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THE EFFECT OF REAL EXCHANGE RATE CHANGES ON CROATIAN BILATERAL TRADE BALANCES

ABSTRACT

The impact of exchange rate fluctuations on merchandise volume has been a major issue for policymakers and economists. The purpose of this study is to examine whether bilateral real exchange rate changes in Croatia have any significant impact on trade balances between Croatia and her six main trading partners (Slovenia, Austria, Germany, Italy, United Kingdom and France), except Bosnia and Herzegovina due to the lack of data. The relationship between the exchange rate and trade balance need to give answer whether depreciation results in increase in export volume and decrease in import volume to overcome the increase in import prices. The present study also tests, using generalized impulse response function, for the J-curve as a J-shaped time path of the trade balance in responses to depreciation. That means that after such an exchange rate change, the trade balance initially falls and then slowly rises, perhaps to a higher level than initially. The results do not provide empirical support for the J-curve. Impulse response function shows that after a current depreciation, there will be a dip in the export-import ratio. The long-run export-import ratio appears to be higher than the point of this early dip in four out of six cases. However, in all cases, the export-import ratio does not achieve higher long-run equilibrium than the initial one, after the depreciation.

***Key words**: Trade balance, real exchange rate, J-curve, VEC model*

1. Introduction

This study addresses the question of whether bilateral exchange rate changes in Croatia have any significant and direct impact on trade balances between Croatia and her main trading partners. Exchange rate is one of the important prices in an open economy since it affects many business, investment and policy decisions. The relationship between the exchange rate and the current account is one of the main issues for macroeconomic policymakers because highly negative or highly positive current account is associated with inoptimal trade situations. In

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addition, movements in current account are reflected in national income. The policymakers can be interested in how the exchange rate can affect the current account.

Investigation of the relationship between the exchange rate and current account need to give answer whether a currency depreciation results in a sufficient increase in export volume and decrease in import volume (the volume effect) to overcome the increase in import prices (the import value effect). In that case the trade balance rises. In contrast, if the value effect is stronger than the volume effect, the trade balance diminishes. In other words we can talk about this relationship in terms of elasticities; if the price elasticities of import and export demand in absolute terms are sufficiently high (low) then the trade balance will rise (fall) in response to currency depreciation. However, price elasticities for import and export demand may be changing over time resulting in the J-curve. The J-curve is a J-shaped time path of the trade balance in response to depreciation because, after depreciation, the trade balance initially falls and then slowly rises to a higher level than initial[1].

The purpose of this paper is to examine the validity of the bilateral J-curve for Croatia as a small open country.[2] We employ a vector error-correction model to analyze the relationships between the following variables: the export-to-import ratio, the real exchange rate, domestic output, and foreign output (for each of the Croatian main trading partner country). We use monthly data since the part of the J-curve for which the value effect is stronger than the volume effect may be observable only at the monthly level and some of the dynamics may fit more appropriately with monthly data. The drawback of using monthly data is that it requires a proxy for domestic and foreign product. For the monthly data, we use the country industrial production indices as a proxy for domestic product.

The paper is organized as follows. In the next chapter, we review some of the literature on the J-curve phenomenon. The short-run effects of the J-curve are presented in the third section. The empirical model is discussed in the fourth section followed by data description used in the study. Chapter six presents the obtained results, while chapter seven concludes followed by the literature.

2. Literature review

Numerous empirical investigations of how exchange rate changes affect the trade balance (or the export-to-import ratio) in the long-run and the short-run have been done for industrialized economies, see for example; Rose and Yellen (1989) and Koray and McMillan (1999) for the US; Gupta-Kapoor and Ramakrishnan (1999) and Lal and Lowinger (2001) for Japan; Hacker and Hatemi-J (2003), for small North European economies; and Boyd, Caporale and Smith (2001), Bahmani-Oskooee and Alse (1994) and Bayoumi (1999) for various industrialized economies. There are also many studies on the J-curve dealing with East Asian economies, see for example, Hsing and Savvides (1996) on Korea and Taiwan; and Wilson and Tat (2001) on Singapore. Rose (1990) and Bahmani-Oskooee and Alse (1994) have also examined the J-curve phenomenon for various developing economies.

[1] This J-shaped time path arises because import and export demand elasticities may be initially low (after depreciation) and higher after some time. Low initial elasticities may arise from the fact that it takes some time for old export and import orders to be fulfilled and it may take some time to change input patterns in production.

[2] The smallness of Croatia makes her heavily reliant upon trade and particularly sensitive to variations in trade.

