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ESTIMATION OF THE J-CURVE EFFECT IN BILATERAL TRADE OF POLAND

OCENA EFEKTU KRZYWEJ J DLA DWUSTRONNEGO HANDLU PROWADZONEGO PRZEZ POLSKĘ

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Streszczenie. Celem pracy jest analiza wpływu zmiany kursów walutowych na bilateralny eksport i import między Polską a jej głównymi partnerami handlowymi. Tekst ten bada efekt krzywej-J za pomocą danych kwartalnych w okresie od 1997:1 do 2011:4. Do badania długotrwałego związku między kursem walutowym i bilansem handlowym służy analiza kointegracji Johansena. Krótkoterminowe skutki i związany z tym efekt J-krzywej badane są przez oszacowanie modelu korekcji błędów oraz funkcją impuls-reakcja. Modele uwzględniają dwustronne obroty handlowe, PKB danego kraju i nominalne kursy walutowe. Deprecjacji złotego towarzyszy pogorszenie polskiego bilansu handlu dwustronnego z Francją oraz Włochami. Częściowy efekt krzywej-J można obserwować w przypadku przepływów handlowych pomiędzy Polską a Niemcami i Republiką Czeską. Dla odmiany, handel zagraniczny z Wielką Brytanią charakteryzuje się odwróconą krzywą-J.

Key words: exchange rate, impulse-response function, international trade, J-curve, trade balance.
Słowa kluczowe: bilans handlowy, funkcja impuls-reakcja, handel międzynarodowy, J-krzywa, kurs walutowy.

INTRODUCTION

The intensity of Poland's participation in international trade is still at a relatively low level. This is due to size of the economy, which is now the sixth largest in the European Union (hereafter EU), as well as its geographical location. Although the volume of Poland's international trade has been increasing since joining the EU in 2004, it is constantly characterised by a long-term negative trade balance. Poland's negative trade balance has been significantly reduced in recent years. That was largely affected by the foreign direct investment inflow since the companies with foreign ownership account for a substantial share in Poland's exports.

Such a development raises the need for more intensive cooperation with foreign countries and, on the other hand, makes Poland's economy more vulnerable to any adverse changes in other economies. Both, exports and imports, depend on exchange rates and their development. According to Abeysinghe and Yeak (1998), policy prescriptions have generally assumed that currency depreciation stimulates exports and curtails imports, while currency appreciation is detrimental to exports and encourages imports.

Transformation from fixed exchange rate regimes to free float systems has brought obvious volatility and uncertainty. Despite vast research dealing with the relationship between currencies and international trade having been conducted, there is still considerable uncertainty concerning this issue. One can find some support in theory for the pattern known as J-curve phenomenon. It means that after currency depreciation trade balance deteriorates 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.

The aim of this paper is to explore whether exchange rate depreciation improves bilateral trade balances between Poland and its major trading partners. Data used in this study covers the period from 1997 to 2011.

Hence, this study provides additional evidence of the effect of exchange rate development on trade flows in the context of emerging market after the most turbulent part of economic transformation. One aspect of this transformation was a transition from a fixed exchange rate arrangement into a crawling peg and recently to a free-float regime. In addition, Poland is an interesting objective to study the J-curve effect because international trade serves as a major channel of economic integration within the Group of Visegrad countries (Czech Republic, Hungary, Poland, Slovakia) or the EU as a whole. Usually, international trade tends to be a driver of the economy in countries neighbouring economies with open trade regimes, a high presence of multinational companies and a large volume of re-exports. The fact that this example fits Poland can be illustrated with increasing share of merchandise trade on Poland's GDP. In 2011, it was 76.8% compared to 36.5% in 1997.

Theoretical framework and literature review

The theoretical basis of the J-curve comes from Marshall and Lerner. The Marshall--Lerner condition is the basis of the elasticities approach to the balance of payments. It states that the sum of export and import demand elasticity has to be at least one and then the currency depreciation or devaluation (in fixed currency regimes) will have a positive impact on trade balance. As depreciation (devaluation) of the currency means a reduction in the price of exports, the quantity demanded for these will increase. At the same time, the price of imports will rise and the quantity demanded will decrease.

According to literature review by Bahmani-Oskoee and Ratha (2004), empirical examination of the Marshall-Lerner condition has a long history with very different views. In general, it has been found that goods tend to be inelastic in the short run, as it takes time to change consumption patterns. Thus, the Marshall-Lerner condition is not met in the short run and depreciation deteriorates the trade balance initially. In the long run, consumers can adjust to the new prices, and the trade balance will improve.

