Subsidies versus economics, finances and income of farms (2)

INSTITUTE OF AGRICULTURAL
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Subsidies versus economics, finances and income of farms (2)

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The paper aimed at *ex-post* analysis of impact of subsides on the economic situation of farms, with special emphasis on the impact of environmental payments and compensatory payments (the so-called LFA payments).

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INTRODUCTION

The principles of environmental protection and use of natural resources are an imperative and a challenge for the modern society. Currently, one of the most important aspects of rural economy is activity that does not violate the natural landscape and does not reduce the stock of public goods. The ecological system and integrated production are preferred due to provision of high quality food and their positive impact on the quality of soil, water and biodiversity. Improvements in the Common Agricultural Policy (CAP) aim at encouraging agricultural producers to change their attitude towards public goods (reduction in internalisation of negative externalities) and to use technologies that take account of the legal regulations and restrictions of agricultural production rules (in accordance with the Porter hypothesis). Agriculture, which uses over 60% of the total area of Poland, has large impact on the shape of the natural environment. It uses its resources directly in production processes. Production in this sector may negatively affect surface and underground waters, soil or air. Improper use of industrial means of production (artificial fertilisers and plant protection agents) may lead to disappearance of natural flora and fauna, disturb water balance, and microclimate.

Provision of public goods is an argument for state intervention in the market economy, and particularly legitimisation for use of agri-environment-climate payments under the CAP (agri-environment-climate subsidies under Rural Development Programme 2014-2020). In the agricultural activity, there are specific requirements for farms known as cross-compliance rules. The Agri-Envrionmental-Climate Scheme existing in Poland is the primary programme addressed directly to farms.

Farmers, who function in the market economy, have to produce goods according to the market needs and at the same time maximise their goal functions through production and economic effect. Therefore, a significant portion of this monograph is devoted to these issues. The analysis covered economic and production effects of environmental payment beneficiaries. The changes to these outturns in 2004-2014 was presented on the basis of FADN data from individual holdings.

Another Common Agricultural Policy instrument, to which a significant portion of this publication is dedicated, is compensatory payment for farms in less-favoured areas. In this case, economic and production outturns were also presented. What is more, it is also worth analysing the effects of these subsidies split up into lowland and mountain areas.

It is worth emphasising that areas qualified to LFA payments (lowland or mountain areas) overlap with areas of great natural value. The beneficiaries of compensatory payments also quite often benefit from environmental subsidies. This induced the authors to analyse these two beneficiary groups in a single study. This also allowed them

to obtain a fuller picture of economic situation of farms, which was the main objective of this publication. But the paper omits the research on environmental effects (benefits) of the agricultural policy instruments in question. The assessment of these is another challenge, both for the academics and the European Commission itself.

Aside from that, the authors presented the most recent changes to the EU agricultural policy and their impact on economic outturn, which is discussed in the third chapter. The entire publication was supplemented with detailed economic and financial analyses, which constitute continuation of research started in previous years. These analyses was presented in the two final chapters.

1. Changes to the economic and production situation of farms implementing the agri-environmental scheme in Poland

1.1. Introduction

The main objective of the agri-envrionmental scheme is the protection of biodiversity, soil, water, climate, landscape, and preservation of and improvement in the condition of valuable natural habitats, protection of endangered species, and promotion of sustainable farming. It is a form of institutional intervention addressed to agriculture, where relevant payments are paid in exchange for active participation in measures aimed at improving agricultural environment and provision of environmental goods. According to the assumed objectives (*Program Rozwoju...*, 2014), the measure aims at implementing environmental goals while taking account of the economic and social significance of agriculture in the context of growing demand for agricultural raw materials and still great importance of agricultural activity for rural employment and development in Poland. The fundamental issue is the concurrent and not confrontational approach to environmental and economic objectives. In the context of economic activity, the agri-environmental scheme creates an instrument which results in modification of the conventional economic calculation (Krasowicz and Oleszek, 2013). State intervention under the agri-environmental scheme demonstrates the indissoluble connection between the necessity to remunerate all the production factors (land, capital, and the farmer's labour) actively involved in the environmental measures. From this perspective, the effect and, at the same time, an assessment criterion of the scheme will be the environmental and economic impact. The environmental impact resulting from the implementation of the agri-environmental scheme depends on the type of measure undertaken under a relevant package. The measuring of environmental results is extremely difficult and sometimes impossible or immoral (the environmental "cost" of extinction of a species should not be assessed). All the more, an appropriate methodology of the economic assessment of environmental changes has not yet been found. On the other hand, the agri-environmental effectiveness will directly depend on the economic dimension of this agri-environmental policy.

The interest of the addressees, i.e. farmers, arises from several factors. The readiness to join the agri-environmental scheme results from such issues as: the scale of procedural complication, the level of environmental needs (e.g. existence of endangered areas in the region), information flow, farmers' awareness[1], and the level of support. The final element involves comparing the cost of joining the scheme and the

[1] In the initial period, the implementation of the agri-environmental scheme came across numerous obstacles, which resulted primarily from procedural difficulties in applying for aid, lack of social awareness, poor preparation of agri-environmental advisers, insufficient knowledge, and farmers' mistrust (Kamiński, 2012).

payments resulting from the participation[2]. At the farm level, the calculated cost includes transaction cost, cost related to additional measures or abandonment of certain farming procedures, and the cost of lost profits. The reason for the research is the fact that there might be fundamental discrepancies between the assumed goals and planned results expected by the initiators, i.e. state authorities that initiate the policy, and actual economic phenomena observed among addressees, i.e. farms, in individual agricultural policy instruments. From the policymaker perspective, a wide range of impact of economic, environmental, social and territorial mechanisms is assumed. On the other hand, the goal of business entities is to maximise the economic outturn in the form of profit (Bezat-Jarzębowska et al., 2013). In agriculture, achievement of an economic goal is also identified with the fact that a farmer has earned satisfying income (Floriańczyk and Buks, 2013). The opportunity to attain a macroeconomic effect will determine the interest among entities. In an extreme case where the use of policy instruments in unprofitable or the risk is too high, the potential addressees can be uninterested in the particular mechanism[3], which in turn precludes achievement of non-economic goals. Confronting both dimensions, the assumptions and the actual achievements, will provide an answer to the question about the effectiveness of the scheme, at least in the economic aspect. The analysis of the impact of the EU aid on the development of pro-environment measures on farms will include reflection on the context of achievement of goals assumed in the scheme, by creating a group of entities, where the application of guidelines will not disturb (or will even strengthen) the microeconomic efficiency.

As it is impossible to assess the agri-environmental effects, the study area covered by the economic research concerns two dimensions of the agri-environmental scheme implementation. The first is related to an attempt to characterise farms that are beneficiaries of the scheme. The beneficiary profile was determined based on the data from the period prior to scheme implementation, i.e. before the farm started implementing the scheme and benefited from additional payments. Based on available FADN data, 2004 was taken as the base year for the studied entities. The second field of study concerns changes that took place in the studied farms. Thus, research was to establish characteristic features of agri-environmental scheme beneficiaries and to study the scale and the direction of changes that took place in those farms. The study is supposed to provide answers to some fundamental questions: whether most of the farms that benefited from the agri-environmental scheme were small or rather large, whether scheme implementation improved or aggrevated their situation, to what extent the beneficiaries changed their position with regard to selected production and economic characteristics against other entities.

[2] The rules of the scheme, particularly the amount of compensation for implementation of the agri-environmental package, are determined by the Member State, depending on conditions and needs in a specific country (Niewęgłowska, 2006).

[3] An example to illustrate the point is Package 9 under Rural Development Programme 2007--2013: Buffer zones continuation of which was abandoned under Rural Development Programme 2014-2020 due to such reasons as "small interest of the beneficiaries" (*Program Rozwoju...*, 2014).

This study uses agricultural accountancy data from the FADN system[4]. Studying dynamics of changes to the analysed phenomena required a selection of farms that continuously participated in the FADN system in 2004-2014. The so-called agri-environmental scheme was implemented throughout the studied period. The measures supporting protection of biological and landscape diversity of rural areas were taken under the *Rural Development Plan* 2004-2006 – Measure 4. *Support for agri-environmental enterprises and the improvement of animals' welfare*, and then under the *Rural Development Programme* 2007-2013 – Measure 214 *Agri-environmental payments*, and under the *Rural Development Programme* 2014-2020 – Measure 10 – *Agri-environment-climate payments* and Measure 11 – *Organic farming*.

Due to the subject matter of the research, the farms were divided into two groups: beneficiaries of the agri-environmental scheme and other farms. The beneficiaries include only the farms that received agri-environmental payments at least five times. This approach results from two reasons. First, it would be unreasonable to qualify farms that received the payment only once, e.g. 2014 – the final year of the analysis, as a beneficiary. In a dynamic analysis, such farms conducted conventional activity in the first decade, and the agri-environmental scheme did not affect their functioning. Second, the minimum requirement of five payments results from the assumptions of the Programme. The agri-environmental scheme is a five years' agreement, and the payments under the obligation are awarded once a year over the five years. Receiving at least five payments in the FADN means that the farms that were selected implemented at least single complete programme in 2004-2014[5]. There were 860 such farms. The comparison group[6] consisted of 2,633 farms that continuously participated in the Polish FADN system in 2004-2014

[4] FADN (*Farm Accountancy Data Network*) is a farm accountancy system that has been used in the European Community since 1965. Its primary aim is to support programming and assessment of implementation of particular instruments of the Common Agricultural Policy, therefore introduction of this system is obligatory for each state that joins the organisation. Moreover, the FADN accountancy data may be used for other purposes, such as academic research, provision of information to decision-making authorities of Member States and organisations representing farmers, but also support for managing a single farm. FADN covers entities that produce 90% of the national Standard Gross Margin (since 2010 – Standard Output). This population is the basis for selecting a sample of farms where (after their managers have expressed consent) the accounting data is collected, which is then transferred to the Liaison Agency (in Poland – Institute of Agricultural and Food Economics – National Research Institute), and, after it has been verified, to the European Commission. The basic advantage of FADN is its methodological uniformity, which makes it possible to compare farms that differ in a number of characteristics, such as production size and scale or geographic location. An equally important feature is the reliability of data, which is guaranteed by the extensive multi-level system of control and verification (starting from the farm and up to the European Commission). FADN is the only system in Poland to provide information on size and structure of assets owned by farms, value of production, scale and structure of cost borne by them, or finally, their economic outturn (Goraj et al., 2004; Goraj and Mańko, 2009; www.fadn.pl).

[5] After the five years' obligation ended, the beneficiary could apply and continue the programme.

[6] Also referred to as "other farms" or "control group" in this study.

without receiving any agri-environ-mental payments. The total number amounted to 3,493 entities, i.e. 30% of the farms that participated in the system each year (about 12,000).

The comparative analysis took account of a number of features defining the economic situation of the farms, including primarily: production potential, size of production, asset funding sources, cost borne by the farm, economic outturn.

In the analysis of the dynamic of phenomena that took place in 2004-2014, the financial variables (expressed in PLN) were expressed in the basic prices of 2014 in order to ignore the impact of inflation. Therefore, the results were converted using the following change indicators: global agricultural production, prices of goods and services purchased by individual holdings for current agricultural production, prices of goods and services purchased by individual holdings for investment purposes, total prices of consumption goods and services, and prices of agricultural goods sold by farms (*Ceny w gospodarce narodowej 2005-2015; Rocznik statystyczny RP 2005--2015*). Current prices were used exclusively to calculate proportion or mutual relations between two variables. The study of change dynamic in particular features established the impact of e.g. the undertaken agri-environmental measures on the economic and production situation of farms.

1.2. Findings

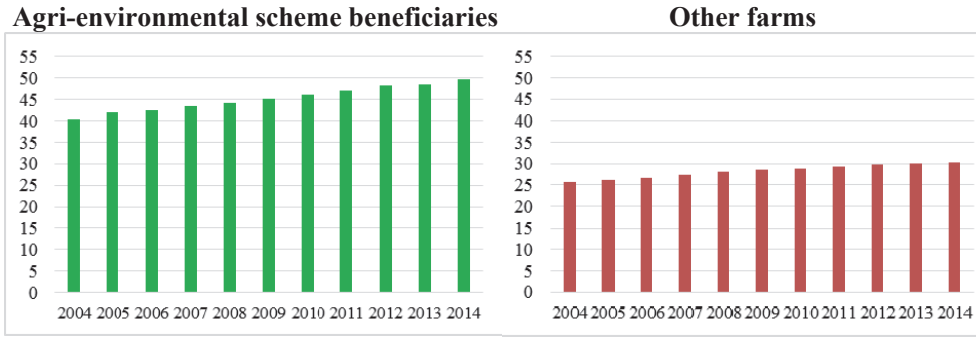
Size and structure of and relations between production factors, i.e. stock of land and capital and labour input determine the production potential of farms and their development capability in building competitive position. Ownership of appropriate assets (not excluding human capital or organisation of an entity) is, at least to some extent, a premise to effectively use development opportunities, whose sources include agricultural policy measures. Comparison of resources in the base year, 2004, will make it possible to determine the initial features of farms that characterised farms that made the decision to implement agri-environmental measures.

What plays the most important role in creating the production potential of farms, is the land. Significant differences can be observed in the areas of agricultural land in the base year. In many opinions (*Problemy...*, 2013), the agri-environmental scheme was addressed to smaller farms whose production function is less important but their role in landscape and nature is significant. They were supposed to provide public goods in the form of improvement in environment quality in lieu of industrial production. The increase in participation in the agri-environmental scheme was supposed to be an element of synergy between the 1st and the 2nd pillar of the CAP (Mickiewicz and Mickiewicz, 2016), and the relevant payments were intended as the primary component of remuneration for production factors involved in provision of public goods. It turns out that the main beneficiaries of that aid were large entities, nearly twice as big as the other ones (the control group)[7]. In 2004, the beneficiaries' farms

[7] See G. Niewęgłowska, *Zdolność rodzinnych gospodarstw rolnych do realizacji programu rolnośrodowiskowego,* Studia i Monografie, No. 130, IERiGŻ-PIB, Warszawa 2005, pp. 160-230; G. Niewęgłowska, *Wdrażanie programu rolnośrodowiskowego w pierwszych latach jego rea-*

had on average 40 ha of agricultural land, while the other farms had 26 ha of agricultural land. The difference in the potential (in terms of land area) grew over time. The research on the dynamic of change shows that the average annual change rate for farms that benefited from the agri-environmental scheme was 1.9%, while in the case of other farms, it was 1.5%. The initial size of the production potential positively impacts further growth, though it does not determine it ultimately. The activity of managers who make strategic decisions, including decisions to apply to the 2nd CAP pillar, is also necessary (Czubak et al., 2014).

Figure 1. The average size of the agri-environmental scheme beneficiaries' farm and other farms in 2004-2014 (ha of agricultural land)



Source: own study based on unpublished Polish FADN data.

Apart from determining the average size of farms, the distribution of farms according to the agricultural land area was also studied (Table 1). There were few farms with less than 5 ha of agricultural land that benefited from the scheme. They constituted less than 1% of the beneficiaries. The large and very large farms dominated. The changes that took place in both groups show that the entities that implemented the scheme developed more dynamically in terms of area. The group of the largest farms grew the fastest (by 8.5 percentage points).

In relation to the average farm size in Poland, which amounted to about 10 ha (*Rocznik Statystyczny Rolnictwa*, 2015), the studied farms that benefited from the agri-environmental scheme were five times larger. In the regional approach, the size of farms (in terms of agricultural land area) that benefited from the agri-environmental scheme was correlated with the general diversity of the average farm area in Poland. The farms that implemented the agri-environmental programme in "Pomorze i Mazury" were two times larger than in "Małopolska i Pogórze". However, in the south-

lizacji, Zeszyty Naukowe AR we Wrocławiu 2006, No. 540, pp. 383-389; G. Niewęgłowska, *Zagrożenia dla środowiska z gospodarstw położonych w strefie ograniczeń środowiskowych (na podstawie danych FADN),* Roczniki Naukowe SERiA 2007, Vol. IX, No. 1, pp. 333-337; G. Niewęgłowska, *Szanse i ograniczenia gospodarstw położonych w strefie ograniczeń środowiskowych na podstawie danych Polskiego FADN*, Journal of Agribusiness and Rural Development 2009, No. 2, pp. 147-156.

eastern part of Poland, the farms of the agri-environmental scheme beneficiaries were even seven times larger than the average agricultural land area per farm in the region (*Rocznik Statystyczny Rolnictwa*, 2015). In other regions, this ratio amounted to 3.5. Therefore, the beneficiaries' farms were in general much larger, which was particularly visible in the area where farm fragmentation is significant.

Table 1. Number and structure of farms according to agricultural land area

Size classes [ha]	Beneficiaries					Other				
	2004		2014		change in percentage (2014-2004)	2004		2014		change in percentage (2014-2004)
	number	percentage	number	percentage		number	percentage	number	percentage	
agricultural land area ≤ 5	8	0.9	2	0.2	-0.7	144	5.5	126	4.8	-0.7
agricultural land area ≤ 10	62	7.2	44	5.1	-2.1	372	14.1	319	12.1	-2.0
agricultural land area ≤ 20	241	28.0	203	23.6	-4.4	940	35.7	844	32.1	-3.6
20 < agricultural land area ≤ 30	171	19.9	153	17.8	-2.1	525	19.9	508	19.3	-0.6
30 < agricultural land area ≤ 50	184	21.4	191	22.2	0.8	402	15.3	464	17.6	2.4
agricultural land area > 50	194	22.6	267	31.0	8.5	250	9.5	372	14.1	4.6
Total	860	100.0	860	100.0	-	2633	100.0	2633	100.0	-

Source: own study based on unpublished Polish FADN data.

In all regions of Poland (Table 2), farms participating in the agri-environmental scheme were larger than the average farms that did not benefit from the scheme.

Table 2. Regional differences in the average size of the agri-environmental scheme beneficiaries' farm and other farms in 2004-2014 (ha of agricultural land)

Region	Group	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
A	Beneficiaries	65	69	69	71	69	70	71	72	72	73	74
	Other	41	41	41	42	42	43	43	44	44	44	44
B	Beneficiaries	43	44	45	46	47	48	49	51	54	53	54
	Other	30	30	30	31	32	32	33	33	34	34	34
C	Beneficiaries	24	25	26	26	28	28	29	29	30	30	31
	Other	21	21	21	22	23	23	23	24	24	25	25
D	Beneficiaries	28	28	28	30	30	32	32	33	33	34	35
	Other	17	18	19	20	20	21	21	21	22	23	24

A – "Pomorze i Mazury", B – "Wielkopolska i Śląsk", C – "Mazowsze i Podlasie", D – "Małopolska i Pogórze"
Source: own study based on unpublished Polish FADN data.

Nonetheless, the differences between the beneficiaries and other farms were the greatest and exceeded 60% in 2014 in the western part of Poland (regions A and B). It is also important that the beneficiaries' farms increased their agricultural land area over the 11 years of analysis, and the only exception was "Małopolska i Pogórze".

In general, farm development leads to the substitution of labour with capital. Such a phenomenon should be observable on farms that implement the agri-environmental scheme, particularly in the case of the packages that provide for extensification of production. However, this does not occur in many cases. Additional funds were used to increase the area and assets (which is discussed below). Investment related to increase in fixed assets forced improvement in labour efficiency or even increase in employment. What is more, an individual holding bases primarily on own labour. Therefore, the rate of change limits the opportunities for family members to engage in non-agricultural activity, particularly in rural areas. These conditions, determined by the specific nature of agriculture, resulted in similar inputs and working hours in both group (Table 3). The dynamic of changes was also identical. Own labour input remained unchanged, but the farms employed additional workers. In both groups hired labour input grew by 16%. However, this had little impact on the total change to input because hired labour input amounted to 13% of the total labour input on the agri-environmental farms and 17% on other farms.

If we associate these trends with the land area, this means that production intensity in terms of number of persons per 100 ha of agricultural land was smaller on beneficiaries' farms. The increasing land area meant that the ratio of people to land area dropped in the following years.

