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Estimation of the Marshall-Lerner Condition and J Curve Dynamics for Turkey

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Abstract

The main purpose of this study is to investigate the validity of Marshall-Lerner condition and the existence of J curve for the Turkish economy. Because of transition to the floating exchange rate regime in 2001, the analyzing period has been chosen as 2003-2016 to use monthly data for the related variables. After conducting unit- root and cointegration tests, the estimated VECM results show that Marshall- Lerner condition holds for the Turkish case. On the other hand, estimated VECM produces impulse- response functions that prove the existence of J curve for the Turkish economy in the long run.

Keywords: Trade elasticity; Marshall-Lerner condition; J-curve; Turkey.

1. Introduction

Marshall Lerner condition which was propounded by Alfred Marshall and Abba Lerner reveals that if the sum of absolute values of a country's export and import price elasticities are greater than one, devaluation of national currency provides advantage that country's trade balance.

Trade balance of a country is obtained from the absolute value of its export minus the absolute value of its import. If currency is devaluated, expert prices decrease causing an increase in export volume and import prices increase causing a decrease in import volume of the country. It is important and necessary factor that export or import quantities respond adequately to compensate for the worsening in price. This is a requirement for trade balance to be affected positively by devaluation. Sum of the elasticities in absolute value of export price and import price must greater than one to get influential devaluation that can improve country's trade balance.

Previous studies conclude that the devaluation of national currency will positively affect the trade balance in the long run on the condition that in the sum of absolute value of export and import demand elasticity are greater than one. However, Bahmani-Oskooee (1985) proves that although ML condition holds, the trade balance may proceed to get worsen. This empirical test reveals the evidence of trade movements defined by J curve. This curve includes beneficial tools to get results about response of trade balance to exchange rate and other important variables.

A change in exchange rate effects the trade balance in two ways; price effect and volume effect. The price effect refers that foreign buyers find import more expensive and domestic exports cheaper because of the national currency depreciation in the short run. This case may cause trade balance to be deteriorate. In the short run, price effect dominates on the volume effect. This situation changes in the long run if ML condition holds. The volume effect dominates the price effect and this effect provides trade balance to be improved. The total effect of exchange rate on the trade balance over time is referred as J curve (Gupta- Kapoor and Ramakrishnan, 1999). In other words; shock in real exchange rate, a national currency depreciation, makes worse the trade balance in the short run but develops in the long run (Rose and Yellen, 1989).

There are various studies examining the ML condition. Several studies use the least square methods to estimate price elasticities in export and import equations (Bahmani-Oskooee, 1986; Krugman P. R. and Baldwin, 1987; Warner and Kreinin, 1983). Main problem of these studies is not to check the stationarity of the series. Hence the results are seemed to be biased (Pandey, 2013).

Some of ML condition tests are estimated using the Johansen approach to cointegration and vector error correction model. Bahmani-Oskooee and Niroomand (1998) use Johansen Cointegration Test and stationary series to get new trade elasticities for nearly 30 countries. Jamilov (2013) tests Johansen approach and vector error correction model (VECM) to investigate J curve dynamics and ML condition for Azerbaijan economy. Eita (2013) also uses Johansen cointegration model and VECM to test ML condition for Namibia. Dong (2017) examines Marshall Lerner condition in the U.S. and other G7 member countries using Johansen cointegration method and VECM.

Generally, J curve is examined using usual time-series econometrics. Bahmani-Oskooee and Alse (1994) investigates relationship between the real effective exchange rate and the trade balance using the error correction model (ECM). Gupta- Kapoor and Ramakrishnan (1999) use Johansen- Juselius method and ECM to test whether J-curve exists with Japanese data. Akbostanci (2004) studies existence of J curve by estimating ECM and using generalized impulse response method. Halicioglu (2008) examines J- curve effect for Turkey with her 13 trading partners using bounds cointegration test developed by Pesaran and Sith (2001).

In this study relationship between the real exchange rate and the trade balance is investigated for Turkish data from 2003:01 to 2016:10 by using vector autoregressive (VAR) methodology. Cointegration analysis and VECM are

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used in order to explain differences of the short run and the long run equilibrium. Besides generalized impulse response functions are used to investigate the dynamics of trade balance.

