

Research Paper

The Phenomenon of Twin Deficits in Poland in 2009–2018

The purpose of this article is to determine the degree, direction and strength of the impact of the studied variables, i.e. the state budget balance and the current account balance as part of Poland's balance of payments in the years 2009–2018 based on the data of the Statistics Poland. The main research questions focus on determining the type of relationships connecting the studied deficits and the degree, direction and type of interaction in light of previous studies dedicated to the hypothesis of twin deficits. The methodology used is based on integrated correlation analysis, linear regression and an analysis of the coefficient of variation. As a result of the study, a strong correlation was found between the cumulative values of the examined deficits, confirming the existence of the twin deficit hypothesis in Poland in the examined period; this means that the budget deficit affects the current account balance of payments. The main balance stabilizing the negative balance of primary incomes, in which the income of non-residents from foreign direct investment is the dominant position, was the balance of extremely dynamically developing service exports.

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Introduction

Twin deficits are a type of relationship that occurs in the economy between a budget

deficit and a current account deficit¹. In the early 1980s, significant increases in the current account deficit and budget deficit were observed in the US, which was the result of so-called „Reganomics”². Initially, sources of this state of affairs were seen

¹ Romatowski, M. 2005. „Twin deficits – czy to rzeczywiście bliźniacze deficyty?”. *Bank i Kredyt*, No. 8, pp. 17-25
² Frankel, J. A. 2006. *Twin deficits and twin decades. The Macroeconomics of Fiscal Policy*. Cambridge, MA: MIT Press

in excessive budget deficits. The double deficits hypothesis has been one of the most controversial economic problems in developed and developing countries in the world over the last 40 years and which is reflected in the scientific discourse. It can generally be summarized as follows. The neo-Keynesian theory, and especially the New Cambridge School (but also monetary theory), postulates the existence of a causal relationship between current account deficits and fiscal deficits. The neoclassical approach assumes the opposite is true: when the government increases the budget deficit, the private sector saves more, which leads to a reduction in the current account deficit. Finally, the structural gap approach demonstrates that in small open economies the current account deficit can lead to fiscal surpluses in the long run³.

The relationship between the budget deficit and the current account deficit may take different directions of interaction, which is the basis of at least four hypotheses⁴. The first of these is the twin deficits hypothesis (TDH), where the budget deficit leads to the appearance of a current account deficit⁵. When explaining the TDH hypothesis, an absorption and

quantitative approach should be distinguished. According to the absorption approach of Keynesian absorption theory, there should be greater government spending. When the economy is in a state of full employment, as the budget deficit increases, the government aims to reduce the tax burden, which in turn entails an increase in disposable income and an increase in demand for imported goods. Imports are starting to outperform exports, leading to a current account deficit as a result of increased aggregate demand for goods and services, both domestic and imported⁶. According to the quantitative approach to explaining the TDH hypothesis, reference should be made to the Mundell-Fleming model, called the IS-LM-BP model or the impossible trinity model, where the increase in the budget deficit causes an increase in the domestic interest rate, inflow of foreign capital, the actual exchange rate appreciates, there is a decrease in exports and an increase in imports, and as a result the current account deficit deepens. In countries where employment and balance of payments policies are limited to monetary and fiscal instruments, monetary policy should be reserved to achieve the

³ Ganchev, G. T., Stavrova, E., Tsenkov, V. 2012. "Testing the twin deficit hypothesis: The case of Central and Eastern Europe countries". *International Journal of Contemporary Economics and Administrative Sciences*, Vol. 2, No. 1, pp. 1-21.

⁴ Misztal, P. 2011. „Współzależności między deficytem budżetowym i deficytem bilansu obrotów bieżących w Polsce w latach 1999–2009”. *Ekonomista*, No. 2.

⁵ Hallwood, C. P., MacDonald, R. 2000. *International money and finance*. Malden, MA: Blackwell Publishing; Kumhof, M. M., Laxton, M. D. 2009. *Fiscal deficits and current account deficits*: International Monetary Fund; Makin, A. J. 2002. *International macroeconomics*. Melbourne, Australia: Pearson Education; Marinheiro, C. F. 2008. "Ricardian Equivalence, Twin Deficits, and the Feldstein-Horioka puzzle in Egypt". *Journal of Policy Modeling*, Vol. 30, No. 6, pp. 1041-1056.

⁶ Charusheela, S. 2013. *Structuralism and individualism in economic analysis: the „contractionary devaluation debate” in development economics*. London: Routledge.

desired level of balance of payments, and fiscal policy to maintain internal stability; a reverse system would lead to a gradual deterioration in the labour market mainly by increasing the unemployment rate and also worsening the balance of payments⁷.

The second hypothesis is the so-called Ricardian equivalence hypothesis (REH), under which the budget deficit does not affect the current account balance, which should be explained by the fact that governments can raise money through taxes or by issuing bonds, because the bonds are de facto loans that are eventually paid off, raising taxes in the future, and therefore the real choice is „tax now or later”. D. Ricardo was the first to propose such a possibility, although he was not convinced by it⁸, while A. De Viti De Marco developed the Ricardian equivalent from 1890⁹; on the other hand, the theoretical basis for REH was given by R. J. Barro¹⁰, who noticed that government financial strategies have no impact on consumer behaviour,

tax cuts are seen as a tax increase in the future, and the increase in the budget deficit does not change the interest rate and the real exchange rate, therefore the budget deficit is unlikely to cause a deficit in the current account when there is Ricardian equivalence.