Table 3. Labour input on agri-environmental scheme beneficiaries' farm and other farms in 2004-2014

Items	Group	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Total labour input (AWU)	Beneficiaries	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
	Other	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1
Hired labour input (AWU)	Beneficiaries	0.2	0.2	0.3	0.3	0.3	0.2	0.2	0.3	0.3	0.3	0.3
	Other	0.3	0.3	0.4	0.4	0.4	0.4	0.3	0.4	0.4	0.4	0.4
Total working time (hours)	Beneficiaries	4,338	4,332	4,394	4,364	4,370	4,345	4,580	4,558	4,542	4,556	4,572
	Other	4,543	4,586	4,639	4,615	4,664	4,626	4,783	4,797	4,827	4,787	4,778

Source: own study based on unpublished Polish FADN data.

Small changes to employment were characteristic of all regions and very similar regionally. Only in the south-eastern part of the country was the labour input (in terms of persons employed on full-time basis and total working hours) smaller (by 15%) on the farms implementing the agri-environmental scheme.

The difference in agricultural land area in comparable groups showed that the farms implementing the agri-environmental scheme were significantly larger. And the initial value of capital at the disposal of the farms prior to joining the scheme was almost

identical. The drop[8], which occurred in 2005 in both groups, was also similar. After the first two years, a clear difference in trends manifested itself. The beneficiaries of the agri--environmental scheme systematically increased their fixed assets. The explanation of this phenomenon requires a reference to the level of aid that the farms receive (Table 3). The accounting data does not make it possible to unambiguously determine to what extent the additional funds from the scheme contributed to this difference, but it can be implied that this contribution was significant. In general. the beneficiaries of the agri-environmental scheme received much higher operating subsidies for two reasons. First, due to the difference in the area, the direct payments were even 60% higher per farm every year. Second, additional payments due to the agri-environmental scheme had significant impact. They amounted to 20% additional operating subsidies every year. As far as absolute values are concerned, an average beneficiary's farm received (in terms of basic prices) about PLN 15,000 of additional agri-environmental payments. This resulted in the fact that operating subsidies received by an average farm implementing the agri-environmental scheme were nearly two times higher every year. In the initial period, the difference was smaller, but on average, the farms implementing the agri-environmental scheme received PLN 27,000 more due to the operating subsidies over the 11 years of the analysis.

Table 4. Operating subsidies on studied farms in 2004-2014 (basic prices of 2014)

Items	Group	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Operating subsidies (PLN thousand; basic prices)	Beneficiaries (n=860)	29.6	40.8	55.6	54.9	38.7	48.0	70.3	72.9	69.4	71.1	71.5
	Other	18.6	24.1	31.5	28.3	17.0	22.4	35.3	37.5	34.6	34.5	35.3
Agri-environmental payments (PLN thousand; basic prices)	Only farms benefiting from the agri-environmental scheme in the given year[1]		13.1	12.6	12.5	14.0	13.6	14.1	15.7	16.0	17.8	16.9
	– number (n)	(2)	(35)	(359)	(451)	(683)	(733)	(771)	(720)	(664)	(715)	(654)
Agri-environmental payments as percentage of operating subsidies	All beneficiaries' farms (n=860)	0.1	1.2	8.7	11.5	19.0	16.7	17.9	17.9	17.6	20.6	17.7
	Only farms benefiting from the agri-environmental scheme in the given year[1]	-	30.4	17.7	17.4	22.2	18.9	19.8	20.6	21.4	23.6	22.2

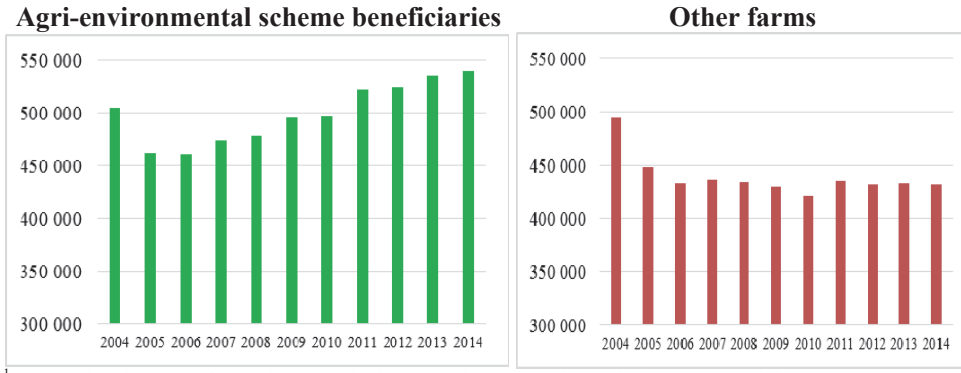
[1] According to the adopted methodology, 860 farms that implemented at least a single complete agri-environmental scheme, i.e. received at least 5 payments due to the implementation of the scheme, were qualified as beneficiaries. Differences in numbers in specific years result from the fact that some farms only started implementation of the scheme in a given year (e.g. 33 such entities in 2005) or did not receive payments in a year following the year of the last payment (e.g. for farms that continued implementation of the scheme, the application was just submitted, the Agency for Restructuring and Modernisation of Agriculture did not issue a decision yet, or the scheme implementation agreement was not yet signed). Thus, the total amount (sum) of agri-environmental scheme payment was compared to the total amount (sum) of operating subsidies but only for entities that received subsidies in a given year.

Source: own study based on unpublished Polish FADN data.

[8] In terms of basic prices, a stagnation was observed, but a high price rate of change for goods and services purchased for investment purposes contributed to a decrease of asset value in terms of 2014 basic prices.

Depending on the agri-environmental package (or packages) that were implemented, a portion of the funds was spent on implementation of tasks and obligations under the scheme. Nonetheless, some portion constituted additional support which was sufficient to co-finance investment. Studies by Czubak and Jędrzejak (2011) and Czubak (2013) show that farms use direct payments to finance running expenses and investment, but the payments have the greatest investment effect on larger farms that receive relatively more support. Therefore, at a certain level of support, direct payments become transfers that stimulate investment. Findings that show an increase in fixed asset value demonstrated that a similar effect was observed on farms that participated in the agri--environmental scheme. Apart from the above-mentioned increase in land area, the value of fixed assets not including land[9] grew by 17% between 2005 and 2014.

Figure 2. Fixed assets value (not including land value1) in PLN per farm on studied farms in 2004-2014 (basic prices of 2014)



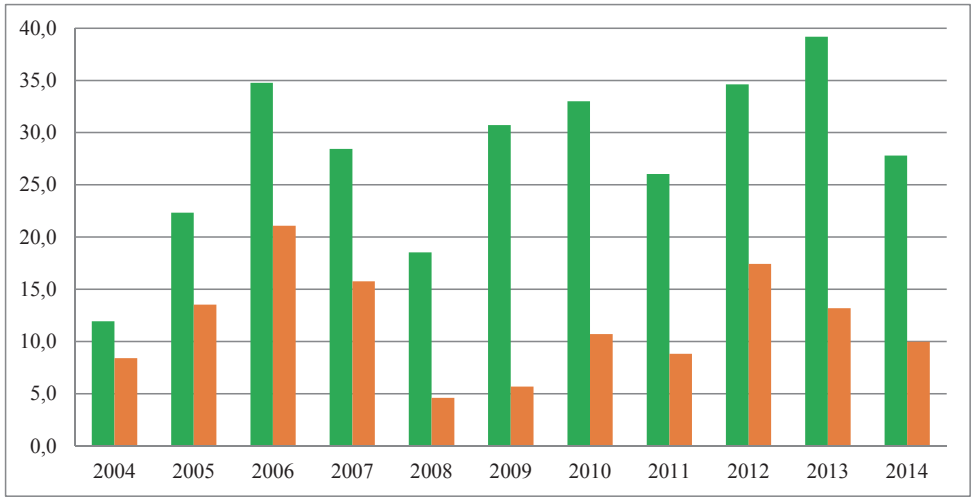
[1] Due to the change to the land value calculation methodology, the analysis of state and dynamic of fixed assets change was calculated as fixed asset value less land value for all years.
Source: own study based on unpublished Polish FADN data.

The pro-investment nature of the payments, including the agri-environmental payments, is confirmed by investment expenditure borne by the farms. The studies have demonstrated that the percentage of farms with positive net investment was higher among the farms that implemented agri-environmental scheme compared to other farms. In early 2004, about 25% of farms were capable of increasing their assets, and this group dynamically grew up to about a half of all entities in 2006 and 2007. The 2008 economic crisis resulted in a situation, where about 1/3 of farms made investments that exceeded the loss of asset value or partial sales of fixed. In the comparison group, such investment constituted about 1/4 of farms. The difference can be seen in average investment

[9] In this study, the value of fixed assets is calculated as value of fixed assets less the value of land. This approach was justified by the change to the methodology of land value calculation in the Polish FADN system. Until 2009, it was calculated on the basis of rye price assumed for the purpose of farm tax calculation. Since 2010, it has been calculated according to market prices. This has resulted in incomparable nominal land values in 2004-2009 and 2010-2011, therefore, land value was omitted while calculating fixed assets value to preserve the correctness of analysis.

values (Fig. 3). Though the fixed assets value was comparable in both groups in 2005, the net investment value among the beneficiaries was on average 40% higher. This difference increased in the following years. What is important, agricultural policy support, including agri-environmental payment, was a kind of buffer during the economic crisis. In 2008, investment was lower, but, due to additional support, the drop was not that big as among other farms. Aside from this, the beneficiaries returned to the net investment spending level from before the crisis faster.

Figure 3. Net investment on studied farms in 2004-2014 in PLN thousands (basic prices of 2014; green – beneficiaries of agri-environmental payments; orange – other farms)



Source: own study based on unpublished Polish FADN data.

This made it possible to increase fixed capital (Fig. 2), which was accompanied by increasing investment value, exceeding the growing value of capital (Table 5). The farms that benefited from the agri-environmental scheme were also developing more dynamically. Findings in Table 5 show can be read as investment comprehensiveness indicator. For this purpose, the sum of gross investment expenditure (from 11 years) was compared to the initial fixed assets value, the value of 2004. As far as the comparison group is concerned, the total gross expenditure constituted 3/4 of the initial fixed assets value. On the other hand, the beneficiaries doubled their fixed assets value.

Table 5. Ratio of investment to fixed assets value (not including land)

Items	Group	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
gross investment	Beneficiaries	7.8	10.7	13.5	12.3	10.9	13.1	13.6	12.2	13.8	14.9	12.2
	Other	6.9	8.8	10.8	9.9	8.0	8.5	9.7	9.3	11.2	10.5	9.2
net investment	Beneficiaries	1.6	4.4	7.4	5.9	4.0	6.4	6.8	5.0	6.6	7.2	5.1
	Other	0.9	2.6	4.7	3.5	1.2	1.5	2.7	2.1	4.0	3.0	2.3

Source: own study based on unpublished Polish FADN data.

Changes to the value of capital and increase in land area affected the capital to land ratio (Table 6). It is one of the measures of agricultural production intensity on farms.

Table 6. Capital to land ratio (total assets not including land in PLN thousand/1 ha of agricultural land; basic prices of 2014)

Items	Group	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Total	Beneficiaries	16.5	14.2	14.7	15.0	14.6	14.6	14.9	15.7	15.0	15.1	14.8
	Other	24.2	21.3	21.2	21.1	20.0	19.6	19.8	20.5	19.8	19.5	18.9
Region A	Beneficiaries	11.0	9.3	9.7	10.2	10.2	10.5	10.6	11.2	11.0	10.8	10.9
	Other	16.1	14.4	14.3	14.9	14.1	13.6	14.3	14.8	14.5	13.9	13.8
Region B	Beneficiaries	18.5	16.0	16.7	17.0	16.6	16.4	16.9	17.7	16.4	16.8	16.3
	Other	23.7	20.6	20.5	20.2	19.1	18.6	18.8	19.4	18.5	18.6	17.9
Region C	Beneficiaries	21.4	18.6	18.5	19.0	17.8	17.6	17.8	18.6	17.9	17.7	17.2
	Other	25.4	22.5	22.8	22.9	21.8	21.5	21.6	22.6	21.9	21.5	21.1
Region D	Beneficiaries	18.4	16.7	16.8	16.0	15.0	14.9	14.9	15.9	16.4	15.9	15.3
	Other	41.1	35.5	33.1	31.9	30.1	29.0	29.0	29.9	28.4	26.6	25.2

Source: own study based on unpublished Polish FADN data.

Higher capital to labour ratio was observed on farms that have not implemented the agri-environmental scheme. This corresponds to the objectives of the agri-environmental scheme pursuant to which care for the environment accompanies intensification of production. As it can be implied from the findings analysed earlier, the fixed asset value per 1 ha of agricultural land decreased, mainly due to the growth in the land area that was faster than the change to the capital, though the course and effects of both phenomena differed. The agri-environmental farms dynamically increased the value of their buildings, machines, means of transport and breeding livestock, but the growth in land area was higher. On the other hand, the value of capital in 2005 and 2014 did not differ much on other farms (Fig. 2), and the increase in land area was lower than on agri-environmental farms.

These phenomena results in decreasing difference between both groups of farms. This comparison leads to a conclusion that the agri-environmental scheme was implemented by farms where the technical intensity of land use was lower. The ongoing changes to these entities, causes of which include agri-environmental payments, result in a drop in capital intensity of land use, but results obtained by the beneficiaries approach the entities that do not implement the agri-environmental measures.

The said phenomena related to change in capital and the conclusions from them are confirmed by analysis of particular regions. The results for the "Wielkopolska i Śląsk" region are particularly illustrative. The average area of a farm implementing the agri-environmental scheme increased by 10 ha to 54 ha. At the same time, the fixed assets value (not including land value) grew by 26%, while the investment in the comparison group meant recovery measures, i.e. the value of fixed assets did not change. It may

be stated that the farms developed dynamically while implementing the agri--environmental scheme, and the technical intensity of land used clearly approached the value for other farms. The findings for FADN regions are also confirmed by Niewęgłowska (2006), who wrote that the scheme was most popular in those parts of Poland (particularly at the initial stage of implementation) where agriculture was intensive and where farms own large area of agricultural land.

Another important aspect of the effect of the agri-environmental payments on the way the farms function is the entities' capability to use external sources of funding for their development. Purchase of land and investment in fixed assets required not only expense of own funds from their own operations and transfers from the 1st and 2nd pillar of the CAP, but also repayable external funds. It should be emphasised that the implementation of most agri-environmental packages did not require the farmer to bear significant cost, but it was supposed to result in extensification of production as a principle. Therefore, incurring a debt for investment in fixed assets aimed at development of the farm. Average debt of farms implementing agri-environmental measures nearly doubled (Table 7).

Despite that, the debt to total liabilities ratio decreased. This means that farms that received subsidies and agri-environmental payments were more credible, which made it easier to obtain a loan. Apart from the external assessment, it was easier for farm managers to make a decision to incur a debt when, apart from the operational profit margin, the agricultural income was supplemented by the payments from the agricultural policy mechanisms. Thus, the funds from the 1st and the 2nd pillar of the CAP become a kind of buffer for market fluctuations.

Table 7. Debt of studied farms in 2004-2014

Items	Group	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Total liabilities (PLN thou.; basic prices)	Beneficiaries	83.8	82.9	97.9	105.9	117.8	125.5	123.4	131.9	140.0	151.3	156.1
	Other	75.3	73.4	81.9	88.6	90.7	89.4	88.1	88.9	93.1	97.6	100.7
Debt as a percentage of liabilities (basic prices)	Beneficiaries	12.5	12.9	14.0	13.5	14.7	8.5	8.3	8.5	9.0	9.6	9.6
	Other	12.1	12.3	13.0	12.9	13.1	7.7	7.6	7.5	7.8	8.3	8.4

Source: own study based on unpublished Polish FADN data.

Regional analysis demonstrated that the debt was the highest (over PLN 200,000 per farm in 2013 and 2014) in the case of beneficiaries located in the western and central part of the country. Compared to other farms, the average amount of liabilities was nearly two times higher. In the eastern part of Poland (regions C and D), liabilities amounted to PLN 80,000 and were nearly identical in both analysed groups. These findings, compared to the changes to the value of land and capital, lead to the conclusion that farms that benefited from the agri-environmental scheme, particularly in the western part of Poland, were large and very large farms, and the implementation of the measure allow them to develop much faster (which included development using the repayable sources of capital) than the farms not implementing the scheme.

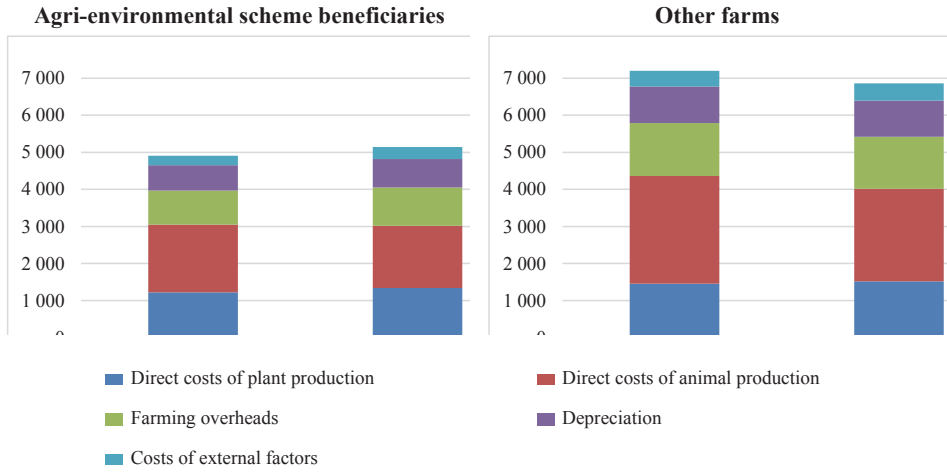
The findings include the technical efficiency of production. In plant production, the wheat yield proves that the implementation of obligation under agri-environmental scheme packages did not affect the extensification of production. During the 11 years subject to analysis, the beneficiaries managed to reduce the difference in wheat yields and milk productivity, which was low anyway. In principle, the comparable 2014 performance for both groups was significantly higher than the average national performance, which amounted to 47 dt/ha (*Wyniki...*, 2016). Similarly, the technical efficiency in animal production, illustrated by milk productivity, grew on beneficiaries' farms and reached a level similar to other farms from the FADN pool and significantly higher efficiency than the average value for the entire country (5,047 l/head). Therefore, inclusion of agri-environmental scheme requirements did not result in the drop in productivity.

Table 8. Technical efficiency of production

Items	Group	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Wheat yield (dt/ha)	Beneficiaries	53.7	50.6	41.5	45.8	51.4	51.0	50.9	51.1	45.8	53.5	62.2
	Other	57.4	52.6	44.3	49.4	55.7	52.2	51.7	53.2	49.2	55.9	63.3
Milk productivity (kg/cow)	Beneficiaries	4,290	4,622	4,728	4,730	4,835	4,932	5,082	5,226	5,564	5,581	5,766
	Other	4,570	4,933	4,979	5,041	5,147	5,225	5,303	5,450	5,720	5,738	5,888

Source: own study based on unpublished Polish FADN data.

Figure 4. Level and structure of cost in PLN per 1 ha of agricultural land on studied farms in 2004-2014 (basic prices of 2014)



Source: own study based on unpublished Polish FADN data.

In the context of animal production, it is worth demonstrating that the stocking density in terms of number of livestock units per 1 ha of fodder crops on agricultural land was clearly lower among the agri-environmental farms than in the control group. Among the agri-environmental farms, the clear increase in the number of animals (by

50% in 2004-2014) was accompanied by the increase in land area that was so dynamic that the final stocking density amounted to 1.3, while in the case of other farms, this index amounted to 1.9.

The production factors and relations between them determine the development potential. The direction and dynamics of resource use, expressed by means of production scale, is related to the level and structure of production cost (Fig. 4).

Average costs borne for production on agri-environmental farms were lower than among other entities. In the initial and final years of analysis, the proportion of direct costs of animal production dropped in both groups, but there was no significant change to the total cost.

