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Decomposition of variations of direct payments rates on the example of selected support instruments applied in Poland

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Abstract: In this paper, an original analysis of the direct payment rate shaping mechanism – in terms of the process and from the perspective of game theory – has been carried out. The factors determining the direct payments rates were identified. The results of measuring the impact of these factors on payments rates fluctuations were presented. The territorial scope of the study is Poland. The time range covers the years 2016–2020. The objective scope of the analysis includes four direct support instruments. It was found that the rates of sectoral area payments vary to a greater extent than the rates of general payments due to fluctuations in the area approved for a payment. The findings of this study can be used to develop a method for predicting payments rates based on the analysis of the fundamental factors. The prediction of payments rates could be used to support decision-making processes in agricultural policy. Therefore, the research results involving the decomposition of payments rates are of significant practical value in addition to their cognitive significance.

Keywords: Common Agricultural Policy; coupled support; direct payments; redistributive payment; single area payment

Direct payments currently account for around three-quarters of the expense incurred under the Common Agricultural Policy (CAP) of the EU, which in turn account for almost a quarter of the EU's general budget (European Parliament 2022). Considering the share in the EU agricultural budget, direct payments are the most important element of the CAP. At the same time, they occupy a crucial position in the expenditure structure of the EU general budget. Therefore, they are an instrument with a strong impact not only on EU agriculture but also on other agribusiness links, the land market and rural areas in general. They are partly transfers or subsidies and partly a form of remuneration for the provision of public goods and services (Sadłowski 2022). Even though the relevance of support via direct payments for agricultural incomes in Europe is decreasing, it is still substantial (Finger and El Benni 2021).

Research confirms the important role of direct payments (1st pillar of the EU's CAP) in supporting farmers' incomes in the new EU Member States. According to Volkov et al. (2019b), direct payments play a key role in maintaining farm income in Lithuania, which is particularly important as the agricultural sector is exposed to increased risk and financial instability. Similarly, Beluhova-Uzunova et al. (2020) believe direct payments play an essential role in stabilising and supporting the income of Bulgarian farmers. However, the distri-

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bution of aid is too uneven. Bojnec and Fertő (2019) conducted research with a broader subject scope (they covered all subsidies applied under the CAP, not just direct payments) concerning Hungary and Slovenia, concluding that subsidies mitigate instability in farm income because their variability is lower than that of market revenue income. However, according to Bojnec and Fertő (2019), while CAP subsidies thus represent a stable source of farm income, they have played a limited countercyclical role in stabilising total farm income. In the opinion of Czyżewski et al. (2019), the effectiveness of CAP may be substantially lowered by the counterproductive side effects of direct payments since they are very likely to enhance price-cost squeeze (as well as the market treadmill).

The support implemented under the direct payments scheme is a significant part of farmers' income (Ciaian et al. 2015; Szerletics and Jámbor 2020). It is often the factor determining a farm's positive economic result (Breen et al. 2005). At the same time, many different instruments (payments) are used under the direct support scheme. For example, the direct payments scheme in Poland in 2020, under the Act (Polish Parliament 2015), consisted of 17 instruments (excluding the so-called transitional national aid) and most of these (13) were focused on supporting selected plant production sectors (9) or animal production sectors (4). Consequently, farmers' decisions about production directions and the structure of crops impact the level of funds absorbed by their farms.

This paper aims to measure the influence of the factors determining direct payments rates on their fluctuation, using factual knowledge as empirical input for mathematical calculations based on deterministic relationships (as opposed to the stochastic model). For the study, the following research questions were formulated:

i) What determines the rates of direct payments in the EU Member States applying the simplified system?

ii) In what direction do the individual factors affect, and what is the strength of their impact?

iii) What types of instruments are particularly prone to payment rate fluctuations?

Concerning the third question, a hypothesis was adopted that the rates of sectoral area payments (i.e. granted to the area of crops of specific plant species), to a greater extent than the general payments rates (i.e. given to all agricultural land), change due to fluctuations in the area approved for a given payment.

Awareness of the causes of fluctuations in the unit level of support makes it easier for farmers to predict the amount of direct payments rates to make the right choices regarding the direction of using the available resources. The results of research involving the decomposition of payments rates volatility in the past period and their prediction as part of the variant analysis (for various scenarios of the general level of support) may, at the same time, support policymakers in their efforts to achieve the desired level of unit support. Therefore, research in this area, apart from cognitive importance, has significant practical values – their results are beneficial both for farmers for whom payments rates are an important component of systemic farming conditions and for authorities for whom an appropriate level of unit support should ensure a satisfactory degree of achieving the assumed socio-economic goals.

Based on the literature review of the research topic, it can be concluded that the researchers are concerned about the total level of support under the entire direct payment system rather than the payments rates under specific instruments. They mainly focus on:

i) analysing the differentiation of the average level of support between the EU Member States (Volkov et al. 2019a),

ii) relations between the level of support and the economic performance of farms (Cortignani et al. 2017),

iii) simulating the effects of cyclical CAP reforms (Potori et al. 2013; Cortignani et al. 2017).

Therefore, considering the subject and aspect of the research, this study is an original approach and, at the same time, has significant application values.