Various studies have been done to show the influence of exchange rate on trade balance and to provide valuable inputs to policy makers based on the devaluation adjustment process (effected through the nominal exchange rate) to county's trade balance, see for example, Himarios (1989); Rose and Yellen (1989) Bahmani-Oskooee (1991); Arize (1994); Buluswar et al. (1996); Rahman and Mustafa (1996), Rahman et al. (1997); Wei (1999); Baharumshah (2001); Bahmani-Oskooee (2001); Singh (2002). Some studies have presented a little evidence of existence of the J-curve. Rose and Yellen (1989) found no statistically reliable indications of a J-curve for the US bilateral trade with respect to the G-7 countries or for aggregate US trade. Rose (1990) likewise found no evidence for the J-curve among some developing countries using a similar methodology. Bahmani-Oskooee and Alse (1994) considered the relationship between the import-to-export ratio and the real effective exchange rate for nineteen developed countries and twenty two developing. In six cases they found evidence of cointegration; namely for Brazil, Costa Rica, Ireland, The Netherlands, Singapore and Turkey. The data from all of these countries indicated that depreciations resulted in trade balance increases in the long run (the opposite was true in the Irish case). Using an error-correction model these authors also determined that for Costa Rica, Ireland, the Netherlands and Turkey, depreciation results in the short-run trade balance deterioration. Hsing and Savvides (1996) tested whether the trade balances of Korea and Taiwan show the J-curve effect. They examined the trade balances of each of these countries with respect to Japan and with respect to the US. Their estimated results generally failed to show the existence of a J-curve effect when using an unrestricted distributed lag model. However, they found some evidence for the J-curve when using the polynomial distributed lag model, most notably in the case of Korea-US trade.

3. Short-run effects of the J-curve

The analysis of the J-curve effect in Croatia is based on the model, in which the volume of import and export depends on income and on real exchange rate, *i.e.*:

$$T_B = f(Y_F, Y_D, R_R) \qquad (1)$$
$$(+\ ,\ -,\ \ +)$$

Y_F and Y_D are foreign and domestic incomes. R_R is the real exchange rate which is bilateral exchange rate between the Croatian kunas and currencies of the Croatia's leading trading partners, *i.e.*:

$$R_R = \frac{P_D}{P_F R_E} \ . \qquad (2)$$

In equation (2) P_F are the producer' prices of a specific country (the main Croatian trading partners), and R_E is the bilateral exchange rate defined as a number of domestic currency units per unit of a foreign currency. P_D are producers' prices in Croatia. The assumed signs of partial derivations are showed under the equation (1). It is also assumed that:

$$dT_B/dY_F>0 \quad \text{and} \quad dT_B/dY_D<0, \qquad (3)$$

i.e. that the increase in the world income will lead to an improvement of the trade balance and the increase in domestic income will lead to a deterioration of the trade balance. Additionally, it is assumed that:

$$dT_B/dR_R>0\ , \qquad (4)$$

since, under assumption of validity of critical values for coefficients of price elasticity, the devaluation will lead to an increase in export volume and decrease of import volume, due to cheaper domestic products intended for export and reduced import volume (as exported domestic goods will be less expensive in foreign currency and imported foreign goods will be more expensive in national currency). When trade balance is defined as an export-to-import ratio, then trade balance is in equilibrium when $T_B=1$, in surplus when $T_B>1$ and in deficit when $T_B<1$. The equation (1) can also be expressed in the form:

$$T_B = A\left(\frac{Y_F}{Y_D}\right)^a R_R{}^b \varepsilon \,, \qquad (5)$$

where A, a and b are constants and ε is a stochastic error. Based on preceding assumptions, it follows that a>0 and b<0. When real depreciation (increase in real exchange rate) turns up the export quantity rises and the import quantity falls. This leads to improvement of the trade balance, *i.e.* to a volume effect. On the other hand, the real depreciation results in more expensive unit of import which has a negative effect on the trade balance. This effect is known as the J-curve effect. The traditional J-curve theory is based on the assumption that initially the import value effect is stronger than the volume effect, because the quantities of export and import slowly adjust to the real exchange rate changes. There are several reasons for such a slow reaction in export and import quantities. One of them is the time required for economic agents to accept the occurred changes. Another is the time required to take new actions after the newly established situation has been recognized. New orders and the establishment of business connections may take a while. Finally, there is also production lag delivery and substitution of materials and equipment of which relative prices are changed.

The traditional explanation of the J-curve has often been criticized, too. It should be pointed out that a higher speed of price adjustment with regard to quantities is not the only reason for the short-run deterioration of the trade balance, caused by the real depreciation. Such effect can also come up in a case of sticky prices, where export and import quantities adjust freely in time immediately after depreciation. Thus the J-curve effect does not necessarily imply a fast pass through. If import prices are sticky, the consumers will anticipate their increase as a consequence of devaluation and will revise their future purchase, which might possibly lead to dynamics similar to the J-curve effect. There are also other explanations for deterioration of trade balance in the short-run because of exchange rate depreciation; such as habits in consumption, overlapping phenomena (Mansoorian, 1998) or explanations based on the theory of hysteresis (Dixit, 1994).

