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Determinants of the Agricultural Budget in Poland in the Light of Its Relation to GDP and State Budget Expenditure

Introduction

In the literature, there are many studies that analyse and explain the rationale for supporting agriculture with public funds, and thus justify the level and make-up of budget transfers allocated to this sector. This rationale refers to changes in the functions of agriculture in the economy, or, more precisely, to the appearance or social appreciation of functions other than satisfying food needs. It also applies to the provision of public environmental (ecological), social and cultural goods, for which society should – at least partially – pay, as they are not subject to valuation by the market mechanism and are usually not exchanged on the market (see Woś and Zegar 2004; van Huylenbroeck and Durand 2003; Buckwell 2009; B. Czyżewski 2016; Grzelak et al. 2019).

Agricultural support is also justified from the point of view of the sectoral approach. It is based on the specific features of agriculture, like, first of all, immobility of resources involved in agricultural production (land) or their low mobility and substitutability (labour, buildings and structures) (Woś 2005; Zegar 2012, 2018; Kułyk 2013; Sobiecki 2015). Moreover, despite technological progress, agricultural production is still highly dependent on natural conditions. Agriculture, due to these characteristics, is relatively susceptible to various imperfections of the market mechanism resulting from e.g. the presence of transaction costs, incompleteness

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of markets, information asymmetry, and failure of the market to take into account important social goals, including ecological ones (Stiglitz 1987). Moreover, the market mechanism, through pricing schemes, depreciates agriculture as a raw material sector. This leads to the transfer of added value produced in agriculture to the sectors being closer to the consumer or sectors with a higher level of resource concentration (agri-food processing and agricultural supply) (Czyżewski 2007; B. Czyżewski and Brelik 2014). This brings certain consequences such as lower factor productivity in agriculture compared to other sectors of the economy, disparity of agricultural incomes, high risks accompanying agricultural activities, slow structural transformation processes and high entry barriers (Gabre-Madhin et al. 2002; Rizov et al. 2013; Barath and Ferto 2017; B. Czyżewski and Majchrzak 2018). The latter feature makes it very difficult to recreate agriculture where it has been degraded. The sectoral features justify the "special treatment" of agriculture in the process of reallocation and redistribution of national income by the budget.

The above-mentioned unique functions and features of agriculture, which justify the need for public transfers, such as various types of subsidies supporting farmers' income or agricultural transformation and development, are reflected in the objectives of the agricultural policy (allocative, income, environmental and other) (Kulawik 2009; Czyżewski, Kata, Matuszczak 2019a, 2019b). This, in turn, determines the level and breakdown of public spending on agriculture, which also depends on the assessment of how effective and efficient the fulfilment of these objectives is both at the sector level (see e.g. Rizov et al. 2013; Baer-Nawrocka 2013; Lenkiewicz et al. 2014; Kirchweger et al. 2015; Barath and Ferto 2017) and at the microeconomic level (Kulawik et al. 2017; Latruffe et al. 2017).

The amount of public spending on agriculture is also explained by the public choice theory and the interest group theory, which indicate the ability of farmers to pile pressure on those in power to obtain specific budget transfers (Olson 1965; Swinnen et al. 2000; Rausser et al. 2011; Zawojska 2011; Wilkin 2012; Kiryluk-Dryjska 2014; Mogues 2015). This theoretical trend points out that agricultural support is an example of political rent and is largely guided by political reasons, although the objectives of support are essentially economic (reducing the income disparity of farmers, supporting investment processes in agriculture, improving the quality of life in rural areas etc.). Empirical research touches on the issue of modelling the impact of farmers' lobbying on agricultural policy decisions (Johnson 2007), which depends, in particular, on the number, size and geographical concentration of farms, as well as the level of democratisation (Swinnen et al. 2000; Olper 2007).

Other studies address the influence of institutions, including those studying agriculture, on the level of public transfers to this sector. They point to the influence of such factors as the political system and electoral system, international agreements and arrangements, the quality of institutions protecting and enforcing property rights, or the quality of institutions supporting agriculture (Alson et al. 1993; Allcott et al. 2006; Cameron and Porche 2007; Mogues 2015).

There is fairly large literature on the relationship between a country's level of economic development and financial support for agriculture. The available studies use different types of measures describing the level of financial support for agriculture, such as the Producer Support Estimate (PSE) and the Effective Rate of Assistance (ERA) index (see Blandford 2007; Andreson 2009; Czyżewski and Poczta-Wajda 2011; Kułyk 2013; Poczta-Wajda 2017). They apply to both developing and economically developed countries. There are also publications which describe the level and make-up of public spending on agriculture (for example, the share of investment spending in agricultural budget expenditures) in relation to total GDP and GDP produced by agriculture, as well as in relation to the state budget (see e.g. Akroyd and Smith 2007; Czyżewski and Matuszczak 2014). However, these studies do not include an analysis of the convergence of trends of these macroeconomic quantities or an analysis of their interdependence. Such an analysis would provide insight into the extent to which the agricultural sector participates in the fruits of economic growth. On the other hand, it would help determine whether these two macroeconomic variables (GDP and total state budget expenditures) have an impact on budget expenditures on agriculture, and what that impact is, taking into account the time shifts. A prerequisite for such research is the collection of data on budget spending on agriculture over a long period of time. The data available to us are the result of many years of research on agricultural budgets and provide a unique database of information, covering a long enough time period to undertake this type of analysis.

