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Bilateral trade elasticity of Serbia: Is there a J-Curve effect?

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Many countries try to use real exchange rate depreciation to address a trade balance deficit. Real depreciation of the national currency leads to a deterioration of the balance of trade in the short term, but in the long term it leads to an improvement in the balance of trade. Changes in the exchange rate result in changes in prices and volumes of both exports and imports of products and services. In the short run, real depreciation makes imports more expensive and exports cheaper, i.e. it causes a decline in the export prices of products and services, and an increase in the import prices of products and services.On the other hand, the volume of imports remains unchanged in the short run, while in the long run it declines. The economic equilibrium in terms of the trade balance is gradually established when demand adjusts to the changes in the prices of products and services (Khieu Van, 2013; Hacker and Hatemi-J, 2003; Jamilov, 2012; Kun Sek and Mun Har, 2014; Kurtovic et al., 2016). Therefore, real depreciation causes the balance of trade to exhibit a amplitude of movement in the shape of a slanted J, the so-called J-curve (Bahmani-Oskooee and Kantipong, 2001; Bahmani-Oskooee and Goswami, 2003; Harvey, 2013; Kurtovic et al., 2016). Already Magee (1973) had investigated and confirmed the existence of the J-curve phenomenon between the USA and its major trading partners as a result of real devaluation in the short run, with a certain time lag effect (Magee, 1973; Junz and Rhomberg, 1973; Meade, 1988; Kurtovic et al., 2016).

In fact, the elasticity of trade flows to the exchange rate is of particular importance to macroeconomic policy makers as well as to

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exporting firms (Rose and Yellen, 1989). It provides essential information regarding the price formation process of products and services, in the domestic and international markets; it measures the 'resistance level' of exports in the face of a negative shock of foreign demand; and it indicates the competitive position of domestic products vis-à-vis foreign products (Uz, 2010; Imbs and Mejean, 2010; Looi Kee et al., 2004; Kurtovic et al., 2016).

Over the last two decades, Serbia has been facing the problem of negative economic indicators in terms of balance of payments, i.e. high current account and trade deficits. Since year 2000 it has launched extensive reforms to try and ameliorate its trade performance at the global and regional levels. At the same time, Serbia recurred to real depreciation of the dinar in relation to/against its major trading partners in order to improve its balance of trade situation.

Changes that occurred in the dinar exchange rate against the euro can be divided into four stages. In a first stage (2004-2006), the dinar depreciated against the euro by 11.1%; in the a second stage (2006-2007) it slightly appreciated, by 0.95%; the third stage (2010-2011) was marked by further appreciation of the dinar against the euro, by 0.09%; and finally, in the fourth stage (2012-2015) the dinar depreciated against the euro, by 10.1%.

The issue of assessing the elasticity of bilateral trade between Serbia and its most important trade partners has not been sufficiently explored in the past. The prevalent opinion among economists is that the real exchange rate of the dinar is overvalued in comparison with the foreign exchange rates of the Serbia's leading trading partners, but also that there is no adequate currency policy that would ensure greater exports and thus ensure an improvement in the trade balance. In this regard, the main aim of our research is to examine the effect of real depreciation and of changes in income on bilateral and on Serbia's import demand and export demand functions. We hope that the results of this research will help the economic policy makers to enact effective measures that may result in greater trade exchanges with Serbia's major trading partners and may improve the trade balance.

Specifically, in this work we will first assess the short-term and long-term effects of the elasticity of real depreciation and of income on export and import demand functions; second, we will explore the presence of a J-curve in the short-term; then, we will explore whether the Marshall-Lerner conditions are fulfilled; and finally we will investigate whether real depreciation or changes in the income of both trading partners have a greater effect on bilateral trade.

The paper is structured as follows: section 1 provides an overview of literature or research closely related to this paper's research subject; section 2 describes the econometric techniques and data sources used; section 3 presents the empirical results, and section 4 discusses the main conclusions of the analysis.

1. Literature review

Several studies have been conducted to evaluate the effect of a depreciation of the exchange rate and of changes in incomes respectively on bilateral trade elasticities and on the balance of trade. In this section, we briefly introduce those most relevant to our analysis, with a special emphasis on the outstanding work of Rose and Yellen (1989), which investigated the effect of real depreciation on the bilateral trade between the USA and their six major trade partners.

Rose and Yellen's research is based on simple autoregressive and cointegration analysis of disaggregated data. It is important for our research because it is part of a pioneering line of research that employs disaggregated data. Rose and Yellen's results are different from ours for they do not find a J-curve effect. However, one of the shortcomings of their empirical method, based on the cointegration methodology proposed by Engle and Granger, is that it does not have enough power and requires the application of augmented Dickey-Fuller (ADF) tests. Their results, especially relating to the short-term, are not as reliable as they would have been had they applied error correction modeling. Moreover, they did not use *F* tests when selecting the optimal lag length.

Earlier, Bahmani-Oskooee (1985) had investigated the effect of real depreciation on the bilateral trade between Korea, India, Greece and Thailand. He carried out a cointegration analysis on quarterly data from 1973 to 1980. What makes the results of this study less reliable than our research is that an error correction model and a robust analysis was not used. The results of Bahmani-Oskooee's study are consistent with our results, that is the presence of a J-curve was observed.

More recently, Marwah and Klein (1996) examined the impact of real depreciation on the trade balance of Canada and the USA with their leading trade partners. They run OLS regressions on quarterly data from 1977 to 1992. Their research differs from ours by relying on the application of the OLS regression, which in this context should be considered less reliable and suitable. Yet, their results too are in line with our own, concerning the presence of J-curve effects in the short term, while they differ in that they find the presence of a S-curve in the long run.

