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Searching for more balanced distribution of direct payments among agricultural farms in the CAP post-2020

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Abstract: The study aimed to examine the changes in income inequalities in Polish farms and the impact of introducing the threshold of direct payments for farms (EUR 60 000) to form these inequalities. The research was based on data from the Farm Accountancy Data Network (FADN) for the years: 2006, 2013 and 2018. In each year, the sample included at least 10 000 observations that represented over 700 000 farms. The results were verified using statistical tests relating to the comparisons of averages and distributions of farm income for two samples and the Gini coefficient. The study noted deepening income inequalities in Polish farms, as evidenced by the increasing value of the Gini coefficient in the subsequent years and the growing share of payments in the formation of these inequalities. Neither for the sample analysed nor the field of observation of farms will introduce the threshold for direct payments per farm of at least EUR 60 000 (including labour costs) change the polarisation of income.

Keywords: capping; farm income inequality; Gini coefficient

Numerous attempts to explain the occurrence of economic inequality have been undertaken by many schools of economics (neoclassical, Marxist, development economics, welfare economics and others). It has been repeatedly concluded that these inequalities lead to important and complex social problems of varying intensity. Both the uneven concentration of wealth (static approach) (Mankiw 2010) and too high volatility of income earned by households (dynamic approach) inhibit economic growth (Banerjee and Duflo 2003). Therefore, they constitute a premise for the creation of various support systems (Stiglitz 2009). Particular interest among economists and political decision-makers may arouse the so-called "sensitive" sectors, which include agriculture (Hill 2012).

The direct payments operating under the Common Agricultural Policy (CAP) significantly affect agricultural production's size and structure. The reallocation function of the CAP is slowly being replaced by a redistributive one, influencing the distribution of agricultural income. On the one hand, income disparities are often seen as an incentive for higher economic efficiency. On the other hand, a high level of income inequality is undesirable in terms of the social context of sustainable agricultural development (Sinabell et al. 2013).

The EU statistics point to the unequal distribution of direct payments among farms, which has continued for years. About 75% of the beneficiaries receive less than EUR 5 000, which accounts for 15% of all payments, while 0.5% receive more than EUR 100 000 (16.3% of all payments) (European Commission 2018a). Such a distribution of payments results from the concentration of land in large farms and the support's nature, which is mainly area-based. Direct payments

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linked to land influence land rents because only those who own or have rented eligible land can claim public support (Kirwan and Roberts 2015). As eligibility for direct payments depends on control over the land, this type of aid is capitalised into land value (Matthews 2017). The distributive leakage of the benefits of direct payments to non-farm groups reduces the transfer efficiency of direct payments. It has been estimated that due to the payment granting rules applicable from 2014–2020, EUR 10.2 billion leaked out of the agricultural sector in the EU every year in the period from 2014 to 2020 (Ciaian et al. 2017).

The impact of direct payments on farm income distribution has been addressed in many publications. According to some researchers, direct payments cause a decrease in income inequalities, which means that payments are distributed more equally (Ciliberti and Frascarelli 2018). In turn, others point to the growing polarisation of income at the farm level and the concentration of payments in high-income farms (El Benni et al. 2012). However, most studies concerned all payments granted to farms, and only a few took account of individual measures of the CAP and their impact on farm income. Ciliberti and Frascarelli (2018) noted four types of payments that aim to enhance farm income: basic payments, redistributive payments, the small farmer's scheme and voluntary coupled payments. In a study by Severini and Tantari (2015), all direct payments received by farms were efficient in the equalisation of income, when voluntary coupled payments resulted in a greater payment concentration at the farm level.

