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The effects of real exchange rates and income on the trade balance: A second generation panel data analysis for transition economies and Turkey

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I dedicate this article to Doç. Dr. Yılmaz Kılıçaslan.

Abstract. *In this study, effects of real exchange rate, domestic and foreign income on the external trade balance has been analysed in the framework of the extended Marshall-Lerner condition and J-curve phenomenon using 1995:Q1-2015:Q4 period data for fourteen transition economy and Turkey by means of panel cointegration analysis with multiple structural breaks under cross-sectional dependency.*

Cross-sectional dependence has been analysed with the bias-adjusted cross-section dependence Lagrange multiplier developed by Pesaran et al. (2008) and cross-section dependency has been observed among the countries. Stationary of the series has been tested with the panel unit root test with multiple structural breaks developed by Carrion-i-Silvestre et al. (2005) and it has been found that series are non-stationary in level. The existence of a cointegration relationship between series has been tested with the panel cointegration test with multiple structural breaks developed by Basher and Westerlund (2009) and a cointegration relationship has been observed between the series. Cointegration coefficients have been estimated with the Pesaran (2006) Common Correlated Effects method. According to the analysis result we found evidence that support the extended Marshall-Lerner condition in Belarus, Bulgaria, Croatia, Hungary, Latvia, Poland, Romania, Russia, Slovakia, Slovenia and Turkey. Furthermore, the J-curve phenomenon is valid in Belarus, Romania and Slovenia.

Keywords: trade balance, real exchange rates, cross-sectional dependence, panel data analysis, transition economies.

JEL Classification: C33, F31, O24.

Introduction

In the 1980s, with the beginning of the transition process to the market economy and globalisation, economies have made more dependent on each other and more sensitive to external events. Therefore, relationship between foreign exchange policies and the external trade performances of countries has become a common subject of research (Thirlwall and Gibson, 1986; Taylor and Sarno, 1998; Hook and Boon, 2000). Understanding the relationship between the terms of exchange rates and the trade balance is the key to a successful trade policy (Bahmani-Oskooee and Ratha, 2004).

The relationship between exchange rate policies and a country's trade balance is traditionally analysed by examining Marshall-Lerner condition(1). The condition suggests that real currency depreciation improves a country's trade balance in the long run if export and import volumes are sufficiently elastic with respect to the real exchange rate. In order to take place the Marshall-Lerner condition as econometric, the coefficient of the real exchange rate variable should be positive in the long run (Gocer and Elmas, 2013). After real currency depreciation, a country's trade balance worsens immediately and begins to improve later, its figure looks like the J letter, and therefore is called the "J-curve" (Krugman and Obstfeld, 1997). Dynamic impacts of the exchange rate on the trade balance are known as the J-curve phenomenon. In order for this hypothesis to econometrically take place, the coefficient of the real exchange rate variable should be negative in the short run and positive in the long run (Gocer and Elmas, 2013).

In studies recently, it is reported that explaining the effects of changes in exchange rates on foreign trade balance with the elasticities calculated by just observing changes in the price and the amount of goods is not sufficient and income effects should also be involved in the model Bahmani-Oskooee ve Niroomand, 1998; Fan et al., 2004; Gomez and Ude, 2006; Sastre, 2012). Therefore, Marshall-Lerner condition was extended with domestic and foreign income by following Ahmad and Yang (2004), Gocer and Elmas (2013) and many other studies, we adopt the following specification:

$$BT_{it} = \beta_{0i} + \beta_1 REXR_{it} + \beta_2 Y_{it}^{d} + \beta_3 Y_{it}^{f} + \varepsilon_{it} \quad (1)$$

where *BT, REXR,* Y^d, Y^f and ε_{it} express respectively trade balance, real exchange rate, domestic income, foreign income and error term. Note that estimate of β_1 is expected to be positive to fulfil the extend Marshall-Lerner condition. Because, a real exchange depreciation improves the foreign trade deficit. Estimate of β_2 is expected to be negative, for usually an increase in domestic income stimulates to higher imports. If an increase in the foreign income leads to higher exports yielding a positive estimate for β_3. Therefore, foreign trade balances of countries are determined depending on the real exchange rate, the domestic income and foreign income levels. In this study, in order to observe the effects of transition countries' membership to European Union on foreign trade balance, the EU dummy variable was also added and the following model was obtained:

$$BT_{it} = \beta_{0i} + \beta_1 REXR_{it} + \beta_2 Y_{it}^{f} + \beta_3 Y_{it}^{d} + \beta_4 D_{EU} + \varepsilon_{it} \quad (2)$$

Several studies have been carried out analysing the relationship between the real foreign exchange rate and the trade balance and different results have been obtained depending on the countries and periods used within the analysis.

This study was divided two sections. In the second part following the introduction, an abstract of literature will be given, in the third part empirical analysis will be presented and the study will be completed with conclusions and evaluation at the end. It is evaluated that this study will a contribute to the literature with the subject matter and the used analysis methods.