Bahmani-Oskooee and Kantipong (2001) examined whether there is a J-curve effect in the trade patterns between Taiwan and its five leading trading partners. They applied an ARDL approach to quarterly data from 1973 to 1997. What in our view makes the results of this study less reliable than ours, is the lack of robust analysis. Anyway, the results of the evaluation, similarly to our own research, show the presence of a J-curve effect. Bahmani-Oskooee and Kutan (2006) examined the effect of a real depreciation on the trade balance of 11 Central and South-Eastern European countries. Unlike our research, they only tested the elasticity of the depreciation of the exchange rate on trade balance. They used both a cointegration approach and error-correction modeling on data from 1990 to 2005. This research is particularly important for our research because it deals with the issue of bilateral trade elasticity in transition countries of Central and South-Eastern Europe. The results of this study show the presence of J-curve effects for Russia, Croatia and Bulgaria. Hsing and Sergi (2009) examined the effect of real depreciation on the bilateral trade between Lithuania, Latvia, and Estonia with the United States. In comparison to

our model, they applied a vector-error correction model, Johansen's multivariate cointegration and impulse response function. They used quarterly data from 1993 to 2007. The results of this study show the presence of J-curve effects in the case of Estonia, while the Marshall-Lerner conditions hold in the cases of Estonia and Lithuania.

Finally, Šimáková (2013; 2014) examined whether there was a J-curve effect in the case of the bilateral trade between Hungary and Slovakia with their major trading partners. Both works use the Johansen's cointegration test as well as impulse response functions on quarterly data. In contrast to our research, which explores the bilateral elasticity of depreciation of the real exchange rate and of changes of income, these studies were aimed at investigating the effect of depreciation on bilateral trade. The results of this both studies show the presence of J-curve effects.

2. Methodology and data

Bilateral trade elasticity relates to the assessment of the effect of a real depreciation of the exchange rate and of changes in income on the export and import demand functions. In this work we consider the case of Serbia's bilateral trade with its nine major trading partners: Germany, Italy, Austria, Bosnia and Herzegovina (henceforth B&H), Croatia, Russia, Romania, Macedonia,[1] and Montenegro. Seasonally adjusted data from the first quarter of 2004 (henceforth 2004Q1) to the last of 2015 (henceforth 2015Q4) were used.

The length of the time series is limited due to the lack of official data. Quarterly data from 2004 to 2009 pertaining to import, export and GDP for Montenegro and B&H were obtained by employing an interpolation method. The data were collected from various sources, as specified in the appendix.

Our assessment of the trade elasticity in Serbia is based on the imperfect substitutes model developed by Goldstein and Kahn (1976)

[1] In this work, "Macedonia" refers to the Former Yugoslav Republic of Macedonia.

and Rose and Yellen (1989). The main assumptions of the model are as follows: a) domestically produced goods and imported goods are perfect substitutes; b) the model distinguishes between the domestic economy and a foreign country; c) each country produces a single good with a fixed price (Kurtovic et al., 2017).

The imperfect competition model consists of import and export demand functions for the domestic and the foreign country. The import demand function for the domestic country is given as follows:

$$M_d = M_d(P_{md}, Y) \tag{1}$$

where M_d represents the import demand function of the country, P_{md} is the relative price the goods imported by the domestic country, and Y is the country's real income. The import demand function of the foreign country is defined as follows:

$$M_d^f = M_d^f\left(P_{mf}^f, Y^f\right) \tag{2}$$

where M_d^f represents the import demand function of the foreign country, P_{mf}^f is the relative price of the goods imported by the foreign country, and Y stands for the real income of the foreign country.
Once the import demand functions of the domestic and the foreign country have been introduced, the export supply function of the domestic country can be expressed as follows:

$$X_s = X_s(P_{xd}) \tag{3}$$

where X_s represents the export supply function of the domestic country, and P_{md} represents the relative price of the exported domestically produced goods. In turn, the export supply function of the foreign country can be expressed as follows:

$$X_s^f = X_s^f(P_{xf}^f) \tag{4}$$

where X_s^f represents the export supply function of the foreign country, and P_{xf}^f denotes the relative price of the goods imported by the foreign country.

Based on the equations above, the relative import price for the domestic country can be defined as the ratio of the prices of the domestically produced and foreign produced goods at home and abroad:

$$P_{md} = \frac{eP_x^f}{P} = \left(\frac{eP^f}{P}\right)\left(\frac{P_x^f}{P^f}\right) = QP_x^f/P^f = QP_{xf}^f \quad (5)$$

where e stands for the nominal exchange rate, $Q = eP^f/P$ denotes the real exchange rate, and P is the consumer price index. In turn, the relative import price of the foreign country is expressed as follows $P_{mf}^f = P_{xf}/Q$. The quantity of goods traded and their relative prices are determined by the following equilibrium conditions: $M_d = X_s^f$ and $M_d^f = X_s$ which represent the equality between the exports of a country and the imports of the other one. Real income, price levels and nominal exchange rates are considered exogenous. As a consequence, the trade balance of the domestic country is:

$$TB = TB(Q, Y, Y^f) \quad (6)$$

Equation (6) can be considered as a partial reduced form that depends on Q, Y and Y^f.

It represents the basic equation for our analysis, and it can be expressed in log-linear form:

$$logTB_{i,j,t} = \beta_0 + \beta_1\, logEXR_{i,t} + \beta_2 logY_{i,t} + \beta_3 logY_{j,t} + e_{i,j,t} \quad (7)$$

where i stands for the domestic country, j for the foreign country, and t for time. The variables of the bilateral trade model in the equation (7) are: trade balance between the domestic and the trading partner countries, real income of the domestic country and the real income of the trading partner countries. Export is expressed in f.o.b, while import is expressed in c.i.f; the values of both exports and imports are expressed in millions of US dollars. The real income of the domestic country and of the trade partners are expressed in constant dollars with base 2010 = 100.

During the period between 2004 and 2015, Serbia recorded an improvement in the trade balance with its main trading partners, as

shown in figures 1 and 2), and the real exchange rate depreciated against all the currencies of Serbia's main trading partners, as shown in figure 3.

