

## Testing the Marshall-Lerner condition for Romania

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**Abstract.** *In this paper, we test if a depreciation of a national currency will lead to an improvement of the trade balance. We chose the bilateral relationship of Romania and its ten main trading partners. This study will fill the gap in the Romanian literature on this topic in two ways. Firstly, by using a larger data set than it is used in previous studies. The data set consists of panel data for the period 1999-2019. Secondly, by applying a Fully Modified Ordinary Least Square model we test the long-run relationship between the real exchange rate and trade balance. Through the analysis carried out, we obtained the result that a depreciation of the RON will lead to an improvement in the Romanian trade balance.*

**Keywords:** Marshall-Lerner panel, national currency depreciation, trade balance, Romania.

**JEL Classification:** C33, F14, F40.

## 1. Introduction

The Romanian economy has registered a continuous deficit in the trade balance since 1991 (Ciutacua and Chivua, 2015). In this case, we wonder if the depreciation of the national currency would lead to an improvement in the trade balance. In other words, we will test the validity of the Marshall-Lerner condition, which argues that trade balance will improve in the long run after depreciation of the national currency only if the sum of the elasticities of imports and exports is greater than one (Cheng, 2020).

In the literature there exists also a very close theory to the Marshall-Lerner condition. This is the J curve. The phenomenon consists of the fact that in the short term the depreciation of the national currency leads to the worsening of the trade balance. Firstly, this happens because consumers are reticent to change their behaviour. Secondly, they need more time to find substitutes for the products they used to buy. The main reason for this is due to the fact that on short term are very few substitutes for products or, moreover, doesn't exist at all, so the demand is inelastic (Šimáková, 2013). But, of course this short-term worsening it is followed by an improvement on long-term of the trade balance. This hypothesis is the basis for the J curve theory (Yazgan and Ozturk, 2019).

Bahmani-Oskooee and Kutan (2009) conducted a study on some countries from the Eastern European Union, also including Romania. This study was carried out with the aim of testing the presence of the J-curve theory and was a first attempt to include Romania in such an analysis. The data included were monthly data from the interval of time January 1991-June 2005. Empirical methods were used for cointegration and error correction modelling. The final results do not indicate in the case of Romania the presence of the J curve. However, we think it is relevant to test if in the long run a depreciation of the national currency leads to the trade balance improvement, because it is important to see if this can be a suitable measure in the case of a developing country.

Literature on this topic in Romania is scarce. Only two studies tested the Marshall-Lerner condition for Romania: Tuteanu (2015) and Ban and Pellegrini (2016). The present study will have an important contribution to the existing literature.

Firstly, by the fact that we will perform the analysis on a panel data set, consisting of the main commercial partners of Romania. The period of time of the data set is 1999-2019. We chose this period on the basis of data availability.

Secondly, by applying Fully Modified Ordinary Least Square estimator (FMOLS). This method avoids the problems of endogeneity. In addition to this, we prefer the FMOLS method because it removes the serial correlation effect by applying a cointegration regression, rather than the OLS estimator, which may suffer from serial correlation.

The paper is structured as follows. Section 2 will present the literature review, Section 3 consists of empirical methodology and data description, Section 4 presents the results, while Section 5 concludes.

## 2. Literature review

The Marshall-Lerner condition has become an important hypothesis for those who focus on the exchange rate as a determinant factor of trade balance. This condition supports the idea that a devaluation or depreciation of the national currency leads to an increase in exports. Actually, it is possible by making exports cheaper and discourage imports, which is implicitly becoming more expensive. In this way, the trade balance will be improved.

Over time, this condition has been tested by different econometric methodologies for many economies. For example, in some studies, the model used was ARDL (Autoregressive Distributed Lag Model). Liu et al. (2007) concluded that the Marshall-Lerner condition is valid for the bilateral relationship between Hong Kong and China. Ketenci and Uz (2011) found evidence of the J curve for the bilateral relationship between the European Union and her main trading partners (Canada, China, Japan, and NAFTA). Chan and Hooy (2017) tested whether the depreciation of the yuan will have a positive effect on China's trade balance. The analysed period of time was the 1990-2008 interval. The authors reached the conclusion that the Marshall-Lerner condition for China's bilateral relationship with Malaysia is fulfilled. Moreover, by running an ARDL estimation the Marshall-Lerner condition was also validated in the case of Asian countries. Ebadi (2020) confirmed this in his study. In addition, Asian countries were taken into account and 22 OECD countries. The period analyzed was 2000-2017. But for the OECD countries included in the study, the depreciation of the national currency does not work.