Production intensity, measured e.g. in terms of material and service inputs (intermediate consumption) affects the resultant production value, but there are other factors that play a significant role, such as natural condition (soil quality, weather), market conditions (including primarily price scissors), and the farmers' skills and knowledge. Having regard to this, it was decided that the next measure of production intensity level used to analyse farms should be intermediate consumption per 1 ha of agricultural land. In the control group, there was no significant change to the cost. The case was similar among the farms implementing the scheme. This proves that the increase in agricultural land area was accompanied by a proportional growth in direct cost and farming overheads. Thus, increase in the area resulted primarily from production considerations.

Table 9. Intermediate consumption in PLN per 1 ha of agricultural land on studied farms in 2004-2014 (basic prices of 2014)

Items	Group	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Intermediate consumption (PLN thousand; basic prices)	Beneficiaries	3,966	3,544	3,719	4,341	4,307	3,685	3,756	4,311	4,318	4,184	4,049
	Other	5,788	5,180	5,353	6,064	6,075	5,275	5,306	6,016	5,940	5,736	5,420

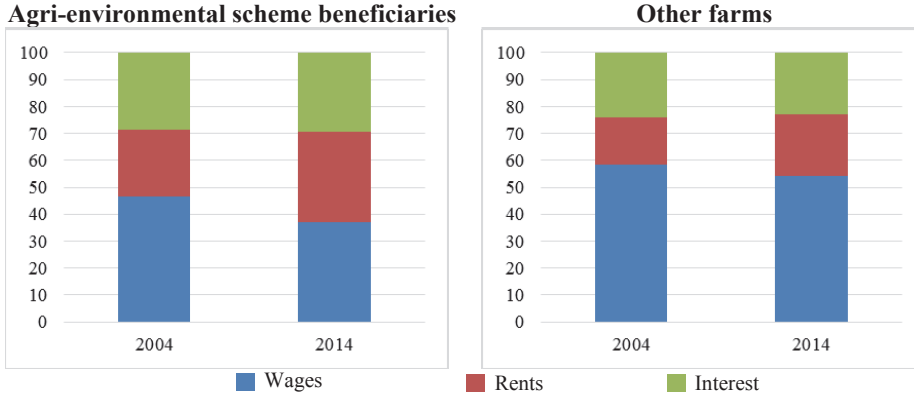
Intermediate consumption includes direct cost (including products produced and consumed during production process on the farm) and farming overheads accompanying operations during an accounting year.

Source: own study based on unpublished Polish FADN data.

The rate used for evaluating the development strategy of farms is the use of external production factors, i.e. labour, land, and capital. Where own resources are limited, farms raise their production potential through tenancy of land, loans, or employment of workers. Finally, the payment for the external production factors is reflected in the cost. The cost of external production factors amounted to 5% of total cost in 2004 in both groups, and the dynamic of its change was identical – to about 6.5% in 2014. This shows the similar development strategy among entities. However, the difference lies in the structure of external production factors cost (Fig. 5). Implementation of the agri-environmental scheme did not require employing additional workers. Though, the percentage of farms that employed additional people was similar, about 30% (Table 10), the hired labour input constituted 13% of the total labour input, while this percentage amounted to 18% in the control group. Therefore, the cost of hired labour was smaller.

In the dynamic approach, the cost of hired labour (in terms of basic prices) increased at an identical rate. The agri-environmental farms bore higher tenancy cost, which (apart from other factors, such as difference in rents) is confirmed by the higher proportion of leased land. Upon joining the agri-environmental scheme, the farms leased on average 30% of total land area in tenancy (among other farms, it was 27% in 2014). In 2014, this proportion increased (primarily due to the increase in farm rents), though the increase in area of those farms was based primarily on purchase of land – leased land constituted about 30% in 2014. What was characteristic of both studied groups was the decrease in the number of entities taking advantage of loans, but the percentage dropped from about 80% in 2004 to 60% among the beneficiaries of the agri-environmental programme, and to 50% in the control group. In general, this trend may be related to the substitution of repayable external funds with non-repayable funds – subsidies. It could be expected that the beneficiaries of the agri-environmental scheme will be able to resign from using commercial loans and will become capable of further reducing their debt due to higher amount of support by virtue of scheme implementation.

Figure 5. Structure of external factors cost



Source: own study based on unpublished Polish FADN data.

Table 10. Number of farms using external production factors in the first and the final year of analysis

Type of external production factors	Group	2004	2014
Work (hired labour)	Beneficiaries	278	266
	Other	862	828
Tenancy of land and buildings	Beneficiaries	561	620
	Other	1,387	1,601
Loans for purchase of land, buildings, machines and equipment, animals and materials	Beneficiaries	698	514
	Other	2,052	1,315

Source: own study based on unpublished Polish FADN data.

The starting point and the direction of change on beneficiaries' farms and in the control group defined the level and structure of production. In all years of analysis, the fluctuations of production value were similar. The unstable situation on agricultural

markets, which resulted from the economic crisis resulted in the drop in the value of production in 2008 and 2009 (Table 11). In the following years, the increase in the value of production was a bit more dynamic among the beneficiaries. In the five final years, the farms implementing the agri-environmental scheme reached a higher production level, and the difference eventually amounted to 15%.

If we take the agricultural land resource into consideration, land productivity was lower among beneficiaries (Table 11). This results from lower labour and capital intensity. The key factor to economically evaluate the effects of the agri-environmental scheme for production is labour productivity. On the farms applying for agri-environmental payments (judging from the earliest years of scheme implementation), the workers were characterised by higher productivity. With the relatively constant labour input, the growth in the value of production that was faster than in the control group contributed to the improvement in the performance.

Table 11. Total value of production on studied farms in 2004-2014 in PLN thousand (basic prices of 2014)

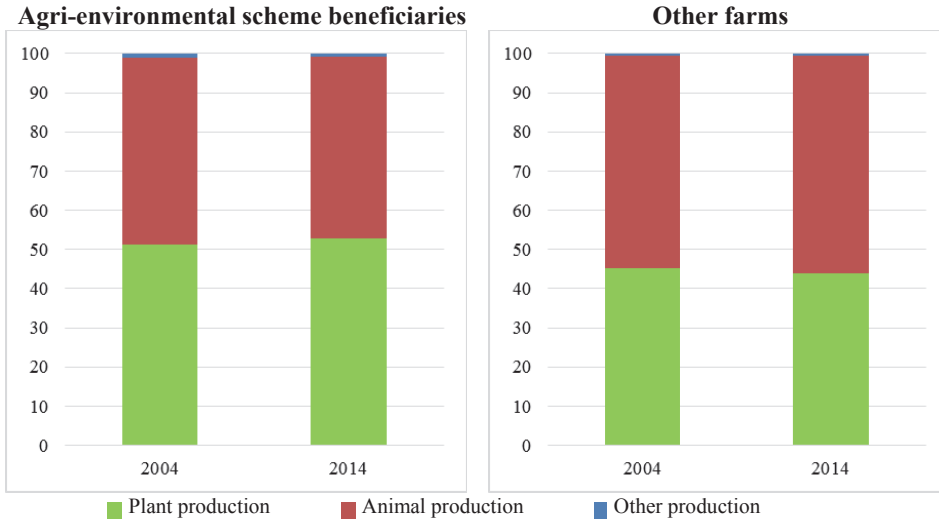
Items	Group	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
average per farm	Beneficiaries	277.1	218.7	256.2	301.9	243.7	239.9	303.4	338.2	323.2	312.7	305.2
	Other	256.8	218.0	248.7	287.7	234.1	229.5	282.2	306.9	285.1	273.7	263.3
average per 1 ha of agricultural land	Beneficiaries	6.9	5.2	6.0	6.9	5.5	5.3	6.6	7.2	6.7	6.4	6.1
	Other	9.9	8.3	9.3	10.5	8.3	8.1	9.8	10.5	9.5	9.1	8.7
average per 1 AWU	Beneficiaries	140.5	111.1	128.3	152.2	122.7	121.5	154.2	169.2	162.3	156.1	151.6
	Other	124.4	104.6	118.0	137.1	110.4	109.1	136.8	145.3	134.0	129.6	124.6

Source: own study based on unpublished Polish FADN data.

It is worth pointing to the proportion of animal production in the production structure. On the beneficiaries' farms, animal production constituted about 50% of the total value. In the dynamic approach, the proportion of animal production basically remained unchanged in both studied groups, but it slightly dropped in the control groups and grew among the beneficiaries. It occurred without any additional environmental pressure, i.e. without an increase in stocking density. As it has been mentioned above, stocking density remained at about 1.3 livestock units per 1 ha of fodder production area. It is worth noticing that the agri-environmental payment includes compensation for loss (e.g. decrease in production) resulting from decreased stocking density. Stocking density did not drop, but this is not a negative phenomenon. In this regard, it is necessary to maintain balance, and the proper selection of production direction that includes animal production ensures use of organic fertilisers, closing of the organic matter cycle and organic matter balance on the farm and also supports achievement of sufficient production efficiency. Adjustment of stocking density to the absorption potential of the ecosystem requires taking account of relations and feedbacks between plant and animal production, which is the essence of the organic approach and an important environmental indicator (Krasowicz, 2005).

From the agricultural producer's perspective, income is the most important effect in business activity assessment. It is also the key gauge of economic effectiveness of agricultural policy measures. The results affect the standard of living for the farmer's family and fundamentally determine opportunities for further development of the farm. The analysis of income earned by the studied farms shows that there was basically no difference between the farms that joined the agri-environmental scheme and other farms when the CAP mechanisms started to be implemented. Therefore, the common opinion that the benefits of the 2nd pillar of the CAP, including the agri--environmental packages, were (and are) the domain of farms characterised by a definitely better financial situation.

Figure 6. Production structure



Source: own study based on unpublished Polish FADN data.

The evaluation of income, particularly with regard to changes in the dynamic approach, should take account of the fact that the final result is the effect (and thus a gauge) of the agricultural producer's decision concerning current operations and strategic measures – primarily investment. What is more, income is determined by a number of exogenous factors that farm managers can do little or nothing about. This was the case of the situation of the entire economy, including agriculture, in 2008 and 2009, when the economic crisis had negative impact on income of farms. Referring to the earlier findings, we may indicate that the phenomenon with the greatest impact was the drop in value of production resulting from worse situation on global and national food markets. Due to this, the price relations also deteriorated. Price fluctuations resulted primarily in the drop in the value of production (on average by PLN 58,000) with simultaneous increase in production cost (on average by PLN 50,000). The research shows (Czyżewski and Grzelak, 2011) that the factor which stabilised the situation in agriculture itself was the increasing direct payments. Therefore, payments under the agri-

-environmental scheme became even more of an additional stabilising factor for farms that benefited from the 2nd pillar of the CAP. However, the research shows that this was not the case. A significant drop in income that occurred in 2008 and 2009 affected all entities, and the increase in payments was an insufficient buffer to protect farms during the crisis. This results from the fact that the payments constituted only a small portion of income (particularly at the initial stage of the EU membership, which coincided with the crisis), and the income situation was most dependent on the market.

In 2009, payments per farm were similar in both studied groups. As the scheme was implemented and further payments flowed in, the dynamic of income growth of the beneficiaries' farms was higher. After four years, the beneficiaries' income very clearly exceeded the outturn of the group that did not implement the scheme. The previous analyses show that the effect of systematic investment manifested itself. In the early years following the investment (which, as it has been pointed above, was to some extent stimulated by additional payments), it is possible that the outturn of entities will deteriorate because the debt servicing cost increases and the first production effects have not yet been visible. In agriculture, particularly in the animal production where the production cycle is long, the delay is a characteristic feature. Only in later years, do the effects of investment exceed the running cost resulting from the investment expenditure.

Figure 7. Family farm income on studied farms in 2004-2014 in PLN thousand (basic prices of 2014)

dark green – total beneficiaries' income; light green – beneficiaries' income without agri-environmental payments; red – other farms

Source: own study based on unpublished Polish FADN data.

Differences in average production factors resources at the disposal of entities in the four studied regions and farm management translated into regional differences in farm income. The most important observation when comparing regions is the division of Poland into the north-western (regions A and B) and the south-eastern part (regions C and D) – Table 12. In the former region, where the situation in the fields of structure and production is relatively better, income of the agri-environmental scheme benefi-

ciaries increased by 40%[10], while on the other farms, this increase amounted to 12%. This means that the agri-environmental payments were among the factors that made the more dynamic improvement in the financial outturn and increase in differences in income. In regions C and D, the trends were analogous, but the increase in income amounted to 25% and was 13 percentage points lower than in the control group. It results from the fact that the agri-environmental scheme made it possible to accelerate improvement in income of farms, particularly of larger ones.

Table 12. Family farm income in particular regions in 2004-2014 in PLN thousand (basic prices of 2014)

Region	Group	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Region A	Beneficiaries	136.2	76.7	131.4	163.0	45.7	91.7	185.6	182.3	170.9	164.2	161.5
	Other	112.5	94.5	117.9	138.4	43.8	69.5	166.5	166.4	130.9	114.1	123.6
Region B	Beneficiaries	129.2	79.1	124.9	136.1	47.7	84.4	175.6	184.1	154.3	146.9	147.9
	Other	102.2	69.1	101.9	108.5	32.0	64.1	131.3	130.5	106.3	95.1	97.2
Region C	Beneficiaries	64.8	47.5	82.2	85.4	41.0	50.7	112.1	113.6	82.2	87.3	74.0
	Other	69.8	57.9	84.2	95.7	34.3	45.2	103.2	106.3	81.3	81.6	76.5
Region D	Beneficiaries	71.6	50.6	88.6	86.5	35.2	47.1	109.8	111.7	99.3	86.9	82.0
	Other	71.9	53.3	96.2	108.4	39.5	57.3	109.2	107.6	88.7	81.4	77.8

Source: own study based on unpublished Polish FADN data.

These conclusions are confirmed by one of the most important business activity indicators in agriculture, i.e. income per employee (Table 13). On beneficiaries' farms, labour profitability increased by 35%[11]. Compared to other farms, the outturn proves the economic benefit from the implementation of the agri-environmental scheme. Labour profitability in entities not implementing agri-environmental measures increased only by 10%, which means PLN 20,000 per employee in terms of absolute values. Even if payments under the scheme are not included in the income, the beneficiaries' outturn is better. After subtracting the agri-environmental payments, the beneficiaries' income per employee was on average PLN 13,000 higher in the three final years (i.e. 2012-2014), while in the initial part of the studied period, this difference (in terms of basic prices) amounted to PLN 7,000.

Productivity analysis showed that despite the higher value of production per farm, the land resources held by beneficiaries were higher, but land productivity was lower. As a consequence, income per hectare of land was lower than on other farms (Table 13).

When comparing both groups, implementation of obligations under the scheme, including the necessary investment, did not affect the profitability of fixed capital. Development of farms, which manifested itself in the form of investment and fixed assets, resulted in higher income. Just like in all farms after the Polish accession to the EU and implementation of CAP mechanisms, this income largely resulted from the subsidies.

[10] In order to eliminate accidental market fluctuations, the evaluation of change takes account of average outturn (expressed in basic prices) for three subsequent years at the beginning and the end of the studied period, i.e. 2004-2006 and 2012-2014.

[11] The average values for the three initial and three final years of the studied period were compared.

Table 13. Production factor profitability on studied farms in 2004-2014 (basic prices of 2014)

Items	Group	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Income per 1 ha of agricultural land (PLN thou.)	Beneficiaries	2.6	1.6	2.6	2.8	1.0	1.6	3.3	3.3	2.7	2.6	2.5
	Other	3.4	2.5	3.6	3.9	1.2	2.0	4.2	4.2	3.2	3.0	2.9
	Beneficiaries – income without agri-environmental payments	2.6	1.6	2.5	2.6	0.7	1.3	3.0	3.0	2.5	2.3	2.2
Income per 1 AWU (PLN thou.)	Beneficiaries	53.8	33.8	55.2	61.3	22.1	36.5	77.3	77.9	66.1	63.2	60.8
	Other	42.2	31.5	45.5	50.8	16.5	26.8	58.8	57.8	45.6	42.7	42.4
	Beneficiaries – income without agri-environmental payments	53.8	33.5	52.5	58.0	16.5	30.6	70.9	71.3	59.8	55.8	54.5
Income per PLN 1 of fixed assets not including land (PLN)	Beneficiaries	0.21	0.14	0.24	0.26	0.09	0.15	0.31	0.30	0.25	0.24	0.23
	Other	0.18	0.15	0.22	0.24	0.08	0.13	0.29	0.28	0.22	0.21	0.21
	Beneficiaries – income without agri-environmental payments	0.21	0.14	0.23	0.24	0.07	0.12	0.28	0.27	0.23	0.21	0.20

Source: own study based on unpublished Polish FADN data.

Table 14. Subsidies as proportion of income of studied farms in 2004-2014 (basic prices of 2014)

Items	Group	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Subsidies as proportion of income (basic prices)	Beneficiaries	35	60	60	50	66	77	58	52	50	56	58
	Other	28	37	42	30	42	54	38	35	33	38	39
Agri-environmental payments as proportion of income (basic prices)	Only farms benefiting from the agri-environmental scheme in the specific year	-	27.2	11.8	9.2	15.6	14.7	11.7	10.9	11.1	13.6	13.8

Source: own study based on unpublished Polish FADN data.

Subsidies constituted over 50% of the income. The agri-environmental payments were quite important – they constituted about 10-15% of income (Table 14). It should be emphasised that the income of beneficiaries' farms increased regardless of transfers (after subtracting the subsidies). This increase was actually small as it amounted to mere PLN 4,000 per farm (from PLN 52,000 to PLN 56,000), but the income of other farms that did not receive the payments slightly dropped.

1.3. Summary

It turns out that the main beneficiaries of that aid were large entities, nearly twice as big as the other ones (the control group). The difference was particularly noticeable in areas characterised by large degree of farm fragmentation. In addition, they increased their agricultural land area much more dynamically. The farms that

applied for agri-environmental funds were farms characterised by higher productivity. The research shows that benefiting from the 2nd pillar of the CAP, including the agri-environmental package, was not the domain of much more profitable farms. Changes to the agricultural land area resulted in higher agricultural policy support. Direct and agri-environmental payments allowed those farms to develop faster. What is more, large farms could easier balance agri-environmental and economic goals. Where area was smaller, they could maintain lower land intensity, and the scale guaranteed appropriate income despite the lower land productivity and profitability. Niewęgłowska (2011) confirms the conclusion that participation in the scheme and other programmes under the CAP has provided farms with measurable economic benefits. In general, these farms are larger in terms of area, their economic outturn is better, they have more funds at their disposal to finance their running costs and investment, i.e. they are better managed compared to other farms.

Apart from compensation for lost profits and a kind of flat amount reimbursement of agri-environmental obligations, the outturn shows that the transfers played two important roles. First, they stimulate investment. The level of investment expenditure, the dynamics of fixed assets value growth and increase in land resource confirm the observation that the payments stimulated development of farms. By stabilising the economic situation of the farms, they increased their capability to use external sources of funding for development. The support in the form of agri-environmental payments constituted a significant portion of operating subsidies, and thus an important component of financial package of all possible funding sources for investment.

Second, the agri-environmental payments and other transfers from agricultural policy funds were a kind of buffer when the market situation was worse. During the economic crisis, the drop in investment was not as big as in the control group. What is more, the beneficiaries returned to the net investment spending level from before the crisis faster. However, the payments, even when we add the agri-environmental payments, were not a sufficient buffer to protect farm income in times of economic crisis.

Growing land resources meant that the ratio of persons to land decreased in the subsequent years, and production intensity expressed as the number of persons per 100 ha of agricultural land was lower on the beneficiaries' farms. The agri-environmental scheme was implemented by farms where the technical intensity of land use was lower. Nonetheless, implementation of agri-environmental scheme requirements did not result in the drop in productivity. Due to the growth in land resources that was faster than the change in capital, the value of assets per 1 ha of agricultural land decreased. Changes to the area translated into significantly lower stocking density on agri-environmental farms than in the control group. The farmers did not reduce the stocking density per hectare, but this is not a negative phenomenon for two reasons. Stocking density remained within the allowed limits and made it possible to maintain environmental balance understood as provision of natural fertilisers and organic matter to the soil.