MATERIAL AND METHODS

In the EU Member States that apply a simplified direct payment system, the unit level of support can be equated with the payment rate, and often more than one form of direct support applies to a given land area. In Poland, rates are expressed in PLN·ha^{-1} – in the case of area payments, in PLN·item^{-1} – in the case of payments to animals, and in PLN·kg^{-1} – in the case of transitional national aid for tobacco. The payments rates do not differ between regions – they are the same throughout the country. Based on Article 20 of the Act (Polish Parliament 2015) setting out the method for calculating the rates of direct payments, it is possible to identify the factors which determine the amount of these rates. Thus, in Poland, as in other countries using the simplified support scheme, the rate of a given payment depends on:

i) the amount of funds allocated to finance the given instrument in a given year,

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ii) the exchange rate applied in a given year when converting this amount into national currency (which applies to countries outside the Euro area),

iii) the area of land (in the case of area payments), the number of animals (in the case of payments to animals) or the weight of the raw material (in the case of payments up to the mass of agricultural product) approved for a given payment in a given year.

The rates of direct payments are determined annually by the Minister of Agriculture and Rural Development in relevant regulations.

A mathematical method was used to calculate the strength of influence of individual factors determining the number of direct payments rates (based on the example of four selected area payments).

The data were:

$P(\text{EUR})_{(x-1)}$, $P(\text{EUR})_x$, ... – financial envelope (in EUR) allocated to finance the support instrument, respectively, in the year $(x-1)$, x, ...;

$PR\left(\frac{\text{PLN}}{\text{ha}}\right)_{(x-1)}$, $PR\left(\frac{\text{PLN}}{\text{ha}}\right)_{x, \ldots}$ – the rate of area payment in question (in PLN·ha^{-1}), respectively, for the year $(x-1)$, x, ...;

$ER\left(\frac{\text{PLN}}{\text{EUR}}\right)_{(x-1)}$, $ER\left(\frac{\text{PLN}}{\text{EUR}}\right)_{x, \ldots}$ – the exchange rate (in PLN/EUR), respectively, in the year $(x-1)$, x, ...

The financial envelope allocated to finance the support instrument expressed in the national currency $P(\text{PLN})$ was obtained by multiplying the envelope expressed in EUR by the exchange rate expressed in PLN·EUR^{-1}. For instance, in the year x the envelope was

$$P(\text{PLN})_x = P(\text{EUR})_x \times ER\left(\frac{\text{PLN}}{\text{EUR}}\right)_x \tag{1}$$

The area authorised for payment $A(\text{ha})$ was calculated by dividing the financial envelope (in PLN) allocated to finance the instrument by the rate of this payment (PLN·ha^{-1}). For instance, in the year x the surface area authorised for payment amounted to

$$A(\text{ha})_x = \frac{P(\text{PLN})_x}{PR\left(\frac{\text{PLN}}{\text{ha}}\right)_x} \tag{2}$$

The change to the area payment rate in the year compared to the previous year was the result of the calculation

$$\Delta PR\left(\frac{\text{PLN}}{\text{ha}}\right) = PR\left(\frac{\text{PLN}}{\text{ha}}\right)_x - PR\left(\frac{\text{PLN}}{\text{ha}}\right)_{(x-1)} \tag{3}$$

This change was the net result of the three factors enumeratively listed above. The net result of the area payment rate change could, therefore, be broken down into three components

$$\Delta PR\left(\frac{\text{PLN}}{\text{ha}}\right) = \Delta PR\left(\frac{\text{PLN}}{\text{ha}}\right)_{P(\text{EUR})} + \Delta PR\left(\frac{\text{PLN}}{\text{ha}}\right)_{ER\left(\frac{\text{PLN}}{\text{EUR}}\right)} + \Delta PR\left(\frac{\text{PLN}}{\text{ha}}\right)_{A(\text{ha})} \tag{4}$$

where the individual components stood for:

$\Delta PR\left(\frac{\text{PLN}}{\text{ha}}\right)_{P(\text{EUR})}$ – the component resulting from the change to the financial envelope (in EUR) allocated to finance the instrument;

$\Delta PR\left(\frac{\text{PLN}}{\text{ha}}\right)_{ER\left(\frac{\text{PLN}}{\text{EUR}}\right)}$ – the component resulting from the change to the exchange rate;

$\Delta PR\left(\frac{\text{PLN}}{\text{ha}}\right)_{A(\text{ha})}$ – the component resulting from the change to the surface area authorised for payment.

The impact on the payment rate of the change to the financial envelope (in EUR) was calculated according to the formula

$$\Delta PR_{P(\text{EUR})} = \frac{P(\text{EUR})_x \times ER\left(\frac{\text{PLN}}{\text{EUR}}\right)_{(x-1)}}{A(\text{ha})_{(x-1)}} - PR\left(\frac{\text{PLN}}{\text{ha}}\right)_{(x-1)} \tag{5}$$

Therefore, it is a change in the rate that results only from a change in the pool of funds allocated to support, i.e. the difference between:

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i) the rate in the year x calculated assuming that the other factors determining the rate (the exchange rate and area approved for payment) remained at the level from the previous year (x–1) and

ii) the payment rate in the year (x–1).