1. The aim and research methodology

The analysis of the dynamics and proportions of agricultural expenditure in Polish budgets in the long period of 1995–2020, concluded that the fluctuation of these expenditures was relatively high, and their level and make-up significantly changed after Poland joined the EU. In particular, the negative tendencies observed in the first subperiod, before 2004, which marginalised the agricultural sector as compared to other sectors of the economy, were reversed, which manifested itself in financing this sector almost 2.5 times higher than before. The nature of the public funds being disbursed also changed significantly: from freezing the previous support funds to introducing pro-development ones, largely forced by co-financing from the CAP funds.

The aim of this part of the paper is to look for interdependencies between budget expenditures on agriculture and the dynamics of GDP and the state budget in general, as well as to identify internal determinants of the changes in budget expenditures on agriculture and long-term external determinants in Poland between 1995 and 2020. This analysis will serve to answer the following question: what are the determinants of the changes in budget expenditure on agriculture?

The answer to this question will allow us to verify the following hypotheses:

H1 – the dynamics of budget expenditure on agriculture is positively influenced by the growth of GDP and state budget expenditure and the increase in the amount of European funds allocated to agriculture;

H2 – the economic situation in agriculture, measured by the price scissors index, as well as changes in the level and proportion of farmer income affect agricultural budget expenditure in Poland with an annual lag.

We understand state budget expenditure as national budget expenditure together with the budgets of voivodes. Moreover, we understand the Polish agricultural budget, also referred to in the article as the total agricultural budget, as all public expenditure allocated directly or indirectly to agriculture. In the analysis, we deliberately omit budget revenues in departments related to the agricultural sector.[1]

The main research period covers the years 1995 to 2020 and the analysis looks at the data based on single years (base year 1995) and from year to year. Such a long period of time allowed us to identify long-term trends in the development of the studied values, to analyse the trends and to establish their functions as well as to search for causal relations between those values.

The sources of empirical materials on the agricultural budget expenditure in Poland were mainly data from the Ministry of Agriculture and Rural Development (formerly the Ministry of Agriculture and Food Economy) and annual Opinions (expert opinions) on the Budget Act in the part concerning agriculture (1999–2021), prepared by Professor A. Czyżewski. Moreover, the sources of materials were data of the Central Statistical Office (CSO) on GDP and inflation as well as on farmers' household income and publications of the Supreme Chamber of Control (NIK) on the execution of state budgets.

In order to identify the trends across the studied values, we applied an additive model of the development tendency in the form of a linear trend function. In the first step, the trend function was established for real values of particular variables, and in order to compare the average annual change rate of the studied values, the trend function was calculated on the basis of standardised data (classical standardisation).

In order to determine which factors affect the dynamics of budget expenditures on agriculture in general (Y_t), i.e. the total of funds from the national budget and the budget of the European Funds (BEE), a multiple regression function was used. As diagnostic variables X_i, we selected internal and external characteristics relative

[1] Budget is a concept that describes in the most general terms both revenues and expenditure. In the article, however, the revenues side of the agricultural budget is omitted, since state budget revenues generated in the section Agriculture (in the part covering agriculture, rural development and agricultural markets) are of little (promille) importance for the state budget and thus for the fiscal policy towards agriculture. "Agricultural budget" both in popular perception and in scientific discussion is identified almost exclusively with budget expenditures on agriculture. Taking the above into account, also in this article we adopt "agricultural budget" as a synonym of budget expenditures on agriculture (more precisely, expenditures from the state budget and the European funds budget).

to the total agricultural budget which may affect its size and thus its dynamics. The selection of explanatory variables for estimation in the regression model was preceded by the Pearson correlation analysis and dispersion analysis using the coefficient of variation V. This procedure was designed to eliminate independent variables that highly correlated with each other ($r_{xy} > 0.7$) and features with low range of variability ($V < 10\%$).

Finally, the following variables X_i were adopted for the estimation of the regression model of the variable Y_t:

X_1 – expenditure on ASIF in PLN million,
X_2 – European funds (under CAP) in PLN million,
X_3 – dynamics of GDP in constant prices (%),
X_4 – dynamics of state budget expenditure in constant prices (%),
X_5 – the price scissors index (in %),
X_6 – subsidy rate of farm income (%),[2]
X_7 – share of farm income in farmers' disposable income (%),
X_8 – dynamics of final output in agriculture at constant prices (%),
X_9 – dynamics of real gross disposable income in agricultural holdings (%).[3]

Statistical analyses were performed using the STATISTICA PL package, with the significance level set at 0.05. The ADF unit root test, i.e. an extended Dickey-Fuller test, was used to verify the stationarity of the variables and the random component (Majsterek 2014). The examined explanatory variables were found to be non-stationary ($p > 0.1$), except for the variable X_5, which was taken into account in the estimation of the regression function: it was examined how the increments of non-stationary variables (e.g. expenditure on ASIF) affect the increments of the dependent variable Y_t.

