The Relationship among Nominal Exchange Rate, Import and Export in Turkey for the Period 1988:1 to 2015:3

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Abstract

This study analyzes the relationship between nominal exchange rate, and import and export in Turkey for the period 1998:1 to 2015:3 using VAR model on three-month data. The data were analyzed by means of Granger causality variance decomposition and impulse-response analysis. According to the Granger causality test, there is a one-direction relationship of causality from import to export. There is no causal relationship between nominal exchange rate and export, and import. Variance decompositions and impulse response analysis also confirm the results of Granger analysis of causality. These results show that the exchange rate does not have a significant effect on the export, import, and trade balance, and the measures for import restrictions will adversely affect exports.

Keywords: Nominal exchange rates, Export, Import, Causality Analysis
JEL Classification: F31, F40, O24, C21

I. Introduction

Exchange rates affected commercial movements and international trade volume negatively in 1930s when competitive devaluation was implemented. The stability in exchange rates with the acceptance of Bretton Woods System ended with a resolution taken by the United states in 1971. The transition from fixed rate to floating rate began with abolishment of convertibility of dollar into gold. The exchange rate system determined at Bretton Woods was revoked in 1973. The uncertainty and fluctuations in exchange rates affected all economies including primarily the developing countries. In addition to fluctuations in exchange rates, oil crises (1973-1974 and 1978) had a negative impact on the trade balance of developing countries in particular. In order to reduce foreign trade deficit and control import in particular, countries used exchange rates (especially devaluations) as well as non-tariff barriers. Competitive devaluations (i.e. beggar the neighbor policy) that were common before Bretton Woods Systems are today implemented in different ways.

In floating (flexible, free) exchange rate regimes, the exchange rate is determined in the market based on supply and demand. If a country has a deficit in its balance of payments, the currency of the country loses value. This is expected to increase exports and reduce imports. However, where international capital movements are free, the differences of interest between the countries cause exchange rates to deviate from the actual balance.

The effect of devaluations on foreign trade balance depends on the flexibility of demand on exported and imported goods. On the assumption that flexibility of supply is infinite, according to Marshall-Lerner condition, devaluation can positively affect trade balance to the total demand flexibility of import and export should be greater than or equal to 1 ($em+ex \geq 1$). According to this theory, devaluation causes the foreign trade deficit to first increase, then decrease, and foreign trade balance starts to give surplus. This effect of devaluation on foreign trade balance resembles J curve effect (Krugman, and Obstfeld, 2003: 464-465). This is caused by the low reaction of export and import to changes in exchange rates, since the flexibilities are low in short term. In long term, on the other hand, it rapidly increases exports while decreasing imports, and causes a surplus in foreign trade balance (Krugman, and Obstfeld, 2003: 477-480; Yılmaz and Kaya, 2007: 70).

In the actual economic life, inefficiency, insufficiency of production, and technological and governmental underdevelopment would reduce flexibility of supply. Therefore, the assumption that supply flexibility is infinite is in contradiction with the practice. From the demand point of view, fixing the prices in the country, stability of the prices of imported goods abroad, and consumer habits affect flexibility of demand in goods subject to foreign trade. After all, the conditions of supply and demand should be complete in order for devaluation to affect the foreign trade balance positively.

The relationship among the exchange rate, export, and import in Turkey can be discussed from the perspective of two basis periods. First one is fixed rate regime. It was used in Turkey before 1980 when import was kept under control through various prohibitions and restrictions. On the other hand, export could not be increased to a desirable size. The deficit in trade balance, and appreciation of the national currency were attempted to be rectified by devaluations. The effect of devaluations on trade balance was limited. Once the competitive advantage provided by the exchange rate disappeared, exports started to slow down, while imports continued to grow, upsetting the balance of foreign trade and current accounts.

Second one is flexible exchange rate regime. The process of transition to floating rate regime began with the resolutions of stability on 24 January 1980. Foreign exchange rates were gradually made free from 1980 to 1989. First, exports showed a rapid growth and then the foreign trade balance became better. Then the foreign trade deficit rapidly increased. Although the exchange rates were determined in free market after 1992, the central bank tried to direct the exchange rate through interventions. A restricted fluctuation was attempted in 2000 to 2002, and after the devaluation in the crisis of February 2001 (local crisis for Turkish economy), the transition to floating exchange rate occurred. However, the central bank intervenes in the exchange rate when necessary.