The third is the reverse (perverse) hypothesis of twin deficits (PHTD), according to which the current account deficit contributes to the state budget deficit¹¹. The increase in the current account deficit, resulting in a slower pace of economic development, simultaneously causes a budget deficit¹².

The last hypothesis is the Feldstein-Horioka (HFH) hypothesis, under which budget and current account deficits interact¹³. M. Feldstein and C. Horioka have shown that long-term averages of domestic investment and savings, expressed as shares in gross domestic product, were positively and highly correlated in cross-sectional regression for 16 OECD countries in the period 1960–1974¹⁴.

⁷ Mundell, R. A. 1962. "The appropriate use of monetary and fiscal policy for internal and external stability". *Staff Papers*, Vol. 9, No. 1, pp. 70-79.

⁸ Ricardo, D., McCulloch, J. R. 1888. *The Works of David Ricardo: With a Notice of the Life and Writings of the Author*. London: John Murray.

⁹ Feldstein, M., Auerbach, A. J. 2002. *Handbook of Public Economics (Vol. 4)*. North Holland: Elsevier

¹⁰ Barro, R. J. 1974. "Are government bonds net wealth?". *Journal of Political Economy*, Vol. 82, No. 6, pp. 1095-1117; Barro, R. J. 1976. "Perceived wealth in bonds and social security and the Ricardian equivalence theorem: Reply to Feldstein and Buchanan". *Journal of Political Economy*, Vol. 84, No. 2, pp. 343-349.

¹¹ Kumhof, M. M., Laxton, M. D. 2009. *Fiscal deficits...*, op.cit; Mosayeb, P., Saleh, A. S. 2009. "Budget Deficits and Current Account Deficits in the Philippines: A Casual Relationship?". *American Journal of Applied Sciences*, Vol. 6, No. 8, pp. 1515-1520; Siddiqui, A. 2007. *India and south Asia: Economic developments in the age of globalization*: Armonk, NY: M.E. Sharpe; Tumpel-Gugerell, G., Mooslechner, P. 2003. *Economic convergence and divergence in Europe: growth and regional development in an enlarged European Union*. Cheltenham, UK: Edward Elgar Publishing.

¹² Misztal, P. 2011. Współzależności między deficytem budżetowym..., op.cit.

¹³ Feldstein, M. S., Horioka, C. Y. 1979. *Domestic savings and international capital flows*. National Bureau of Economic Research. Cambridge, MA.

¹⁴ Strzała, K. 2005. „Korelacja inwestycji i oszczędności w krajach Unii Europejskiej-weryfikacja empiryczna z zastosowaniem podejścia panelowego”. *Prace i Materiały Wydziału Zarządzania UG*, pp. 141-157.

International differences in national savings rates between major industrial countries correspond to almost equal differences in national investment rates. Savings increase capital resources and the domestic marginal capital product and can replace foreign investment. The HFH hypothesis with respect to double deficits is that domestic savings and investments are often uncorrelated (just like scattered puzzles, hence the term Puzzle Feldstein-Horioka in the literature) in conditions of excellent capital mobility in the world markets. In the absence of Ricardian equivalence, when the budget deficit increases, domestic savings and investment would fall, causing capital flight. Foreign currency would flow into the country as a kind of international financial assistance to reduce the fiscal deficit. The real exchange rate would appreciate, which causes a fall in exports and an increase in imports. Ultimately, the current account deficit is increasing.

It follows from the aforementioned considerations that the relationship between the budget deficit and the current account deficit should be empirically established because the available theories do not provide clear and unambiguous indications. In analytical terms, this relationship should be considered from both a long-term balance perspective and a short-term adjustment perspective¹⁵. In the long term, a positive relationship can be expected between the deficits under investigation in the open economy, as the inflow of foreign capital

makes it easier to finance the budget deficit, and the outflow of capital makes it difficult and forces governments to reduce spending or raise taxes. However, in the short term, an increase in the current account deficit may be correlated with a reduction in the fiscal deficit, given that capital inflows typically stimulate economic growth and the balance of fiscal burdens, while capital outflows are correlated with declining economic growth and deteriorating fiscal developments¹⁶. In addition to hypotheses regarding the attempt to explain the phenomenon of double deficits, attempts are being made to theoretically interpret them. M. Romatowski distinguishes three main channels of twin deficits¹⁷. The first interpretation assumes the exchange rate liquidity and free movement of capital (a situation characteristic of an open economy). If the state maintains a high budget deficit, the interest rate increases. The increased interest rate causes an inflow of foreign investments, as a result of which the foreign currency is converted into the national currency. This leads to the appreciation of the native currency. Prices of imported goods are falling and prices of exported goods are rising. In this situation, the current account deficit is growing. The second channel is related to financing the budget deficit from savings. An increase in the budget deficit means lowering savings and widening the gap between investments and savings. Consequently, the only alternative is foreign

¹⁵ Ganchev, G. T., Stavrova, E., Tsenkov, V. 2012. Testing the twin deficit hypothesis..., op.cit., pp.1-21.

¹⁶ *ibid.*

¹⁷ Romatowski, M. 2005. Twin deficits..., op.cit. pp. 17-25

borrowing by the state budget; this implies an increase in the current account deficit. The third channel concerns the way the money spent on bond issues is disbursed by the state budget. Most of them cause an increase in consumer demand, which affects the economy. Higher consumption expenditure increases imports and limits exports, because internal demand is first met, which leads to a deepening of the current account deficit.