Most CAP measures have at least the partial objective of income redistribution towards the neediest farming population (El Benni and Finger 2012). However, multiple attempts to redesign the CAP for the fairer distribution of direct payments have still been inefficient. The first attempts were made with the introduction of modulation in 2005 (5% reduction in payments), which covered all farms receiving over EUR 5 000. From 2014 to 2020, a threshold (capping) per farm was introduced, making it possible to reduce payments by 5% for farms receiving over EUR 150 000, with it being possible to apply progressive tranches of payment reduction (degressivity) depending on the member state's decision. Capping was voluntary for countries that allocated more than 5% of the national ceiling for the redistributive payment. The reduction applied only to the basic payment. The deduction of labour costs was not mandatory. The voluntary implementation of capping and degressivity caused minor changes in the redistribution of payments. According to the European Commission's estimates (European Commission 2019), in 2015 these instruments covered EUR 98 million, accounting for 0.44% of the total, while in 2017 they amounted to EUR 74 million, i.e. 0.35% of the total.

In the new CAP for 2021–2027, the European Commission proposed introducing mandatory capping of direct payments, covering all payments received by a farm. The threshold would be EUR 60 000, while the further diversification depends on a tranche (25%, 50%, 75% and 100%). After the mandatory deduction of labour costs, no surplus payments exceeding EUR 100 000 will be paid (European Commission 2018b).

Introducing the mandatory deduction of labour costs prior to the reduction in payments granted to a farm will still make this instrument inefficient. Matthews (2018) estimates that capping in this form will cover only large farms in Bulgaria, Romania and Lithuania. This is due to the great flexibility in defining which labour costs can be attributed to agricultural activity.

Polish farms became eligible for direct payments in 2004 and were gradually reaching 100% of payments by 2013 due to the phasing-in mechanism. It is worth examining the impact of payments on the formation of income inequalities over these years and the role of capping, a CAP measure occasionally analysed in the literature. Researchers usually focus on the evaluation of various options of the upper limit on payments and/or their effects on the economic condition of large farms (Sahrbacher et al. 2012; Jelínek et al. 2018). However, to the authors' knowledge, there has been no analysis of the European Commission's proposal regarding the effect on income inequalities of introducing the capping at EUR 60 000. This aspect is increasingly important in shaping the CAP towards a more balanced distribution of direct payments post-2020. In view of the above, the objective of the paper was to verify the following research hypotheses:

H_1: Direct payments under the CAP deepened income inequalities among farms.

H_2: Introducing EUR 60 000 per farm payment threshold, including labour costs under the CAP 2021–2027, will not change income polarisation.

MATERIAL AND METHODS

Source data. The unit data of Farm Accountancy Data Network (FADN) were used to verify the hypotheses. However, they are not available for the general public. Open access to the FADN database is provided

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only for aggregated data (FADN 2018). The study included the selected years relating to the three financial perspectives of agricultural policy, i.e. 2006, 2013 and 2018. Each year's results are comparable because of the sampling procedure in FADN, using regional location, economic size, and type of farming as the stratification criteria, which enables the proper representativeness of certain types of farms. The FADN focuses on commercial farms, i.e. producing at least 90% of the standard output (SO). For Poland, the field of observation covers farms whose economic size exceeds EUR 4 000 of SO. In each year, the study sample included at least 10 000 observations representing over 700 000 farms, which accounts for about half of the Polish agricultural sector. Given the technical aspects of verifying the hypotheses, farms with zero utilised agricultural area (UAA) were removed from the sample. The following variables were used in the study (per 1 ha of UAA):

– Family farm income: payment for involving own production factors in a farm's operating activity and payment for a risk taken by the farmer in the financial year;
– Market income: family farm income minus subsidies received under the CAP;
– Direct payments in a given financial perspective;
– Other subsidies in a given financial perspective (mainly from the second CAP pillar): the total subsidies to operating and investment activities of a farm minus the value of direct payments.