The most important observation when comparing Polish regions broken down into the north-western (regions A and B) and the south-eastern part (regions C and D). Large and very large farms took advantage of the agri-environmental scheme particularly in the western part of Poland, and implementation of the measure allowed them to develop much faster. In the north-western part of the country, where the situation in the field of structure and production is relatively better, income (and labour profitability) of farms implementing the agri-environmental scheme clearly increased in the last five years of the analysis.

2. Economic condition of beneficiaries of compensatory aid in less-favoured areas (the so-called LFA)

2.1. Introduction

The diversity of rural areas results from different natural and geographic conditions. Some farms in problem areas (where soil is poor, topographical relief is unfavourable, etc.), located in less-favoured areas (the so-called LFA) face the following problems:

1. handicaps due to topographical relief and/or poor quality soil;
2. small area of agricultural land and small scale of production;
3. inefficiency of production and predominant low labour efficiency;
4. depopulation in some cases (e.g. the Carpathians);
5. change to demographic structure of the population (ageing, e.g. the Sudetes);
6. defeminisation;
7. absence of successors – the young escaping the so-called "lack of prospects";
8. negative migration balance, and the related issue of loosening family, social and cultural ties (e.g. the Carpathians).

The above problems make it significantly more difficult to function on the competitive EU market[12].

But then there are specific areas affected by additional factors that restrict agricultural development which were not appropriately estimated under valorisation of production area. Institute of Soil Science and Plant Cultivation (Matyka et al., 2013) attempted to determine the borders of those areas, using the information system on

[12] J. Góral, *Płatności ONW jako instrument realizacji celów konkurencyjnych i społecznych*, [in:] *Konkurencyjność gospodarki w kontekście działań polityki społecznej – perspektywa krajowa*, A. Kowalski (ed.), M. Wigier (ed.), Monografia Programu Wieloletniego 2015-2019 No. 26, IERiGŻ-PIB, Warszawa, 2016; A. Marcysiak, *Zakres oddziaływania płatności dla obszarów o niekorzystnych warunkach gospodarowania na wyniki ekonomiczne gospodarstw*, Zeszyty Naukowe SGGW. Ekonomika i Organizacja Gospodarki Żywnościowej, No. 68, 2008, pp. 127-133; T. Sobczyński, *Wyniki gospodarstw z terenów ONW na tle pozostałych – czy grozi nam zaniechanie produkcji w trudnych warunkach?*, Journal of Agribusiness and Rural Development, no. 2 (24), 2012, pp. 243-251; S. Kukuła, S. Krasowicz, *Regionalne zróżnicowanie polskiego rolnictwa w świetle badań IUNG – PIB*, 2006, http://sybilla.iung.pulawy.pl/Aktualnosci/pdfy/Regionalne_zroznicowanie_rolnictwa_w_swietle_badan_IUNG.pdf.

agricultural production area and the data from the National Agricultural Census 2010. On this basis, the following areas were classified as specific areas:

- protected natural areas,
- detention basins,
- suburban areas,
- mountains and foothills,
- problematic areas (see Table 1).

These areas are characterised by mosaic landscapes and a larger percentage of permanent grassland. About 620,000 farms function in those areas. These farms are characterised by extensive organisation of production (over 90% of cereals in cropping patterns in certain communes), low crop yields, and low stocking density. The necessity to respect the principles of nature protection raises the production cost, and this difference is particularly large in the case of Natura 2000 sites, where the environmental protection principles are most rigorous (Niewęgłowska, 2011).

Table 1. Specific areas in Poland

Breakdown	Agricultural land area (thousands of ha)*	Proportion of Polish agricultural land
Protected natural areas	3,736.8	25.2
Detention basins	971.0	6.6
Suburban areas	794.0	5.4
Mountains and foothills	675.2	4.6
Areas problematic for agriculture	4,563.3	30.8

* The specific areas should not be added because they may partially overlap.

Source: J. Kuś, M. Matyka, Zróżnicowanie warunków przyrodniczych i organizacyjnych produkcji rolniczej w Polsce, [in:] Z badań nad rolnictwem społecznie zrównoważonym (20) Wybrane zagadnienia zrównoważonego rozwoju rolnictwa, Monografia Programu Wieloletniego 2011-2014,IERiGŻ-PIB, No. 93, Warszawa, 2013, pp. 47-71.

The analysis by J. Kuś and M. Matyka (2013)[13] shows that agricultural area classified as mountains and foothils constitutes 4.6% of Polish agricultural land in three mountain ranges, i.e. the Carpathians, the Sudetes, and the Świętokrzyskie Mountains. These areas are characterised by unfavourable climate conditions, large slopes that make agriculture difficult and restrict machine efficiency, strong water erosion, and organisational constraints, such as significant farm and field fragmentation. As a consequence, agriculture in these areas is characterised by low efficiency, low stocking density, large proportion of land lying fallow, and decreasing interest in continuation of farming. There are about 250,000 farms in such areas (larger ones in the Sudetes and smaller in the Carpathians) producing mainly for subsistence. According to the above authors, the example of the Wielkopolskie and the Podlaskie Voivodeships indicates that proper organisation of production makes it possible to reduce negative effects of natural constraints. It should be

[13] J. Kuś, M. Matyka, *Zróżnicowanie warunków przyrodniczych…*, *op. cit.*

stressed that significant opportunities for increasing productivity are related to improvement in production organisation, i.e.:

- increase in area and land layout,
- optimisation of cropping patterns and crop succession,
- balancing of fertiliser management, with particular attention to improvement in soil pH, increase in stocking density,
- use of biological progress.

2.2. Compensatory payments

The EU states have been using a compensatory payment system since 1975. The idea to support farmers in less-favoured areas (LFA)[14] originated in 1946 in England, where support covered farmers raising sheep and cattle in hilly regions. The idea of compensatory payments remained the same across its history, but the criteria of calculation of payments for farm owners slightly changed. The basic purpose of this measure (under Rural Development Programme – RDP) is to compensate for smaller opportunities of farms located in areas where agricultural production is more difficult due to unfavourable environmental conditions[15]. These payments are supposed to compensate for profits (economic goal) lost due to natural constraints and to prevent depopulation of rural areas and loss of their agricultural character (social goal). At the European level, the framework of the LFA measure is defined broadly. Each Member State has much freedom as far as delimitation of LFA and determination of beneficiaries is concerned (Niewęgłowska, 2008).

In Poland, the following categories of less-favoured areas were distinguished: (1) mountains (2.1%), (2) areas with specific handicaps (5.3%), (3) lowland type I and II (92.6% of LFAs)[16]. In total, LFA payments in Poland cover nearly 11 million hectares, which constitutes about 60% of agricultural land in the country[17]. It is worth stressing that 98% of the Podlaskie Voivodeship is situated in such areas. The lowest percentage of LFAs was reported in the Opolskie Voivodeship (26%). So far, the beneficiaries of this instruments were farmers from 823,000 farms (including nearly 60,000 farms that was classified as mountain LFAs). Table 2 and Graph 1 show information on the number of beneficiaries of those payments in subsequent years. It is also

[14] LFAs were divided into 3 groups: lowlands, mountains and areas with specific handicaps. The division was done according to characteristic features.

[15] When applying for LFA payments, an agricultural producer is obliged to: (1) conduct agricultural activity on the area reported for payment for at least 5 years from the day the first payment is received; (2) apply normal good agricultural practice according to the need to protect the environment and maintain rural areas, particularly through sustainable agriculture.

[16] https://www.minrol.gov.pl/.../Zalacznik_1_PROW_2007_2013_w_3_21122009.pdf (retrieved on 22/05/2016); http://www.lfa.iung.pulawy.pl/gminy.htm (retrieved on 10/05/2016).

[17] In Poland, a beneficiary may be an agricultural producer managing the total area of agricultural land of at least 1 ha (arable land, orchards, grassland) situated in areas classified as Less-Favoured Areas under the RDP and following the normal good agricultural practice (a set of a few tens of standards related to rational fertiliser and sewage management, soil and water protection, plant protection agent storage, preservation of valuable habitats and species present in agricultural areas, and protection of landscape beauty).

worth emphasising that nearly 80% of beneficiaries are farmers who manage agricultural area of up to 15 hectares. The average Polish LFA payment amounts to about 60% of the average EU LFA payment. However, it should be mentioned that about 2.3 million hectares of agricultural land classified as LFAs is omitted in these payments due to the size of farms (area smaller than 1 ha)[18].

Table 2. Direct and LFAa payments in 2004-2014 (paid)

Year	Number of submitted applications (thou.)	Area covered by payments (thou. of ha)	Amount[b] of payments (PLN million)	Average amount (PLN per farm)	Average amount (PLN per 1 ha)
2004	1,400.4	13,689	6,342.5	4,529	463.3
2005	1,483.6	14,242	6,691.7	4,510	469.6
2006	1,478.6	14,020	8,201.5	5,585	585.0
2007	1,452.7	14,000	8,279.0	5,699	591.4
2008	1,419.5	14,210	8,583.9	6,047	604.1
2009	1,394.6	14,180	11,563.8	8,278	815.5
2010	1,373.3	14,100	12,403.1	9,032	879.6
2011	1,358.5	14,060	13,928.9	10,252	990.7
2012	1,359.0	14,100	14,297.4	10,518	1014.0
2013	1,356.0	14,100	14,500.0	10,716	1028.0
2014[c]	1,353.0	14,200	14,800.0	10,923	1042.0
LFA payments					
2004	628.8	6,439.3	1,145.5	1,822	177.9
2005	706.4	7,070.8	1,268.1	1,795	179.3
2006	717.6	7,150.0	1,295.2	1,805	181.1
2007	737.7	7,200.0	1,294.0	1,754	179.7
2008	744.6	7,400.0	1,280.0	1,719	173.0
2009	735.9	7,300.0	1,300.0	1,766	178.1
2010	734.0	7,260.0	1,245.0	1,696	171.7
2011	727.5	6,792.0	1,325.0	1,821	195.0
2012	730.0	7,020.0	1,355.0	1,856	193.0
2013	729.0	7,000.0	1,370.0	1,879	195.0
2014[c]	736.0	7,000.0	1,370.0	1,861	195.0

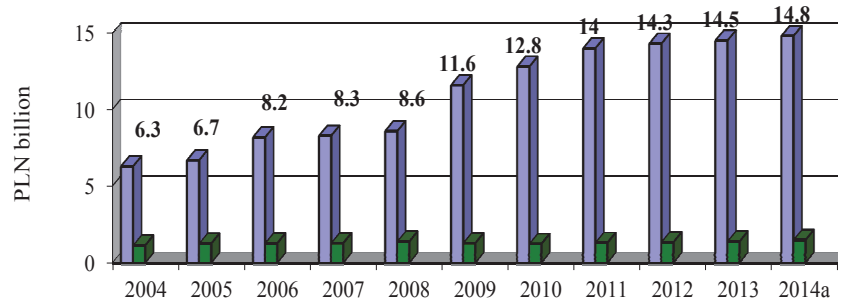
[a] Since 2007, there have been 4 LFA zones (mountains, lowlands type I and II, areas with specific handicaps); [b] Sum of SAP and CAP, SAP – Single Area Payment, CAP – Complementary Area Payment, SAP (2012) = PLN 732.06 /ha, CAP (2012) = PLN 201.88 /ha, sugar payment (2012) = PLN 52.44 / ha, support for fodder plant cultivation on permanent grasslands (2012) = PLN 206.99 /ha; [c] own estimates.

Source: M. Gruda, Finanse rolnictwa, [in:] Analiza produkcyjno-ekonomicznej sytuacji rolnictwa i gospodarki żywnościowej w 2013 roku. Edycja 51, A. Kowalski (ed.), IERiGŻ-PIB, Warszawa, 2014, pp. 69-107.

The average Polish LFA payment amounts to about 60% of the average EU LFA payment. Table 3 shows current rates of compensatory payments in Poland, which do not differ much from the rates of 2007-2014 (only the mountain LFA payments rose by about 40%). It should be stressed that the LFA payments are degressive at the farm level and are awarded where the area does not exceed 75 ha.

[18] Farms that do not receive such payments dominate in the most problematic areas, such as the Małopolskie and Podkarpackie Voivodeships (Czyżykowska, 2012). In this case, negligence of land use for farming and degradation of environment may occur.

Graph 1. Direct (blue) and LFA payments (green) in Poland in 2007-2013 (PLN billion)



Source: M. Gruda, Finanse rolnictwa…, op. cit.

Table 3. Rates of payment for particular LFA types in 2014-2020

LFA type		Rate [PLN/ha/year]
Mountains		450 (formerly: 320)
Lowland	Lowland zone I	179
	Lowland zone II	264
Specific		264

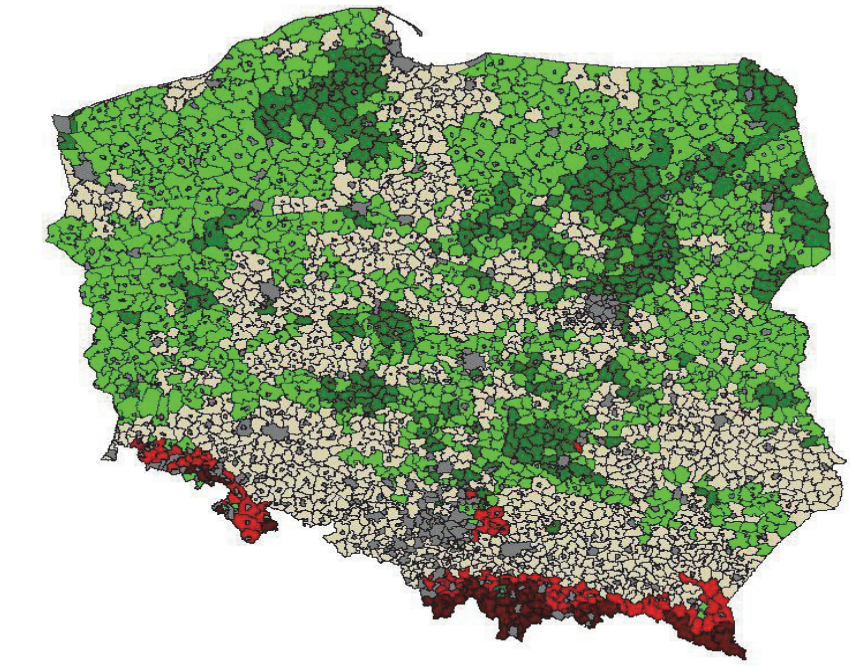
Source: own study based on information from: http://www.minrol.gov.pl/Wsparcie-rolnictwa/Program-Rozwoju-Obszarow-Wiejskich-2014-2020/Aktualnosci/Platnosci-ONW (retrieved on 20/06/2016).

Compensatory and environmental payments are not mutually complementary. The principle of complementarity remains one of the most important rules of public intervention. Its application results from the fact that effects of measures can be significantly increased using the means at one's disposal (the so-called synergy effect). Areas included into LFA payments and the agri-environmental scheme (currently the agri--environmental-climate scheme) cover most of the area of Poland (see Map 1-2), Due to this, farmers can improve competitiveness of their farms in a more visible way at the same time caring for the condition of the environment (sustainable intensification of production).

The LFA measure is an interesting research issue because it is based on two--way interaction: environment–man–environment. At the first stage, the areas where the natural conditions are unfavourable for agricultural activity. Owners of farms located in such areas receive compensatory payments. At the next stage, these payments make it possible to influence the environment by introducing a change to the method of fertilisation or recultivation of land that was previously not cultivated due to unprofitability of the process[19].

[19] K.Ł. Czapiewski, G. Niewęgłowska, *Przestrzenne zróżnicowanie dopłat wyrównawczych ONW w Polsce w 2004 roku*, Raport Programu Wieloletniego IERiGŻ-PIB 2005-2009, No. 31, IERiGŻ-PIB, Warszawa, 2006, p. 7.

Map 1. Areas covered by LFA payments in Poland



lowland-type LFA (zone I)

lowland-type LFA (zone II)

mountain-type LFA (zone I)

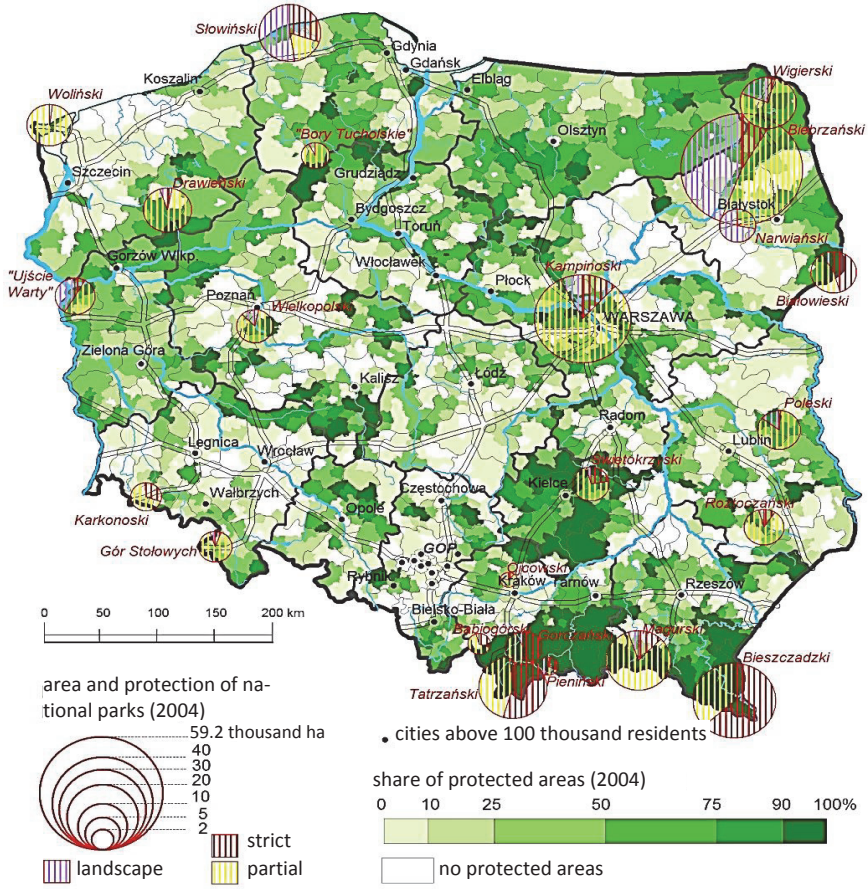
mountain-type LFA (zone II)

non-LFA areas

cities

Source: http://www.lfa.iung.pulawy.pl/dokumenty/zalacznik_c.pdf.

Map 2. Protected areas in Poland



Source: http://www.ios.edu.pl/pol/obszary_chronione.htm.

2.3. Findings from empirical research

It is doubtless that Polish farms in mountains and foothills were and still are in the most difficult situation (the average farm income per family member amounts to 30-50% of the parity income)[20]. The literature stresses primarily problems of the Carpathian area[21]. Due to the small agricultural land area of those farms, the com-

[20] J. Jadczyszyn, A. Rosner, *Próba charakterystyki społeczno-ekonomicznej obszarów o cechach niekorzystnych dla rozwoju funkcji rolniczej*, Wieś i Rolnictwo, No. 3 (160), 2013, pp. 77-94; W. Musiał, *Obszary problemowe rolnictwa w terenach górzystych Europy*, Studia i Raporty IUNG-PIB, No. 12, 2008, pp. 81-92.

[21] P. Cymanow, *Wybrane czynniki warunkujące mobilność ludności rolniczej na obszarach migracyjnych Karpat,* Roczniki Naukowe SERiA, Vol. 17, Issue 5, 2015, pp. 41-46; P. Cymanow, A. Florek-Paszkowska, *Ocena kosztów migracji ludności wiejskiej Karpat w kontekście zarządzania problemowymi obszarami migracyjnymi*, Zeszyty Naukowe SGGW, Problemy Rolnictwa Światowego, Vol. 15, Issue 2, 2015, pp. 26-34; B. Kutkowska, T. Berbeka,

pensatory payments constituted about 10% of their income. Studies by W. Józwiak and G. Niewęgłowska (2008; 2010)[22] show that only 10% of such entities support themselves exclusively due to agricultural production. The remainder earns their income from additional sources. Such farms are characterised by large proportion of fallow and uncultivated land, permanent grasslands and fodder crops[23]. Table 4 shows that farms that were granted mountain-type LFA payments have identical labour input as nearly two times larger farms classified as lowland LFAs. Table 4 shows examples of workforce surplus on Polish farms (particularly in mountain areas) whose economic situation was analysed on the basis of FADN data concerning particular years (2007, 2010, 2013). The outflow of a portion of agricultural employees seems reasonable. What it also necessary is the influx of capital to mountain farms, which would allow them to recover their assets and develop, e.g. towards agritourism or organic farming.

