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The validity of Marshall-Lerner condition in Turkey: A cointegration approach

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Abstract. *In recent years, it is discussed that the currency adjustments (devaluations) may frequently have impact on current account deficit associated with the increase in current account deficit. The impact of devaluation on balance of trade depends on the effectiveness of Marshall-Lerner condition. In this study, the validity of Marshall-Lerner condition in Turkey was investigated. According to the results of Johansen cointegration test and error correction model which were obtained by using annual data of 1980-2012 period; some findings were obtained about the validity of Marshall-Lerner condition in the long run.*

Keywords: Marshall-Lerner Condition, Current Account Deficit, Cointegration, Error Correction Model.

JEL Classification: C22 F32.
REL Classification: 8N.

1. Introduction

Export-led growth policies which are applied in Turkey after 1980 increased foreign trade volume rapidly, however this situation caused the emergence of current account deficit problem. Economic and political crises which arise from the liberalization of capital movements in 1989 led to increase in current account deficit problem. In particular, the increase in current account deficit quickened after 2001 crisis. In discussions about current account deficit which is one of the most important economic problems of Turkey in recent years, it was frequently claimed that Turkish Lira is overvalued and currency adjustments may decrease current account deficit. However the increase in export and the decrease in import after appreciation of foreign currencies depends on demand and supply elasticity of exported and imported goods (Miles, 1979).

2. The elasticity approach and Marshall-Lerner condition

Several theories were developed to explain current account balance. One of these theories is "The Elasticity Approach". The Elasticity Approach focuses on balance of trade which is one of the main subcategories of current account balance and it assumes that relative international prices are main explanatory variable determining current account balance. This approach analyses the impact of a potential devaluation on balance of trade (Erkılıç, 2006: 17).

According to the Elasticity Approach, when a country devaluates its currency, offsetting of balance of payments depends on demand elasticity of exported and imported goods. Devaluation affects balance of payments in three ways: firstly the decrease in the amount of imported goods because of the increase in the prices of these goods; secondly increase in export because of the decrease in the prices of exported goods; and thirdly lower revenue from one exported good because of devaluation. Net results of these three impacts depend on export and import elasticity. If the sum of the export and import elasticity are bigger than 1 (one) the impact will be positive. This condition is known as Marshall-Lerner condition (Yıldırım and Özer, 2006: 332).

In studies, it was found that the elasticity of exports and imports with respect to the exchange rate is very low in short run, that is Marshall-Lerner condition cannot be fulfilled, however the elasticities are high in the long run and sum of the elasticities may be higher than 1 (one). Thus, devaluation will increase the foreign trade deficit in the short run. The reason is that devaluation makes import more

expensive and the value of export cheaper in the short run in terms of foreign currency revenues and it has less impact on the increase in export and the decrease in import. That is, economic entities need a certain time period in order to adapt themselves to new prices. However, the expected impacts of devaluation can be seen after a while and balance of trade will recover.

In Marshall-Lerner condition, for a devaluation to have a positive impact on foreign trade performance, the sum of absolute values of demand elasticity of exported and imported goods must be greater than 1 (Marshall, 1923; Lerner, 1944). In recent studies, it is asserted that the impacts of changes in foreign exchange rates on balance of trade cannot be explained with elasticity which is calculated by seeing only the changes in the prices and quantities of goods and so income effect should be added to the model.

This study is based on the export and import functions which were used in the 'Long-Run Price Elasticities and the Marshall–Lerner Condition revisited' study of Mohsen Bahmani-Oskooee and Farhang Niroomand in 1998 (Bahmani-Oskooee and Niroomand, 1998: 102). According to this model;

Import demand function:

$LnM_t = a + bLn(PM/PD)_t + cLnY_t + \varepsilon_t$.

In this function: M –import, PM – price of import, PD – domestic price level, Y – domestic income, ε – error term. Natural logarithms of all variables in the model were taken.

The increases in import price levels with respect to domestic price levels decrease import and price elasticity of import is expected to be negative ($b < 0$). According to Keynesian theory, it is expected that increase in domestic income raises import, hence income elasticity is expected to be positive ($c > 0$). However, in literature since the increase in domestic income raises import-substituting production, income elasticity will be negative.

Export demand function:

$LnX_t = a' + b'Ln(PX/PXW)_t + c'Ln(YW)_t + \varepsilon_t'$.