2. Model

With assumption of infinite elasticities of export and import goods, currency market stability depends on the sum of the domestic demand elasticity of import goods ($\mathfrak{E}_m$) and foreign demand elasticity of export goods ($\mathfrak{E}_x$). If the sum of the elasticities in absolute value is greater than one, currency market is stable.

Modelling relationship between trade balance and exchange rate is fulfilled by using economic theory. Real exchange (E_t) rate can be defined as:

$$E_t = \frac{S_t.P_t}{P_t^*} \qquad (1)$$

In this equation P is domestic prices, P* is foreign prices and S is nominal exchange rate. Export value of the country is defined as the multiplication of export volume and domestic prices ($P_t.X_t$). Import value of the country is obtained from multiplication of import volume, foreign price level and nominal exchange rate ($P_t^*.S_t.M_t$). If B refers to ratio of export to import, then the trade balance can be written as follow:

$$B_t = \frac{P_t.X_t}{P_t^*.S_t.M_t} \qquad (2)$$

Using the logarithmic form of Equation (2):

$$b_t = x_t - m_t - (s_t - p_t + p_t^*) = x_t - m_t - e_t \qquad (3)$$

where $e_t = s_t - p_t + p_t^*$ is the real exchange rate in Equation (3). Long- term export and import demand functions are indicated by:

$$x_t = \alpha_0 + \alpha_1 y_t^* + \alpha_2 e_t + \varepsilon_{x,t} \qquad (4)$$
$$m_t = \beta_0 + \beta_1 y_t - \beta_2 e_t + \varepsilon_{m,t} \qquad (5)$$

where y_t and y_t^* show domestic and foreign real income, respectively. In these equations, α_2 and β_2 coefficients represent export and import elasticities, respectively.

The long- term trade balance is given by:

$$b_t = (\alpha_0 - \beta_0) + \alpha_1 y_t^* - \beta_1 y_t + (\alpha_2 + \beta_2 - 1)e_t + (\varepsilon_{x,t} - \varepsilon_{m,t}) \qquad (6)$$

The function in Equation (6) gives information about the existence of ML condition. Coefficient of e_t determines satisfaction of ML condition. This coefficient must be statistically significant and positive to improve the balance of payments. Based on the reduced form equation above, validity of ML condition is considered as:

$(\alpha_2 + \beta_2 - 1) > 0$

$(\alpha_2 + \beta_2) > 1$

3. Data and Methodology

In this part of the study, the effect of a change in the value of domestic currency on trade balance is analyzed for the floating exchange rate period in Turkey. Therefore, the estimation period covers 2003-2016 period. Since ML condition is a long term concept, it is the suitable way to use monthly frequency data. In this context, the real exchange rate (LREER) is represented by the data on real effective exchange rate index published by the CBRT. Since we do not have the monthly income series, industrial production indices which indicate a high correlation with GDP are used as the proxy variables for income. For the domestic income, the industrial production index (LIPITR) published by Turkish Statistical Institute and, for the foreign income, industrial production index published by EUROSTAT are the proxy variables. Considering the fact that more than 60% of Turkey's international trade is with the European countries, it is assumed that European Region industrial production index (LIPIEU) is the best proxy for foreign income level. The domestic data for the study period are obtained for the CBRT's electronic data distribution system; the data for the European Region are obtained by using the EUROSTAT data base. The logarithmic levels of the data for the related variables such as trade balance (LBLNC) and other variables can be seen in following graphs and the time series properties of the data is given Table 1.

Table-1. Descriptive Statistics

	LBLNC	*LIPITR*	*LIPIEU*	*LREER*
Mean	-0.437	4.597	4.631	4.685
Median	-0.437	4.622	4.625	4.690
Maximum	-0.073	4.914	4.731	4.850
Minimum	-0.679	4.001	4.514	4.495
Std. Dev.	0.097	0.192	0.043	0.078
Skewness	0.358	-0.574	0.021	0.012
Kurtosis	3.717	2.681	3.340	2.500
Number of Observation	168	168	168	168