Farms situated in mountain LFAs are the farms of the lowest economic strength, up to 8 ESU, the specific handicaps LFA category includes farms whose economic size ranges up to 40 ESU, while type II lowland LFA farms are not represented in the group of farms exceeding 100 ESU. This means that farms located in LFA classified areas are characterised by smaller economic strength than non-LFA farms (Niewęgłowska, 2008).

In the case of lowland LFA beneficiaries, the situation appears to be much better. They are economically viable farms with prospects of development. In this case, LFA payments, particularly type I lowland payments, should be gradually reduced to cover those farms that have not yet overcome the difficulties resulting from their location for objective reasons and are situated in areas that are valuable due to their natural quality and landscape. The review of areas covered by the LFA instrument in 2018 will surely improve the effectiveness of compensatory payments (delimitation of lowland LFAs). This reform is supposed to consist in e.g. excluding the areas that have managed to overcome the natural constraints, e.g. through intensification of production, production practice (the so-called fine tuning), which will contribute to the reduction in the risk of the dead-weight effect.

Wspieranie rolnictwa na obszarach o niekorzystnych warunkach gospodarowania (ONW) na przykładzie rolnictwa Sudetów, Roczniki Naukowe Ekonomiki Rolnictwa i Rozwoju Obszarów Wiejskich, Vol. 101, Issue 2, 2014, pp. 55-69.

[22] G. Niewęgłowska (ed.), *Obszary o niekorzystnym gospodarowaniu w rolnictwie. Stan obecny i wnioski na przyszłość*, Raport PW 2005-2009, No. 95, IERiGŻ-PIB, Warszawa 2008; W. Józwiak (ed.), *Polskie gospodarstwa rolnicze w pierwszych latach członkostwa – kwestie efektywności i konkurencyjności*, Raport PW 2005-2009, No. 181, IERiGŻ-PIB, Warszawa 2010.

[23] A. Czudec, *Wielofunkcyjność rolnictwa górskiego i podgórskiego (na przykładzie Bieszczadów i Beskidu Niskiego)*, Polish Journal of Agronomy, No. 13, 2013, pp. 3-9.

Table 4. Economic effect of compensatory payments (average values for studied groups of farms from the Polish FADN base)

Breakdown	Year	Non-LFA	**Lowland LFA**	**Mountain LFA**
Total agricultural land (ha)	2007	30.8	**32.3**	**18.8**
	2010	35.0	**35.9**	**23.8**
	2013	35.6	**36.0**	**24.9**
Total workforce (full-time employees on the farm in the year)	2007	2.2	**2.0**	**1.9**
	2010	2.1	**2.0**	**2.0**
	2013	2.0	**2.0**	**2.2**
Return on equity (ROE)	2007	3.4	**2.4**	**-1.1**
	2010	1.5	**2.9**	**-1.4**
	2013	0.6	**0.2**	**-1.5**
Return on assets (ROA)	2007	2.6	**1.6**	**-1.5**
	2010	1.3	**1.1**	**-1.2**
	2013	0.5	**0.1**	**-1.5**
Debt to equity ratio	2007	14.0	**26.8**	**13.3**
	2010	7.4	**17.4**	**6.0**
	2013	8.0	**7.8**	**6.5**
Full-time employee's annual income (PLN)	2007	31,785.3	**30,360.5**	**21,020.4**
	2010	42,760.2	**41,341.1**	**26,401.3**
	2013	46,093.6	**44,268.9**	**26,856.3**
Total subsidies per 1 ha of agricultural land (PLN/ha)	2007	569.2	**711.0**	**724.1**
	2010	1,140.6	**1,334.1**	**1,553.5**
	2013	1,232.5	**1,335.8**	**1,652.1**
Subsidies as percentage of income (%)	2007	23.8	**35.0**	**32.9**
	2010	45.5	**58.2**	**68.7**
	2013	47.5	**55.8**	**71.9**
LFA payments as percentage of income (%)	2007	0.0	**6.0**	**6.2**
	2010	0.0	**6.3**	**9.1**
	2013	0.0	**5.9**	**10.1**
Agritourism income as percentage of income (%)	2007	0.1	**0.2**	**1.7**
	2010	0.2	**0.3**	**3.1**
	2013	0.1	**0.2**	**9.9**
Other services as percentage of income (%)	2007	1.4	**1.6**	**2.4**
	2010	1.2	**1.6**	**5.4**
	2013	1.3	**1.6**	**3.8**

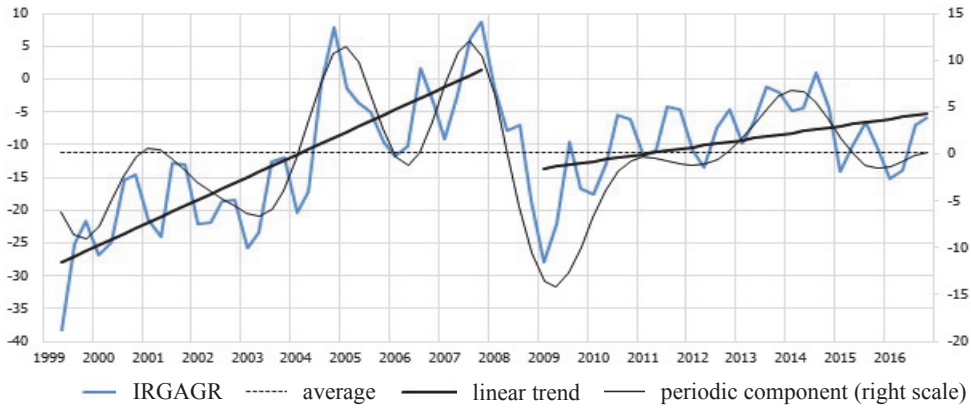
Source: J. Góral, Płatności ONW jako instrument realizacji celów konkurencyjnych i społecznych, [in:] Konkurencyjność gospodarki w kontekście działań polityki społecznej – perspektywa krajowa, A. Kowalski (ed.), M. Wigier (ed.), Monografia Programu Wieloletniego 2015-2019, No. 26, IERiGŻ-PIB, Warszawa, 2016.

LFA conditions (particularly in areas where the productivity of the natural environment is low) directly affect plant production, and indirectly – through fodder – animal production, which is accumulated in the economic outturn. Unfavourable outturn may induce farmers to abandon use of lower quality land (Sobczyński, 2012). The research by T. Sobczyński shows that fertiliser cost on farms situated in less-favoured areas in the EU countries was about 40% lower than cost borne in more favourable areas. Accordingly, the plant protection agent cost per hectare of agricultural land was nearly 60% lower. The clearly lower efficiency and higher plant production failure rate and risk in LFAs could induce farmers to stop using this land agriculturally, but the subsidies influenced land profitability. The subsidy system (not only the LFA payment) reduces disparities in land profitability between areas where conditions are favourable and less-favourable, which reduces phasing out of production in less-favoured areas.

The beneficiaries of compensatory payments were shown in quite a different perspective in Tables 5-10. There, farms were divided into plant, animal and mixed production according to production type (TF14 code)[24]. Then, each group has been divided into LFA beneficiaries and farms not benefiting from this CAP instrument. Among plant producing farms (Table 5), both groups reported increase in the value of production. In both cases, we can also observe a downward trend in labour input, which is a very desirable phenomenon due to low labour productivity in Polish agriculture and the surplus of workforce in rural areas. On the other hand, there was an unfavourable change to direct cost, which in 2014 grew significantly compared to 2007 (market situation in agriculture – Graph 2). This was reflected in economic indicators (Table 6), particularly in the decrease in productivity indexes.

It is worth adding that the situation of farms declined slightly in 2015, which was clearly shown in Graph 2. A similar trend continues in 2016.

Graph 2. Market outlook in Polish agriculture



Source: http://kolegia.sgh.waw.pl/pl/KAE/struktura/IRG/koniunktura/Strony/rolnictwo.aspx.

[24] www.fadn.pl, http://fadn.pl/publikacje/wyniki-standardowe-2/wyniki-standardowe-srednie-wazone/.

The 2015 farm income estimate based on macroeconomic calculations for the agricultural sector in the EU showed that the real value of income on production factor fell by 4.3% per full-time employee against 2014. This drop results from the decrease in the real value of farm income in the EU by 6.0%, and the simultaneous decrease in employment (by 1.8%). The calculations for 2014 showed that the income decreased by 1.7% against 2013, and the calculations for 2013 – 1.3% drop in income against 2012. Comparison of estimates with the 2010 data shows that the real value of agricultural income per full-time employee increased on average by 8% in the EU-28 (Floriańczyk, 2011; Chmielewska, Floriańczyk, Goraj, 2011). Comparison of the 2015 estimate with 2014 shows that Poland was among 18 countries which noted a drop in real value of income. The value of the indicator – 23.8% – means that Poland ranks second, after Germany, in terms of the drop in real value of income per full-time agricultural employee.

Table 5. Characteristics of farms with a predominance of crop production by TF14 (value per farm at current prices)

Items	Value of total production (PLN)	Farmland income (conversion ha)	Labour input (full-time employment)	Direct costs (PLN)	Depreciation (PLN)	LFA payments (PLN)
Non-LFA farms in **2007**						
average	206,112.2	53.7	2.2	65,053.2	25,253.0	0.0
standard deviation	301,568.2	78.9	1.6	101,532.0	27,507.1	0.0
median	126,189.4	31.2	1.8	37,415.5	17,152.3	0.0
Beneficiaries of LFA in **2007**						
average	209,376.1	48.7	2.3	68,132.8	26,302.4	7515.8
standard deviation	391,625.9	82.6	2.2	113,553.0	32,314.8	13576.9
median	104,672.5	21.6	1.8	30,870.7	16,527.3	4356.0
Non-LFA farms in **2010**						
average	235,394.7	62.0	2.0	79,986.7	34,522.0	0.0
standard deviation	287,560.2	72.8	1.5	105,684.1	37,016.7	0.0
median	156,041.1	38.9	1.8	48,689.9	22,800.2	0.0
Beneficiaries of LFA in **2010**						
average	208,915.6	50.9	2.0	72,151.4	33,576.8	8157.0
standard deviation	258,407.5	65.4	1.6	98,432.1	33,610.8	7122.0
median	123,336.6	28.5	1.8	37,487.7	21,933.9	5634.5
Non-LFA farms in **2014**						
average	253,502.0	56.4	1.9	100,640.9	40,048.2	0.0
standard deviation	316,405.7	65.5	1.3	132,001.4	44,762.2	0.0
median	157,567.8	36.6	1.7	58,925.2	25,242.2	0.0
Beneficiaries of LFA in **2014**						
average	215,574.8	43.9	1.9	85,875.7	38,255.0	6,940.5
standard deviation	289,654.3	57.6	1.4	118,145.3	42,668.3	5,568.3
median	118,120.5	24.3	1.6	43,846.2	24,582.3	5,257.0

Source: own study based on unpublished Polish FADN data.

Analysing these results it should be borne in mind that the population of beneficiaries of LFA were farms with agricultural land situated in the area of lowland. The farms were entities with very good economic condition, with the results often exceeded

the units that are outside the LFA payments. Therefore, these results inflated productivity of the whole group (Table 6). Apart from the separation of the individual subgroups LFA (lowland zone I and zone II and mountain), also seems necessary to analyze the data by region on the basis of FADN region or province. It is worth noting that the farms with plant production had the greatest amount of the LFA payments against the other two groups (animal and mixed production). The beneficiaries obtained slightly better economic results than the group outside the zone of compensation payments.

Table 6. Characteristics of farms with a predominance of crop production

Items	Value of total production per conversion ha (PLN/ha)	Value of total production per employee (PLN/employee)	Direct cost per conversion ha (PLN/ha)	Direct cost per employee (PLN/employee)	Productivity index (Tornquist index*)
Non-LFA farms in **2007**					
average	5,087.3	91,415.4	1,458.1	29,848.4	1.7
standard deviation	4,502.1	84,857.7	1,114.2	30,977.6	1.6
median	3,609.5	63,517.9	1,137.5	19,769.6	1.1
Beneficiaries of LFA in **2007**					
average	6,638.8	85,421.1	1,962.4	29,041.9	1.8
standard deviation	6,965.9	91,115.4	2,548.0	33,861.1	2.3
median	4,505.2	55,936.5	1,391.2	16,010.9	1.2
Non-LFA farms in **2010**					
average	4,776.7	119,083.2	1,441.0	39,083.2	2.5
standard deviation	4,254.9	101,270.6	998.4	21,270.6	3.4
median	3,525.8	88,939.9	1,184.0	18,939.9	1.3
Beneficiaries of LFA in **2010**					
average	6,329.9	103,176.0	1,817.6	33,176.0	2.7
standard deviation	7,320.0	101,442.7	1,699.7	15,442.7	4.1
median	4,073.0	71,140.0	1,360.2	18,140.0	1.4
Non-LFA farms in **2014**					
average	5,011.1	134,382.1	1,850.6	53,914.0	1.0
standard deviation	3,452.9	121,406.5	1,098.5	52,180.2	0.7
median	4,089.9	95,474.5	1,616.6	37,009.5	0.8
Beneficiaries of LFA in **2014**					
average	6,432.5	110,442.7	2,333.7	44,889.1	1.1
standard deviation	7,526.6	114,970.9	2,417.0	49,431.7	0.7
median	4,762.1	68,046.6	1,845.8	25,542.4	0.9

* Productivity and efficiency are concepts that relate to the efficiency of the economic entity in which the expenditures are processed in effects (Ziółkowska, 2008, 2009). This concept is well illustrated by the operations of the company. Measurement and analysis of productivity is a tool for effective management. Productivity, next to the company's ability to develop, it is essential sign of competitiveness. It determines the capacity for rational (optimal) use of resources. It is worth noting that the production activity is not the total sum of partial productivity, but rather the product. It recognizes the configuration of production factors and their utilization, identifies areas and possible synergies. Analysis of productivity carried out in companies of developed countries is regarded as an early warning system. Central database is created which enables to compare productivity at the industry scale. The result of their dissemination is to increase the productivity of businesses and the general improvement in productivity in the whole economy (Kosieradzka, 2000). To study the total productivity (Total Factor Productivity – TFP) in a situation of multidimensional inputs and the effects of the most commonly used indexes cover Malmquist productivity index and Tornquist index. Here the latter was estimated and presented.

Source: own study based on unpublished Polish FADN data.

Table 7. Characteristics of the farms with predominance of livestock production by code TF14 (value per farm)

Items	Value of total production (PLN)	Farmland income (conversion ha)	Labour input (full-time employment)	Direct costs (PLN)	Depreciation (PLN)	LFA payments (PLN)
Non-LFA farms in **2007**						
average	250,052.9	24.1	2.0	129,724.7	22,140.7	0.0
standard deviation	426,410.5	27.1	1.1	298,971.6	21,619.0	0.0
median	146,649.6	17.1	1.9	59,838.0	16,489.2	0.0
Beneficiaries of LFA in **2007**						
average	192,564.1	16.6	1.9	92,201.9	20,231.4	4,640.5
standard deviation	297,428.2	19.7	0.8	183,848.0	18,472.5	3,580.1
median	122,752.3	11.6	1.9	48,747.9	15,379.7	3,732.6
Non-LFA farms in **2010**						
average	272,602.2	28.0	2.0	137,878.5	29,410.0	0.0
standard deviation	394,260.2	25.5	0.7	260,308.2	26,265.2	0.0
median	173,387.9	21.3	2.0	69,781.7	21,739.6	0.0
Beneficiaries of LFA in **2010**						
average	220,329.9	18.4	2.0	103,224.2	28,075.3	5,509.2
standard deviation	347,114.5	19.7	0.8	217,920.5	27,152.0	4,553.7
median	132,038.5	13.2	1.9	51,099.1	20,590.8	4,322.0
Non-LFA farms in **2014**						
average	332,541.1	28.7	2.0	171,452.6	37,736.0	0.0
standard deviation	453,118.6	22.0	1.0	301,521.5	37,299.6	0.0
median	210,108.3	21.0	2.0	93,278.4	27,357.8	0.0
Beneficiaries of LFA in **2014**						
average	285,610.4	18.8	1.9	142,718.3	36,757.0	5,524.3
standard deviation	454,387.9	20.8	0.7	351,586.4	37,386.4	3,861.7
median	172,745.0	13.6	1.9	71,205.8	26,321.3	4,392.0

Source: own study based on unpublished Polish FADN data.

The population of farms with livestock production (Tables 7-8) was characterised by even greater variability than that of crop farms. At relatively similar levels of production direct costs were significantly higher than in groups shown in Tables 5-6. Beneficiaries of compensatory payments obtained relatively high results, especially better productivity (Table 8).

Beneficiaries of compensatory payments in the group with mixed production had relatively the lowest amounts of these grants (Table 9). They also had less--favorable relation results (Table 10). One suspects that the low level of specialisation and its high level of diversification increased costs. As a result, the average area of farms similar, as in the group with livestock production, achieved lower results. In this group, also in 2014 it stood out most unfavourably, which is associated with an abrupt downturn in agriculture.

Table 8. Characteristics of farms with the predominance of livestock production

Items	Value of total production per convertion ha (PLN/ha)	Value of total production per employee (PLN/employee)	Direct cost per convertion ha (PLN/ha)	Direct cost per employee (PLN/employee)	Productivity index (Tornquist index*)
Non-LFA farms in **2007**					
average	13,057.5	110,582.1	6,705.5	55,467.0	1.2
standard deviation	67,794.9	119,585.7	48,573.2	80,737.4	0.9
median	8,408.4	79,181.3	3,642.4	31,678.7	1.0
Beneficiaries of LFA in **2007**					
average	13,900.8	91,727.5	6,466.1	43,377.7	1.3
standard deviation	15,136.3	88,492.0	10,429.8	59,312.8	0.8
median	10,546.9	68,443.5	4,335.7	27,011.6	0.9
Non-LFA farms in **2010**					
average	11,693.5	126,221.4	5,973.0	62,984.9	1.1
standard deviation	41,489.0	137,309.5	29,016.0	93,261.0	0.3
median	7,891.5	90,492.3	3,427.7	37,696.4	1.0
Beneficiaries of LFA in **2010**					
average	13,514.0	102,531.0	5,973.2	46,912.7	1.2
standard deviation	11,827.6	103,110.3	7,356.1	64,800.6	0.3
median	10,246.6	70,951.0	4,089.8	26,844.1	0.7
Non-LFA farms in **2014**					
average	12,740.3	154,117.4	6,291.5	78,788.7	1.4
standard deviation	11,320.5	155,872.8	7,343.0	110,057.6	0.6
median	10,070.1	116,795.6	4,556.8	51,116.3	1.3
Beneficiaries of LFA in **2014**					
average	17,089.7	135,661.8	7,928.4	65,721.2	1.5
standard deviation	14,795.0	143,930.9	9,202.1	91,604.5	0.6
median	13,066.7	93,560.2	5,603.9	38,456.7	1.2

Source: own study based on unpublished Polish FADN data.