2. Relation of the agricultural budget to GDP and state budget expenditures

The total agricultural budget expenditures in Poland, in 1995–2020, are quite strongly positively correlated with state budget expenditures (correlation coefficient $r_{xy} = 0.71$) and with the GDP growth rate ($r_{xy} = 0.75$). To determine the similarities and differences in the trends of the studied values, the trend function was used. The basic parameters of the trend function for real values (in constant prices) of GDP, state budget expenditures and total agricultural budget expenditures without ASIF are presented in Table 1.

[2] The share of subsidies to agricultural activity (without ASIF and investment funds) in nominal gross disposable income in individual farms in agriculture.

[3] The variables that were initially adopted for the study and then eliminated from the regression model estimation due to the strong correlation with variable X_1 and X_2 were: share of ASIF in total agricultural budget (in %) and share of EU funds in total agricultural budget (in %).

Table 1

Parameters of the trend function of the Polish agricultural budget, GDP and state budget expenditure in 1995–2020 (in constant prices of 2020[a], in PLN million)

Description	GDP	State budget	Agricultural budget (including EU funds)	
			Total	without ASIF
Value 1995	970 556.7	256 434.6	24 396.4	6 763,1
2004	1 286 040.8	272 479.4	36 800.0	15 288.7
2020	2 323 859.0	504 851.0	49 533.5	30 590.4
Change 2020/1995 (%)	239.4	196.9	203.0	452.3
Trend function parameters (constant prices, in PLN million)	$Y = 55899X$ + 814 819	$Y = 8327.7X$ + 211 089	$Y = 1475.4X$ + 24 989	$Y = 1565.4X$ + 4027.6
Coefficient of fit R^2	0.971	0.864	0.621	0.625

[a] Deflator – CPI price index.

Source: Based on CSO data, Ministry of Agriculture and Rural Development (MRiRW) and information on the draft state budget and budget of European funds in the field of agriculture, rural development and agricultural markets, materials for the Sejm Committee on Agriculture and Rural Development, 1998–2020 and CSO data: https://stat.gov.pl/wskazniki-makroekonomiczne/ (accessed 07.07.2021).

The equations of the linear function describe the upward trend of the studied quantities fairly accurately. The values of the R^2 coefficient for the trend equations prove that total agricultural budget spending and agricultural budget spending excluding ASIF show much larger deviations from the trend line as compared to GDP and state budget expenditures. This indicates less stability of the dynamics of agricultural expenditure compared to the dynamics of the state budget and GDP.

Figure 1 shows how the time series of standardised values of GDP and expenditures of the state budget and the total agricultural budget evolved. It can be clearly seen that the trends of GDP and state budget spending in constant prices were increasing throughout the period under study with annual deviations (declines) occurring most often. We can distinguish three phases in the trend of agricultural budget expenditures:

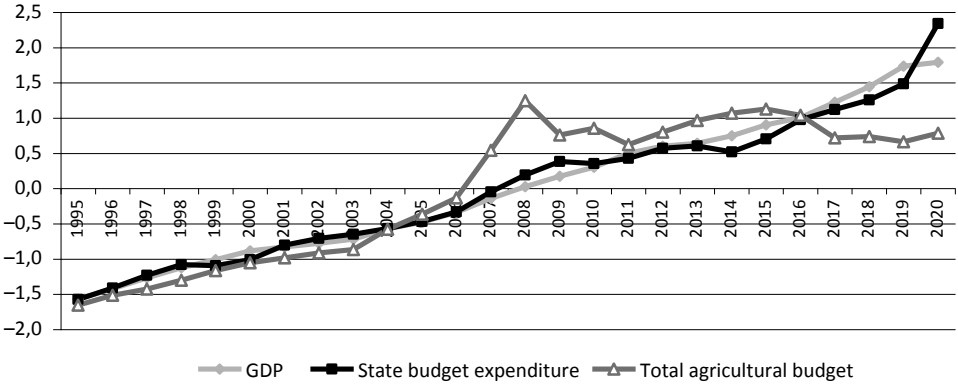
1) the period when agricultural budget expenditure "followed" the trend of GDP and state budget expenditure in the years 1995–2003;

2) the period of significantly higher growth rate of agricultural budget expenditures relative to the growth rate of GDP and state budget expenditures in the years 2004–2008;

3) the years 2009–2020, in which the agricultural budget expenditure showed an ambiguous trend, but in relative terms – relative to the upward trend of GDP and state budget – we could observe their general downward trend.

Figure 1

Standardised values of GDP, state budget expenditure and total agricultural budget expenditure (in constant prices) in 1995–2020[a]



[a] Value 0 corresponds to the average size of a given variable in the studied period, while value 1 corresponds to the standard deviation.

Source: Based on the same data as Table 1.

It should be mentioned that the third period is characterised by high variability in the trend of agricultural budget expenditures. With a general downward trend, we can also distinguish periods of growth of these expenditures year-on-year, which occurred in several years of this period.

