

The Effects of Exchange Rate Change on the Trade Balance of Slovakia[#]

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Introduction

Slovakia is relatively small, open economy, partly relying on export revenues to promote economic growth. Exports, therefore, play an important role in its efforts to be more economically prosperous country. Furthermore, domestic market is insufficiently large to support large-scale production and inevitably depends on imports from other countries to supply a part of domestic consumption. Both, exports and imports solidly depend on exchange rates and their development. According to Abeysinghe and Yeak (1998), policy prescriptions have generally assumed that exchange rate depreciation stimulates exports and curtail imports, while exchange rate appreciation is detrimental to exports and encourages imports.

The impact of exchange rates on volume of international trade has been intensively studied since 1970s, when the world economy moved from fixed exchange rate system to free floating exchange rate system. Despite vast of research dealing with this relationship, results are still not clear. In theory, there is some support for the pattern known as J-curve effect, which means that at the beginning, trade balance decreases before it subsequently improves. There are numerous empirical studies exploring this issue, but their findings are mixed and depend on region and period under estimation as well as data and methodology used.

Many studies that have tested the J-Curve phenomenon have employed the effective exchange rate. According to Bahmani-Oskoei and Brooks (1999), a problem with this approach is that a country's currency

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could appreciate against one currency and simultaneously depreciates against another one. The weighted averaging will therefore smooth out the effective exchange rate fluctuations, yielding an insignificant link between the effective exchange rate and the total trade balance. Furthermore, as Rose and Yellen (1989) argue, when estimating a trade balance model using aggregate data one needs to construct a proxy for the world income. These constructs can be partly misleading. Therefore many other studies employ bilateral exchange rates and bilateral trade balance data.

The aim of this paper is to explore whether the J-curve effect exists in Slovakia. In other words, whether exchange rate depreciation improves Slovakia's trade balance or vice versa. This paper covers the period from 1997 to 2013 and employs both approaches, model with aggregated and disaggregated data as well. Hence, this study provides additional evidence on the effect of exchange rate development on trade flows in the context of emerging economy after the most turbulent part of economic transformation is over. In addition, Slovakia is an interesting country to study J-curve effect as it joined the European Union as well as the euro area during the analysed period and its foreign trade represents a significant channel of economic integration within the Visegrad group countries or the EU as a whole. The importance of studying this issue for Slovakia is evidenced as well by its openness, which shifted from 79 % to 175 % in examined period according to World Bank data.

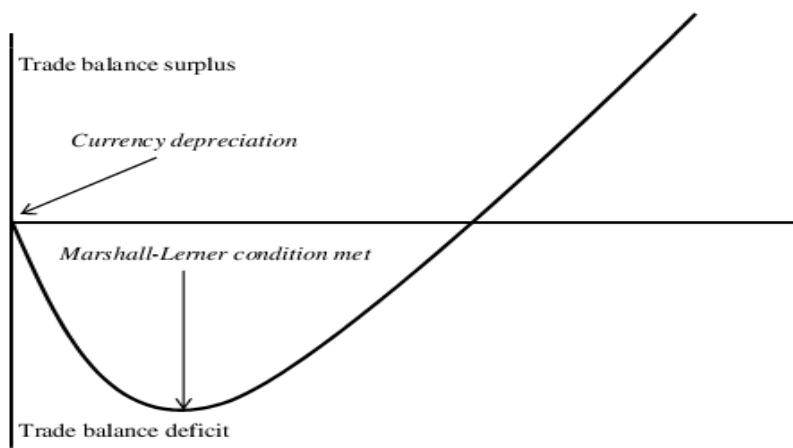
1. Theoretical Framework and Literature Review

The theoretical basis of the J-curve comes from Marshall and Lerner (Kulkarni and Clarke, 2009). The Marshall-Lerner condition states that the sum of export and import demand elasticity has to be at least one and then the currency devaluation will have a positive impact on trade balance. As currency devaluation means a reduction in the price of exports, 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 been provided in many different views. It has been found that goods tend to be inelastic in the short run, as it takes time to change consuming patterns (Bahmani-Oskoei and Ratha, 2004). Thus, the Marshall-Lerner condition is not met, and devaluation is likely to worsen the trade balance initially. In the long run, consumers will adjust to the new prices, and trade balance will improve. This effect is called J-curve phenomenon.