The purpose of this article is to determine the degree, direction and strength of the impact of the studied variables, i.e. the state budget deficit in relation to the current account balance of Poland's balance of payments in the years 2009–2018, as well as to indicate the main source of system imbalance and any factors that may limit the identified imbalance. The main research questions focus on determining whether there is a correlation between the examined deficits, their strength and whether on the basis of the established correlation between the examined deficits we can determine the regression equation and indicate the potential future directions of both deficits (Does the budget deficit have a stronger impact on the account deficit, or vice versa?), as well as which of the deficits has a higher level of volatility, and are there analytical positions with strong correlation within it? Ultimately, which of the hypotheses regarding the phenomenon of concurrent deficits can be confirmed or rejected? The methodology used is based

on correlation analysis, linear regression and analysis of the coefficient of variation. The adopted hypothesis was formulated as follows: based on data from the Statistics Poland for 2009–2018, there was a phenomenon of strongly correlated twin deficits (their cumulative values) in Poland with the leading role of the impact of the budget deficit on the current account deficit, which confirms the TDH. In the area of deficit balances on the current account of the balance of payments, there is a strong negative correlation between the balance of services and primary income, which indicates that the export of services offsets the negative outflow of income from foreign direct investment as part of the balance of primary income.

Review of selected empirical studies on twin deficits in Poland

In the field of research on the phenomenon of twin deficits in Poland, the research was conducted by P. Misztal¹⁸ and A. Możdzierz¹⁹. The analysis based on the Lau and Baharumshah model revealed a two-way cause and effect relationship between the budget deficit and the current account deficit in Poland in the period 1999–2009, thus confirming the existence of a relationship in accordance with HFH in Poland, indicating a two-way, mutual interaction of the deficit budget and current account deficit; at the same time, a stronger impact of the current account deficit on the size of the state budget

¹⁸ Misztal, P. 2011. Współzależności między deficytem budżetowym..., op.cit.

¹⁹ Możdzierz, A. 2018. *Paradygmat deficytów bliźniaczych a doświadczenia krajów Europy Środkowo-Wschodniej*. Polskie Wydawnictwo Ekonomiczne.

deficit was found compared to the impact of the budget deficit on the size of the current account deficit. The results of testing the TDH in Poland in synthetic terms (for the period 1Q2002–4Q2016) based on the VAR model showed a statistically significant positive impact between the current account deficit and the budget deficit, and between the budget deficit and the current account deficit there existed a positive or negative impact, depending on the degree of delay of the variable in the form of a budget deficit. In contrast, the Granger test showed no causality between both the current account deficit and the budget deficit, and between the budget deficit and the current account deficit²⁰.

In turn, other studies on twin deficits in post-communist countries, including Poland, have rejected the TDH hypothesis²¹. However, in the studies concerning Bulgaria, Croatia, Poland and Romania for the period 1999–2011, based on the VAR model, the TDH hypothesis was rejected and the reverse hypothesis was noted²².

Undoubtedly, the widest available summary of previous empirical research on twin deficits was presented by A. Moździerz in the system concerning the United States, a group of developed countries, selected highly developed countries and

also post-communist countries²³. A review of empirical research using various methods, including the Granger test, VAR and VECM model, cointegration, linear regression, correlation and other different world economies failed to provide clear arguments for maintaining or rejecting TDH²⁴.

Methodology

Data analysis was carried out in MS Excel (Office 2016), descriptive statistics and regression statistics were calculated using the Analysis ToolPak add-on. The critical value of the Student's t-statistic ($t_{\alpha, v}$) with a given significance level $\alpha = 0,05$ and the number of degrees of freedom $v = 8$ was determined in MS Excel (Office 2016) based on the „ROZKŁAD.T.ODW” function. In order to perform an empirical analysis consisting of comparing budget deficit streams and the current account deficit in Poland's balance of payments account, data from the Statistics Poland were used, made available as part of the macroeconomic database for the period 2009–2018. Due to the fact that the balance of payments data are presented in the Euro currency, the values were multiplied using the average National Bank of Poland (NBP) exchange rate on the last

²⁰ Moździerz, A. 2018. *Paradygmat deficytów bliźniaczych...*, op.cit. p. 243.

²¹ Gabrisch, H. 2015. "On the twin deficits hypothesis and the import intensity in transition countries". *International Economics and Economic Policy*, Vol. 12, No. 2, pp. 205-220. doi:10.1007/s10368-014-0272-0; Şen, H., Kaya, A. 2016. Are the twin or triple deficits hypotheses applicable to post-communist countries? *Bank of Finland, BOFIT*.

²² Obadić, A., Globan, T., Nadoveza, O. 2014. „Contradicting the twin deficits hypothesis: The role of tax revenues composition". *Panoeconomicus*, Vol. 61, No. 6, pp. 653-667. doi:10.2298/PAN14066530

²³ Moździerz, A. 2018. *Paradygmat deficytów bliźniaczych...*, op.cit., pp 64-80.

²⁴ Ganchev, G. T., Stavrova, E., Tsenkov, V. 2012. Testing the twin deficit hypothesis..., op.cit. pp. 1-21; Moździerz, A. 2018. *Paradygmat deficytów bliźniaczych...* op.cit., p.80; Romatowski, M. 2005. Twin deficits..., op.cit., pp. 17-25.