The effect of the change in the exchange rate (PLN/EUR) on the payment rate was calculated in the same way

$$\Delta PR_{ER\left(\frac{\text{PLN}}{\text{EUR}}\right)} = \frac{P(\text{EUR})_{(x-1)} \times ER\left(\frac{\text{PLN}}{\text{EUR}}\right)_{x}}{A(\text{ha})_{(x-1)}} - PR\left(\frac{\text{PLN}}{\text{ha}}\right)_{(x-1)} \quad (6)$$

The impact of the last component (changes to the area authorised for payment) can be calculated analogously or could be treated as the residual element which remained after subtracting the sum of the effects of the first two components from the net effect

$$\Delta PR_{A(\text{ha})} = \Delta PR\left(\frac{\text{PLN}}{\text{ha}}\right) - \left(\Delta PR_{P(\text{EUR})} + \Delta PR_{ER\left(\frac{\text{PLN}}{\text{EUR}}\right)} \right) \quad (7)$$

Changes in nominal payments rates and their component parts were visualised in a combined graph (bar and line).

The time frame of the analysis was five years, 2016–2020. Data from 2015–2020 were used because the changes in payments rates in a given year in relation to the previous year were examined, and the year before the opening year 2015 was the time frame for the analysis. It was also the first year of applying the direct payment scheme in its reformed form. The spatial scope of the analysis is Poland (the whole country).

The volatility of payments rates was measured in relation to selected support instruments – the subject of the analysis includes four area payments whose conditions of granting did not change in the period analysed. The data published on the Polish Ministry of Agriculture and Rural Development website constituted the source material. These data refer to the whole country and are complete data.

RESULTS AND DISCUSSION

The characteristics of the analysed instruments. The analysis covered four (out of 17 applied in Poland) instruments co-creating the direct support system for farmers (1st pillar of the CAP). All instruments included in the analysis are area payments, i.e. subsidies depending on the surface area of agricultural land. This means that their rate is expressed in PLN·ha^{-1}.

One of the instruments analysed (the single area payment) is an obligatory payment in terms of an EU Member State using the simplified system. The other three instruments are voluntary payments, two of which (payment for the starch potatoes cultivation area, payment for the hops cultivation area) are payments granted under the so-called coupled support. Any decision by a Member State to apply optional payments does not affect the amount of EU funds allocated to that Member State for direct support (i.e. the amount of the so-called national ceiling) and only determines the allocation of funds.

As implied by the data presented in Table 1, the compared instruments are very diverse in terms of both the amounts of financing and the area covered by support. Single area payment is due to the area of agricultural parcels included in the farm on which agricultural activity is carried out. Single area payment is basic payment because any other possible area payments can be granted only for the area covered by the single area payment. Therefore, the area for which the single area payment was granted, amounting to 14.3 million ha in Poland, is the total agricultural area covered by direct support simultaneously. The average annual financing level of the single area payment in the analysed period amounted to almost PLN 6.67 billion.

Redistributive payment is granted in Poland to those hectares of agricultural land within the farm in the range (3; 30]. Consequently, payments are not granted for specific agricultural plots but for some abstract surface area which is part of the farm's area. The sum of these areas annually, on average in the analysed period, was approximately 7 million ha. This is slightly less than half the agricultural area covered by direct support. In contrast, the average annual allocation of the redistributive payment was less than 1/5 of the average annual funding level of the single area payment.

In the case of crop production sectors, the so-called coupled support can only be provided in the form of area payments. This means that the amount of support granted to a farmer is proportional to the area of a given crop and not the amount (mass) of the agricultural raw material produced. In the case of animal production sectors, the amount of support depends

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Table 1. The level of funding of the instruments analysed, the payments rates and the area covered in 2016–2020

Year		Support instrument				Exchange rate (PLN/EUR)
		single area payment	redistributive payment	payment for the starch potatoes cultivation area	payment for the hops cultivation area	
2016						
Level of financing	(EUR thousands)	1 517 699	281 810	8 707	841	4.3192
	(PLN thousands)	6 555 246	1 217 194	37 606	3 634	
Area covered by payment	(ha thousands)	14 187	7 044	29	2	
Payment rate	(PLN·ha^{-1})	462.05	172.79	1 287.75	2 317.00	
2017						
Level of financing	(EUR thousands)	1 525 099	289 802	8 749	845	4.3042
	(PLN thousands)	6 564 331	1 247 366	37 659	3 639	
Area covered by payment	(ha thousands)	14 222	7 046	32	2	
Payment rate	(PLN·ha^{-1})	461.55	177.02	1 163.02	2 198.06	
2018						
Level of financing	(EUR thousands)	1 533 762	293 930	8 749	845	4.2774
	(PLN thousands)	6 560 514	1 257 256	37 424	3 616	
Area covered by payment	(ha thousands)	14 287	7 063	35	2	
Payment rate	(PLN·ha^{-1})	459.19	178.01	1 065.89	2 129.87	
2019						
Level of financing	(EUR thousands)	1 542 379	298 036	8,749	845	4.3782
	(PLN thousands)	6 752 844	1 304 861	38 306	3 701	
Area covered by payment	(ha thousands)	14 318	7 054	35	2	
Payment rate	(PLN·ha^{-1})	471.64	184.98	1 110.09	2 054.33	
2020						
Level of financing	(EUR thousands)	1 519 679	281 452	8 749	845	4.5462
	(PLN thousands)	6 908 763	1 279 538	39 776	3 843	
Area covered by payment	(ha thousands)	14 280	7 030	35	2	
Payment rate	(PLN·ha^{-1})	483.79	182.02	1 128.24	2 072.01	

Source: Own elaboration based on the data published on the website of the Polish Ministry of Agriculture and Rural Development

on the number of animals kept. The included in the comparison area payments made under the coupled support are those granted to the cultivation areas of selected plants – starch potatoes and hops.