The J-curve phenomenon was firstly advanced by Magee (1973), who pointed out that short run deterioration and long run improvement of the trade balance after currency depreciation resemble the letter “J”, as seen in Fig. 1.

Fig. 1: J-curve Pattern



Source: Kulkarni and Clarke (2009).

Junz and Rhomberg (1973) have 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 (1983) has explained the phenomenon by the fact that at the time of change of exchange rate, goods purchased under contract have been already in transit and the completion of those transactions dominates the short run change in the trade balance. Therefore, change of exchange rate deteriorates the trade balance firstly, but as the elasticity increases the trade balance is improving.

Despite of numerous J-curve studies, just few of them are focused on Middle and Eastern European countries. An extensive study for emerging Europe i.e. for Bulgaria, Croatia, Cyprus, Czech Republic, Hungary, Poland, Romania, Russia, Slovakia, Turkey and Ukraine was written by Bahmani-Oskooee and Kutan (2009). They used monthly data over the period January 1990 and June 2005 and applied ARDL cointegration approach and corresponding error correction model on the bilateral level. They 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. The J-curve effect in Croatia was revealed also by Stučka (2003). His ARDL cointegration approach used quarterly data on the aggregate level.

Hsing (2009) examined the J-curve for the bilateral trade between Croatia, Czech Republic, Hungary, Poland, Slovakia or Slovenia and the USA. He found that the J-curve is not empirically confirmed for any of these six countries and in case of Slovakia, after a shock from real depreciation, the trade balance with USA worsens.

Using generalized impulse response functions; Hacker and Hatemi (2004) tested the trade J-curve for the Czech Republic, Hungary, and Poland. 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. Using disaggregated approach, Sequeira and Ferreira-Lopes (2010) assessed the existence of an S-curve pattern in ten Central and Eastern European countries. The S-curve reflects that the cross-correlation function between current terms of trade and future values of the trade balance is positive, but between current terms of trade and past values of the trade balance it is negative (Backus et al., 1994). Empirical results support the existence of this curve for Slovenia, Czech Republic and Hungary. In the case of Slovakia the pattern is weaker than in the mentioned countries but is partly proven.

Paper by Petrović and Gligorić (2010) shows that exchange rate depreciation in Serbia improves trade balance in the long run, while giving rise to a J-curve effect in the short run. Both Johansen's and autoregressive distributed lag approach were respectively used giving similar long-run estimates showing that real depreciation improves trade balance. Corresponding error – correction models as well as impulse response functions indicate that following currency depreciation, trade balance first deteriorates before it later improves. Authors consider these results relevant for policy making both in Serbia and in a number of other emerging Europe countries as they face major current account adjustments after balance of payments crises of 2009.

In summary, the existing empirical literature on the J-curve phenomenon concerning the Slovakia and its international trade is very limited. Results of the few previously published studies indicate almost no evidence for the J-curve effect. Therefore, this study substantially contributes to scientific discussion in this field and fills the gap in literature about international trade of small open economy. Small open

economy's trade tends to be more impacted by exchange rate changes than larger economies (OECD, 2011).

2. Model Specification

As was mentioned before, there are two different types of the basic empirical literature that test the J-curve phenomenon. The aggregate approach (which considers the trade flow of a country with the rest of the world), use effective exchange rate, domestic GDP and trade-weighted foreign GDP as the regressors. To solve the possible aggregation bias problem, another part of the literature has been emerged to employ the bilateral trade flows, domestic GDP, partner country's GDP, and the corresponding bilateral exchange rates.