Table 2 presents the parameters of the trend function for the entire period under study and for the three sub-periods distinguished, while the trend function was estimated for standardised data, which allows comparative analysis and evaluation of the changes in the analysed values. In the whole period of 1995–2020, agricultural budget expenditures showed an upward trend, similarly to GDP and state budget expenditures. However, the values of the directional coefficient for standardised data indicate that the agricultural budget grew more slowly than GDP and state budget spending. This leads to the conclusion that the growth of these quantities was not balanced and that agriculture – in terms of budgetary redistribution of national income – did not benefit from the fruits of economic growth in the same degree as the whole economy.

The analysis of the trend function of the examined variables indicates that budget expenditures on agriculture grew between 1995 and 2003, but more slowly than GDP (Table 2). In this period, the linear trend function for state budget expenditures is not statistically significant, which means that state budget spending was subject to relatively high fluctuations at that time.

Table 2

Parameters of trend functions for GDP, state budget expenditures and agricultural budget expenditures – constant prices, standardised variables

Parameters	GDP	State budget expenditures	Agricultural budget expenditures
1995–2020			
Constant	–261.11*** (5.44)	–243.97*** (19.76)	–206.76 (33.00)
Slope	**0.130***** (0.003)	**0.122***** (0.009)	**0.103***** (0.016)
R^2	0.986	0.929	0.788
1995–2003			
Constant	–125.51*** (15.64)	–17.78 (44.70)	–118.37*** (9.46)
Slope	**0.062***** (0.008)	0.0084 (0.0223)	**0.059***** (0.0047)
R^2	0.900	0.019	0.956
2004–2008			
Constant	–380.92*** (21.27)	–481.94*** (71.57)	–1096.25*** (143.0381)
Slope	**0.190***** (0.0106)	**0.240***** (0.0357)	**0.55***** (0.0713)
R^2	0.987	0.919	0.936
2009–2020			
Constant	–301.46*** (21.249)	–296.79*** (63.879)	159.743*** (44.852)
Slope	**0.150***** (0.010)	**0.148***** (0.031)	**–0.078***** (0.022)
R^2	0.973	0.815	0.730

Source: as in Table 1.

An analysis of the changes in nominal and real values of agricultural budget and state budget expenditures indicates higher growth of the agricultural budget. Thus, in the pre-accession period, we noted relatively balanced growth of the agricultural budget relative to GDP and to state budget expenditure, but in comparison with GDP, agriculture was somehow "falling behind", which the fiscal policy tried to compensate for by a higher growth rate of agricultural expenditure in relation to the growth rate of state budget expenditure. This tendency is also confirmed by the slightly increasing share of the agricultural budget in state budget expenditure (from 9.5% to 11.6%).

In the first years of the EU membership (2004–2008), the growth rate of agricultural expenditure significantly exceeded the growth rate of GDP and state budget expenditure, as evidenced by the values of the directional coefficient α_1 for the trend functions of the analysed values (Table 2). Obviously, this above-average rate of growth of the total agricultural budget was due to the inflow of European funds under the CAP instruments. In that period, also state budget expenditures grew faster than GDP, but it was agriculture that benefited most from this growth.

In the third period, from 2009 to 2020, agricultural budget expenditures in nominal and real terms (in constant prices) showed quite large fluctuations. As a result, the linear trend function defined for the agricultural budget is fitted at 73% (R^2), but the parameters of this function are statistically significant (at $p < 0.05$). In the analysed period, we observed both years in which the agricultural budget in real terms showed growth and years of decline in agricultural spending, both nominally and in real terms. Comparing the figures for the outer years of the period (i.e. for 2009 and 2020), the agricultural budget recorded a slight nominal increase of 1%, while it decreased by 16.5% in real terms. The equation of the trend function for the whole period indicates a downward trend of the agricultural budget in real terms (the directional index is –0.078). This is the opposite trend to the trend of GDP and of state budget expenditure. An open question remains: what does this mean and what are the reasons for it?

Undoubtedly, the downward trend in spending on agriculture, especially visible between 2016 and 2019, is partly due to the sharp increase in the agricultural budget in the first years of Poland's membership in the European Union. The high growth in the total agricultural budget resulted from the inflow of European funds to Polish agriculture under the CAP and the need to secure an appropriate pool of funds in the state budget to supplement the national contribution for specific payments. In later years, EU funds and the national contribution were relatively stable. The amount of the agricultural budget was, therefore, a derivative of the national agricultural policy and, more broadly, the fiscal policy, in which objectives related to rural areas and agriculture competed with other economic and social objectives. It seems that, especially between 2015 and 2020, national budget expenditure on agriculture, rural development and agricultural markets ranked lower in the hierarchy of importance than other objectives pursued by the fiscal policy, if measured by the volume of funds allocated to specific sectors. It should be stressed, however, that budgetary funds allocated to the Polish rural areas and agriculture are not only limited to the category "Agriculture and hunting", while in the budget of the European funds they apply only to expenditure within the framework of CAP instruments.[4] The Polish countryside and farming families received a significant portion of funds under social programmes launched since 2016, such as "Family 500+" or "Good Start". It is enough to point out that in 2014, the expenditure on

[4] For example, in 2019 27.8% of the expenditure budget of the EU was allocated for the implementation of the CAF (NIK 2020).