The short term effect of currency depreciation and related J-curve phenomenon was first advanced by Magee (1973). He pointed out that the short term deterioration and long term

improvement after depreciation resemble the letter “J” as it can be seen in Figure 1. Consequently, a large number of empirical studies exploring this problem have appeared. They investigate the long run impact of exchange rate on trade balance and whether the J-curve effect is present.

Junz and Rhomberg (1973) attributed the J-curve phenomenon to lags in the recognition of exchange rate fluctuations, in the decision to changes of real variables, in delivery time, in the replacement of inventories and materials, and in production. Krueger (1983) explained the phenomenon by the fact that at the time an exchange rate fluctuation 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 fluctuations first deteriorate the trade balance, but as the elasticity increase, it improves the trade balance. This phenomenon is not always applicable in each country. This is due to time lags in the consumer's search for acceptable, cheaper alternatives which might not exist.

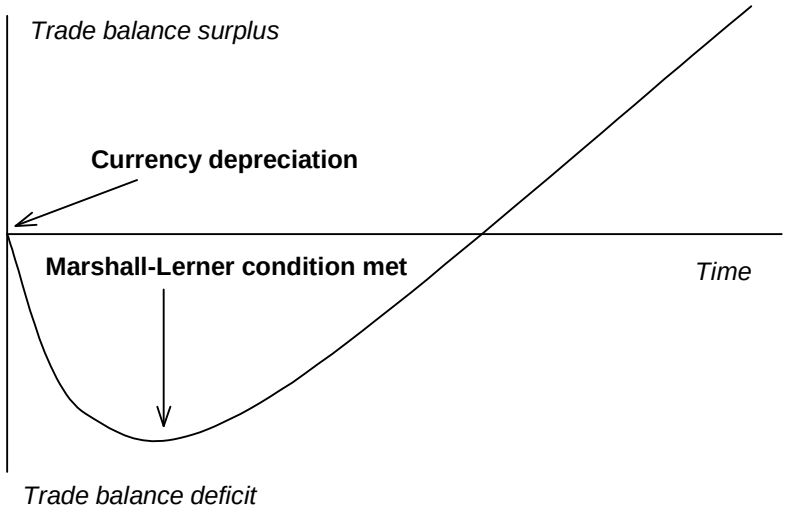

Fig. 1. J-curve Pattern
Source: Clarke and Kulkarni (2009).

Despite numerous J-curve studies, only a few of them are focused on Central and Eastern European countries, including Poland. An extensive study for emerging Europe (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 between January 1990 and June 2005 and applied the ARDL cointegration approach and corresponding error correction model. They found empirical support for the J-curve effect (short term deterioration combined with long term improvement) in Bulgaria, Croatia and Russia. In Poland, they did not find any characteristics or signs of the J-curve effect in existence.

Stučka (2003) also applied the ARDL cointegration approach to quarterly data and showed the existence of the J-curve also in Croatia. Hsing (2009) examined the J-curve for bilateral trade between Croatia, Czech Republic, Hungary, Poland, Slovakia, Slovenia and the USA. This paper concluded that the J-curve is not empirically confirmed for any of these six countries.

Using generalised impulse response functions, Hacker and Hatemi (2004) tested the J-curve for three transitional Central European countries (Czech Republic, Hungary, and Poland) in their bilateral trade with respect to Germany. Their findings suggested that for Poland there are some characteristics associated with the J-curve effect. In particular, trade balance deteriorates within a few months after depreciation and then rises to a long term equilibrium at a value higher than the initial one.

Trade balance in Central and Eastern European countries was also studied by Sequeira and Lopes (2010). They assessed the existence of an S-curve pattern, which represents the relationship between trade balance and the terms of trade using cross correlation. Empirical results support the existence of this curve for Slovenia, Czech Republic, and Hungary, but no evidence for Poland.

In summary, the existing empirical literature on the J-curve phenomenon concerning Poland and its international trade is very limited. The results from the previously published studies indicate almost no evidence for the J-curve effect. i.e. no effect of the Złoty depreciation on the Poland's trade balance. Therefore, this study substantially contributes to scientific discussion in this field and fills the gap in literature. Compared to other papers we use the most recently available data on bilateral trade with the largest partners, we distinguish invoicing currencies where applicable and we employ cointegration approach and corresponding error correction modelling with impulse response functions.