After the devaluation in 2001, the local currency (TL) gained value in both nominal and real terms from 2002 to 2008. Despite appreciation of the national currency, exports increased. Since imports increased more rapidly than exports, the foreign trade deficit grew. With the effect of the global crisis in 2008, the deficit in trade balance decreased significantly. The appreciation of the national currency (TL) continued until 2010. Despite this appreciation, the increase in exports continued until 2014. In 2015, exports decreased by 14 billion dollars compared to the previous year. Imports, on the other hand, followed the same course as the export until 2009, and showed a faster increase than exports. When the increase in import slowed down, so did the export.

II. Literature Review

It is stated in the theory that there is a relationship among exchange rate, import, and export; and the changes in the exchange rate affect imports and exports, shifting the trade balance. The conditions of supply and demand that are necessary for formation of these effects may differ among countries and periods. For this reason, different studies on exchange rates, export, import, and trade balance find different results.

The studies in the literature mostly examine the relationship between the exchange rate (nominal or real) and foreign trade balance, investigate whether the Marshall-Lerner condition is satisfied and the J-curve hypothesis is valid. The information on some studies in the literature are given at Appendix 1. Arize (1994), Demirden ve Pastine (1995) Kulkarni (1996), Bahattacharya (1997), Hernan Rinco (1999), and Lal and Lowinger (2002) found evidence partially or fully supporting the Marshall-Lerner condition between the exchange

rate and foreign trade balance. Rose and Yellen (1989), however, managed to find very little evidence for the J-curve effect in the relationship between the real exchange rate and trade balance in short and long term but these findings are not statistically significant. Backus (1998) states that the exchange rate is not the most significant determinant of foreign trade volume in Japan.

Acharyya (1994) found that devaluation was unsuccessful at improving the foreign trade balance. Koray and McMillin (1999) claimed that the appreciation in foreign exchange rate deteriorated the foreign trade balance in medium term even though it provided an improvement in short term. According to Onafowora (2003), at first, a drop in the real exchange rate deteriorates trade balance, then improves it and then deteriorates it, again. The effect of the real exchange rate on the trade balance resembles the letter S rather than J. The findings of Onafowora (2003) are consistent with Koray and McMillin (1999). Yuen-Ling et al. (2008) found a relationship between the real exchange rate and trade balance, but argued that it didn't have an impact that resembles the letter J. Ogundipe (2013) reached the conclusion that devaluation disrupts the foreign trade balance.

There are also different outcomes in the studies focusing on the export, import and real exchange rate in Turkish economy. The information about models/methods, and periods used in this study, and the results are in Appendix 2. Looking at the literature regarding Turkey, generally similar results were obtained, in these studies. However, these studies related the sub-sectors, different results were found. Abuşoğlu (1990), Terzi and Zengin (1999), Sivri and Usta (2001), Akbostancı (2002), Gül and Ekinci (2006), Alptekin (2009), Aktaş (2010) Yıldırım and Kesikoğlu (2012) reached the conclusion that exchange rates are correlated with neither exports nor imports. On the contrary, most of the studies find that there is a relationship between import and export.

Göçer and Elmas (2013) analyzed the relationship between real exchange rate and the balance of external trade of Turkey by using the intermediate goods, capital goods, consumption goods total external trade data, within the extended Marshall-Lerner Condition framework, for 1989: 1-2012: 2 period. They used to the unit root test and cointegration methods with multiple structural breaks. They have found that extended Marshall-Lerner Condition is valid for all production groups in Turkey. Yıldız and Özdamar (2014) studied the relationship between the exchange rate and exports and imports as different from other studies. They found a relationship between the import and export of certain subsectors of the manufacturing industry and the exchange rate.

III. Data and Methodology

The data used in the study are three-month data from the period 1998:1-2015:3. The data are made up of nominal exchange rate (NER), export (EX), and import (IM), and were taken from the electronic data distribution system of the Central Bank of Turkey. The study investigates a relation of causality between the nominal exchange rate (NER) and export (EX) and import (IM) variables.

The vector autoregression (VAR) model developed by Sims (1980) is used for identification of the relationship among the variables. According to the VAR model, the current value of a dependent variable depends on the lagged values of itself and other descriptive variables as well as the random error terms (ε_t) representing the effects of the shocks caused by the factors out of the model. VAR method differs from structural models in that all variables in the model are considered intrinsic and that each intrinsic variable is a function of the lagging

values of all intrinsic variables in the model (Enders, 2004: 264-265). The primary purpose in VAR modeling is not only to identify the one-way relationship among the variables but also to find the forward and backward dependencies among the variables. In its most basic sense, a VAR equation has K intrinsic variables, which are k=1, …,K and yt= (y1t, ...,ykt, ..., yKt). A VAR model for k variables.

$$y_t = c + A_1 y_{t-1} + A_2 y_{t-2} + \cdots + A_p y_{t-p} + \varepsilon_t$$

Here, y_t is the variable vector sized (k x 1), c is the fixed terms vector sized (k x 1), and A_i are the parameter matrices sized (k x k). The lag coefficient p of VAR model is considered, and the model is called p degree VAR model and written as VAR (p). As stated above, all variables are considered intrinsic without a distinction of intrinsic and extrinsic. This brings significant conveniences to the model (Yılmaz and Kaya 2007: 75).

