price and oil price on the consumption expenditures of the households is also high in their sensitivity to the shocks that may occur in these markets. Secondly, food

Eurasian
Research
Journal
Winter 2023
Vol. 5, No. 1

prices determine the production costs, as it also affects the interaction of labor with other sectors of the economy. The main reason for the increase in food prices is the increase in energy costs and the price of basic foodstuffs. This situation causes both the inflation rate and the core inflation rate to increase in the economy.

One of the approaches that provide important information about the spread of the supply and demand indicator relations of the economy is the connectivity analysis. Considering this analysis, the relationship between the spillover effect of Crude oil price, Baltic dry price, global inflation rate, and food commodity prices and positive/negative changes in the markets will be investigated. Therefore, this article will expand on previous work in the following aspects. First, determining the spillover through these markets allows us to determine the direction of the connection between the markets and where the spread of change is higher in other markets. Therefore, determining the spread of change from one market to another senables economic decision-makers to decide on these changes in a timely and effective manner. Second, the literature is often based on traditional VAR, GARCH, and their derivative models, which cannot determine the extent and direction of spillover effects. Therefore, previous studies on the subject do not measure spillovers sufficiently in detail. For this reason, in this research, we discuss in detail these spillovers between markets. Moreover, the effects of negative/positive changes are different between these markets which allow for the examination of heterogeneous volatility links. Because the effect of negative/positive changes on the markets and the determination of the markets that are net receiver/transmitter of the change between markets, facilitate the determination of the dynamics of the transmission of the change. Therefore, this study provides a more comprehensive analysis of the spillover of dynamic and temporal changes between markets.

In the following parts of this research the data set, and the econometric method is presented in the second part, empirical findings would be mentioned in the third part and in the fourth part we present the results of the analysis.

DATASET AND ECONOMETRIC METHOD

In this study, monthly data from 2003M3 to 2022M9, the Global Price Index of All Commodities, Food commodity price index, Baltic Dry Index, and Crude oil prices are used. The Baltic Dry Index and Crude oil price were obtained from the Investing website, the global price index was obtained from the World Bank, and the food commodity price index was obtained from the database of the Food and Agriculture Organization. In addition to that Baltic Dry Index shows transportation costs.

The asymmetric TVP-VAR method was used to examine the spillover relationship between the markets. The asymmetric TPV-VAR method was developed by Adekoya et al., (2022) based on the Diebold & Yilmaz (2009, 2012, 2014) methodology. This method has been developed as a new dynamic connectedness method that structurally explains the asymmetries in the spillover between markets. This method is a new extension of the time-varying parameter vector autoregressive (TVP-VAR) model. In this method, the approach spillover interaction is estimated by separating the total change, positive and negative change according to three effects. Thus, parameters are calculated by the TVP-VAR technique to examine the different characteristics of the asymmetric change

Eurasian
Research
Journal
Winter 2023
Vol. 5, No. 1

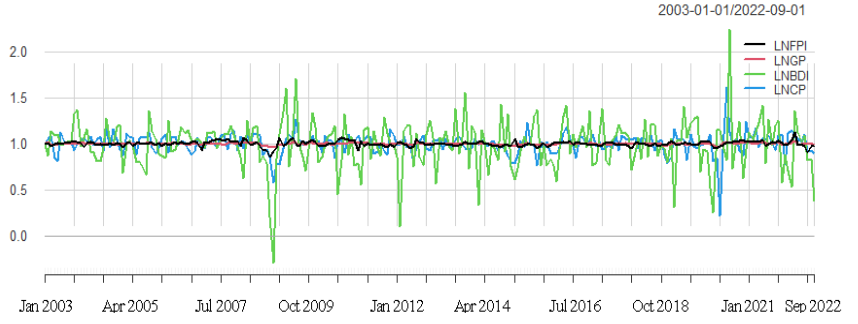
spillover effect between markets. Thus, when a change occurs, it is determined which market is a net receiver or a net transmitter. Thus, the spillover relation of the change between the markets is obtained.