All data in this study were obtained from the OECD iLibrary statistical database. The data are in current prices and denominated in USD. International trade data refer to declared transaction values. Imports are reported c.i.f. and exports are reported f.o.b. with the exception of the Slovak Republic where imports are reported f.o.b. as well. Quarterly GDP data are used as real income both for Slovakia and the trading partner countries. The time series used in the analysis are adjusted by a logarithmic transformation. This helps to reduce skewness and heteroscedasticity and to stabilize variability.

2.1. Aggregated Approach

The consensus among all recent studies concerning the J-curve issue is that the trade balance depends on a measure of domestic income, a measure of foreign income and the real exchange rate. In order to detect the long run co-movement among the variables, the cointegration procedure developed by Johansen (1997) is used. Thus, following Bahmani-Oskooee (1986; 1989) and many other studies, equation (1) for aggregate approach is adopted:

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

where TB is a measure of a trade balance defined as the ratio of Slovakia's exports to its imports.

Hence, TB is expressed in unit free term and both real and nominal TBs are the same. Y_d is a measure of Slovakia's income that was following Bahmani-Oskooee (1991) set in index form to make it unit free as well.

Y_f is index of the world gross domestic product. It is computed as a weighted real income of major trading partners. The selection criterion of relevant foreign trade partners was based on share on the total trade turnover in the period 1997 to 2013; these countries cover on average 80 % of total Slovak foreign trade turnover during the sample period. Shares of 15 selected trading partners were normalized, so their sum in each quarter equals to one. The countries included in the calculation of Y_f are Germany, Czech Republic, Austria, Italy, Poland, Hungary, France, Russia, United Kingdom, China, United States, Netherlands, Belgium, Spain and South Korea. Normalized weights were multiplied by GDP of each country for relevant period, the Y_f is its sum transformed into unit free index form.

REER is the real effective exchange rate between Slovakia and its major trading partners defined in a way that an increase reflects a depreciation of Slovak currency to a basket of currencies of major trading partners. It measures the development of the real value of a country's currency against the basket of the trading partners of the country. *REER* aims to assess a country's price or cost competitiveness relative to its principal competitors in international markets. Changes in cost and price competitiveness depend not only on exchange rate movements but also on cost and price trends.

Estimation of β is supposed to be 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, which means a negative β (Bahmani-Oskoe, 1986). Estimate of γ is supposed to be positive, as the world income represents larger demand for exported goods. If real depreciation of domestic currency improves the trade balance, an estimate of λ is expected to be positive (Bahmani-Oskoe and Ratha, 2004).

The above trade balance model represents the long run relationships among the trade balance and its main 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 (2009) the models are modified to the error correction-modelling format. In this case, the error correction model is as follows:

$$\begin{aligned} \Delta \ln TB_t = & \alpha + \sum_{k=1}^K \omega_k \Delta \ln TB_{t-k} + \sum_{k=1}^K \beta_k \Delta \ln Y_{d,t-k} + \sum_{k=1}^K \gamma_k \Delta \ln Y_{f,t-k} \\ & + \sum_{k=1}^K \lambda_k \Delta \ln REER_{t-k} + \vartheta_k EC_{t-1} + \varepsilon_t \end{aligned} \quad (2)$$

where EC is the disequilibrium term and $\vartheta_k EC_{t-1}$ represents the error correction mechanism.

2.2. Disaggregated Approach

Regarding to disaggregate approach, trade balance depends on a measure of domestic income, a measure of income of trading partner and the bilateral exchange rate. The procedure for this model is similar to aggregated approach. To detect long-term co-movement among the variables, the same cointegration procedure is used. Thus, following Bahmani-Oskooee (2009) equation (3) is adopted:

$$\ln TB_{i,t} = \alpha + \beta \ln Y_{d,t} + \gamma \ln Y_{i,t} + \lambda \ln ER_{i,t} + \varepsilon_t, \quad (3)$$

where TB_i is a measure of trade balance defined as the ratio of Slovakia's exports to country i over its imports from the same country; thus in unit free term. Y_d is a measure of Slovakia's income and Y_i is the index of income in trading partner i ; both time series set in index form.

