Asymmetric Effects of Exchange Rate Changes on Exports: A Sectoral Nonlinear Cointegration Analysis for Turkey

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Abstract

This paper examines the effects of the real exchange rate changes on the selected sectoral exports of Turkey's manufacturing industry in the context of nonlinear auto-regressive distributed lag model (NARDL). NARDL method includes short-run and long-run coefficient estimates and embraces the asymmetric effects. The previous studies generally used the linear models on the aggregated data and they offered ambiguous results. The latest studies have preferred to use the method of NARDL on the bilateral trade balance data. Instead of using bilateral data, this paper considers the data of sectoral exports, specifically the exports of the selected Turkey's manufacturing sectors. The estimated NARDL models supply the empirical information about the asymmetric effects of the real exchange rate on the sectoral exports. Results from the model for each sector provide the evidence indicating that the depreciation and appreciation of the domestic currency have asymmetric significant effects on the sectoral exports.

Keywords: Real exchange rate, Sectoral Export, Nonlinear Cointegration, Asymmetric Effects

1. Introduction:

The researches on exchange rate changes have been extended especially after the propagation of the use of floating exchange rate regimes all over the world, since the movements in exchange rate affect imports and exports. Depreciation or appreciation of nominal exchange rate causes changes in real exchange rate generating an important impact on trade balance. It is theoretically expected that import decreases and export increases when there is a real depreciation of domestic currency since import becomes more expensive and export becomes cheaper; thus trade balance is obviously improved. On the other way around, a real appreciation of domestic currency is supposed to increase imports and to decrease export. Arize et.al., (2017) claims that although the effect of the real depreciation on the trade balance seem

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to be immediate thanks to the effects of the price changes, an improvement in trade balance does not appear abruptly since the previous purchase orders or contracts for import and export quantities had been determined at the time of depreciation.

The export and import models were estimated to examine the effects of currency depreciation on trade balance in the empirical papers such as Houthaker & Magee, (1969), Goldstein and Khan (1978), Warner and Kreinin (1983) and Arize, (1990). The Marshall-Lerner (ML) condition of stability have been analyzed in the papers and they mostly found that devaluation is beneficial in the long run for a country's trade balance. Instead of using ML condition, the other studies searched the direct relation between trade balance and exchange rate. Haynes and Stone (1982) and Himarios (1985) obtained the result that devaluation improved the trade balance almost for all of their samples while Miles (1979) found insignificant relationship between exchange rate and trade balance. Bahmani-Oskooee (1991), Arize (1994) used the cointegration technique introduced by the Engle and Granger (1987) and they revealed a significant long run relation between trade balance and real effective exchange rate. They also had the result indicating that the trade balances for the most of the developing countries are improved by the currency depreciation. The following studies such as Bahmani-Oskooee and Alse (1994), Bahmani-Oskooee (2001), Singh (2002) Onafowora (2003), Aziz (2008), Sun and Chiu (2010) used econometric modeling of the full information maximum likelihood presented by Johansen (1988) and developed by Johansen and Juselius (1990). They also worked with ARDL models which were introduced by Pesaran, Shin and Smith (2001). These studies found the evidence supporting that currency depreciation has a positive effect on the trade balance. Conversely, the other studies of Rose, (1990), Bahmani-Oskooee and Malixi (1992), Liew et al (2000), Wilson and Tat (2001), Hatemi and Irandoust (2005) using the similar econometric techniques could not find significant relation between real exchange rate and trade balance.

The historical path of exchange rate in Turkey suggests that the domestic currency, Turkish Lira, has lost much of its nominal value. Researchers have been tended to use the real exchange rate to search the effects of this immense depreciation on the trade balance of Turkey since the variabilities of the domestic and foreign prices are considerably affected by the alterations in the real exchange rate. Concerning the ML condition in Turkey, Khan (1974) and Gylfason and Risager (1984) resulted with the favorable impact of devaluation on the trade balance while Bahmani-Oskooee and Kara (2005) obtained the opposite result. The J-curve approach introduced by Magee (1973) is the other way of searching how real exchange rate affect trade balance. This approach proposes that depreciation of domestic currency has the negative instant effect on trade balance, however the depreciation begins to affect trade balance positively. The outcomes of Bahmani-Oskooee and Alse (1994), Halicioglu (2008a), Halicioglu (2008b) verify the validity of this theorem for Turkey. On the contrary, the results coming from the works of Bahmani-Oskooee and Malixi (1992), Brada et al. (1997) could not find the evidence of the validity of the J-curve approach. Similarly, the more recent works of Akbostanci (2004), Bahmani-Oskooee and Kutan (2009) did not obtain the findings of supporting the validity of J-curve for Turkey. Rather than using aggregated data, Rose and Yellen (1989) and Halıcıoglu (2007) used the Turkey's bilateral trade data with its trading partners to estimate long-run relations. The estimated results showed that real depreciation of the domestic currency had the encouraging effects on the trade balances of Turkey with the United Kingdom and the United States.

The models of the studies referred above assume that changes in real exchange rate has the symmetric effects on trade balance; that is, the changes in real exchange rate have the uniform symmetric effect on trade balance regardless of the type of the changes. Depreciation and appreciation of domestic currency are both supposed to have the symmetrical effects on trade balance. According to Arize and Malindretos (2012), positive and negative deviations from the equilibrium are tend to revert the mean, but asymmetry in these reversions can occur if there is a nonlinearity in interactions between these deviations. The linear models implying symmetry assume that trade balance reacts to the changes in real exchange rate in the same way as in appreciation or appreciation. The asymmetric effects of the changes in real exchange rate implied by nonlinear models, on the other hand, may include the asymmetries in the size of the effects or in the directions of the effects (Bahmani-Oskooee and Fariditavana, 2016). Arize et al. (2017) explains the asymmetric movements and adjustment of trade balance with hysteresis in trade; the export revenue of the current exporters would decrease if exporters did not exit the market in the case of currency appreciation. In other words, during depreciation periods, change in revenues of export might be comparatively marginal and in case of currency appreciation the level of revenues of export may even fall. The other argument of nonlinearity-asymmetries is about price stickiness. Rhee and Rich (1995) and Peltzman (2000) present that prices increase quickly but they decrease slowly so that firms increase prices more rapidly than they cut prices; prices are stickier downwards than upwards, and quantities are rigid upwards.

