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MAJOR DETERMINANTS OF FOOD PRICE VOLATILITY IN TURKEY: INFLATION SURGE AFTERMATH OF 2016

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ABSTRACT

Purpose- Food price index is a crucial indicator for the stability of overall economic conditions in emerging markets since it has a considerable weight in regular spending of households. In the last decade, Turkey experienced higher food price inflation compared to consumer price index. In this context our main purpose is to provide useful insight for policymakers and governors to manage food price inflation.

Methodology- The vector autoregressive (VAR) approach is one of the most widely applied forms of multiple time series approaches. This approach describes the dependency and interdependency of normalized data in time. This paper undertakes the analysis of volatility and volatility spillover between Turkey Food Price Index (Turkey), Dollar-TL exchange rate (USDTRY), and Turkish Food Price Index (World). The monthly data set covers the period 1 January 2000–31 December 2020. We utilized VECM-VECH models by incorporating this data set to analyze food price inflation fluctuations in Turkey.

Findings- The results indicate that the volatility spillover effect between Turkish food price index and world food price index is more significant compared to the return spillover effect. Also, our results indicate a significant volatility spillover effect between Turkish food price index, exchange rates and world food price index exist in the short run while the effect vanishes in the long run. However, in the long run the main indicator for Turkish food prices index is Production Price Index of Agricultural Products after 2016 which is the milestone for the food price index hike.

Conclusion- Food-inflation, the change in exchange rate and recent global food commodity price surge have significant and persistent impact on the level and the volatility of inflation in Turkey in this context, It is crucial to control food price inflation by controlling market pricing behavior and transforming agricultural industry to reduce costs simultaneously to reduce divergence of Turkish food price index and CPI.

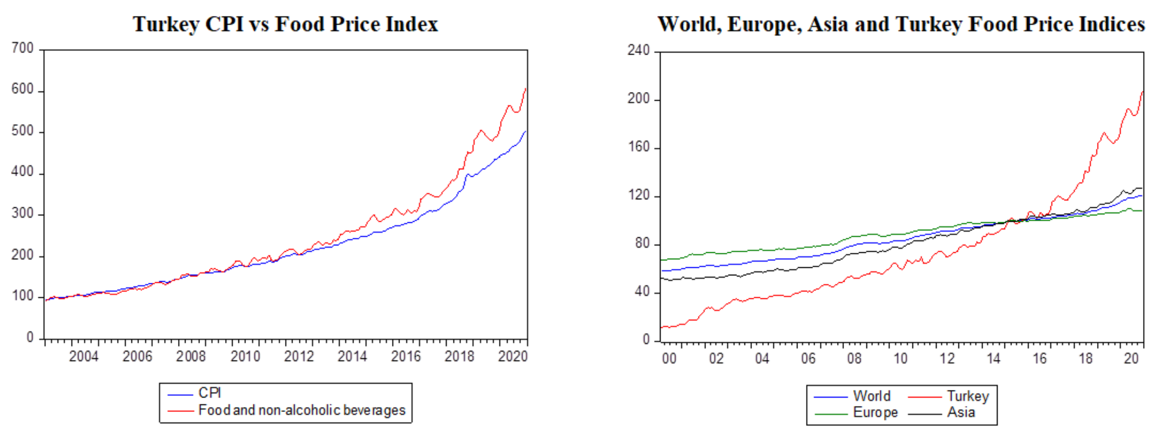
Keywords: Dynamic correlation, spillover, food prices, agriculture, inflation
JEL Codes: C32, C58, E31.

1. INTRODUCTION

Considering the epidemic, drought, climate change and the rapidly increasing world population the importance of research on food is increasing. While agricultural products are becoming more and more inadequate to meet the need due to rapid population growth, chemical inputs used to increase yield and crop yield due to decreasing cultivation areas make agricultural economy and agricultural sector analyzes increasingly necessary and complex. Especially during the pandemic period, increase in food commodity prices and the possibility of famine became an important global problem. The solutions vary according to the characteristics of the countries, even the local regions of each country, rather than a unique solution set. Moreover, food market is one of the most important signals about the behavior and expectations of consumer/markets, since its weight is highest in CPI basket which is 25.94%. According to Turkish Statistics Institute research food and non-alcohol beverages constitute 20.3% and 20.8% of total household expenditures in 2018 and 2019 respectively which shows that household budget can easily be distorted by the fluctuations and inefficient food market developments.

In this context, food price index is a crucial indicator for the stability of overall economic conditions in emerging markets since it has a considerable weight in regular spending of households. Coherently, the volatility in food prices makes it more challenging for households to arrange their budget and the gap between perceived inflation and official inflation statistics increase. In the last decade, Turkey experienced higher food price inflation compared to consumer price index (CPI). Coherently, although fueled by recent Covid-19 pandemic and drought issue in the world, food price index in Turkey increases more than world, Europe, and Asia since 2016 (Figure 1). The co-movement between international and Turkish food price indices still exist in terms of trend however the main driver of steeper increase in Turkish food price index is exchange rate (USD-TRY) volatility. Furthermore, high volatility due to exchange rate fluctuations is built-in in food price indices while there is a persistent upward trend which is a crucial problem for policy makers and economic actors especially in emerging markets. In this paper, our main purpose is to provide useful insight for policymakers and governors to manage food price inflation. Food price shocks show greater and more volatile behavior. However, if these shocks do not show persistency, they will not have significant effect on inflation. Therefore, it is important for decision makers whether the shocks to food inflation are transmitted into general inflation.

Figure 1: Turkish Food Price Index vs Benchmark Indices



In that respect, our main goal is to investigate the dynamic spillover relationship between Turkish food prices, world food prices and exchange rates by utilizing monthly data between 1 January 2000–31 December 2020. According to the to our results we find that a significant volatility spillover effect between Turkish food price index, exchange rates and world food price index exist in the short run while the effect vanishes in the long run. The rest of the paper is organized as section 2 gives a brief information about related literature. In section 3, we introduce methodology of econometric models briefly. In section 4, introduce data set and present relevant analysis about the structure of the dataset. In Section 5 we provide empirical results and finally in Section 6, we conclude and summarize important outcomes of the paper.