Causality test is important in sorting the variables in VAR modeling. The existence and direction of interaction can be determined with Granger (1969) test. This test does not make a distinction of dependent and independent variables. It is able to analyze the interactions among variables simultaneously.

$$X_t = \sum_{i=1}^{m} \alpha_i X_{t-i} + \sum_{i=2}^{m} \beta_1 Y_{t-i} + u_t \qquad (1)$$

$$Y_t = \sum_{i=1}^{m} \theta_i Y_{t-i} + \sum_{i=2}^{m} \gamma_1 X_{t-i} + u_t \qquad (2)$$

In the equation (1), if adding the lagging (previous) values of Y to estimation of X increases the prediction performance of X, Y is a cause of X. In other words, Y affects X. The hypotheses for causality;

$H_0: \beta_i = 0$ There is not a relation of causality from Y to X.
$H_1: \beta_i \neq 0$ There is a relation of causality from Y to X.

In the equation (1), whether the β_i coefficient equals zero is investigated. If it is found in the analysis that the β_i coefficient is different from zero at a certain level of significance, it is decided that Y is a cause of X. Determination of the length of lag correctly is of great importance in causality analysis. The appropriate length of lag is determined by VAR analysis.

There should not be an auto-correlation problem in order for the model to be healthy. The auto-correlation of the series is studied and whether the error term of a period is affected by the error terms of previous error terms is investigated. Here, the previous period is not limited to a single period. Whether there is an auto-correlation between multiple periods is considered. When ρ=0, the current error term is not affected by the previous period's error term.

$$u_t = \rho u_{t-1} + e_t \qquad AR\ (1)$$
$$u_t = \rho u_{t-1} + \rho_2 + e_t \qquad AR\ (2)$$
$$u_t = \rho_1 u_{t-1} + \rho_2 u_{t-2} + \cdots \rho_k u_{t-k} + e_t \qquad AR\ (k)$$

$H_0 : \rho = 0$ There is not auto-correlation problem.
$H_1 : \rho \neq 0$ There is auto-correlation problem.

If there is auto-correlation in level values, the problem of auto-correlation is resolved by taking the difference of the series.

The source of the changes in a variable is attempted to be identified by separation of variance. Separation of variance shows the change in one of the intrinsic variables as separate shocks that affect all intrinsic variables. Thus, separation of variance informs the researcher about the dynamic structure of the system (Kosova, 2011: 116-117).

Impulse-Response Analysis is used to analyze the effect of a shock that occurs in a variable on the other variables of the model. The results of impulse-response analysis are important indicators for policy makers. They indicate the outcomes of the measures to be taken in foreign trade. Representation of the vector of moving average (VMA) makes it possible to draw the route of time for the effects of shocks on the variables included in the VAR system in the method of Sims (1980) (Barışık and Kesikoğlu, 2006: 69-70).

IV. Empirical Results

One should measure whether the variables are stable before proceeding to analysis. Before the stability test in this study, the logarithms of the series of three variables were taken and purified of seasonal effects. The outlier values were attempted to be removed by taking the level values of the series.

Firstly, the stability of the variables export (LNEXSA), import (LNIMSA) and nominal exchange rate (LNNERSA) were tested by Augmented Dickey-Fuller (ADF), Phillips-Perron (PP) (1988) ve Zivot-Andrews (ZA) (1992) structural break unit root tests. PP test is considered stronger than ADF in the analysis of the series that include trends in particular. PP resolves the issue of auto-correlation using the Newey-West error correction mechanism. Contrary to the extrinsic break point assumption of Perron (1989), ZA developed a new unit root test procedure that allows an estimated break in the trend function of the alternative hypothesis (H1) (Zivot and Andrews, 1992). Once the date of break is identified, if the t statistics that is calculated is smaller than the critical value calculated by Zivot and Andrews (1992), the basic hypothesis (H0) arguing that there is a unit root is accepted (Yıldırım Tıraşoğlu, 2014: 73-74). Since ZA takes into account the break in series, it is superior to ADF and PP.