Model specification

The consensus among all recent studies is that the bilateral trade balance should depend on domestic income, income of the trading partner and bilateral exchange rate. In order to detect the long term co-movement among the variables, the cointegration procedure developed by Johansen (1997) is used. This avoids the main criticism of early studies, whose results could suffer from the problem of regression due to non-stationary data. Thus, following Bahmani-Oskooee and Kutan (2009), equation (1) is adopted in empirical modelling of the J-curve effect:

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

where: *TB* – measure of trade balance in time period,

t – the ratio of exports of Poland to country,

f – to Poland's imports from country *f*.

Hence, the model could be expressed in log-linear form. Y_d is measure of the Poland's real income set in index form to make it unit free (Bahmani-Oskoee 1991); Y_f is the index of real income in trading partner *f* and *ER* is the nominal bilateral exchange rate between the Złoty and the currency of trading partner *f.*

The above defined trade balance model represents the long term relationships between the trade balance and its determinants. When testing the J-curve phenomenon in the short term, a short term dynamics must be incorporated into the long term model. According to Hsing (2009) we apply for this purpose the following modified error correction model:

$$\Delta \ln TB_t = \alpha + \sum_{i=1}^{n} \omega_i \Delta \ln TB_{t-i} + \sum_{i=1}^{n} \beta_i \Delta \ln Y_{d,t-i} + \sum_{i=1}^{n} \gamma_i \Delta \ln Y_{f,t-1} + \sum_{i=1}^{n} \lambda_i \Delta \ln ER_{t-i} \qquad (2)$$

Empirical results

This section reports the estimates of the J-curve for Poland and its five major trading partners: Germany, Italy, United Kingdom, Czech Republic and France. The vector error correction model (2) is estimated by using quarterly data over the period 1997–2011. All data is obtained from the OECD iLibrary statistical database. The data is in current prices and denominated in euro. The country selection is based on the share of total international trade turnover. Average shares of selected trading partners for the entire sample period are reported in Table 1.

Table 1. Average shares in international trade of Poland (1997–2011, in %)

Trading partner	Share on total imports	Share on total exports	Share on total trade turnover
Czech Republic	3.4	5	4
France	4.3	7.6	5.7
Germany	21.8	37.4	28.3
Italy	4.7	9.7	6.8
United Kingdom	3.8	4.8	4.1

Source: Authors' calculation based on data obtained from OECDiLibrary.

Before conducting the necessary tests and empirical estimations, the time series used in the analysis is adjusted by a logarithmic transformation. This helps to reduce skewness and heteroscedasticity and to stabilise variability. The stability of regressors is needed in initial testing. Before estimation of the cointegration parameters, the order of integration for each time series should be examined. Integration is determined using the augmented Dickey-Fuller (ADF) test as recommended by Engle and Granger (1987). The ADF test for each individual time series confirmed the presence of unit roots, i.e. the first-difference stationarity was found for all variables. According to Balke and Fomby (1997), non-stationarity on levels is the basic precondition of cointegration between variables.

Since the choice of the lag orders of the variables in the vector error correction model specification can have a significant effect on the inference drawn from the model, another

step of analysis is to sequentially determine the appropriate lag length for each variable by using Akaike Information Criterion and Schwarz Bayesian Criterion. In general there is no agreement on which criterion is better, but in case of different results for optimal lag we prefer Schwarz-Bayesian criterion, which is more consistent.

When the optimal lag order is determined, we can perform cointegration analysis and test the existence of a stable long term equilibrium between non-stationary variables. If the variables are found to cointegrate (parameters are stable), the final step in the analysis is the estimation of the vector error correction model to generate the impulse response functions and to construct the J-curves.

We proceed to examine the dynamic responses by generating impulse response functions showing the response of the trade balance to the Polish Złoty depreciation. As indicated before, the short term 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 can be seen in graphs in Figure 2. Note that for trading with the United Kingdom and Czech Republic two J-curves are constructed based on the invoicing currency.

Graphical representations of the impulse response functions do not present any typical J-curve. For Poland's trading flows with Germany and the Czech Republic, a partial bilateral J-curve effect can be observed. In case of Germany, the results are similar to those of Hacker and Hatemi (2004). One can find some features of the J-curve effect in the obtained results. The initial deterioration of the Poland's trade balance lasts two quarters in trade with Germany, four quarters in trade with the Czech Republic in the Czech Koruna, and three quarters in trade with the Czech Republic invoiced in the euro. Subsequently, a partial improvement of bilateral trade balance occurs.