Data on the total surface area of land authorised for payment for the starch potato crops, without the risk of making a significant mistake, can be equated with the area of starch potato cultivation in Poland (Sadłowski 2020). Similarly, the total surface area of land covered by the funding for hops cultivation can be treated as the cultivation area of this plant in the country. The requirement to conclude a supply contract laid down in Article 15(3) of the Act (Polish Parliament 2015) as a condition for granting payment for the starch potato cultivation area does not affect the accuracy of this conclusion.

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The cultivations of starch potatoes (as well as the cultivations of hops) are industrial crops that are not carried out for self-supply for consumption or direct sale.

The less popular the crop, the smaller the financial envelope necessary to ensure a certain level of unit support, i.e. converted into one hectare of surface area. In the analysed period, the average annual area of hops cultivations (approximately 1 700 ha) was almost 20 times smaller than the average yearly area of starch potatoes cultivations (approximately 33 300 ha), therefore – even though the financial envelope allocated to support the hops cultivations was over 10 times smaller than the financial envelope allocated to support of the starch potatoes cultivations – the payment rate for the area of hops cultivation was significantly higher than the payment rate for the area of starch potato cultivation.

Data on the unit level of support under individual instruments in nominal terms, i.e. on payments rates, shows that in the case of the analysed instruments which form part of the so-called coupled support (payment for the area of starch potato cultivation and payment for the area of hops cultivation), the payments rates are many times higher than the general subsidies considered in the comparison (single area payment and redistributive payment).

The formation of payments rates – the process approach. Factors shaping the external conditions of management can be divided into quantitative-material and systemic. The first informs about the degree of general material affluence of the enterprise's environment and the structure of resources of the economy in which it operates. The second determines whether, how, for what purpose and to what extent the company uses quantitative-material factors quantitative-material. The systemic conditions of management consist, in turn, of the rules of the system ('rules of the game') and the parameters of the economic account, based on which an individual makes specific decisions in a particular place and time. The parameters of the economic calculus are inherently variable. Their fluctuations reflect economic proportions, resource availability, and market condition changes. A given economic quantity is a parameter when management units are forced to take it into account in their decisions, not administratively, but under the threat of losses. The external conditions of management are 'hard', implying the directness, severity and automaticity of economic consequences of a wrong decision or inability to adapt to the situation (Wilczyński 1985).

The direct payments rates belong to the factors shaping the external conditions of farm management. On the one hand, the rates of direct payments are an expression of the state's agricultural policy in a specific form, they are defined in regulations and are not shaped spontaneously in connection with the operation of the market mechanism, which makes them similar to the 'rules of the game'. On the other hand, only the general (and not per unit) level of support is guaranteed by the state, so in the regulation, the payment rate is determined ex-post – as the quotient of the total amount of funds allocated fora given type of support and the area of land / number of animals reported by farmers for payment and approved for this payment by the competent authority (it is a mechanical statement of the state of affairs). Therefore, the payments rates can be included among the parameters of the economic account, which make up the systemic conditions of farm management. The predicted rates of direct payments are reliable for farmers' decisions about the direction of using their resources.

Figure 1 presents (as a diagram, on the example of an area payment) the impact of individual factors determining the payment rate. As outlined in the method section, the financial envelope expressed in the national currency is obtained by multiplying the envelope allocated to finance the support instrument expressed in EUR by the exchange rate expressed in PLN/EUR. It is also the approximate total amount of support granted, i.e. the sum total of all the individual amounts of support granted to individual beneficiaries. A slight discrepancy between the financial envelope allocated to finance a given instrument and the total amount of support granted under this instrument results from creating by a paying agency a provision for possible revisions to the authority's decisions on granting payments. We obtain the payment rate by dividing the financial envelope expressed in the national currency by the total area authorised for payment (consisting of areas authorised for payment in individual farms).

From the beneficiary's perspective, the amount of support granted depends on the individual surface area authorised for payment on the farm and the rates of payment. Specifically, the amount of support granted to the farmer is the product of these two amounts. The dependencies on the farm level are depicted in the diagram with light grey items.

As mentioned, the total area authorised for payment is the sum of the individual areas authorised for payment in individual farms. These, in turn, depend on the production decisions of individual farmers. The lower part of the diagram shows the predicted payment rate