4. The empirical model

The primary relation we are interested in within this study is that between the trade balance and the real bilateral exchange rate. We do not define trade balance as exports minus imports. Instead we analyse the ratio of exports to imports because of its property that it can be logged regardless of whether there is a trade surplus or not. The trade balance is, of course, affected by other factors besides the real exchange rate. The most important is national income or GDP because of demand effects: a rise in domestic national income causes a decrease in the trade balance due to higher imports, and a rise in foreign national income causes an increase in the trade balance due to higher exports. As a result of the importance of domestic and foreign outputs to trade, we include them both in our empirical model as variables of interest, along with the export-to-import ratio and the real exchange rate. The discussion of obtained empirical results is based on using bilateral data on monthly basis. Therefore, we use the real effective exchange rate for the real exchange rate and indices of industrial production for domestic and foreign output. We are interested in linear interaction between the four variables logged to take advantage of elasticity interpretations, namely; the logged export to import ratio *ln(EX/IM),* the logged real effective exchange rate *ln(RER)*, logged domestic real output *ln(Y)* and logged foreign real output *ln(YF).* For the analysis of trade balance in a multivariate framework we defined a vector of variables:

$$Z_t = (tb, rer, y, yf)' . \tag{6}$$

and allow all four variables to be potentially endogenous.[3] The vector autoregressive (VAR) model is defined:

$$Z_t = A_1 Z_{t-1} + \ldots + A_k Z_{t-k} + \mu + u_t , \quad u_t \approx \text{IN}(0, \Sigma) , \tag{7}$$

Model (7) can be transformed into a vector error-correction, VEC model, which is more suitable for the analysis of interactions between the variables, both in the short-run and in the long-run. The associated VEC model is:

$$\Delta Z_t = \sum_{i=1}^{k-1} \Gamma_i \Delta Z_{t-i} + \Pi Z_{t-1} + \mu + u_t , \tag{8}$$

where μ is a vector that captures the deterministic components and Γ_i are matrices of parameters[4] for the growth rates of the variables. Matrix Π contains information on the long-run relationships. In fact, $\Pi = \alpha\beta'$, where β is 4 by *r* matrix of the long-run coefficients (cointegration vectors) and α is 4 by *r* matrix of the respective loadings and represents the speed of adjustment towards the long-run equilibrium. *r* is a number of cointegrating vectors of the system, and *k* is a lag length of the VAR model.

An important issue in applying the model is the selection of the optimal lag order (*k*) because the entire analysis is sensitive to the lag length. *k* is determined to solve the trade-off between improving the fit of the model (which requires additional lags) and granting a sufficiently high number of degrees of freedom (which requires parsimonious parameterization).

After choosing the optimal lag length[5] each variable was tested for unit roots. In order to classify the series based upon trend and unit root properties we performed ADF tests (e.g. Dickey-Fuller, 1979). As a confirmation to the ADF results we additionally performed KPSS tests (e.g. Kwiatkowski *et al.,* 1992) which differ in the specification of the null hypothesis. ADF test has a nonstationarity as a null hypothesis *i.e.* the null hypothesis is that the variable under investigation has a unit root, while in the KPSS test it is assumed that the variable is stationary.

If all variables appear to have a unit root, testing for cointegration is feasible. We want to find out if there are some linear combinations between variables that are stationary, *i.e.* I(0). In that case the variables are said to cointegrate and the linear combinations between them are called cointegrating vectors. The implication of cointegration is that the variables are genuinely related and they establish the long-run steady state. In order to test for cointegration, we employed

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[3] Small letters denote ln transformation, *i.e.* ***tb*** is ln of export to import ratio (trade balance), ***rer*** is ln of real effective exchange rate, ***y*** and ***yf*** are domestic and foreign income in the ln form.

[4] $\Gamma_i = -(I - A_1 - \ldots - A_i)$, i=1,…,k-1 and $\Pi = \alpha\beta' = -(I - A_1 - \ldots - A_k)$

[5] The lag length is chosen to be the same for all variables in the model.

Johansen's reduced-rank procedure, (Johansen, 1988, and Johansen and Juselius, 1990). For the Johansen's procedure, there are two test statistics for the number of cointegrating vectors: the trace (λ_{trace}) and the maximum value statistics, ($\lambda_{\max}$). In the trace test, the null hypothesis is that the number of cointegrating vectors is less than or equal to r, where r = 0 to 4. In each case the null hypothesis is tested against the general alternative. The maximum eigenvalue test is similar, except that alternative hypothesis is explicit. The null hypothesis r=0 is tested against the alternative that r=1, r=1 against r=2, etc.