In the regulation on limiting direct payments for 2021–2027 introduced four new capping thresholds (European Commission 2018b). The basis for reducing direct payments is the value of a tranche minus the labour cost, which is determined as a product of an average standard salary related to the agricultural activity at the national level and the number of annual work units (AWU) on a farm. In the study, the labour cost on individual farms was calculated as an average annual gross salary in agriculture, forestry, hunting and fishing (in accordance with the Polish Classification of Activities compiled on the basis of the Statistical Classification of Economic Activities in the European Community) multiplied by the number of AWUs declared by those farms (European Commission 2018b). An average monthly salary in agriculture in Poland in the years analysed was respectively: EUR 608.62 in 2006, EUR 938.92 in 2013 and EUR 1 144.58 in 2018. The study included an income simulation using the lowest level of reduction in direct payments depending on the tranche amount.

Table 1 presents the number of farms that would have been covered by capping if the limit on direct payments had been introduced in 2006, 2013 and 2018. The size of groups was indicated for the sample and field of observation in the FADN. It should be noted that the estimation of the number of farms covered by limitations at the level of the field of observation entails an assumption that the same farms in terms of the type of farming, economic size and geographical location receive a similar value of direct payments and incur similar labour costs.

Table 2 presents the descriptive statistics for family farm income and its components. The mean and median of a family farm and market income in the subsequent years indicate the relatively high right-skewed distribution of these characteristics. The average income grew in the subsequent years. The differences in average family farm income between 2006 and 2018 resulted mainly from differences in net value-added, especially for farms specialising in grazing livestock. Between 2006 and 2013, the income median increased slightly, and between 2013 and 2018, it decreased, which was particularly visible in the case of the market income median. The distribution both of direct payments and other subsidies was almost symmetrical in all years.

Methods. The research hypotheses were verified using statistical tests relating to comparisons of averages and distributions of farm income for two samples and the Gini coefficient. The formation of family farm income in 2006, 2013 and 2018 was assessed based on the Wilcoxon non-parametric signed-rank test results, used

Table 1. Size of the sample and field of observation for farms covered by capping

Limit for tranches (EUR)	Sample (number)			Field of observation (number)		
	2006	2013	2018	2006	2013	2018
60 000–75 000	2	3	1	17	34	10
75 000–90 000	1	2	0	25	23	0
90 000–100 000	0	0	0	0	0	0
> 100 000	0	0	0	0	0	0
Total (number)	3	5	1	42	57	10

Source: Own elaboration based on data from the FADN (2018)

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Table 2. Descriptive statistics for family farm income and its components for the sample and field of observation

Variable		Sample			Field of observation*		
		2006	2013	2018	2006	2013	2018
Family farm income (EUR/ha of UAA)	mean	2 275.37	3 765.37	6 003.94	3 508.00	6 525.78	13 126.23
	median	430.44	542.87	524.19	375.05	438.58	435.04
	SD	27 392.21	25 177.19	36 334.55	36 950.34	41 486.40	61 441.34
Market income (EUR/ha of UAA)	mean	2 052.48	3 440.12	5 631.76	3 264.67	6 194.49	12 751.85
	median	226.85	225.72	177.48	138.76	122.16	92.14
	SD	27 384.91	25 158.01	36 331.37	36 955.03	41 488.81	61 446.32
Direct payments (EUR/ha of UAA)	mean	118.45	189.64	183.67	122.83	215.28	188.70
	median	117.31	207.70	173.44	118.85	219.12	175.74
	SD	92.21	151.73	85.35	82.69	164.78	88.41
Other subsidies (EUR/ha of UAA)	mean	104.44	135.61	188.51	120.50	116.01	185.68
	median	46.04	78.51	143.06	62.53	62.42	136.51
	SD	485.21	324.47	251.90	300.09	290.01	269.88
Number of observations		11 823	12 117	12 032	745 023	730 905	730 883

*Weighted results for sample; UAA – utilised agricultural area
Source: Own elaboration based on data from the FADN (2018)

to compare the average income in two samples, and the Kolmogorov-Smirnov test, used to compare income distributions in two samples. The zero hypothesis for the significance level of P-value = 0.05 was rejected when using the Wilcoxon and Kolmogorov-Smirnov tests.