Figure-1. Industrial Production Index of Turkey

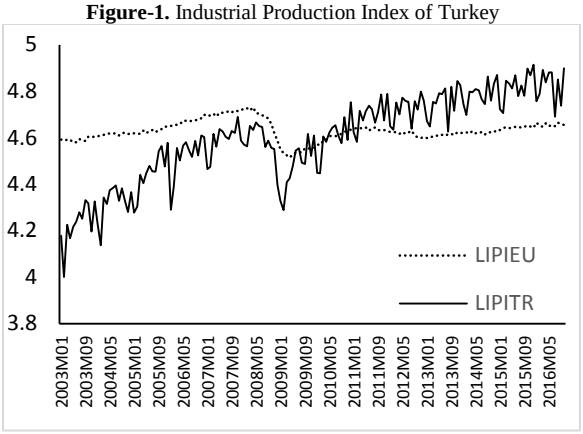


Figure-2. Trade Balance of Turkey and European Zone

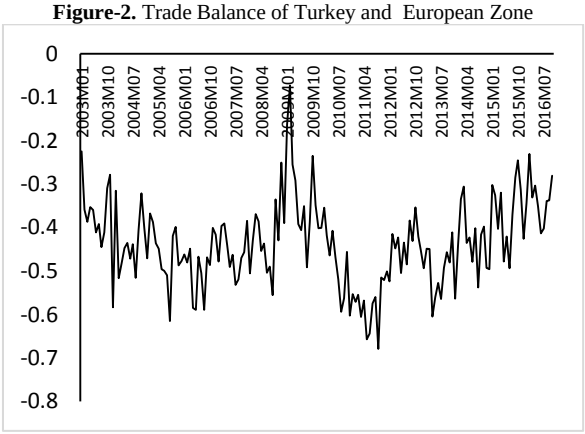
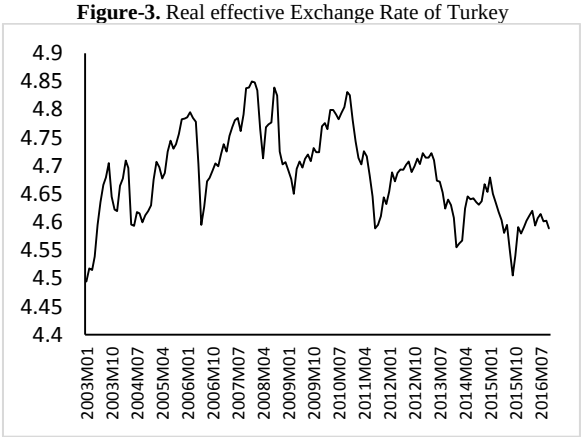


Figure-3. Real effective Exchange Rate of Turkey



It is necessary to investigate stationary properties of time series firstly. For this purpose, we will test whether the series contain a unit root or not; in other words, it is necessary to examine they show I(0) or I(1) characteristics. Augmented Dickey Fuller (ADF) test is to be used for this purpose (Dickey and Fuller, 1979). Akaike Information Criteria (AIC) was used to determine proper lag length in every model while performing this test. Table 2 displays obtained test results and series' unit root properties.

Table-2. Results of Unit Root Test

Variable	*Level*			*First Difference*			*Result*
	Lag	*ADF*	*Prob.*	*Lag*	*ADF*	*Prob.*	
LBLNC	4	2.441	0.132	2	3.947	0.002	I(1)
LIPITR	3	1.406	0.578	2	3.096	0.029	I(1)
LIPIEU	3	3.297	0.071	2	3.968	0.002	I(1)
LREER	2	2.385	0.386	4	5.388	0.000	I(1)

As seen in the result column of Table 2, all of the time series used in this study are stationary in the first differences of log levels at 5% level of significance. In other words, all series are integrated of order one. As revealed in econometric theory, existence of relationship between non-stationary time series in the long term must be investigated. Nonstationarity means that the variable doesn't clearly tend to turn back to a fixed value or linear trend. If there is at least one cointegrating vector which reveals long term steady state relationship among nonstationary time series, long term relationship can be examined among these variables.

Since all of the time series are not stationary in their log levels, but, are stationary in their first differences of log levels, the Johansen multivariate cointegration test can be used. In conducting this test, as before, the lagging structure of the model is determined by using Akaike Information Criteria and the obtained results for the Johansen test are summarized in Table 3 below.

Table-3. Results of Johansen Cointegration Test.