It is aimed to make three different analyzes from the results obtained regarding the relations between the markets representing the available variables. First, the relationships between markets are examined more extensively. Because the TPV-VAR connectivity method also shows the relationships and interdependencies of the markets with each other. Second, the connectivity approach shows how a change in relative prices affects another global price over the course of the time series. Thirdly, the effect of the asymmetric behavior of producers regarding uncertainty and risk on the asymmetry in the transmission of change is discussed. In this context, the heterogeneity of the sensitivity of economic decision units plays an important role in causing the asymmetry of information transmission patterns and transmission density among markets. Fourth, the effect of increases in transportation costs on inflation will be discussed.

EMPIRICAL APPLICATION

In this study, the distribution relationship among the return series will be estimated within the framework of the asymmetric TVP-VAR model. Before moving on to the model estimation, the return estimations of all markets are shown in Figure 1. Then, the basic statistical specialty and stationarity of all return series were tested. These results are shown in Table 1. The correlation matrix showing the relationship between the return series is also shown in Table 2.

Figure 1. *Return Forecasts For All Markets*



Changes in oil prices and commodity prices reveal the propagation effect of shocks through the feedback effect between themselves (Narayan & Narayan, 2007). Especially during the period under consideration, food commodity prices vary greatly in connection with the price of oil (Baffes, 2007). Changes between oil prices and commodity prices reveal the propagation effect of shocks through the feedback effect between themselves. Finding such a relationship also shows that there is a direct interaction between these variables. Considering the alteration in the Baltic dry price index, there has been a positive change in transportation costs since the second half of 2020. 'By October 2021, indicators of the cost of shipping containers by sea have increased by over 5 percent from pre-pandemic levels, while the cost of shipping bulk cargoes by sea has tripled' (Carrière-Swallow et al., 2022:4). 'This will first increase the global import price level and consumer price levels, according to UNCTAD. Second, supply chains will be impacted by higher shipping costs. Third, these effects may cause changes in the terms of trade

Eurasian
Research
Journal
Winter 2023
Vol. 5, No. 1

of low-value-added products produced in small economies. Fourth, the increase in transportation costs has an impact on exports and imports, which also leads to an asymmetrical effect on global trade. In this context, increases in freight rates will have an impact on global production and inflation, but these effects will not be the same for each country.'

Table 1. *Basic Statistics Estimation*

	Mean	Variance	Skewness	Ex.Kurtosis	JB	ERS	Q(20)	Q2(20)
Food Commodity	1,003***	0,001***	(-0.481***)	3,895***	158,945***	(-6,050***)	48,997***	47,045***
prices	0,00		-0,003	0,00	0,00	0,00	0,00	0,00
Global Inflation	1,001***	0,000***	(-0,909***)	2,385***	88,799***	(-5,375***)	42,356***	41,615***
Rate	0,00		0,00	0,00	0,00	0,00	0,00	0,00
Baltic Dry Cargo	0,998***	0,071***	(-0,439***)	4,200***	181,797***	(-8,218***)	22,133***	19,478**
Prices	0,00		-0,006	0,00	0,00	0,00	0,00	-0,022
Crude Petrol	1,004***	0,013***	(-1,027***)	11,630***	1377,317***	(-7,664***)	16,497*	15.110
Prices	0,00		0,00	0,00	0,00	0,00	0,00	-0,117

Notes: The results are based on a TVP-VAR model with a first order lag length (BIC) and 20 steps forward generalized prediction error variance decomposition.

Variance values can be expressed as a measure of the variability of the price in the market. Series representing the variables show negative skewness and kurtosis is greater than three. This gives information that each market has the characteristics of a fat-tailed distribution. JB test statistics reject the null hypothesis that all variables used in this study are normally distributed. When we look at the ERS[1] values, being significant in all markets also shows that these series are stationary. The LjungBox (Q(20)) test rejects the null hypothesis of the existence of autocorrelation. When the value of $Q^2(20)$[2] is taken into account, it is statistically significant in all markets except the crude oil market. In other words, it gives information that the effects of a shock in these markets will be permanent.