The level of income inequality among farms was estimated using the Gini coefficient, assuming the values from 0, which indicates an even distribution of income, to 1, which indicates an extremely uneven distribution of income. One farm achieves the whole income in the population analysed.

It was also attempted to measure the extent to which income inequalities result from the basic components of farm income, also from direct payments. Family farm income was thus defined as a total of market income, direct payments and other subsidies. The share of individual components in the formation of income inequalities was determined using an approach proposed by Fields (2003) and Brewer and Wren-Lewis (2016), based on the Shorrocks' theorem (Shorrocks 1982). The following equation of family farm income was estimated:

$$\ln Y_{it} = \alpha_{0t} + \beta_{1t} Y_{it}^{\text{market}} + \beta_{2t} S_{it}^{\text{direct}} + \beta_{3t} S_{it}^{\text{other}} + \varepsilon_{it} \quad (1)$$

where: $\ln Y_{it}$ – natural logarithm from income of the i^{th} farm in t period; α_{0t} – constant term in the income model for t period; β_{1t}, β_{2t}, β_{3t} – structural parameters in the income model for t period; Y_{it}^{market} – market income of the i^{th} farm in t period; S_{it}^{direct} – direct payments received by the i^{th} farm in t period; S_{it}^{other} – other subsidies received by the i^{th} farm in t period; ε_{it} – random component in the income model for t period.

For the given t period, the decomposition of income inequalities is presented as follows (Fields 2003):

$$s_j(\ln Y) = \frac{\text{cov}\left[a_j Z_j, \ln Y\right]}{\sigma^2(\ln Y)} \quad (2)$$

$$\sum_{j=1}^{J+2} s_j(\ln Y) = 100\% \quad (3)$$

$$\sum_{j=1}^{J+1} s_j(\ln Y) = R^2(\ln Y) \quad (4)$$

where: $s_j(\ln Y)$ – relative factor inequality weight; $a_j = \{\alpha_1, \alpha_2, \alpha_3\}$; Z_j – independent variable in the model of the equation of family farm income.

On this basis, the share of the j^{th} independent variable in explaining income inequalities is defined as follows:

$$p_j(\ln Y) \equiv \frac{s_j(\ln Y)}{R^2(\ln Y)} \quad (5)$$

As proved by Fields (2003), these conditions are met for a broad range of inequality measures, also for income inequality measures such as the Gini coefficient.

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RESULTS

The results of the statistical tests reveal that there have been significant inequalities in the formation of family farm income in the subsequent years, while there are no differences between capped income and non-capped income. As shown in Table 3, the Wilcoxon signed-rank test statistics indicate significant inequalities between an average income per 1 ha of UAA in 2006, 2013 and 2018. Also, comparing average income calculated according to the FADN methodology with a simulation of average income, considering the introduction of the planned limit of payments per farm, makes it possible to conclude the absence of significant differences between these two groups.

The results of the distribution inequalities show similar relationships test also presented in Table 3. The Kolmogorov-Smirnov test statistics indicate significant differences in the income distribution per unit of UAA in 2006, 2013 and 2018. Yet in the individual years, there were no significant differences in income distribution, including and excluding capping.

Table 4 presents the level of income inequalities among Polish farms. The Gini coefficient, which in 2006, 2013 and 2018 was close to 1, indicates significant income inequalities in Polish agriculture and a further strengthening of this phenomenon. Besides, the scale of these inequalities is larger when generalising the results obtained by applying the weights assigned to each farm by selecting the entity from the field of observation to the FADN sample. The introduction of capping in the form proposed by the European Commission will only marginally translate into a change in income formation, as indicated by the similar values of the Gini coefficient.