social purposes from the state budget and the EEB amounted to PLN 19.3 billion, and in 2016 it was already PLN 40.8 billion, while in 2017–2018 it increased to just over PLN 50 billion, whereas in 2019 it reached PLN 60.4 billion (NIK 2018, p. 124; NIK 2020, p. 130). This represents a nominal increase of 213% compared to 2014. It is estimated that about 60% of these funds went to rural areas,[5] and a significant part of them to farming families. These funds, feeding the income of farmers, undoubtedly supported the social-income objective within the redistributive function of fiscal policy towards the rural areas and agriculture. They contributed to the reduction of income disparity of farmer households. Between 2011 and 2015, the average income gap of farmers as compared to total households was 18.3%, while as compared to workers' households, it was 18.8%. Between 2016 and 2020 the disparity was on average 7.9% and 8.7%, respectively (Household Budgets 2019).[6] This happened with very similar price ratios in agriculture in the period under study (the average price scissors index for 2011–2015 [products sold to purchased] was 1.026, while for 2016–2020 it was 1.021).[7] Consequently, the improvement of the income situation in agriculture between 2016 and 2020, relative to the previous five years, was not due to more favourable market conditions for agriculture, but mainly due to transfers of public funds to support farmers' income and agricultural development. The second reason for the improvement in farmers' income was the increase in agricultural productivity, as the average value of final output at constant prices from 2016 to 2020 was 11.6% higher than the average between 2011 and 2015 (Statistical Yearbooks of Agriculture 2012, 2016, 2018, 2020).

The declining trend of agricultural budget expenditure in constant prices, particularly evident since 2015, against the positive trend of state budget expenditure indicates that fiscal policy objectives directly related to agriculture are giving way to other economic and social objectives. When we take into account the fact that social and income objectives in agriculture are partly "taken over" by increasing social expenditures from the state budget, this means a relative – compared to other sectors – decrease in the financing of pro-development objectives related to the allocative function of fiscal policy in agriculture and the stabilising objectives. It can be said that in recent years, for financing these objectives, agriculture does not receive fewer funds than it did in 2010s, although a real decrease was recorded in 1995–2019, but it receives less in cross-sectoral terms. Whether it is an effect of the natural trajectory of economic development, in which agriculture comprises a less important share in the economy, is a subject for a broader discussion. Certainly, it is an effect of changes in the fiscal policy towards growth of social spending and increase of importance of redistributive function objectives.

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[5] https://www.farmer.pl/prawo/przepisy-i-regulacje/60-procent-srodkow-z-programu-rodzina-500-plus-trafia-na-wies,78462.html (access: 7.07.2021 r.).

[6] Data for 2020: https://stat.gov.pl/download/gfx/portalinformacyjny/pl/defaultaktualnosci/5486/3/20/1/sytuacja_gospodarstw_domowych_w_2020_w_swietle_wynikow_badania_budzetow_gospodarstw_domowych.pdf (access: 7.07.2021).

[7] *Rocznik statystyczny rolnictwa 2020 r.*, GUS, Warszawa 2020; *Rocznik statystyczny rolnictwa 2016 r.*, GUS, Warszawa 2016.

3. Factors determining the dynamics of Poland's agricultural budget expenditure

In order to identify the internal and external determinants of the dynamics of budget expenditures on agriculture (Y_t), a multiple regression function was applied. Nine independent variables (X_i) were adopted for estimation of the regression model, whose selection was based on substantive and statistical criteria. The selected explanatory characteristics included variables related to agricultural income, i.e. the rate of subsidisation of agricultural income (X_6), the share of farm income in the disposable income of farmers (X_7), and the dynamics of real gross disposable income in farms (X_9). Their selection for regression analysis was due to their potential impact on the dynamics of agricultural budget expenditures in a given fiscal year or in the following year. The rationale for adopting these variables was that agricultural income (its appropriate level and stability) is one of the key objectives of the Common Agricultural Policy, and thus is reflected in budget expenditures on agriculture (from EU and national funds). Agricultural policy should react to changes in the sphere of agricultural income by means of budget transfers. Hence, the level, dynamics and breakdown of income obtained by farmers constitute a premise for the implementation of specific budget expenditures allocated to agriculture. These expenditures can be generally divided into two groups: those that are relatively fixed and stable (e.g. direct payments and subsidy for ASIF) and those that are an element of discretionary tools of the state fiscal policy (e.g. amounts paid to farmers for losses caused by drought, flood, infectious diseases, and expenditures for market intervention). Budget expenditure policy can play a stabilising role not only in the sphere of agricultural income, but also in the sphere of investment in agriculture (Czyżewski, Kata, Matuszczak 2019b; Barczyk 2020). The stabilisation tools embedded in budget expenditures on agriculture are themselves the most important factor determining the variability of these expenditures, but their changes are a response to fluctuations in agricultural income under the influence of market and natural (climatic and natural) factors. An independent variable representing changes in the price determinants of agricultural production, i.e. the price scissors index (X_5) – the ratio of the price index of agricultural products sold to the price index of goods and services purchased by farmers – was also introduced into the estimation of the regression model describing the dynamics of budget expenditures. In turn, the variability of climatic and natural conditions in agriculture translates into changes in agricultural productivity, which are reflected in the dynamics of final output expressed in constant prices (X_8).