Asymmetries and nonlinearities might be generated by the attitudes of intervention policies that generate ambiguity about the value of exchange rate in the long run and thus create the uncertainty in market. It is not unusual to say that currency appreciation is more tolerable than depreciation for monetary authorities. Central banks are tented to sell their foreign reserves when there is a currency depreciation, but they may accumulate its reserves or prefer to do nothing when currency rises. Accordingly, equal shocks to the market will have different effects depending on the forms of their relations with exchange rate appreciation or depreciation. The market participants might have different views about the equilibrium level of the nominal exchange rate. They also might perceive the real exchange rate misalignment in different perspectives. These differentiated positions of the market actors may cause nonlinearity and asymmetries. Finally, asymmetric pricing-to-market behavior of the exporters can lead asymmetric responses. When there is a currency depreciation, exporters may have a tendency to keep the same prices to increase their sales volume and market shares. When currency appreciation occurs, exporters would be willing to reduce export prices to prevent the corresponding foreign currency prices and thus to maintain or increase their market share. What is worse is that if appreciation is large enough, it would be difficult for exporters to lower prices because of contracting profit margins (Arize et al., 2017).

Most of the previous studies, worked on aggregate or bilateral data, have used the linear models assuming that trade balance is affected by the exchange rate changes in a symmetric ways. The other studies such as Bahmani-Oskooe and Faridtavana (2015, 2016), Bahmani-Oskooee et al (2016), Arize and Malindretos (2012) Arize et al.(2017) include nonlinear models implying asymmetric effects of exchange rate. These studies have shown that depreciation or appreciation of domestic currency has a significant coefficient in nonlinear models even if exchange rates gave insignificant coefficients in linear models. Recently, Bahmani-Oskooee and Halicioglu (2017) have used quarterly bilateral Turkey's external trade data with its trading partners to estimate the asymmetric-nonlinear models and they have found that the trade balance is not significantly affected by the real appreciation of the domestic currency. On the other hand, the results from the same study has indicated that the real depreciation of the domestic currency improved the trade balances with several countries such as France, Italy, United Kingdom, Portugal, and Germany.

The researchers have been mostly analyzed the effects of changes in exchange rate on exports by using the linear models. These studies assumed the symmetric effects of depreciation and appreciation of the currencies on exports. As Arize and Malindretos (2012) pointed out, the asymmetric effects should be taken into account by using nonlinear models. The most recent studies have used the nonlinear models and they have proved the existence of the asymmetric effects. On the one hand, the number of these sort of studies is inadequate; on the other hand, they all have tried to find out the asymmetric effects based on the bilateral aggregated data. This paper has attempted to search the asymmetric relations based on the micro level data for the first time, namely the export values of the manufactural sectors. In this manner, the validity of the asymmetric effects has been handled through the sectors. The findings derived from the paper have supported the current empirical literature about the asymmetric effects. Moreover, the paper has provided the opportunity to evaluate the asymmetric effects of the depreciation and appreciation for the manufacturing sectors. It can be thought an important contribution since the manufacturing sectors have been the main drivers of the export-led growth.

The aim of this paper is to evaluate the effects of the depreciation and appreciation of the domestic currency for Turkey's sectoral export performances. The nonlinear models have been used to assess the asymmetric effects of these value changes in the domestic currency. Instead of using bilateral trading data, the paper includes the export data of the manufactural sectors. Specifically, 10 out of the 22 manufacturing sectors of Turkey were selected. The exports of these selected sectors provide 85 percent of the export share in the whole manufacturing sector. It is found that eight out of the ten sectors include significant effects of the real appreciation and depreciation altogether or separately. Besides, the statistical evidences of the short run asymmetries were attained in the nine of out the ten sectors. To indicate these results, the methodology and the definitions of the models are presented in Section 2. In the paper, Section 3 includes the empirical results and their interpretations. Lastly, Section 4 provides the conclusion of the paper.

2. Data, Methodology, Model Specification

The previous empirical literature included domestic income and foreign income in real terms in addition to trade balance and real effective exchange rate in the models searching the long run relation. (Bahmani Oskooe, 2001; Arize et al., 2000; Himarios, 1989; Rose and Yellen, 1989, Arize et al., 2017) How the real effective exchange rates affect the trade balances of different countries was evaluated based on the country level data. The long run relation takes the following form (Arize et al.,2017);

$$TB_t - \alpha_0 - \alpha_1 R_t - \alpha_2 Y_t - \alpha_3 Y_t^W = \epsilon_t \quad (1)$$

where TB_t denotes the trade balance, R_t denotes the real effective exchange rate, Y_t and Y_t^w denote indexes of real domestic income and foreign real income respectively, and ε_t is the error term. Finally, the variables are all in natural logarithmic forms.

In this paper, it is attempted to assess the features of the real exchange rate efficiencies for the sectoral exports. For this aim, 10 among the 22 manufacturing sectors of Turkey were selected since the exports of these 10 sectors amount to almost 85 percent of the export share in the whole manufacturing sector in Turkey. These manufacture sectors are defined under the ISIC Rev. 3 classification at two-digit level. The selected sectors are namely; 1. Manufacture of food products and beverages, 2. Manufacture of textiles, 3. Manufacture of wearing apparel; dressing and dyeing of fur, 4. Manufacture of chemicals and chemical products, 5. Manufacture of rubber and plastics products, 6. Manufacture of basic metals, 7. Manufacture of fabricated metals, except machinery and equipment, 8. Manufacture of machinery and equipment n.e.c., 9. Manufacture motor vehicles, trailers and semi-trailers, 10. Manufacture of furniture; manufacturing n.e.c.

The annual sample data covers the period of 1983-2017. Sectoral exports (EX) data were extracted from the Turkish Statistical Institute and real exports are derived by deflating the export values using export unit value indices based on 2010=100. Real effective exchange rate data (ER) were obtained from the OECD database. As defined in this database, the real effective exchange rate signifies trade competitiveness of a country; it comprises of both export and import competitiveness. An increase in the ER series is associated with the appreciation of the Turkish Lira. On the contrary, a decrease in ER implies the depreciation of TL indicating the advance in competitive position of Turkey. The values for the rates are computed by the OECD; 34 OECD countries and 15 non-OECD countries were included in the calculation. Data on sectoral industrial production index (SP) were taken from the Turkish Central Bank. As a foreign income, we use Gross Domestic Product volume index of OECD Total based on the year 2010 derived from OECD database.

Henceforth, the transformed version of the equation (1) consisted with the sectoral data will be considered for the long run relationship. Specifically, the long-run relation between the sectoral real export and the real effective exchange rate, extended with sectoral industrial production index and real foreign income takes the following form:

$$EXP_t - \alpha_0 - \alpha_1 RER_t - \alpha_2 SP_t - \alpha_3 Y_t^F = \epsilon_t \quad (2)$$

where EXP_t is the sectoral real export, RER_t denotes the real effective exchange rate, SP_t is the industrial production index for each sector, Y_t^F is the index of real foreign income. All of these variables are in the logarithmic forms. Hence, the slope coefficients denote the elasticities of the explained variable with respect to the explanatory variables.