ER_i is the real bilateral exchange rate between Slovakia and trading partner i . ER_i is defined as $NER_i * P_i / P_d$, where P_i is the Consumer Price Index (CPI) in trading partner i , P_d is the CPI in Slovakia and NER_i is the nominal bilateral exchange rate (period average) defined as the number of domestic currency per unit of trading partner i 's currency. Consequently, an increase reflects the real depreciation of the Slovak currency with respect to trading partner i 's currency. According to aggregated approach, we expect the same estimation of β and γ coefficient. ER_i is defined in a way that an increase reflects depreciation of domestic currency. If real depreciation of domestic currency improves her trade balance with partner i , an estimation of λ is again expected to be positive.

The vector error correction model (3) is estimated for Visegrad countries trading partners Czech Republic, Hungary and Poland. The analysis is provided by using quarterly data over the period 1997 to 2013.

These three countries count approximately 35 % of Slovakia's trade in the sample period.

To test the J-curve effects, model is modified into error correction model format. Model with short-term dynamics is as follows:

$$\begin{aligned} \Delta \ln TB_{i,t} = & \alpha + \sum_{k=1}^K \omega_k \Delta \ln TB_{i,t-k} + \sum_{k=1}^K \beta_k \Delta \ln Y_{d,t-k} + \sum_{k=1}^K \gamma_k \Delta \ln Y_{i,t-k} \\ & + \sum_{k=1}^K \lambda_k \Delta \ln ER_{i,t-k} + \vartheta_k EC_{t-1} + \varepsilon_t \end{aligned} \quad (4)$$

3. Empirical Results

In this section, we report the estimates of the J-curve estimations for Slovakia and its major trading partners. In order to perform cointegration that shall be used to test the long-term relationship between selected variables it is necessary for the logarithmized time series being stationary on the first difference $I(1)$ and nonstationary on its own values (Balke and Fomby, 1997). Integration is determined using the augmented Dickey-Fuller (ADF) test recommended by Engle and Granger (1987). The ADF test for each individual time series confirmed the presence of unit roots and we found the first-difference stationarity for all time series.

3.1. Results for Aggregated Approach

In applying the Johansen procedure, it is needed to specify the number of lags in cointegration equation. Optimal lag 1 (3 months) in cointegrated time series is based on Akaike Information Criterion and Schwarz Bayesian Criterion. Results of cointegration procedure with number of cointegration equations are in Tab. 1.

Tab. 1: Results of Cointegration Procedure for Aggregated Data

Cointegration Equations	Eigenvalue	Trace Statistic	0.05 Critical Value	Probability
None *	0.253855	49.03206	47.85613	0.0386
At most 1	0.182373	29.70489	29.79707	0.0512
At most 2 *	0.125266	16.41589	15.49471	0.0363
At most 3 *	0.108536	7.582769	3.841466	0.0059

Source: Authors computation.

Note: * denotes rejection of the hypothesis at the 0.05 level.

According to Tab. 1, the null hypothesis, which means no cointegration, can be rejected and it can be concluded that there is evidence for existence of long-run equilibrium among these variables. Hence, these variables can be retained in the model. Estimated normalized cointegrating coefficients are as follows, standard errors are in parentheses:

$$\ln TB_t = -1.286 \ln Y_{d,t} + 3.365 \ln Y_{f,t} + 1.191 \ln REER_t \quad (5)$$

(0.538) (1.108) (0.736)

The above equation (5) shows that if the real effective exchange rate of Slovakia increases by 1 %, there is a growth in its trade balance of 1.191 %. An additional result emerging from this estimate of the trade balance equation is that 1 % increase in Slovak gross domestic product is connected with 1.286 % decrease in trade balance and 1 % growth in world gross domestic product is accompanied by 3.365 % positive change in trade balance. Estimated parameters β , γ , λ represent a long run relationship between variables. In this case, real depreciation of domestic currency has direct relationship with Slovak trade balance from the long run perspective, as was expected. Improving in trade balance means increased export or decreased import, eventually higher rate of positive change in export and simultaneous lower negative change in import, which may be affected by real effective exchange rate development.