2. LITERATURE REVIEW

There two main issues in Turkish food price index which are high volatility in food price and the persistency of food price volatility. Sekhar et al (2017) state that high persistency in food price volatility fuels food price inflation. Poterba and Summer (1986) highlight high volatility persistence in food prices refers to the slow decay of shocks on food prices. Distribution of relative price changes affect aggregate inflation. Inflation rises when the distribution is skewed to the right. In this context Ball and Mankiw (1995) states that large shocks to commodities have asymmetric effect on the overall price level due to firms' adjustment costs. According to their conclusion when price adjustment is costly, firms adjust to large shocks but not to small shocks. Because of this reason large shocks have asymmetric effects on the price level. Bhat et all (2017) analyzed the dynamic impact of oil and food price shocks on the macroeconomy of India, using the monthly time series data from April 1994 to May 2016 in a structural vector autoregression (SVAR) framework and observed inflation downward rigidity even in the long run.

Empirical analysis with time series data supports the possibility of volatility spillover of between countries' inflation and exchange rate fluctuations to emerging market inflation. Majority of the literature on the relationship between inflation and inflation uncertainty utilize GARCH models. Moreover, MGARCH models are used very frequently in economic literature to analyze agricultural price volatility. In this context multivariate Generalized Autoregressive Conditional Heteroskedasticity (MGARCH) models is an efficient tool to analyze such contagion relationships. For example, Rapsomanikis (2011) and Rapsomanikis and Mugera (2011) employ MGARCH models to analyze the spillover effects in rice markets. Lee and Valera (2016) use panel GARCH models to analyze price transmission and volatility spillovers in Asian rice market by extending panel data framework of Cermeno and Grier (2006), Lee (2010), and Escobari and Lee (2014). An et al (2016), Minot (2014), Rezitis and Stavropoulos (2010), Gardebroek et al. (2016) also use MGARCH models to analyze volatility and spillovers in agricultural prices.

The importance of price and volatility dynamics of agricultural commodities increase due to the population growth and the production issues all around the world. Supply chain breakdowns fueled by global incidents such as Covid-19 pandemic, drought and flood boost the impact of food price fluctuation for emerging markets, relatively low- or mid-income countries. However, spillover effect of food prices is not a newly introduced research area. Especially aftermath of 2008 global financial crisis, contagion impact across all kinds of markets and assets become the hot topic. Mensi et al (2013) investigated the relationship between agricultural commodities, beverages, metals, and crude oil in terms of conditional return and volatility. Rezitis (2015) also studied US exchange rate, crude oil, and international agricultural price relationship while Baltzer (2013) studies the same relationship for rice, maize, and wheat markets. Similarly, Diao (2017) focused on domestic and international soybean market relationship of China. Local research of Turkey also studies food prices in many aspects because of the importance of food inflation in Turkish economy. Ogunc (2010), Akçelik et al (2016) show the divergence of food prices in Turkey from both international food prices and CPI. The importance of unprocessed food in this hike is crucial as Atuk and Sevinc (2010) documented. Lopçu and Şengül (2018) investigate the impact of food price and its volatility in the overall level and volatility of inflation measured by the consumer price index employing ARDL bounds tests, VAR models and ANN. According to their results food-inflation and the change in exchange rate proxied by the US dollar have significant and lasting impact on the level and the volatility of inflation in Turkey. Recently Ertuğrul and Seven (2021) showed that exchange rate significantly increases the difference between Turkish and international food prices while oil prices reduce it.

3. DATA AND METHODOLOGY

The vector autoregressive (VAR) approach is one of the most widely applied forms of multiple time series approaches. This approach describes the dependency and interdependency of normalized data in time. The VAR model extends the univariate autoregressive (AR) to vector autoregressive (VAR) by internalizing the related variables into endogenous variables to examine the contagion and spillover effect between major financial markets.

The basic mathematical expression of the VAR model is as follows:

$$R_t = C + A_1 R_{t-1} + A_2 R_{t-2} + \cdots + A_k R_{t-k} + \varepsilon_t \quad [1]$$

$$\varepsilon_t \mid \mathrm{I}_{t-1} \sim N(0, H_t)$$

Where R_t refers to the value of endogenous variables vector at time t, C is the constant vector, matrix A is the estimated coefficients and k is the lag operator. Residual vector ε_t is assumed to be normally distributed with a zero mean and constant variance where the market information available at time t-1 denoted as $d_{t-1.}$ The lag order of *(k)* VAR structure is decided via AIC criterion.

The diagonal VECH[1] approach, called DVECH hereafter, was developed by Bollerslev et al. (1988) and represents one of the main types of the MGARCH approach. The VECH term presents the half-vectorization operator, which stacks the column of a square matrix from the diagonal downwards in a vector.

In this approach, we incorporate a three-dimensional model to examine the news spillover between different markets. Suppose that our model structure is as follows:

$$\varepsilon_{i,t} = \upsilon_{i,t}.h_{i,t}, \quad \upsilon_{i,t} \sim N(0,1) \quad [2]$$

$$h_{i.t} = c_i + a_i \varepsilon_{t-1}^2 + \beta_i h_{i,t-1} \quad [3]$$

$$H_t = C^T C + A^T \varepsilon_{t-1} \varepsilon_{t-1}^T A + B^T H_{t-1} B \quad [4]$$

Equation [2] specifies the relation between the residual term $\varepsilon_{i.t}$ and the conditional variance $h_{i.t}.\upsilon_{i.t}$ which is normally distributed with a zero mean and constant variance. α, β are the coefficients. $H_{i,t}$ represents the conditional variance-covariance matrix, C represents the lower triangular matrix, A and B are square arrays. If C^TC is positive, then it is almost positive.

$$H_t = \begin{bmatrix} h_{11,t} & h_{12,t} & h_{13,t} \\ h_{12,t} & h_{22,t} & h_{23,t} \\ h_{31,t} & h_{32,t} & h_{33,t} \end{bmatrix}$$