Depreciation of the Polish Złoty is accompanied by a deterioration of Poland's bilateral trade balance with France and Italy. In the bilateral trade balance with France, a cyclical pattern can be observed. The deterioration lasts three quarters, then it is followed by a one-quarter improvement and again by deterioration. In the case of Italy, deterioration of the trade balance prevails in the entire course of examined period of ten quarters after depreciation. An inverse J-curve was revealed for trade between Poland and the United Kingdom. The respective impulse response function shows an initial improvement during the first two quarters followed by a deterioration of the bilateral trade balance.

As already mentioned, we distinguish Poland's trade with the Czech Republic and United Kingdom into trades denominated in the euro and trades in the Czech Koruna and British Pound respectively. As it is evident from Figure 2, there is no significant difference and, hence, the effect of depreciation is independent on the invoicing currency.

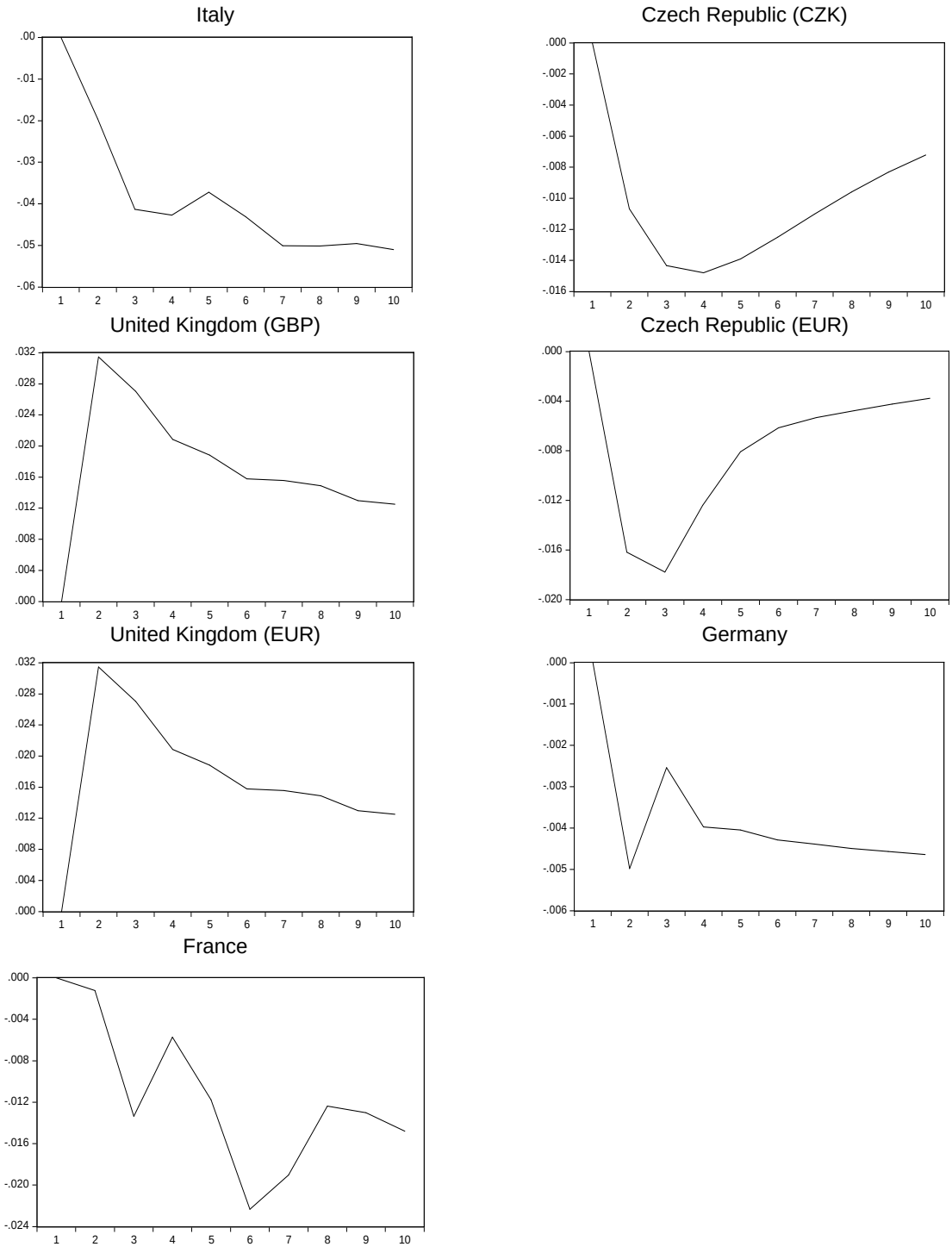

Fig. 2. Bilateral J-curves of Poland
Source: Authors' calculation.