1. Literature review

Arize (1994) has researched the relationship between the real exchange rate and the trade balance with 1973-1991 period data for nine Asian countries. He reported that there is a positive and significant relationship between the trade balance and the real effective exchange rate in these countries and the Marshall-Lerner condition is valid in these countries. Bahmani-Oskooee and Niroomand (1998) have reported the elasticity condition using 1960-1992 period data and as certained that the elasticity condition is supported in many countries.

Wilson (2001) tested the relationship between the real exchange rate and the trade balance of Singapore, Korea and Malaysia with the USA and Japan and it was found no evidence supporting the J-Curve phenomenon in Singapure and Malaysia. Baharumshah (2001) has researched the effects of macroeconomic factors on the trade balance of the USA, Japan, Thailand and Malaysia using the 1980-1996 period data and concluded that the real exchange rate is a crucial variable affecting the trade balance in the long run Fan et al. (2004) tested extended Marshall-Lerner condition for China and found sum absolute values of export and import elasticities 1.93. Therefore, they reported that extended Marshall-Lerner condition is satisfied in China. Narayan (2004) analysed the relationship between the real exchange rate and the trade balance with the cointegration method using the 1970-2000 period data of New Zealand’s economy. However, he has not obtained any support about the cointegration relationship between the real exchange rate and the trade balance of New Zealand, although he has reported that the J-curve phenomenon is valid.

Gianella and Chanteloup (2006), have researched the effects of increases in the real exchange rate on imports and exports with the 1995-2004 period data for OECD countries. He found that price elasticities are 0.6 for imports and 0.7 for exports and the Marshall-Lerner condition is supported. Yazici (2008) reported the response of exchange rate changes on Turkish trade balances for 1986-1998 periods. He found that after domestic currency depreciation, the trade balance first improves, then deteriorates and then improves again. Matesanz and Fugarolas (2009) checked the J-curve phenomenon for Argentina by means of impulse-response functions and were unable to derive a conclusion to support a J-curve phenomenon pattern in the short run. Bahmani-Oskooee and Kutan (2009) analysed the validity of the J-curve phenomenon in the Bulgaria, Croatia, Cyprus, Czech Republic, Hungary, Poland, Romania, Russia, Slovakia, Turkey and Ukraine economies with the limit test methods and determined that this effect is valid in Bulgaria, Croatia and Russia.

Yazici and Klasra (2010) investigated how the response of trade balance to devaluation is affected in J-curve framework using the generalised impulse response function analysis for the manufacturing and mining sectors of the Turkish economy. The obtained results indicate that the J-curve phenomenon is valid in neither sector. Hsing (2010) tested whether the Marshall-Lerner condition is valid for eight Asian countries and confirmed that the Marshall-Lerner condition holds for India, Korea, Japan and Pakistan, it is valid for Hong Kong, Singapore and Thailand using relative CPI, but cannot be confirmed for Malaysia. Wen (2011) reported that the Marshall-Lerner condition is not supported in China's economy. Jamilov (2011) analysed the validity of the J-curve phenomenon for Azerbaijan's economy and observed that an actual depreciation of the domestic currency would cause a decline in the trade balance in the short run and an increase in the long run hence indicating that the J-curve phenomenon is valid. Bahmani-Oskooee and Hegerty (2011) investigated the effects of the North American Free Trade Agreement (NAFTA) on US-Mexico trade and was unable to find any support for the J-curve phenomenon. Sastre (2012) tested the Marshall-Lerner condition under the assumption that the GDP is independent from the exchange rate and the foreign trade flow to GDP ratio is high and found that the Marshall-Lerner condition is not supported. Hsiao et al. (2012) stated that the Marshall-Lerner condition is valid in Chinese trade with Japan and the J-curve phenomenon is also valid in its trade with EU countries.

Gocer and Elmas (2013) analysed the relationship between the trade balance and the exchange rate with the panel cointegration with multiple structural breaks under cross-sectional dependence method by using the 1980-2011 period data of Bulgaria, Hungary, Poland and Romania. They determined Marshall-Lerner condition works for Bulgaria, Hungary and whole panel. Additionally they found that J-curve phenomenon is valid in Hungary, Poland, Romania, Turkey and whole panel. Mwito et al. (2015) investigated the Marshall-Lerner condition in Kenya's bilateral trade using the Extended Trade Balance Model. The findings indicated that the Marshall-Lerner condition was only fulfilled for trade between Kenya and China, UAE, India and South Africa. Bandyopadhyay (2016) tested the Marshall-Lerner condition for India in the pre-reform (1962-1990) and post-reform interlude (1991-2013) period and concludes that the Marshall- Lerner condition is satisfied in the pre-reform and the post-reform period in India, but there has been decline in the numerical terms.