The analysis of interdependence of X_i variables with the Y_t variable was conducted in two variants, namely by including explanatory variables without time lags (X_t) and with annual lags (X_{t-1}). This is justified because the factors under study may affect the agricultural budget expenditure with a certain time lag. The reason is that the fiscal policy towards agriculture, which originates from the agricultural policy, is, as explained earlier, partly a reaction to the processes occurring in agriculture. For example, a good economic situation may induce fiscal policy makers to plan higher spending on agriculture in the next budget year, while unfavourable prices in agriculture may result in specific intervention (protection) measures for

farmers, which may be implemented quickly (during the budget year) or only in the next budget year.

Table 3 presents the parameters of the regression function for the dynamics of total agricultural budget expenditure (Y_t) in two variants: for explanatory variables included in the same budget year as expenditure ($X_{i,t}$) and for explanatory variables included in the year preceding the given budget year ($X_{i,t-1}$).

The parameters of the regression function for the model without time lags (model 1) indicate that only two explanatory variables statistically significantly affect the increasing dynamics of agricultural budget expenditure (Table 3). Agricultural budget spending increases when there is an increase in European funds allocated to the agricultural sector under the CAP instruments compared to the previous year. Moreover, agricultural budget expenditure increases in real terms when there is a real (in constant prices) increase in state budget expenditure.

Table 3

Parameters of the regression function determining the dynamics of agricultural budget expenditures in constant prices (Y) in 1996–2020

Function parameters	Slope	Standard error (HAC)	*t*-Student	*p* value	Significance
1) Function: $Y_{i,t} = \alpha_0 + \alpha_i X_{i,t} + \varepsilon_t$ – model without time lags					
Const.	100.633	2.71447	37.07	0.000001	***
ΔX_2 – European funds (under CAP) in PLN million	0.001496	0.000659	2.269	0.0409	**
X_4 – State budget expenditure dynamics in constant prices (%)	0.37304	0.3739	1.162	0.0960	*
Sum of squared residuals: 1732.44; regression standard error: 11.544; $R^2 = 0.218$; adjusted $R^2 = 0.135$; F (2, 13) = 4.9035; F-test p-value = 0.02589; AR1 (p) = 0.04010; Durbin-Watson statistics = 1.1831			Statistical significance: ***$p < 0.001$; **$p < 0.05$; *$p < 0.1$		
2) Function: $Y_{i,t} = \alpha_0 + \alpha_i X_{i,t-1} + \varepsilon_t$ – model with annual time lags					
Const.	49.4799	15.7752	3.137	0.0064	***
ΔX_1 – Expenditure on ASIF in PLN million	0.002848	0.001184	2.405	0.0286	**
ΔX_2 – European funds (under CAP) in PLN million	0.000551	0.000297	1.858	0.0816	*
X_3 – GDP dynamics in constant prices (%)	2.16626	0.999875	2.167	0.0457	**
X_4 – State budget expenditure dynamics in constant prices (%)	0.861768	0.434345	1.984	0.0688	*
X_5 – Price Scissors Index (%)	50,9344	14,8842	3,422	0,0035	***
ΔX_6 – Farm income subsidy rate (%)	0.78310	0.12508	6.261	0.0001	***
Sum of squared residuals: 1208.77; regression standard error: 8.6918; $R^2 = 0.493$; adjusted $R^2 = 0.3012$; F (6, 13) = 23.8933; F-test p-value = 0.00003; AR1 (p) = 0.31623; Durbin-Watson statistics = 1.3446			Statistical significance: ***$p < 0.001$; **$p < 0.05$; *$p < 0,1$		

Source: own calculations.

The revealed interdependencies are not surprising: since agriculture in Poland has been covered by the CAP instruments, European funds make a very significant contribution to the sum of amounts allocated from public funds to agriculture, the support for agricultural markets and the development of rural areas. Since 2004, their share in the total Polish agricultural budget has ranged from 20.1% (2004) to 51.7% (2015). Therefore, the increase in the amount of European funds compared to the previous year is naturally responsible for higher agricultural budget expenditure, although it is also true that in some years of the analysed period, despite the real increase in European funds under the CAP instruments, there was a decrease in agricultural budget expenditure (in constant prices) compared to the previous year. Such a situation occurred in 2011 and in 2018. This confirms the thesis that in some years European funds partly replaced national funds within the entire agricultural budget, or to put it another way, the national funds in the agricultural budget did not "follow" the increase in the funds allocated to agriculture from EU funds.

The second of the revealed relationships, i.e. positive correlation between the dynamics of the state budget and the dynamics of the total agricultural budget also seems quite obvious, but one should remember about the trend of the decreasing share of the agricultural budget in the state budget, which was recorded basically uninterruptedly from 2009 to 2020 (except for 2014). The positive correlation between these two budgets and the presence of state budget growth as a stimulant of agricultural budget expenditures in the regression model prove that the growth of the agricultural budget is highly dependent on the growth of expenditures of the entire state budget. When the state budget grows in real terms, the agricultural budget grows as well, although there were two exceptions to this regularity, namely 2010 and 2014, when the state budget recorded negative growth in real terms and the agricultural budget in total recorded a small but positive growth.