Table 5 shows the decomposition of income inequalities, including income components, such as: market income, direct payments and other subsidies. Owing to the use of regression methods to decompose the Gini coefficient, the results were also presented for the model's residues. According to the estimations of the $p_j(\ln Y)$ coefficients, income inequalities in over 50% of Polish farms were related to factors other than those included in the model (apart from the result for the farms from the field of observation in 2018). Of the independent variables listed, both with and without income capping, the highest share in the formation of income inequalities was that of market income. In the subsequent years, the impact of market income on family farm income inequalities grew steadily; however, this increase was more dynamic at the level of the field of observation than in the sample of FADN farms.

When analysing only the farms included in the sample, the share of market income in the polarisation of family farm income ranged from 13% to 37%. For the farms from the field of observation, the results were between 23% and 50%. In both cases, the total share of all subsidies in the income inequalities did not exceed 2.3%, of which the formation of income was largely due to payments under the second CAP pillar. The relatively high difference in the impact of market income on the rate of change in family farm income in 2006

Table 3. Results of the Wilcoxon signed-rank and Kolmogorov-Smirnov tests

Compared averages/distributions	Wilcoxon signed-rank test		Kolmogorov-Smirnov test	
	test statistic	*P*-value	test statistic	*P*-value
Family farm income in 2006 and 2013	60 189 000	< 0.01	0.13529	< 0.01
Family farm income in 2006 and 2018	63 074 000	< 0.01	0.11130	< 0.01
Family farm income in 2013 and 2018	74 998 000	< 0.01	0.04289	< 0.01
Family farm income with and without capping in 2006	59 987 000	> 0.10	0.00027	> 0.10
Family farm income with and without capping in 2013	63 546 000	> 0.10	0.00027	> 0.10
Family farm income with and without capping in 2018	60 556 000	> 0.10	0.00018	> 0.10

Source: Own elaboration based on data from the FADN (2018)

Table 4. Results of the Gini coefficient

Farms	Without capping			With capping		
	2006	2013	2018	2006	2013	2018
Sample	0.85060	0.87995	0.91446	0.85061	0.87997	0.91446
Field of observation	0.91262	0.93184	0.93850	0.91263	0.93185	0.93850

Source: Own elaboration based on data from the FADN (2018)

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Table 5. Decomposition of the Gini coefficient

Income components	Sample			Field of observation		
	2006	2013	2018	2006	2013	2018
Without capping						
Market income	0.13138	0.32780	0.36543	0.23291	0.41652	0.50014
Direct payments	0.00282	0.00558	0.01366	0.00448	0.00425	0.00441
Other subsidies	0.01534	0.01294	0.00999	0.02139	0.01029	0.00910
Residual	0.85046	0.65368	0.61092	0.74122	0.56894	0.48637
With capping						
Market income	0.13135	0.32775	0.36543	0.23290	0.41651	0.50014
Direct payments	0.00283	0.00559	0.01367	0.00448	0.00425	0.00441
Other subsidies	0.01534	0.01295	0.00999	0.02139	0.01030	0.00908
Residual	0.85048	0.65371	0.61092	0.74122	0.56894	0.48637

Source: Own elaboration based on data from the FADN (2018)

and 2013 was due to factors not included in the model (differences in residuals). While at the sample level, the impact of direct payments on income inequalities in the last year analysed exceeded the share of other subsidies in their formation, there were no similar relationships at the level of the FADN field of observation.

The relatively high value of residuals points to the existence of other factors influencing the altered rate of income growth. Given the study's scope, including the assessment of income inequalities in the context of the existing agricultural policy measures, the issue of identifying all the factors contributing to farm income inequalities was not addressed. It is worth noting that the studies on the uneven distribution of income in agriculture draw attention to the fact that a farm and a household are separate concepts, i.e. it is possible to obtain off-farm income which translates into investment decisions made by agricultural producers and affects the amount and variability of farm income (Mishra et al. 2009; El Benni et al. 2012).