2. Econometric analysis

2.1. Data set

Variables of the study are Trade balance (*BT*), Real Exchange Rate (*REXR*), Domestic Income (Y^d) and Foreign Income (Y^f).The quarterly data 1995:Q1-2015:Q4 periods for fifteen countries[(2)] has been used. Fifteen countries in the study have got similar economic characteristics in terms of transition to market economy and most of their exports to EU-27 countries. Most of them recently gained full membership to the EU and Turkey recently initiated full membership negotiations. The trade balance data has been obtained by dividing the exports of goods and services to the imports of goods and services. GDP of USA was used as proxy variable of foreign income. The data set was obtained from the World Development Indicators (World Bank, 2016) and International Financial Statistics (IMF, 2016). The Gauss 9.0 and codes for this software have been used for this analysis.

2.2. Testing the cross-section dependency

Before proceeding with further steps, the adjusted Lagrange Multiplier (LM_{adj}) test has been employed in order to test for cross section dependency (*CD*), which was firstly proposed by Breusch-Pagan (1980) but developed by Pesaran et al. (2008) who eliminated or adjusted for deviation in the classical *LM* test. In the absence of investigating cross section dependency, results might not be robust but might be biased and inconsistent (Breusch and Pagan, 1980; Pesaran, 2004). Therefore, the existence of cross-section dependency in the series and the cointegration equation should be tested before the other further analyses.

The first developed test for cross-section dependency is Breusch-Pagan (1980) *LM*. This was followed by Pesaran (2004) *CD* and Pesaran et al. (2008) the bias-adjusted *LM* test (LM_{adj}) test. LM_{adj} test was used in this study. The first form of *LM* test statistics is as the following:

$$LM = T\sum_{i=1}^{N-1}\sum_{j=i+1}^{N}\hat{\rho}_{ij}^{2} \sim \chi^{2}_{\frac{N(N-1)}{2}} \tag{3}$$

Equation (3) can be rewritten with the following with the adjustment:

$$LM_{adj} = \left(\frac{2}{N(N-1)}\right)^{1/2}\sum_{i=1}^{N-1}\sum_{j=i+1}^{N}\hat{\rho}_{ij}^{2}\frac{(T-K-1)\hat{\rho}_{ij}-\hat{\mu}_{Tij}}{\upsilon_{Tij}} \sim N(0,1) \tag{4}$$

where $\hat{\mu}_{Tij}$ represents the avarage, υ_{Tij} represents the variance. The test statistics to be obtained here show a standard normal distribution as asymptotic. The null hypothesis of the LM_{adj} test is that of no cross-sectional dependency (Pesaran et al., 2008). The LM_{adj} test has been used and results are presented in Table 1.

Table 1. *Cross-sectional dependency test (LM_{adj}) results*

	LM	*CD*	LM_{adj}
BT	521.360*** (0.000)	28.732*** (0.000)	48.071*** (0.000)
REXR	724.450*** (0.000)	42.746*** (0.000)	13.866*** (0.000)
Y^d	805.603*** (0.000)	48.346*** (0.000)	86.478*** (0.000)
Y^f	456.201*** (0.000)	42.205*** (0.000)	45.369*** (0.000)
Cointegration Equation	838.072*** (0.000)	50.587*** (0.000)	17.392*** (0.000)

Note: *p*-values were computed 1000 bootstrap replications. In the parentheses are probability values. *** indicates the presence of cross-sectional dependency at level of 1%.

According to the results in Table 1, the null hypothesis has been strongly rejected. It has been inferred that there is cross-section dependency in the series and cointegration equation. Therefore, a trade and real exchange rate shock experienced by one of the countries affects the others. For that reason, countries should consider the other countries' external trade balance and real exchange rate policies. In addition, cross-section dependency should be taken into consideration while choosing the next test methods.

2.3. Panel unit root test with multiple structural breaks

Panel unit root tests are regarded as stronger than the time series unit root tests because of for using both the time and the cross-section dimension information (Choi, 2001). Not considering the existence of cross-sectional dependency among the countries, which are forming the panel, is an important problem. Panel unit root tests here are divided two parts as first and second generation tests. The first generation includes Fisher-type test of Maddala and Wu (1999), Hadri (2000), developed Fisher-type test of Choi (2001), Levin, Lin and Chu (2002), Im, Pesaran and Shin (2003) and Breitung (2005).

First generation unit root tests are based on all countries are affected equally from incoming shocks. But, it isn't a realistic approach when countries so different. In order to overcome this problem, new generation unit root tests have been developed. Main second generation unit root tests are Taylor and Sarno, (1998), Bai and Ng (2001), Breuer, Mcknown and Wallace (2002), Phillips and Sul (2003), Moon and Perron (2004), Pesaran (2003), Chang (2004) and Pesaran, (2006).

