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THE ANALYSIS OF THE RELATIONSHIP BETWEEN TURKEY'S REAL EFFECTIVE EXCHANGE RATE AND THE PROCESSED AND UNPROCESSED AGRICULTURAL PRODUCTS EXPORT TO THE EU

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Abstract

The aim of this study is to determine the effects of changes in real effective exchange rates on the Turkey's processed and unprocessed agricultural product exports to the EU. Despite that many studies have been carried out on this subject, this study focuses on the processed and unprocessed agricultural products and enables us to compare the effects of real effective exchange rates on these agricultural product classes. In this study, Johansen Cointegration Analysis was used for the relation between real effective exchange rates and processed agricultural products, and the Bounds test was utilized for the relationship with unprocessed agricultural products. As a result of the empirical results, at the significance level of 5%, the maximum eigen values and trace values, which were calculated using Johansen Cointegration Analysis regarding the relationship of real effective exchange rate and the processed agricultural products, were found to be lower than the threshold values. In other words, no cointegration vector was found. According to the results of bounds test applied for the analysis of model establish for unprocessed agricultural products, no interpretation was made because the F statistics for the cointegration relationship between real effective exchange rates and unprocessed agricultural products was between the upper and lower limits.
Keywords: Foreign Trade, Real Exchange Rate, Time Series, Bounds Test, Johansen Cointegration Test

1. Introduction

Among the agricultural manufacturers on the earth, Turkey is the 7th largest one. It is the world's leading manufacturer of agricultural products such as dried figs, hazelnut, dried seedless grape, and dried apricot. Turkey is very rich in terms of the number of plant species. While the total number of plant species in Turkey is 11,000, it is 11,500 in entire Europe. Besides that, Turkey is also a leading honey manufacturer. According to the data of year 2015, Turkey produced 18.6 million tons of milk, 38.6 million tons of cereals, 28.5 million tons of vegetables, 2 million tons of poultry, and 1.1 million tons of red meat. (Ministry of Agriculture and Foods)

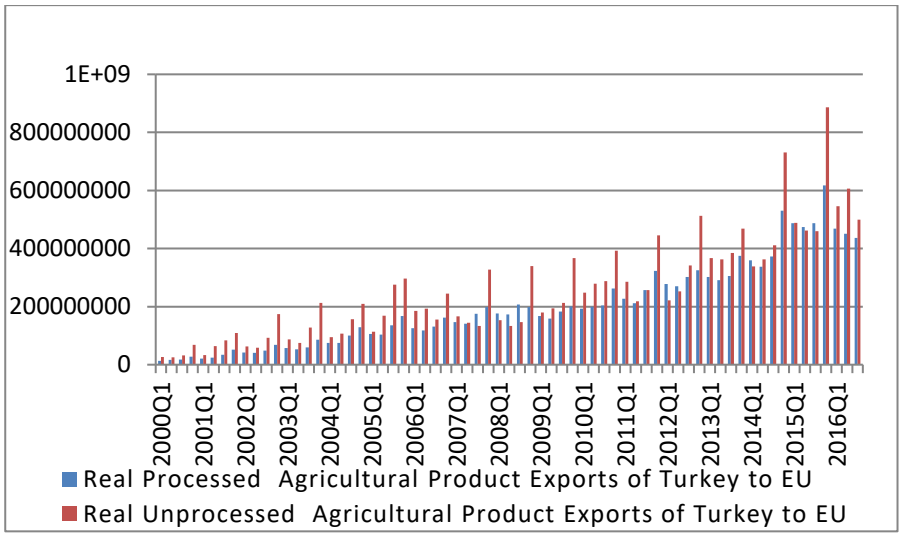
The processed agricultural products may be defined in different ways by different researchers. In this study, the classification used by the EU and accepted by Turkey and EU as a result of Association Council Decision Nr.1/95 is employed. On the other hand, in this study, agricultural products other than processed agricultural products were regarded as unprocessed agricultural products. In 5th section of Association Council Decision Nr.1/95, the processed agricultural products are specified.The processed agricultural products accepted by Turkey according to Association Council Decision Nr.1/95 are listed in Table 1 (Association Council Decision Nr.1/95).