After deciding if variables in the model cointegrate and obtaining the number of cointegrating relationships, we proceed to generate the impulse response functions (IRFS) based on the VEC model to trace out the possible J-curve effect. The impulse response functions are the dynamic responses of each endogenous variable to a one-period standard deviation shock to the system. From these functions we can observe if there is a J-curve effect and causal run from exchange rate to trade balance. If we identify the J-curve effect we can observe if it is the 'strong-form' (the ratio immediately drops after the shock and gradually rises thereafter) or the 'weak-form' form (the trade ratio drops soon, but not immediately, after the shock and gradually rises thereafter) and whether the trade balance ends up higher in the long-run after the shock.

IRFS are obtained from the moving average representation of the VEC (VAR) model[6]. By construction, the errors in any equation in a VEC (VAR) model are usually uncorrelated. However, there could be contemporaneous correlations across errors of different equations. It is customary to transform these correlation by ortogonalizing the innovations in the model according to a prespecified causal ordering. After the factorisation, the transformed innovations become uncorrelated with each other at all lags as well as contemporaneously. Usually, errors are orthogonalized through Choleski factorization. However, the Choleski factorization suffers from the problem of depending on the ordering of the variables. Usually, the most variance is attributed to whichever variable comes first. An attempt to avoid the difficulties of identifying orthogonal shocks is estimating the generalized impulse response functions (GIRFS) introduced by Pesaran and Shin, (1998). Unlike the traditional impulse response analysis, GIRFS do not require orthogonalization of shocks and are invariant to ordering of the variables in the model[7].

5. Data

For the study of bilateral trade flows with respect to Croatian main trading partners, we used monthly data. The empirical period is from January 1995 to January 2005. The beginning of the empirical period has been chosen due to the fact that effects of the stabilization program brought in Croatia by the end of 1993 started to show only by the mid of 1994. The data come from the IMF's *International Financial Statistics* (*IFS*).

As the most important Croatian trading partners we consider France, Germany, Italy, Slovenia, the United Kingdom and Austria[8]. The real effective exchange rate, variable *RER*, is in terms of domestic currency per foreign currency, *i.e.* a rise in the variable represents a real depreciation of the domestic currency against the specific country, indicating a gain in competitiveness. The real exchange rate for each bilateral trade analysis is computed by using the domestic nominal

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[6] The choice of VEC or VAR depends on existence of cointegration among variables

[7] The idea in computing the GIRFS is in computing the shocks with each variable in turn being first in a Choleski ordering. However, if the shocks are highly correlated it is very difficult to interpret the GIRFS sensibly. Fortunately, it was not the case in our study.

[8] Bosnia and Herzegovina was not included in the analysis due to data unavailability.

exchange rates with a specific country (domestic currency per euro) multiplied by the specific country consumer price index and divided by the domestic consumer price index. For domestic real output and foreign real output, we used data that differ from GDP, which is not available on a monthly basis. Therefore, for our monthly data analysis we employed the industrial production indexes which showed to be the adequate approximation for the GDP variable. The data are seasonally adjusted using Tramo-Seats method.

6. Empirical results of real exchange rate change

First we examined the time series properties of the macro variables performing the unit root tests. The results of ADF tests are presented in Table 1. They show that all variables except trade balance for France and the United Kingdom are integrated of order one[9]. In spite of that, to make analysis similar for all countries, we proceed with the analysis with all variables treated as being I(1).

Prior to testing for cointegration, the optimal lag length of the VEC model had to be determined. Applying the strategy discussed in the previous section, we chose *k* by minimizing information criteria (AIC, BIC and HQ)[10] and at the same time we tried to reduce auto-correlation[11]. Performing a battery of diagnostic checks with various values of lag lengths, k=2, proved to be the optimum for France, Germany, Italy and Austria. For Slovenia and the United Kingdom we opted for lag, k=3.

Table 2 reports the results from the cointegration analysis. Focusing on the Johansen test results, one cointegration vector is detected for France, Germany, the United Kingdom and Austria. In the case of Slovenia, $\lambda_{\max}$- statistic suggests one cointegrating vector while λ_{trace} indicates two. The graphs of cointegrating relationships and the roots of the companion matrix clearly signify one cointegrating relation. Thus, for Slovenia we conclude that there is one long-run relationship among variables. Exception is Italy for which the null hypothesis of no cointegration cannot be rejected.

The estimated cointegrating vectors for each country applying Johansen procedure and normalised for the trade balance is given in Table 3. For each country, the adjustment parameter $\hat{\alpha}_{1i}$ has an expected negative sign denoting the speed of adjustment towards the long-run equilibrium. Their significance indicates the significance of the error-correction term[12] in the short-run model[13].