The bilateral trade balance equation above is characterized by the problem of bilateral trade assessment due to the lack of import and export prices. Accordingly, import and export values (disbursements and payments) are used to determine currency and income changes that efficiently reflect changes in disbursements and payments of the country. Therefore, in order to investigate the bilateral elasticity effect on exchange rate depreciation and of income on the import and export demand functions, employing the imperfect substitutes model, we define import and export demand functions as shown below:

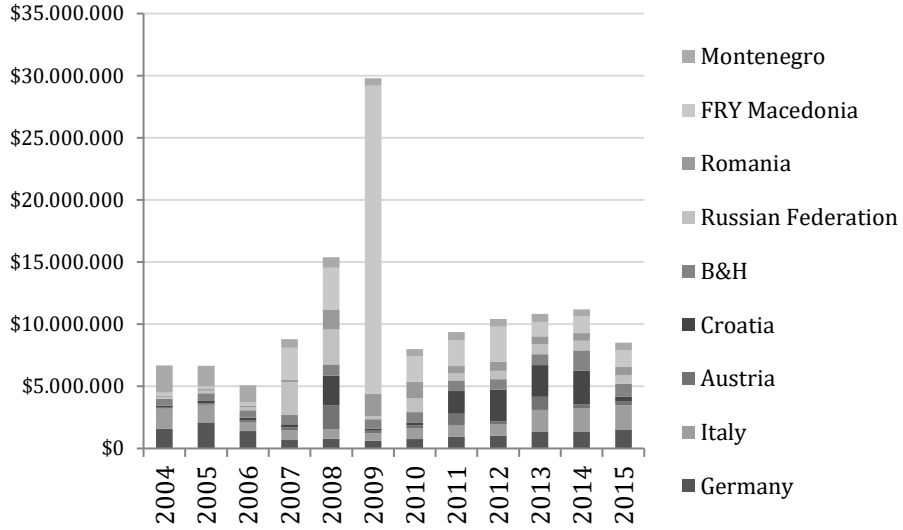
$$log\ X_{srb,t} = \beta_0 + \beta_1\ logY_{fc,t} + \beta_2\ logEXR_{i,t} + e_{1,t} \quad (8)$$

$$log\ M_{srb,t} = \alpha_0 + \alpha_1\ logY_{srb,t} + \alpha_2\ logEXR_{i,t} + e_{2,t} \quad (9)$$

where $logX_{srb,t}$ is the home country exports to its main trading partners; $logY_{fc,t}$ is the real income of the foreign country; $logEXR_{i,t}$ is the nominal exchange rate; $logM_{srb,t}$ are the domestic country's imports from trading partners; $logY_{srb,t}$ is the real income of the domestic country; and $e_{1,t}$ and $e_{2,t}$ are idiosyncratic error terms.

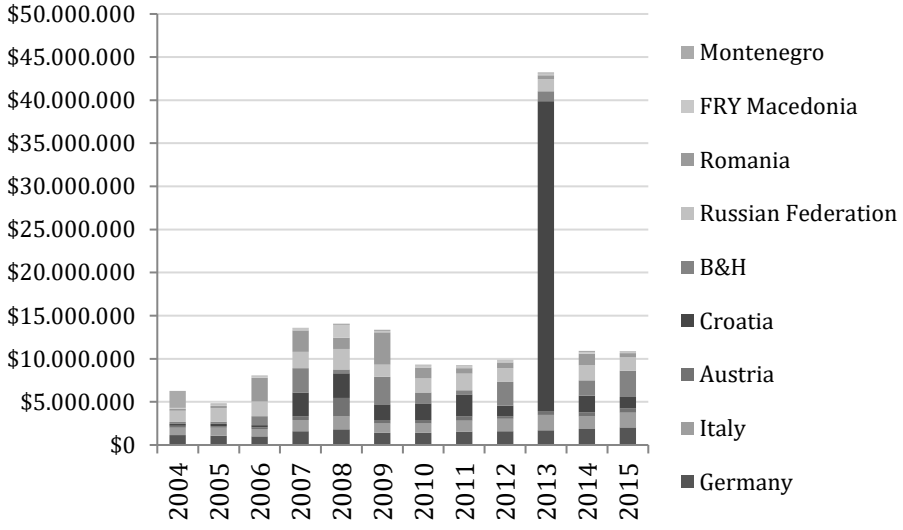
In the export demand function (8) we expect that an increase (decrease) in the foreign trading partner's real income will result in an increase (decrease) of Serbia's exports, i.e. β_1 is assumed to have a positive sign. On the other hand, the appreciation of foreign currencies against the Serbian dinar can positively affect the growth of Serbia's exports to the countries concerned. In the import demand function (9) we expect an increase (decrease) of Serbia's real income to lead to an increase (decrease) in Serbia's imports from its trading partners, i.e. α_1 is assumed to have a positive sign. Real depreciation of the Serbian dinar against the currency of its major leading partners may lead to a decrease in imports from the respective countries, i.e. α_2 is assumed to have a negative sign.

Figure 1 – *Serbia's exports to its leading trade partners, 2004-2015*



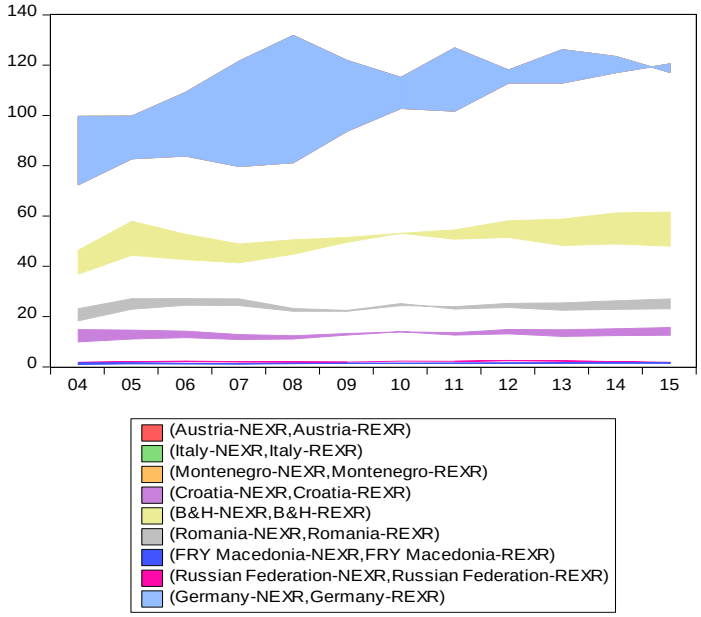
Sources: see Appendix.