According to the unit root test results of ADF, PP, and ZA, all series are stable in the first difference. Table 1 shows the level values of the series as well as the stability test results of ADF and PP in the level values and first differences o the series. In the first differences of the series, since probability (prob) values are smaller than 0.05 and ADF and PP test statistical values are greater than 1%, 5% and 10% critical values of McKinnon as absolute values, the variables are stable. In the break unit root test of ZA, the break in exports occurs in the 4th quarter of 2008, the break in imports occurs in the 3rd quarter of 2001, and the break in exchange rate occurs in the 1st quarter of 2002.

Granger causality test was used to identify the direction of causality after stability analysis. In VAR analysis, variables are used at levels where they are stable. For this reason, each of the three variables was analyzed in their first difference where they were stable. The appropriate length of lag is 1 in the VAR model. Although the lags of 0 and 1 have two asterisks (*) in the Table 2, Akaike information criterion (AIC) was taken as basis and the lag of 1 was selected.

Table 1: ADF and PP Tests' Results

Variables	ADF Test Statistics	Critical Values			PP Test Statistics	Critical Values		
		%1	%5	%10		%1	%5	%10
lnexsa	-0.844 [5]	-4.105	-3.480	-3.168	-0.503 [0]	-4.094	-3.475	-3.165
Δlnexsa	-7.292** [0]	-3.528	-2.904	-2.589	7.360* [2]	-3.528	-2.904	-2.589
lnimsa	-1.883 [1]	-4.096	-3.476	-3.165	-1.614 [2]	-4.094	-3.475	-3.165
Δlnimsa	-5.612* [0]	-3.528	-2.904	-2.589	-5.422* [5]	-3.528	-2.904	-2.589
lnnersa	-3.005 [5]	-4.105	-3.480	-3.168	-3.019 [1]	-4.094	-3.475	-3.165
Δlnnersa	-5.496* [0]	-3.528	-2.904	-2.589	-5.496* [1]	-3.528	-2.904	-2.589

Note: Fixed terms and trend models are used in level values and first differences. The values in brackets show the bandwidth identified using the Newey-West measure. * shows stationary 1% level of significance. Stable in the first difference when Akaike and Schwarz information criterions are taken as basis in ADF and PP unit root tests

Table 2: VAR Lag Order Selection Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	240.0235	NA	1.22e-07	-7.406984	-7.305786*	-7.367117*
1	251.0477	20.67046	1.14e-07*	-7.470241*	-7.065451	-7.310774
2	254.1536	5.532362	1.38e-07	-7.286050	-6.577667	-7.006982
3	258.4248	7.207660	1.61e-07	-7.138275	-6.126299	-6.739607
4	268.1770	15.54263	1.58e-07	-7.161783	-5.846213	-6.643514
5	280.3474	18.25548*	1.46e-07	-7.260855	-5.641693	-6.622985
6	282.6641	3.257951	1.84e-07	-7.052004	-5.129249	-6.294534

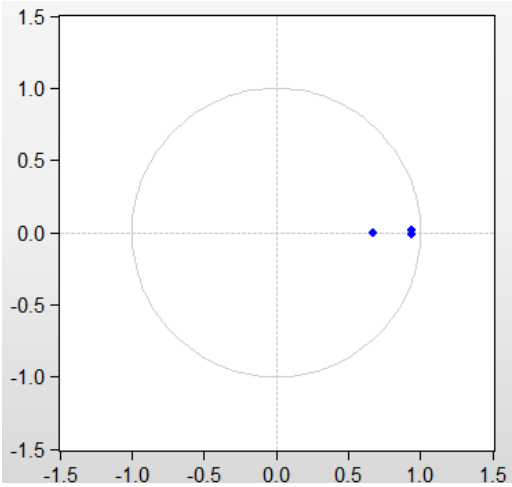
* indicates lag order selected by the criterion

When the stability of the lags in the VAR models above is tested by AR characteristic polynomial reverse roots, no modulus data is out of the reference range. Showing this result on a graph indicates that no AR root is out of the unit circle. As a result, the VAR model that is established can be said to be stable.

Table 3: Inverse Roots of AR Characteristic Polynomial

Root	Modulus
0.944348- 0.011152i	0.944414
0.944348- 0.011152i	0.944414
0.669923	0.669923

Figure 1: Inverse Roots of AR Characteristic Polynomial



Auto-correlation was studied and whether the error term of a period is affected by the preceding terms was considered in the series. The first lag has auto-correlation in the level values, and another LM test was conducted by taking the first degree difference of the series. Since the probability (prob) values in the series were greater than 0.05 up to 6 lags, it is seen that there is not a problem of auto-correlation.