day of a given year (data are presented in Table 1, p. 188). In the context of the concept of „current account deficit”, it should be clarified that the audit concerns the value of the current account of Poland’s balance of payments, prepared in accordance with the standards of the International Monetary Fund, and current account should be understood as the current account balance constituting a summary of payments of a given country resulting from international trade in goods and services, income from capital and unilateral transfers²⁵. Then, deficit streams were compiled and the correlation coefficient r -Pearson was determined (a dimensionless indicator whose value ranges from -1.0 to 1.0 inclusive and reflects the degree of linear relationship between two sets of data). Its absolute value indicates the strength of the relationship between the studied variables. If it is found that there is a correlation between the studied data (variables) at a level considered sufficient ($0.7 < r < 1$ for positive correlation and $-1 < r < -0.7$ for negative correlation is assumed), the form can be determined as a linear regression function²⁶. Due to a very weak correlation (data in Table 2, p. 188), which apparently confirms the REH hypothesis, the streams of individual deficits examined were accumulated. After accumulating (cumulatively) the value of deficits in individual years, the r -Pearson’s correlation was calculated again. In view of obtaining a high correlation value indicating a strong correlation between the

cumulative values of the examined deficits, the examined streams have been compiled as part of the function, which presents changes in the expected value of the explained variable (budget deficit) caused by changes in the explanatory variable (current account deficit). Descriptive statistics and regression statistics together with the value of the coefficient of determination for the cumulative state budget deficits and the balance of payments are presented in Table 3, p. 189. Thereafter, R^2 was calculated for the purpose of estimating the structural parameters of the linear regression function based on numerical data using the least squares method. The obtained linear regression function is presented in Figure 3, p. 191. The purpose of developing the regression function between the phenomena studied was to determine to what extent one phenomenon affects the other, i.e. how much the state budget deficit will change in the case of a given percentage change in the current account deficit. The regression function allows researchers to determine which activity is leading and which is complementary, in addition to the level of impact of one leading deficit on its complementary counterpart. In order to formulate the final conclusions, it was important to examine the level of variability of the deficit growth processes examined. In order to compare the variability of various processes (i.e. the dynamics of the budget deficit increase and the dynamics of the current account deficit increase), relative volatility measures

²⁵ Budnikowski, A. 2017. *Ekonomia międzynarodowa*: Polskie Wydawnictwo Ekonomiczne, p. 291.

²⁶ Parlińska, M., Parliński, J. 2018. *Statystyczna analiza danych z Excelem*: Wydawnictwo SGGW.

called volatility coefficients were used, which show the relation between the absolute variability of the process and its average value. To calculate the coefficient of variation, the coefficient of variation of the standard deviation was used according to the subsequent formula:

$$V_x = \frac{S_x}{\bar{x}} \cdot 100$$

where:

V_x – coefficient of variation of the standard deviation of the data tested x ,

S_x – standard deviation of the tested data set,

\bar{x} – arithmetic average.

The presented coefficient of variation assumes non-negative values and inform researchers about the percentage of the arithmetic mean of the examined feature (process) being the standard deviation. This makes it possible to answer the question: what percentage, on average, do the values of the examined process differ from the arithmetic mean? The higher the value of the coefficient of variation, the greater the diversity of the examined characteristic (process). A vital feature of the coefficient of variation is that we can use it to compare the degree of variability of various processes (phenomena). The resulting values for the coefficient of variation of the standard deviation V_x , the value of the standard deviation S_x and the arithmetic mean \bar{x} are presented in Table 2, 3 i 6.

Due to the higher value of the coefficient of variation for the deficit stream in the current balance of payments, an analysis of the positions of individual balance of payments was carried out in order to determine the positions generating the highest level of correlation. Then, due

to the high level of correlation, the value of R^2 was determined, and the equation of the ordinary least squares (OLS) regression function was calculated during which the most correlated balances, i.e. the balance of services (explained variable) and the balance of primary income (explanatory variable) were compared using the least squares method, which enabled an indication of the positions of balances having a decisive influence on the formation of the main positions of balances in the current account, together with an indication of the value of the coefficient of variation presented previously. Data on the flows of the balance of services and primary income are presented in Table 4, p. 192, r -Pearson's correlations between individual types of balances of the balance of payments are presented in Table 5, p. 192, and Table 6, p. 193 presents descriptive statistics of the balance of services and primary income balances together with regression statistics and the value of the coefficient determination. Due to the high correlation identified between the service balance and the primary income balance, a linear regression equation was developed, which is presented in Figure 4, p. 194. Due to the wide scope of research on the analysis of budget items, the study was completed at the stage of determining the main correlations within the balance of payments.

The research results

There is a very weak correlation of the r -Pearson 0.0766 with R^2 of 0.0059 between the balances of the studied deficits in 2009–2018, which does not allow this study to determine the regression

Table 1. Data on the current balance of payments account and budget deficit in 2009–2018

Position	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Current account of the balance of payments (EUR billion)	-12,6	-19,5	-19,6	-14,4	-5,0	-8,5	-2,4	-2,2	0,3	-5,0
<i>NBP average exchange rate</i>	4,1082	3,9603	4,4168	4,0882	4,1472	4,2623	4,2615	4,4240	4,1709	4,3000
Current balance of payments account (PLN billion)	-51,9	-77,1	-86,7	-59,0	-20,7	-36,3	-10,1	-9,9	1,2	-21,7
Result (balance) of the state budget (PLN billion)	-23,8	-44,6	-25,1	-30,4	-42,2	-29,0	-42,6	-46,2	-25,4	-10,4
<i>Accumulated data (PLN billion)</i>										
Current balance of payments account	-51,9	-129,0	-215,7	-274,7	-295,4	-331,7	-341,8	-351,8	-350,5	-372,2
Result (balance) of the state budget	-23,8	-68,4	-93,6	-124,0	-166,2	-195,1	-237,7	-283,9	-309,3	-319,7

Source: own study based on the Statistics Poland data (macroeconomic database) for 2009–2018.