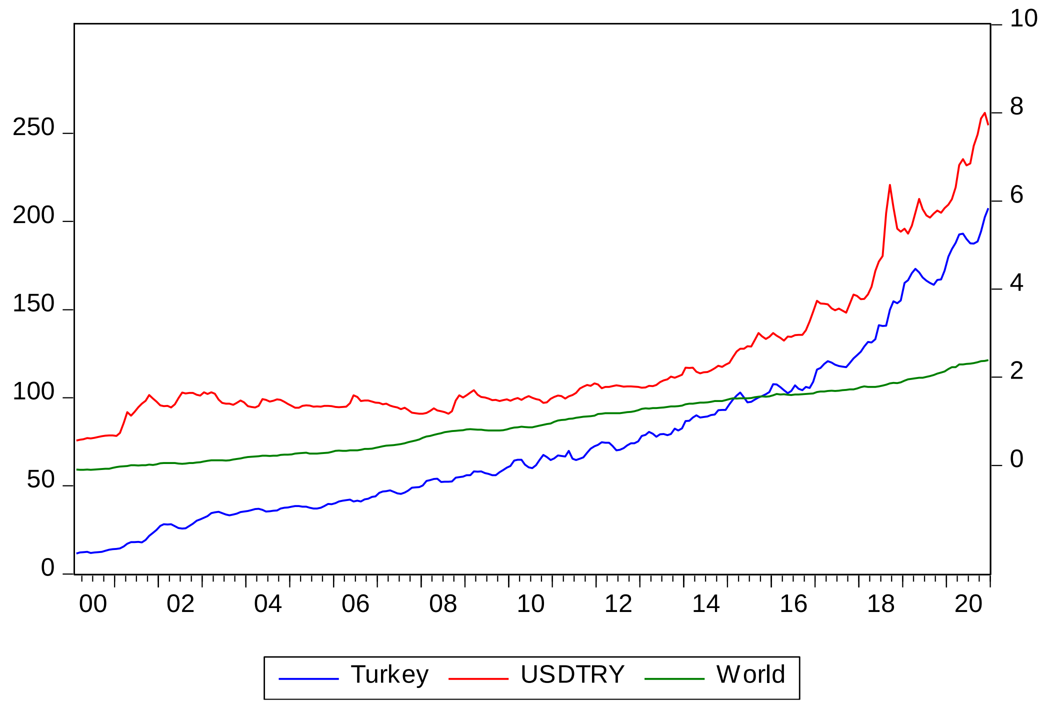
[1]Eviews does not estimate the general form of BEKK in which A and B are unrestricted. However, a common and popular form, diagonal BEKK, may be specified that restricts and to be diagonals. This Diagonal BEKK model is identical to the Diagonal VECH model where the coefficient matrices are rank one matrix. For convenience, EViews provides an option to estimate the Diagonal VECH model but display the result in Diagonal BEKK form.

$$C = \begin{bmatrix} c_{11} & c_{12} & c_{13} \\ c_{21} & c_{22} & c_{23} \\ c_{31} & c_{32} & c_{33} \end{bmatrix} \quad A = \begin{bmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{bmatrix} \quad B = \begin{bmatrix} b_{11} & b_{12} & b_{13} \\ b_{21} & b_{22} & b_{23} \\ b_{31} & b_{32} & b_{33} \end{bmatrix}$$

where $h_{11,t}$, $h_{22,t}$, $h_{33,t}$ in the matrix H_t represent the conditional variances. Matrix A is the ARCH coefficients of the model, a_{11},a_{22},a_{33} represent the ARCH effect while Matrix B is the GARCH coefficients of the model, b_{11},b_{22},b_{33} are the GARCH effect.

The data of this paper incorporates five variables which are utilized for three different model systems: Turkish Food Price Index (Turkey), Dollar-TL exchange rate (USDTRY), and World Food Price Index (World) for the period between for the period 1 January 2000–31 December 2020 and Turkish Producer Price Index of Agricultural (TRAGRIINP) series which are available for the period only between 2016-2020. Food price data is collected from Food and Agriculture Organization (FAO) statistics and exchange rate is collected from Central Bank of the Republic of Turkey. Producer Price Index of Agricultural is collected from Turkish Statistics Institute (TURKSTAT). We divided our analysis in to two periods between 2000-2020 and 2016-2020. Figure 2 foreshadows that the exchange rate significantly affects the growing difference between Turkish and international food price.

Figure 1: Turkish Food Index, USDTRY, and World Food Index Walk



Next, the return of each market is calculated as follows:

$ln(P_t) - ln(P_{t-1})$ [5]

where RTurkey, RUSDTRY, and RWorld refers to the return series of related variables.

Figure 2: Daily Returns of RTurkey, RUSDTRY, and RWorld

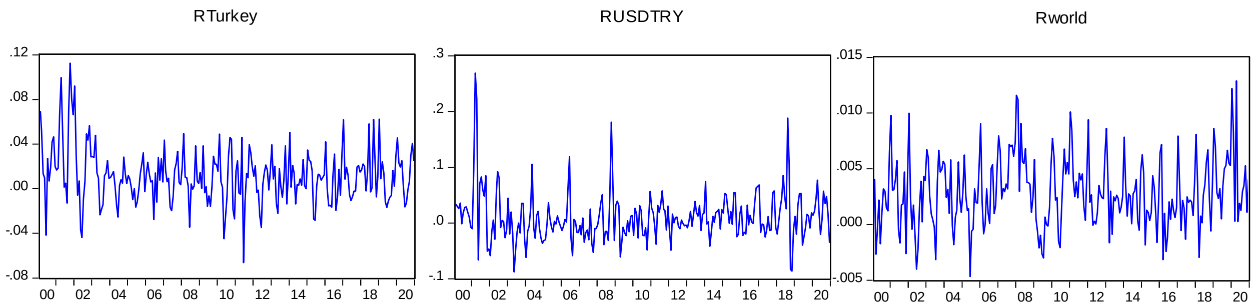


Figure 3 shows the time series of the daily returns of the markets. Table 1 exhibits the descriptive statistics for the returns. The mean values are close to zero for all the returns. The statistics of each return differ from each other, but in common the skewness of each return is not equal to zero and neither is the kurtosis, indicating that each return has typical characteristics of leptokurtosis and fat-tail. It is well known that leptokurtosis and fat-tail are the typical characteristics of financial time series. The J-B statistic of each return is significant from zero, which means none of the returns obeys the normal distribution. Further, the stationarity of the variables has been examined using the Augmented Dickey-Fuller (ADF) unit root test. The null hypothesis of the unit root is rejected for all return series.

Table 1: Descriptive Statistics

	RTURKEY	RUSDTRY	RWORLD
Mean	0.0118	0.0106	0.0029
Median	0.0100	0.0041	0.0025
Maximum	0.1125	0.2690	0.0129
Minimum	-0.0662	-0.0878	-0.0047
Std. Dev.	0.0246	0.0437	0.0031
Skewness	0.6316	1.8213	0.4316
Kurtosis	4.7980	10.5947	3.2996
Jarque-Bera	50.5011	741.9973	8.7314
Probability	0.0000	0.0000	0.0127
ADF Test Level	-10.119	-7.764	-3.546
	[0.0000]	[0.0000]	[0.0000]