The nonlinear cointegrating model allowing short-run and long-run asymmetry was developed by Shin et al (2014). In addition to this advantage of allowing asymmetries, the method of nonlinear autoregressive distributed lag model (NARDL) which is represented in a dynamic error-correction form may exhibit the measures of the responses of the dependent variable to positive and negative shocks of the independent variables. Following Schordert (2003) and Shin at al. (2014), the new variables covering occurrences of appreciation and depreciation were presented by Arize et al. (2017). According to this approach, the time series of RER_t is decomposed into two series as RER_t^+ and RER_t^- in the following formulas:

$$RER_t^+ = \sum_{j=1}^{t} \Delta RER_t^+ = \sum_{j=1}^{t} max\left(\Delta RER_{t,0}\right)$$

$$RER_t^- = \sum_{j=1}^{t} \Delta RER_t^- = \sum_{j=1}^{t} min(\Delta RER_{t,0})$$

Here ΔRER_t^+ and ΔRER_t^- are the partial sum processes of appreciations and depreciations. Following the studies of Shin et al. (2014), Arize et al. (2017) the sectoral export equation is defined by the following asymmetric NARDL model:

$$\Delta EXP_t = \omega_0 + \omega_1 EXP_{t-1} + \omega_2^+ RER_{t-1}^+ + \omega_2^- RER_{t-1}^- + \omega_3 SP_{t-1} + \omega_4 Y_{t-1}^F + \sum_{i=1}^{P} \lambda_i \Delta EXP_{t-i} + \sum_{i=0}^{q} \rho_i^+ \Delta RER_{t-i}^+ + \sum_{i=0}^{q} \varepsilon_i^- \Delta RER_{t-i}^- + \sum_{i=1}^{r} \epsilon_i \Delta SP_{t-i} + \sum_{i=1}^{s} \epsilon_i \Delta Y_{t-i}^F + u_t \quad (3)$$

The model includes short-run and long-run asymmetries. The level variables imply the long-run relations. By following the explanations from Arize et al. (2017), it can be said that the real exchange rate has the long run coefficients as $L_r^+ = -\frac{\omega_2^+}{\omega_1}$ and $L_r^- = -\frac{\omega_2^-}{\omega_1}$. Besides, the coefficients of the lags of first difference asymmetric exchange rate terms represent the short-run asymmetries. The ordinary least squares (OLS) estimation of the equation (3) leads the way of testing the existence of an asymmetric nonlinear long-run relation. Technically, we test the null hypothesis saying that all of the coefficients of the level variables are zero ($H_0: \omega_1 = \omega_2^+ = \omega_2^- = \omega_3 = \omega_4 = 0$) against the hypothesis that these coefficients are jointly non-zero. It is referred as F_{PPS} test and the critical values of the F_{PPS} test statistic are derived from Pesaran et al. (2001) as 4.01 for the 0.05 level of significance and 3.52 for the 0.10 percent level of significance where K=4. Rejecting the null hypothesis implies the very existence of the asymmetric nonlinear cointegration. A Wald testing approach can be helpful to test the long-run symmetry and the short-run symmetry. For the former one, we can test the hypothesis saying that the asymmetric long-run coefficients are equal to each other ($H_0: L_r^+ = L_r^-$) against the alternative hypothesis that they are not equal. The short-run symmetry can be searched by imposing to test the hypothesis that sum of the short run asymmetric coefficients are equal ($H_0 = \sum_{i=1}^{q-1} \rho_i^+ = \sum_{i=1}^{q-1} \varepsilon_i^-$) against the alternative one that the sums are not equal.

3. Empirical Results

First of all, the variables of the model were analyzed regarding with their time series properties. Specifically, the stationarities of the series were searched by the method of the augmented Dickey-Fuller (ADF) testing procedures. Table 1 gives the test results for all of the variables. For each sector, I imposed ADF unit root tests on the variables *EXP* and *SPI*.

	Level[a]		First Difference[b]	
	EXP	SPI	EXP	SPI
Sector 1	-2.34 (2)	-2.39 (1)	-2.63 (1)*	-3.92 (1)**
Sector 2	-1.37 (1)	-2.29 (1)	-3.04 (1)**	-4.91 (1)**
Sector 3	-1.22 (1)	-1.73 (1)	-3.02 (1)**	-5.49 (1)**
Sector 4	-1.43 (1)	-3.33 (1)	-3.03 (1)**	-4.23 (1)**
Sector 5	-0.99 (3)	-0.18 (1)	-3.51 (1)**	-2.97 (1)**
Sector 6	-2.87 (1)	-3.14 (1)	-5.08 (1)**	-5.31 (1)**
Sector 7	-1.29 (1)	-0.73 (1)	-3.71 (1)**	-3.67 (1)**
Sector 8	-1.72 (1)	-3.18 (1)	-4.15 (1)*	-4.85 (1)**
Sector 9	-1.02 (1)	-3.12 (2)	-2.68 (1)**	-5.07 (1)**
Sector 10	-1.99 (1)	-2.93 (1)	-2.49 (1)*	-4.28 (1)**

RER = -2.36 (1) ΔRER = -3.64 (1)** and Y^F = -1.76 (1) ΔY^F = -3.33 (1)*

The number in parentheses are the appropriate lag lengths consistent with Schwarz information criteria

[a] tests include constant and trend, [b] tests include no constant no trend

* implies that the test statistic is significant at the 5 percent significance level

** implies that the test statistic is significant at the 1 percent significance level

Table 1: Unit Root Test Results

Table 1 indicates the unit root test results for the variables of *RER* and Y^F. All of the variables are nonstationary in levels since the unit root null hypotheses could not be rejected. The null hypothesis for each series in first difference form was rejected at the 5 significance level in all cases. Hence, we can conclude that all of the variables in difference forms are stationary even if they are nonstationary in levels so that no second-differencing of the variables is needed.

The estimated asymmetric NARDL models for the sectors are indicated by the Table 2. The estimated models allow for nonlinearity; they include the long-run with the short-run asymmetries. The diagnostic tests imply that the models are statistically acceptable and adequate models. The adjusted R-squares ranging from 0.736 to 0.973 imply the strong fitness of the models to the data. The numbers in brackets for the statistics of *LM* and *HET* tests represent the p-values. *LM* test is the serial correlation test; all of the *LM* tests p-values indicate that the null hypothesis of no autocorrelation is not rejected for each model. *HET* denotes the test statistic for heteroskedasticty; the p-values shows that there is no heteroskedastic problem in all significance levels except the fourth model which is statistically insignificant in 1% significance level. The tests of *CUSUM* and *CUSUMSQ* are indicating the models have the stable estimates.