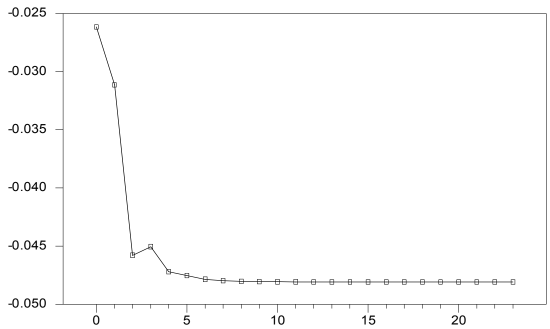
Using our findings of one cointegrating vector for the specified countries and no cointegration relationship for Italy, we proceed with the estimation of the generalized impulse response function (GIRFS) based on the VEC model (VAR model which incorporates the ECT variable) to trace out the possibility of the J-curve effect. For Italy, GIRFS were calculated using VAR model of the first differenced variables. Impulse response functions showing the effect of trade balance (*tb*) to a unit increase (a one standard deviation "shock") in the real effective exchange rate, *i.e.* the increase in real exchange rate for each country is presented in Figure 1.

[9] The results are confirmed by KPSS test and are obtained upon request.
[10] AIC, BIC and HQ are Akaike (1973), Schwarz (1978) and Hannan and Quinn (1979) criteria respectively.
[11] We tested for block significance of the variables.
[12] The error correction term, *ECT* variable, is a difference between actual trade balance and its long run value as predicted by the cointegration relationship.
[13] The estimates of the short-run relationships for each of the Croatian main trading partner country are given in Table 4 in Appendix.

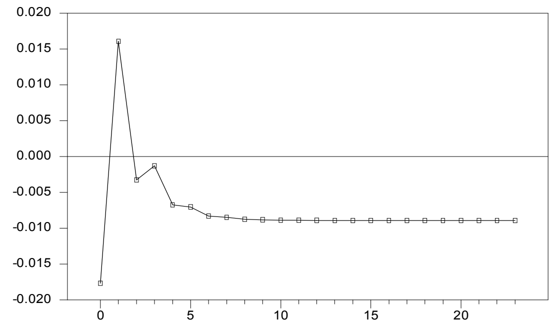
One standard deviation increase ("shock") in real bilateral exchange rate changes equals 0,97% depreciation of Croatian kunas in the case of France, for Germany it equals 0,92% and for Italy it corresponds to 1,5% depreciation of kunas. For Slovenia, the United Kingdom and Austria, one standard deviation depreciation in real exchange rate is equivalent to 0,83%, 1,65% and 0,78% depreciation of Croatian kunas, respectively.

Figure 1: Generalized impulse responses of a trade balance with regard to real bilateral exchange rate changes

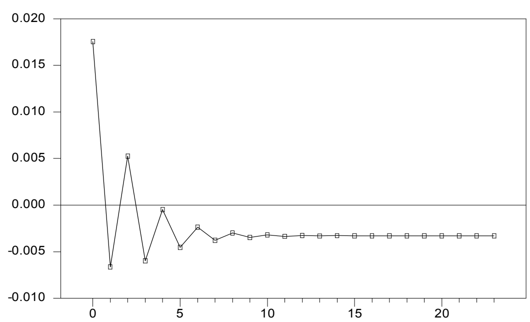
France



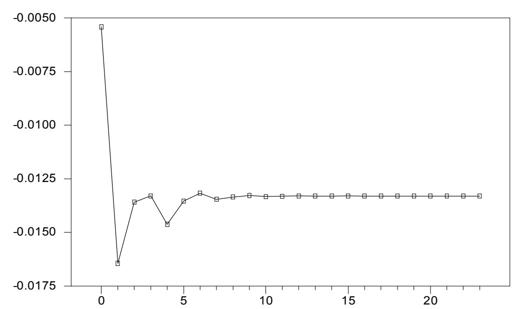
Germany



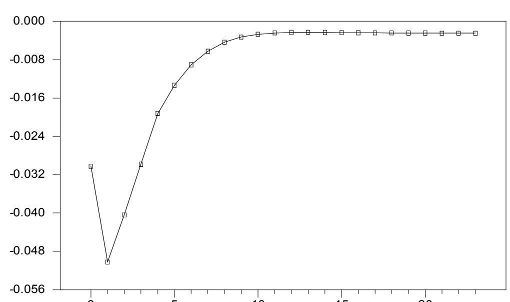
Italy



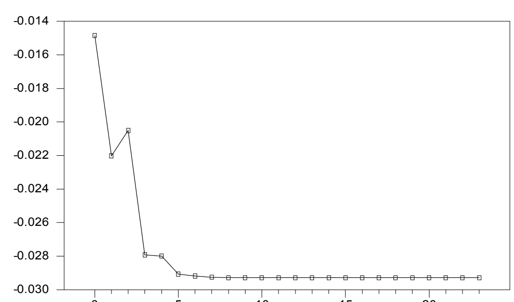
Slovenia



United Kingdom



Austria



As it can be seen in Figure 1, the contemporaneous response to a real depreciation is a decrease of export to import ratio for all countries except Italy. For France the contemporaneous decrease equals 2,6% and it drops to its lowest value within the first six months. Constancy in the export to import ratio is then attained being 4,8% lower than its initial value.