The regression equation of the variable Y_t without time lags (for variables $X_{i,t}$) shows a relatively low level of fit (R^2 is less than 22%). This means that the correlations shown only partially describe the determinants of the agricultural budget dynamics. The low level of the coefficient of determination may also result from the fact that the variable X_2, i.e. European funds channelled to agriculture in Poland (to be more precise, their year-to-year change rather than their level, which is a consequence of the non-stationarity of the variable X_2) did not occur in the whole analysed time period (1996–2020), but only in the years 2001–2020 (including pre-accession funds).

In order to find a better-fitting regression equation describing the dynamics of agricultural budget expenditures, the model with annual time lags for independent variables was estimated (model 2 in Table 3). In this case, a statistically significant causal relationship was established between the dynamics of agricultural budget expenditure Y_t and six independent variables with an annual lag, X_{t-1}. For all the variables included in the regression equation, the coefficient α_i was positive, i.e. they are all stimulators of the dynamics of agricultural budget expenditure in constant prices. The agricultural budget grows in the following year if in the previous year there was an increase in expenditure on ASIF and an increase in European funds

allocated to agriculture under the CAP. Moreover, a positive correlation was shown between Y_t and the dynamics of GDP and of state budget expenditure. Real growth of GDP and growth of state budget expenditure in a given year (t–1) stimulates the growth of agricultural budget expenditure in the following year (t). These correlations support the claim that agricultural budget expenditure depends to some extent on the economic situation and the growth rate of total public expenditure. Nevertheless, a lower average annual growth rate of agricultural budget expenditure than the growth rate of GDP and state budget expenditure observed since 2009 indicates that agriculture benefits from economic growth, but these benefits are relatively smaller compared to other sectors of the economy and social spheres.

In the analysed regression equation for the variable Y_t in the model with annual time shifts, there also appeared a variable X_5 – price scissors in agriculture – which is also positively correlated with the dynamics of agricultural budget expenditure. Such a relationship may be somewhat surprising, as it implies that when market conditions in agriculture improve (the price scissors index increases), then, other things being equal, agricultural budget expenditure increases in the following year. However, it is interesting to note that the variable X_5 (price scissors) appeared in the regression models for the variable Y_t without time shifts of the variables X_i, but with a negative sign for the regression coefficient. However, these models, due to very low R^2 (less than 15%) were discarded. These results confirm that the agricultural budget is to some extent shaped by discretionary fiscal policy instruments intended, among others, for specific market interventions in a situation of worsening price relations in the whole agriculture or in the markets of specific agricultural products. Usually, however, these interventions are short-lived and do not translate into the dynamics of the agricultural budget in the long term. The positive correlation of the price scissors index with the dynamics of agricultural budget expenditure in the model with annual time shifts may be explained by the fact that a good economic situation in agriculture (in year t–1), just as a good economic situation overall, constitutes grounds for increased budget expenditure on agriculture in the following year (t) by the fact that it contributes to the increase in state budget revenue (in year t–1).

The last of the explanatory variables that showed a positive, statistically significant relationship with the explained variable is the rate of agricultural income subsidy (Table 3). This value indicates what percentage of farmers' disposable income is shaped by budget transfers that directly support farmers' income (excluding measures that support investment in agriculture). An increase in the subsidy rate in the previous year causes, all other things being equal, an increase in agricultural budget expenditure in the following year. This relationship may be explained by the fact that many payments addressed to farmers are implemented in a cycle of several years (e.g. agri-environmental and climatic payments), which means that the right to specific transfers acquired by farmers is exercised in the following years, thus creating an increase in budget expenditure on agriculture.

Conclusions

The data presented in this article and the analysis of macroeconomic relations and cause-and-effect relations with regard to Poland's agricultural budget over a long time period lead to the following conclusions:

(1) In 1995–2020, Poland's agricultural budget expenditures showed a relationship with the dynamics of GDP and the size of the state budget, although these relationships were not the same throughout the study period. In 1995–2003 agricultural budget expenditures followed the dynamics of GDP and state budget expenditures. In the first four years of Poland's membership in the European Union, the agricultural budget grew much faster than GDP and total state budget expenditures. Since 2009, the agricultural budget expenditures showed an ambiguous development trend; however, in the last years of the studied period, i.e. 2016–2020, the tendency to decrease real agricultural budget expenditures prevailed. In this period we could also observe a successive decrease in the importance of agriculture in the structure of state budget expenditures in favor of other sectors of the economy and social spheres. Although government expenditure on social policy, including family policy, supported the incomes of farm families, reducing the disparity of farmers' incomes with respect to other socio-professional groups, the objectives of the allocative and stabilizing function of fiscal policy in agriculture were relatively less supported than in the early years of Poland's membership in the EU. In view of the challenges facing agriculture in Poland at present (market, demographic, environmental, climate-energy and technological challenges), an increase in public spending on this sector should be considered, as well as its greater targeting at the objectives related to the transformation and development of agriculture.