However, these methods were insufficient with the presence of structural breaks in series and give biased results (Charemza and Deadman, 1997). Carrion-i-Silvestre et al. (2005) developed PANKPSS (Panel Kwiatkowski-Phillips-Schmidt-Shin), which is one of the second-generation unit root tests. PANKPSS takes the cross-section dependency and the structural breaks in series into consideration while testing for unit roots. Through PANKPSS, the average of the series and in the case of the existence of the structural breaks, the stationary of the series in their trends can be tested. It also allows the occurrence of structural breaks in different numbers and dates in each cross-section unit in the panel. Therefore, the stationary of the series can also be estimated respectively for overall panel and each cross-section (Carrion-i-Silvestre et al., 2005). The model of the test is as follows:

$$Y_{i,t} = \alpha_{i,t} + \beta_{i,t} t + \varepsilon_{i,t} \qquad i = 1, 2, \ldots\ldots, N \ \ and \ t = 1, 2, \ldots., T \tag{5}$$

where

$$\alpha_{i,t} = \sum_{k=1}^{m_1} \theta_{i,k} D_{1i,t} + \sum_{k=1}^{m_1} \gamma_{i,k} D_{2i,t} + \alpha_{i,t-1} + u_{i,t}$$

$$\beta_{i,t} = \sum_{k=1}^{n_1} \varphi_{i,k} D_{1i,t} + \sum_{k=1}^{n_1} \gamma_{i,k} D_{2i,t} + \beta_{i,t-1} + v_{i,t}$$

D_1 and D_2 above are dummy variables and can be defined as:

$$D_1 = \begin{cases} 1, & t = T_B + 1 \\ 0, & t \neq T_B + 1 \end{cases}$$

$$D_2 = \begin{cases} 1, & t > T_B + 1 \\ 0, & t \leq T_B + 1 \end{cases}$$

Where T_B expresses the breakpoint and allows *m* structural break in constant term and *n* structural break in trend. Carrion-i-Silvestre et al. (2005) test considers up to five structural breaks. This test, following Bai and Perron (1998), determines structural break points where residual sum of squares are at minimum. The general expression for the test statistic is:

$$LM(\lambda) = N^{-1} \sum_{i=1}^{N} \left(\hat{\omega}^{-2} T^{-2} \sum_{t=1}^{T} S_{i,t}^2 \right) \tag{6}$$

where

$$S_{i,t} = \sum_{j=1}^{t} \hat{\varepsilon}_{i,j}$$

denotes the partial sum process that is obtained using the estimated OLS residuals of (5), with

$$\hat{\omega}^2 = N^{-1} \sum_{i=1}^{N} \hat{\omega}_i^2$$

where $\hat{\omega}^2$ is a consistent estimate of the long-run variance of $\varepsilon_{i,t}$ and

$$\omega_i^2 = \lim_{T \to \infty} T^{-1} S_{i,T}^2 \qquad i = \{1, 2, \dots, N\}$$

The null hypothesis denotes that series are stationary under multiple structural breaks. PANKPSS test was applied and results are presented in Table 2.

Table 2. *PANKPSS panel unit root test*

	BT		***ΔBT***	***REXR***		***ΔREXR***	***Y^d***		***$ΔY^d$***	***Y^f***		***$ΔY^f$***
	Test Stat.	Break Dates	Test Stat.	Test Stat	Break Dates	Test Stat.	Test Stat	Break Dates	Test Stat.	Test Stat	Break Dates	Test Stat.
Belarus	0.073 (0.037)	2008Q1	0.046* (0.537)	0.057 (0.054)	1996Q3; 1997Q4; 2000Q4; 2004Q1	0.112* (0.513)	0.121 (0.039)	2004Q1; 2007Q1	0.107* (0.468)	0.268 (0.197)	2004Q1	0.111 (0.433)
Bulgaria	0,061 (0.041)	1998Q2; 2000Q2 2005Q1; 2008Q4; 2010Q2	0.056* (0.499)	0.241 (0.178)	1997Q4; 2001Q4; 2007Q1; 2008Q4	0.105* (0.464)	0.258 (0.159)	2003Q1; 2007Q1	0.389* (0.429)	0.268 (0.197)	2004Q1	0.111 (0.433)
Croatia	0.045 (0.031)	1996Q4; 1998Q2; 2001Q4; 2008Q4	0.365* (0.472)	0.134 (0.026)	2004Q1; 2007Q1	0.098* (0.444)	0.211 (0.157)	2003Q1; 2006Q1	0.297* (0.443)	0.268 (0.197)	2004Q1	0.111 (0.433)
Czech Rep.	0.046 (0.041)	1997Q4; 2003Q4; 2008Q4	0.048* (0.294)	0.225 (0.076)	1997Q1; 2001Q4; 2005Q1; 2007Q4	0.308* (0.486)	0.283 (0.160)	2003Q1; 2007Q1	0.383* (0.449)	0.268 (0.197)	2004Q1	0.111 (0.433)