Figure 2 – *Serbia's imports from its leading trade partners, 2004-2015*



Sources: see Appendix.

Figure 3 – *REXR and NEXR of the dinar against the currencies of Serbia's main trading partners*



Sources: see Appendix.

Our analysis is based on the application of the cointegration approach, better known as the Autoregressive Distributed Lag (ARDL). The ARDL model, developed by Pesaran et al. (1997; 1999), has the following characteristics: the model is statistically more efficient in the process of determining cointegration relationships in small samples; and it can be applied when the regressors are not of the same order, or when the regressors are I(1) and/or I(0), i.e. it is not necessary to perform pre-testing for unit roots (Pesaran et al., 1999; Pahlavani et al., 2005; Ketenci and Uz, 2011; Kurtovic et al., 2016).

The ARDL model requires the following two steps: the first relates to the process of determining any significant long-term relationship between the variables concerned, using an *F*-test; the second step relates to the long-term relationship variables and determining their

value, as well as assessing the variables' short-term elasticity with an error correction representation of the model. The results of the error correction model are informative about the speed of adjustment from a short-term shock to the long-term balance, and the way dependent variables adjust to the independent variables (Siddiqui et al., 2008; Cerro et al., 2010; Ketenci and Uz, 2011; Kurtovic et al., 2016). The ARDL model is represented by the following equations:

$$\Delta log\ X_{srb,t} = \beta_0 + \sum_{i=1}^{m} \beta_{1,i} \Delta log\ X_{srb,t-1} + \sum_{i=0}^{m} \beta_{2,i}\, \Delta log Y_{fc,t-i} + \sum_{i=0}^{m} \beta_{3,i}\, \Delta log EXR_{i,t-1} + \gamma_1 log\ X_{srb,t-1} + \gamma_2 log\ Y_{fc,t-1} + \gamma_3 log\ EXR_{\,i,t-1} + e_{1,t} \quad (10)$$

$$\Delta log\ M_{srb,t} = \alpha_0 + \sum_{i=1}^{m} \alpha_{1,i} \Delta log\ X_{srb,t-1} + \sum_{i=0}^{m} \alpha_{2,i}\, \Delta log Y_{fc,t-i} + \sum_{i=0}^{m} \alpha_{3,i}\, \Delta log EXR_{ij,t-1} + \lambda_1 log\ X_{srb,t-1} + \lambda_2 log\ Y_{fc,t-1} + \lambda_3 log\ EXR_{\,i,t-1} + e_{2,t} \quad (11)$$

where β_2 and α_2 respectively denote the impact of a change in real the income of Serbia's trading partners, which may lead to a short-run effect on the change in exports from and imports to Serbia; α_1 and β_1 represent the coefficient of a change in Serbia's real income, which could cause a short-term effect on the change of Serbia's imports and exports; β_3 and α_3 denote the short-term effect of real appreciation or depreciation on Serbia's imports and exports; m represents the number of lags, β_0 and α_0 represent movement or drifts; and $e_{1,t}$ and $e_{2,t}$ represent the error terms.

We assume that a real depreciation causes a J-curve effect, i.e. α_3 is assumed to have a negative sign with short time lags and a positive value with longer time lags. If the sum of the absolute value of the real exchange rate elasticities in the import and export demand functions equals or is greater than 1, we can say that the Marshall-Lerner conditions hold.

Concerning the impact of real depreciation in the export demand equation (10), we expect β_3 and γ_3 to have a positive sign, that is a depreciation has a positive effect on Serbia's exports in both the short-term and long-term. In the import demand equation (11), real

depreciation of the Serbian dinar should lead to a decrease in imports both in the short-term and long-term.

Concerning changes in trading partners' income, there is a high probability that short-term and long-term effects will affect the growth of exports from Serbia, i.e. β_2 and γ_2 are assumed to have a positive sign. Finally, a change in Serbia's income will result in a short-term and/or long-term decrease or increase of imports from its major trading partners, i.e. β_1 and γ_1 are assumed to have a positive sign.

3. Empirical results

3.1. Tests for cointegration, short-run and long-run estimates

In this section we will present the main results related to the bilateral elasticity effects of real depreciation and of income on the import and export demand functions of Serbia and its nine main trading partners. In equations (10) and (11), the error-correction model was employed along with the ARDL approach, in order to check for the existence of cointegration among the variables (dependent and independent ones).

The first step of our analysis consists of the use of F tests, which is very sensitive to the chosen length of lags. Accordingly, we introduce a rather long sequence of lags in the first-differenced variable. The results are shown in table 1.

As shown in the table, the *F*-tests indicate that in all import and export demand functions the existence of cointegration between the dependent and the independent variables cannot be rejected already at 0 lag length. We applied the Akaike Information Criterion (AIC) to find the optimal length of lags for the import and export demand functions of bilateral trade with each country. Table 2 shows the results of the estimates of equations (10) and (11) with the estimated optimal number of lags.