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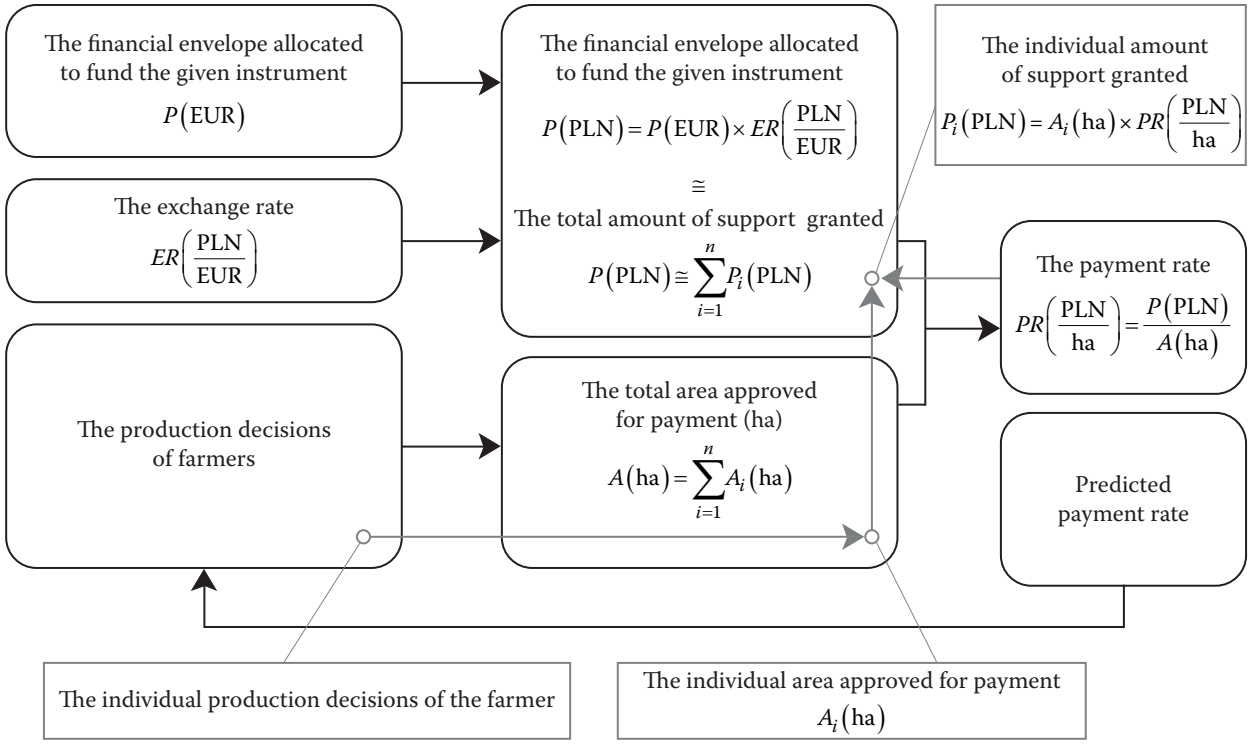

Figure 1. The influence of factors determining the amount of the area payment rate

Source: Own elaboration

as one of the parameters influencing farmers' production decisions.

It can be assumed that farmers trying to predict payments rates are primarily guided by the previous year's rates or by the trends of rate changes during the last years, as well as the promises made by ruling politicians regarding the level of support under the individual instrument. The higher the predicted payment rate, the greater the importance of the payment rate predicted by farmers as determining their decisions on the sowing structure. Thus, farmers' predictions about the form of the agricultural policy (the rates of direct payments) influence their decisions concerning the direction of production or crop structure. On the other hand, the sum of the specific choices by individual farmers determines the total area under cultivation – the number of animals approved for the given payment, which, in turn, determines the unit (i.e. per ha of area, in the case of area payments, or per animal, in the case of payments for animals) support level, i.e. the amount of the payment rate. There is some feedback here between the agricultural policy and the form of behavioural functions of farming entities. These functions manifest themselves in specific decisions of farmers in the production area.

The predicted unit amount of support is only one of the numerous factors considered by farmers when deciding on the structure of crops. Other factors are: *i*) soil conditions, *ii*) topography, *iii*) the location and proximity of plots (e.g. cultivation areas with peripheral locations, i.e. far from buildings, close to forests, close to backwoods, are particularly exposed to wildlife damage), *iv*) technical infrastructure available in the plots (e.g. fences, drainage), *v*) crop rotation, *vi*) perennial nature of some crops (e.g. short rotation coppices, orchards, hops), *vii*) the availability of specialised machinery and equipment for the cultivation, harvesting, and transporting agricultural produce, as well as buildings and structures within the farm to store them (warehouses, silos), *viii*) disposing of the seed material / price of seed material, *ix*) experience in cultivating the given plant, *x*) the cost of the cultivation, *xi*) the farm's ability to finance current assets and, if necessary, fixed assets, the creditworthiness of the farm, *xii*) possible obligations towards the beneficiaries included in the cultivation contracts, *xiii*) the conditions resulting from the use of direct support (in particular, the obligation to implement 'agricultural practices beneficial for the climate and the environment', i.e. the diversification of crops, maintaining

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permanent grasslands, and the separation of the so-called ecological focus areas), or the possible long-term commitments resulting from the implementation of agri-environmental programmes, *xiv*) the needs resulting from the farm's production self-supply, *xv*) the expected demand for the agricultural product concerned, *xvi*) the distance of the purchasing centres from the place of business.

Due to such numerous conditions, in the case of specific agricultural plots, few alternative crops are usually considered the criterion for choice. Generally, the criterion for choosing a crop is the predicted relative profitability of production. At the same time, in the conditions (typical for developed countries), the permanent low profitability of the agricultural output compared to the profitability in other sectors of the economy, only a few activities aimed at changing the conditions of management to broaden the opportunities the productive use of plots can be viable in economic terms.

The formation of payments rates – the Game-Theory approach. As agreed in the previous section of the article, individual decisions by farmers concerning the directions of production, and the structure of crops, determine the amounts of support received. At the same time, the amounts largely depend on the decisions other farmers make in the country. This results from the fact that a specific financial envelope allocated to fund the given instrument is divided among farmers proportionally to the surface area of land or the number of animals authorised for the payment in question.