Recall that F_{PPS} test statistic is used to search the asymmetric nonlinear cointegration. Remember that the critical value for 5% significance level was 4.01. All of the computed values are greater than this critical value implying that that the null hypothesis is rejected for all sector in 5% significance level. In other words, there is an asymmetric nonlinear cointegration among the variables for each sector.

The alternative approach for testing the existence of an asymmetric nonlinear long-run relation is the t-test on the coefficient of the error correction term. (Arize et al.,2017)

Specifically, the null hypothesis is $\omega_1 = 0$ and alternative hypothesis is $\omega_1 \neq 0$; if the null hypothesis is rejected, then there is long run relationship between the variables. Critical values are derived from Pesaran et al. (2001) as -3.78 and -4.37 for 5% and 1% significance levels respectively. Almost all of the estimated models have the significant t-statistics implying that there are long run relations.

Wald test statistics are specified as W_{LR} and W_{SR}; they test long-run and short-run symmetries. The values in brackets just under the test results are the p-values. For the long-run, the null hypothesis is $H_0: L_r^+ = L_r^-$ and alternative hypothesis is $H_1: L_r^+ \neq L_r^-$; if the null hypothesis rejected, then there is a long-run asymmetry. The computed values indicate that the estimated models for the sector of 1, 3, and 5 are suggesting long-run asymmetries. For the short run, the null hypothesis is $H_0 = \sum_{i=1}^{q-1} \rho_i^+ = \sum_{i=1}^{q-1} \varepsilon_i^-$ and the alternative hypothesis is $H_1 = \sum_{i=1}^{q-1} \rho_i^+ \neq \sum_{i=1}^{q-1} \varepsilon_i^-$. According to the estimated models, the p-values of the W_{SR} test statistics are less than 0.01 for the sector of 1, 2, 3, 5, 7, 8, 9 and 10, thus there is a short-run asymmetries in these sectors.

In Table 2 ΔPOS_t and ΔNEG_t are corresponding to the variables of ΔRER_t^+ and ΔRER_t^- in the equation 3. Accordingly, RER_{t-1}^+ and RER_{t-1}^- in the equation 3 are defined as POS_{t-i} and NEG_{t-i} in Table 2; the former one implies the appreciation of Turkish Lira while the latter one implies the depreciation of Turkish Lira. By using the estimated coefficients of these variables, the long run elasticity of the export for each sector were computed. These long run coefficients are separately derived for the appreciation and depreciation of the domestic currency; mainly L_{POS} and L_{NEG}.

Sector 1: Manufacture of food products and beverages

Variables

Lag	ΔEX_t	ΔPOS_t	ΔNEG_t	ΔIP_t	ΔYF_t	EX_{t-i}	POS_{t-i}	NEG_{t-i}	IP_{t-i}	YF_{t-i}	D
0			1.09 (10.91)		-5.54 (6.61)						
1					-1.44 (3.23)	-0.64 (10.07)	-0.24 (1.77)	0.80 (5.87)	0.32 (2.54)	1.08 (2.97)	-0.19 (3.96)
2	0.79 (13.14)				-2.46 (4.91)						
3	0.64 (7.08)		0.44 (4.19)								
4		-0.95 (6.42)		0.25 (2.13)							

Summary Statistics

$AdjR^2$	LM	HET	CUSUM	CUSUM SQ	F_{PPS}	t_{bdm}	L_{POS}	L_{NEG}	W_{LR}	W_{SR}
0.933	0.61 [0.449]	16.89 [0.325]	Stable	Stable	30.15	-10.08	-0.379	0.16	40.60 [0.000]	103.7 [0.000]

Sector 2: Manufacture of textiles

Variables

Lag	ΔEX_t	ΔPOS_t	ΔNEG_t	ΔIP_t	ΔYF_t	EX_{t-i}	POS_{t-i}	NEG_{t-i}	IP_{t-i}	YF_{t-i}	D
0		0.55 (2.40)	0.76 (6.84)		2.73 (4.57)						
1			-0.95 (-5.12)	0.29 (2.65)	-0.74 (-1.11)	-0.19 (-1.77)	-0.06 (-0.34)	1.11 (5.08)	-0.33 (-2.51)	-0.94 (-2.12)	-0.38 (-8.57)
2	-0.16 (-1.79)				2.79 (4.71)						
3			-0.27 (-2.65)								
4	0.17 (2.16)	0.88 (4.75)		-0.41 (-6.30)							

Summary Statistics

$AdjR^2$	LM	HET	CUSUM	CUSUMSQ	F_{PPS}	t_{bdm}	L_{POS}	L_{NEG}	W_{LR}	W_{SR}
0.915	0.103 [0.754]	25.94 [0.101]	Stable	Stable	13.47	-1.77	-0.32	5.8	2.35 [0.153]	15.12 [0.0025]

Sector 3: Manufacture of wearing apparel; dressing and dyeing of fur

Variables

Lag	ΔEX_t	ΔPOS_t	ΔNEG_t	ΔIP_t	ΔYF_t	EX_{t-i}	POS_{t-i}	NEG_{t-i}	IP_{t-i}	YF_{t-i}	D
0					1.52 (3.24)						
1				-0.16 (1.81)		-0.38 (6.91)	-0.24 (1.92)	0.53 (6.89)	-0.02 (0.25)	0.54 (1.25)	-0.15 (5.13)
2	0.12 (2.10)	0.41 (3.50)									
3		0.76 (4.89)			0.98 (2.27)						
4	-0.31 (8.16)	0.74 (5.21)									

Summary Statistics

$AdjR^2$	LM	HET	CUSUM	CUSUMSQ	F_{PPS}	t_{bdm}	L_{POS}	L_{NEG}	W_{LR}	W_{SR}
0.9342	2.24 [0.160]	11.78 [0.624]	Stable	Stable	26.15	-6.91	-0.63	1.40	39.94 [0.000]	No need

Sector 4: Manufacture of chemicals and chemical products

Variables

Lag	ΔEX_t	ΔPOS_t	ΔNEG_t	ΔIP_t	ΔYF_t	EX_{t-i}	POS_{t-i}	NEG_{t-i}	IP_{t-i}	YF_{t-i}	D
0			0.67 (4.16)		7.77 (5.83)						
1		-1.00 (-3.07)				-0.37 (-3.73)	0.71 (2.97)	0.33 (1.71)	0.33 (1.91)	-1.42 (-2.61)	0.40 (4.00)
2	0.34 (3.34)										
3		0.92 (2.83)									
4			-0.64 (-3.73)								