Considering the Kernell correlation matrix coefficients estimation results, there is a positive correlation among all markets. The high correlation between the crude oil price and the global inflation rate causes a difference in the crude oil price to change the production inflation rate in the same direction. Considering the correlation between crude oil prices and food commodity prices, positive or negative changes in oil prices generally affect commodity prices in the long run. In other words, a change in oil prices can cause inflation to change in the same direction.

Table 2. *Kernell Correlation Matrix Estimation*

kendall	LNFPI	LNGP	LNBDI	LNCP
LNFPI	1.000***	0.293***	0.043	0.116***
LNGP	0.293***	1.000***	0.046	0.316***
LNBDI	0.043	0.046	1.000***	0.074
LNCP	0.116***	0.316***	0.074	1.000***

The existence of a positive correlation relationship between markets also means that a shock in one market will have an impact on other markets. However, the extent of the impact of this change on the markets is caused by economic dependence between countries (Guo & Tanaka, 2022) and a strong economic integration or a large impact of the country's exports/imports on global commodity markets.

[1] See for detailed information. Elliott et al., (1996).

[2] See for detailed information. Fisher and Gallagher (2012).

Eurasian
Research
Journal
Winter 2023
Vol. 5, No. 1

Table 3. *Averaged Connectedness Estimate Results*

Indicator	Food Commodity Prices	Global Inflation Rate	Baltic Dry Cargo Prices	Crude Petrol Prices	FROM
Food Commodity Prices	86,10	6,69	6,64	0,57	13,90
Global Inflation Rate	5,32	84,79	2,88	7,02	15,21
Baltic Dry Cargo Prices	0,08	0,95	96,21	2,77	3,79
Crude Petrol Prices	0,70	1,46	5,75	92,1	7,90
TO	6,09	9,09	15,27	10,36	40,81
Inc.Own	92,19	93,87	111,48	102,46	cTCI/TCI
NET	-7,81	-6,13	11,48	2,46	13,60/10,20
NPT	1	1	3	1	

Notes: The results are based on a TVP-VAR model with a first order lag length (BIC) and 20 steps forward generalized prediction error variance decomposition.

Looking at the average connectivity estimation results, food commodity markets explain 86.10% of their variance. Food Commodity prices have a connectedness effect on the highest global inflation rate (6.69%) and the Baltic dry price (6.64%). This means that the variance of commodity prices is explained by the global inflation rate of 6.69% (6.64%) and the Baltic dry price. Moreover, the highest interconnectedness effect on food commodity prices is the global inflation rate (5.32%). In other words, while food commodity prices affect the global inflation rate the most, they are also most affected by the global inflation rate. Therefore, an increase in the price of Baltic dry transportation increases the transportation costs and is the base reason for the price increases in food commodity prices. In addition to this, the price of crude oil and food commodities prices are effective on the Baltic dry price. Therefore, an alteration in the oil price also causes an alteration in the Baltic dry price (Choi & Yoon, 2020).

When we look at the TO value in Table 2, it shows the spillover effect of the change from one market to another. In this framework, the market with the highest spillover of change overall markets is the Baltic dry index market. In other words, an increase/decrease in transportation costs may be the cause of both the inflation rate and the increase in food commodity prices. Because a rise in transportation costs has an impact on consumer prices. First, they can directly impact import prices, as the local price of imported goods increases in proportion to the cost of transportation. Second, when there is a rise in the cost of transportation of intermediate goods, it creates supplemental cost pressures for producers and puts oppression on local consumers to demand higher prices. Third, it can have an impact on core inflation, for instance, when wage bargaining is indexed to past inflation (Carrière-Swallow et al., 2022:4). When we look at the FROM value, it shows the effect of the change in one market from the other. The global inflation rate, food commodity prices and Baltic dry prices show that they are the markets where the change is most effective during an economic recession or crisis period. In particular, the fact that food commodity prices are the market with the highest effects of change also shows that many factors are effective on the dynamics of this market. In the framework of these effects, it states that monetary policies in both global and domestic markets should be handled carefully.