Table 2. Descriptive statistics for non-cumulative values

Position	r	R^2	
Value	-0,0766	0,0059	
Position	S_x	\bar{x}	V_x
Current balance of payments account	30,18	-37,2	-81,07%
Result (balance) of the state budget	11,60	-32,0	-36,29%
<i>Current balance of payments account (in PLN bln)</i>		<i>Result (balance) of the state budget (in PLN bln)</i>	
Average	-37,2246	Average	-31,9664
Standard error	9,5428	Standard error	3,6687
Median	-28,9765	Median	-29,6917
Standard deviation	30,1769	Standard deviation	11,6015
Sample variance	910,6468	Sample variance	134,5953
Kurtosis	-1,1312	Kurtosis	-0,5520
Slant	-0,4680	Slant	0,3604
Range	87,9025	Range	35,7533
Minimum	-86,6929	Minimum	-46,1595
Maximum	1,2096	Maximum	-10,4062
Sum	-372,2459	Sum	-319,6643
Counter	10	Counter	10
Biggest (1)	1,2096	Biggest (1)	-10,4062
Smallest (1)	-86,6929	Smallest (1)	-46,1595
Confidence level (95,0%)	21,5873	Confidence level (95,0%)	8,2992

Source: own study based on the Statistics Poland data (macroeconomic database) for 2009–2018.

Table 3. Descriptive statistics of cumulative values and regression statistics of cumulative values

Position	<i>r</i>	<i>R</i> ²						
Value	0,9132	0,8339						
Position	<i>S</i> _x	\bar{x}	<i>V</i> _x					
Current balance of payments account	107,29	-271,5	-39,52%					
Result (balance) of the state budget	104,4	-182,2	-57,33%					
<i>Current balance of payments account (in PLN bln)</i>		<i>Result (balance) of the state budget (in PLN bln)</i>						
Average	-271,4917	Average	-182,1680					
Standard error	33,9296	Standard error	33,0253					
Median	-313,5771	Median	-180,6497					
Standard deviation	107,2949	Standard deviation	104,4352					
Sample variance	11512,1874	Sample variance	10906,7066					
Kurtosis	0,5459	Kurtosis	-1,3967					
Slant	1,2406	Slant	0,0558					
Range	320,2977	Range	295,8193					
Minimum	-372,2459	Minimum	-319,6643					
Maximum	-51,9482	Maximum	-23,8450					
Sum	-2714,9171	Sum	-1821,6797					
Counter	10	Counter	10					
Biggest (1)	-51,9482	Biggest (1)	-23,8450					
Smallest (1)	-372,2459	Smallest (1)	-319,6643					
Confidence level (95,0%)	76,7541	Confidence level (95,0%)	74,7084					
<i>Regression statistics for cumulative values</i>								
Multiple R	0,9132							
<i>R</i> ²	0,8339							
Matched <i>R</i> ²	0,8131							
Standard error	45,1495							
Observations	10							
<i>Analysis of variations</i>								
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>			
Regression	1	81 852,5678	81 852,5678	40,1538	0,0002			
Residual	8	16 307,7912	2 038,4739					
Together / in total	9	98 160,3590						
	<i>Coefficients</i>	<i>Standard error</i>	<i>t Stat</i>	<i>p-Value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>	<i>Lower 95,0%</i>	<i>Upper 95,0%</i>
Intersection	59,1405	40,6696	1,4542	0,1840	-34,6437	152,9247	-34,6437	152,9247
Variable x Current account of the balance of payments. (in PLN bln)	0,8888	0,1403	6,3367	0,0002	0,5654	1,2123	0,5654	1,2123
Significance level α							0,05	
The number of degrees of freedom <i>v</i>							8	
<i>t</i> _{α,v} (reading from Student's t-distribution tables)							2,3060	
Coefficient of determination (<i>R</i> ² x 100%)							91,32%	

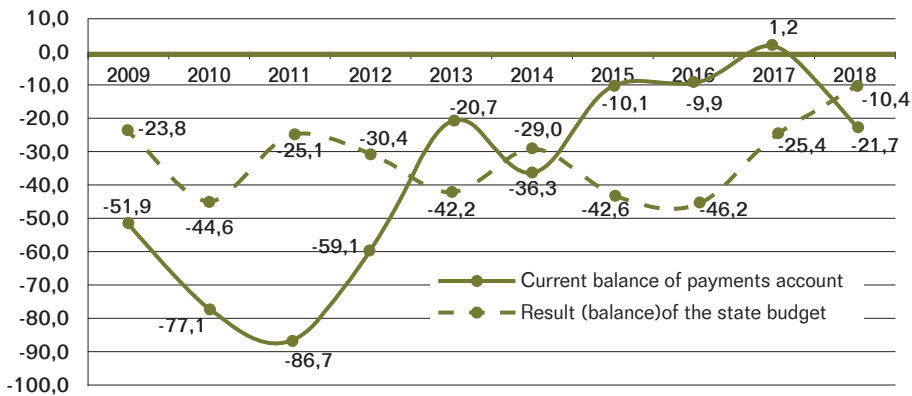
Source: own study based on the Statistics Poland data (macroeconomic database) for 2009–2018.

function (descriptive statistics are presented in Table 2, p. 188). Therefore, cumulative accumulation of deficit items was made over the period considered. The cumulative deficits examined in the period 2009–2018 are characterised by a strong positive correlation of the

r -Pearson 0.9132, which allows the equation of the regression function to be determined (descriptive statistics and cumulative regression statistics are presented in Table 3, p. 189).

