Bilateral J-Curve between Slovakia and its major trading partners

Jana Šimáková[1]

Abstract. The primary purpose of this paper is to analyse the impact of exchange rate on bilateral trade flows between Slovakia and its seven major trading partners. Devaluation or depreciation of a currency worsens the trade balance before improving it, resulting in a J-curve pattern. This paper investigates J-curve phenomenon using quarterly time series data over the period 1997:1 to 2010:4. In this paper is applied the Johansen cointegration test to analyse the long run relationship between exchange rate and trade balance. Short term effects and the related J-curve effect is explored by estimating error correction model and by assessing the impulse response function of the trade balance on the exchange rate shock. The results reveal that the trade balance between Slovakia and its trading partners does not support the J-curve phenomenon in all cases. The J-curve phenomenon was revealed in case of Hungary and partially in Czech Republic, in case of Austria S-curve pattern was found, in other cases, the coefficient estimates follow any specific pattern in response to currency depreciation.

Keywords: J-curve, trade balance, exchange rate, international trade
JEL Classification: F10, F14, F31
AMS Classification: 62M10

1 Introduction

Slovakia, as a small open economy, depends on the rest of the world and the level of interdependence has increased in last two decades. Domestic market is small to support large scale demand and inevitably depends on imports from other countries to supply a part of domestic consumption. On the other hand, there is a huge amount of exported slovak production to the other countries. This fact makes Slovak economy vulnerable to any adverse changes in other economies. One of the most important factors which influence international trade development is exchange rates.

Discussion about exchange rates and its impact on international trade flows begun in 1973, after the Bretton-Wood system collapse. This transformation period has brought obvious volatility and uncertainty. Despite the many research dealing with this interconnection, results are not always clear. From theoretical point of view, if the Marshall-Lerner condition holds, an improvement in the trade balance would occur [14]. On the empirical level, it is still open issue. There is some support in theory for the pattern known as J-curve effect. It means that at the beginning trade balance detoriates before it subsequently improves. There are numerous empirical studies exploring this issue, some of these are mentioned in following section. Their findings are mixed and depend on used data and methodology.

The aim of this paper is to explore whether exchange rate depreciation improves Slovakia´s trade balance and vice versa. Data used in this study covers period from 1997 to 2010.The methodology used while exploring the long run relationship between exchange rate and trade balance in this paper is cointegration analysis. In this paper is used Johansen cointegration test [10]. Short term effects and the related J-curve effect is explored by estimating error correction model and by assesing the impulse response of the trade balance on the exchange rate shock.

This paper continues as follows. In the next section theoretical framework and some of the previous research are reviewed and reported. Section 3 offers model specification. The presence of a J-curve phenomenon is explored in section 4, employing an vector error correction model and impuls responses. Setion 5 concludes the paper.

2 Theoretical framework and literature review

The theoretical basis of the J-curve comes from Marshall and Lerner. The Marshall-Lerner condition states that the sum of export and import demand elasticity has to be at least one and that the currency devaluation will have a positive impact on trade balance. As a devaluation of the currency means a reduction in the price of exports,

[1] Silesian University in Opava, Department of Finance, Univerzitní náměstí 1934/3, 733 40 Karviná, simakova@opf.slu.cz.

quantity demanded for these will increase. At the same time, price of imports will rise and their quantity demanded will decrease.

Empirical examination of the Marshall-Lerner condition has a long history with very different views. It has been found that goods tend to be inelastic in the short term, as it takes time to change consuming patterns [4]. Thus, the Marshall–Lerner condition is not met, and devaluation is likely to worsen the trade balance initially. In the long term, consumers will adjust to the new prices, and trade balance will improve. This effect is called J-curve phenomenon.

As to the short run effect and J-curve effect it was first advanced by Magee [13], after the fact that short run deterioration and long run improvement after currency depreciation resemble the letter "J" as seen in Figure 1. After that a large number of empirical studies exploring this problem has appeared. They explore long run impact of exchange rate on trade balance and whether J-curve effect is present.