The NET spillover value reveals the difference between the change spillover or received from one market to another market. A positive value indicates that the market acts as a transmitter of change, and a negative value indicates that the market acts as a net receiver. In this context, while the crude oil price and the

Eurasian
Research
Journal
Winter 2023
Vol. 5, No. 1

Baltic dry price are the net transmitters of the change, the global inflation rate and food commodity prices are the net receiver of the change. When we look at the NPT value, it shows the changes that occur in a market. Therefore, the highest change occurred in the price of Baltic dry price. 'The reason for this situation is first, the strong increase in the demand for intermediate goods due to increased manufacturing activities has increased the demand for container transportation. Second, shipping capacity has been constrained by logistical barriers and deficiencies in container shipping equipment, often associated with pandemic disruptions. Tariffs and congestion at ports have also led to an increase in fees, including delay and detention fees' (Carrière-Swallow et al., 2022:4). Considering the findings obtained in this framework, it can be stated that the most effective factor on global markets is the increase of costs caused by supply shocks.

Figure 2. *Dynamic Total Connectivity Estimation Results*

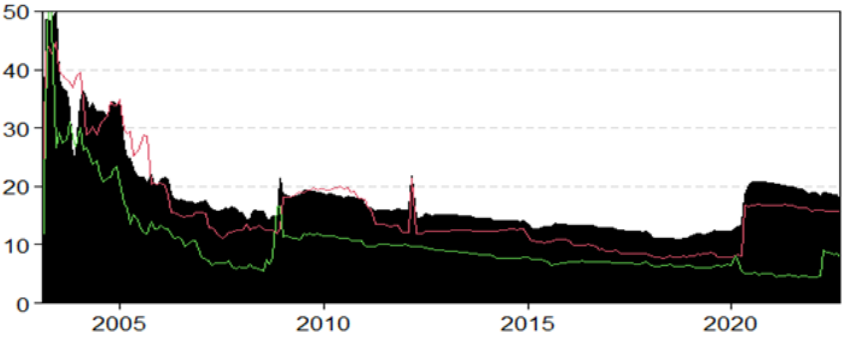


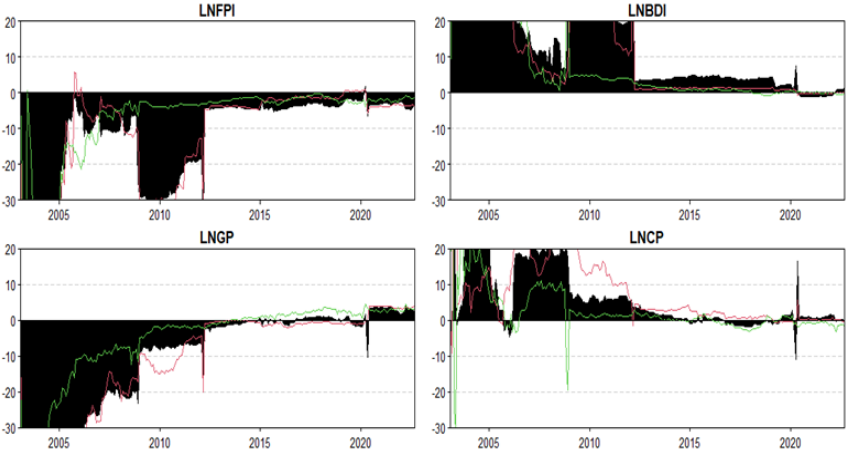
Figure 2 shows the black-shaded area total connectivity (TCI) in the Dynamic total connectivity estimation. Also, the green line represents the positive change and the red line progression of TCI over time based on the negative change. This frame also shows high volatility (more than approximately 50%) of TCI. Therefore, it shows that the reaction of a change in these markets to different economic and political events is high. The total, negative, and positive change varies in similar time intervals until 2010-2020 when dynamic connectivity is taken into account. After 2020, it shows different changes. Especially after 2020, while positive change decreases, TCI increases with negative change. However, there are common inequalities between positive and negative change. Also, dependency based on mostly negative changes is high during the period under consideration. In other words, since the markets are more sensitive to negative news than positive news, it is stated that the change in negative information has a stronger effect on all markets than negative information.