Table 4: Autocorrelation LM Test

Lags	LM-Stat	Prob
1	3.903587	0.9176
2	5.104272	0.8251
3	9.618296	0.3823
4	7.895433	0.5447
5	15.88412	0.0693
6	3.398689	0.9464

Table 5: VAR Estimates

Variables	df_lnexsa	df_lnimsa	df_lnnersa
df_lnexsa	-0.111876 (-0.77876)	0.039469 (0.19723)	-0.125651 (-0.72617)
df_lnimsa	0.271415 (2.27442)	0.356043 (2.14187)	0.149530 (1.04033)
df_lnnersa	0.021136 (0.18617)	-0.033985 (-0.21489)	0.314218 (2.29782)
C	0.021666 (2.21639)	0.010980 (0.80634)	-0.024026 (-2.04066)
	R^2=0.116501 F=2.857028	R^2=0.126522 F=3.138378	R^2=0.159973 F=4.126147

Note: t-statistics in ( )

According to the estimation results of the VAR model, an export value lagged by a period affects imports positively, and exchange rate negatively and insignificantly. An export value lagged by a period affects exports and nominal exchange rate positively and significantly. It is seen in the VAR model that nominal exchange rate does not have a significant effect on export and import. For this reason, nominal exchange rate is not suitable for use as an effective instrument for establishing the foreign trade balance.

Table 6: Granger Causality Test

Variables	Direction of Causality	F-statistics
Nominal Exchange Rate- Export	-	2.26575
Nominal Exchange Rate- Import	-	0.05296
Export – Import	-	0.04557
Import – Export	⟶	7.65936

Granger Causality analysis was conducted to identify the direction of the relationship among the variables. There is not a relationship of causality between nominal exchange rate and exports and imports according to the results of Granger causality test. There is a relationship of causality from import to export. However, there is not a relationship of causality from export to import. Considering these results, the exchange rate policy alone was not effective in establishing the foreign trade balance in the period 1998:1-2015:3. The measures for reducing imports, on the other hand, will affect exports negatively.

Table 7: Variance Decomposition of df_LNEXSA

Period	S. E.	df_LNEXSA	df_LNIMSA	df_LNNERSA
1	0.065281	100.0	0.0	0.0
2	0.069086	90.11487	9.844905	0.040228
3	0.069433	89.66674	10.29125	0.042009
6	0.069488	89.57641	10.38010	0.043487
10	0.069488	89.57626	10.38023	0.043506

Variance decomposition is used to make a proportional measurement of the effects of shocks on their variables by distributing the prediction error variance of each variable among each of the variables. A consideration of variance decomposition results reveals that exports are affected the most their own shocks and then by import shocks. Of the changes that occurred in exports by the end of the 2nd quarter, 90.1% was caused by exports while 9.8%, by the developments in imports. The effect of nominal exchange rate is almost nonexistent.

Table 8: Variance Decomposition of df_LNIMSA

Period	S. E.	df_LNEXSA	df_LNIMSA	df_LNNERSA
1	0.090936	28.86797	71.13203	0.000000
2	0.096566	29.66115	70.28562	0.053235
3	0.097275	29.75490	70.17077	0.074336
6	0.097378	29.77284	70.14607	0.081083
10	0.097378	29.77289	70.14599	0.081120

An observation of the variance decomposition in import reveals that import is affected mostly (70.1%) by its own shocks. Export has second top effect on import. 29.6% of the changes in imports by the end of 2nd quarter was attributable to the development of export. The effect of exchange rate on import is almost nonexistent.

Table 9: Variance Decomposition of df_LNNERSA

Period	S. E.	df_LNEXSA	df_LNIMSA	df_LNNERSA
1	0.078629	3.667627	26.81399	69.51838
2	0.084913	3.348822	31.15607	65.49511
3	0.085638	3.443220	31.68087	64.87591
6	0.085755	3.472236	31.78719	64.74331
10	0.085756	3.472411	31.78746	64.74013

According to variance separation, nominal exchange rate is mostly (65.4%) affected by its own shocks. About 31% of the change in the exchange rate in the 2nd term and subsequent terms are attributable to the developments in import. The effect of developments in exports on the change in exchange rate is 3.4%.

As can be seen in variance separation results, exports and imports are not affected by the developments in the nominal exchange rate. While import is affected considerably by the developments in export (29.7%), export is affected less (10.3%) by the changes in import.