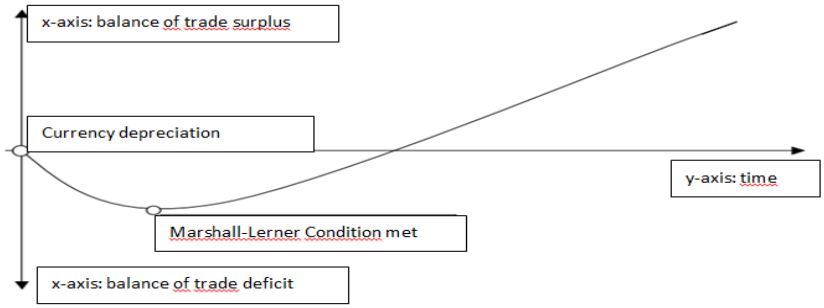


Figure 1 J-curve pattern [6]

Junz and Rhomberg [11] has attributed the J-curve phenomenon to lags in the recognition of exchange rate changes, in the decision to changes of real variables, in delivery time, in the replacement of inventories and materials, and in production. Krueger [12] has explained the phenomenon by the fact that at the time an exchange rate change occurs, goods already in transit and under contract have been purchased, and the completion of those transactions dominates the short term change in the trade balance. Therefore, exchange rate change first deteriorates the trade balance, but as the elasticities increase, it improves the trade balance. This phenomenon is not always aplicable in each country.

Bahmani-Oskooee and Kutan [3], by using monthly data over the January 1990 and June 2005 period from eleven European emerging economies (including Slovakia), after applying ARDL cointegration approach and corresponding error correction model, found empirical support for the J-curve effect in three countries: Bulgaria, Croatia and Russia - short run deterioration combined with long-run improvement was revealed. It was solved on the bilateral industry level trade balanace between two countries. Stučka [16] showed the existence of the J-curve also in Croatia. The ARDL cointegration approach used quarterly data. Hsing [9] examined the J-curve for the bilateral trade between Croatia, the Czech Republic, Hungary, Poland, Slovakia, or Slovenia and the USA. This paper found that the J-curve is not empirically confirmed for any of these six countries. In case of Slovakia, after a shock to real depreciation, the trade balance detoriates.

Using generalized impulse response functions, Hacker and Hatemi [8] tested the trade J-curve for three transitional central European countries – the Czech Republic, Hungary, and Poland – in their bilateral trade with respect to Germany. Their findings suggest that for each country there are some characteristics associated with a J-curve effect: after a depreciation trade balance decreases within a few months and then rises to a long run equilibrium value higher than the initial one. Ferreira-Lopes and Neves Sequeira [15] assessed the existence of a S-Curve pattern in ten Central and Eastern European Countries for the relation between the trade balance and the terms of trade. Empirical results support the existence of this curve for Slovenia, Czech Republic, Hungary. In the case of Slovakia the pattern is weaker than in the mentioned countries but is stills prevail.

3 Model specification

The consensus among all recent studies is that the trade balance should depend on a measure of domestic income, a measure of foreign income and the real exchange rate. In order to detect the long term co- movement among the variables, the cointegration procedure developed by Johansen [10] is used. Thus, following Bahmani-Oskooee and Kutan [3] and many other studies, equation (1) is adopted:

$$\ln TB_t = \alpha + \beta \ln Y_{d,t} + \gamma \ln Y_{f,t} + \lambda \ln REX_t + \varepsilon_t \qquad (1)$$

In equation (1) *TB* is a measure of trade balance defined as the ratio of Slovakia's exports to country *f* to her imports from country *f* ; Y_d is a measure of Slovakia's real income set in index form to make it unit free [2]; Y_f is the index of real income in trading partner *f* and *REX* is the real bilateral exchange rate between Slovakia and trading partner *f* defined in a way that an increase reflects a real depreciation of Slovak currency to currency of trading partner *f* . Estimate of β could be positive or negative. Usually an increase in domestic income leads to higher imports, what means positive estimate for β. However, if the increase in domestic income is due to an increase in production of import substitute goods, imports could actually decline, what means a negative β [1]. According to this, estimate of γ could also be positive or negative. REX is defined in a way that an increase reflects real depreciation of domestic currency. If real depreciation of domestic currency improves her trade balance with partner *f*, an estimate of λ is expected to be positive [4].

The above trade balance model represents the long run relationships between the trade balance and its determinants. To test the J-curve phenomenon (short term relationship), a short term dynamics must be incorporated into the long run model. According to Hsing [9] it is modified to error correction modeling format. In this case, the error correction model is as follows:

$$\Delta \ln TB_t = \alpha + \sum_{k=1}^{K} \omega_k \Delta \ln TB_{t-k} + \sum_{k=1}^{K} \beta_k \Delta \ln Y_{d,t-k} + \sum_{k=1}^{K} \gamma_k \Delta \ln Y_{f,t-k} + \sum_{k=1}^{K} \lambda_k \Delta \ln REX_{t-k} \tag{2}$$

4 The results

This section reports the estimates of J-curve for Slovakia and her major trading partners. The vector error correction model (2) is estimated for seven major Slovakia´s trading partners: Austria, Czech Republic, France, Germany, Hungary, Italy and Poland, using quarterly data over the period 1997 to 2010. The selection of sample countries is based on share of total foreign trade turnover of Slovakia. Data are obtained from OECDiLibrary.