In 2021, negative changes were more effective in the markets. The reason for this situation is primarily the disruptions in oil and grain shipments in Ukraine due to the war. In other words, according to the IMF, Russia's blocking of Ukraine's export shipments caused a shock in the grain supply. Thus, barriers to export shipping would decrease global wheat and maize supplies by 1.5 percent compared to current expectations, while increasing grain prices by 10 percent within a year. Secondly, a 1 percent decrease in global harvest due to the global climate crisis causes food commodity prices to increase by 8.5 percent. Weather events such as temperature increases, regional imbalances in precipitation and drought increase the change in food prices, that is, negative

Eurasian
Research
Journal
Winter 2023
Vol. 5, No. 1

supply shocks surge food prices due to a decrease in production. Thirdly, the 1 percent increase in fertilizer prices, which has recently amplified due to the increase in natural gas prices, rises the food commodity prices by 0.45 percent. Thus, an escalation in natural gas prices pushes production costs to go higher. Fourth, a 1 percent rise in oil prices increases food commodity prices by 0.2 percent[3] (Price, 2022). In this context, shocks in the markets due to various factors are the main reason for the rise in global inflation.

Figure 3. *Dynamic Net Total Directional Connectedness*



Dynamic net directional interconnectivity estimation results[4] show the role of net receiving or net transmitting in the spillover of change in the markets during the time period under consideration. In this frame, positive values show net transmitters in the system, and negative values show net receivers. While food commodity prices and the global inflation rate are net receivers, crude oil prices and Baltic dry prices are net transmitters. In this context, a change in the Baltic dry price and crude oil price causes changes in other markets. Positive change is effective in the oil market until 2006-2005. In all markets except food commodity prices, the effect of negative change on the market increased between 2009 and 2020. In particular, the effects of the COVID-19 epidemic are seen in all markets.

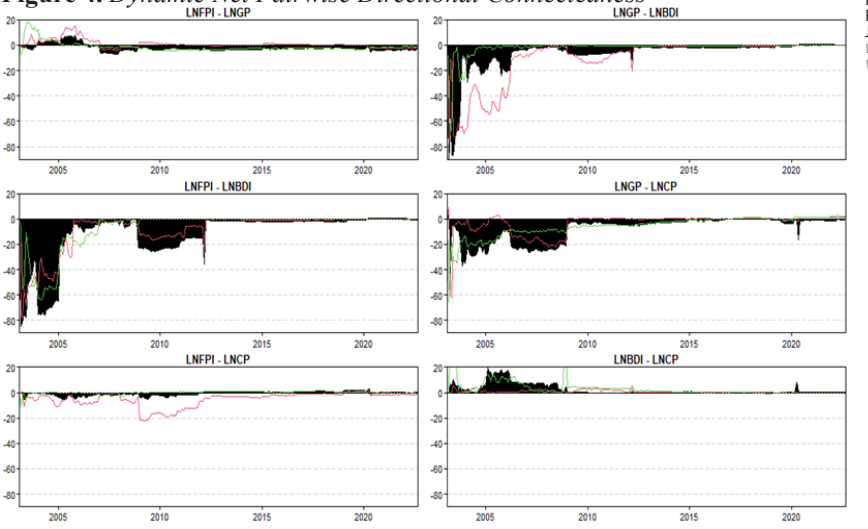
It shows the connectivity dynamics between the series pairs of change in dynamic dual connectivity estimation. For example, when we look at the price of food commodities and the global inflation rate, the change shows that the variable between these two markets is the net receiving and which variable is the net transmitter. In food commodity prices, the black shadowy area, the red straight line and the green continuous line are below zero. This situation shows that there is a spillover to food commodity prices at a higher rate than the global inflation rate price. The effect of a positive or negative spillover in the global inflation rate creates an asymmetrical effect on both the food commodity prices and the Baltic dry price. Therefore, while food commodity prices are the net receiving of change until 2020, they become the net transmitting market of change after 2020. However, there is heterogeneity in price responses in all

[3] See for detailed information. https://www.imf.org/en/Blogs/Articles/2022/12/09/global-food-prices-to-remain-elevated-amid-war-costly-energy-la-nina

[4] Variables used in estimation; LNFPI shows the global food commodity return series, LNGP shows the global inflation rate return series, LNBDI Baltic dry return series and LNCP crude oil return series.