In this function: X – export of Turkey, PX – price of export, PXW – world export price levels, YW – world income level and ε_t' – error term. Natural logarithms of all variables in the model were taken. The increases in export prices with respect to world export price levels create the expectation of a decrease in export. So b' should be smaller than 0 ($b' < 0$). When world income level increases it is

expected that the export of country will increase so c' is expected to be higher than 0 ($c' > 0$).

According to 'Marshall-Lerner Condition', the sum of price elasticity of export demand and import demand should be higher than 1. In other words, for a change in foreign exchange rates to have a positive impact on balance of trade, sum of these demand elasticities should be higher than 1.

3. Literature

Bahmani-Oskooee and Niroomand (1998) asserted that demand elasticity of export and import is inelastic in the short run and elastic in the long run by using data of 27 countries in the period of 1960-1992. For this reason, while devaluation has negative impacts on current account balance in the short run, it has positive impacts in the long run.

Baharumshah (2001) investigated the impacts of macroeconomic factors of USA, Japan, Thailand and Malaysia on balance of trade through VaR model by using data of 1980-1996 period. In conclusion, he inferred that exchange rate is an important variable affecting balance of trade in the long run.

Narayan (2004) analysed the relationship between exchange rate and balance of trade in New Zealand's economy through cointegration method by using data of 1970-2000 period and he could not find a cointegration relationship between exchange rate and balance of trade in New Zealand. However it was verified that there is J curve for balance of trade of New Zealand.

Mahmood et al. (2004) estimated elasticity of export and import prices of 6 developed countries. Based on these estimations, they showed that Marshall-Lerner Condition is partially satisfied in some periods and it is valid in fixed exchange rate regime.

Hooy and Chan (2008) made analysis through Bounds Testing Approach (ARDL) and generalized impulse response analysis by using data of January 1990-January 2008 period and they found results which support Marshall-Lerner Condition.

Jamilov (2011) investigated the validity of J curve for Azerbaijan's economy and concluded that an increase in exchange rates affects balance of trade negatively in following 12 months and after that positive impacts can be seen and J curve will be valid.

Hsiao et al. (2012) ascertained that Marshall-Lerner Condition is satisfied in trade of China with Japan, and J curve is valid in trade of China with European Union countries.

There is not an agreement about studies in which the validity of Marshall-Lerner Condition in Turkey's economy. The reason of dissidence is that different time periods, data structures (monthly, quarterly and annual) and methods are used.

Yamak and Korkmaz (2005) investigated the impacts of real exchange rate changes on balance of trade of Turkey through Granger causality test and VaR model-based impulse response analysis by using data of 1995Q1-2004Q4 period. They concluded that there is not a long-run correlation between the variables.

Şimşek and Kadılar (2005) analysed export demand model in Turkey through bounds testing approach by using data of 1970-2002 period and they concluded that Marshall-Lerner Condition is satisfied.

Peker (2008) analysed the relationship between exchange rate and balance of trade in Turkey through cointegration method by using monthly data of 1992-2006 period and they concluded that Marshall-Lerner Condition is not satisfied.

Hepaktan (2009) investigated Marshall-Lerner Condition in Turkey through cointegration method by using data of 1980-2008 period and concluded that this condition does not work accurately.

Çil Yavuz et al. (2010) investigated the validity of Marshall-Lerner Condition in Turkey through bounds testing approach by using data of 1988-2007 period and they concluded that this condition is invalid in Turkey.

Okay et al. (2012) analysed the relationship between exchange rate and balance of trade in Turkey through Johansen cointegration test and vector error correction model (VECM) by using data of 2003:M01-2010:M12 period and they concluded that Marshall-Lerner Condition is valid in Turkey.

Göçer and Elmas (2013) performed cointegration test through dynamic ordinary least square (DOLS) method and used data of 1989Q1-2012Q2 period. They concluded that Marshall-Lerner Condition is valid.

4. Method and data set

Turkey's import (M) and export (X) data, import price index (PM) and export price index (PX), Turkey's gross domestic product (GDP) and world gross domestic product (WY) data were used in order to test the elasticity approach. The period of data is 1980-2012 and annual data were used in the analysis. GDP, export and import data are taken in terms of million dollar (USD) and these data were deflated by using 2005-based related price indexes. Natural logarithms of all variables in the model were taken.

Data were collected from the web sites of Turkish Republic Central Bank electronic data delivery system, Ministry Of Development, General Directorate of Budget and Fiscal Control, and United Nations data set (UNDATA).

4.1. Stationarity tests

In literature, there are several unit root tests in order to determine stationarity of series and the most commonly used test is Augmented Dickey Fuller (ADF) test. In this study, unit root test which regards structural breakage suggested by ADF test and Zivot-Andrews were used.