Table 9. Characteristics of the farms with mixed production (code TF14, value per farm)

Items	Value of total production (PLN)	Farmland income (conversion ha)	Labour input (full-time employment)	Direct costs (PLN)	Depreciation (PLN)	LFA payments (PLN)
Non-LFA farms in **2007**						
average	151,289.6	28.9	1.8	68,551.8	18,003.5	0.0
standard deviation	235,016.8	43.7	1.1	112,159.3	20,403.1	0.0
median	94,174.3	18.6	1.8	39,505.5	13,054.5	0.0
Beneficiaries of LFA in **2007**						
average	127,791.9	20.7	1.8	62,626.8	16,424.7	4,751.3
standard deviation	157,333.8	28.2	0.7	82,634.4	15,496.1	4,830.8
median	77,233.4	11.8	1.7	35,851.6	11,729.3	3,217.0
Non-LFA farms in **2010**						
average	161,022.6	30.2	1.8	73,398.2	22,570.1	0.0
standard deviation	186,242.9	33.4	0.7	93,811.1	22,810.2	0.0
median	103,135.1	20.9	1.7	42,731.4	16,132.2	0.0
Beneficiaries of LFA in **2010**						
average	145,071.0	22.2	1.8	68,214.9	21,806.1	5,235.4
standard deviation	261,488.5	32.7	0.7	124,888.9	23,306.7	4,818.3
median	86,961.6	13.2	1.7	37,884.6	15,148.2	3,868.5
Non-LFA farms in **2014**						
average	200,527.7	31.1	1.8	100,411.5	28,229.6	0.0
standard deviation	214,815.1	30.6	0.7	114,801.3	26,848.4	0.0
median	134,644.3	22.7	1.8	63,244.5	19,976.0	0.0
Beneficiaries of LFA in **2014**						
average	173,182.4	23.0	1.8	93,087.8	27,514.5	5,189.3
standard deviation	243,478.1	29.7	0.7	139,387.1	27,971.9	4,365.0
median	96,257.6	14.1	1.7	47,672.9	17,982.6	3,809.0

Source: own study based on unpublished Polish FADN data.

Table 10. Characteristics of the farms with mixed production

Items	Value of total production per conversion ha (PLN/ha)	Value of total production per employee (PLN/employee)	Direct cost per conversion ha (PLN/ha)	Direct cost per employee (PLN/employee)	Productivity index (Tornquist index*)
Non-LFA farms in **2007**					
average	6,000.5	75,797.7	2,673.7	34,473.7	2.2
standard deviation	4,570.0	65,328.2	2,025.8	33,517.9	2.1
median	5,022.9	55,553.4	2,169.1	23,939.8	2.0
Beneficiaries of LFA in **2007**					
average	7,940.6	67,276.9	3,804.8	32,923.3	2.1
standard deviation	6,192.7	57,555.9	3,143.6	31,090.5	0.9
median	6,248.3	47,802.4	2,995.7	22,745.4	1.9
Non-LFA farms in **2010**					
average	6,044.1	84,557.1	2,593.9	38,468.2	1.3
standard deviation	7,078.2	72,220.1	1,983.7	37,626.0	0.5
median	4,970.5	61,755.4	2,136.9	26,502.1	1.3
Beneficiaries of LFA in **2010**					
average	8,066.3	74,302.8	3,603.3	35,106.5	1.3
standard deviation	6,776.5	68,825.9	3,064.0	38,665.9	0.4
median	6,257.5	51,645.7	2,776.4	22,288.7	1.2
Non-LFA farms in **2014**					
average	6,873.8	106,094.4	3,360.6	53,400.1	1.5
standard deviation	4,553.6	91,953.3	2,117.1	51,886.8	0.7
median	6,065.8	79,398.5	2,981.9	36,612.1	1.3
Beneficiaries of LFA in **2014**					
average	8,917.8	88,118.9	4,690.8	47,345.0	1.3
standard deviation	7,789.1	91,970.6	4,445.2	54,254.1	0.7
median	7,157.6	56,207.7	3,596.5	28,514.6	1.2

Source: own study based on unpublished Polish FADN data.

The situation of the whole group is shown in Table 11, which shows all farms from FADN database divided into using and not using the LFA payments in 2007, 2010 and 2014. In addition, Table A1 placed in the annex, presents data on the largest scale farms in Poland, and also separates a subgroup of the beneficiaries of compensation payments. In this group you can see less consumption of NPK per hectare in comparison with the group outside the LFA. Both groups achieved similar levels of indices of productivity (TFP). It should be also remembered that the largest scale farms benefit most from environmental payments.

Table 11. Characteristics of all analysed farms from the Polish FADN database

Year	Location	Statistics	Soil valuation indicator	Profitability of total production	Return on equity	Return on assets	Net value added	Farm income (PLN)
2007	Farms outside the LFA	average	1.0	21.3	0.9	0.7	86,054.6	69,993.1
		standard deviation	0.4	25.1	7.6	5.8	161,964.1	125,997.5
		median	1.0	20.9	0.7	0.6	44,291.6	37,966.5
	LFA	average	0.6	20.2	0.8	0.6	79,959.8	68,792.8
		standard deviation	0.3	20.6	5.3	3.8	153,547.2	132,013.1
		median	0.6	18.9	0.7	0.4	43,442.4	38,850.0
2010	Farms outside the LFA	average	1.1	19.6	0.7	0.9	103,340.5	85,596.9
		standard deviation	0.3	20.4	9.8	10.0	160,735.9	132,150.9
		median	1.1	18.3	0.6	0.8	57,492.3	49,419.6
	LFA	average	0.6	18.9	0.6	1.2	97,394.5	83,037.8
		standard deviation	0.3	24.1	9.8	9.6	156,135.8	127,312.6
		median	1.1	17.6	1.0	1.2	58,493.8	49,916.7
2014	Farms outside the LFA	average	1.0	17.1	-0.8	-0.9	94,332.8	81,087.8
		standard deviation	0.3	24.4	11.3	9.3	165,451.5	137,782.2
		median	1.0	15.6	-0.5	-0.5	52,535.4	44,969.4
	LFA	average	0.6	16.5	-0.5	-0.8	88,174.4	80,201.6
		standard deviation	0.3	25.3	11.9	10.4	145,759.7	137,459.4
		median	0.6	12.9	-0.9	-0.8	47,884.8	44,765.8

Source: own study based on unpublished Polish FADN data.

2.4. Summary

Solutions regarding compensatory payments, just as environmental payments, meet frequent criticism. The key complaints include the lack of precision, lack of optimal assumptions, outflows from the support system and as a result – unjustified support for economically strong farms from the lowland zone I.

Uneven rates of these payments in the European Union are also subject to criticism. For example, in 2007-2013 summary LFA payments in Poland (EUR 41.2 per ha/year) were much lower than in Austria (EUR 164.8 per ha/year), France (EUR 100.8 per ha/year) and Italy (83.0).

The evolution of the LFA subsidies changed its goals – from social to environmental ones. Social objectives and putting an end to depopulation of the rural areas were eliminated, and the payment is intended to preserve the landscape and biodiversity through environment-friendly sustainable farming.

A review of literature and empirical research show that farms located on lowland LFA I are little different than non-LFA farms and the prevalence of intensive production activities is not conducive to environment-friendly sustainable farming. Therefore, this group of farms needs to be most thoroughly tightened.

An important element differing farms classified to compensatory payments are cost items, such as the use of employees, use of services, cost of chemical plant production products. These cost items mostly appear at non-LFA farms.

Undoubtedly, the largest amount of public aid is justified in the case of mountain farms, which do not have sufficient resources to reproduce fixed assets and invest in development. These areas require complex support and many simultaneous programmes, to make it possible to improve the quality of human capital and motivate residents to continue and expand their current activities.

It is possible that in the future it will be possible to combine environmental payments with compensatory payments, thus contributing to the simplification of the support system. To this end, it is also necessary to better clarify the purpose of this new instrument, which will greatly facilitate verification and assessment of the effectiveness of this support.

Appendix

Table A1. Characteristics of beneficiaries of LFA in a group of large-scale farms (over 100 ha)

Year	Statistics	LFA / outside the LFA	Total area of UAA (ha)	Ratio of total fixed assets to full-time workers	Direct pay-ments (PLN thou.)	2. Pillar pay-ments (PLN thou.)	Agri-envir. payments (PLN thou.)	Total subsidies (PLN thou.)	Equity / debts	Gross investment / depreciation	Current liquidity	Coverage the liabilities of financial surplus	kg NPK per ha	Livestock units (LU) per 100 hectares	Total employ-ment	TFP
2007	average	outside the LFA	**830.5**	**792.4**	**464.3**	**11.2**	**11.7**	**621.3**	**9.2**	**70.4**	**149.3**	**2.7**	**275.2**	**2.3**	**21.4**	**2.6**
	SD*		1,180.1	620.7	637.1	21.4	24.9	839.4	24.1	133.4	339.2	8.3	97.3	4.6	24.8	0.6
	median		476.5	**643.9**	267.0	0.0	0.0	336.0	2.1	37.8	5.9	0.7	279.0	1.9	9.0	1.8
	average	**LFA**	**626.8**	**765.2**	**352.0**	**10.4**	**40.3**	**494.8**	**5.6**	**54.2**	**138.5**	**1.5**	**223.7**	**2.1**	**14.6**	**2.5**
	SD		564.9	608.5	329.4	18.7	74.1	447.4	17.1	141.2	463.0	4.7	97.4	3.1	16.5	0.8
	median		454.5	**553.8**	246.0	0.0	0.0	369.0	1.6	7.6	3.3	0.4	238.0	1.6	10.0	1.5
2008	average	outside the LFA	**827.6**	**935.0**	**474.8**	**12.6**	**19.7**	**641.5**	**13.1**	**63.4**	**175.3**	**2.1**	**246.3**	**2.4**	**20.0**	**2.7**
	SD		1,219.9	652.7	789.0	20.6	38.4	954.7	29.5	134.7	371.2	5.0	113.2	4.6	22.8	0.9
	median		474.0	838.8	287.0	0.0	0.0	384.0	2.8	12.1	6.9	0.6	266.0	1.6	9.0	1.7
	average	**LFA**	**612.1**	**847.5**	**347.6**	**11.7**	**41.0**	**540.0**	**6.7**	**37.6**	**113.8**	**0.8**	**208.9**	**1.9**	**14.6**	**2.6**
	SD		554.4	696.6	320.0	18.9	75.1	464.2	17.9	73.6	341.7	2.2	94.7	3.4	17.7	0.7
	median		446.0	671.0	242.0	0.0	0.0	413.0	2.0	14.5	2.9	0.3	216.0	1.5	10.0	1.6
2009	average	outside the LFA	**834.5**	**962.1**	**671.6**	**16.3**	**23.0**	**925.2**	**8.6**	**25.8**	**114.4**	**1.6**	**256.2**	**2.3**	**19.8**	**2.6**
	SD		1,239.7	648.1	993.2	21.5	38.7	1,257.8	28.7	55.7	277.5	4.9	129.4	4.6	21.7	1.0
	median		476.0	787.3	386.0	0.0	0.0	545.0	2.5	2.7	5.4	0.5	262.0	1.7	9.0	2.1
	average	**LFA**	**616.7**	976.8	**473.0**	**21.8**	**33.4**	**704.3**	**5.5**	**44.3**	**57.0**	**1.3**	**191.7**	**1.7**	**14.1**	**2.3**
	SD		543.0	755.4	446.2	26.0	66.3	624.8	8.4	80.0	171.4	2.2	92.0	3.1	18.1	0.9
	median		442.0	746.9	341.0	5.0	0.0	520.0	2.5	11.2	3.0	0.4	190.0	1.4	9.0	1.6
2010	average	outside the LFA	**799.4**	1,109.1	**608.3**	**31.4**	**27.9**	**846.4**	**4.6**	**25.7**	**155.8**	**2.9**	**247.2**	**1.7**	**17.7**	**3.6**
	SD		1,164.6	767.5	758.2	34.4	46.0	959.1	5.6	43.0	406.9	9.0	99.5	2.6	19.7	1.2
	median		487.0	918.0	414.0	27.0	0.0	572.0	3.3	6.0	7.9	0.8	262.0	0.9	8.0	2.6
	average	**LFA**	**635.3**	978.5	**533.8**	**34.1**	**51.9**	**779.4**	**6.5**	**14.0**	**86.6**	**2.5**	**236.9**	**2.1**	**15.4**	**2.6**
	SD		678.5	774.9	592.5	49.4	70.4	824.6	11.0	18.1	247.9	5.1	141.1	5.1	19.8	0.9
	median		442.0	791.0	328.0	17.0	13.0	537.0	3.2	8.3	5.5	0.8	228.0	1.2	10.0	1.7

*SD – standard deviation.

Source: own study based on data from Economics of Farm Holdings Department of IAFE-NRI.

3. Impact of changes to direct payment system in 2014-2017 on support for selected types of farms

3.1. Introduction

The Common Agricultural Policy undergoes frequent reforms. The changing political and economic environment and new challenges determine new goals. At present, one of the goals of the CAP is to support environmental protection and to facilitate acceleration of rural development throughout the EU.

One of the key changes in the history of the CAP was the departure from supporting production to supporting producers by assigning payments to area of land in use. This fundamental change to the philosophy of financial support for farmers in the EU was made mainly due to the external pressure by the WTO to eliminate disturbances of the international trade in food and agricultural goods. External conditions were also the stimulus to start preparation of the next CAP reform 2014-2020, whose basic features included greening. The implicit goal of this measure was to legitimise financial support for agriculture due to the influence of the WTO, but also in response to expectations of the public in the EU.

Such change was necessary because of the challenges the Common Agricultural Policy faced at that time. To a large extent they resulted from the pressure from external factors. They were defined[25] as:

- economic (including food security and globalisation, drop in productivity growth rate, price fluctuations, pressure on production cost due to high cost of means of production, declining position of farmers in the food supply chain);
- environmental (related to the efficiency of resource use, soil and water quality, and threats to habitats and biodiversity);
- territorial (rural areas in some regions face demographic, economic and social changes, such as depopulation or relocation of businesses).

The last serious reform of the Common Agricultural Policy was decided jointly by the Council of the EU and the European Parliament. The process took such course for the first time in the history of the EU because the role of the European Parliament was limited to the advisory capacity.

The public debate on the future form of the CAP was initiated as early as in 2010, when the Commission presented the communication titled *The CAP towards 2020: Meeting the food, natural resources and territorial challenges of the future*[26] which discussed the initial goals and possible CAP reform scenarios for 2014-2020. In 2014, the process, which took nearly four years, resulted in the final shape of the CAP

[25] Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, COM(2010) 672, 18/11/2010.
[26] Ibidem.

reform 2014-2020. The final version of the regulation[27]is to a large extent based on an earlier proposal by the European Parliament. However, the final regulations that shape the future agricultural policy were made much more specific.

A significant change that is part of the last reform was the fact that some power to regulate direct payments was delegated to Member States. A new structure of aid instruments was introduced by dividing them into obligatory and optional. Due to this flexibility, the direct support system may be adjusted to the specific situation and needs of the agricultural sector in each country. The obligatory elements in the entire EU include:

– Single Area Payment,
– greening payment,
– young farmer payment.

Apart from the obligatory elements, optional ones were provided for, and their implementation depends on the decision of the Member States. These include: small farm payment, coupled payment, transitory national aid, additional payments[28].

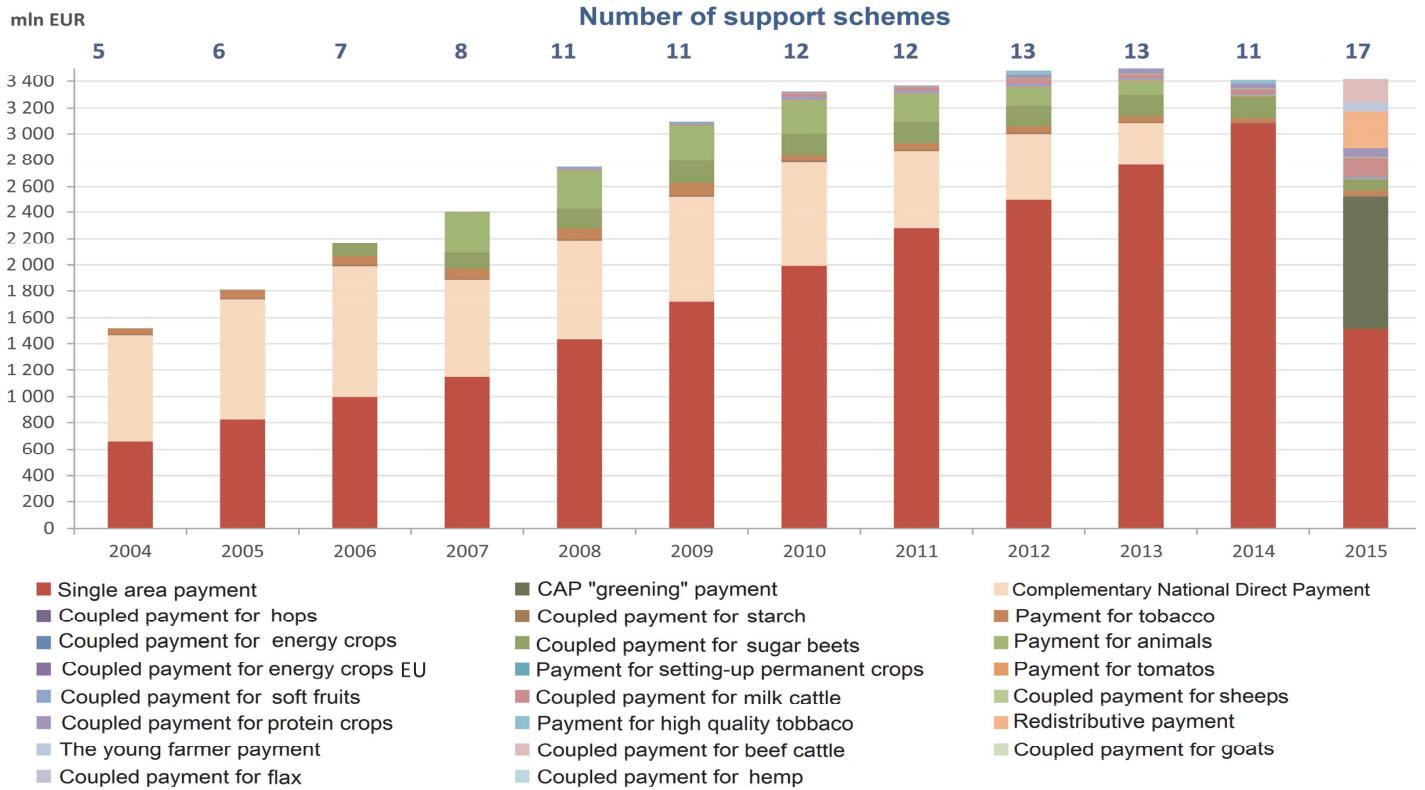
Another instance where decentralisation took place is the introduction of different sets of practices equivalent to a single requirement of the reformed CAP by individual Member States, i.e. the maintenance of the ecological focus area (EFA). In Poland, there will be a relatively extensive list of pro-environment practices (measures equivalent to EFA), which will include most of the practices provided for under the EU law. The only practices allowed under the EU law that were precluded are the terraces, traditional stone walls, and the so-called agroforestry systems. The national regulations define weighting and conversion factors that will be binding in Poland. They determine the degree of substitution of the EFA by specific landscape features.

Despite the repeated demands for simplification of the agriculture support system under the CAP[29], its partial decentralisation made it less transparent and more difficult to handle for third parties. Since the accession to the EU in 2004, the number of support schemes under the direct payment system increased over three times, from 5 to 17 (Graph 1). The significant increase in the number of support schemes resulted from the implementation of the most recent CAP reform starting in 2015.

As the number of support schemes grew, the complexity of the system increased. At the same time, it should be noted that in many cases, support depends on compliance with additional criteria related to the herd size, structure of crops, or the farmer's age (young farmer payment).

[27] 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.
[28] System płatności bezpośrednich w Polsce w latach 2015-2020 [Direct payment scheme in Poland for 2015-2020]; Ministry of Agriculture and Rural Development 2015.
[29] Mid-term review/revision of the multiannual financial framework 2014-2020. An EU budget focused on results [COM (2016) 603 final].

Graph 1. Evolution of budget schemes and changes to direct payments in Poland



Source: unpublished materials from the Ministry of Agriculture and Rural Development[30].