S u m m a r y S t a t i s t i c s

$AdjR^2$	LM	HET	CUSUM	CUSU MSQ	F_{PPS}	t_{bdm}	L_{POS}	L_{NEG}	W_{LR}	W_{SR}
0.813	2.68 [0.100]	21.77 [0.040]	Stable	Stable	5.69	-3.74	0.019	0.46	1.20 [0.287]	0.028 [0.868]

Sector 5: Manufacture of rubber and plastic products

Variables

Lag	ΔEX_t	ΔPOS_t	ΔNEG_t	ΔIP_t	ΔYF_t	EX_{t-i}	POS_{t-i}	NEG_{t-i}	IP_{t-i}	YF_{t-i}	D
0			0.83 (2.70)	0.56 (1.90)	2.41 (1.47)						
1	0.49 (3.79)	-1.30 (-2.17)			-3.58 (-2.38)	-1.15 (-6.87)	2.31 (4.36)	-0.24 (-0.55)	0.88 (2.98)	-0.54 (-0.55)	0.07 (0.72)
2	0.57 (3.87)										
3	0.27 (2.15)										
4	0.64 (4.91)										

S u m m a r y S t a t i s t i c s

$AdjR^2$	LM	HET	CUSUM	CUSU MSQ	F_{PPS}	t_{bdm}	L_{POS}	L_{NEG}	W_{LR}	W_{SR}
0.736	1.74 [0.209]	18.02 [0.261]	Stable	Stable	10.67	-6.86	2.015	-0.207	23.39 [0.0003]	10.229 [0.0064]

Sector 6: Manufacture of basic metals

Variables

Lag	ΔEX_t	ΔPOS_t	ΔNEG_t	ΔIP_t	ΔYF_t	EX_{t-i}	POS_{t-i}	NEG_{t-i}	IP_{t-i}	YF_{t-i}	D
0			-0.33 (-1.39)	0.81 (3.51)							
1	0.48 (6.20)					-0.22 (-2.98)	-0.89 (-2.40)	-0.46 (-1.97)	0.47 (2.03)	3.14 (3.15)	-0.22 (-2.60)
2				0.97 (6.95)							
3	0.13 (2.11)	1.39 (3.49)	0.39 (2.07)	-0.014 (-0.11)	-9.20 (-5.68)						
4			-1.30 (-6.23)	0.82 (6.90)	8.89 (7.47)						

S u m m a r y S t a t i s t i c s

$AdjR^2$	LM	HET	CUSUM	CUSU MSQ	F_{PPS}	t_{bdm}	L_{POS}	L_{NEG}	W_{LR}	W_{SR}
0.943	0.0296 [0.867]	24.65 [0.172]	Stable	Stable	9.89	-2.97	-4.1	-2.1	0.809 [0.389]	24.96 [0.0005]

Sector 7: Manufacture of fabricated metal products, except machinery and equipment

Variables

Lag	ΔEX_t	ΔPOS_t	ΔNEG_t	ΔIP_t	ΔYF_t	EX_{t-i}	POS_{t-i}	NEG_{t-i}	IP_{t-i}	YF_{t-i}	D
0				0.43 (2.36)							
1						-0.48 (-4.30)	0.44 (1.02)	0.06 (0.208)	-0.06 (-0.88)	2.03 (2.41)	0.004 (0.05)
2	0.41 (3.47)										
3											
4	-0.21 (2.34)			-0.26 (-1.86)							

Summary Statistics

$AdjR^2$	LM	HET	CUSUM	CUSUMSQ	F_{PPS}	t_{bdm}	L_{POS}	L_{NEG}	W_{LR}	W_{SR}
0.693	0.038 [0.847]	9.07 [0.522]	Stable	Stable	7.108	-4.302	0.93	0.13	0.947 [0.342]	No need

Sector 8: Manufacture of machinery and equipment

Variables

Lag	ΔEX_t	ΔPOS_t	ΔNEG_t	ΔIP_t	ΔYF_t	EX_{t-i}	POS_{t-i}	NEG_{t-i}	IP_{t-i}	YF_{t-i}	D
0				-0.29 (-2.36)							
1	0.34 (6.12)		-0.86 (-3.50)		-2.91 (-2.77)	-0.58 (-11.3)	0.36 (1.09)	0.95 (3.01)	-0.39 (-4.38)	2.66 (3.34)	-0.21 (-2.51)
2											
3					-1.83 (-1.76)						
4		0.58 (1.87)			-1.74 (-1.64)						

Summary Statistics

$AdjR^2$	LM	HET	CUSUM	CUSUMSQ	F_{PPS}	t_{bdm}	L_{POS}	L_{NEG}	W_{LR}	W_{SR}
0.915	1.86 [0.192]	14.06 [0.369]	Stable	Stable	45.013	-11.30	0.60	1.63	2.70 [0.119]	14.76 [0.0014]

Sector 9: Manufacture of motor vehicles, trailers and semi-trailers

Variables

Lag	ΔEX_t	ΔPOS_t	ΔNEG_t	ΔIP_t	ΔYF_t	EX_{t-i}	POS_{t-i}	NEG_{t-i}	IP_{t-i}	YF_{t-i}	D
0				-0.43 (-3.68)	6.06 (1.88)						
1						-0.39 (-3.26)	0.62 (1.05)	0.56 (1.37)	-0.36 (-2.79)	2.02 (1.26)	-0.07 (0.74)
2											
3	0.25 (2.08)										
4	0.35 (2.53)		-0.88 (-2.66)								

Summary Statistics

$AdjR^2$	LM	HET	CUSUM	CUSUMSQ	F_{PPS}	t_{bdm}	L_{POS}	L_{NEG}	W_{LR}	W_{SR}
0.603	1.44 [0.246]	13.02 [0.291]	Stable	Stable	4.47	-3.27	1.6	1.44	0.0092 [0.924]	No need

Sector 10: Manufacture of furniture											
Variables											
Lag	ΔEX_t	ΔPOS_t	ΔNEG_t	ΔIP_t	ΔYF_t	EX_{t-i}	POS_{t-i}	NEG_{t-i}	IP_{t-i}	YF_{t-i}	D
0		3.03 (14.6)	0.97 (7.86)								
1	0.16 (4.15)		-1.22 (-10.8)			-0.84 (-20.8)	1.89 (9.05)	1.67 (11.3)	-0.08 (-1.84)	0.98 (2.41)	-0.18 (-4.86)
2	0.40 (9.71)				3.41 (5.94)						
3	0.32 (5.97)	0.75 (3.70)									
4		1.17 (6.74)		0.29 (5.36)							