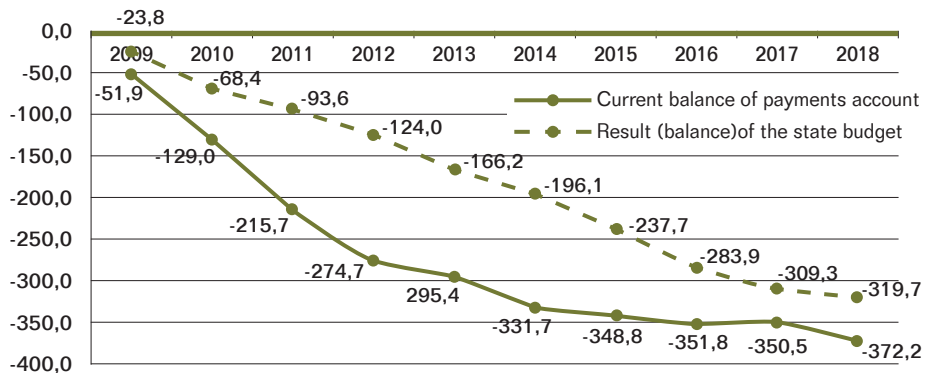
As regards the data of the cumulative streams of the budget deficit and

Figure 1. Deficits: budget and current account 2009–2018 (data in PLN billion)



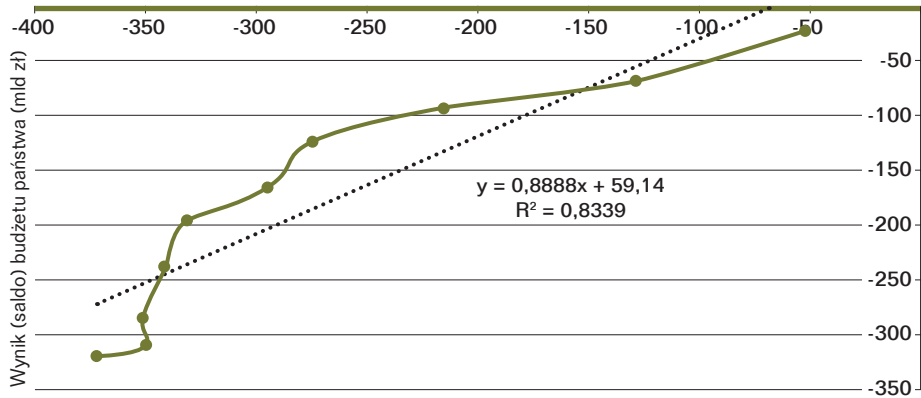
Source: own study based on the Statistics Poland data (macroeconomic database) for 2009–2018.

Figure 2. Cumulative values of examined deficits (data in PLN billion)



Source: own study based on the Central Statistical Office data (macroeconomic database) for 2009–2018.

Figure 3. Ordinary least squares (OLS) regression function for cumulative deficits



Source: own study based on the Statistics Poland data (macroeconomic database) for 2009–2018.

the current account deficit in the years 2009–2018, the null hypothesis $H_0: \rho = 0$, where ρ is the estimator of the correlation coefficient in the general population, indicating the lack of correlation between the studied deficits, was submitted against the alternative hypothesis $H_1: \rho \neq 0$, indicating that the test deficits are correlated.

Value of statistics $t_{obl} = 6.3367$ for the regression function of cumulative budget deficits and in the current account of the balance of payments. For the chosen significance level $\alpha = 0.05$ and the number of degrees of freedom $\nu = 8$, the critical $t_{\alpha, \nu}$ was determined (read from the distribution tables of Student's t-statistics). As $t_{obl} = 6.3367 > t_{\alpha, \nu} = 2,3060$, this proves the significance of the regression function subsequently determined. Thus, the determined form of the regression function $y = 0.8888x + 59.14$ can be used to describe the relationship between the

studied features. A 1% change in the budget balance leads to a 0.89% change in the current account balance.

The measure of the fit of the regression line to the observed variables x and y is the coefficient of determination equal to the square of the correlation coefficient and expressed as a percentage ($R^2 \times 100\%$). The calculated coefficient of determination is 91.32%, which indicates that such a part of the variability of the y feature (cumulative current account balance of the balance of payments) is caused by the linear influence of the x feature (cumulative balance of the budget deficit).

In the further research process, due to the high correlation of cumulative balances and the higher coefficient of variation of current account balances Vx at a level of -81.07%, a correlation analysis was carried out within the balances shaping the current account.

Table 4. Current account of the balance of payments and balance (data in PLN billion)

Position	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Current balance of payments account	-51,95	-79,95	-80,64	-59,28	-20,55	-34,94	-9,76	-9,22	1,19	-20,73
Trade balance	-31,67	-44,94	-54,62	-33,40	-1,38	-13,37	9,09	12,06	5,86	-19,65
Service balance	20,61	13,54	21,23	24,67	31,41	37,22	44,82	57,36	73,77	88,95
Primary income balance	-36,88	-48,37	-50,36	-50,03	-48,83	-57,24	-60,20	-72,78	-77,87	-84,19
Secondary income balance	-4,02	-0,18	3,11	-0,51	-1,75	-1,55	-3,48	-5,86	-0,56	-5,85

Source: own study based on the Statistics Poland data (macroeconomic database) for 2009–2018.

The highest level of r -Pearson correlation was found between the service balance and the balance of primary incomes $r = -0.9531$ (in correlation r , we examine the absolute value of the obtained result). The data are presented in Table 5, p. 192.

Due to the strong negative correlation between the service balance and the primary income balance, the regression function was determined (descriptive statistics of the examined balances are presented in Table 6, p. 193 and the obtained regression function in Figure 4, p. 194).