[30] Materials titled *Przegląd wieloletnich ram finansowych UE – skutki dla WPR, wnioski na przyszłość* [Review of the EU Multiannual Financial Framework – impact on the CAP, conclusions for the future], presented at the seminar organised by the Ministry of Agriculture and Rural Development, 13/10/2016.

Further factors that affect the amount of aid received by particular farms include changes to national regulations governing the prerequisites for the aid. After two years (2015-2016), there was a decision to implement changes related to optional elements of the direct payment system in Poland. The rules of dairy cow payments, sheep payments, legume, tomato and soft fruit payments will change starting in 2017. Despite the fact that the total support remains at a nearly identical level, the change to the way the aid is distributed can affect the amount of aid received by individual farms and thus the manner they implement the goals of the CAP. Therefore, this study attempts at determining the impact of changes to the direct payment system in 2014-2017 on the aid under the direct payment system by particular types of farms in Poland.

3.2. Research methodology

In order to study the impact of the changes to the direct payment system on aid received by particular types of farms, the 2014 data from the FADN system was used. The amount of selected direct payments paid in 2014-2017 was calculated for all 12,123 farms in the FADN sample. Calculations for 2014-2016 used historical records of payments published by the Agency for Restructuring and Modernisation of Agriculture[31], while the calculations concerning 2017 used estimated payment rates for the next year. Next, due to the stratified nature of selection of the FADN sample (each farm in the sample represents a specific number of farms in the population), the results were aggregated and the average aid for specific types of farms was determined using the economic size of farms, type of agricultural activity and location in the FADN region and LFAs as variables.

Due to the method used for calculating direct payment based on the distribution of a defined portion of the budget (the so-called financial envelope) under the particular support scheme rates of payments are not known until the eligible farmers submit their applications and the Agency for Restructuring and Modernisation of Agriculture makes the decision to grant the aid. If the interest in the specific support scheme exceeds the predicted interest, the rates are reduced proportionally in order to preserve the adopted budget plan.

Because the adopted budget is in euro, the exchange rate also affects the amount of aid paid to farmers. The European Central Bank exchange rates of the 30 September of the specific year are used to convert the payment amounts. In the studied period, it was:

- EUR 1 = PLN 4.1776 in 2014;
- EUR 1 = PLN 4.2428 in 2015;
- EUR 1 = PLN 4.3129 in 2016.

This study uses the 2016 exchange rate for 2017. The rates of payments determined for the purpose of this study are presented in Table 1.

[31] http://www.arimr.gov.pl/pomoc-unijna/platnosci-bezposrednie/platnosci-bezposrednie-w-2014-roku.html, http://www.arimr.gov.pl/pomoc-unijna/platnosci-bezposrednie/platnosci-bezposrednie-w-roku-2015.html, http://www.arimr.gov.pl/pomoc-unijna/platnosci-bezpo-srednie/plat-nosci-bezposrednie-w-roku-2016/stawki-platnosci-bezposrednich-obowiazujace-w-roku-2016.html.

Table 1. Rates of direct payments and financial envelopes for 2014-2017

Types of direct payments	2014 financial envelope (PLN million)	Rates of payments for 2014	Types of direct payments	Financial envelope for 2015 (PLN million)	Rates of payments for 2015	2016 financial envelope (PLN million)	Rates of payments for 2016	Estimated rates of payments for 2017
Single Area Payment (SAP) [PLN/ha]**	**12,859.4**	**910.87**	**Single Area Payment (SAP) [PLN/ha]**	**6,414.68**	**453.7**	**6,555.25**	**462.05**	**464.20**
			Greening payment [PLN/ha]	**4,302.45**	**304.31**	**4,399.49**	**310.1**	**311.39**
			Additional payment [PLN/ha]	**1,190.34**	**170.22**	**1,217.19**	**172.79**	**173.64**
			Young farmer payment [PLN/ha]	**282.80**	**258.97**	**293.30**	**231.97**	**233.13**
Cow payment [PLN/head]	**190.50**	**595.3**	**Cattle payment [PLN/head]**	**729.23**	**261.37**	**745.68**	**256.2**	**257.68**
			Cow payment [PLN/head]	**644.89**	**314.28**	**659.43**	**322.62**	**355.92**
Sheep payment [PLN/head]	**8.03**	**125.32**	**Sheep payment [PLN/head]**	**19.76**	**116.56**	**20.21**	**111.95**	**112.62**
			Goat payment [PLN/head]	**1.13**	**77.8**	**1.16**	**68.25**	**68.48**
Special legume payment [PLN/ha]	**125.33**	**556.37**	**Special legume payment [PLN/ha]**	**286.83**	**415.21**	**293.30**	**430.49**	**706.52/297.01****
Complementary hops cultivation payment (decoupled payments) [PLN/ha]	2.11	1,000.39	Hops payment [PLN/ha]	3.55	2,311.32	3.63	2317	
Complementary starch payment (decoupled payments) [PLN/ha]	36.09	351.69	Starch potato payment [PLN/ha]	36.78	1,387.12	37.61	1,287.75	
Separate sugar payment [PLN/tonne]	**665.88**	**53.61**	**Sugar beet payment [PLN/ha]**	**344.68**	**2,138.45**	**352.45**	**1,952.25**	**1,961.48**
Separate fruit and vegetable payment (tomato payment) [PLN/tonne]	28.05	165.55	Tomato payment [PLN/ha]	17.88	4,272.62	18.28	3,074.09	
Separate soft fruit payment [PLN/ha]	**46.12**	**1,569.76**	**Separate soft fruit payment [PLN/ha]**	**63.67**	**927.65**	**65.11**	**904.78**	**1,090.60**
Special aid for tobacco producers	121.30		Flax payment [PLN/ha]	2.42	411.92	2.48	289.94	
Complementary tobacco payment (decoupled payments)			Industrial hemp payment [PLN/ha]	0.39	572.49	0.40	547.59	
– light tobacco of Virginia variety group [PLN/kg]	103.02	4.53	Tobacco payment – Virginia variety group [PLN/kg]	98.13	4.34	93.20	4.12	
– other tobacco varieties [PLN/kg]	57.82	3.18	Tobacco payment – other varieties [PLN/kg]	55.08	3.05	52.31	2.89	

* The payment was paid only in selected voivodeships. ** Starting in 2017, a separate payment for fodder legume plants (lupin, soy, fodder peas, pigeon bean) cultivated for their beans and fodder plants (except for cultivation as green manure). *** Schemes analysed later in this study marked in bold.

Source: own elaboration based on materials from the Agency for Restructuring and Modernisation of Agriculture.

The analysis ignores support schemes for very specialist activity with relatively small budgets, e.g. tomato, hops, tobacco and starch potato payments, etc. Taking account of the fact that the FADN sample is representative due to e.g. the type of their agricultural activity and not due to the cultivation of particular plant species, its use for the analysis of the above types of activity would be fraught with error. At the same time, a significant portion of payments omitted in the analysis is historic in nature and results in the referential levels of support established earlier (starch potato payment and complementary tobacco payment), and changes to the amount depend only on the euro to zloty exchange rate.

Consequently, the analysis takes only the following aid schemes into account:

1. Single Area Payment,
2. greening payment,
3. additional (redistributive) payment,
4. young farmer payment,
5. cattle payment,
6. cow payment,
7. sheep payment,
8. goat payment,
9. high protein plant payment,
10. sugar beet payment,
11. soft fruit payment.

In order to compensate for the differences in aid for LFA farms, these payments were also taken into consideration. At this point, however, it should be stressed that these payment are not strictly part of the direct payment system, and they are not paid under the Rural Development Plan. Nonetheless, due to their character (these are payments related to area of cultivated land) and the manner of applying for them (the application accompanies the application for direct payments) and the date of payments (close to the date the direct payments are granted), their impact on the economic situation of farms is similar to the impact of direct payments.

As already mentioned, the rates of payments in 2014-16 were based on historical data. 2017 rates of direct payments are based on the following assumptions:

- the amount of financial envelopes for particular payment schemes should not be higher than the amount planned by the Agency for Restructuring and Modernisation of Agriculture[32];
- the assumed rates may not exceed the maximum rates for particular [in euro] which were negotiated with the EU using the ECB exchange rate of 30 September of the given year (here: 2016)[33].

Schemes that enter into force in 2017 have been taken into consideration particularly when estimating payments. Where cow payments are concerned, it was assumed that the change to the size of herd eligible for aid (from 3-30 cows to 3-20

[32] http://www.arimr.gov.pl/fileadmin/pliki/PB_2015/Srodki_finansowe.pdf.
[33] See above.

cows), under the draft act proposed by the government, will enter into force[34], which will result in the increase in rates proportional to the reduction in the number of animals covered by the aid.

In the case of the soft fruit payment, it was assumed that the strawberry payment will amount to the maximum planned level (EUR 252.5/ha). Due to the abandonment of support for raspberry cultivation under the soft fruit aid scheme, this rate should not be reduced in 2017 due to the excessive number of applications.

The 2017 legume payments have been estimated on the basis of information from the Agency for Restructuring and Modernisation of Agriculture: "As previously, the amount allocated to the aid in the high-protein plants is supposed to constitute 2% of the total EU funds allocated to direct payments in Poland. With regard to 2017, this results in the amount approaching EUR 68.24 million, out of which as much as EUR 51.18 (i.e. 75% of funds allocated to the support for high-protein plant cultivation) is to be allocated to the cultivation of legume plants for seeds, and the remainder (nearly EUR 17.06, i.e. 25% of the amount) – to the fodder plant subsector." At the same time, it was assumed that the crop areas of all individual species eligible for payment will be identical to the 2015 area according to the data from the Central Statistical Office of Poland.

The amount of aid for individual farms in 2014-2017 was calculated based on the cropping patterns and livestock numbers provided in 2014 FADN data. Due to the rapid increase in the legume cultivation area after 2014 (which probably resulted from the implementation of the CAP reform, particularly classification of *Papilionaceae* cultivation as an EFA equivalent), it was assumed that the legume cultivation area for the purpose of legume payment calculation, established on the basis of 2014 FADN data, will increase proportionally to the change observed on the national scale on the basis of the Central Statistical Office data

The young farmer payment, which was introduced in 2015, may be paid to a person "who establishes a farm for the first time, manages a farm or has established such a farm in the period of 5 years prior to the first application for single area payment under the direct payment system for 2015-2020 and who is not older than 40 in the first year of submission of the application for single area payment under the direct payment system for 2015-2020 (i.e. they did not turn 41 in the first year of submission of application for single area payment under the direct payment system for 2015-2020)"[35]. In order to establish the amount of payment for further reflection, it was initially assumed that the payment will be granted to farms managed by persons under the age of 41 (according to FADN 2014). However, upon aggregation of payment amounts at the national level, such an assumption resulted in the financial envelope being exceeded over four times. Due to the impossibility to verify the other prerequisites for aid (the year the activity started or the duration of the

[34] Draft Act on change to direct payments under the direct aid system of 13 September 2016 KRM-10-94-16.

[35] Materiały informacyjne ARiMR dotyczące płatności bezpośrednich w kampanii 2015: http://www.arimr.gov.pl/fileadmin/pli-ki/PB_2015/P_WZSO/30_03_2015/platnosci_ bezposrednie/Platnosc__dla__mlodych_rolnikow_30_03_2015.pdf.

period of farm management), the rate of payment for the purpose of this work was finally reduced to 24% of the nominal rate, and this was the basis for calculating payments for all farms managed by farmers who meet the age criterion. Due to the lack of verification of FADN data representativeness with regard to the farmers' age and the assumption that there are no differences between the studied farms as far as other criteria are concerned, the amount of payments thus calculated is likely to be fraught with error to some extent, but in the author's opinion, it is the best possible estimate for this support scheme.

The study assumes that the cropping patterns do not change (except legume crops) in the studied period. The last known cropping patterns in the FADN farm sample of 2014 was extrapolated to the following years for which the calculation was done. Due to the requirements, introduced alongside the greening of CAP starting in 2015, the assumed invariability of the cropping patterns requires justification. But based on the findings from earlier research[36], it can be stated that compliance with the greening requirements will not mean the necessity to radically change cropping patterns. Analysing the level of adjustment of particular farm types (Table 2), it can be observed that most of the farms fully meet the new requirements, and the farms that do not meet them need only to increase the proportion of the ecological focus area (EFA). Taking account of the fact that meeting this criterion is now much easier (a broad range of EFA equivalents), it can be assumed that all farms will receive additional payments without a change to cropping patterns that would be significant from the perspective of direct payment calculation.

Table 2. Structure of farms represented in the FADN population in 2012 divided into production types according to their level of compliance with greening CAP requirements

According to the number of represented farms (FADN 2012)						
Breakdown	Plant	Cattle	Pig	Mixed	Other	TOTAL
Exempted	36%	61%	36%	59%	93%	57%
Green	30%	20%	24%	23%	3%	23%
No EFA	30%	18%	33%	16%	2%	18%
No diversification	1%	0%	2%	1%	1%	1%
No EFA and diversification	3%	1%	5%	1%	1%	1%

Source: Dopłaty..., IERiGŻ 2014[37].

This assumption is confirmed by payment statistics published by the Agency for Restructuring and Modernisation of Agriculture concerning the 2015 campaign. The transfers due to the greening payment, which amounted to PLN 4,243,005,392.86, constituted 98.6% of the financial envelope allocated to this purpose (PLN 4,302,448,628.80). Taking into consideration the fact that in the case of the direct payments the transfers also amounted to nearly 98% of the financial envelope, it can be stated that all Polish farms

[36] S. Czekaj, W. Czubak, J. Góral, A. Kagan A., J. Kulawik, E. Majewski, R. Płonka, W. Poczta, A. Sadowski, A. Wąs, Dopłaty bezpośrednie i dotacje budżetowe a finanse i funkcjonowanie gospodarstw i przedsiębiorstw rolniczych, J. Kulawik (ed.), IERiGŻ-PIB, Warszawa 2014.
[37] Ibidem.

whose owners decided to apply for payment were capable of proving their compliance with the greening requirements.

Taking account of the assumed 2014 cropping patterns and number of animals and rates of payments for particular years, it was possible to established the amount of studied direct payments for individual years. In order to present the findings (according to the FADN rules, it is allowed to publish findings for groups of at least 15 farms), farms were divided into groups according to the production type and economic size class. In addition, the findings were presented according to the FADN regions and location in LFAs.

Farms from the FADN sample were divided according to production types based on the nTF14 classification. The farms were arranged into the following production type groups (according to nTF14):

- plant (15,16,61),
- cattle (45,46),
- pig (51),
- mixed (73,74,83,84),
- other (e.g. 2x, 3x, 48, 52, 53).

Table 3 shows details concerning the division and descriptions of particular types according to production types.

Table 3. Farm classes by production type according to the Community Typology for Agricultural Holdings (CTAH)

nTF14		Production type
15	Specialist cereals, oilseed and protein crops	PLANT
16	General field cropping	
61	Mixed cropping	
45	Specialist dairy	CATTLE
46	Specialist cattle-rearing and fattening	
51	Specialist pigs	PIGS
73 and 74	Mixed livestock	MIXED
83 and 84	Mixed crops and livestock	
20	Specialist horticulture	OTHER
35	Specialist vineyard	
36	Specialist fruit and citrus fruit	
37	Specialist olives	
38	Various permanent crops combined	
48	Sheep, goats and other grazing livestock	
52	Specialist poultry	
53	Other granivores combined	

Source: own elaboration based on L. Goraj et al., 2010, Analiza skutków…, and FADN data[38].

[38] L. Goraj, I. Cholewa, D. Osuch, R. Płonka, Analiza skutków zmian we Wspólnotowej Typologii Gospodarstw Rolnych, IERiGŻ, Warszawa 2010.

The division of farms by production scale criterion is based on the nES14 economic size classification. Finally, three economic size classes, conventionally labelled small, medium and large farms, were established by the number of farms in individual economic size classes (among the large farms, the number of farms that represent specific production types is often lower than the required 15) and by the transparency of findings. Defining the cut-off criteria for separated classes the researchers were guided by as equal as possible share of respective classes in agricultural production volume in the FADN group (based on the 2014 data), share in occupied agricultural land and number in the FADN group. Table 4 presents grouping of farms by economic size.

In order to evaluate resultant changes to the allocation of direct payment, the impact of change in the direct payment system at the FADN region level was aggregated and analysed (Map 1).

Table 4. Farm classes by their economic size according to the Community Typology for Agricultural Holdings (CTAH)

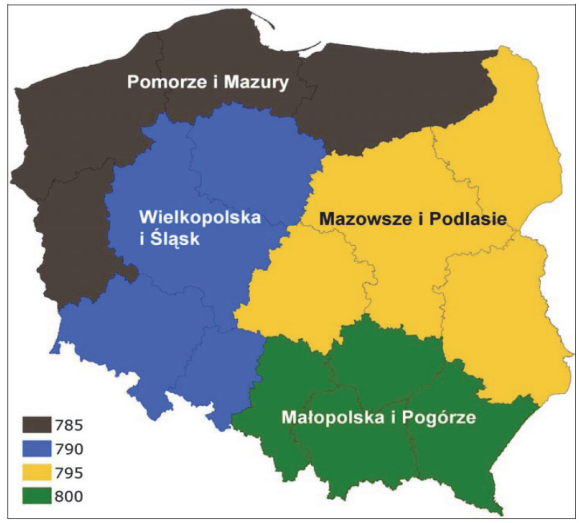
nES9		nES	Range in euro			ECONOMIC SIZE CLASS
		1		euro <	2,000	NOT ANALYSED
1	Very small	2	2,000	≤ euro <	4,000	SMALL
		3	4,000	≤ euro <	6,000	
2	Small	4	8,000	≤ euro <	15,000	
3	Small	5	15000	≤ euro <	25,000	MEDIUM
4	Medium-small	6	25000	≤ euro <	50,000	
5	Medium-large	7	50,000	≤ euro <	100,000	LARGE
6	Large	8	100,000	≤ euro <	250,000	
7	Large	9	250,000	≤ euro <	500,000	
8	Very large	10	500,000	≤ euro <	750,000	
		11	750,000	≤ euro <	1,000,000	
		12	1,000,000	≤ euro <	1,500,000	
9	Very large	13	1,500,000	≤ euro <	3,000,000	
		14		euro ≥	3,000,000	

Source: own elaboration based on L. Goraj et al., 2010, Analiza skutków…, and FADN data [39].

What is more, location in LFAs was one of the variables considered in the classification. Therefore, FADN sample was used to determine which farms are situated in LFAs (Map 2). The obtained results should be seen as an estimate. The sample selection under the FADN system is to ensure its representativeness with regard to three variables: production type, economic size, and location in LFAs. Due to the fairly large number of farms in the sample and the rather large proportion of all LFAs in each region, it can be reckoned that the FADN data can suitably reflect the differences in the economic situation between particular areas without constraints and the less-favoured areas. However, it should be kept in mind that the use of thus selected sample to draw conclusions concerning the entire population of LFA farms, mainly with regard to mountain LFAs, whose representation in the FADN is not very numerous, may lead to a significant error.

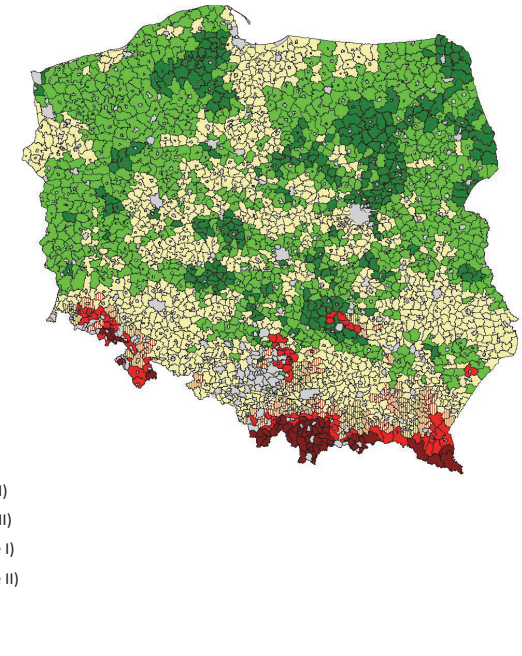
[39] Ibidem.