Summary Statistics										
$AdjR^2$	LM	HET	CUSUM	CUSUMSQ	F_{PPS}	t_{bdm}	L_{POS}	L_{NEG}	W_{LR}	W_{SR}
0.973	1.65 [0.222]	12.56 [0.704]	Stable	Stable	103.62	-20.79	2.25	1.98	0.851 [0.372]	215.78 [0.000]

The numbers in parentheses are the t-statistic values and the number in brackets are the p-values

Table 2: The Estimated NARDL Models for the Sectors

For the sector 1, 10 percent increase of the real exchange rate (appreciation of TL) generates a decrease in the export by 3.7 percent; the estimated coefficient of POS_{t-1} is statistically significant at only 10 percent significance level. On the other hand, the estimated coefficient of NEG_{t-1} is statistically significant at even 1 percent significance level and the long run coefficient, L_{NEG}, computed based on this coefficient suggests that a 10 percent decrease in the real exchange rate (depreciation of TL) causes a rise of 1.6 percent in the export. In the sector of food-beverages, the strong statistical evidence for the effect of the depreciation and the weak evidence for the effect of the appreciation seem to point the asymmetric effect of the changes in the exchange rate on the export. The model for the sector 2 presents the similar results with the previous one; the coefficient of POS_{t-1} is not statistically significant at even 10 percent level, but NEG_{t-1} has a statistically significant coefficient. Thus, it would be said that the changes in exchange rate have obviously asymmetric effects on the export for this sector of textiles. The long-run coefficient, L_{NEG}, is 5.8 proposing a strong elasticity; if there is a depreciation of TL by the amount of 1 percent, there would be an increase of 5.8 percent in the export. The results for the third model seem to be parallel to the first two models. The estimated coefficient of POS_{t-1} is negative and statistically significant at 10 percent level. The estimated long run coefficient L_{POS} is given as -0.63; the export of the wearing apparel reacts as a decline by 6.3 percent to the appreciation of the domestic currency by 10 percent. On the other hand, the value of L_{NEG} is 1.40 giving us the elasticity that is greater than unit elasticity. The export in this sector of wearing apparel reacts to the 1 percent increase of the real exchange rate by increasing with the amount of 1.4 percent. In addition to the differences of the statistically significance levels of the depreciation and appreciation, there is a great difference between the long run coefficients of these (-0.63 and 1.40) that indicates the asymmetric effects of the real exchange rate.

The fourth sector estimated model has turned out to be different from the prior models. The estimated coefficients of POS_{t-1} and NEG_{t-1} both have the positive signs but the first one is statistically significant while the second is not significant at the 5 percent level. There is a strong statistical evidence that the appreciation of TL has positive effect on the export of the chemical-chemical products sector, but the long-run coefficient, L_{POS}, gives us a fairly low elasticity which is 0.019; if there is an appreciation of TL by 10 percent, the increase in the export the sector would be only 0.19 percent. The elasticity of the export to the depreciation of the domestic currency, L_{NEG}, is 0.46; it is inelastic but greater than the value of L_{POS}, although it is hardly significant at 10 percent level. The excessive import dependency of the sector seems to be instructive for these estimated results. The export level depends on the production level and the production uses mostly the imported raw materials.

The sector 5 gives us similar estimated results with the ones derived for sector 4. The estimated coefficient of POS_{t-1} has a positive sign and it is statistically significant while the coefficient of NEG_{t-1} is not statistically significant even at 10 percent significance level. The long-run coefficient, L_{NEG}, is 2.015; if the exchange rate increases by 1 percent, the export in this sector increases by approximately 2 percent. The main input for the plastic production is obtained from the sector of petrochemical which has the property of economies of scale and technology intensive production. The sector of rubber and plastic products thus an import dependent sector at the rate of 90 percent. (Republic of Turkey, Ministry of Economy, 2016) Therefore, the appreciation of domestic currency seems to cause an increase in production and export by decreasing the cost of production in this sector.

The estimated model for the sector 6 signifies the asymmetric effect of the exchange rate change on the export since the coefficient of POS_{t-1} is significant at the 5 percent but the coefficient of NEG_{t-1} is significant at 10 percent level. The model provides a great value of the long-run coefficient for the appreciation of the currency, L_{POS}, as 4.1; the reaction of the export to the 1 percent of the appreciation is a 4.1 percent decrease. Besides, the coefficient of the NEG_{t-1} is negative. The increasing international competition in the sector of basic metals and the changing structure of demand in the commodities markets conditions may explain the strong elasticity of the export with respect to the appreciation and the negative sign of the depreciation coefficient. When it comes to the sector 7, the estimated model gives us the long run coefficients as 0.93 and 0.13 for L_{POS} and L_{NEG}. These values are fairly and they are not statistically significant. The sector of fabricated metal products in Turkey has relatively lower imported inputs for the production; the share of imported inputs in production is given as 15.5 % and the sector ranks fifteenth among the all sectors of manufacturing with regard to the import dependency. Revealed Comparative Advantages (RCA) measures the competitive power of a sector in international trade and if the score of a sector is greater than 50 it would be said that the sector has a high competitive power. The average RCA score for the sector of the fabricated metal products in Turkey over the period of 2005-2010 is 83 which implies a high competitive power in international trade (Ersoy, 2012). The low import dependency and the high international competitive power of the sector may explain why the real exchange rate does not have any significant effect on the export.

The estimated coefficient of POS_{t-1} is not statistically significant even at 10 percent significance level while the coefficient of NEG_{t-1} is significant even at 1 percent level for the sector 8; this situation signifies the asymmetric effect of the exchange rate changes in the sector of machinery and equipment. Long run coefficient of L_{NEG} is 1.63; domestic currency depreciation of 1 percent leads an increase of 1.63 percent in the export of the sector. The estimated model for the sector 9 provides the long-run coefficients as 1.6 and 1.44 for L_{POS} and L_{NEG} but they are statistically insignificant at 10 percent level. The share of imported input and the score of *RCA* for this sector of motor vehicles-trailers and semi-trailers are given as 18.6 percent and 65 respectively. (Kafalı, 2012) With these similar results as provided by the sector 7, these numbers have the potential of explaining why there is linkage between the real exchange rate and the export of the sector. Finally, both coefficients for the appreciation and depreciation in model for the sector 10, POS_{t-1} and NEG_{t-1}, are statistically significant. The long run coefficients for L_{POS} and L_{NEG} are 2.25 and 1.98 respectively. The share of imported inputs for this sector for furniture is rather high as given 31.3 and the ranking position of the sector is 3 among all the sectors of manufacturing. (Boya, 2012) Thus, the appreciation of the domestic currency makes the imported inputs cheaper and it decreases the production costs in the sector.