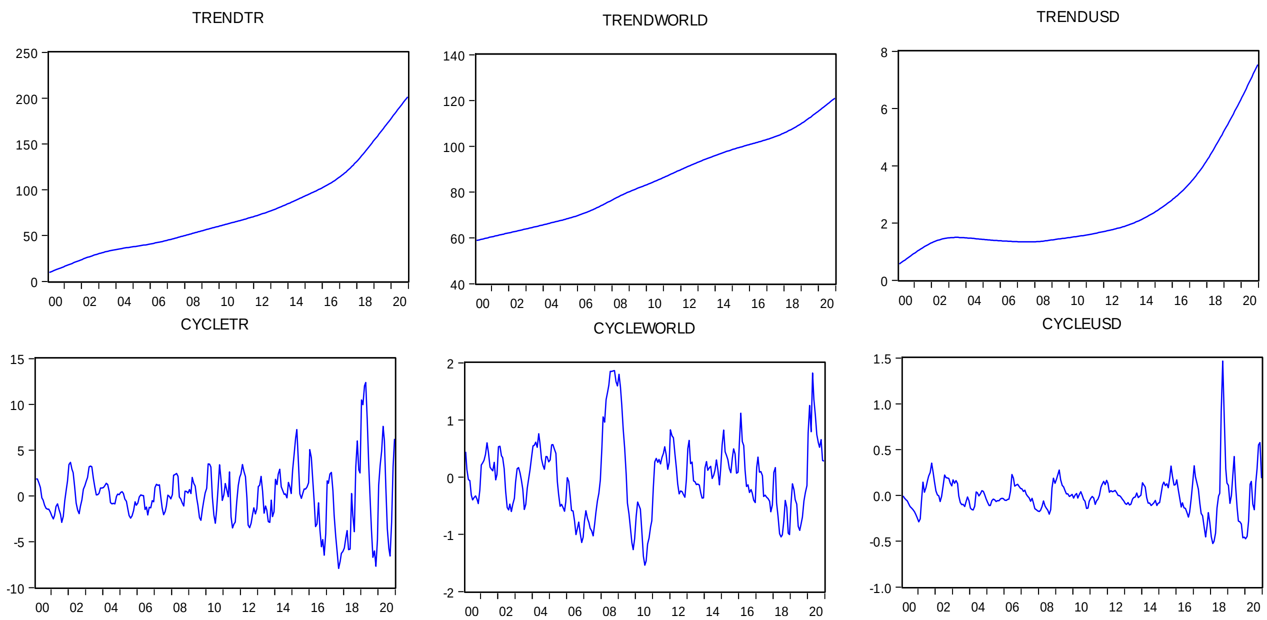
Notes: Between parenthesis: p-values.
The number of observations is 251 ADF Tests refer to
Augemented Dickey Fuller test for the presence of unit

Figure 4 represents the results of a Hodrick-Prescott Filter analysis. The Hodrick-Prescott Filter is a smoothing method that is widely used among macroeconomists to obtain a smooth estimate of the long-term trend component of a series. The method was first used in a working paper by Hodrick and Prescott (1997) to analyze postwar U.S. business cycles. Briefly, the Hodrick-Prescott (HP) filter is a two-sided linear filter that computes the smoothed series ***s*** of by ***y*** minimizing the variance of ***y*** around, subject to a penalty that constrains the second difference of ***s***. That is, the HP filter chooses ***s*** to minimize:

$$\sum_{t=1}^{T}(y_t - s_t)^2 + \lambda \sum_{t=2}^{T-1}\left((s_{t+1} - s_t) - (s_t - s_{t-1})\right)^2 \quad [6]$$

The penalty parameter λ controls the smoothness of the series σ. The larger the λ, the smoother the σ. As λ=∞, ***s*** approaches a linear trend. The filter results clearly show that there is a dramatic hike in Turkish food prices index and USDTRY currency after 2016. The increase in world food prices index is much more linear compared to Turkey. These results made us divide our analysis in to two periods between 2000-2020 and 2016-2020. In Model 3 we replaced world food prices index with producer price index for agricultural products of Turkey.

Figure 3: World, Turkey and USDTRY Trend Changes



4. FINDINGS AND DISCUSSIONS

We constructed a model with VECM[2] system specification which is as exhibited in Table 2. According to the model results in Table 2, the volatility spillover effect between Turkish food price index and world food price index is more significant compared to the return spillover effect. In Panel A influence of world food price index returns and Dollar-TL returns to Turkey food price index are exhibited. Panel B exhibits the volatility relationship between these variables.

Table 2: Estimation Results of VECM-VECH (1,1) Models

Panel A: Influence of World and USDTRY to Turkey

Model 1	Coefficient		z-Statistic	P-Value
β_1	-0.04459	***	-3.03867	0.00240
β_2	-0.29387	***	-3.75141	0.00020
β_3	0.04737		1.12716	0.25970
β_4	0.37262		0.90939	0.36310
α_1	-0.00013		-0.09529	0.92410
β_5	0.30692	***	8.02297	0.00000
β_6	-0.33706	***	-4.95764	0.00000
β_7	0.25917	***	3.17676	0.00150
β_8	-0.02107		-0.02918	0.97670
α_2	-0.00029		-0.12591	0.89980
β_9	0.00238		0.82155	0.41130
β_{10}	0.00874		1.13269	0.25730
β_{11}	0.00372		0.68601	0.49270
β_{12}	-0.27003	***	-3.64580	0.00030
α_3	0.00003		0.11813	0.90600

Notes: ***, ** and * denote the rejection of null hypothesis at 1%, 5% and 10% sigificance levels respectively.
In Panel B , Turkey Food Price Index, USDTRY, and World Food Price Index are represented by 1,2 and 3.

Panel B: Transformed Variance Coefficients

Model 1	Coefficient		z-Statistic	P-Value
M(1,1)	0.00012	**	1.7062	0.0880
M(1,2)	0.00007		1.4385	0.1503
M(1,3)	0.00001		1.4944	0.1351
M(2,2)	0.00067	***	2.5273	0.0115
M(2,3)	0.00000		0.2424	0.8085
M(3,3)	0.00001	**	1.7375	0.0823
A1(1,1)	0.20987	**	2.3397	0.0193
A1(1,2)	0.26089	***	3.0695	0.0021
A1(1,3)	0.19643	**	2.2423	0.0249
A1(2,2)	0.32432	***	3.8040	0.0001
A1(2,3)	0.24418	***	2.8210	0.0048
A1(3,3)	0.18385	**	2.0651	0.0389
B1(1,1)	0.59555	***	3.6261	0.0003
B1(1,2)	0.37987		1.5239	0.1275
B1(1,3)	0.37292		1.2062	0.2277
B1(2,2)	0.24230		1.1266	0.2599
B1(2,3)	0.23787		0.8623	0.3885
B1(3,3)	0.23352		0.6862	0.4926

[2] Based on the Johansen cointegration tests, existence of cointegration between variable made us to choose VECM model.