Before conducting other tests, time series are modified by logarithmic transformation. This helps reduce skewness and heteroscedasticity and to stabilize variability. The stability of regressors is needed in initial testing. Before estimating the cointegration parameters, the order of integration for each time series should be examined. Integration is determined using the augmented Dickey-Fuller test recommended by Engle and Granger [7]. ADF test for each individual time series confirmed the presence of unit roots and for all variables was found the first-difference stationarity. According to Blake and Fomby [5], non-stationarity on the first level I (1) is the basic precondition of cointegration between variables. In applying the Johansen procedure, it is needed to specify the number of lags in each cointegration equation. Optimal lags in cointegrated time series are based on Akaike Information Criterion and Schwarz Bayesiani Criterion. Results of cointegration procedure are in Table 1.

	Lag	Trace Statistic	Critical Value at 5%	Max-Eigen Statistics	Critical Value at 5%	No. of CE
Austria	5	35.09788	29.79707	21.91651	21.13162	r=2
Czech Republic	2	65.52314	47.85613	34.21242	27.58434	r=1
France	5	76.95363	47.85613	32.96911	27.58434	r=1
Germany	5	32.67442	29.79707	23.21361	21.13162	r=2
Hungary	1	66.70999	47.85613	29.21835	27.58434	r=1
Italy	1	64.37987	47.85613	32.60939	27.58434	r=1
Poland	1	59.26424	47.85613	29.95219	27.58434	r=1
Note: 'r' refers to the number of cointegrating vector which are significant under both tests. The critical values are from MacKinnon-Haug-Michelis (1999).						

Table 1 The results of cointegration procedure

According to Table 1, the null hypothesis which means no cointegration can be rejected and it can be concluded that there is evidence for cointegration among these variables. Hence, these variables should be retained in the model.

	Austria	Czech Republic	France	Germany	Hungary	Italy	Poland
ΔlnREX	-0.568943	-0.721994	2.175522	1.655021	-1.765323	7.613189	-0.351836
	(1.10363)	(0.49113)	(0.80396)	(0.74296)	(1.26944)	(2.18217)	(0.06152)
ΔlnREX$_{t-1}$	-0.272752	-0.521229	0.032102	0.122986	-0.054983	0.314381	0.136150
	(0.38692)	(0.29895)	(0.38026)	(0.07301)	(0.50313)	(0.70176)	(0.12491)
ΔlnREX$_{t-2}$	-0.246366	0.007815	-0.104801	0.093252			
	(0.41014)	(0.30450)	(0.43975)	(0.07270)			
ΔlnREX$_{t-3}$	-0.100033		-0.580613	0.093958			
	(0.38198)		(0.47113)	(0.07117)			
ΔlnREX$_{t-4}$	0.266375		-0.792028	0.067719			
	(0.38900)		(0.51141)	(0.07056)			
ΔlnREX$_{t-5}$	0.758932		-0.101349	0.090621			
	(0.36440)		(0.40890)	(0.06004)			
EC	-0.074777	-0.028764	-0.078975	-0.020244	0.016175	0.020754	2.977690
	(0.02351)	(0.02401)	(0.02908)	(0.11428)	(0.00824)	(0.00571)	(0.48252)
Note: Figures in the parentheses are absolute values of t-statistics.							

Table 2 Estimated coefficients of the real Exchange rate and error correction term

As indicated before, the short run effects of depreciation are reflected in the coefficient estimates obtained for the lagged value of the first differenced exchange rate variable. The J-Curve phenomenon should be supported by negative coefficients followed by positive ones. To construct J-curve, impulse response function is used. The result can be seen in Figures 2 to 8.