Suppose farmers' decisions are unidirectional (e.g. an increase in the cultivation area of the plant covered by the so-called coupled support), *ceteris paribus*. In that case, this results in a decrease in the unit level of support, i.e. the rate of payment. With the given surface area of the farm and in conditions of the full use of its acreage, the decision to increase the cultivation area of a given plant is, at the same time, a decision to reduce the cultivation area of some other plant(s). The plant(s) are also covered with the sectoral payment in a special situation since the financial envelope allocated to funding a given instrument is defined in advance, how this individual decision of the farmer translates into the amount of absorbed funds depends on the analogous decisions of the other farmers.

This dependence of the effect (result) of the farmer's decision (called 'payouts' in the nomenclature of Game Theory) from the decisions of the remaining farmers ('players') makes the situation of the farmer facing the choice similar to the situation analysed in Game Theory. Considering the types of games mentioned in the subject literature (Straffin 1993), this is:

i) a constant-sum game – since the sum of 'payouts' is pre-determined, it does not depend on the decisions of individual 'players'; and when the strategy changes, the 'profit' of some players is fully compensated by the 'losses' of others,

ii) a multiplayer game with a vast number of participants (there are approximately 1.35 million beneficiaries of direct payments in Poland), whereas – bearing in mind that the net effect of other decisions of 'players' is relevant – the analysis is the same as in the case of a two-player game, after the aggregation of the decisions of the other 'players'.

Moreover, it can be concluded, without prejudice to the quality of the analysis results, that this is a regular game, a game in which the 'players' decide on their strategies at the same time and independently of each other, not knowing the decisions taken by the other participants. The greater the number and fragmentation of the beneficiaries, the lesser extent the decision of a single entity translates into the 'payouts' of other participants.

The analysis using the game theory approach allows us to understand the interdependencies between farmers' individual decisions and the support level in the form of direct payments.

The breakdown of fluctuations in payments rates. Figure 2 is a combined chart presenting the year-on-year changes in the rates of selected direct payments in 2016–2020 in absolute terms (vertical bars) and relative terms (function lines). The bars also illustrate the contribution of individual factors to the volatility of the payments rates.

In the analysed period, in absolute terms, fluctuations in the rates included in the comparison of sectoral payments (payment for the areas of starch potato cultivation and payment for the areas of hops cultivation) were higher than the fluctuations in the rates included in the comparison of general payments (single area payment and redistributive payment). However, in relative terms, the fluctuations in the rates of all the analysed payments were moderate, at most, because they rarely exceeded ±5%.

The volume of the impact on the payment rate of a change to the financial envelope (in EUR) allocated for funding the instrument in question is a derivative of the Member State's decision on the directions of the distribution of funds allocated to direct payments (the so-called national ceiling) in individual years. When the envelope earmarked for financing

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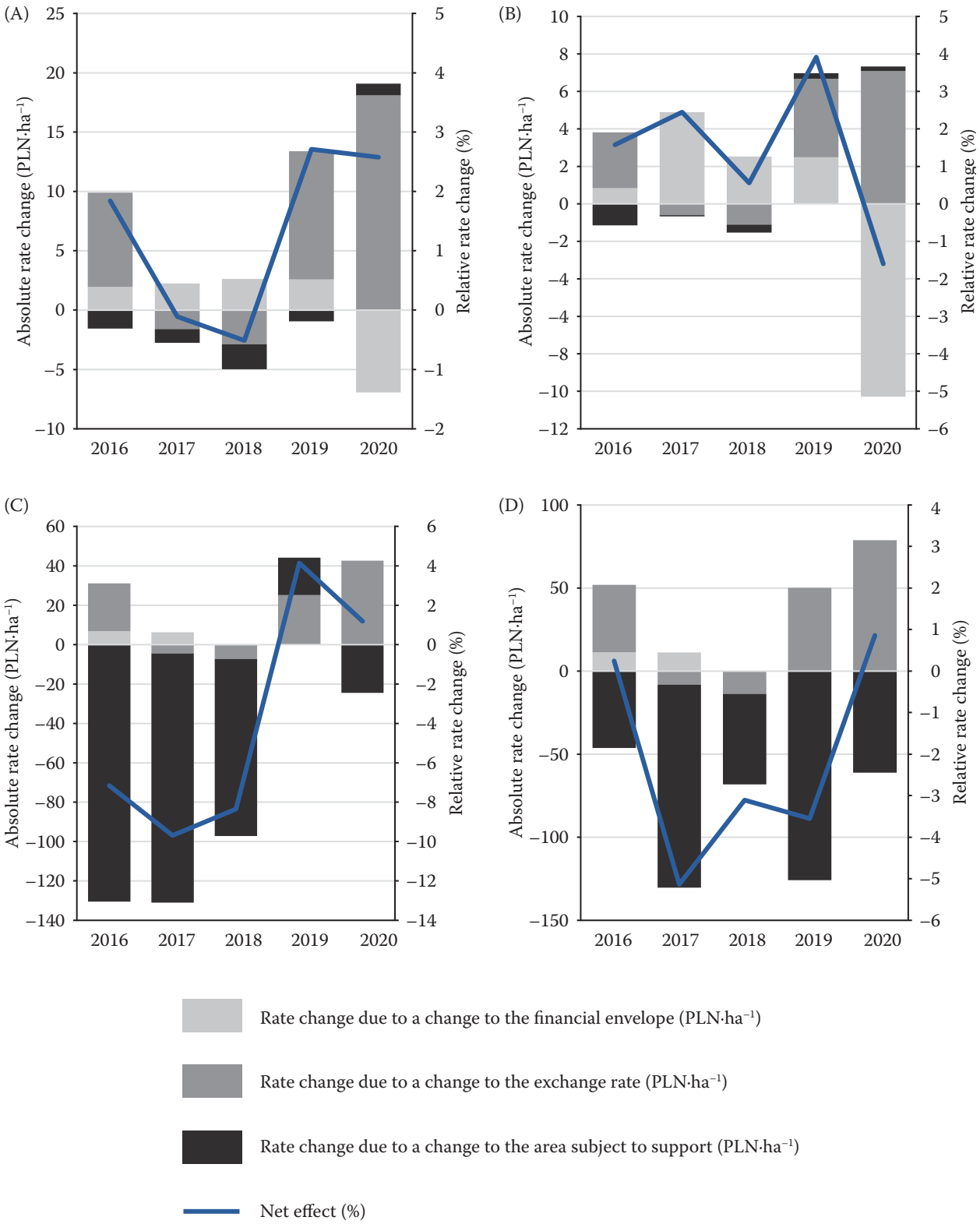