	BT		*ΔBT*	*REXR*		*ΔREXR*	Y^d		ΔY^d	Y^f		ΔY^f
	Test Stat.	Break Dates	Test Stat.	Test Stat	Break Dates	Test Stat.	Test Stat	Break Dates	Test Stat.	Test Stat	Break Dates	Test Stat.
Estonia	0.051 (0.047)	1996Q2; 1998Q4; 2008Q3	0.056* (0.639)	0.043 (0.036)	1996Q2; 2003Q1; 2005Q2; 2007Q1	0.418* (0.462)	0.407 (0.164)	2003Q1; 2006Q1	0.272* (0.438)	0.268 (0.197)	2004Q1	0.111 (0.433)
Hungary	0.052 (0.032)	1999Q3; 2001Q1; 2004Q4; 2008Q4	0.038* (0.253)	0.106 (0.044)	2000Q2; 2001Q4; 2004Q1; 2007Q1; 2008Q4	0.258* (0.502)	0.214 (0.163)	2002Q1; 2004Q1	0.373* (0.442)	0.268 (0.197)	2004Q1	0.111 (0.433)
Latvia	0.035 (0.029)	1996Q2; 2003Q1; 2008Q3	0.028* (0.478)	0.045 (0.044)	1996Q2; 2005Q3; 2007Q1; 2009Q3	0.210* (0.481)	0.203 (0.226)	1998Q1; 2003Q1; 2006Q1	0.307* (0.433)	0.268 (0.197)	2004Q1	0.111 (0.433)
Lithuani a	0.046 (0.035)	1996Q4; 1999Q3; 2005Q4; 2008Q4; 2010Q2	0.070* (0.172)	0.098 (0.094)	1996Q2; 1998Q1; 2003Q1; 2006Q1; 2009Q4	0.304* (0.492)	0.276 (0.208)	1997Q1; 2003Q1; 2006Q1	0.416* (0.448)	0.268 (0.197)	2004Q1	0.111 (0.433)
Poland	0.089 (0.065)	1996Q2; 2000Q2; 2004Q2; 2007Q1; 2008Q4	0.395* (0.485)	0.056 (0.050)	1996Q2; 2000Q4; 2002Q3; 2007Q1; 2008Q4	0.113* (0.489)	0.397 (0.189)	2004Q1; 2007Q1	0.721* (0.448)	0.268 (0.197)	2004Q1	0.111 (0.433)
Romani a	0.088 (0.074)	1998Q4; 2000Q2; 2003Q2; 2006Q1; 2008Q4	0.206* (0.486)	0.049 (0.032)	1997Q4; 1999Q4; 2005Q1; 2007Q1; 2008Q4	0.118* (0.486)	0.378 (0.163)	2003Q1; 2006Q1	0.191* (0.449)	0.268 (0.197)	2004Q1	0.111 (0.433)
Russia	0.088 (0.074)	1998Q4; 2000Q4; 2006Q4	0.056* (0.223)	0.061 (0.032)	1996Q2; 1998Q3; 2001Q1; 2005Q1; 2007Q1	0.136* (0.491)	0.181 (0.166)	2003Q1; 2006Q1	0.161* (0.448)	0.268 (0.197)	2004Q1	0.111 (0.433)
Slovakia	0.027 (0.019)	1996Q2; 1998Q4; 2000Q4; 2002Q4; 2008Q4	0.345* (0.590)	0.032 (0.030)	1996Q4; 2003Q1; 2005Q1; 2007Q1; 2008Q4	0.614* (0.459)	0.224 (0.164)	2003Q1; 2007Q1	0.196* (0.441)	0.268 (0.197)	2004Q1	0.111 (0.433)
Slovenia	0.228 (0.036)	1998Q4; 2000Q4; 2005Q2; 2007Q2; 2008Q4	0.170* (0.475)	0.267 (0.052)	1996Q3; 2008Q1	0.425* (0.463)	0.150 (0.125)	2004Q1; 2007Q1	0.425* (0.438)	0.268 (0.197)	2004Q1	0.111 (0.433)
Turkey	0.040 (0.034)	2003Q4; 2010Q2	0.118* (0.509)	0.047 (0.027)	1998Q4; 2000Q4; 2005Q1; 2010Q2	0.120* (0.476)	0.274 (0.183)	2005Q1	0.157* (0.434)	0.268 (0.197)	2004Q1	0.111 (0.433)
Ukraine	0.052 (0.028)	1999Q1; 2005Q2	0.070* (0.519)	0.071 (0.046)	1996Q2; 1998Q3	0.217* (0.476)	0.130 (0.040)	2004Q1; 2006Q1	0.085* (0.454)	0.268 (0.197)	2004Q1	0.111 (0.433)
Panel	1.946 (1.474)	-	0.194* (5.501)	5.505 (5.193)	-	1.529* (5.561)	17.739 (7.621)	-	3.252* (7.451)	13.219 (8.131)	-	2.629 (6.927)

Note: Critical values were computed 1000 bootstrap replications. *; expresses that the series is stationary in the 10% significance level. The model allowing the structural break in constant and trend has been chosen as a test model. *Δ*; shows the first difference.