Table 1 – *Results of the F-test for cointegration, by partner country*

	Bilateral exports										
Lag length	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Germany	4.9	4.5	4.7	4.5	4.4	3.6	2.7	4.2	7.6	9.6	3.3
Italy	7.1	6.6	8.2	9.9	8.5	8.3	6.8	7.8	8.9	3.6	5.9
Austria	6.9	9.6	8.4	7.9	7.7	7.1	7.5	6	9.6	1.8	2.7
B&H	11.1	11.7	10.8	10.1	9.7	9.3	8.3	7.3	6.6	5.9	5.8
Croatia	4.4	4.4	3.6	3.5	2.8	3.5	1.9	1.8	1.6	1.7	1.2
Russia	6.4	5.9	4.9	5.7	7.5	7.6	4.2	4.4	5.3	4.3	4.7
Romania	4.1	4.6	7.1	11.3	10.4	14.9	11.7	9.5	6.8	7.5	8.6
Macedonia	7.4	7.8	8.4	10.5	9.8	9.3	13.5	11.3	12.6	15.9	18
Montenegro	8.6	8.3	7.9	6.6	6.3	5	5.8	4.4	4.2	5.2	3.7
	Bilateral imports										
Germany	10.7	7.9	7.8	8.3	8.5	7.9	7.2	4.8	11.2	5.9	4.6
Italy	10.5	10.7	10.9	9.1	9.8	15.9	4.8	3.8	5.8	8.1	6.8
Austria	10.4	11.9	10.9	12.1	9.6	7.7	5.4	4.8	6.9	4.9	4.3
B&H	7.6	5.9	7.1	6.7	8.2	14.3	8.7	7.6	5.3	4.7	5.9
Croatia	7.1	6.6	7.6	9.1	7.4	6.3	5.5	4.7	6	5	2.1
Russia	12.5	10.9	8.5	8.4	14.7	8.7	9.2	7.1	9.6	5.3	5.6
Romania	4.5	4.5	6.1	4.8	7.7	9.9	7.3	6.3	8.5	6	4.3
Macedonia	5.4	5.5	7.8	6.7	6.6	5.3	3.8	3.7	3.7	3.7	3
Montenegro	13.9	14.3	11.1	9.9	10.6	10.8	9.5	7.7	8.5	9	9.1

Notes: the relevant critical value bounds for the *F*-statistics are taken from tables C1.iii case III in Pesaran et al. (1999). They refer to unrestricted intercept and no trend and correspond to (4.29-5.61) at 90% significance level, and (3.23-4.35) at 95% significance level.

As shown in the table, there is no evidence of J-curve effects in the case of the bilateral export demand functions, and there is no significant short-term effect of real exchange rate depreciation on the export demand function. The short-term coefficient of the effect of real exchange rate depreciation of bilateral import demand function causes the J-curve effect to occur in the cases of Germany, Austria and Croatia.

This position can be substantiated by the negative values corresponding to the first few lag lengths, followed by positive values corresponding to longer lengths. Therefore, the results concerning

Table 2 - *Short-run coefficient estimates of the exchange rate and of the error correction term, EC(–1)*

	Bilateral exports									
Lag length	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**EC (–1)** $(\gamma_1, \gamma_2, \gamma_3)$
Germany	0.48 (3.71)*	0.74 (0.36)	-0.31 (-0.14)	1.13 (0.51)						-0.58 (0.16)
Italy	-0.06 (-0.03)	-0.07 (-0.04)	-1.18 (-0.54)	-1.55 (-0.8)	0.13 (0.06)					-0.47 (0.14)
Austria	-0.22 (-0.16)	-0.14 (-0.1)	-0.22 (-0.16)	-0.26 (-0.18)	-0.56 (-1.25)	-2.45 (-0.53)	2.56 (0.54)	-6.28 (-1.35)	-3.55 (-0.73)	-0.67 (0.22)
B&H	1.17 (0.81)	1.19 (0.83)	-1.12 (-0.73)	-1.52 (-0.93)	-2.18 (.1.37)	-2.37 (-1.61)				-0.44 (0.24)
Croatia	-2.98 (-0.61)	-2.99 (-0.62)	-4.21 (-0.81)	-5.27 (-0.94)	-1.07 (-0.18)	-7.34 (1.29)	-1.1 (-1.18)	-10.12 (-1.70)	-3.06 (0.48)	-0.55 (0.22)
Russia	2.07 (1.16)	-1.56 (-0.79)	-1.94 (-1.1)	-3.55 (-1.9)	-2.6 (-1.18)					-0.43 (0.14)
Romania	2.76 (0.77)	2.8 (0.78)	3.72 (0.97)	-6.99 (-1.89)	-4.37 (-1.16)					-0.01 (0.01)
Macedonia	5.6 (1.36)	-4.39 (-1.05)	1.42 (0.32)	0.39 (0.08)	-4.78 (-1.02)	-2.11 (-0.44)				-0.38 (0.21)
Montenegro	0.05 (0.02)	0.06 (0.02)	0.36 (0.17)							-0.71 (0.16)
	Bilateral imports									$(\lambda_1, \lambda_2, \lambda_3)$
Germany	-0.82 (-0.71)	-0.83 (-0.72)	-0.4 (-0.32)	-1.93 (-1.5)	-1.56 (-1.22)	-2.5* (-3.26)	0.43 (0.5)			-0.16 (0.12)*
Italy	-1.22 (-0.97)	-1.23 (0.98)	-0.4 (-0.29)	-2.63 (-1.87)	-0.95 (-0.67)	-3.24* (-3.66)	0.68 (0.69)	-1.42 (-1.63)	-0.4 (-0.51)	-0.53 (0.15)
Austria	-052 (0.43)	-0.47 (0.39)	-6.32* (-1.89)	-0.45 (-0.12)	-2.46 (-0.62)	-4.24 (-1.06)	-3.25 (-0.78)	0.42 (0.10)		-0.57 (0.16)**
B&H	1.51 (0.32)	1.5 (0.33)	-3.95 (-0.78)	-1.48 (-0.27)						-1.69 (0.53)
Croatia	-7.16 (-1.36)	-7.18 (-1.36)	-8.9 (-1.58)	-6.32 (-1.01)	4.65 (0.76)					-0.71 (0.15)**
Russia	-0.18 (-0.25)	-0.16 (-0.23)	-0.74 (-1.04)	-0.78 (-1.02)	0.67 (0.86)	-0.69 (-0.81)	-1.26 (-1.35)			-0.82 (0.23)
Romania	-2.27 (-0.57)	-2.37 (-0.6)	-4.33 (-1.05)	-039 (-0.09)	0.98 (0.24)	-2.98 (-0.73)				-0.43 (0.15)
Macedonia	5.18* (2.71)	5.11* (2.75)	3.31 (1.7)							-0.58 (0.13)
Montenegro	-0.93 (-0.54)	-0.93 (-0.54)	1.78 (0.97)	0.28 (0.13)	2.69 (1.29)	0.63 (0.29)				-5.49 (2.52)

*, **, and *** show significance levels at 1%, 5% and 10% respectively.