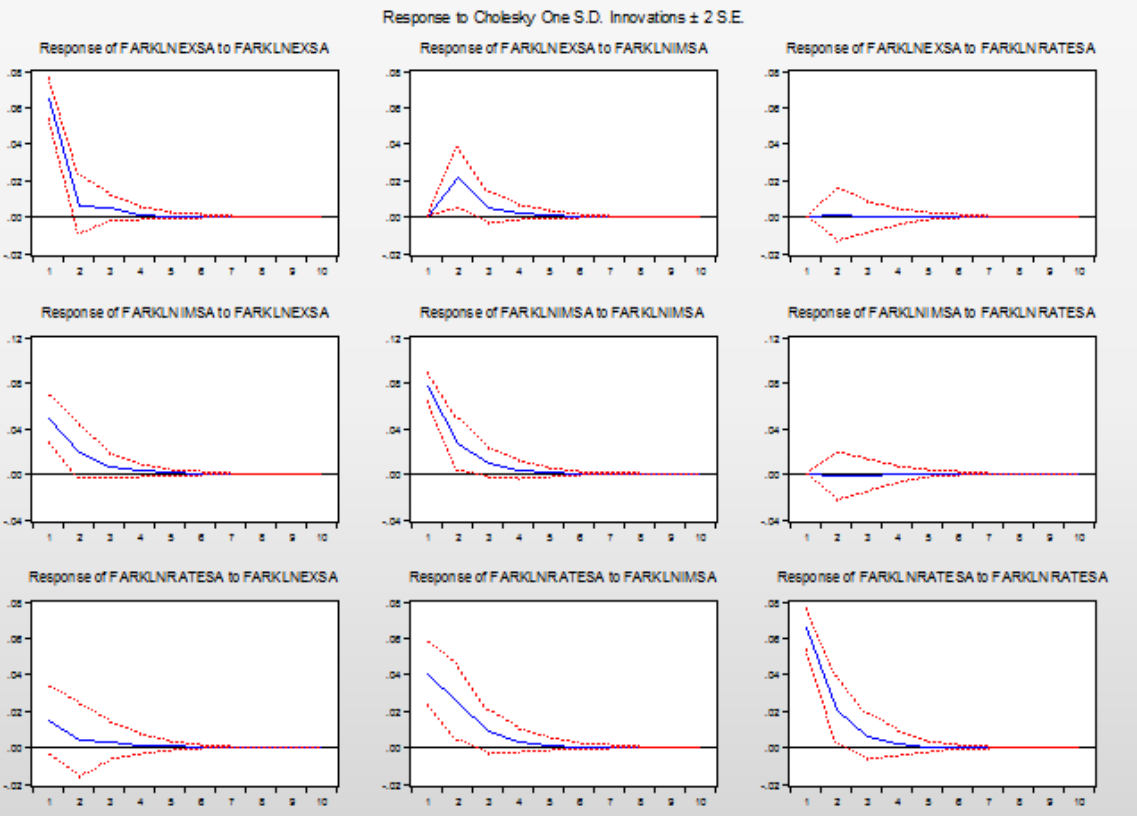
An examination of the impulse-response analysis reveals that the reaction of export to a shock in export is very strong to the middle of the quarter 1 and 2 (until about the 4th month). This response later slows down and starts to follow a stable pattern. The response of import to a shock in export is softer compared to export, and the said response becomes stable after the third period.

The response of the nominal exchange rate to a shock in export is smaller compared to the response of export and import. This response slows down and gets closer to zero after the two periods.

The response of import to a shock in import emerges in the first 1,5 quarter (4 months), and the responses decrease and approach zero after 2,5 quarters. The response of export to a shock in import continues up to 2,5 quarters (about 7 to 8 months), and decreases gradually thereafter. The response of nominal exchange rate to import is observed considerably up to 3 quarters, and then slows down.

The response of the exchange rate to a shock in the nominal exchange rate is very severe in the beginning. The response slows down after the 3rd quarter and approaches zero after the 4th quarter. The responses of import and export to a shock in the exchange rate is almost nonexistent. These results are in coherence with the causality analysis and variance decomposition. The response of import to exchange rate.

Figure 2: Impulse Response Analysis



V. Conclusion

In this study the relationships between the nominal exchange rate and import and export were examined with VAR model using the quarterly data of the period from 1998:1 to 2015:3. The results were interpreted by variance decompositions and impulse-response analysis. No causality was found between the exchange rate and the import and export using the Granger causality test. On the contrary, there is a one-way causality from import to export. According to these results, the policies for shifting the balance of trade by altering the exchange rates would not yield effective results. The policies for keeping the import under control will also

affect exports negatively. The fact that majority of Turkish import is made up of intermediate goods and investment goods required for production is consistent with this result.

An examination of variance decompositions reveals that the values of all variables are mostly determined by themselves. While the impact of export shocks on imports is 30%, the impact of imports on exports is 32%. The impact of nominal exchange rate shocks on exports and imports is in the range of 0 to 1%. The relationship of exchange rate with import and export is consistent with Granger causality. In impulse-response analysis, the response of export and import to a shock of a standard error in exchange rate is very low. This result is consistent with Granger causality and variance decomposition. The reaction of exchange rate to export is smaller than that to import. Serious increases in import, and the payments made to abroad for these imports may exert pressure on the exchange rate.