As regards data on service balance streams and primary income balance for the years 2009–2018, the null hypothesis $H_0: \rho = 0$, where ρ is the estimator of the correlation coefficient in the general population, indicating the lack of correlation between the examined balances, against the alternative hypothesis $H_1: \rho \neq 0$, suggesting that the examined balances are correlated. Value of $t_{obl} = 8.9111$ for the regression function of the cumulative streams of budget deficits and the current account deficit. For

Table 5. Correlations of balance of payments in the period 2009–2018

	Trade balance	Service balance	Primary income balance	Secondary income balance
Trade balance	1	-	-	-
Service balance	0,5894	1	-	-
Primary income balance	-0,5397	-0,9531	1	-
Secondary income balance	-0,5760	-0,5506	0,4243	1

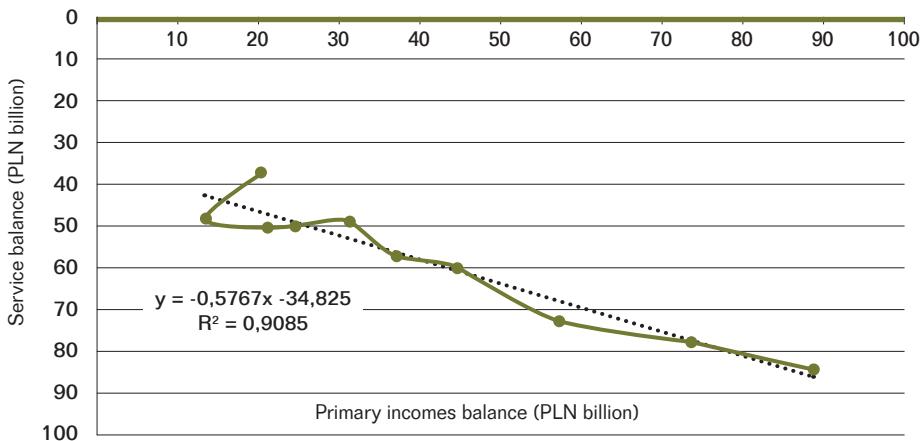
Source: own study based on the Statistics Poland data (macroeconomic database) for 2009–2018.

Table 6. Descriptive statistics of service balance and primary income balance

Position	r	R ²						
Value	0,9531	0,9085						
Position	S _x	\bar{x}	V _x					
Service balance	24,92	41,36	60,25%					
Primary income balance	15,07	-58,67	-25,69%					
Service balance (in bln PLN)		Primary income balance (in bln PLN)						
Average	41,3581	Average	-58,6741					
Standard error	7,8793	Standard error	4,7671					
Median	34,3137	Median	-53,7989					
Standard deviation	24,9167	Standard deviation	15,0749					
Sample variance	620,8418	Sample variance	227,2530					
Kurtosis	-0,1858	Kurtosis	-0,7211					
Slant	0,91283	Slant	-0,5216					
Range	75,4060	Range	47,3141					
Minimum	13,5447	Minimum	-84,1893					
Maximum	88,9507	Maximum	-36,8752					
Sum	413,5807	Sum	-586,7413					
Counter	10	Counter	10					
Biggest (1)	88,9507	Biggest (1)	-36,8752					
Smallest (1)	13,5447	Smallest (1)	-84,1893					
Confidence level (95,0%)	17,8243	Confidence level (95,0%)	10,7839					
<i>Regression statistics for cumulative values</i>								
Multiple R	0,9531							
R ²	0,9085							
Matched R ²	0,8970							
Standard error	4,8373							
Observations	10							
<i>Analysis of variations</i>								
	df	SS	MS	F	Significance F			
Regression	1	1 858,0836	1 858,0836	79,4080	0,0000			
Residual	8	187,1936	23,3992					
Together / in total	9	2 045,2772						
	Coefficients	Standard error	t Stat	p-Value	Lower 95%	Upper 95%	Lower 95,0%	Upper 95,0%
Intersection	-34,8245	3,0827	-11,2968	0,0000	-41,9332	-27,7158	-41,9332	-27,7158
Variable x Service balance	-0,5767	0,0647	-8,9111	0,0000	-0,7259	-0,4274	-0,7259	-0,4274
Significance level α	0,05							
The number of degrees of freedom ν	8							
$t_{\alpha,\nu}$ (reading from Student's t-distribution tables)	2,3060							
Coefficient of determination (R ² x 100%)	95,31%							

Source: own study based on the Statistics Poland data (macroeconomic database) for 2009–2018.

Figure 4. Ordinary least squares (OLS) regression function for the balance of services and primary incomes



Source: own study based on the Statistics Poland data (macroeconomic database) for 2009–2018.

the chosen significance level $\alpha = 0.05$ and the number of degrees of freedom $v = 8$, the critical $t_{\alpha,v}$ was determined. As $t_{obl} = 8.9111 > t_{\alpha,v} = 2,3060$, this proves the significance of the regression function subsequently determined. Thus, the determined form of the regression function $y = -0,5767x - 34,825$ can be used to describe the relationship between the studied features.

The measure of the fit of the regression line to the observed variables x and y is the coefficient of determination equal to the square of the correlation coefficient and expressed as a percentage ($R^2 \times 100\%$). The calculated coefficient of determination is 91.32%, which indicates that such

a part of the variability of the y feature (cumulative current account balance of the balance of payments) is caused by the linear influence of the x feature (cumulative balance of the budget deficit).

A 1% change in the balance of services leads to a 0,58% change in the balance of primary incomes. The balance of services is characterized by a higher coefficient of variation Vx .