In general, the results derived from the estimated models in this paper point out the existence of asymmetric reactions of the export to the exchange rate changes. One of the coefficient estimates of NEG_{t-1} and POS_{t-1} is statistically significant while the other one is not significant in seven models out of ten models, if we take the significance level as a one percent significance level; this is remarking the asymmetric effects of the changes in the real exchange rate since these variables represent the depreciation and appreciation of the domestic currency.

Almost all of the sectors have the statistically significant short-run symmetry test statistics, W_{SR}, while the long-run symmetry test statistics, W_{LR}, are significant only for three models; this can be thought as another indication of the asymmetric effect of the exchange rate change on the export in sectoral perspective. Furthermore, that all of the significant coefficients of the depreciations except the one in the sector 6 have positive signs suggesting that the depreciation of domestic currency causes generally an increase in the export in these sectors, namely in the sector of 1, 2, 3, 4, 8 and 10. The statistically significant coefficients of the appreciations in the sectors of 1, 3 and 6 have negative signs; the appreciation of the domestic currency decreases the export in these sectors. On the other hand, in the sectors of 4, 5 and 10, the significant coefficients of the appreciations turned out to have positive signs suggesting the increasing reaction of the export to the domestic currency appreciation in these sectors.

4. Conclusion:

Over the past years, the researchers have been studying the relationship between real exchange rate and trade balance by studying the time series analysis methods. In the early studies, the unit root tests, stationarity and linear cointegration techniques have been used with the country base aggregated data while the later studies have preferred to work with the bilateral trade data of a country. The results of these studies have provided mixed conclusions. The most recent studies have taken the nonlinearity of cointegration into account that implies of the asymmetric effects of the changes in exchange rate. For this aim, they attempted to divide real effective exchange rate changes as the partial sum of the positive and the partial sum of the negative changes that reflect the separation of the appreciation and depreciation of the domestic currency. These studies provided statistical evidence in favor of the asymmetric effects of the exchange rate on the trade balance by using bilateral data.

In this paper, instead of searching the relations between exchange rate and trade balance based on bilateral data, the selected sectoral data of manufacturing industry in Turkey has been used to apply the newly developed nonlinear ARDL bounds testing method. Specifically, the effects of the changes in the real exchange rate on each manufacturing sectoral export in Turkey have been examined based on the assumptions of nonlinearity and asymmetric effects. The nonlinear ARDL approach gives the statistically robust relationships since it embraces the cointegration and long-run asymmetry and short-run asymmetry. The results derived from the estimated models present that there is a significant nonlinear asymmetric cointegration among the variables in each sector; that is, for all sectors, there are statistical evidences of the long-run relationships between the sectoral exports and the real exchange rate.

The estimated results indicate that there are statistically significant coefficients of the appreciation and depreciation of the domestic currency for the most of the sectors. The coefficients of the depreciations are statically significant in the manufacture sectors of furniture, basic metals, textiles, wearing apparel, food products-beverages, chemicals, machinery-equipment. Their positive signs imply that the depreciation of the domestic currency is inclined to raise the sectoral export. The relevant depreciation elasticities of the exports are bigger than one for the sectors of wearing apparel, textiles, furniture and machinery-equipment. The coefficients of the appreciation turned out to be statistically significant in the sectors of food products-beverages, rubber-plastic products, wearing apparel, chemicals, basic metals and furniture. The signs of the estimated coefficients are positive in the sectors of rubber-plastic products, chemicals, furniture; that is, the appreciation of the domestic currency causes an increase in the exports of these sector. The sectors of the rubber-plastic products, chemicals, and furniture use intensively imported inputs as it is discussed before in details. Thus, it seems that the appreciation of the domestic currency makes these inputs cheaper so that the production costs of the sectors would be lower. Alternatively, the exporters of these sectors might have reduced their prices to maintain their market share. Besides, the significant coefficients of the appreciation are negative in the sectors of food products, wearing apparel and basic metals. The appreciation of the domestic currency leads decreases in the exports of these sectors because of the rising export prices. The elasticity of the export with respect to the appreciation has the value of bigger than one in only the sector of the basic metals, the elasticities in the other two sectors are less than one.

The findings derived from the estimated model signify the validity of the asymmetric effects. On the one hand, most of the coefficients of depreciations and appreciations are statistically significant. On the other hand, the magnitudes of the depreciation coefficients are rather different from the ones of the appreciation coefficients implying the asymmetric effects. It is obvious that each sector has different export reaction to the changes of the real exchange rate. Thus, knowing the information about these reactions might be helpful for raising export level. The elastic deprecation coefficients for the sectors of furniture, textiles, wearing apparel and machinery-equipment imply that Turkey has relatively higher competitive power in these sectors. In addition to the policy of low currency value, the cost-cutting policies and thus lower export prices in these sectors generate positive contribution to the export level of the country. The elastic appreciation coefficient of the basic metals sector indicates that the appreciation of the domestic currency has high adverse effect only on the export of this sector. The other sectors are not affected that much by the appreciation. The model results imply that the adverse effects of the appreciation of the domestic currency are much less than the favorable effects of the depreciation. In other words, the currency depreciation is a more preferable policy option for raising the export level of the country.

References

Akbostanci, E. (2004). Dynamics of the Trade Balance: The Turkish J-Curve. Emerging Markets Finance and Trade 40, 57–73.

Arize, A. C. (1990). An Econometric Investigation of Export Behavior in Seven Developing Countries. Applied Economics, 891–904.

Arize, A. C. (1994). Cointegration Test of a Long-Run Relation between the Real Effective Exchange Rate and the Trade Balance. International Economic Journal, 8(3), 1–9.

Arize, A. C., Osang, T., & Slottje, D. J. (2000). Exchange-rate Volatility and Foreign Trade: Evidence from thirteen LDC's. Journal of Business and Economic Statistics, 18(1), 10–17.

Arize, A. C., & Malindretos, J. (2012). Nonstationarity and Nonlinearity in Inflation Rate: Some Further Evidence. International Review of Economics Finance, 24(1), 224–234.

Arize, A. C., & Malindretos, J.& Igwe, E.U. (2017). Do Exchange Rate Changes Improve the Trade Balance: An Asymmetric Nonlinear Cointegration Approach. International Review of Economics Finance, 49, 313-326

Aziz, N. (2008). The Role of Exchange Rate in the Trade Balance Empirics from Bangladesh. Birmingham, U.K: University Press.

Bahmani-Oskooee, M. (1991). Is There a Long-Run Relation between the Trade Balance and the Real Effective Exchange Rate of LDCs. Economics Letters, 36(4), 403–407.