Table 1. Processed Agricultural Products

HS4 Code	Definition
0403	Buttermilk, curdled milk and cream, yoghurt, kephir and other fermented or acidified milk and cream
0710	Vegetables (uncooked or cooked by steaming or by boiling in water), frozen
0711	Vegetables provisionally preserved
1517	Margarine
1704	Sugar confectionery (including white chocolate) not containing cocoa
1806	Chocolate and other food preparations containing cocoas
1901	Malt extract; food preparations of flour, meal, starch or malt extract
1902	Pasta, whether or not cooked or stuffed (with meat of other substances) or otherwise prepared such as spaghetti, macaroni, noodles, lasagne, gnocchi, ravioli, canneloni, couscous, whether or not prepared
1904	Prepared foods obtained by the swelling or roasting of cereals or cereal products
1905	Bread, pastry, cakes, biscuits and other bakers' wares, whether or not containing cocoa, communion wafers, empty cachets of a kind suitable for pharmaceutical use, sealing wafers, rice paper and similar products
2001	Vegetables, fruit, nuts and other edible parts of plants, prepared or preserved by vinegar or acetic acid
2004	Other vegetables, prepared or preserved otherwise than by vinegar or acetic acid; frozen
2005	Other vegetables, prepared or preserved otherwise than by vinegar or acetic acid; frozen
2008	Fruits, nuts and other edible parts of plants, otherwise prepared or preserved, whether or not containing added sugar or other sweetening matter or spririt, not elsewhere specified or included
2101	Extracts, essences and concentrates of coffee, tea or mate and preparations with a basis of these products
2102	Yeasts (active or inactive); other single-cell micro-organisms
2106	Food preparations not elsewhere specified or included
2202	Waters, including mineral waters and aerated waters, containing added sugar or other sweetening matter or flavored, and other non- alcoholic beverages
2905	Acyclic alcohols and their halogenated, sulfonated, nitrated or nitrosated derivatives
3505	Dextrins and other modified starches (for example, pregelatinized or esterified starches): glues based on starches, or on dextrins or other modified starches
3809	Finishing agents, dye carriers to accelerate the dyeing or fixing of dyestuffs and other products and preparations (for example, dressings and nordants), of a kind used in the textile, paper, leather or like industries, not elsewhere specified or included
3824	Prepared binders for foundry moulds or cores; chemical products and preparations of the chemical or allied industries (including those consisting of mixtures of natural products), not elsewhere specified or included; residual products of the chemical or allied industries, not elsewhere specified or included

The EU is an important processed agricultural product importer. According to the data of year 2013, 4 largest processed agricultural product importer countries are Germany, Holland, France, and United Kingdom. Again, according to the data of year 2013, the leading processed agricultural product supplier of the Union is Switzerland with 16%, followed by the USA with 15%. Other leading processed agricultural product suppliers of the EU are Republic of Cote D'ivoire, China, Indonesia, Turkey, Malaysia, and Thailand (PAPs in the EU).