CONCLUSIONS

The aim of the paper was to investigate the impact of exchange rate fluctuations on bilateral export and import flows between Poland and its major trading partners. We included five largest trading partners into the analysis and the results suggest that effect of depreciation of the Polish Złoty is usually weak and its direction differs across the countries. We revealed that depreciation of the local currency is accompanied by deterioration of Poland's trade balance with France and Italy. A partial J-curve effect can be observed in case of Polish trading flows with Germany and the Czech Republic. By contrast, an inverse J-curve was uncovered for trades between Poland and the United Kingdom. Therefore, the results indicate that an active exchange rate policy aimed at influencing exchange rate development is not supposed to promote any notable improvement of trade balance.

Thus, development of the Poland's international trade seems to be affected by factors other than fluctuations in exchange rates. According to Mandel and Tomšík (2006), foreign direct investments in Poland have a positive impact on real exports and they also reduce imports of final products. On the other hand, foreign direct investments in industrial sector usually need to import inputs, which increases the total volume of imports and makes the import intensity of Poland's export very high. The next important factor in the determination of trade balance is the structure and demand elasticity of traded goods. Negligible impact of exchange rates on trade balance can be also explained increasing volume of hedging instruments used in Poland to manage exchange rate risk.

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REFERENCES

Abeysinghe T., Yeak T.J. 1998. Exchange rate appreciation and export competitiveness. The case of Singapore. Applied Economics, 30 (1), 51–55.

Bahmani-Oskoee M., Kutan A. 2009. The J-curve in the emerging economies of Eastern Europe. Applied Economics, 41 (20), 2523–2532.

Bahmani-Oskoee M., Ratha A. 2004. The J-Curve: a Literature Review. Applied Economics, 36 (13), 1377–1398.

Balke N., Fomby T. 1997. Treshold cointegration. International Economic Review, 38 (8), 627–645.

Clarke A., Kulkarni G. 2009. Testing the Application of Heckscher-Ohlin Theorem to Contemporary Trade between Malaysia and Singapore. Journal of Emerging Knowledge on Emerging Markets, 1 (1), 1–17.

Engle R., Granger C. 1987. Co-integration and Error Correction: Representation, Estimation, and Testing. Econometrica, 55 (2), 251–276.

Hacker S.R., Hatemi A.J. 2004. The effect of exchange rate changes on trade balances in the short and long run. The Economics of Transition, 12 (4), 777–799.

Hsing Y. 2009. Responses of Output to Declining Stock Values and Real Depreciation in Lithuania. International Economics, 62 (4), 429–437.

Johansen S. 1997. Likelihood-Based Interference in Cointegrated Vector Autoregressive Models. Oxford, Oxford University Press, 267.

Junz H., Rhoemberg R.R. 1973. Price Competitiveness in Export Trade among Industrial Countries. Papers and Proceedings of American Economic Review, 63 (5), 412–418.

Krueger A. 1983. The Factor Proportions Explanation of Trade, Distortions, and Employment: Trade and Employment in Developing Countries. Red. National Bureau of Economic Research. Chicago, University of Chicago Press, 55–85.

Magee S.P. 1973. Currency Contracts, Pass Through and Devaluation. Brooking Papers on Economic Activity, 1, 303–325.

Mandel M., Tomšík V. 2006. Přímé zahraniční investice a vnější rovnováha v tranzitivní ekonomice: Aplikace životního cyklu. Politická ekonomie, 54 (6), 723–741.

Sequiera T.N., Lopes A. 2010. On the welfare properties of the Lucas and Romer endogenous growth models. Economics Bulletin, 30 (3), 2143–2150.

Stučka T. 2003. The Impact of Exchange rate Changes on the Trade Balance in Croatia. CNB, Croatian National Bank Working Paper Series no. W–11.