There was revealed long run relationship by applying Johansen procedure. Ability to return to its equilibrium after fluctuations is tested by employing vector error correction model. Estimated error correction term in model is stated in Tab. 4. This shows that the speed of adjustment to equation is -0.03 . This means that 3 % of the discrepancy between the

actual level and the long run equilibrium of trade balance ratio is eliminated or corrected during one quarter.

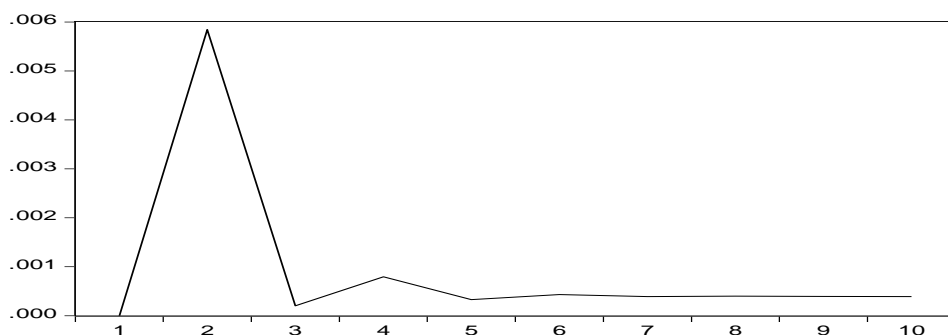
Tab. 1: Estimated Error Correction Term for Aggregated Data

	CointEq1	$\Delta \ln TB(-1)$	$\Delta \ln Y_d(-1)$	$\Delta \ln Y_f(-1)$	$\Delta \ln REER(-1)$
$\Delta \ln TB$	-0.029480	-0.153671	0.001153	-0.386973	0.094985
Errors	(0.06049)	(0.13496)	(0.34254)	(0.50519)	(0.34285)

Source: Authors computation.

As indicated in theoretical framework, 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 obtained function is depicted in Fig. 2.

Fig. 2: Response of Trade Balance to Real Effective Exchange Rate Impulse



Source: Authors computation.

With depreciation of Slovak currency trade balance between Slovakia and its foreign partners improves in the short run, but the effect is reduced in one quarter and the trade ratio falls on the level a little bit higher than the initial one.

3.2. Results for Disaggregated Approach

It is necessary to define appropriate time lag length within this test. Here, an Akaike and Schwarz Bayesian criterion were used while determining the appropriate lag length, which was applied for the non-

differentiated VAR model estimation. Results of cointegration procedure with number of cointegrating equations (CE) are in Tab.3.

Tab. 2: Results of Cointegration Procedure for Disaggregated Data

	Lag	Trace Statistic	Critical Value (5%)	Max-E. Statistics	Critical Value (5%)	No. CE
Czech Rep.	2	65.52314	47.85613	34.21242	27.58434	r=1
Hungary	1	66.70999	47.85613	29.21835	27.58434	r=1
Poland	1	59.26424	47.85613	29.95219	27.58434	r=1

Source: Authors computation.

According to Tab.3, the null hypothesis that means no cointegration can be rejected and it can be concluded that there is an evidence for cointegration among these variables. Hence, these variables can be retained in the model. In disaggregated level we focus only on the time series for exchange rate, as can be seen in Tab.4.