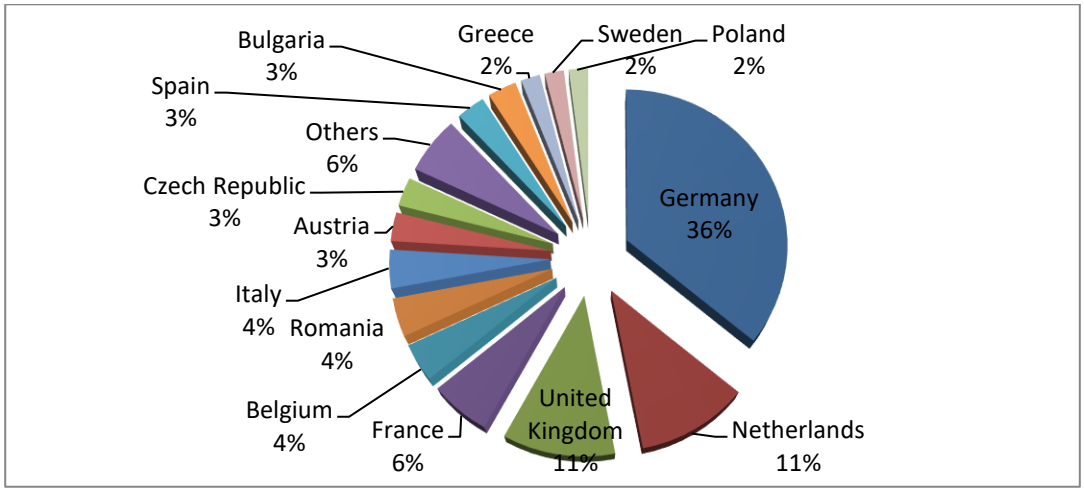
The processed and unprocessed agricultural product exports of Turkey to EU during the period of 2000Q1-2016Q3 are presented in Graph 1 below.



Source: Estimated from TURKSTAT Database.

Graph 1. The Processed and Unprocessed Agricultural Product Exports of Turkey to EU (Euro)

As it can be seen in Graph 1, Turkey's processed agricultural product exports to EU are generally lower than the unprocessed agricultural product exports for the period of 2000Q1-2016Q3.



Source: Estimated from TURKSTAT Database.

Graph 2. The Portions of Countries From The Turkey's Processed Agricultural Product Exports to The EU in Year 2016

As it can be seen in Graph 2 important destinations of Turkey's processed agricultural product exports are Germany, Netherlands, and United Kingdom, which have the percentages of 36%, 11%, and 11%, respectively. 58% of Turkey's processed agricultural product exports are made to these 3 countries.

Many studies on the effects of exchange rates and exchange rate volatility on the foreign trade have been carried out in literature of economics, and the economists have acknowledged the effects of exchange rates on foreign trade long time ago. In study of Edward Schuh in year 1974, the deficiency of exchange rate policy in analyses on agricultural trade and development was eliminated. In the article of Schuh, the idea that the overvaluation of US Dollar and the political measures taken in order to cope with this issue increased the regulatory problems in USA's agriculture, and that the technical payoff caused significant shift in majority of benefits of customers was discussed. Schuh suggested in year 1974 that the overvalued US Dollar caused a decrease in agricultural exports.