The own conditional ARCH effects (a_{ii}) is significant for Turkish food price index and Dollar-TL exchange rate even at %1 level while it is also significant for world food price index at %5 level. These results indicate that all variables are influenced by the volatility of their own markets. Furthermore, there is significant volatility spillover over effects among Dollar-TL exchange rate, world food index and Turkish food index in the short term since a_{12}, a_{13} are statistically significant even at %1 and 5% level respectively.

Moreover, the conditional GARCH effects (b_{ii})in matrix B is significant at %1 level for Turkish food price index. Consequently, for the long-term volatility spillovers, the volatility spillover between Dollar-TL exchange rate, world food index and Turkish food price index are all insignificant even at 10% level that are b_{12}, b_{13}. As a result, we can conclude that a volatility spillover between the mentioned markets strongly exists in the short term while in the long-term same effect is not valid. Figure 5 and Figure 6 exhibits the conditional correlation and conditional covariance between Turkey, USDTRY and world. According to Figure 5, the dynamic conditional correlation between Turkish food price index and world food index along with dollar-TL exchange rate are time varying.

In Model 2 we tested the Model 1 by reducing the data range between 2016 based on the indication we got from Hodrick-Prescott Filter in Figure 4. According to the model results in Table 3 we conclude in the short period the impact world food price on Turkish food price index volatility vanishes while exchange rate impact is still valid. In this context in Model 3, we replaced world food prices index with producer price index for agricultural products of Turkey and the results showed that after 2016 the conditional GARCH effects (b_{ii})in matrix B is significant at %1 level for all variables which means in the long run PPI of agricultural product and USDTRY is strongly significant. These results support that food price inflation in Turkey is a cost-push inflation. Due to pandemic, increasing wages, rising oil and fertilizer prices and dry weather cost-push inflation occurred in Turkey 2016. Other important milestones such as the 15 July 2016 coup d'état attempt, Andrew Brunson case in 2018 and dismiss of Turkish Central Bank Governors Murat Uysal and Naci Ağbal in 2020 and 2021 respectfully, boosted the domestic currency depreciation.

Figure 4: Conditional Correlation between RTurkey and RUSDTRY, RWorld

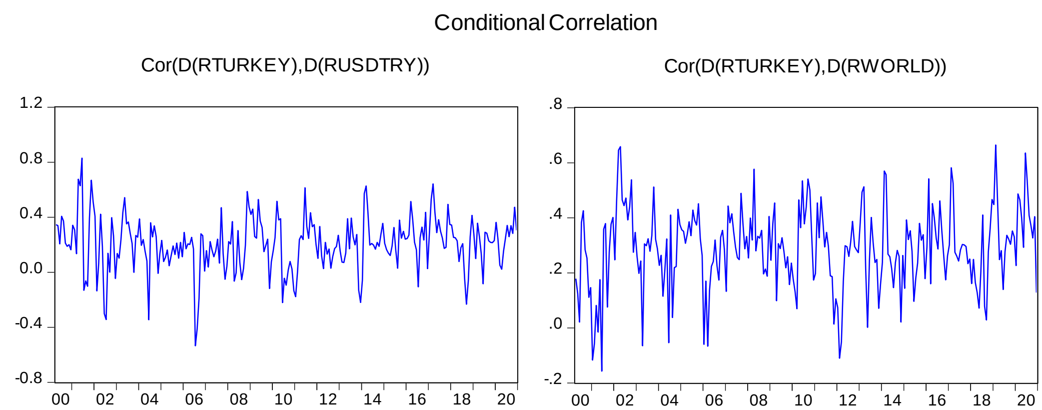


Figure 5: Conditional Covariance between RTurkey and RUSDTRY, RWorld

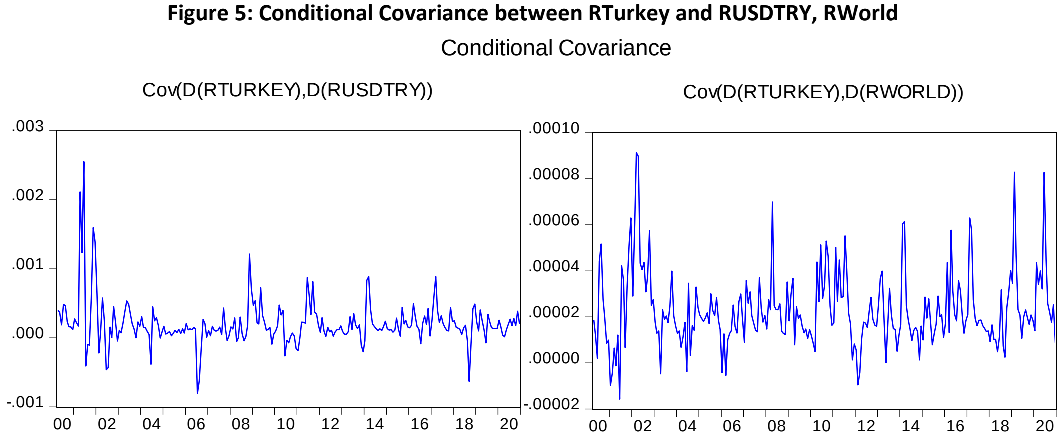


Figure 6: Conditional Correlation between RTurkey and RUSDTRY, RWorld- (2016-2020)