According to results in Table 2 series are stationary in first differences, *I(1)*. Because of the series are integrated of the same order, cointegration tests can be applied.

2.4. Panel cointegration test with multiple structural breaks

Cointegration theory based on Engle and Granger (1987). Panel cointegration tests started with Pedroni (1999). Panel cointegration tests here are divided two parts as first and second generation tests. Main first generation panel cointegration tests are Pedroni (1999), Pedroni (2004), Kao (1999) and a Fisher-type test using an underlying Johansen methodology (Maddala and Wu 1999). These tests aren't considering cross-sectional dependence. Mainly second-generation cointegration tests are O'Connel (1998), Westerlund (2005), Gengenbach, Palm and Urbain (2006), Westerlund and Edgerton (2007, 2008) and Basher and Westerlund (2009).

Basher and Westerlund (2009) cointegration test can considers the cross-section dependence and multiple structural breaks structural breaks in the cointegration equation. This test allows the breaks in the constant term and trend. The test statistic is computed as:

$$Z(M) = \frac{1}{N}\sum_{i=1}^{N}\sum_{J=1}^{M_i+1}\sum_{t=T_{ij-1}+1}^{T_{ij}}\left[\frac{S_{it}^2}{(T_{ij}-T_{ij-1})^2\hat{\sigma}_i^2}\right] \tag{7}$$

where

$$S_{it} = \sum_{s=T_{ij-1}+1}^{t} \widehat{W}_{st}$$

However, $\widehat{W}_{st}$ is the regression residual obtained by using any efficient estimator of the cointegration vector such as the fully modified least squares estimator. $\hat{\sigma}_i^2$ is the usual Newey and West (1994) long-run variance estimator based on $\widehat{W}_{st}$. *Z(M)* becomes the following when it is abbreviated by taking their cross-sectional averages.

$$Z(M) = \sum_{t=T_{ij-1}+1}^{T_{ij}} \frac{S_{it}^2}{(T_{ij}-T_{ij-1})^2\hat{\sigma}_i^2} \sim N(0,1) \tag{8}$$

Null hypothesis is cointegration. The Basher and Westerlund (2009) cointegration test was applied and results are presented in Table 5.

Table 3. *Panel cointegration test results*

	Test Statistics	***p-Value***	***Decision***
No Break in Constant	12.85**	0.020	No Cointegration
No Break in Constant and trend	12.669***	0.000	No Cointegration
Break in Constant	2.760*	0.070	Cointegration
Break in Constant and trend	9.763	0.130	Cointegration

Note: *p*-values were computed with 1000 bootstrap replications. *, ** and *** indicate the presence of cointegration at level of 10%, 5% and 1% respectively.

Results presented in Table 3 indicate that; the decision regarding the presence of cointegration relationship is highly affected depending on whether or not the cross-section dependency and structural breaks are considered. Here, it is decided that there is a cointegration relationship between the series in the panel when the structural breaks and cross-section dependency are taken into consideration in the cointegration equations. Obtained structural break dates from cointegration test presented in Table 4.

Table 4. *Break dates in the cointegration equation*

Country	1th Break	2nd Break	3rd Break
Belarus	2000Q4	2004Q4	2008Q3
Bulgaria	1998Q1	2001Q4	-
Croatia	1998Q1	2003Q4	-
Czech Rep.	1998Q1	2001Q2	2004Q3
Estonia	1998Q3	2008Q2	
Hungary	1999Q4	2003Q1	2008Q3
Latvia	1998Q2	2005Q2	2008Q3
Lithuania	2005Q2	2008Q3	-
Poland	1998Q4	2002Q1	-
Romania	1998Q4	2008Q3	-
Russia	1999Q1	2002Q3	2006Q3
Slovakia	1998Q4	2002Q3	-
Slovenia	1999Q1	2002Q4	2007Q2
Turkey	1998Q1	2008Q3	-
Ukraine	2000Q2	2004Q1	2007Q2

Note: Structural break dates obtained from model with level and trend. In this study, maximum break point is taken three.

The test method has successfully determined the structural break dates in countries. 1998 and 2008 indicate the Russia economic crisis and the global economic crisis.

2.5. The estimation of long run cointegration coefficients

The long run cointegration coefficients can estimate with the Common Correlated Effects (CCE) method developed by (Pesaran, 2006) for each countries. In this analysis, the structural break points that are obtained from the cointegration analysis have been added to the analysis with dummy variables. Long run cointegration coefficients of panel were calculated with the Common Correlated Effects Mean Group (CCEMG) method of (Pesaran, 2006). CCE and CCEMG methods were used in this study and results were presented in Table 5.

$$BT_{it} = \beta_{0i} + \beta_{1i}REXR_{it} + \beta_{2i}Y_{it}^{d} + \beta_{3i}Y_{it}^{f} + \beta_{4i}D_{EU_{it}} + \beta_{5i}D_{1_{it}} + \beta_{6i}D_{2_{it}} + \varepsilon_i \quad (9)$$