This research subject drew significant attention among the researchers in Turkey, and many of the studies examined the effects of exchange rates on the agricultural trade from different aspects. Among the very first studies on this subject, the study of Buguk, Işık, Dellal, and Allen (2003) examined the effects of exchange rate and its volatility on the agricultural export of Turkey by using the error correction model on the data of dried figs (1982-1998) and tobacco (1986-1995). The authors concluded that the changes in exchange rates directly affected the prices for both consumers and producers. The results of the study of Buguk et al. indicated that there was a long-term relationship between the level of exports and the real exchange rate and its volatility. In the study of Fidan (2006) encompassing the period of 1974-2004, the dynamics of agricultural exports, imports, and the real effective exchange rates were examined using VAR model. According to the results of Granger causality test, it was determined that the export is the Granger cause of REER, but not *vice versa*. Gündüz (2010) examined the relationship between the exchange rates and the exports of dried figs by using Vector Auto-Regressive (VAR) model on the monthly time series covering the period of 2003-2008. The empirical results of study showed that the exchange rates have significant effect on the exports of dried figs, and that 20% of the total change in dried figs export was explained by the change in exchange rates. Nazlıoğlu and Erdem (2010) studied the sensitivity of Turkey's agricultural foreign trade to the exchange rate and its volatility by using Vector Error Correction Model (VECM) on Turkey's foreign trade with 16 trade partner countries for the period of 1987:1 - 2007:4. As a result of the cointegration tests, the authors concluded that the foreign income, real exchange rate, and exchange rate volatility were co-integrated with Turkey's export models, while the income in selected countries (except for the USA), real exchange rate, and exchange rate were co-integrated with Turkey's import models. For the period of 1980-2005, Erdem E., Nazlıoğlu and Erdem C. (2010) examined the effects of exchange rate volatility on bilateral agricultural trade between Turkey and its largest trade partner via the cointegration analysis by using panel data on annual basis. According to the empirical results of the study, it was found that the exchange rate has lower level of relationship with trade volume than the exchange rate volatility has. Erdal G., Erdal H. and Esengün (2012) studied the effects of real effective exchange rate volatility on the Turkey's agricultural import and export for the period of 1995-2007. The authors concluded that the agricultural export and import of Turkey were significantly affected from the real effective exchange rates. Using the quarterly data for the period of 1989:01–2011:02, Sever (2012) studied the effects of real effective exchange rate volatility on Turkey's agricultural foreign trade performance via Johansen Cointegration Test and VECM, while the AR-EGARCH methods were used for examining the exchange rate volatility. The empirical results of this study indicated that the agricultural export of Turkey was affected from real exchange rate volatility more than the import was, and that the effect was negative for both parameters. In their study, where they examined the period of 1971-2000, Yanıtkaya, Kaya and Koçtürk utilized the panel data and studied the effects of real exchange rate volatility on the bilateral agricultural foreign trade of Turkey with 46 countries. While the agricultural export of Turkey was not significantly affected from the exchange rate volatility, the real exchange rate had significant effect. Yazıcı and İslam (2010), in their study, concluded that, for EU-15, the real exchange rate and real income positively affected the agricultural trade balance of Turkey, while the domestic income had no significant effect, and the real effective exchange rate was found to be the main determinative parameter for Turkey's long-term agricultural trade balance. In his study, Toktaş (2016) revealed the effect of exchange rate and exchange rate volatility on Turkey's agricultural export to the EU countries via the time-series analysis for the period of 1997Q1-2015Q3. As a result of the bounds test applied in that study, the effects of exchange rate volatility on the total agricultural exports and foodstuff exports were determined. In SITC's 3rd Revision Level II classification, cointegration relationship was found in 4 of 12 export classes, while it was concluded that there was no such relationship for resting 8 classes. Among the traditional agricultural export products, only the hazelnut was found to be affected from exchange rate and its volatility. As a result of the research, as a result of the study, it was determined that the exchange rate and its volatility are not the main determinants of Turkey's agricultural exports to EU-member countries. But, it was also concluded that the effect seen in the most important exports products of Turkey, such as hazelnut, should also be taken into consideration while making decisions about the agricultural policies regarding the hazelnut. Toktaş and Bozkurt (2016), for 1996Q1-2016Q2 period, examined the relationship between the real effective exchange rate of Turkey and hazelnut export to Germany was examined using bounds test. According to the results, it was concluded that the long-term changes in real effective exchange rates in Turkey affect Turkey's hazelnut export to Germany.

Çınar, Huşmat, and Işın (2015) studied the effects of real exchange rate shocks on the exports of processed agricultural products in Turkey by utilizing the VAR model via employing the Impact and Response and Variance decomposition tests. As a result of the empirical findings of the study, it was not found that there was a significant relationship between the real exchange rates and the processed agricultural products.

2. Data, Methodology and Empirical Analyses

In this study, the real series isolated from seasonal effects and encompassing the period between first trimester of year 2000 and third trimester of year 2016, natural algorithm of which was taken, were used. The abbreviations and sources of series are presented in Table 2.