DISCUSSION

The results point to confirmation of the first hypothesis but with some reservations. The authors identified significant income inequalities among farms, which increased in the subsequent years. However, these inequalities were already significant in 2006, as evidenced by the high Gini coefficient (sample 0.85; field of observation 0.91). In the first years of Poland's membership in the EU, the CAP's impact on the formation of income inequalities was small. However, the highest Gini coefficient in 2018 (close to 1) confirmed that the income disparities among farms have deepened, which indicates that the CAP measures used were inefficient.

The results indicated that market income was the main source of income inequalities among Polish farms. However, direct payments, low at the beginning of accession, became more important in shaping these gaps each year. Similar trends were observed in the study by Severini and Tantari (2015), where the main source of income inequalities was also market income (Gini coefficient = 0.98), followed by direct payment income (0.71) and off-farm income (0.66). Since the CAP is more market-oriented, external factors play an increasingly important role in farms' functioning by contributing to greater vulnerability, risk of price volatility and growing pressure on income. Unevenly distributed market income thus increasingly differentiates family farm income.

The growing share of direct payments in farm income indicates that farmers are more dependent on the CAP. However, due to the subsequent reforms of this policy, the support changed over time. Particularly, linking payments to land affects farm income and the distributive effect of direct payments. According to the European Commission (2018a), 80% of direct payments are granted to 20% of beneficiaries, who constitute 82% of the UAA and production in the EU.

Compared to the second CAP pillar, payments from the first pillar were less important in creating income inequalities in the first years of the analysis. It should be presumed that this is due to the significant pool of funds granted to Poland after accession under the CAP second pillar and the gradual achievement of 100% of direct payments by 2013. In the subsequent years, there was an increased impact of direct pay-

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ments and a reduced impact of other payments on income inequalities. Severini and Tantari (2015) explain the greater concentration of payments from the second CAP pillar by their targeting on strictly defined beneficiaries, concluding that they are more effective measures in reducing income inequalities of farms than payments from the first CAP pillar.

The second hypothesis was also confirmed. Capping farms receiving over EUR 60 000 of payments, including labour costs, will not be crucial for reducing income inequalities. It should be assumed that the concerns related to the lowered effectiveness of large farms, expressed by some researchers (Staniszewski and Borychowski 2020), are unfounded. Capping would apply to a small number of Polish farms, which are in economic classes from EUR 100 000 to EUR 500 000 of SO, have an UAA of about 250–640 ha and specialise in arable crops. This is mainly related to the specificity of the agrarian structure in Poland. In the years analysed, it was observed (European Commission 2018a) that all payments granted for small farms receiving under EUR 1 250 decreased, while the pool of payments for farms receiving EUR 1 250–50 000 increased, and the payments for farms of over EUR 50 000 were subject to minor changes. This distribution does not reflect the fact that small farms often provide important environmental public goods. Moreover, they are also more economically sensitive and therefore need support.

CONCLUSION

The paper examined changes in the income inequalities of Polish farms in 2006, 2013 and 2018 and the impact of introducing the threshold of direct payments (EUR 60 000) for farms on the formation of those inequalities. The issues of the redistributive effect of direct payments on farm income have been subject to numerous discussions in the literature. However, there is still a need to deepen these issues and the further reforms of the CAP and amendments to the existing measures. All the more so, as the capping issues are rarely addressed in the literature.

At the level of the sample of farms analysed, the study's results confirm the research hypotheses. The deepening income inequalities of Polish farms were noted, as evidenced by the increasing value of the Gini coefficient in the subsequent years and the growing share of payments in the formation of these inequalities. For the sample analysed and the field of observation of farms, introducing the threshold for direct payments per farm of at least EUR 60 000 (including labour costs) will not change the polarisation of income. These are results from the very small number of farms that would have been covered if capping had been introduced in previous years by the European Commission. It was stated that the market is the main source of income for farms, generating significant income inequalities. The EU agricultural policy contributes to reinforcing these inequalities. The criteria for granting direct payments, favouring large farms, result in increasing income inequalities and concentrating payments on a small number of farms. Instruments such as capping and degressivity will not change this situation unless the CAP stops linking payments with agricultural land.

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