Bahmani-Oskooee, M. (2001). Nominal and Real Effective Exchange Rates of Middle Eastern Countries and Their Trade performance. Applied Economics, 33(1), 103–111.

Bahmani-Oskooee, M., & Malixi, M. (1992). More Evidence on the J-curve from LDCs. Journal of Policy Modeling, 14, 641–653.

Bahmani-Oskooee, M., & Alse, J. (1994). Short-run Versus Long-run Effects of Devaluation: Error-correction Modeling and Cointegration. Eastern Economic Journal, 20(4), 453–464.

Bahmani-Oskooee, M., Kara, O. (2005). Income and Price Elasticities of Trade: Some New Estimates. The International Trade Journal 19, 165–178.

Bahmani-Oskooee, M., Kutan, A.M. (2009). The J-Curve in the Emerging Economies of Eastern Europe. Applied Economics 41, 2523–2532.

Bahmani-Oskooee, M., & Fariditavana, H. (2016). Nonlinear ARDL Approach and the J-curve Phenomenon. Open Economies Review, 27(June), 51–70.

Bahmani-Oskooee, M., Halicioglu, F., Hegerty, S. (2016). Mexican Bilateral Trade and the J-Curve: An Application of the Nonlinear ARDL Model. Economic Analysis and Policy 50, 23–40.

Bahmani-Oskooee, M. & Halicioglu, F. (2017). Asymmetric effects of exchange rate changes on Turkish. Economic Systems. 41, 279-296.

Boya, O.L. (2012). Mobilya İmalatı; Başka Yerde Sınıflandırılmamış Diğer İmalatlar. Türkiye İmalat Sanayinin Analizi. Ekonomik ve Sosyal Araştırmalar Müdürlüğü. Türkiye Kalkınma Bankası. Ankara. 1035-1076.

Brada, J.C., Kutan, A.M., Zhou, S. (1997). The Exchange Rate and the Balance of Trade: The Turkish Experience. The Journal of Development Studies 33, 675–692.

Engle, R. F., & Granger, C. W. (1987). Cointegration and error correction: Representation, estimation and testing. Econometrica, 55, 251–276.

Ersoy, E. (2012). Makine ve Teçhizatı Hariç Fabrikasyon Metal Ürünleri İmalatı. Türkiye İmalat Sanayinin Analizi. Ekonomik ve Sosyal Araştırmalar Müdürlüğü. Türkiye Kalkınma Bankası. Ankara. 661-712.

Gylfason, T., Risager, O. (1984). Does Devaluation Improve the Current Account? European Economic Review. 25, 37–64.

Goldstein, M., & Khan, M. (1978). The supply and demand for exports: A simultaneous. The Review of Economics and Statistics, 60(May), 275–286.

Halicioglu, F. (2007). The J-Curve Dynamics of Turkish Bilateral Trade: A Cointegration Approach. Journal of Economic Studies 34, 103–119.

Halicioglu, F. (2008a). The J-Curve Dynamics of Turkey: An Application of ARDL Model. Applied Economics 40, 2423–2429.

Halicioglu, F. (2008b). The Bilateral J-Curve: Turkey versus 13 Trading Partners. Journal of Asian Economics 19, 236–243

Haynes, S. E., & Stone, J. A. (1982). Impact of the terms of trade on the U.S. trade Balance: A rexamination. The Review of Economics and Statistics, 64(4), 702–706.

Hatemi, J. A., & Irandoust, M. (2005). Bilateral trade elasticities: Sweden versus her major trading partners. American Review of Political Economy, 3(2), 38–50.

Himarios, D. (1985). The effects of devaluation on the trade balance: A critical view and reexamination of Miles's new results. The Journal of International Money and Finance, 4(4), 553–563.

Himarios, D. (1989). Do devaluations improve the trade balance? The evidence revisited. Economic Inquiry, 27(1), 143–168.

Houthaker, H. S., & Magee, S. (1969). Income and price elasticities in world trade. The Review of Economics and Statistics, 111–125.

Johansen, S. (1988). Statistical analysis of cointegrated vectors. Journal of Economic Dynamics and Control, 231–254 June.

Johansen, S., & Juselius, K. (1990). Maximum likelihood estimation and inference on cointegration with application to the demand for money. Oxford Bulletin of Economics and Statistics, 52, 169–210.

Kafali, M.A. (2012). Motorlu Kara Taşıtı, Römork ve Yarı Römork İmalatı. Türkiye İmalat Sanayinin Analizi. Ekonomik ve Sosyal Araştırmalar Müdürlüğü. Türkiye Kalkınma Bankası. Ankara. 941-988.

Khan, M.S., (1974). Import and Export Demand in Developing Countries. IMF Staff Papers 21, 678–693.

Liew, K. S., Lim, K. P., & Hussain, H. (2000). Exchange rate and trade balance: The experience of ASEAN countries. Journal of Management Sciences, 3, 15–18.

Magee, S.P. (1973). Currency Contracts, Pass-Through, and Devaluation. Brookings Papers on Economic Activity 1, 303–325.

Miles, M. A. (1979). The effects of devaluation on the trade balance and the balance of payments: Some new results. Journal of Political Economy, 87(3), 600–620.

Onafowora, O. (2003). Exchange Rate and the Trade Balance in East Asia: Is there a J-Curve. Economic Bulletin, 5(18), 1–13.

Peltzman, S. (2000). Prices rise faster than they fall. Journal of Political Economy, 108(3), 466–502.

Pesaran, M., Shin, Y., & Smith, R. (2001). Bound testing approaches to the analysis of level relationships. Journal of Applied Econometrics, 16, 289–326.

Rhee, W., & Rich, W. (1995). Inflation and the asymmetric effects of money on output fluctuations. Journal of Macroeconomics, 17, 682–702.

Rose, A. K. (1990). Exchange rates and trade balance: Some evidence from developing countries. Economics Letters, 34, 271–275.

Rose, A. K., & Yellen, J. L. (1989). Is There a J-Curve? Journal of Monetary Economics, 24(1), 53–68.

Shin, Y. (1994). A residual-based test of the null of cointegration against the alternative of no cointegration. Econometric Theory, 10(1), 91–115.

Singh, T. (2002). India's trade balance: The role of income and exchange rates. Journal of Policy Modeling, 24(5), 437–452.

Sun, C., & Chiu, Y. (2010). Taiwan's trade balance and exchange rate revisited. Applied Economics, 42(7), 917–922.

Warner, D., & Kreinin, M. (1983). Determinants of international trade. Review of Economics and Statistics, February, 65, 96–104.

Wilson, P., & Tat, C. T. (2001). Exchange rates and the trade balance: The Case of Singapore, 1970 to 1996. Journal of Asian Economics, 12(1), 47–63.