Table 2. Variables Used in Present Study

Abbreviation of Variable	Definition	Period	Source
LNUAP	Turkey's unprocessed agricultural exports to The EU	2000Q1-2016Q3	TURKSTAT Database
LNPAP	Turkey's processed agricultural exports to The EU	2000Q1-2016Q3	TURKSTAT Database
LNRGDP	The EU Real GDP	2000Q1-2016Q3	OECD
LNREER	Real effective exchange rates	2000Q1-2016Q3	BIS

In the study, the model developed by Bahmani-Oskooee and Goswami (2004) was used in order to examine the relationship between the real effective exchange rate and the exports. Model (1) is given below:

$$LNREXP_t = a + bLNRGDP_t + cLNREER_t + \varepsilon_t \quad (1)$$

Two different methods were used for cointegration analysis. These were the Johansen cointegration test developed by Johansen (1988), Johansen and Juselius (1990). The second method used in the cointegration analyses was the bounds test, developed by Pesaran et al. (2001), which enables us to examine the relationship between the variables at different levels.

In this study, unit root analysis was performed by using ADF and PP tests. The results of tests are presented in Table 3. The null hypotheses of ADF and PP test equations were established based on the assumption that the series includes unit root.

The results of ADF and PP unit root tests indicated that the parameters were stationary at different levels, and that none of the parameters was stationary at 2nd level. According to the data in Table 3, the results are as follows; LNPAP I(I), LNGDP I(I), LNUAP I(0), and LNREER I(I) at the significance level of 5%.

Once it was determined that first differences of LNPAP, LNREER and LNGDP series were stationary, the presence of long-term relationship between the series was examined using the cointegration method developed by Johansen (1988), and Johansen and Juselius (1990). Before implementing the cointegration test, an unrestricted VAR model was estimated from the parameters used in model, and it was necessary to find the number of lags. Using the estimated VAR models, it was determined that the suitable lag length for SC and HQ was k=2. The results of Johansen Cointegration Test are presented in Table 4.

The results of Johansen (1988) and Johansen & Juselius (1990) cointegration test with determined lag length are presented in Table 4. Given Table 4, as a result of comparing the calculated trace test and maximum eigenvalue statistics with the critical values, no cointegration vector could be found at the significance level of 5%.

Table 3. Results of ADF and PP Unit Root Tests

Variable			ADF		PP	
			Constant	Constant and Trend	Constant	Constant and Trend
LNPAP	Level	t-statistics	-2.772	-2.622	-2.873	-2.759
		1%	-3.533	-4.103	-3.533	-4.103
		5%	-2.906	-3.479	-2.906	-3.479
		10%	-2.59	-3.167	-2.59	-3.167
	First Difference	t- tatistics	-7.96	-8.068	-8.127	-8.188
		1%	-3.534	-4.105	-3.534	-4.105
		5%	-2.906	-3.48	-2.906	-3.48
		10%	-2.591	-3.168	-2.591	-3.168
LNUAP	Level	t-statistics	-3.31	-3.835	-3.27	-3.748
		1%	-3.533	-4.103	-3.533	-4.103
		5%	-2.906	-3.479	-2.906	-3.479
		10%	-2.59	-3.167	-2.59	-3.167
LNGDP	Level	t-statistics	-1.444	-2.362	-1.219	-1.937
		1%	-3.550	-4.127	-3.548	-4.124
		5%	-2.914	-3.491	-2.913	-3.489
		10%	-2.595	-3.174	-2.594	-3.173
	First Difference	t-statistics	-4.068	-4.103	-4.023	-4.060
		1%	-3.550	-4.127	-3.550	-4.127
		5%	-2.914	-3.491	-2.914	-3.491
		10%	-2.595	-3.174	-2.595	-3.174
LNREER	Level	t-statistics	-2.869	-3.05	-2.8	-3.002
		1%	-3.533	-4.103	-3.533	-4.103
		5%	-2.906	-3.479	-2.906	-3.479
		10%	-2.59	-3.167	-2.59	-3.167
	First Difference	t-statistics	-9.522	-6.249	-8.073	-11.4826
		1%	-3.534	-4.118	-3.546	-4.1213
		5%	-2.906	-3.486	-2.912	-3.48785
		10%	-2.591	-3.171	-2.594	-3.17231