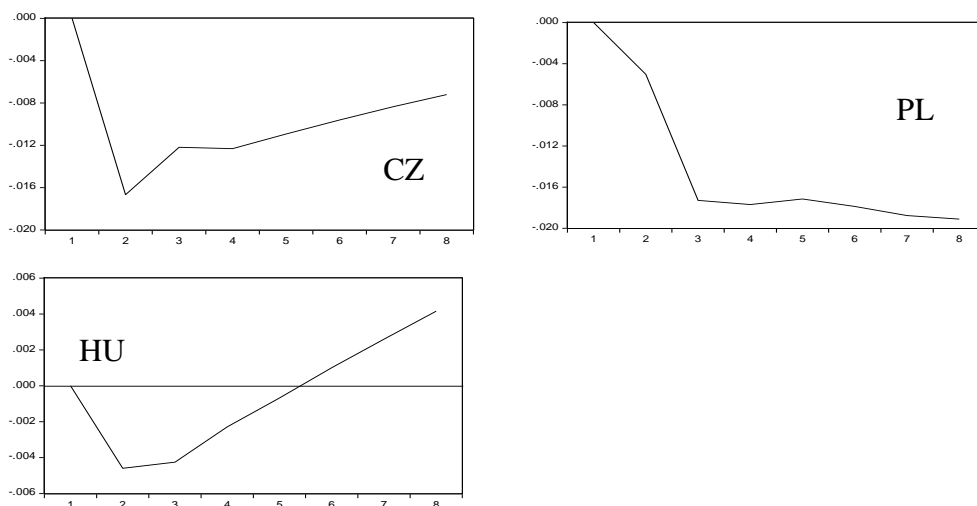
Tab. 3: Estimated Error Correction Term for Disaggregated Data

	$\Delta \ln ER_i$	$\Delta \ln ER_{i,t-1}$	$\Delta \ln ER_{i,t-2}$	EC
Czech Republic	-0.7219 (0.4911)	-0.5212 (0.2989)	0.0078 (0.3045)	-0.0287 (0.024)
Hungary	-1.7653 (1.2694)	-0.0549 (0.5031)		0.0161 (0.008)
Poland	-0.3516 (0.0615)	0.1361 (0.1249)		2.9776 (0.482)

Source: Authors computation (errors in parentheses).

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. The result of impulse response function can be seen in Fig.3.

Fig. 3: Response of Bilateral Trade Balances to Exchange Rate Impulses



Source: Authors computation.

Tab. 4 and Fig. 3 show, that J-curve phenomenon was revealed in case of Hungary and partially in the Czech Republic. For trade balance between Slovakia and Poland, there is noted deterioration after depreciation.

On the aggregate level the results from this study do not support the theory of the J-curve pattern, in respect of which the trade ratio is expected to deteriorate at first and then gradually improve over time and rise in a value over its initial value. Hence, one can point out that we revealed a reverse J-curve for Slovakia with immediate increasing of trade balance after depreciation, which gradually fades away. We can liken these results to those of Bahmani-Oskooee (1989), who found an inverse J-curve after depreciations in the real exchange rates, for four countries (Greece, India, Korea, Thailand). The explanation of Bahmani-Oskooee (1989) is the same like of Perera (2009) or Xiaohong and Pengjiao (2010). They argue that if appreciation of the exchange rate in the long-term perspective for respective country is observed, this can lead to an inverse J-curve.

In Slovakia, an inverse J-curve on aggregated level might be caused by country's currency appreciates in comparison to other nations currencies which lead to the short run movement towards current account surplus, but the other important factor is that import's demand could be and

export's demand inelastic elastic in the short run. If a country primarily imports necessities, raw materials and goods needed as inputs for its industries, the demand elasticity of imports may be very low, and depreciation may not be transformed into satisfied income effect. The Slovak economy has substantial proportion of foreign value added (import) to the total exports of the country. The majority of exports (approximately 60 %) are not produced in Slovakia, but coming into the Slovak economy from abroad in the form of import. This fact can lead to results not supported by traditional economic theory.

The different results for Visegrad group trading partners might be influenced by structure of the bilateral trading flows. For Slovak export and import structure the most important industries are automotive, electrical, mechanical and chemical industries. Slovak export is dominated by cars, vehicles and their components, electrical machinery and appliances, plastics and products made from them.