Table 5. *The long run cointegration coefficients*

Country	***REXR***	Y^d	Y^f	D_{EU}	D_1	D_2
Belarus	0.24**[1.75]	-0.001[-1.18]	0.0001[1.10]	0.004[0.051]	8.55[0.001]	1.05***[2.36]
Bulgaria	0.48**[2.21]	-0.007**[-2.1]	0.1278[0.15]	49.58*[1.56]	-4.23[-0.001]	3.01***[45.21]
Croatia	0.16***[2.54]	-0.003[-0.004]	-0.001[-1.01]	-3.22[-1.02]	1.13[0.001]	-0.02***[-3.2]
Czech R.	1.65[0.72]	0.007[0.025]	0.002**[2.15]	59.22***[7.45]	2.01[0.001]	-2.85***[-8.1]
Estonia	-0.10[-0.75]	-0.09***[-3.5]	-0.04[-0.25]	-1.45[-0.002]	0.39***[10.12]	3.015[1.02]
Hungary	0.22***[2.72]	-0.01**[-1.72]	-0.03*[-1.51]	-7.47**[-2.15]	-1.38[-0.15]	7.18**[1.65]

Country	*REXR*	Y^d	Y^f	D_{EU}	D_1	D_2
Latvia	0.17***[3.15]	-0.05***[-2.3]	-0.001*[-1.41]	33.44***[6.12]	-2.09[-0.001]	-0.15***[-2.5]
Lithuania	0.14[1.02]	-0.009[-0.17]	0.003***[3.11]	84.15***[4.17]	-0.57[-1.14]	3.12[0.12]
Poland	0.25*[1.43]	0.001[0.45]	0.001*[1.55]	40.18***[2.35]	-1.64***[-3.5]	1.25***[3.01]
Romania	0.07***[3.12]	-0.007[-0.41]	0.001**[2.11]	76.38[0.025]	-1.74***[2.41]	4.23***[7.56]
Russia	1.20*[1.43]	-0.02***[-3.2]	0.23***[5.11]	-4.36[-0.001]	7.71***[2.76]	2.12**[2.05]
Slovakia	0.21***[2.91]	-0.004[-0.54]	-0.001*[-1.58]	43.26***[4.65]	9.01***[3.12]	7.41**[1.86]
Slovenia	0.02***[5.74]	-0.021[-1.15]	0.001[0.17]	-1.16[-0.85]	1.25[0.001]	0.015[0.127]
Turkey	0.15**[1.87]	-0.01**[-1.89]	0.001***[3.15]	0.003**[1.91]	8.25**[1.65]	3.45**[2.04]
Ukraine	0.24[1.21]	0.001[0.25]	-0.02**[-2.01]	0.012***[4.32]	-2.2[-0.12]	7.64***[3.05]
Panel	0.34***[1.81]	-0.004[-1.08]	0.0011*[1.45]	24.74***[3.3]	1.63[0.17]	2.75[1.25]

Note: *, ** and *** indicate the significance of coefficients at level of 10%, 5% and 1% respectively. Autocorrelation and heteroscedasticity problems were adjusted with the Newey-West method. [ ]; shows *t* statistics.

According to Table 5, increases in the real exchange rates in all countries positively affect the trade balance. This effect is statistically significant and extended Marshall-Lerner condition is valid in Belarus, Bulgaria, Croatia, Hungary, Latvia, Poland, Romania, Russia, Slovakia, Slovenia, Turkey and panel. Domestic income has got negative effect on trade balance and foreign income positive in line expectations. EU membership has got positive and statistically significant effect on these countries' trade balances.

2.6. Estimation of the short run coefficients

At this stage of the analysis, individual coefficients have been estimated with the CCE method and the panels' coefficient has been estimated with the CCEMG method using following error correction model:

$$\Delta BT_{it} = \beta_{0i} + \beta_{1i} ECT_{i,t-1} + \beta_{2i} \Delta REXR_{it} + \beta_{3i} \Delta Y_{it}^{d} + \beta_{4i} \Delta Y_{it}^{f} + \varepsilon_{it} \quad (10)$$

ECT_{t-1} is error correction term and which is one period lagged error terms of the long-run analysis. Equation (10) was estimated and results were presented in Table 6.