Figure 2. Changes in rates of selected direct payments compared with the previous year, broken down by cause: (A) single area payment, (B) redistributive payment, (C) payment for the starch potatoes cultivation area, (D) payment for the hops cultivation area

Source: Own elaboration based on the data published on the website of the Polish Ministry of Agriculture and Rural Development

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the instrument in question is defined as a percentage share of the national ceiling, changes to the national ceiling (resulting from the so-called external convergence) automatically cause, *ceteris paribus*, changes to the payment rate. The rate changes have the same direction as the changes to the national ceiling, so raising the national ceiling makes the rate go higher when other factors are fixed, and lowering the ceiling makes the rate lower. Defining the level of the financing of the instrument in terms of amounts (in EUR) is an alternative to the option of its specification as a percentage of the national ceiling. Under the conditions of the variable national ceiling, the Member State may not, however, fix the amount allocated in individual years to finance payments for agricultural practices beneficial for the climate and the environment because Regulation (EU) No. 1307/2013 of the European Parliament and of the Council of 17 December 2013 establishing rules for direct payments to farmers under support schemes within the framework of the common agricultural policy and repealing Council Regulation (EC) No. 637/2008 and Council Regulation (EC) No. 73/2009 (OJ L 347, 2013, p. 608–670) states that the level of financing for this instrument is equal to 30% of the national ceiling. Moreover, to ensure the full use of the national ceiling in conditions of its variations, the level of financing of the single area payment should constitute the part remaining after subtracting the amounts allocated to all other support instruments from the national ceiling. As implied by the vertical bars shown in Figure 2, the amounts in EUR intended to finance the sectoral payments included in the comparison were fixed in 2018–2020.

The vertical bars also show that the exchange rate expressed in PLN/EUR was lower in 2017 and 2018 than in 2016 and 2017, respectively. This means that the Polish currency got stronger at that time (compared to the preceding year) against the EUR, negatively impacting prior payments rates. In the remaining years of the analysed period (2016, 2019, 2020), the influence of this variable was positive. According to Poczta (2014), it is in the interests of Polish agriculture to eliminate exchange-rate variations and reduce transfer transaction costs due to the importance of payments from the budget of the EU for farmers' income and the modernisation of the sector.

Based on the charts, we can notice a regularity consisting of the fact that in the case of payments for the area of cultivation of specific plants (i.e. for sectoral payments), compared to general payments (which include the single area payment and redistributive payment), changes to the areas authorised for payment have a much more significant impact on rate fluctuations. This results from the fact that the relative changes in the agricultural areas are smaller than the relatively close changes in the country's specific crop area (e.g. starch potatoes or hops). The relative stability of the areas covered by redistributive payment proves the structural inertia of agriculture.

Discussion. Farmers obtain information on payments rates in October of the year of application, while the basic deadline for submitting applications for direct payments for the year in question is May 15. In turn, the decisions on the directions of production and the structure of crops are made even earlier; for example, the decisions on winter crops are made in the autumn of the year preceding the year of the application at the latest, so about a year before the publication of the regulations on payments rates.