Conclusions

The vital interest of the state is not only to achieve a budgetary balance, but also a balance of payments. The concept of “equilibrium balance of payments” can, however, take different meanings²⁷ i.e.:

²⁷ Budnikowski, A. (2017). *Ekonomia międzynarodowa*: Polskie Wydawnictwo Ekonomiczne, p. 293.

- accounting equilibrium balance (in this respect, the balance of payments is always balanced thanks to the double entry method),
- economic equilibrium (the concept introduced by the British economist J. E. Meade, who defined the equilibrium as a state in which autonomous transactions concluded irrespective of the state of the balance sheet outgoings, and equalising transactions taking place with the intention of equalising the balance of payments do not occur),
- real equilibrium balance (balance of payments in economic terms is maintained without the participation of the state, only as a result of market forces).

Considering the range of available options, there are no obstacles for the state to aim not only for equilibrium but also for a surplus within both balances (e.g. Norway). The budget deficit as well as the current account balance of payments, or more precisely, in the accounting sense, the balance of expenditure and budgetary receipts as well as the balance of the current balance of payments account are the aggregate and result categories. Similarly, the result and aggregate category is profit or loss in the profit and loss account and cash in the company's cash flow statement. For this reason, simply comparing deficits as aggregate and output categories, only in relation to themselves, does not allow the formulation of appropriate conclusions about the reasons for their correlated or uncorrelated *ex-post* balances, as well as the anticipation of shaping their *ex-ante* value.

Any recommendations or actions taken will relate to specific analytical positions and areas. In the scope of tools and

instruments enabling management of the budget balance and balance of payments, in order to restore balance in the accounting and economic sense, we can distinguish: 1) instrumental adversarial – the use of different instruments; 2) instrumental convergence – understood as the use of the same tools or methods. Due to the level of inflows and outflows considered on an annual basis, resulting in the budget balance and the current balance of payments account, a range differential should be distinguished, which determines the broader general significance for the economy of factors affecting the balance of the current balance of payments than the budget balance. Policy directions aimed at surplus, balance and deficit for both types of internal and external flow statements may also have a different subject scope (subject differentiation), both from the policy makers and the entities implementing them.

In the context of determining the causes of a strong correlation between the examined balances, they should rather be sought by establishing strongly correlated analytical positions that ultimately affect the examined balances and therefore it is more appropriate to use a multi-faceted and analytical approach rather than a single-faceted and synthetic one. Both balances perform a convergent social function: they reflect economic activity in internal and external terms. Moreover, after analysing the stability of regulations relating to the principles of reflecting phenomena in the state budget and in the balance of payments, we can point to a significantly higher susceptibility to the manipulation of budget booking rules, which ultimately

leads to significant errors and distortions in the conclusions drawn on the basis of relationships between budget balances and the current account balance of payments (in fact, the objective accounting picture of actual operations may be quite different from those finally presented as part of official reporting). The paradigm of the possibility of maintaining a real balance of payments in the face of the particularisation of state and corporation interests on the global stage and the institutionalisation of interventions of international and state organisations, and even their operationalisation, is not practically feasible and remains only a postulate.

Undoubtedly, in view of the trends observed, leading to the reduction of both deficits in Poland, the ability to implement an appropriate adjustment policy, in particular exchange rate policy in the conditions of changing the degree of economy opening or secular stagnation, will become the main challenge in the coming years, in accordance with J. A. Frankel's incoherent triad of goals or impossible trinity²⁸ [Frankel, 1999], as well as the policy of changing expenses and shifting them in order to maintain internal and external balance within the so-called T. W. Swan diagram²⁹.

To summarise, the analysis of the hypotheses under the coexistence of budget deficits and the current balance of payments account should be analysed

by examining the cumulative balances of these deficits in a stream perspective, otherwise the results obtained indicate a lack of correlation, which may lead to an erroneous and superficial conclusion of adopting Ricardian equivalence under the REH hypothesis.

The strong positive correlation found between the budget deficit streams and the balance of payments current account, with the small but leading role of the budget balance, confirms the TDH hypothesis. Higher volatility in the balance of the current account balance of payments has been established, under which two are dominant in terms of the value of services and primary income, in stream terms within the analysed period 2009–2018, and form a strong negative correlation with the dominant role of the balance of services.

The main balance stabilising the negative balance of primary income, in which non-residents realise income from foreign direct investment (retransfer of benefits obtained as a result of investment activity) is the balance of extremely dynamically developing services. This contributes to the hypothesis that requires further research that the inflow of foreign capital also contributes to the development of exports of services, which allows developing countries to obtain an effective counterweight to the country's outflows of foreign direct investment income realised by non-residents.

²⁸ Frankel, J. A. (1999). *No single currency regime is right for all countries or at all times*. Working Paper 7338, September 1999, National Bureau of Economic Research. Cambridge, MA.

²⁹ Swan, T. W. (1963). Longer-run problems of the balance of payments. *The Australian Economy: A volume of readings*, 384-395.

The low role of the balance of trade in goods (a low level of correlation making it impossible to determine the regression function) may form the basis for the hypothesis concerning the import intensity of exports in relation to the high balances of primary income realised by non-residents with foreign direct investment. Due to the dynamics of limiting the current account deficit, Poland will have to collide, in the next decade, not only with the challenges arising from the need to conduct a balanced adjustment policy within international financial relations, but also the effects of the Covid-19 pandemic.

We are aware of the risk of using cumulative values in research. Nevertheless,

we decided that it would be worth presenting this approach by stating the results obtained on the basis of annual data. We hope it may contribute to further research.

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