Notes: the values reported in parentheses are *t*-statistics. In column EC(-1): .γ_1, γ_2, and γ_3 measure the speed of adjustment of exports after a short-term shock to the exchange rate or domestic income; λ_1,λ_2, and λ_3 measure the speed of adjustment of imports after a short-term shock to the rate or domestic income.

these import demand functions are in accordance with the theoretical assumptions about the presence of J-curve effects.

Research findings of Bahmani-Oskooee and Kutan (2006) indicate that real exchange rate depreciation in the transition countries of South Eastern Europe leads to a J-curve phenomenon, as in the case of Croatia, that is entirely consistent with our research results. Kumar Dash (2013) investigated the presence of the J-curve effect in the case of the bilateral trade between India and Germany, which is in line with our research results.

However, in the case of trade with other countries, such as Italy, Russia, Romania and Montenegro, the first few lags are assumed to have a negative value, followed by a positive value, whereby the respective values are not significant. In the case of these countries, the short-term coefficient of real depreciation of the exchange rate of bilateral elasticity of the import demand function is not significant, which means that a real depreciation of the exchange rate did not have a positive effect on (the decrease of) imports.

In addition, table 2 presents the results concerning the coefficients of the error-correction model, denoted by EC(-1). For all these coefficients, we expected a negative sign to confirm the existence of cointegration among the variables. However, not all error correction coefficients of bilateral export demand functions are statistically significant. The error correction coefficients of the import demand functions in the cases of Germany, Austria and Croatia are significant. In the case of Germany, the coefficient is rather low, equal to 16%, while in the case of Austria it is very high, amounting to 57%, and in the case of Croatia it amounts to 71%. A rather high value of the error-correction coefficients for Austria and Croatia implies a quick correction of imbalances in the bilateral import demand function after a real exchange rate depreciation. The equilibrium condition of the bilateral import demand function is estimated to be reached after six quarters in the case of bilateral trade between Serbia and Germany, while in the case of bilateral trade between Serbia and Austria and Serbia and Croatia it is estimated at less than two quarters.

The results of the long-term effect of exchange rate depreciation and changes in the income of both trading partners on the bilateral import and export demand functions are presented in table 3. The assessment of long-term effects of a real depreciation or income changes on the import and export demand functions is inter alia to check for the existence of cointegration among the dependent and independent variables. In all cases pertaining to bilateral long-term elasticity of real exchange rate depreciation, the coefficients exhibit the expected signs. However, only in the cases of bilateral long-term trade elasticity of the import demand functions for Italy, Austria and Macedonia, was a significant value of the coefficients observed.

Table 3 – *Long-run coefficient estimates elasticities*

	Constant	**REX**	**Y**
Bilateral exports			
Germany	-3.58 (-3.76)*	-0.32 (-0.17)	1.58 (0.45)
Italy	2.18 (4.55)*	1.78 (2.36)**	-2.28 (-0.74)
Austria	-8.79 (5.03)*	-5.7 (-2.71)**	12.32 (3.46)**
B&H	-10.01 (-4.46)*	1.05 (0.69)	2.11 (0.97)
Croatia	-2.51 (-3.03)	4.12 (0.27)	6.46 (1.09)
Russia	-3.41 (-4.21)	-0.86 (-0.36)	1.44 (1.82)***
Romania	-6.38 (-3.81)	-1.01 (-0.29)	2.56 (2.08)**
Macedonia	-3.16 (-5.14)*	-6.91 (-1.94)**	7.31 (2.61)*
Montenegro	14.6 (5.1)**	-1.22 (-1.64)	-0.33 (-0.01)
Bilateral imports			
Germany	1.26 (5.14)	0.25 (0.62)	1.09 (3.03)*
Italy	0.44 (5.49)*	0.45 (1.15)	1.12 (3.25)*
Austria	-8.23 (-5.55)*	-2.58 (-2.63)**	3.58 (3.57)**
B&H	-4.83 (4.27)*	0.51 (0.23)	2.02 (2.06)
Croatia	-9.71 (-4.71)*	-0.58 (-0.28)	3.03 (1.79)***
Russia	7.81 (5.14)*	0.04 (0.07)	0.35 (0.8)
Romania	5.67 (3.79)*	2.07 (0.54)	-0.75 (-0.34)
Macedonia	-3.98 (-4.94)*	-1.17 (0.99)	2.06 (2.07)*
Montenegro	3.03 (4.89)*	-1.07 (-1.22)	1.31 (1.5)

*, **, and *** show significance levels respectively at 1%, 5% and 10%.

Elasticity of real exchange rate depreciation leads to a positive long-term effect on the growth of Serbia's exports to its main trading partners. As is well known, Italy, Austria and Macedonia are among the countries to which Serbia exports the most. Real depreciation of the exchange rate has led to a decrease in export prices which was reflected positively on the growth of exports to these countries in particular.

Concerning the long-term elasticities of the import demand function, the expected sign was found in all cases. The coefficient of the exchange rate is statistically significant in the case of Austria, implying that a real depreciation of the Serbian dinar in the period considered has led to a reduction in the imports of goods from Austria. Many Austrian companies have daughter companies in Serbia, which could explain why the import of Austrian products is more easily substituted by domestic products and/or imports of products from third countries. In the remaining cases, we find insignificant values of a real depreciation.