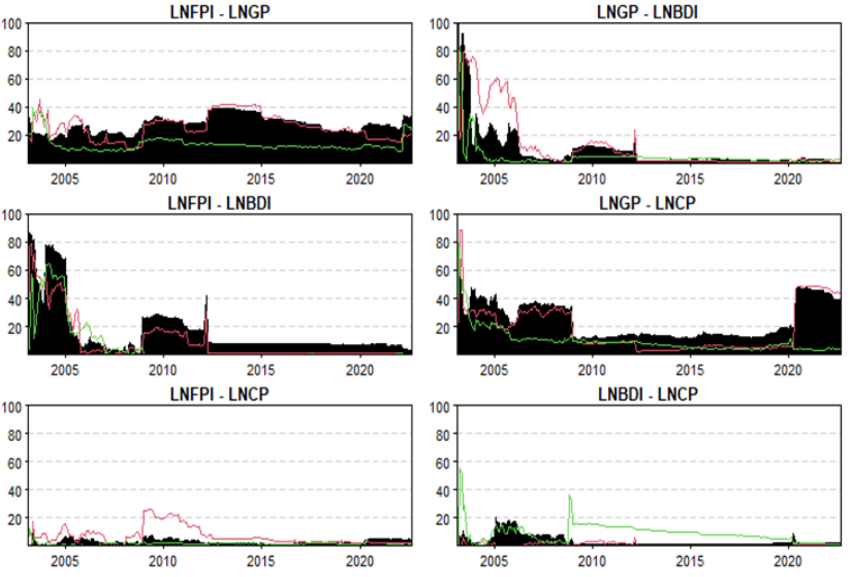
Eurasian
Research
Journal
Winter 2023
Vol. 5, No. 1

Figure 4. *Dynamic Net Pairwise Directional Connectedness*



markets depending on the change. In other words, whether a negative change in a particular market spillovers more to other markets than positive changes, and the reactions to prices in all markets are different. For this reason, it causes the expectations and price sensitivity of producers and consumers are different (Chen et al., 2022). In other words, both the heterogeneity between countries and the differentiation in the expectations of the economic decision-making units affect the spillover of change in the markets.

Figure 5. *Dynamic Pairwise Connectedness*



The black area stands for the symmetrical dual connectedness, while the green and red lines show the dual connectedness measures of positive and negative alteration respectively. Spillover effects under positive and negative alteration are significantly different in all markets. That is, the disposition between the

Eurasian
Research
Journal
Winter 2023
Vol. 5, No. 1

return series is different. During the time period under consideration, spillover effects under negative change are greater than spillover effects of positive alternation, except for the Baltic dry price and crude oil price (LNBDI-LNCP) markets. This shows that the risk of spread of negative changes in the markets is dominant.

Considering the findings, the rapid spillover of negative changes across markets may also cause a reaction in the markets that can affect the general instability. This situation may have an impact on prices and employment policies, taking into account the expectations of companies. Because, depending on the inflation beliefs of the firms according to the price changes observed along the supply chain, it causes heterogeneous expectations among the firms. Therefore, the input prices of the firms constitute inflation and the total inflation expectations according to heterogeneous prices. This situation states that companies use the boundedly rational expectations hypothesis in the decision process instead of the Rational expectations hypothesis (Albagli et al., 2022).

CONCLUSION

In this study, monthly data were used between 2003M1-2022M9 periods. Positive/negative changes between these markets were analyzed by taking into account food commodity prices, crude oil prices, Baltic dry prices and global inflation rate. In this analysis, the asymmetric TVP-VAR method was used. Considering the findings from this analysis, it can be said that spillovers respond differently based on qualitative differences in market dynamics. In addition, the spillovers of negative changes associated with uncertainty and decreases in prices are more effective on the markets during the period under consideration. We can conclude that the spread of negative changes in the markets is driven by it. For this reason, results have been obtained that support the literature on the fact that negative changes are more effective on the markets. This result also supports the existence of asymmetric spillover between markets.