In the case of Germany, after contemporaneous decrease of 1,8% and sudden increase after a month, trade balance collapses to its long-run value, which is 0,9% lower than its initial one, within the first six months.

For Slovenia, the contemporaneous drop of 0,5% is followed by a decrease in the trade balance within the first eight months. Eight to nine months after the shock, export to import ratio stabilizes obtaining its long-run value being 1,3% lower than its initial level.

Austria case is similar. Following the contemporaneous decrease of 1,5%, import to export ratio deteriorates within the first six months after which it stabilizes obtaining its long-run value which is 3% lover than its initial one.

For the United Kingdom, there is an initial drop in the trade balance of 3%, but its lowest value is attained after a month being 5% lower than its initial level. Export to import ratio starts to increase after the second month. Within nine to ten periods, it stabilizes around its long-run value which is almost the same as its initial one (0,3% lower than its initial value).

The case of Italy differs from others in the study. The contemporaneous response of export to import ratio to a one standard depreciation of real exchange rate is increase of 1,8%. After that, trade balance alternates within the first nine to ten months. Its constant, long-run value is achieved after that period being 0,3% lower than its initial value.

7. Conclusion

Analysing obtained results from our empirical study it appears that a J-curve phenomenon is not supportive for almost all of Croatian main trading partners (Slovenia, Austria, Germany, Italy and France) except for the United Kingdom. We have applied the methodology of generalized impulse response functions to investigate the phenomenon with respect to bilateral trade of these countries employing the monthly data. For each country, the impulse response function shows that the effect of export to import ratio to a unit increase in the real effective exchange rate is present within the first six to nine months. After that, the trade balance stabilizes obtaining its long-run value which is mostly lower than its initial value. In the case of Austria the long-run value (achieved after six months) is 3% lower than its initial value. For France, the long-run value (achieved after six months) is 4,8% lower, for Slovenia (achieved after eight to nine months) is 1.3% lower and for Germany the long-run value (achieved after six months) is 0,9% lower than its initial value. In the case of Italy and the United Kingdom, the effect of unit depreciation in real exchange rate on trade balance diminishes after nine to ten months attaining its long-run value that is almost the same as its initial one. The United Kingdom case appears supportive of the J-curve although a higher export-import ratio than initial is not achieved.

These results are very likely to be interesting for policymakers, because of the short-run effect on the export-import ratio after a depreciation (which makes export-import ratio below its initial level), and the long-run effects of depreciation on the export-import ratio (which makes export-import ratio higher than its initial level). The results do not provide empirical support for the J-curve. Impulse response functions show that after a current depreciation, there will be a dip in the export-import ratio. The long-run export-import ratio appears to be higher than the point of this early dip in four out of six cases. However, in all cases, the export-import ratio does not achieve higher long-run equilibrium than the initial one, after the depreciation.

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EFEKT PROMJENA STVARNOG TEČAJA NA HRVATSKU BILATERALNU TRGOVINSKU BILANCU

SAŽETAK

Utjecaj fluktuacije tečaja na volumen roba predstavlja važno pitanje za kreatore ekonomske politike. Cilj ovog rada je ispitati imaju li bilateralne promjene stvarnog tečaja u Hrvatskoj iole značajan utjecaj na trgovinsku bilancu između Hrvatske i njenih glavnih šest trgovinskih partnera (Slovenije, Austrije, Njemačke, Italije, Velike Britanije i Francuske), izuzev Bosne i Hercegovine radi nedostatka podataka. Odnos između tečaja i trgovinske bilance trebao bi pokazati rezultira li deprecijacija povećanjem izvoza i smanjenjem uvoza kako bi se izbjeglo povećanje uvoznih cijena. Ovaj rad također ispituje korištenje generalizirane funkcije impulsnog odziva, gdje je J-krivulja J-oblikovano vremensko kretanje trgovinske bilance kao odaziv na deprecijaciju. To znači da nakon takve promjene tečaja, trgovinska bilanca u početku pada da bi se polako podigla, moguće i na viši nivo od početnog. Rezultati ne daju empirijsku potvrdu J-krivulje. Funkcija impulsnog odziva pokazuje da će nakon tekuće deprecijacije doći do pada u odnosu izvoza i uvoza. Dugoročni odnos izvoza i uvoza čini se veći od tog početnog pada u četiri od šest slučajeva. Ipak, u svim slučajevima, nakon deprecijacije odnos izvoza i uvoza ne dostiže dugoročno viši nivo od onog početnog.