Table 3. *ADF Unit Root Tests*

Variables	Levels		Diferences	
	intercept	intercept and trend	intercept	intercept and trend
lnX	-0,79	-2,67	-4,94**	-4,97**
lnM	-1,31	-3,59*	-7,65**	-7,71**
lnGSYH	0,30	-2,09	-5,96**	-6,14**
WY	-0,53	-3,00	-4,41**	-4,39**
ln(PX/PXW)	-2,80	-2,48	-6,17**	-6,51**
Ln(PM/PD)	-1,49	-2,41	-7,17**	-7,08**

** and * denote significance at 1% and 5% levels.

Table 3. *Zivot-Andrews Unit Root Tests*

Variables	Levels		Break Point
	intercept	intercept and trend	
lnX	-5,04*	-	2003
lnM	-4,23	-4,78	1990
lnGSYH	-3,58	-3,80	2004
WY	-3,51	-4,03	2006
ln(PX/PXW)	-4,73	-	2004
Ln(PM/PD)	-5,17*	-2,41	2003

** and * denote significance at 1% and 5% levels.

When unit root tests are analysed, it was seen that not all variables are stationary and these variables are stationary when taking first differences. Since the variables are first order stationary, cointegration relations between these variables were examined. Import and export demand functions of Turkey were estimated in order to test elasticity approach and determine whether Marshall-Lerner Condition is satisfied.

4.2. Results of cointegration test

Series subjecting to analysis in consequence of unit root tests are not stationary however if they are integrated at the same degree (first degree), cointegration relations between variables can be estimated and long-run relations can be defined.

4.2.1. Estimate of import demand function

Firstly, length of lag was determined through an unrestricted vector autoregression (VAR) model in order to perform Johansen cointegration test. There many criteria of determination of length of lag. AIC (Akaike Information Criterion) is one these criteria and its results are given below.

Lag	AIC
0	1.167435
1	-4.448756
2	-4.381232
3	-4.337920
4	-4.450202*

According to the result, four was chosen as the length of lag. When lag is four, it was seen that there is not autocorrelation problem and this situation was determined through the results of Breusch-Godfrey LM test.

Lag	LM-Stat.	Probability
1	10.17885	0.3362
2	6.097651	0.7301
3	5.320041	0.8056
4	9.035911	0.4340

Table 6. *Johansen's Cointegration Tests*

Number of Cointegration	Eigenvalue	Trace Statistic	0.05 Critical Value	Probability
r=0*	0.841520	70.16339	29.79707	0.0000
r ≤ 1*	0.612287	24.11015	15.49471	0.0020
r ≤ 2	0.016775	0.422929	3.841466	0.5155

Number of Cointegration	Eigenvalue	Max. Eigenvalue Statistic	0.05 Critical Value	Probability
r=0*	0.841520	46.05324	21.13162	0.0000
r ≤ 1*	0.612287	23.68722	14.26460	0.0012
r ≤ 2	0.016775	0.422929	3.841466	0.5155

According to the Table above, it can be seen that there is cointegration between variables and the number of cointegrated vector is at most 2. Cointegration equation is defined as;

$$\underset{}{\textit{Ln}\mathbf{M}} = \underset{\mathbf{(0.23837)}}{\mathbf{-2{,}174023}\ \textit{Ln}\mathbf{(PM/PD)}} + \underset{\mathbf{(0.06983)}}{\mathbf{1.916995}\ \textit{Ln}\mathbf{Y}} + \mathbf{23{,}33509}$$
$$\mathbf{[9.12]} \qquad\qquad \mathbf{[\ 27.45]}$$

In this equation, the values in parenthesis shows standard errors of parameters and the values in square brackets show t-statistics. According to the results of this model, price elasticity of import is negative (-2.17) as expected and it is statistically significant. Income elasticity of import is positive (1.91) as expected and it is statistically significant.