Table 4. The Results of Johansen Cointegration Test

Variables: LNPAP, LNREER, LNGDP				
Lag k=2				
	Trace Statistic	0.05 Critical Value	Max-Eigen Statistic	0.05 Critical Value
None	28.2145	29.797	16.1332	21.131
At most 1	12.0813	15.494	9.61114	14.264
At most 2	2.47016	3.8414	2.47016	3.8414

Since the LNUAP, LNREER and LNGDP series were not stationary at the same level, it is not possible to apply Johansen cointegration test. The relationship between the unprocessed agricultural products and the real effective exchange rate was analyzed using the Bounds test developed by Peseran et al. and allowing the examination of relationships between the series, which were stationary at different levels. The results of bounds test are presented in Table 5.

Table 5. Bounds Test Results

Dependent variable is LNUAP		
F Statistic = 5.7694	**Bottom Limit**	**Top Limit**
5%	5.1598	6.2117
10%	4.3806	5.2996

According to the data presented in Table 5, the F-statistics value of 5.7694 calculated at the significance level of 5% was between the top and bottom limits, thus no cointegration relationship interpretation can be made between the variables of the model, where LNUAP is dependent variable.

In order to determine the number of lags in ARDL model, the Schwarz information criteria were utilized. As seen in Table 4, ARDL (4,0,0) model was chosen as the suitable ARDL model. The results of ARDL (4,0,0) model are presented in Table 6.

Table 6. Long-term ARDL Model Estimations (4,0,0)

Autoregressive Distributed Lag Estimates ARDL (4,0,0) selected based on Schwarz Bayesian Criterion Dependent variable is LNPAP			
Regressor	Coefficient	Standard Error	T-Ratio[Prob]
LNPAP(-1)	0.73067	0.13411	5.4483[0.000]
LNPAP(-2)	0.033519	0.16778	0.19978[0.842]
LNPAP(-3)	0.16671	0.17728	0.94039[0.352]
LNPAP(-4)	-0.41466	0.12816	-3.2355[0.002]
LNREER	0.024261	0.11024	0.22007[0.827]
LNGDP	11.449	0.57467	1.9922[0.052]
INPT	-78.480	71.878	-1.0919[0.280]
TREND	-0.0024981	.0013164	-1.8977[0.064]
Diagnostic Tests			
A:Serial Correlation		6.1754[0.186]	
B:Functional Form		0.79056[0.374]	
C:Normality		3.7899[0.150]	
D:Heteroscedasticity		0.40373[0.525]	

Note: A: Lagrange multiplier test of residual serial correlation, B:Ramsey's RESET test using the square of the fitted values, C:Based on a test of skewness and kurtosis of residuals, D:Based on the regression of squared residuals on squared fitted values

3. Conclusion

The effect of exchange rates on agricultural product trade was studied in various forms in various studies. In this study, the agricultural products were examined under 2 categories as processed agricultural products and unprocessed agricultural products. The empirical results of this study indicate that there was no cointegration relationship between real effective exchange rates and processed agricultural products. Thus, it was concluded that the real effective exchange rates have no effect on Turkey's processed agricultural export to EU countries.

The agricultural products are the products with low level of supply elasticity. Determining the exchange rates' effect on the agricultural product export might be important for suppliers in order to ensure the harmony with market prices. It can be thought that the alternative policies to be taken against the currency risk are actively taken into consideration in agricultural product exports to the EU countries. Although the agricultural policies of EU encourage the in-union trade, the effect of Customs Union between Turkey and EU should be examined in details in terms of the effect on export of agricultural products, which is the category limited by the Customs Union at highest level. Although no relationship was found between processed agricultural products and real effective exchange rate, no interpretation can be made about the cointegration relationship between unprocessed agricultural products and real effective exchange rates. Thus, it can be stated that, when compared to unprocessed agricultural products, the processed agricultural products are not affected more by the changes in real effective

exchange rates. From this aspect, it can be concluded that, rather than exporting unprocessed agricultural product, Turkey can more significantly protect the exports from currency risk by exporting processed agricultural products.

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