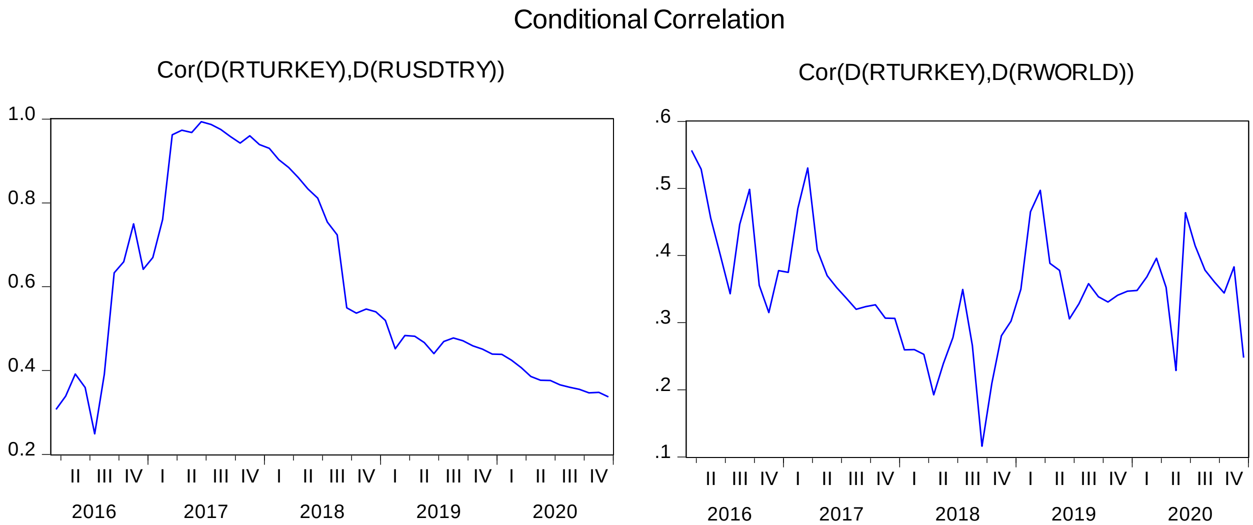


Table 3: Estimation Results of VECM-VECH (1,1) Models-(2016-2020)

Panel A: Influence of World and USDTRY to Turkey

Model 2	Coefficient	z-Statistic	P-Value
β_1	-0.20722	-0.41581	0.67750
β_2	-0.29951	-0.48242	0.62950
β_3	0.13575	0.41954	0.67480
β_4	0.16888	0.05446	0.95660
α_1	0.00352	0.35500	0.72260
β_5	0.96271	0.93443	0.35010
β_6	-0.73796	-0.51774	0.60460
β_7	0.45829	0.40829	0.68310
β_8	3.19875	0.47222	0.63680
α_2	-0.00156	-0.05514	0.95600
β_9	0.02805	0.55223	0.58080
β_{10}	0.02362	0.48038	0.63100
β_{11}	0.03318	1.38213	0.16690
β_{12}	-0.28959	-1.07729	0.28130
α_3	0.00007	0.07351	0.94140

Panel B: Transformed Variance Coefficients

Model 2	Coefficient		z-Statistic	P-Value
M(1,1)	0.00058		0.4062	0.6846
M(1,2)	0.00011		0.3632	0.7164
M(1,3)	0.00002		0.2426	0.8083
M(2,2)	0.00000		0.0028	0.9978
M(2,3)	0.00001		0.1257	0.9000
M(3,3)	0.00001		0.6124	0.5403
A1(1,1)	0.10301		0.2536	0.7998
A1(1,2)	0.34348		0.8182	0.4133
A1(1,3)	0.22762		0.1869	0.8517
A1(2,2)	0.25983		0.3552	0.7224
A1(2,3)	0.24883		0.1310	0.8957
A1(3,3)	0.27334		0.6059	0.5446
B1(1,1)	0.71995		1.0601	0.2891
B1(1,2)	0.99369	***	16.5815	0.0000
B1(1,3)	0.49025		0.2616	0.7937
B1(2,2)	1.07748	***	19.4135	0.0000
B1(2,3)	0.76256		0.4952	0.6205
B1(3,3)	0.38650		0.5135	0.6076

Notes: ***, ** and * denote the rejection of null hypothesis at 1%, 5% and 10% sigificance levels respectively.
In Panel B , Turkey Food Price Index, USDTRY,
and World Food Price Index are represented by 1,2 and 3.

Figures 7 and 9 plot the patterns of the conditional correlation for Model 2 and Model 3. Figure 8 and Figure 10 display the patterns of the conditional covariances for Model 2 and Model 3.

Figure 7: Conditional Covariance between RTurkey and RUSDTRY, RWorld (2016-2020)

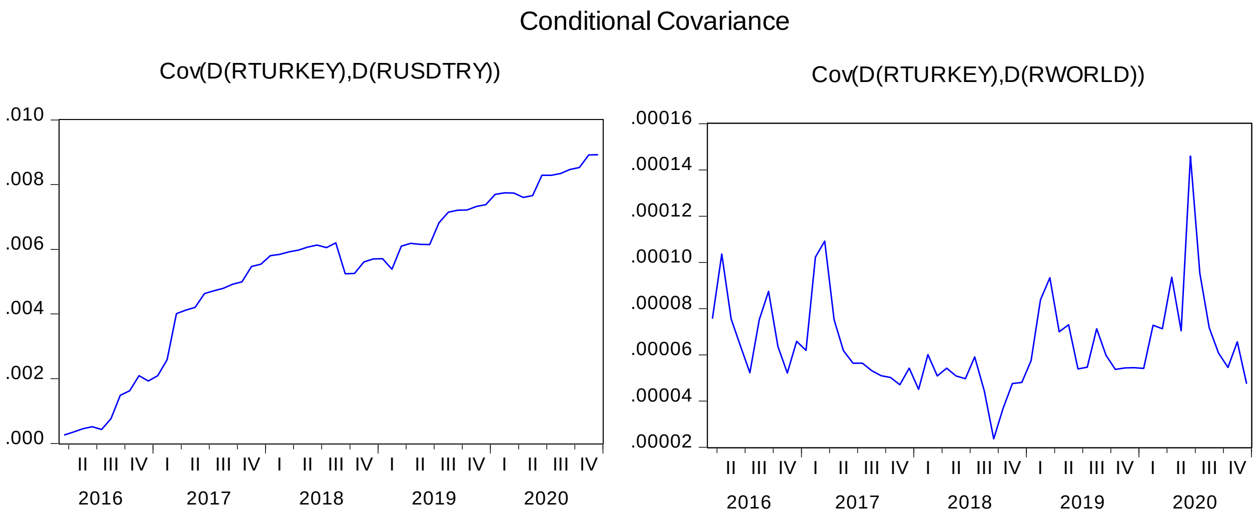


Figure 8 shows that Turkish food price index and USDTRY exchange rate covariance is testing new peaks since 2016 while the covariance between world food price index and Turkish food price index reached a record high peak in 2020. Figure 10 represents even more interesting results such as Turkish food price index and PPI of agricultural products reached a peak level after 2016 and covariance of the series experienced a sharp downfall in 2018 and reached a higher peak in 2019. The covariance between PPI of agricultural products and USDTRY exchange rate reach a peak in 2018 through Andrew Brunson case. The overall positive covariances indicate that Turkish food price index and exchange rate tend to change over time in the same direction.