When there is a deviation in long-run relation between cointegrated variables, it was investigated through Error Correction Model whether the deviation disappears in time and long-run balance is regained. Error Correction Model estimation results which were estimated through cointegration relations are as follows:

	Coefficients	Std. Error	t-statistic	Probability
ECM(-1)	-0.644628	0.246014	-2.620292	0.0238
Δ(LnM(-1))	-1.425449	0.404757	-3.521745	0.0048
Δ (LnM(-2))	-1.031156	0.397060	-2.596979	0.0248
Δ (LnM(-3))	-0.713130	0.462635	-1.541452	0.1515
Δ (LnM(-4))	0.735262	0.354168	2.076023	0.0621
Δ (Ln(PM/PD)(-1))	1.330482	0.701020	1.897924	0.0842
Δ (Ln(PM/PD)(-2))	0.484697	0.549904	0.881420	0.3969
Δ (Ln(PM/PD)(-3))	1.192205	0.564570	2.111705	0.0584
D(Ln(PM/PD)(-4))	1.480563	0.571251	2.591789	0.0251
Δ (LnY(-1))	0.400523	0.442226	0.905697	0.3845
Δ (LnY(-2))	0.738367	0.440472	1.676309	0.1218
Δ (LnY(-3))	0.176877	0.511569	0.345754	0.7360
Δ (LnY(-4))	-1.920769	0.554293	-3.465259	0.0053

	Coefficients	Std. Error	t-statistic	Probability
Sabit	0.286940	0.070849	4.050051	0.0019
R^2	0.671995	Akaike info criterion		-0.798895
Adjusted R^2	0.284352	Schwarz criterion		-0.116324
F-statistic	1.733543	Hannan-Quinn criter.		-0.609579
Prob(F-statistic)	0.183717	Durbin-Watson stat		2.212090

In the model, the coefficient of error correction term is defined as (ECM_{t-1}) –0.644. The sign of error correction term is negative and it is statistically significant. Accordingly, 64% of deviations from long-run balance recover in a period and it will approach to long-run balance.

4.2.2. Estimation of export demand function

According to Akaike information criterion, the length of lag of export demand function was defined as 1 through unrestricted vector autoregression (VAR) model.

Lag	AIC
0	-6.232543
1	-12.55540*
2	-12.28611
3	-11.99749
4	-12.45952

When lag is 1, it was seen that there is not autocorrelation problem and this situation was determined through the results of Breusch-Godfrey LM test below.

Lag	LM-statistic	Probability
1	7.907566	0.5435
2	8.828093	0.4533
3	9.548515	0.3883
4	2.451313	0.9822

Table 6. *Johansen's Cointegration Tests*

Number of		Trace	0.05	
Cointegration	Eigenvalue	Statistic	Critical Value	Probability
r=0*	0.510601	45.03985	35.19275	0.0032
r ≤ 1*	0.490283	24.31713	20.26184	0.0131
r ≤ 2	0.151787	4.774072	9.164546	0.3091
Number of		Max. Eigenvalue	0.05	
Cointegration	Eigenvalue	Statistic	Critical Value	Probability
r=0	0.510601	20.72272	22.29962	0.0817
r ≤ 1*	0.490283	19.54306	15.89210	0.0127
r ≤ 2	0.151787	4.774072	9.164546	0.3091

According to the Table above, it can be seen that there is cointegration between variables and the number of cointegrated vector is at most 2. Cointegration function is defined as;

LnX = -0,139450 Ln(PX/WPX) + 3,734149 Ln(WY) - 55,10708
(0,58117) (0,16042) (2,80986)
[-0,24] [23,27] [-19,61]

Price elasticity of export is negative, however it statistically insignificant; income elasticity of export demand is positive as expected and it is statistically significant. Error correction model estimation results which are based on cointegration relations are given in the table below.

	Coefficient	Std. Error	t-statistic	Probability
ECM_{t-1}	0.180387	0.091220	1.977496	0.0591
$\Delta(LnX_{t-1})$	-0.061247	0.258264	-0.237150	0.8145
$\Delta(Ln(PX/WPX)_{t-1})$	0.041066	0.394144	0.104191	0.9178
Δ(lnWY(-1))	0.783831	1.312146	0.597366	0.5556
R^2	0.089310	Akaike info criterion		-1.987665
Adjusted R^2	0.022002	Schwarz criterion		-1.799073
F-stattistic	0,683229	Hannan-Quinn criter.		-1.928600
Prob(F-statistic)	0.183717	Durbin-Watson stat.		1.633645

In the model, the coefficient of error correction term is defined as (ECM_{t-1}) 0,180387. The sign of error correction term is positive and it is statistically insignificant. It shows that deviations from long-run balance which will occur in short run will diverge gradually.

5. Result and proposals

According to the estimation results of export and import demand functions of Turkey, this study in which the validity of Marshall-Lerner Condition in Turkey was analysed supports Marshall-Lerner Condition because the elasticity of export and import demands is higher than 1. However, in the short run, a statistically significant relation between the variables could not be found. Consequently, it was found that currency adjustments (devaluation) may be effective in reducing current account deficit in the long run.