As the US has experienced a trade balance deficit since 1971, Cheng (2020) has tested the effectiveness of the dollar depreciation in improving the trade balance of the United States of America. The ARDL cointegration model was applied to quarterly disaggregated data from the period 1999-2015, taking into account nine categories of commercial services. The results indicate that the depreciation of the US dollar will improve US exports in the long run, but not for all categories of services analysed.

Other authors have applied the VECM (Vector Error Correction Model) to analyze the hypothesis that depreciation of a country's currency would improve the trade balance of that country. Tochitskaya (2007) argues that the depreciation of the Belarusian rouble will improve the trade balance in the long term. Jamilov (2013) uses as a case study the bilateral relationship between Azerbaijan and the Euro Zone (Euro-17) and finds evidence of both the J curve and the Marshall-Lerner condition. Loto (2011) tests this theory for the economy of Nigeria and denies its validity. Another author who did not find significant empirical evidence for the Marshall-Lerner condition was Hermawan (2011). In his article, he argues that the depreciation of Indonesia's national currency is not an effective policy to increase the level of trade balance and other variables, such as per capita income, population, preference for the country of destination and production and quality efficiency, must be taken into account, which influence the improvement of the Indonesian trade balance.

In other studies, the panel cointegration methodology is used. Irandoust et al. (2006) tested the condition of Sweden's economy in relation to the main trading partners (Denmark, Finland, France, Germany, the Netherlands, Norway, UK and US). Empirical results have shown that only in the relationship of Sweden with France and the Netherlands a depreciation of the national currency would improve trade balance. Chiu et al. applied the same methodology. (2010) for bilateral trade between the United States and its 97 trading partners. Finally, the authors concluded that the depreciation of the dollar will improve the US trade balance in the long run. Moreover, using panel data from 33 countries, Yazgan and Ozturk (2019) tested the theory of the J curve and the Marshall-Lerner condition. By implementing a panel error correction model, the authors find evidence that confirms the Marshall-Lerner condition.

We also have to mention that some countries from Eastern Europe were in the attention of researchers for testing the same assumption. For the empirical estimations, the same methods mentioned before were used. For example, in the case of Serbia ARDL was used. Nine main trading partners were included in the sample (including Romania). The period analyzed was 2004-2015, with quarterly data. The results obtained indicate that just in the case of bilateral relationship with Austria, the Marshall-Lerner condition was confirmed. So, for Serbia, a depreciation of the national currency is not among the best solution in order to improve the trade balance. Rather, in this regard, adequate microeconomic measures should be implemented (Kurtovic et al., 2017). In the case of Turkey with its 25 main partner countries at the panel level, the Marshall-Lerner condition was validated. The data used in the study were quarterly from the period 1996-2015. However, when data are analyzed for the bilateral relationship of Turkey with its trading partners included in this study are obtained, the condition is confirmed only in six cases (including Romania) (Kaya, 2020). In recent years, this theory has been tested in Romania. In the first attempt, only the commercial balance of forest products was taken into account (Tuteanu, 2015). The analysis focused on the effects of the short-term change (J curve) to answer the question of whether the trade balance of forest products is deteriorating in the short term as a result of the depreciation of RON. As an econometrical methodology, the ARDL model was used on an annual data set from 1970-2010. The results obtained invalidate both the J-curve theory and the Marshall-Lerner condition for the forest products category. In 2016, the entire trade balance of Romania was taken into account to test whether the depreciation of the national currency could stimulate the exports of the country analyzed (Ban and Pellegrini, 2016). The bilateral relationship between Romania and the Euro Zone (EA19) was taken into account. An ARDL model was applied on quarterly data for the time frame  $1999Q_1$ - $2016Q_2$ . The dependent variable was the trade balance and, as explanatory variables, GDP of Romania and from the Euro Area and, of course, the real exchange rate of RON. Empirical results attest to the validity of the condition. Therefore, a depreciation of the national currency will have positive effects on the commercial relationship of Romania with the Euro Zone.