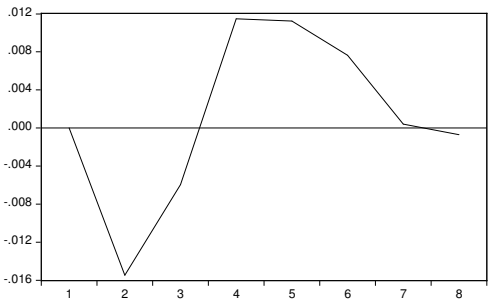


Figure 2 Austria: Response of LNTB to LNREX impulse*

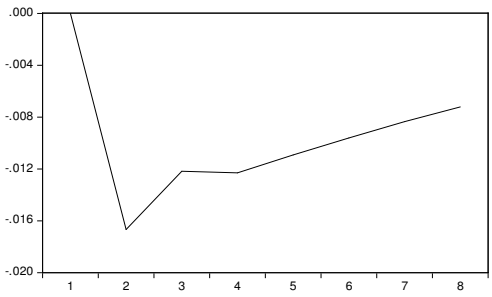


Figure 3 Czech Republic: Response of LNTB to LNREX impulse*

* X axis shows trade balance deficit or surplus
Y axis shows time

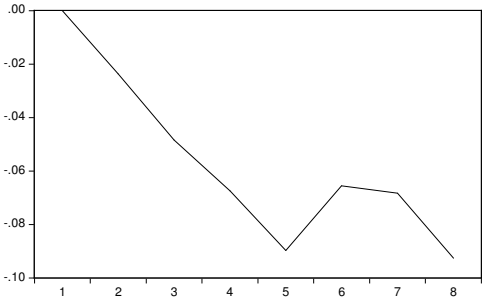


Figure 4 France: Response of LNTB to LNREX impulse*

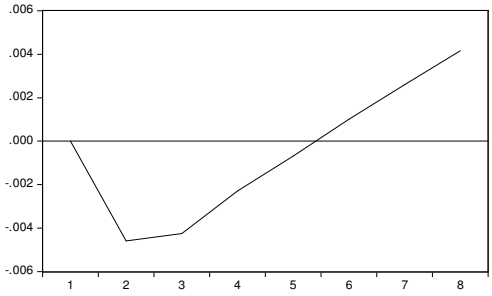


Figure 5 Hungary: Response of LNTB to LNREX impulse*

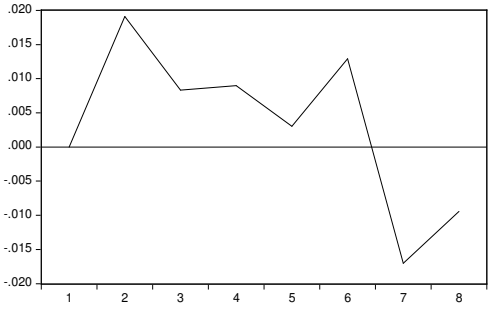


Figure 6 Germany: Response of LNTB to LNREX im-

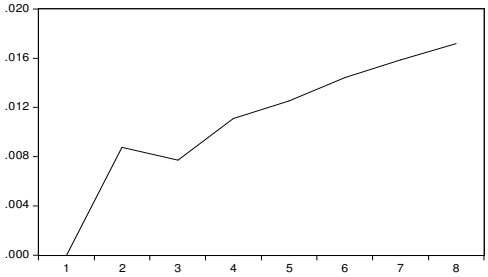
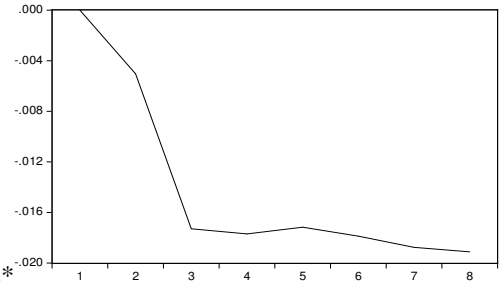


Figure 7 Italy: Response of LNTB to LNREX impulse*



pulse*

Figure 8 Poland: Response of LNTB to LNREX impulse*

From Table 2 and Figures 2 to 8 results, that J-curve phenomenon was revealed in case of Hungary and partially in Czech Republic, in case of Austria S-curve pattern was found, in other cases, the coefficient estimates follow any specific pattern.

5 Conclusion

To explore the J-curve effect, disaggregated bilateral data from Slovakia and her seven largest trading partners are used. The short run and the long run response of the trade balance to currency depreciation was investigated. The methodology was based on Johansen cointegration procedure, vector error correction model and impulse response function.

Estimation of cointegration procedure revealed a long term relationship between Slovakia´s trade balance, real bilateral exchange rate, Slovakia´s gross domestic product and gross domestic product of each trading partner. J-curve phenomenon was revealed in case of Hungary and partially in Czech Republic, in case of Austria S-curve pattern was found, in other cases, the coefficient estimates follow any specific pattern.

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