Number of Cointegrating Vectors	*Eigenvalue*	*Trace Statistic*	*Probability*	*Max. Eigen Statistic*	*Probability*
None	0.251	89.262*	0.000	47.895*	0.000
At Most 1	0.134	41.366	0.071	23.811	0.090
At Most 2	0.070	17.555	0.375	12.001	0.415
At Most 3	0.033	5.554	0.519	5.554	0.519

*Denotes rejection of the null hypothesis at the 0.05 level

According to the test results, both Trace and Maximum Eigenvalue statistics reveal the existence of at least 1 cointegrating vector among the variables at the 0.05 level of significance. This shows us that variables demonstrate an equilibrium relationship in the long run.

Relationship among trade balance, domestic income, foreign income and real exchange rate which are cointegrated in this analysis in the long run can be determined by Vector Error Correction Model (VECM) because of the existence of cointegrated vector among concerned variables. If the coefficients of this model to be estimated are statistically important, they can be evaluated as the long-term elasticity coefficients. Estimation results are given in Table 4.

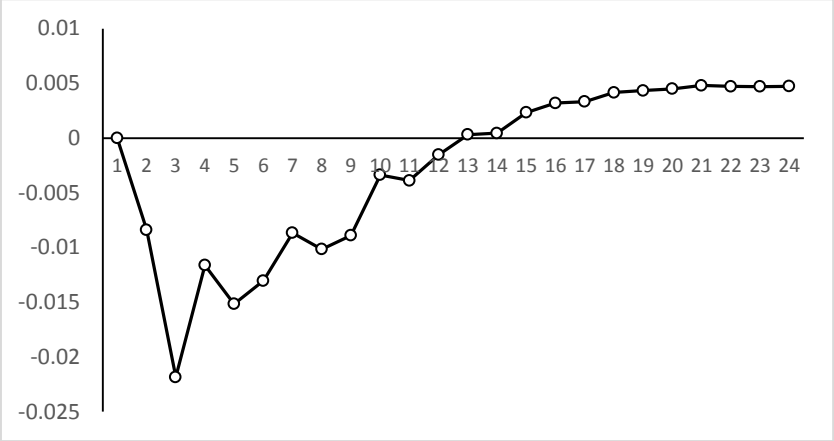
Table-4. VECM Forecast Results

Coefficient	*Forecast*	*t- Statistics*	*Probability*
$(\alpha_0 - \beta_{0})$	-0.815	0.500	0.346
(α_1)	-0.238	0.636	0.285
(β_1)	-0.053	0.677	0.233
$(\alpha_2 + \beta_2 - 1)$	0.554	2.798	0.001

Results indicate that α_1 and β_1 coefficients are invalid statistically. In other words, foreign and domestic income level are not statistically effective on trade balance respectively. Coefficient of real exchange rate is valid at the 0.01 level of significance and this coefficient is greater than zero. This situation shows that ML condition is valid for the investigation period in Turkey. According to this result, 1 percent decrease in the value of Turkish Lira in real terms causes an improvement in trade balance approximately 0.5 percent in the long run.

The forecasting methodology used enables us to determine the short and long terms dynamics of trade balance created by a positive shock in real exchange rate. The following Figure 4 shows the effect of one standard deviation shock in real exchange rate on foreign trade balance.

Figure-4. Response of Trade Balance to Real Exchange Rate



According to the figure, the depreciation of the Turkish Lira causes a deterioration in the trade balance during the first three months. However, this effect turns to be an improvement in trade balance beginning from the 4th month up to 13th month. This effect is neutralized at this period and stays permanent up to the 24th month. This proves us that the so called J curve in international trade theory is valid in the special case of Turkey. As Krugman P. (1991) states it is generally accepted that the short-term adjustment usually occurs in a year. In this case, the J curve concept gains validity under the Turkish economy conditions.

4. Conclusion

This study attempts to estimate Marshall- Lerner condition and to investigate the existence of J curve phenomenon for Turkey. For this purpose, the monthly data over the 2003- 2016 period were used and the effects of real exchange variation on trade balance in the short and the long terms were analysed for the Turkish economy. Since it has the largest share in Turkey's international trade, European region is selected as the representative variable for the international variables in the study. After conducting unit root and cointegration tests, the impulse-response functions produced VECM are analysed to see the response of trade balance to real exchange rate shocks. Empirical results indicate that the Marshall- Lerner condition holds in the long- run for the analysing period in Turkey.

The obtained impulse- response functions for the model reveal that a depreciation of the domestic currency worsens the trade balance in the very-short-run while it improves the trade balance during transition from the short to long-run. Thus, Turkish data present an indication that is coherent with the J curve phenomenon.

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