Our study fills the literature gap for Romania by extending the period in which the Marshall-Lerner condition is tested.

### 3. The empirical model and data description

In what follows, we will describe the econometric model we are using: Fully Modified Ordinary Least Square (FMOLS) model. We choose this model because between the variables there is a significant long-term relationship and it controls for the endogeneity problem.

The first aspect to consider is the stationarity of the variables taken into account. This test is based on two hypotheses. The null one is that each series in the panel has an unit root, and the alternative one is that not all series have an unit root in individual series. If the variables are non-stationary, which means they are integrated at least of the first order, then we employ Pedroni's cointegration tests for panel data. The working hypothesis will be:  $H_0$ : There is no cointegration relation and  $H_1$ : There is a long-term relationship between variables. Hence, we will check if there is a cointegration relationship between the variables, such as:

$$y_{it} = \alpha_i + \sum_{m=1}^M \beta_{mi} \times X_{mit} + \varepsilon_{it}, \quad i = 1, 2, \dots, N; \quad T = 1, 2, \dots, t, \quad (1)$$

where T is the number of observations and N is the number of individual members (Chiu et al., 2010).

This method of cointegration supposes to employ seven tests statistics: Panel v-statistic, Panel rho-statistic, Panel PP-statistic, Panel ADF-statistic (these are panel cointegration tests) and Group rho-statistic, Group PP-statistic, Group ADF-statistic (these are group-mean panel cointegration tests).

If the variables are cointegrated, then we can apply the FMOLS method, which is based on a cointegration coefficient  $\beta$ , defined as:

$$\hat{\beta}_{NT}^* = N^{-1} \sum_{i=1}^N (\sum_{t=1}^T (X_{it} - \bar{X}_i)^2)^{-1} (\sum_{t=1}^T (X_{it} - \bar{X}_i) \times y_{it}^* - T \times \widehat{Y}_i), \quad (2)$$

where:

$$y_{it}^* = (y_{it} - \widehat{y}_i) \frac{\widehat{L}_{21i}}{\widehat{L}_{22i}} \times \Delta x_{it} \quad (3)$$

$$\text{and } \widehat{y}_i \equiv \widehat{\Gamma}_{21i} + \widehat{\Omega}_{21i}^0 \frac{\widehat{L}_{21i}}{\widehat{L}_{22i}} \times (\widehat{\Gamma}_{21i} + \widehat{\Omega}_{21i}^0). \quad (4)$$

The t-statistic for  $\hat{\beta}_{NT}^*$  has the following form:

$$t_{\hat{\beta}_{NT}^*} = (\hat{\beta}_{NT}^* - \beta) \times (\sum_{i=1}^N \widehat{L}_{22i}^{-2} \sum_{t=1}^T (x_{it} - \bar{x}_i)^2)^{-1/2}, \quad (5)$$

which converges to the standard normal distribution as  $T \rightarrow \infty$  and  $N \rightarrow \infty$ .

In this study, we will use an econometric model that includes four variables in logarithmic form: bilateral trade balance, domestic income, foreign income, and bilateral exchange rate. Data were taken from Eurostat. They are annual for the period 1999-2019. The bilateral trade balance between Romania and its 10 main trading partners according to World Exports (Bulgaria, Czech Republic, Germany, France, Italy, Hungary, Poland, United Kingdom, Netherlands, and Turkey) is specified as in the following panel equation:

$$\ln TB_{i,t} = \alpha_i + \beta_1 \times \ln GDP_{RO,t} + \beta_2 \times \ln GDP_{i,t} + \beta_3 \times \ln REER_{i,t} + \varepsilon_{i,t}, \quad (6)$$

where:

$TB_{i,t}$  is the difference between exports of Romania to each trade partner and imports of Romania from each partner country.

$GDP_{RO,t}$  and  $GDP_{i,t}$  are the domestic income, respectively the trading partner income.  $REER_{i,t}$  is the bilateral real exchange rate between Romania and her trading partner.

Taking into account economic theory, we expect that when the national currency depreciates, it will determine an increase of exports, and, at the same time, it will discourage imports. That means the sign of the coefficient “ $\beta_3$ ” should be negative. At the same time, when we find an increase in the level of real income from abroad, then Romanian exports will be stimulated and therefore the sign of the estimated “ $\beta_2$ ” The coefficient should be positive. Furthermore, the increase in domestic real income will cause an increase in imports from Romania, which will involve obtaining a negative sign for the “ $\beta_1$ ” coefficient.