Changes in food commodity prices and Baltic dry prices increase the national inflation rate. This also indicates that these changes are more strongly transmitted to the global inflation rate. Especially when global inflation is high, it will cause the rate of spillover of supply-side shocks to global inflation to increase, both directly and indirectly. In other words, the irregular demand development and unexpected supply disruptions in these markets also cause these markets to face the problem of delays in adjusting supply. However, global inflation is spreading to the domestic markets of countries where the consumption of imported products is high. This situation varies according to the characteristics of the countries and the monetary policy applied. For this reason, it is necessary to determine the monetary policies to be applied correctly.

The monetary policy gives insufficient results when faced with persistent supply shocks that cause inflation expectations to change. For this reason, it is especially important for effective monetary policy to understand from which market negative changes could occur and spill over due to supply and demand shocks.

The findings support the view that cost-side shocks have a greater impact on inflation. In this context, while preparing monetary policy targets, policies should be prepared under flexible inflation targeting, taking into account the changes that may occur in inflation expectations due to supply shocks. Because

Eurasian
Research
Journal
Winter 2023
Vol. 5, No. 1

the ability of economic decision-making units to react to market price volatility varies according to positive and negative changes. This situation causes asymmetrical risk spillover between markets and differences between markets. The most important result of this situation is the differentiation of the change in company expectations. In other words, firms make decisions under boundly rational expectations.

Eurasian
Research
Journal
Winter 2023
Vol. 5, No. 1

REFERENCES

Adekoya, Oluwasegun B., Ademola B. Akinseye, Nikolaos Antonakakis, Ioannis Chatziantoniou, David Gabauer and Johnson Oliyide (2022). "Crude oil and Islamic sectoral stocks: Asymmetric TVP-VAR connectedness and investment strategies. Resources Policy, 78(March): 102877. Doi: 10.1016/j.resourpol.2022.102877.

Albagli, Elias, Francesco Grigoli and Emiliano Luttini (2022). Inflation expectations and the supply chain (WP/22/161).

Baffes, John (2007). Oil Spills on Other Commodities. The World Bank Development Prospects Group, Global Trends Team No. 4333.

Balcilar, Mehmet, David Gabauer and Zaghum Umar (2021). "Crude oil futures contracts and commodity markets : New evidence from a TVP-VAR extended joint connectedness approach". Resources Policy, 73(November 2020): 102219. Doi: 10.1016/j.resourpol.2021.102219.

Bandyopadhyay, Arunava and Prabina Rajib (2021). "The asymmetric relationship between Baltic Dry Index and commodity spot prices: Evidence from Nonparametric Causality-in-Quantiles Test. Mineral Economics, 0123456789. Doi: 10.1007/s13563-021-00287-y.

Bildirici, Melike, Fazil Kayikci and Isil Onat (2015). "Baltic Dry Index as a major economic policy indicator: The relationship with economic growth". Procedia - Social and Behavioral Sciences, 210: 416–424. Doi: 10.1016/j.sbspro.2015.11.389.

Cao, Yan and Sheng Cheng (2021). "Impact of COVID-19 outbreak on multi-scale asymmet-ric spillovers between food and oil prices". Resources Policy, 74(August), 102364. Doi: 10.1016/j.resourpol.2021.102364.

Carrière-Swallow, Yan, Pragyan Deb, Davide Furceri, Daniel Jiménez and Jonathan D. Ostry (2022). Shipping Costs and Inflation, WP/22/61.

Chen, Jiachen, Lucyna Gornicka and Vaclav Zdarek (2022). Biases in Survey Inflation Expectations : Evidence from the Euro Area, WP/22/205.

Choi, Ki-Hong and Seong-Min Yoon (2020). "Asymmetric dependence between oil prices and maritime freight rates: A time-varying copula approach". Sustainability (Switzerland), 12(24): 1–16. Doi: 10.3390/su122410687.