(2) In the past quarter of the century, budgetary expenditures on agriculture were characterised by much higher fluctuations, as compared to state budget expenditures and GDP. This volatility was mitigated by the inflow of EU funds to the sector and relatively rigid expenditure on ASIF. However, this implies high dependence of agricultural development expenditures on European funds, as well as on external macroeconomic factors that originate in the variability of state fiscal policy.

(3) It was shown that the dynamics of budget expenditure on agriculture is positively influenced by the growth of GDP and state budget expenditure, as well as an increase in the amount of European funds allocated to agriculture. In the case of the dynamics of state budget expenditures, this dependence occurs both for a given year and for state budget spending recorded with a one-year lag. These results lead us to accept hypothesis H1. However, it should be noted that since 2009 the average annual growth rate of the state budget is higher than the average annual growth rate of the agricultural budget. Moreover, the average GDP growth in the whole post-accession period is higher than the average growth of the Poland's agricultural budget. This means that the agricultural budget successively falls behind GDP and the state budget, and transfers from European funds are not able to stop this. At the same time, the high dependence of agricultural

expenditure on European funds continues, if we do not count social transfers to agriculture implemented under the state social policy.

(4) Hypothesis H2 assumes that the economic situation in agriculture, measured by the price scissors index, as well as the changes in the level and proportion of farmers' household income, affect agricultural budget expenditure in Poland with a one-year lag. It can be accepted only partially. Our findings have confirmed the influence of the economic situation in agriculture on agricultural budget expenditure, with an advantageous economic situation in the previous year favouring the increase in agricultural expenditure in the following year. In a given budget year, a negative price scissors index stimulates the increase in agricultural expenditure, whereas a positive index does not. Such a relationship is due to the use of discretionary fiscal policy instruments such as market interventions. No direct correlation was found between changes in the level and make-up of agricultural income and changes to the agricultural budget, while a positive relationship was shown with respect to the rate of subsidisation of agricultural income.

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DETERMINANTS OF THE AGRICULTUTAL BUDGET IN POLAND IN THE LIGHT OF ITS RELATION TO GDP AND STATE BUDGET EXPENDITURE

Abstract

The article attempts to identify the relationship between budget expenditure on agriculture and the dynamics of GDP and the state budget in Poland in the years 1995–2020. The aim of the research was also to identify the determinants of the dynamics of budget expenditure on agriculture, both endogenous and exogenous, also taking into account their delayed impact. The source of empirical materials on agricultural budget expenditures of Poland was primarily data from the Ministry of Agriculture and Rural Development. The data used in the analyses were standardised and adjusted by the price index. Moreover, an additive model of development tendency and a multiple regression function were used. The research results indicate that the agricultural budget was positively related to the dynamics of GDP and the dynamics of state budget expenditure. However, in the entire analyzed period, except for the years 2004–2008, the expenditure of the agricultural budget grew at a slower pace than GDP. The increase in the agricultural budget was primarily dependent on the increase in state budget expenditure and the level of European funds allocated to the sector under the instruments of the Common Agricultural Policy. It was also shown that the economic situation in agriculture, measured by the price scissors index, and changes in the level and structure of income of farmers' households partially influenced the expenditure of the Polish agricultural budget, but with a one-year delay.

Keywords: budget expenditure, agriculture, CAP, GDP, ASIF

JEL: E62, H60, Q18

DETERMINANTY BUDŻETU ROLNEGO POLSKI W ŚWIETLE JEGO POWIĄZAŃ Z PKB I WYDATKAMI BUDŻETU PAŃSTWA

Streszczenie

W artykule podjęto próbę identyfikacji zależności między wydatkami budżetowymi na rolnictwo a dynamiką PKB i budżetu państwa w latach 1995–2020. Celem badań było także wskazanie determinant dynamiki wydatków budżetowych na rolnictwo, zarówno endo-, jak i egzogenicznych, biorąc również pod uwagę ich oddziaływanie odroczone w czasie. Źródłem materiałów empirycznych na temat wydatków budżetu rolnego Polski były przede wszystkim dane Ministerstwa Rolnictwa i Rozwoju Wsi. Dane wykorzystane w analizach zostały wystandaryzowane i urealnione, ponadto posłużono się addytywnym modelem tendencji rozwojowej oraz funkcją regresji wielorakiej. Wyniki badań wskazują, że budżet rolny był dodatnio powiązany z dynamiką PKB i dynamiką wydatków budżetu państwa. W całym badanym okresie, poza latami 2004–2008, wydatki budżetu rolnego rosły jednak wolniej od PKB. Wzrost budżetu rolnego był przede wszystkim uzależniony od wzrostu wydatków budżetu państwa oraz poziomu środków europejskich kierowanych do tego sektora w ramach instrumentów Wspólnej Polityki Rolnej. Wykazano ponadto, że koniunktura w rolnictwie mierzona indeksem nożyc cen oraz zmiany poziomu i struktury dochodów gospodarstw domowych rolników wpływały częściowo na wydatki budżetu rolnego Polski, ale z rocznym opóźnieniem.

Słowa kluczowe: wydatki budżetowe, rolnictwo, WPR, PKB, KRUS

JEL: E62, H60, Q18