#### 4. Empirical results

The first step will be to test the stationarity of the variables by applying the unit root test Im, Pesaran, and Shin. The test involves analyzing the null hypothesis  $H_0$ : “The series is not stationary (has unit root)” versus the alternative hypothesis  $H_1$ : “The series is stationary (has no unit root)”. Following the implementation of the model, we obtain at the panel level that the trade balance and the real exchange rate are stationary for the level series (see Table 1). However, for domestic and foreign GDP series after the first differentiation, we will notice that the obtained probabilities lead to the rejection of the null hypothesis, because they do not exceed the level of significance of 1%. Therefore, the alternative hypothesis will be accepted, according to which the series do not have a unit root, and we will be able to state that our variables are integrated of the first order.

The next step consists of applying the Pedroni cointegration tests. In Table 2 we have the results for the panel data. These indicate the rejection of the null hypothesis because six out of eleven results are significant at a 1% level of significance. This means that there exists a long-term cointegration relationship between variables.

**Table 1.** Unit root test

Country/Variable	Order of integration	lnTB	lnGDP_RO	lnGDP_i	lnREER
France	Level	0.6267	0.6478	0.5298	0.4371
	1st difference	0.0668*	0.1606	0.0592*	0.034**
	2nd difference	-	0.0091***	-	-
Netherlands	Level	0.3951	0.6478	0.8363	0.4714
	1st difference	0.0519*	0.1606	0.1076	0.0426**
	2nd difference	-	0.0091***	0.0126**	-
Germany	Level	0.3987	0.6478	0.9928	0.4385
	1st difference	0.0396**	0.1606	0.0017***	0.0445**
	2nd difference	-	0.0091***	-	-
Italy	Level	0.3031	0.6478	0.2756	0.3918
	1st difference	0.0449**	0.1606	0.1105	0.0247**
	2nd difference	-	0.0091***	0.0000***	-

Country/Variable	Order of integration	lnTB	lnGDP_RO	lnGDP_i	lnREER
UK	Level	0.2829	0.6478	0.6281	0.3755
	1st difference	0.021**	0.1606	0.0291**	0.0605*
	2nd difference	-	0.0091***	-	-
Turkey	Level	0.1038	0.6478	0.6792	0.4041
	1st difference	0.0428**	0.1606	0.1103	0.0154**
	2nd difference	-	0.0091***	0.0014***	-
Poland	Level	0.1055	0.6478	0.7784	0.2676
	1st difference	0.005***	0.1606	0.0079***	0.0446**
	2nd difference	-	0.0091***	-	-
Czech Republic	Level	0.0087***	0.6478	0.3577	0.3746
	1st difference	-	0.1606	0.2173	0.0463**
	2nd difference	-	0.0091***	0.0005***	-
Hungary	Level	0.2922	0.6478	0.2371	0.2582
	1st difference	0.1385	0.1606	0.1446	0.0209**
	2nd difference	0.0305**	0.0091***	0.0000***	-
Bulgaria	Level	0.2922	0.6478	0.2371	0.2582
	1st difference	0.1385	0.1606	0.1446	0.0209**
	2nd difference	0.0305**	0.0091***	0.0000***	-
Panel	Level	0.0015***	0.8848	0.8760	0.0937*
	1st difference	-	0.0009***	0.0000***	-
	2nd difference	-	-	-	-

P-value and significance level: \* at 10%, \*\* at 5%, and \*\*\* at 1%.

Source: Author's own calculation.

**Table 2.** Pedroni cointegration tests

Alternative hypothesis: common AR coefficients. (within-dimension)				
	Statistic	Prob.	Weighted Statistic	Prob.
Panel v-Statistic	1.367195	0.0858	1.208481	0.1134
Panel rho-Statistic	-0.031813	0.4873	0.167633	0.5666
Panel PP-Statistic	-1.927741	0.0269	-1.378838	0.0840
Panel ADF-Statistic	-2.881757	0.0020	-1.872644	0.0306
Alternative hypothesis: individual AR coefs. (between-dimension)				
	Statistic	Prob.		
Group rho-Statistic	1.444404	0.9257		
Group PP-Statistic	-1.030772	0.1513		
Group ADF-Statistic	-2.385661	0.0085		

Source: Author's own calculation.