Concerning the long-term income elasticity of the export demand function, we find a significant value of the coefficients pertaining to Austria, Russia and Macedonia, while in the case of long-term elasticity of the import demand function, a significant value of the coefficients for Germany, Italy, Austria, Croatia and Macedonia was found.

It emerges that the bilateral elasticity of the import and export demand functions to income changes is larger than the elasticity of exchange rate depreciation. We conclude that income in comparison to real exchange rate depreciation has a greater effect on bilateral exports and imports. This result confirms those by Ketenci and Uz (2011), whose research too indicates a greater effect of income than real exchange rate depreciation on trade elasticity in the case of the EU and its major trading partners.

Based on the long-term elasticities of exchange rate depreciation on the import and export demand functions, we checked whether the Marshall-Lerner conditions hold in the period considered. As is well known, the conditions hold if the sum of the absolute values of the

exchange rate elasticities of exports and imports equals or is greater than 1. In our sample, only in the case of Austria was this condition fulfilled. This indicates that real depreciation of the Serbian dinar has a positive long-term effect on the bilateral trade with Austria only.

Table 4 – *Diagnostic statistics*

	Adj. R^2	**LM** x^2_{SC}	**Normality** x^2_{FC}	**Heterosk.** x^2_N	**RESET** x^2_H
			Bilateral exports		
Germany	0.24	0.39 (0.67)∗	79.17 (0.00)	3.08 (0.01)∗	0.83 (0.36)
Italy	0.25	2.44 (0.1)∗	7.26 (0.00)	4.19 (0.00)∗	13.8 (0.00)∗
Austria	0.25	0.52 (0.59)∗	3.69 (0.00)	0.63 (0.76)	6.19 (0.01)∗
B&H	0.51	0.01 (0.98)∗	3.52 (0.00)	0.39 (0.97)	2.69 (0.12)
Croatia	0.47	0.76 (0.47)∗	2.73 (0.25)∗	0.47 (0.7)	3.85 (0.05)∗
Russia	0.30	4.33 (0.02)	4.34 (0.11)∗	1.56 (0.16)	0.27 (0.86)
Romania	0.40	5.58 (0.00)	15.14 (0.00)	3.38 (0.01)∗	3.3 (0.00)∗
Macedonia	0.27	2.27 (0.11)∗	3.13 (0.2)∗	0.75 (0.62)	0.76 (0.45)
Montenegro	0.26	3.48 (0.04)	2.33 (0.00)	1.54 (0.19)	5.73 (0.02)∗
			Bilateral imports		
Germany	0.49	1.59 (0.21)∗	1.64 (0.00)	8.81 (0.00)∗	8.38 (0.00)∗
Italy	0.52	1.23 (0.3)∗	7.8 (0.00)	5.37 (0.00)∗	1.52 (0.22)
Austria	0.24	0.59 (0.56)∗	2.84 (0.00)	1.35 (0.23)	12.23 (0.00)∗
B&H	0.21	1.12 (0.33)∗	1.47 (0.47)∗	1.2 (0.32)	5.19 (0.02)∗
Croatia	0.28	3.13 (0.05)	3.39 (0.18)∗	0.42 (0.72)	0.45 (0.5)
Russia	0.27	3.77 (0.15)∗	11.96 (0.00)	5.06 (0.00)∗	11.01 (0.00)∗
Romania	0.30	0.74 (0.48)∗	4.28 (0.11)∗	0.87 (0.5)	0.25 (0.8)
Macedonia	0.31	2.86 (0.06)∗	2.91 (0.00)	1.03 (0.38)	2.21 (0.03)∗
Montenegro	0.29	0.22 (0.8)∗	6.02 (0.00)	0.8 (0.67)	2.03 (0.05)∗

*, **, and *** show significance levels respectively at 1%, 5% and 10%.

3.2. Checking the robustness of findings

The results of diagnostic tests are presented in table 4. They demonstrate the validity of the ARDL approach applied. In the first column, Lagrange Multiplier tests, LM (x^2_{SC}), show no serial correlation in general between the tested variables in our model: only in two cases out of 18 tested cases has a serial correlation been found, related to the Russian Federation and Romania. The normality Jarque-Bera statistic (x^2_{FC}) test takes on a significant value in seven out of 18 test cases. The heterosckedasticity (x^2_N) test shows six significant values out of 18 tested cases. Finally, the REST test (x^2_H) showed no functional limitations in most of the 18 test cases.

Given these results, we conclude that our model meets the required criteria of all diagnostic tests.

Table 5 – *Stability tests results*

	CUSUM	**CUSUMSQ**	**CUSUM**	**CUSUMSQ**
	Bilateral export		**Bilateral import**	
Germany	unstable	unstable	stable	unstable
Italy	stable	unstable	unstable	unstable
Austria	stabile	stabile	stable	stable
B&H	stable	unstable	stable	unstable
Croatia	stable	stable	stable	stable
Russia	stable	stable	stable	stable
Romania	stable	unstable	stable	stable
Macedonia	stable	stable	stable	unstable

Notes: the table shows the results of the CUSUM and CUSUMQ tests with reference significance level 5%.

The results of stability tests are provided in table 5. The CUSUM test of stability provides more positive results than the CUSUMSQ test.

Indeed, the CUSUM test indicates high stability in 16 out of 18 cases in our analysis. In the case of Germany's bilateral export demand function, instability was found using both tests. Also, stability tests indicated limited reliability in the cases of the bilateral export demand functions of Italy, Bosnia and Herzegovina, and Romania, as well as the bilateral import demand functions of Germany, Italy, Bosnia and Herzegovina, and Macedonia.