Dahl, Roy E., Atle Oglend and Muhammad Yahya (2020). "Dynamics of volatility spillover in commodity markets: Linking crude oil to agriculture". Journal of Commodity Markets, 20: 100111. Doi: 10.1016/j.jcomm.2019.100111.

Diebold, Francis X. and Kamil Yilmaz (2009). "Measuring financial asset return and volatil-ity spillovers, with application to global equity markets". Economic Journal, 119(534): 158–171. Doi: 10.1111/j.1468-0297.2008.02208.x.

Diebold, Francis X. and Kamil Yilmaz (2012). "Better to give than to receive: Predictive directional measurement of volatility spillovers". International Journal of Forecasting, 28(1): 57–66. Doi: 10.1016/j.ijforecast.2011.02.006.

Diebold, Francis X. and Kamil Yilmaz (2014). "On the network topology of variance decompositions: Measuring the connectedness of financial firms". Journal of Econometrics, 182(1): 119–134. Doi: 10.1016/j.jeconom.2014.04.012.

Elliott, Graham, Thomas J. Rothenberg and James H. Stock (1996). "Efficient tests for an autoregressive unit root". Econometrica, 64(4): 813–836.

Fisher, Thomas J. and Colin M. Gallagher (2012). "New weighted Portmanteau Statistics for time series goodness of fit testing". Journal of the American Statistical Association, 107(498): 777–787. Doi: 10.1080/01621459.2012.688465

Guo, Jin and Tetsuji Tanaka (2022). "Do biofuel production and financial speculation in agricultural commodities influence African food prices? New evidence from a TVP-VAR extended joint connectedness approach". Energy Economics, 116(November): 106422. Doi: 10.1016/j.eneco.2022.106422.

Hanif, Waqas, Jose A. Hernandez, Shahzad J.H. Shahzad and Seong-Min Yoon (2021). "Tail dependence risk and spillovers between oil and food prices". Quarterly Review of Economics and Finance, Vol.80: 195–209. Doi: 10.1016/j.qref.2021.01.019.

Hanson, Kenneth, Sherman Robinson and Gerald Schluter (1993). "Sectoral effects of a world oil price shock: Economywide linkages to the agricultural sector". Journal of Agricultural and Resource Economics, 18(1): 96-116.

Khalfaoui, Rabeh, Umer Shahzad, Mahdi G. Asl and Sami B. Jabeur (2023). "Investigating the spillovers between energy, food, and agricultural commodity markets: New insights from the quantile coherency approach". Quarterly Review of Economics and Finance, 88(2): 63–80. Doi: 10.1016/j.qref.2022.12.006.

Meng, Juan, He Nie, Bin Mo and Yonghong Jiang (2020). "Risk spillover effects from global crude oil market to China's commodity sectors". Energy, 202(C): 117208. Doi: 10.1016/j.energy.2020.117208.

Narayan, Paresh K. and Seema Narayan (2007). "Modelling oil price volatility". Energy Policy, 35(12): 6549–6553. Doi: 10.1016/j.enpol.2007.07.020.

Pindyck, Robert S. (2004). "Volatility and commodity price dynamics". Journal of Futures Markets, 24(11): 1029–1047. Doi: 10.1002/fut.20120.

Price, C. (2022). How Persistent are Implications for Monetary Policy (WP/22/207).

Sun, Xiaolei, Chang Liu, Jun Wang and Jianping Li (2020). "Assessing the extreme risk spillovers of international commodities on maritime markets: A GARCH-Copula-CoVaR approach". International Review of Financial Analysis, 68(15): 101453. Doi: 10.1016/j.irfa.2020.101453.

Umar, Zaghum, Francisco Jareño and Ana Escribano (2021). "Agricultural commodity markets and oil prices: An analysis of the dynamic return and volatility connectedness". Resources Policy, 73(October 2020). Doi: 10.1016/j.resourpol.2021.102147.

Youssef, Manel and Khaled Mokni (2021). "On the nonlinear impact of oil price shocks on the world food prices under different markets conditions". International Economic Journal 35(1): 73–95. Doi: 10.1080/10168737.2020.1870524.