Table 4: Estimation Results of VECM-VECH (1,1) Models w/ Agriculture PPI-(2016-2020)

Panel A: Influence of World and USDTRY to Turkey

Model 3	Coefficient	z-Statistic	P-Value
β_1	-0.26000	-1.22896	0.21910
β_2	-0.26040	-1.04477	0.29610
β_3	-0.56995	-0.75156	0.45230
β_4	0.11228	0.81827	0.41320
α_1	0.00171	0.44023	0.65980
β_5	-0.07505	-0.90366	0.36620
β_6	-0.00380	-0.03309	0.97360
β_7	-0.49846	-1.89554	0.05800
β_8	0.05280	0.82123	0.41150
α_2	0.00097	0.69735	0.48560
β_9	0.81527	0.79532	0.42640
β_{10}	-0.38931	-0.51391	0.60730
β_{11}	0.15889	0.05436	0.95670
β_{12}	0.49801	0.70884	0.47840
α_3	-0.00005	-0.00284	0.99770

Notes: ***, ** and * denote the rejection of null hypothesis at 1%, 5% and 10% sigificance levels respectively. In Panel B , Turkey Food Price Index, Producer Price Index of Agricultural Products, and USDTRY are represented by 1,2 and 3.

Panel B: Transformed Variance Coefficients

Model 3	Coefficient		z-Statistic	P-Value
M(1,1)	0.00012		0.1731	0.8625
M(1,2)	0.00001		0.5954	0.5516
M(1,3)	0.00004		0.2456	0.8060
M(2,2)	0.00000		0.4307	0.6667
M(2,3)	0.00002		0.2946	0.7683
M(3,3)	(0.00005)		-0.2089	0.8345
A1(1,1)	0.01464		0.1244	0.9010
A1(1,2)	0.11358		0.6577	0.5107
A1(1,3)	0.12864		1.0297	0.3032
A1(2,2)	0.27137		0.8584	0.3906
A1(2,3)	0.07410		0.2037	0.8386
A1(3,3)	0.16221		0.6398	0.5223
B1(1,1)	0.74788		0.5378	0.5907
B1(1,2)	0.77123	**	2.1368	0.0326
B1(1,3)	0.95719	***	7.7612	0.0000
B1(2,2)	0.69175	***	2.8586	0.0043
B1(2,3)	0.92009	***	3.3004	0.0010
B1(3,3)	1.03304	***	20.5851	0.0000

Figure 8: Conditional Correlation between RTurkey and Agriculture PPI, USDTRY

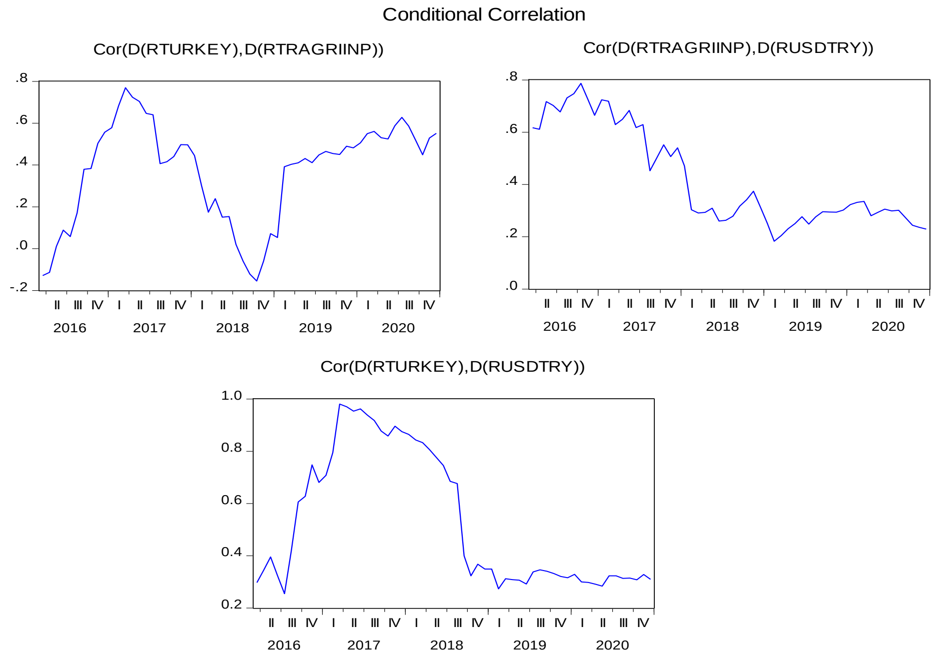
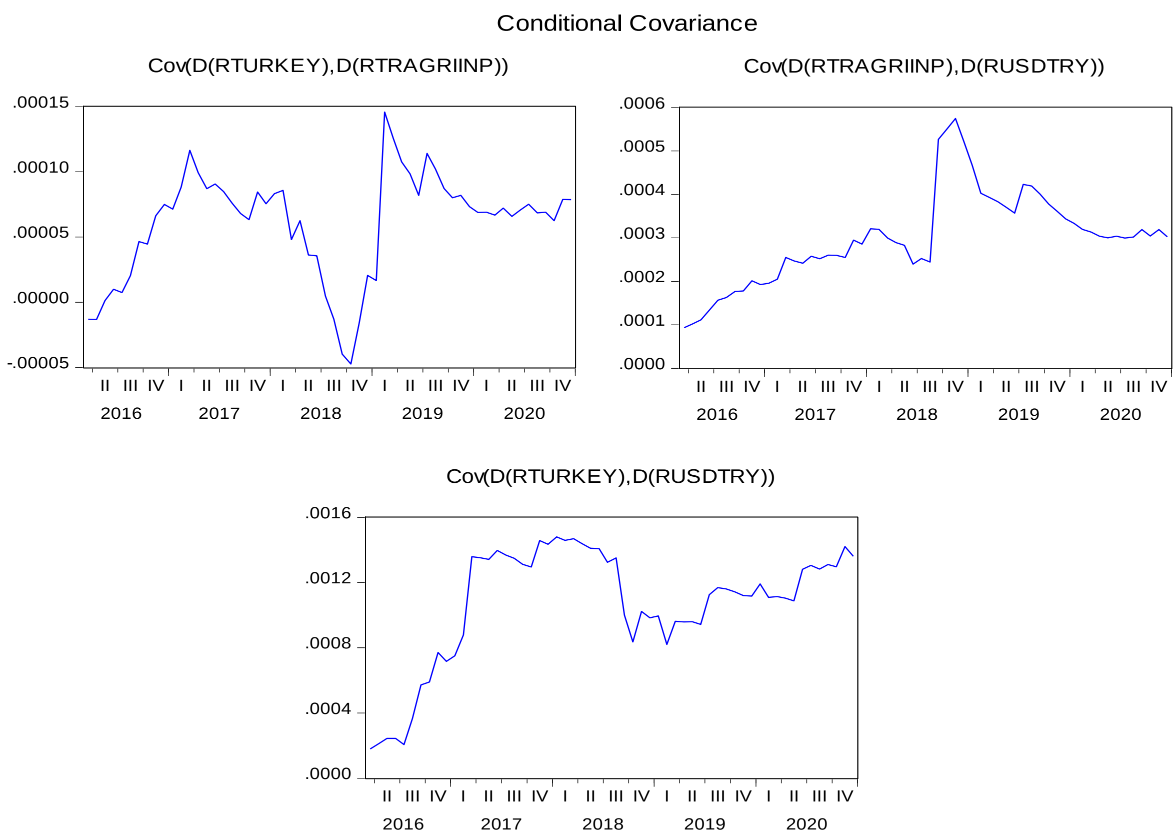