In conclusion, no relationship is found among the nominal exchange rate and the foreign trade of Turkey (i.e. export, import and trade balance). The relationship that resembles the J-curve effect as stated by Marshall-Lerner is not valid between the nominal exchange rate and trade balance for the period examined by the study. The most important reason for the failure to find a significant correlation between the exchange rate and export and import is the quality of the goods that are subject to foreign trade. The fact that the products exported by Turkey usually have a low flexibility of price and demand restricts the possibility of increasing the exports by devaluation. The reason for the lack of causality between the exchange rate and import is that the majority of imports are made up of intermediate goods and investment goods. The production that increases in line with economic growth requires the use of imported input. Therefore, a higher or lower rate of exchange does not affect import. Considering the relation of causality from import to export, the measures for reducing imports may affect exports and economic growth.

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Appendix 1: The Relationship Among Exchange Rate, Export and Import at the International Literature

Author	Period	Model/Method	Countries	Result
Rose and Yellen (1989)	1960:1-1985:4 (quarterly)	DF, Phillips Test, Engle-Granger (1987), Chi-quare test, OLS	US-Japan, Canada, U.K., France, Germany, Italy	In the commercial activity of the United States with five countries, there is not any finding that supports the J-curve in bilateral trade. OLS estimations do not support the J-curve much.
Acharyya (1994)		Extends J-C model (1976)	India	Devaluation is not successful at restoring the trade balance. Devaluation creates an inflationist effect by increasing the imported input costs.
Arize (1994)	1973:1-1991:1 (quarterly)	DF, ADF, Perron (1988), OLS, Johansen cointegration, Engle-Granger cointegration	Korea, India, Indonesia, Malaysia, Pakistan, the Philippines, Singapore, Sri Lanka, Thailand	In long term, devaluation has positive effects on the trade balance in 7 countries other than India and Sri Lanka.
Hernan Rinco (1999)	1979:1-1995:4 (quarterly)	Dickey-Fuller (DF), Phillips (1986), Phillips-Perron (1988), Ljung-Box Q Test, ARCH, Vector error correction model (VECM)	Colombia	Exchange rates play a determining role in trade balance in short and long term. This is coherent with the Marshall-Lerner condition.
Yuen-Ling et al (2008)	1955-2006 (yearly)	ADF, PP, KPSS, Engle-Granger long-run cointegration, Johansen-Juselius, Impulse response function, VECM	Malaysia	There is a relationship between the real exchange rate and foreign trade balance. The loss of value in the local currency firstly deteriorates the trade balance and then restores it. The classical J curve does not form in this process because the restoration of foreign trade balance takes place slowly in 2 to 7 years. In Granter test of causality, there is a one-way causality from the real exchange rate to the trade balance.
Lal and Lowinger (2002)	1985:1-1998:4 (quarterly)	ADF, Engle-Granger (1987), Johansen-Juselious (1990)	Bangladesh, India, Nepal, Pakistan, Sri Lanka	A relationship was found between the effective exchange rate and foreign trade balance both in long term and in short term.
Onafowora (2003)	1970:1-1996:4 (quarterly)	ADF, Johansen (1988) and Johansen-Juselius (1990), Impulse response functions, VECM, CUSUMSQ	ASEAN countries - Thailand, Malaysia, and Indonesian their bilateral trade to the US and Japan	There is a positive and long-term relationship between the real exchange rate and real trade balance. For Indonesia and Malaysia in their bilateral trade to both the US and Japan, and for Thailand in its bilateral trade to the US, our findings suggest that there are short run J-curve effects. Thailand has the opposite movement in its bilateral trade to Japan: a real exchange rate devaluation shock initially improved then worsened and then improved the trade balance. This

				pattern does not support the classic J-curve hypothesis but is consistent with the S-curve pattern described
Demirden and Pastine (1995)	1978:2-1993:2 (quarterly)	OLS, VAR	US.	A partly-significant relationship was found between the real exchange rate and the trade balance.
Ogundipe (2013)	1970-2010 (yearly)	Johansen cointegration analysis, Variance decomposition	Nigeria	There is an important relationship between the exchange rate and the trade balance. Devaluation deteriorates the foreign trade balance.