Ključne riječi: *Vanjskotrgovinaska bilanca, realni tečaj, J krivulja, VEC model*

APPENDIX

Table 1.

ADF unit root tests for bilateral data (significance 5%)[14]

H_0 I(1), H_1 I(0)	Conclusion	H_0 I(2), H_1 I(1)	Conclusion
	France		
Trade balance	Series stationary around a non-zero mean		
Real Exchange rate	Series contains a unit root with zero drift	Real Exchange rate	Series has no unit root
Indust. Product. Index	Series contains a unit root with zero drift	Indust. Product. Index	Series has no unit root
	Germany		
Trade balance	Series contains a unit root with zero drift	Trade balance	Series has no unit root
Real Exchange rate	Series contains a unit root with zero drift	Real Exchange rate	Series has no unit root
Indust. Product. Index	Series contains a unit root with zero drift	Indust. Product. Index	Series has no unit root
	Italy		
Trade balance	Series contains a unit root with zero drift	Trade balance	Series has no unit root
Real Exchange rate	Series contains a unit root with zero drift	Real Exchange rate	Series has no unit root
Indust. Product. Index	Series contains a unit root with zero drift	Indust. Product. Index	Series has no unit root
	Slovenia		
Trade balance	Series contains a unit root with zero drift	Trade balance	Series has no unit root
Real Exchange rate	Series contains a unit root with zero drift	Real Exchange rate	Series has no unit root
Indust. Product. Index	Series contains a unit root with zero drift	Indust. Product. Index	Series has no unit root
	United Kingdom		
Trade balance	Series has no unit root		
Real Exchange rate	Series contains a unit root with zero drift	Real Exchange rate	Series has no unit root
Indust. Product. Index	Series contains a unit root with zero drift	Indust. Product. Index	Series has no unit root
	Austria		
Trade balance	Series contains a unit root with zero drift	Trade balance	Series has no unit root
Real Exchange rate	Series contains a unit root with zero drift	Real Exchange rate	Series has no unit root
Indust. Product. Index	Series contains a unit root with zero drift	Indust. Product. Index	Series has no unit root
	Croatia		
Indust. Product. Index	Series contains a unit root with zero drift	Indust. Product. Index	Series has no unit root

[14] The appropriate number of lagged differences was determined by Schwarz (1978) BIC criterion.

Table 2.

Johansen's test for the number of cointegrating vectors

France (k= 2)						
H_0: r =	p-r	λ	λ_{max}	λ_{trace}	λ_{max} - 10% critical value	λ_{trace} - 10% critical value
0	4	0.2852	39.96*	51.67*	24,73	43,95
1	3	0.0625	7.67	11.71	18,60	26,79
2	2	0.0291	3.51	4.04	12,07	13,33
3	1	0.0044	0.53	0.53	2,69	2,69
Germany (k=2)						
H_0: r =	p-r	λ	λ_{max}	λ_{trace}	λ_{max} - 10% critical value	λ_{trace} - 10% critical value
0	4	0.2227	29.99*	44.18*	24,73	43,95
1	3	0.0803	9.96	14.19	18,60	26,79
2	2				12,07	13,33
Italy(k=2)						
H_0: r =	p-r	λ	λ_{max}	λ_{trace}	λ_{max} - 10% critical value	λ_{trace} - 10% critical value
0	4	0.1700	22.17	40.58	24,73	43,95
1	3	0.1108	13.98	18.41	18,60	26,79
2	2				12,07	13,33
Slovenia(k=3)						
H_0: r =	p-r	λ	λ_{max}	λ_{trace}	λ_{max} - 10% critical value	λ_{trace} - 10% critical value
0	4	0.1926	25.25*	54.37*	24,73	43,95
1	3	0.1328	16.81	29.12*	18,60	26,79
2	2				12,07	13,33
United Kingdom(k=3)						
H_0: r =	p-r	λ	λ_{max}	λ_{trace}	λ_{max} - 10% critical value	λ_{trace} - 10% critical value
0	4	0.1968	25.86*	45.43*	24,73	43,95
1	3	0.0904	11.19	19.57	18,60	26,79
2	2				12,07	13,33
Austria(k=2)						
H_0: r =	p-r	λ	λ_{max}	λ_{trace}	λ_{max} - 10% critical value	λ_{trace} - 10% critical value
0	4	0.2587	35.62*	50.24*	24,73	43,95
1	3	0.0833	10.35	14.62	18,60	26,79
2	2	0.0351	4.25	4.27	12,07	13,33
3	1	0.0002	0.02	0.02	2,69	2,69

Notes: Critical values for Johansen's test were taken from Osterwald-Lenum, (1992).

Table 3.