Figure 9: Conditional Covariance between RTurkey and Agriculture PPI, USDTRY



5. CONCLUSION AND IMPLICATIONS

Global incidents such as epidemic, drought, climate change and the rapidly increasing world population food prices hiked significantly which also fueled the food price index in Turkey. Moreover, the exchange rate fluctuations also increased the volatility in Turkish food price index. Before 2013 exchange rate was more durable for domestic currency however after 2013 Turkish lira became highly volatile and depreciated dramatically. Also, the increasing level of agricultural food import did not help food price index volatility to stabilize at all. Other important milestones such as the 15 July 2016 coup d'état attempt, Andrew Brunson case in 2018 and dismiss of Turkish Central Bank Governors Murat Uysal and Naci Ağbal in 2020 and 2021 respectfully, boosted the domestic currency depreciation. According to the to our results we find that a significant volatility spillover effect between Turkish food price index, exchange rates and world food price index exist in the short run while the effect vanishes in the long run. Consequently, we can also see the negative effects of commodity prices on inflation. The price in agricultural commodities which are mainly foreign exchange denominated have a negative impact on food prices.

The depreciation of the Turkish Lira against the dollar also hikes import costs in food which is another important fact. Furthermore, increasing prices in raw materials, exchange rate volatility, increasing input costs, and speculative acts are among the reasons for food price inflation in Turkey, according to sectoral professionals. In this context our findings are important to provide insight to policymakers which should guide them to promote local agricultural production, decrease import, give significant incentives to food producers to ensure sustainability and improve structural problems.

However, Turkish government established a new committee that will help to bring down inflation which gives clue about government's approach on food price index is more related with market pricing behavior rather that cost increase due to global input prices and dollarization. The Price Stability Committee, under the coordination of the Treasury and Finance Ministry, is expected to contribute to the permanent establishment and maintenance of price stability. It is crucial to run both approaches simultaneously in order to reduce divergence of Turkish food price index and CPI.

REFERENCES

Akcelik, F., Yucel, C. Y. (2016). Türkiye'de gıda fiyatları: uluslararası bir karsılastırma. CBT research notes in economics, No: 2016-23. Research and Monetary Policy Department, Central Bank of the Republic of Turkey.

An, H., Qui, F., Zheng, Y. (2016). How do export controls affect price transmission and volatility spillovers in the Ukrainian wheat and flour markets?. Food Policy, 62, 142-150.

Ball, L., Mankiw, G. (1995). Relative price changes as aggregate supply shocks. Quarterly Journal of Economics, 110 (1), 161–193.

Bhat,A.,J, Ahmad, Ganaie,A.,A., Sharma, K., N (2018). Macroeconomic response to oil and food price shocks: a structural VAR approach to the Indian economy. International Economic Journal, 32(1), 66-90. DOI: 10.1080/10168737.2018.1446038

Bollerslev, T., Engle, R.F., Wooldridge, J. (1988). A capital asset pricing model with time varying covariances. Journal of Political Economy, 96, 116-131.

Cermeño, R., Grier, K. B. (2006). Conditional heteroskedasticity and cross-sectional dependence in panel data: an empirical study of inflation uncertainty in the G7 - 30 countries. In B. H. Baltagi, ed., Panel Data Econometrics 10, 259–278.

Ertugrul H.M., Seven Ü. (2021). Dynamic spillover analysis of international and Turkish food prices. International Journal of Financial Economics, 1–11.

Escobari, D., Lee, J. (2014). Demand uncertainty and capacity utilization in airlines. Empirical Economics, 47(1), 1–19.

Gardebroek, C., Hernandez, A., M., Robles, M. (2015). Market interdependence and volatility transmission among major crops. Agricultural Economics, 47, 141-155

Lee, J. (2010). The link between output growth and volatility: evidence from a GARCH model with panel data. Economics Letters, 106(2), 143–145.

Lopçu, K, Şengül, S (2018). Is the food price volatility responsible for inflation volatility? An investigation for Turkey. Topics in Middle Eastern and African Economies. Proceedings of Middle East Economic Association, 20(2), 105-124.

Mensi,W., Beljid, M.,Boubaker,A., Managi,S. (2013). Correlationsand volatility spillovers across commodity and stock markets: Linking energies, food, and gold. Economic Modelling, 32, 15–22.

Minot, N. (2014). Food price volatility in sub-Saharan Africa: Has it really increased? Food Policy, 45, 45-56.

Ogunc, F. (2010). Turkiye'de islenmemiş gıda enflasyonunda oynaklık: durum tespiti, CBT Research Notes in Economics 1005, Research and Monetary Policy Department, Central Bank of the Republic of Turkey.

Orman, C., Öğünç, F., Saygılı, Ş., Yilmaz, G. (2010). İşlenmemiş gıda fiyatlarında oynaklığa yol açan: yapısal faktörler (Sources of Volatility in Unprocessed Food Prices: Structural Factors). Central Bank of the Republic of Turkey Research Notes in Economics No. 10/16, Available at SSRN: https://ssrn.com/abstract=1759563

Poterba, J. M., Summers, L. H. (1986). The persistence of volatility and stock market fluctuations. The American Economic Review, 76(5), 1142–1151. http://www.jstor.org/stable/1816476

Rezitis, A. N., Stavropoulos, S., K. (2010). Modeling beef supply response and price volatility under CAP reforms: The case of Greece. Food Policy, 35, 163-174.

Rezitis, A. N. (2015). The relationship between agricultural commodity prices, crude oil prices and US Dollar exchange rates: A panel VAR approach and causality analysis. International Review of Applied Economics, 29(3), 403–434.

Sekhar, C., Roy, D., Bhatt, Y (2017). Food inflation and food price volatility in India trends and determinants. The International Food Policy Research Institute (IFPRI) Discussion Paper 01640.