Finally, we applied the FMOLS model to test whether a depreciation of the RON will result in an improvement in Romania's trade balance. According to the results in Table 3, we can say that the coefficient signs are the expected ones and, moreover, are statistically significant at 5%. This means that the demand for Romanian exports will be higher if there is a depreciation in the national currency. However, when applying the econometric model at the country level, we obtain the validity of the Marshall-Lerner condition only in five cases out of ten. More precisely, the condition was confirmed for the bilateral relationship between Romania and the UK, Turkey, the Czech Republic, Hungary, and Bulgaria (see Table 4). Although at the panel level a depreciation of the national currency seems to be a solution to rapidly improve the trade balance, bilateral relationships show that not in all cases it will lead to an improvement. Therefore, depreciation of the national currency can have a positive influence on trade balance, it can affect negatively the economy. This is happening due to rising prices. So, to exist in reality a benefic impact on trade balance should be taken in consideration the increasing of quality of products.

**Table 3.** FMOLS results

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNGDP	0.736506	0.260662	2.825519	0.0052
LNREER	-0.782783	0.204714	-3.823788	0.0002
LNGDP_RO	-0.295854	0.130482	-2.267388	0.0245
R-squared	0.662839	Mean-dependent var		-0.246024
Adjusted R-squared	0.641203	S.D. dependent var		0.496963
S.E. of regression	0.297679	Sum squared resid		1.657062
Long-run variance	0.183138			

**Source:** Author's own calculation.

**Table 4.** FMOLS results at the country level

	lngdp_ro	lngdp	lnreer
France	0.519353(0.0006)***	-0.533825(0.0011)***	1.118509(0.0223)**
Netherlands	-0.349985(0.1335)	0.180138(0.4901)	1.630408(0.0469)**
Germany	0.444834(0.0069)***	-0.514459(0.0047)***	1.734032(0.0041)***
Italy	0.228508(0.0007)***	-0.272569(0.0005)***	0.950641(0.0014)***
UK	-0.828031(0.0037)***	0.467508(0.0496)**	-0.708856(0.0260)**
Turkey	-0.881073(0.0085)***	1.285324(0.0009)***	-0.482063(0.0207)**
Poland	-0.369259(0.2829)	0.843169(0.1034)	0.098002(0.8531)
Czech Republic	-1.914461(0.0049)***	2.600438(0.0014)***	-3.062703(0.0006)***
Hungary	-1.961873(0.0000)***	1.806229(0.0000)***	-2.365863(0.0003)***
Bulgaria	-2.628536(0.0026)***	3.279415(0.0013)***	-5.368785(0.0002)***

**Source:** Author's own calculation.

## 5. Conclusions

Most of the countries have an external deficit. Romania is such a country with persistent deficit. In theory, there exists a very well-known approach to dealing with the trade balance deficit. This is called the Marshall-Lerner condition. It claims that if the sum of exports and imports elasticities is greater than one, then the trade balance will be improved in the long run.

In the present paper, we tested the relationship between the exchange rate and the trade balance. The study consisted of the bilateral analysis of Romania and its ten main trading partners. We applied the FMOLS model, using annual data from 1999-2019. We obtained statistically significant results for the panel level.

Based on the results of the analysis carried out, we arrive at the conclusion that the depreciation of the RON improves the Romanian balance of trade. We can say that in the case of Romania, the Marshall-Lerner condition is confirmed. According to the Marshall-Lerner condition, a country could improve its balance of trade by depreciating the national currency. This depreciation will increase the prices of imported products while the prices of exported goods will become more accessible. Therefore, Romanian exports will be more competitive on the global level.

This positive result has important policy implications for Romania. This means that policy makers can use the real exchange rate as an important tool to improve the external deficit of Romania. Knowing the real exchange rate can result in a more stable external balance. However, we consider that although the depreciation of the national currency improves the



trade balance of a country, it can have adverse effects on the economy by increasing the inflation rate. In this case, our results should be interpreted with caution. The study has limits not taking into account other variables that could improve trade balance (foreign direct investment), not employing robustness checks (sub samples, sub periods) and not considering the whole group of trade partners of Romania due to data availability.

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