4. Conclusions

The growth rate of income in Serbia in the period 2004-2008 was 6.14% on average. However, from 2009 to 2016, the average growth rate of income was only 0.2%, due to the economic crisis and European recession. In order to increase income, industrial policy measures related to improving the business environment were taken, i.e. eliminating administrative obstacles and regulatory constraints that hinder the development of entrepreneurship, and institutional support for small and medium-sized enterprises was given to develop innovation and investment based on research and development. These measures were aimed at improving competitiveness of the economy and free market competition.

The elasticity of bilateral trade, and the effects of a real depreciation of the exchange rate and of real income changes on the import and export demand functions have been the focus of many economists. Bilateral trade elasticity provides answers to many questions, such as: will a real depreciation lead to a solution of problems regarding the balance of trade; will changes in the income of either trading partner lead to an improvement of the balance of trade? In this regard, the objective of this paper has been to evaluate these issues for the case of Serbia and its nine top trading partners.

We applied an ARDL model to data from 2004Q1 to 2015Q4. The results indicate the presence of a short term real depreciation effect on the import demand function, which implies a J-curve effect, in the cases of Serbia's bilateral trade with Germany, Italy and Croatia. In

contrast, such effect was not found in the case of the export demand function. The presence of a short-term real exchange rate depreciation effect implies a decrease of imports to Serbia from the respective trading partners, which accordingly leads to an improvement of Serbia's balance of trade. These results are indirectly supported by Bahmani-Oskooee and Kutan's (2006) research, who found the presence of J-curve effects in Croatia's bilateral trade with Central and Eastern European countries.

Beside the real exchange rate depreciation, imports decrease also as a consequence of a rise in import prices. In the short run, we do not observe a growth of exports to these trading partners, which is in line with the theoretical assumptions on the effects of the J-curve. An error-correction model formulation confirms the results of the short-term effect of real depreciation of the exchange rate on the import demand function. After a real depreciation of the exchange rate, the equilibrium state of the bilateral import demand function is established within six quarters, in the case of bilateral trade between Serbia and Germany, and in less than two quarters in the cases of bilateral trade between Serbia and Austria, and between Serbia and Croatia. Therefore, real exchange rate depreciation has a stronger and shorter effect in the cases of trade with the latter two countries: this may be attributed to the effect of rising import prices and the replacement of foreign products with cheaper domestic products.

Furthermore, the effect of depreciation on the export demand function in the cases of long-term bilateral trade with Italy, Austria and Macedonia was found to be statistically significant. Thus, long-term real depreciation of the exchange rate (and increased demand from these countries) seems to lead to a growth of Serbian exports, which is in line with our theoretical assumptions. Indeed, these countries are among the most important trade partners with which Serbia has a favorable trade balance. The exports of Italian and Austrian daughter-companies operating in Serbia to their country of origin constantly grow year after year. In the case of Austria, depreciation is found to significantly affect the import demand function too, which means that real depreciation elasticity of the

Serbian dinar has led to a decrease in imports from Austria in the period considered. The reduction of imports from Austria confirms the presence of a J-curve phenomenon, i.e. in the long run it reduces imports due to the rise in import prices, but at the same time it suggests that imports are replaced by domestic products produced in Austrian companies in Serbia.

A significant value of coefficients has been noted in the cases of the long-term bilateral elasticity of export demand of Austria, Russia and Macedonia, while statistically significant values of the respective coefficients was found in the cases of bilateral long-term elasticity of the import demand income functions of Germany, Italy, Austria, Croatia and Macedonia. Finally, we found that the Marchall-Lerner conditions hold in the case of Austria, i.e. a real depreciation of the Serbian dinar has a positive long-term impact on bilateral trade with Austria, with a decrease in imports and a growth of exports. The results of the research done by Hsing and Sergi (2009) and Kumar Dash (2013) support the results of our research.

Concerning non-price variations, we found that a growth of income in Austria, the Russian Federation and Macedonia has a positive effect on Serbia's growth of exports. On the other hand, a decrease of income in Serbia leads to a fall in the imports of products from Germany, Italy, Austria, Croatia and Macedonia, possibly due to a replacement of foreign products for domestic products and/or products imported from third countries.

Finding that income elasticity has a greater effect on bilateral elasticity of the import and export demand functions than real exchange rate depreciation, we obtain results in accordance with those by Ketenci and Uz (2011).

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Appendix – Data sources and description

The following data sources were used for the present analysis:

a) International Monetary Fund, International Financial Statistics;
b) Eurostat National Accounts database;
c) OECD database;
d) World Integrated Trade Solution;
e) International Monetary Fund, Direction of Trade Statistics;
f) The Statistical Office of the Republic of Serbia database;
g) Onada.com;
h) The Agency for Statistics of Bosnia and Herzegovina database;
i) The Statistical Office of Montenegro database.

These sources allowed the identification of the following variables:

Xsrb, domestic country's export to its trading partners. Value of imported goods and services expressed in euros–national currency and converted from the euro-national currency by market average bilateral currency rate (data was taken from the following sources: d, e, f);

Msrb, domestic country's import from its trading partners. Value of imported goods and services in national currency has been converted from the euro-national currency by market average bilateral currency rate (data was taken from the following sources: d, e, f);

Yfc, real income of the foreign country in constant prices, with base 2010 = 100 (data was taken from the following sources: b, c, h, i);

Ysrb, real income of the domestic country in constant prices, with base 2010 = 100 (data was taken from the following sources: b, f);

EXR, bilateral real exchange rate between the Serbian dinar and the national currency of its trading partners. It is defined as the number of monetary units of dinars per foreign currency unit. Real bilateral exchange rate is (*Pfc x NER*)/*Psrb*, where *Pfc* denotes a consumer price index of foreign country and is a consumer price index of Serbia (data was taken from the following sources: b, g, f);

NER is nominal bilateral exchange rate expressed as number of monetary units of dinars per foreign currency. Real exchange rate growth implies depreciation of the Serbian dinar (data was taken from the following sources: b, g, f).