References

Bahmani-Oskooee, M., Niroomand, F. (1998). "Long-Run Price Elasticities and The Marshall-Lerner Condition" Revised, *Economics Letters*, 61(1), pp. 101-109

Boyd, D., Caporale Gugielmo, Maria, Smith, R. (2001). "Real Exchange Rate Effects on The Balance of Trade:Cointegration And The Marshall–Lerner Condition", *International Journal Of Finance And Economics*, 6, pp.187-200

Çil Yavuz, N., Güriş, B. Kıran, ve B. (2010). "The effect of real exchange rate on trade balance: The test of Marshall Lerner condition for Turkey", *İktisat İşletme ve Finans*, 25(287), pp. 69-90

Erkılıç, Serdar (2006). "Türkiye'de Cari Açığın Belirleyicileri" (Uzmanlık Yeterlik Tezi), Türkiye Cumhuriyeti Merkez Bankası İstatistik Genel Müdürlüğü, Ankara

Göçer İ., Elmas, B. (2013). "The Effects of Real Exchange Rate Changes on Turkey's Foreign Trade Performance within the Framework of the Extended Marshall-Lerner Condition: Time Series Analysis with Multiple Structural Breaks", *Journal of BRSA Banking and Financial Markets*, 7(1), pp.137-157

Hepaktan, C.E. (2009). 'The Analysis of Fractional Co-Integration related to Marshall-Lerner Condition of Turkey", *Journal of Management and Economics*, Celal Bayar University The Faculty of Economic and Administrative Sciences Journal, 16(1), pp. 39-55

Hooy, Chee-Wooi, Chan, Tze-Haw (2008). "Examining Exchange Rates Exposure, J-Curve and the Marshall-Lerner Condition for High Frequency Trade Series between China and Malaysia", *MPRA Paper 10916*, University Library of Munich, Germany

Johansen, S. (1988). "Statistical Analysis of Cointegration Vectors," *Journal of Economic Dynamics and Control*, Vol. 12, No. 2-3, pp. 231-254

Johansen, S., Juselius, K. (1990). "Maximum Likelihood Estimation and Inferences on Cointegration – with Application to the Demand for Money", *Oxford Bulletin of Economics and Statistics*, 52, pp. 169-210

Lerner, A.P. (1944). The Economics of Control: Principles of Welfare Economics, The Macmillan Company, New York

Mahmud, S.F., Ullah, A., Yücel, E.M. (2004). "Testing Marshall-Lerner Condition: A Non-Parametric Approach", *Applied Economics Letters*, Volume 11, Issue 4, Marshall, A. (1923), Money, Credit and Commerce, Macmillan, London

Mocan, Naci, H. (1987). "Marshall-Lerner Condition, Expected Market Change and Exchange Rate Determination", *Atlantic Economic Journal*, Vol. 15(1), City University of NewYork, USA, March 1987, p. 121

Miles, M.A. (1979). "The Effects of Devaluation on the Trade Balance and the Balance of Payment: Some New Results", *Journal of Political Economy*, 6, pp. 600-620

Okay, E., Atabay Baytar, R. ve Sarıdoğan, E. (2012). "The effects of the exchange rate changes on the current account balance in the Turkish economy", *İktisat İşletme ve Finans*, 27(310), pp. 79-101

Peker, O. (2008). "Reel Döviz Kurunun Ticaret Dengesi Üzerindeki Etkileri: Türkiye Örneği", *Atatürk University Journal of Economics and Administrative Sciences*, 22(2), pp. 33-43

Sivri, U. ve C. Usta (2001). "Reel Döviz Kuru, İhracat ve İthalat Arasındaki İlişki", *Uludağ Üniversitesi İ.İ.B.F. Dergisi*, 19 (4), pp. 1-9

Şimşek, M. ve Kadılar, C. (2005). "The Cointegration Analysis of Turkey's Export Demand Function by Bounds Test", *Doğuş University Journal*, 6 (1), pp. 144-152

Yamak, R. ve Korkmaz, A. (2005). "Reel Döviz Kuru ve Dıs Ticaret İlişkisi: Kritik Elastikiyetler (Marshall-Lerner) Şartı", *İstanbul Üniversitesi Ekonometri ve İstatistik Dergisi*, 2, pp. 16-38

Yıldırım, K.; Mustafa Özer (2006). "İktisat Teorisi", Anadolu Üniversitesi Yayınları, Eskişehir