On the one hand, the lack of data on payments rates before taking decisions on the direction of production and crop structure is unfavourable for the farmer because this expands the area of uncertainty under which the farmer makes economic choices. On the other hand, this situation can be favourable for the beneficiaries of payments if it makes it difficult for consecutive links of agribusiness to 'capture' the support, in particular by large buyers of agricultural products, e.g. food-processing companies with monopsonistic characteristics on the local market. The phenomenon of 'capturing' direct payments by buyers of agricultural products, just like the phenomenon of 'capturing' payments by owners of agricultural land in conditions of the separation of land ownership from land use, reduces the effectiveness of direct payments as an instrument supporting farmers' income (Sadłowski 2017). In the case of some agricultural products, e.g. soft fruit, the need for quick processing after harvesting or storage in proper conditions (cold stores), as well as relatively high transport costs in relation to the value of transported produce, make the position of monopsony strong. What is more, the lack of knowledge of the payments rates (especially sectoral-payments rates) when the farmers decide on the choice of production directions, to some extent, limits the impact of agricultural-policy instruments on the allocation of production resources. It can be in line with the idea of subsequent reforms of the CAP, in which the so-called decoupling was an important element (Ciaian et al. 2014). The reforms were intended to reduce the impact of the applied tools on the production decisions of farmers (Sckokai and Antón 2005) and to en-

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sure their allocative neutrality as much as possible (Sinabell et al. 2013), thus leading to greater flexibility and a more robust market orientation of farms (Happe et al. 2005). In the reformed form, the instruments were meant to ensure effective support to farmers' income without causing undesirable side effects on the hitherto scale. A significant impact on the volume and structure of agricultural production, manifested by their maladjustment to the size and design of the demand for agricultural products, was a particularly undesirable side effect of this intervention. According to Pe'er et al. (2020), there is strong evidence that coupled payments lead to market distortions, favour greenhouse gas emissions and support practices with proven negative impacts on biodiversity.

If the national ceiling is fixed, the decision to increase the pool of funds for financing a given instrument is also a decision to reduce the financing level of another instrument(s). At the same time, such a decision will not necessarily translate into a proportional increase in the payment rate. The land area or the number of animals submitted for payment should be expected to increase in sectors where production is relatively more attractive. This increase will at least partially offset the effect of an increase in the overall level of funding. Increasing the level of financing of a given instrument may quite strongly translate into an increase in the payment rate only in sectors with relatively high inertia, where the land area or livestock population is relatively weakly sensitive to changes in the payment rate. This may result in a slight propensity to increase the area of a given crop or the number of animals of a given species on farms already engaged in production in a given sector and a slight inclination of farmers not producing in a given sector to enter this sector. On the other hand, a more favourable exchange rate from the point of view of farmers, as opposed to increasing the level of financing of a given instrument (at the expense of other instruments), does not cause compensatory changes in the agricultural area or a number of animals reported for payment, as it leads to a proportional increase in the level of support in all sectors, without changing relative values.

CONCLUSION

The rates of direct payments can be included among the parameters of the economic account that form the systemic conditions of agriculture management. Farmers are forced to take into account the predicted payments rates in their economic decisions. This is not imposed administratively but with the threat of a worse economic result.

Although the rates of direct payments are specified in legal acts (regulations), they are shaped as the result of the pool of funds earmarked for financing a given instrument, the exchange rate and the area of land or the number of animals approved for payment.

The first of the factors mentioned above is a political one because it reflects the preferences of political decision-makers as to the directions of distribution of the funds at their disposal; the second is a macroeconomic factor as it reflects the convertible relation of the national currency to the EUR. Therefore, both factors are external from the farmers' point of view. The third factor reflects the balance of atomised decisions of farmers regarding the directions of use of the resources. It can be defined as a behavioural factor.

Each of the identified factors influencing the volatility of direct payments rates may have a positive or negative effect on them. The counter-directional interaction of individual factors may lead to mutual compensation, making the net effect manifest in a slight rate change. In the Member States outside the Euro area, fluctuations in payments rates largely explain the fluctuations in the national currency's exchange rate against the Euro.

The rates of payments granted to the area of crops of specific plant species are more prone to fluctuations under the influence of area changes authorised for payment than are the rates of general payments (i.e. for all agricultural land). This is because the area under cultivation or the number of animals reported for payment is more stable the broader its conceptual scope (for example, more significant fluctuations in the area of wheat cultivation can be expected than in the area of cereal crops). Therefore, the hypothesis put forward in the introduction has been confirmed. This is the most important conclusion from the farmer's point of view.

Although the potential impact of exchange rate changes is tremendous, especially in the current unstable international situation, the exchange rate change affects all payments rates in the same direction and the same proportion, maintaining the same support level relationships under individual instruments. A consequence of greater volatility of sectoral payments rates is a greater risk of a relative decrease in the profitability of a given crop compared to alternative production directions.

This study's first application dimension (micro level beneficiary's perspective) results from the reconnoitring of the importance of changes in individual factors

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determining the direct payments rates on their fluctuations, which may be the starting point for estimating the risk of support level fluctuations.

The findings in this study can be used moreover to develop a method for predicting payments rates based on the analysis of fundamental factors. By estimating the exchange rate level and the crop area or the number of animals approved for payment and knowing the amount of funds allocated for financing a given instrument, a point forecast of the payment rate is possible.

The prediction of payments rates could be used to support agricultural policy decision-making processes, including adjusting the funds allocated to the financing of individual instruments (second application dimension – macro level).

In identifying factors determining the direct payments rates and measuring their signification in the past, it is a deterministic model. In contrast, the prediction of payments rates and the risk of a decrease in the support level is stochastic.

The above general conclusions are universal – notwithstanding some possible differences in the administration of the direct payment system, they remain valid for all Member States using the simplified payment system, wherein the one relating to the exchange rate applies only to countries outside the Euro area.

Further research in this area could consist in the quantification of the phenomenon using the methodology proposed in this article and focus, i.e. on the fluctuation of the payments rates in other countries applying the simplified system, in particular, based on more extended time series for instruments with stable conditions of support grant.

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