Table 6. *The short run coefficients*

Country	ECT_{t-1}	$\Delta REXR$	ΔY^d	ΔY^f
Belarus	-0.022***[-4.74]	-0.32**[-2.12]	-0.002[-1.06]	0.02***[10.01]
Bulgaria	0.001[0.007]	0.27[0.41]	-0.003***[-7.46]	0.02[0.001]
Croatia	-0.001[-0.0001]	0.012**[1.86]	-0.001[-0.50]	-2.063[-1.01]
Czech Rep.	-0.001[-1.19]	-0.36*[-1.51]	0.0001[0.001]	-0.32[-0.01]
Estonia	-0.001[-0.001]	-0.084[-0.76]	-0.0001[-0.004]	0.001[1.15]
Hungary	-0.001[-0.54]	0.46***[4.10]	-0.001[-0.42]	1.78***[5.17]
Latvia	0.005[0.0001]	0.58[0.11]	-0.002[-0.001]	0.001[1.01]
Lithuania	-0.001[-0.016]	-0.19[-0.70]	-0.001[-0.002]	2.0[1.05]
Poland	-0.062***[-6.19]	0.22[0.41]	0.001[0.001]	7.81***[15.41]
Romania	-0.004[-0.4]	-1.48***[-5.15]	0.001[0.15]	0.719***[7.15]
Russia	-0.001[-0.05]	-1.32[-0.001]	0.001[0.001]	-7.02[-0.001]
Slovakia	-0.017[-0.054]	2.27[1.05]	0.001[0.002]	1.48[0.90]
Slovenia	0.02[0.013]	-1.25**[-1.65]	-0.001[-0.50]	0.001[0.07]
Turkey	-0.09[-0.01]	-0.65[-0.001]	-0.001[-0.25]	-3.22**[-2.15]
Ukraine	0.015***[3.01]	-1.12*[-1.35]	-0.001[-0.063]	0.825[0.14]
Panel	-0.01*[-1.62]	-0.19[-0.80]	-0.0006***[-2.56]	0.13[0.007]

Note: *, ** and *** indicate the significance of coefficients at level of 10%, 5% and 1% respectively. Autocorrelation and heteroscedasticity were adjusted with the Newey-West method. Values in brackets are *t* statistics.

When the results in Table 6 are examined, it can be seen that increases in the real exchange rates in Belarus, Romania, Slovenia and panel affect the trade balance negatively in the short run and the *J*-curve phenomenon is valid in these countries. Also, error correction term is negative and statistically significant in Belarus, Poland and panel. In the other words, the short run deviations converge to the long run balance level in these counties.

Conclusion and evaluation

In this study, effects of the real exchange rates, domestic and foreign income on the balance of external trade has been analysed in the framework of the extended Marshall-Lerner condition and J-curve phenomenon using 1995-2015 period quarterly data for fourteen transition economy and Turkey by means of panel cointegration analysis with multiple structural breaks under cross-sectional dependency.

The existence of cross-section dependency among the countries in the panel has been analysed with the LM_{adj} test and it has been concluded that cross-section dependence exists among these countries. The fact that all of these countries have most of their exports to EU countries is considered to be influential in this dependence. Since cross-section dependence exists among these countries, a real exchange rate or foreign trade crises experienced in one of these countries may affect the others. Therefore, countries should also take into consideration events in related countries.

The stationarity of the series has been analysed with the Carrion-i-Silvestre et al. (2005) method, which considers the multiple structural breaks in series. It has been found that series are non-stationary in level and they become stationary when their first differences are taken.

The existence of a cointegration relationship between series has been analysed with the Basher and Westerlund (2009) test, which considers the cross-section dependency and the multiple structural breaks. It has been observed that when the structural breaks in series are not considered, there is no cointegration relationship, although there is a cointegration relationship when the structural breaks are considered.

The long run individual cointegration coefficients have been estimated with the CCE method developed by Pesaran (2006), which considers the cross-section dependency. The long run panel cointegration coefficients have been estimated with CCEMG and it has been found that increases in real exchange rates positively effects the trade balance of the countries. In addition, it has been identified that the Marshall-Lerner condition is valid in Belarus, Bulgaria, Croatia, Hungary, Latvia, Poland, Romania, Russia, Slovakia, Slovenia and Turkey. The short run coefficients have also been estimated with the CCE and CCEMG methods again. According to short run analysis, the J-curve phenomenon is supported and there is proof that the J-curve phenomenon is valid for only Belarus, Romania and Slovenia.

As a result, it can be said that depreciation of the domestic currency can be used as a policy instrument to achieve an improvement in the trade balance and a decrease in the current account deficit for Belarus, Bulgaria, Croatia, Hungary, Latvia, Poland, Romania, Russia, Slovakia, Slovenia and Turkey. In order to ensure trade balance exchange rates it is an effective policy instrument in these countries. Real exchange rate increases have a positive effect on the trade balance in the Croatia and Hungary economy in the short run. Therefore it is indicated that policy makers of these countries can use the real exchange rate is an effective policy instrument.

In addition to these findings in study, in considering cross-sectional dependency and multiple structural breaks, differs from former studies and improves on the empirical literature concerning effects of the real exchange rates, domestic and foreign income on the trade balance. For this reason, in this paper we fill an important gap in the literature by studying the impact of the real exchange rate changes on the trade balance in the 13 East emerging European economies and Turkey.

Notes

(1) However, Marshall-Lerner condition implicitly assumes that the GDP is independent from the exchange rate. But this assumption is not sustained (Sastre, 2012).

(2) Belarus, Bulgaria, Croatia, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Russia, Slovakia, Slovenia, Turkey and Ukraine.

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