The estimated cointegrating vector(s) for each country applying Johansen's reduced-rank procedure

Country		***tb***	***rer***	***y***	***yf***
France	β'	-1.000	4.035	2.482*	1.450
LR-test	CHISQ(1)		3,27	7,27	0,43
	p-value		(0,07)	(0,01)	(0,51)
	α'	-0.622*	0.000	-0.008	-0.004
	t-value	(-6.488)	(0.113)	(-1.198)	(-1.800)
Germany	β'	-1.000	1.428	2.374*	-0.410
	CHISQ(1)		2,55	12,57	0,18
	p-value		(0,11)	(0,00)	(0,67)
	α'	-0.363*	-0.016	-0.062*	-0.005
	t-value	(-3.463)	(-1.941)	(-3.290)	(-0.479)
Italy		No cointegration relationship			
Slovenia	β'	-1.000	2,285	2,507	-4,168*
	CHISQ(1)		2,14	1,86	7,30
	p-value		(0,14)	(0,17)	(0,01)
	α'	-0,278*	-0,009	0,003	0,047*
	t-value	(-3,379)	(-1,439)	(0,179)	(3,128)
UK	β'	-1.000	-0.357	0.344	-8.482
	CHISQ(1)		0,10	0,16	0,16
	p-value		(0,75)	(0,69)	0,20
	α'	-0.245*	-0.012	0.005	0.005
	t-value	(-4.252)	(-1.707)	(0.584)	(1.563)
Austria	β'	-1.000	4.158*	-1.210	0.203
	CHISQ(1)		9,30	2,58	0,08
	p-value		(0,00)	(0,11)	(0,77)
	α'	-0.552*	-0.012*	0.007	0.003
	t-value	(-5.682)	(-2.170)	(0.454)	(0.245)

Notes:

a) *β represents the cointegrating vector and α represents the adjustment parameter vector.*

b) *∗ represents statistical significance at 5%. For vector β, the value of likelihood ratio statistic and the p-value are presented in the parentheses. For vector α, t-values are presented in the parentheses.*

c) *−1.000 implies that the cointegrating vector is normalised with respect to the variable.*

Table 4.

Estimates of the short-run relationship; $ECT_{t-1} = \alpha_1 \beta_1' Z_{t-1}$

Country: France						
Variable	Constant	Δtb_{t-1}	Δrer_{t-1}	ΔY_{t-1}	ΔYf_{t-1}	ECT_{t-1}
Coefficient	10,381*	-0,038	0,169	0,239	-6,646*	-0.622*
"t-value"	6,479	-0,433	0,057	0,198	-2,015	-6.488

Country: Germany						
Variable	Constant	Δtb_{t-1}	Δrer_{t-1}	ΔY_{t-1}	ΔYf_{t-1}	ECT_{t-1}
Coefficient	2,993*	-0.338*	3.015*	0.229	0.571	-0.363*
"t-value"	3,452	-3.722	2.623	0.505	0.612	(-3.463)

Country: Italy					
Variable	Constant	Δtb_{t-1}	Δrer_{t-1}	ΔY_{t-1}	ΔYf_{t-1}
Coefficient	0.001	-0.615*	-0.582	-1.409	-4.438
"t-value"	0.031	-8.288	-0.415	-1.451	0.03125

Country: Slovenia										
Variable	Constant	Δtb_{t-1}	Δtb_{t-2}	Δrer_{t-1}	Δrer_{t-2}	ΔY_{t-1}	ΔY_{t-2}	ΔYf_{t-1}	ΔYf_{t-2}	ECT_{t-1}
Coefficient	-2.094*	-0.154	-0.086	-1.050	0.698	0.522	0.552	-0.655	-0.218	-0,278*
"t-value"	-3.382	-1.497	-0.884	-0.909	0.609	1.059	1.161	-1.305	-0.456	-3,379

Country: United Kingdom										
Variable	Constant	Δtb_{t-1}	Δtb_{t-2}	Δrer_{t-1}	Δrer_{t-2}	ΔY_{t-1}	ΔY_{t-2}	ΔYf_{t-1}	ΔYf_{t-2}	ECT_{t-1}
Coefficient	0,898*	0.077	0,193*	-1.479*	0,697	0,148	-0,075	0,699	0,687	-0,245*
"t-value"	3,989	0.861	2,240	-2,007	0,941	0,259	-0,133	0,401	0,395	-4,252

Country: Austria						
Variable	Constant	Δtb_{t-1}	Δrer_{t-1}	ΔY_{t-1}	ΔYf_{t-1}	ECT_{t-1}
Coefficient	-3.084*	-0.103	0.606	-1.019	1.684*	-0.552*
"t-value"	-5.677	-1.155	0.363	-1.799	2.564	(-5.682)

*Note: t-values are presented in the parentheses. * denotes significance at 5% level.*