Appendix 2: The Literature on the Relationship among Exchange Rate, Export and Import in Turkey

Author	Period	Model/Method	Results
Zengin and Terzi (1995)	1950-1994	Engle-Granger two-stage cointegration, Granger Causality, Impulse response analysis	There is not a statistically significant relationship between exchange rate and export, import and foreign trade balance.
Bahmani-Oskooee and Domac (1995)	1947-1990	Cointegration analysis,	Import and export are cointegrated. An increase in import leads to an increase in export.
Durusoy and Tokatlıoğlu (1997)	1987:1-1995:2 (quarterly)	VAR	The positive effect of devaluation on trade balance does not occur earlier than 1 year. Devaluation is not an appropriate instrument of establishing the foreign trade balance.
Terzi and Zengin (1999)	1989:1-1996:12 (monthly)	VAR, Causality analysis, Impulse response analysis, variance decomposition	A relationship was not found between the exchange rate and import, therefore exchange rate is not an effective way of establishing the foreign trade balance.
Sivri and Usta (2001)			There is not a relationship between exchange rate and export, import and foreign trade balance.
Akbostancı (2002)	1987-2000 (quarterly)	VECM, Impulse response analysis	There is not any finding that supports the J-curve in the relationship between the real exchange rate and trade balance.
Gürbüz and Çekerol (2002)	1995:1-2002:1 (monthly)	ADF, Granger (1981) Causality, Engle-Granger (1987) cointegration	No relationship was found among the exchange rate and import, export and trade balance.
Yamak and Korkmaz (2005)	1995:1-2004:4 (monthly)	Engle-Granger (1987) cointegration	There is not a relationship between the real exchange rate and the trade balance in long term, and there is a causality from the foreign trade balance to real exchange rate in short term.
Karagöz and Doğan (2005)	1995:1-2005:6 (monthly)	Chi-square test (LB), Cointegration analysis	No relationship was found among the exchange rate and import and export. The effect of devaluation in 2001 was found significant.
Gül and Ekinci (2006)	1990:1-2006:8 (monthly)	Granger causality analysis, ADF; Johansen cointegration analysis	There is a one-way causality from export and import to real currency rate. For this reason, the real exchange rate is not used effectively in establishing the trade balance.
Barışık and Demircioğlu (2006)	1980-1989:3, 1989-4-1999	ADF, KPSS, Granger Causality, Johansen cointegration analysis, Variance decomposition	There is a weak relationship between the exchange rate and export-import.
Kızıltan and Ciğerlioğlu (2008)	1982 – 2005 (quarterly)	Time series, Cointegration analysis	The real exchange rate is not effective in establishing the trade balance. The measures for reducing the imports also affect the exports negatively.
Alptekin	1992:1-	VAR, Granger	There is not a short-term causality relation

(2009)	2009:1	causality, Variance decomposition, Impulse response analysis, Cointegration analysis	between the real exchange rate and foreign trade. THe real exchange rate is not an effective instrument of establishing the foreign trade balance.
Aktaş (2010)	1989:1-2008:4 (quarterly)	VAR analysis, Variance decomposition, Impulse response analysis	The changes in exchange rate does not affect foreign trade.
Hepaktan et al.	1982:1-2011:7 (monthly)	ADF, Phillips-Perron, KPSS, Engle-Granger causality test,	Exchange rate policies alone are not enough to provide the foreign trade balance.
Yıldırım and Kesikoğlu (2012)	2003:1-2011:9 (monthly)	VAR analysis, MWald test, ADF; KPSS; Hacker and Hatemi-J (2006) bootstrap causality test	There is a two-way causality relation between total export and total import. No causality was found between exchange rate and import and export.
Göçer and Elmas (2013)	1989:1-2012:2 (quarterly)	Carrion-i-Silvestre (2009) unit root method with multiple structural fraction, Maki (2012) cointegration analysis with multiple structural fraction, Dynamic least squares	The Extended Marshall-Lerner condition applies to all commodity groups in Turkey.
Tapşın and Karabulut (2013)	1980-2011 (yearly)	Toda and Yamamoto (1995) causality analysis	There is a causality from import to export and from real exchange rate to the import variable.
Çil Yavuz et al. (2010)	1988-2007 (quarterly)	ARDL limit test	A long-term relationship was found between the foreign trade balance and real exchange rate. Marshall-Lerner condition does not apply.
Yıldız and Özdamar (2014)	2005:1-2012:12 (monthly)	Dickey and Fuller, Monte Carlo simulations, Engle ve Granger (1987) cointegration analysis, Granger (1969) causality analysis	The relationship between the exchange rate, export and import in 22 subsectors in manufacturing industry varies among different sectors.
Keskingöz (2015)	1993–2014 (monthly)	Granger causality test	In an equation where import is the dependent variable in the trade between Turkey and Kyrgyzstan, a relationship was found between import and export but no relationship was found among the equations.