Tab. 4: Average shares of traded goods on international trade with analysed countries (in %, 1997 – 2013)

	CZ	HU	PL
Food and live animals	8.18	11.19	8.30
Beverages and tobacco	1.89	0.59	0.76
Crude materials, except fuels	3.70	5.26	3.47
Mineral fuels, lubricants, related materials	1.20	9.58	9.94
Animal and vegetable oils, fats and waxes	0.62	1.17	0.33
Chemicals and related products	9.29	9.37	8.71
Manufactured goods	26.42	19.67	30.39
Machinery and transport equipment	28.70	35.47	28.07
Miscellaneous manufactured articles	8.54	7.09	9.05

Source: Authors computation.

The results can differ across the trading partners due to different character and elasticity of trading goods and time lags in the consumers search for acceptable, cheaper alternatives. In Tab. 5, we can observe trade concentration in manufactured goods and machinery and transport equipment for all three analysed trading partners, same as on the aggregated level. These categories of goods are supposed to be purchased under long-term contracts and it usually takes more time to adapt to new price conditions, demand elasticity for these commodities is lower. The only J-curve can be observed for Hungary, which can be caused by the

fact that there is presence of higher share and active balance in trading with food, animals, crude materials, animal and vegetable oils, fats and waxes. In comparison to the trade with the Czech Republic and Poland, the structure of traded goods can be considered as one of the assumptions for different results.

Conclusion

To explore the J-curve effect, two approaches were used. In case of aggregated approach, data from Slovakia and its fifteen major trading partners were used. The short run and the long run response of the trade balance to currency depreciation were investigated. The methodology was based on Johansen cointegration procedure, vector error correction model and impulse responses function. Estimation of cointegration procedure revealed a long-term relationship among Slovakia's trade balance, real effective exchange rate, Slovakia's gross domestic product and world gross domestic product. It can be stated, that J-curve in Slovakia during sample period 1997 – 2013 was not revealed. There can be observed an inverse J-curve pattern, which means that depreciation leads immediately to improvement of the trade balance and then this effect gradually wanes.

These findings are similar to those of Bahmani-Oskooee (1989), Perera (2009) and Xiaohong and Pengjiao (2010). They also found out that the trade balance after currency depreciations increased at first, but then deteriorated over time. The inverse J-curve can be observed in economy with long-term currency appreciation. The results are supposed to be affected as well by structure of trade balance and by import intensity of Slovak export.

To explore the J-curve effect using disaggregated approach, data from Visegrad countries were used. The short run and the long run response of the trade balance to currency depreciation were investigated on the bilateral level. Estimation of cointegration procedure revealed a long-term relationship among Slovakia's trade balance, real bilateral exchange rates, Slovakia's gross domestic product and gross domestic product of each trading partner in the sample period 1997 – 2013. J-curve phenomenon was revealed in case of Hungary and partially in the Czech Republic. For Poland, there is revealed deterioration in bilateral trade balance after depreciation. The different results for Visegrad group trading partners are supposed to be influenced by different structure of the bilateral trading flows with respective country.

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The Effects of Exchange Rate Change on the Trade Balance of Slovakia

ABSTRACT

This paper empirically investigates the impact of change in exchange rate on export and import flows between Slovakia and its major trading partners. Devaluation or depreciation of a currency worsens the trade balance before improving it, resulting in a J-curve pattern. For the purpose of this paper, aggregated and disaggregated approaches are used. This paper investigates J-curve phenomenon using quarterly time series data over the period 1997:1 to 2013:4. The results provide evidence that the classical J-curve effect does not exist in Slovakia on the aggregated level. Instead, currency depreciation (increase in real effective exchange rate) is accompanied only by positive change in trade balance with no deterioration under initial value. On the bilateral level, there exists J-curve in trade with Hungary.

Key words: J-curve; Trade balance; Exchange rate; International trade; Cointegration.

JEL classification: F10, F14, F31