Map 1. FADN regions in Poland



Source: own elaboration based on materials from the Ministry of Agriculture and Rural Development.

Map 2. Delimitation of LFAs in Poland



Source: RDP 2004-2006[40].

[40] Plan Rozwoju Obszarów Wiejskich 2004-2006, Załącznik C, Mapa zasięgu ONW [Rural Development Plan 2004-2006, Annex C, Location of LFAs], Ministry of Agriculture and Rural Development 2004.

The structure of farms in the FADN reference population significantly differs from the structure of farms in the FADN sample. This results from the stratified selection of farms and the application of Neyman's optimal allocation, as a result of which, representations of strata comprising more homogeneous elements (farms) are more numerous in the sample than their proportion in the general population would suggest. In order to obtain results that reflect changes to the FADN population, the number of farms represented by individual farms in the FADN sample, the SYS02 variable, was taken into account. Therefore, it can be assumed that the presented findings describe the changes to the subsidy levels in the population of farms represented by the FADN sample.

3.3. Research findings

The application of the adopted farm typology resulted in the division of the FADN sample into 12 types of farms. In order to establish their significance in the studied population, their proportion in the total number of farms, total agricultural land area and total size of agricultural production (Table 5) was determined.

Despite the relatively low economic size threshold (up to EUR 15,000 of standard output – SO), small farms constitute the majority of entities represented by the FADN sample – 56%. Due to their low average area, their share in agricultural land use is nearly two times lower. They produce less than 1/5 of the total output. Plant and mixed production farms dominate among the small agricultural holdings.

Medium farms are represented by nearly 37% of the FADN population, use 45% of the land, and produce over 40% of the output value. In this group, the majority of farms belong to the mixed and cattle production types.

The economically strongest farms (over EUR 50,000 of standard output) constitute only a bit over 7% of the represented agricultural holdings, they use nearly 1/4 of the total agricultural land area, and produce over 40% of the output value. The most common production types are the specialist cattle farms and other farms, mainly horticultural holdings and poultry producing farms.

The observed disproportion between the number of farms and the agricultural land area is not a novelty. It should be emphasised, however, that these relations are very relevant from the perspective of direct payment distribution, large portion of which is distributed according to the area of cultivated land. In this context, farms whose area is large are in a relatively favourable situation. Due to this, the medium and large farms are in a privileged situation. The latter, however, use their resources better, thus generating a significantly greater output value per unit of area. In the case of nearly all types of large agricultural holdings (except plant producing ones), the proportion of the produced agricultural output. This can be a symptom that they are less dependent on external support.

The 2015 direct payment system reform, which resulted in the allocation of 15% of funds to payments depending on production, led to the situation where the area of the farm is not the only factor that determines the amount of payment.

Table 5. Characteristic of the structure of studied population based on 2014 FADN data

Breakdown	PLANT TF 1x,60	CATTLE TF 4x	PIG TF 51	MIXED TF 7x,8x	OTHER	TOTAL
Small SO < 15,000 [EUR]						
Number of farms in the FADN sample	843	302	34	1,016	172	2,367
Number of represented farms	115,381	47,168	5,216	209,882	30,436	408,083
Proportion in the total number of farms in the FADN population	15.8%	6.5%	0.7%	28.8%	4.2%	56.0%
Proportion in the total agricultural land area in the FADN population	10.7%	3.7%	0.2%	15.0%	1.0%	30.7%
Share in the agricultural output value in the FADN population	5.6%	1.7%	0.3%	8.7%	1.6%	17.9%
Average 15,000 < SO < 50,000 [EUR]						
Number of farms in the FADN sample	1,735	1,806	250	1,886	424	6,101
Number of represented farms	49,742	76,132	11,874	101,784	29,053	268,583
Proportion in the total number of farms in the FADN population	6.8%	10.5%	1.6%	14.0%	4.0%	36.9%
Proportion in the total agricultural land area in the FADN population	11.2%	13.2%	1.4%	17.2%	2.2%	45.2%
Share in the agricultural output value in the FADN population	8.1%	11.7%	2.0%	13.6%	5.0%	40.4%
Large SO > 50,000 [EUR]						
Number of farms in the FADN sample	881	1,089	524	879	282	3,655
Number of represented farms	9,033	13,286	6,413	10,972	11,960	51,664
Proportion in the total number of farms in the FADN population	1.2%	1.8%	0.9%	1.5%	1.6%	7.1%
Proportion in the total agricultural land area in the FADN population	8.8%	5.5%	2.1%	5.5%	2.2%	24.2%
Share in the agricultural output value in the FADN population	6.5%	7.5%	4.8%	5.8%	17.1%	41.8%

Source: own elaboration based on the 2014 FADN data.

The newly introduced payments support specific types of crops (e.g. legumes) and cattle keeping (cows, cattle aged 12-24 months, sheep, goats). Table 6 illustrates the production structure on the studied types of farms with regard to the potential for obtaining additional payments. Additionally, it shows the impact of direct payments on the economic outturn and the percentage of farms situated in less-favoured areas.

The smallest farms in the studied groups have on average a bit less than 10 ha of agricultural land. The specialist pig farms, whose area is even smaller, are an exception, but their proportion in the group of small farms is marginal. Small mixed production and cattle farms keep relatively small herds of cattle. Taking account of the requirements for dairy cow and cattle payments, where payment is granted if the herd includes more than three cows or heads of cattle aged 12-24 months, a significant share will not be eligible for the new payments despite the fact that they keep cattle. Among the smallest cattle farms, there is a relatively larger goat and sheep stocking density compared to larger cattle farms. In this case, at least 10 female sheep or goats

are required to be granted payment under these support schemes. The proportion of farms located in LFAs among the smallest farms in general approaches the average. It should be noted, however, that there is a significant percentage of entities active in terrains with handicaps among cattle farms. In 2014, the average payments ranged between PLN 9,000 and PLN 10,000 in all production types among the small farms. At the same time, the proportion of payments in the income hovered around 90%. Both the amounts of payments and the income are a basis to regard those farms as an additional activity for the owner providing additional source of income.

Table 6. Characteristic of selected farm types (FADN 2014)

Breakdown	PLANT TF 1x,60	CATTLE TF 4x	PIG TF 51	MIXED TF 7x,8x	TOTAL
Small SO < 15,000 [EUR]					
Agricultural land area	11.4	9.5	5.8	8.8	9.2
Number of dairy cows	0.1	2.5	0.0	0.9	0.8
Heads of cattle aged 12-24 months	0.3	5.8	0.1	3.3	2.5
Number of sheep and goats	0.1	1.8	0.0	0.2	0.3
Legume crop area as proportion of agricultural land	3.5%	2.6%	1.4%	2.8%	2.9%
Family farm income	14,640	12,530	1,770	7,880	10,428
Payments received*	11,618	10,663	6,162	9,451	9,730
Payments* as percentage of income	79%	85%	348%	120%	93%
Proportion of farms located in LFAs	43.7%	83.4%	58.8%	63.8%	57.4%
Average 15,000 < SO < 50,000 [EUR]					
Agricultural land area	27.6	21.3	14.2	20.8	20.7
Number of dairy cows	0.2	12.7	0.1	2.7	4.7
Heads of cattle aged 12-24 months	1.3	16.1	0.7	10.1	8.7
Number of sheep and goats	0.2	1.6	0.0	0.3	0.6
Legume crop area as proportion of agricultural land	4.8%	2.0%	1.7%	3.8%	3.3%
Family farm income	50,115	48,144	23,815	31,159	39,576
Payments received*	29,789	22,735	14,172	22,857	22,107
Payments* as percentage of income	59%	47%	60%	73%	56%
Proportion of farms located in LFAs	33.8%	77.9%	58.0%	56.3%	55.5%
Large SO > 50,000 EUR					
Agricultural land area	120.0	51.2	41.2	61.1	57.5
Number of dairy cows	0.3	38.0	0.2	7.9	11.5
Heads of cattle aged 12-24 months	3.8	46.2	2.2	23.6	17.9
Number of sheep and goats	0.2	0.5	0.0	1.5	0.5
Legume crop area as proportion of agricultural land	3.4%	2.2%	3.4%	4.3%	3.1%
Family farm income	215,753	171,119	125,575	122,179	175,432
Payments received*	126,112	53,114	43,618	67,726	59,893
Payments* as percentage of income	58%	31%	35%	55%	34%
Proportion of farms located in LFAs	35.3%	73.2%	60.9%	51.4%	55.9%

* Table includes amounts from support schemes and LFA payments analysed in this article (see: Research methodology).

Source: own elaboration based on the 2014 FADN data.

In the case of the medium farm, both the agricultural land area and the size of cattle herds lead to the conclusion that they benefited from the payments introduced in 2015, particularly the redistributive payment (3-30 ha) and the dairy cow payments (herds of 3-30 cows in 2015 and 2016, and herds of 3-20 cows in 2017) and the cattle payments (herds of 3-30). In 2014, the proportion of legume crops was also the highest on those farms. The average amount of payments they receive exceeds PLN 20,000 and constitutes a bit more than a half of income.

The average agricultural land area of the largest farms is 57.5 ha. The plant producing farms are an exception, their area is over two times larger. The large agricultural land area makes it possible to receive high amounts of payments, particularly in the case of plant producing farms. The relatively large area and large average size of cattle herds allow us to suppose that a large portion of the large farms does not receive the full amount of the aid in the case of the redistributive payment, dairy cow payment (particularly in 2017), cattle payment, and the legume payment. This may lead to further reduction in the proportion of payment in income, which was lower than in the case of medium and small farms in 2014.

In accordance with the presented methodology, amounts of payments for the analysed support schemes and LFA payments was established for all farms in the 2014 FADN sample. In order to observe changes to the amounts of payments in the studied period, the total amount of 2015-2017 payments was equated to the 2014 amount. Table 7 shows the calculation results, in their most synthetic form, divided according to the economic size and production type. They indicate that the average level of aid for the represented FADN population under the analysed instruments is systematically growing. This results primarily from the fluctuations of exchange rates used to determine the rates of payment in PLN.

Table 7. Changes to the level of aid under the analysed direct payment schemes according to farm types (2014=100)

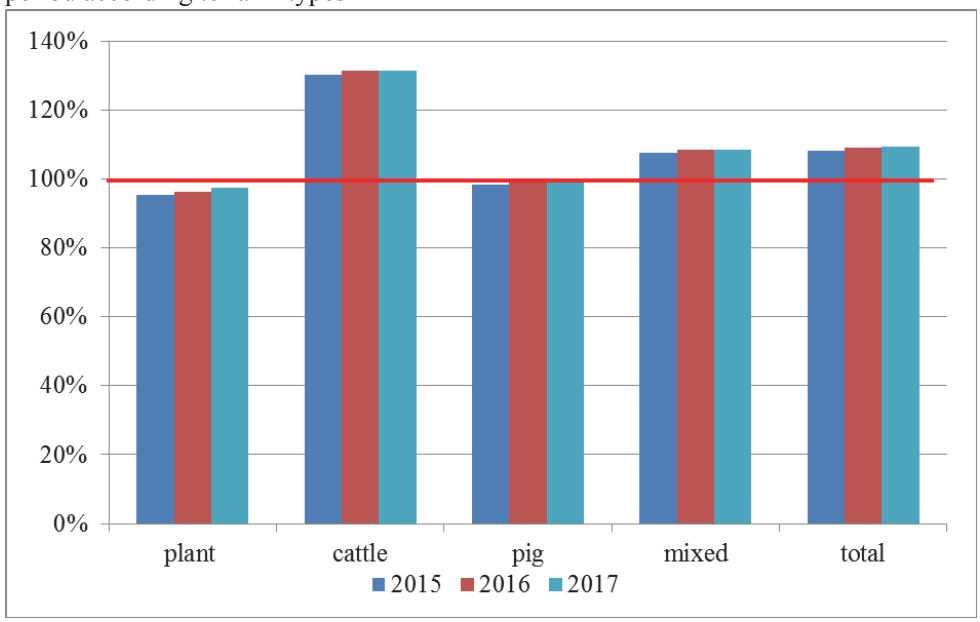
Farm types	2015	2016	2017	2015	2016	2017
	Small			Medium		
Plant	99.9	101.1	101.8	97.5	98.2	99.4
Cattle	115.7	116.8	117.4	136.0	137.3	138.4
Pig	96.6	97.7	98.3	101.1	102.4	103.2
Mixed	103.7	104.8	105.0	112.7	113.5	113.8
TOTAL	103.6	104.8	105.1	114.9	115.9	116.5
	Large			Total		
Plant	87.8	88.4	89.6	95.5	96.3	97.4
Cattle	126.8	128.1	124.6	130.3	131.6	131.5
Pig	97.0	98.0	98.2	98.4	99.6	99.9
Mixed	101.6	102.2	101.5	107.5	108.4	108.5
TOTAL	101.6	102.4	101.7	108.3	109.3	109.5

Source: own elaboration.

The listed findings clearly show that the doubtless beneficiaries of the 2015 reform are the cattle farms, where the nominal amounts of payments increase on average by over 30% in 2014-2017. The 2015 direct payment system reform is also favourable for mixed production farms, which on average receive 9% higher payments since 2015. The decrease in the level of aid under the analysed support schemes may be observed in the case of plant producing farms, where the payments slightly dropped compared to the 2014 level (Graph 2).

Definitely larger differences in the payment level may be observed if we considers groups of farms according to their economic size. Graph 3 shows the 2017 payments compared to 2014 in a relative approach, taking account of both production type and the scale of activity. According to the expectations, the type of farms that definitely benefited the most is the medium cattle farm, where the average amount of payments increased by nearly 40%. In the case of other production types, the medium farms also benefit from the changes to the payment system. Among the small farms, the changes to the payment level are slight. The exception is the cattle producing type, which to a small extent benefits from the reform. Changes concerning large farms can be seen differently. Though in the case of cattle or mixed production farms, the amounts of aid did not change compared to 2014, in the case of large plant producing farms the amounts calculated for 2017 will be lower than the 2014 amounts.

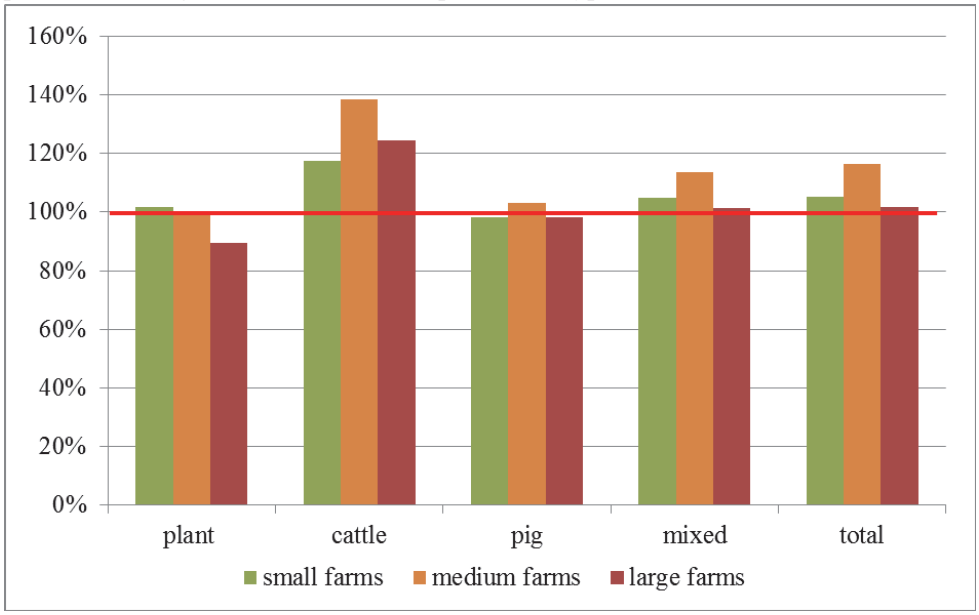
Graph 2. The change to the support level under the analysed aid schemes in the studied period according to farm types



* 2014 payments = 100% – the red line

Source: own elaboration.

Graph 3. The change to the support level under the analysed aid schemes in the studied period according to economic size and production type of farms



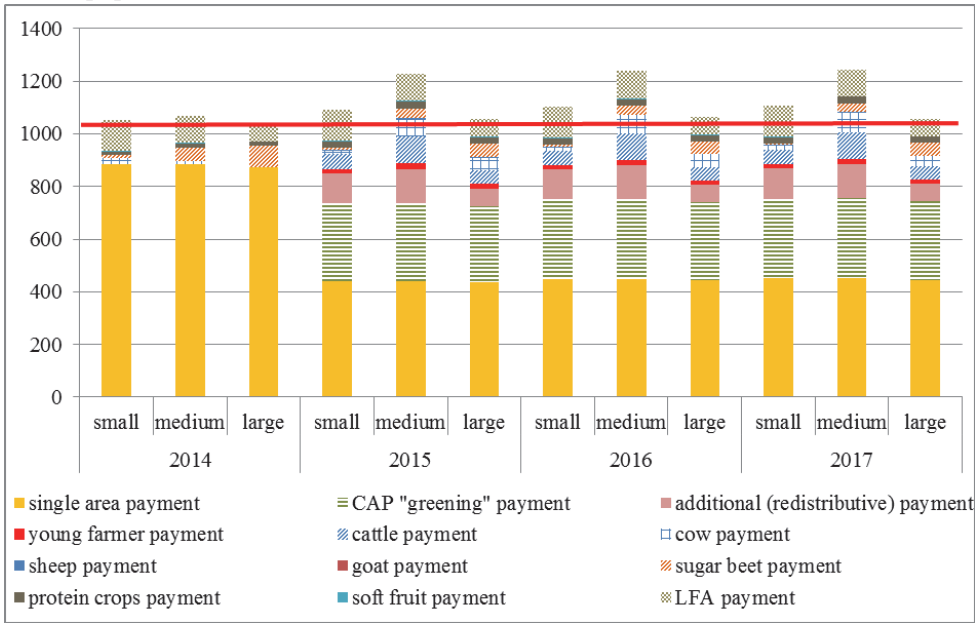
* 2014 payments = 100% – the red line

Source: own elaboration.

When looking for actual causes of differences in the amounts of aid, we should analyse the structure of payments received by individual farms. Graph 4 shows average amounts from the particular aid schemes per hectare of agricultural land in specific farm size groups in 2014-17. It should be noted, that the 2014 amount of payment per 1 ha of agricultural land did not depend on the economic size of the farm to a large degree. Apart from the single area payment, in the case of smaller farms, the LFA payment and the cattle payment were an important element of support. Going up the scale, the sugar payment became more and more important, but the total amount of payments was similar and hovered around PLN 1050/ha. A significant reduction in the single area payment rate in 2015 and introduction of other aid schemes resulted in changes to the structure of payments.

To a large extent, the drop in the SAP rates was compensated by the greening payment and the redistributive payment. However, due to the specific nature of the redistributive payment (the fact that it is related to the agricultural land area ranging from 3 to 30 ha), its proportion in the payments received by the largest farms is much lower than in smaller entities. The dairy cow payment, which was introduced throughout the country in 2015 (in 2014, it was paid only in selected voivodeships), and the cattle payment definitely became more significant. Also in this case, due to the limits to the number of animals covered by these payments, they play the biggest role in the case of medium farms.

Graph 4. Average amount of payment per 1 ha of agricultural land on farms in the FADN population



* The red line corresponds to the 2014 average amount of payment.
Source: own elaboration.

The changes to the payment system introduced in 2017 (e.g. reduction in the size of dairy cow herds eligible for aid, changes to legume or soft fruit payments) have barely any impact on the level of payments in groups of farms based on their economic size taking the adopted aggregation level into consideration. The average dairy cow payment per 1 ha of agricultural land on medium farms increases from PLN 70.3 per ha of agricultural land in 2016 to PLN 74.5 per ha of agricultural land in 2017, which is done at the expense of the amount of this payment paid to large farms, which is on average reduced to PLN 9.4 per ha of agricultural land. At the same time, the average legume crop payment for the largest farms increases at the expense of the medium farms, which results from the replacement of the upper limit of area eligible for payments under this scheme with degressive payments.

Analogous to the above analysis of the amount and structure of direct payments, the calculation was made with regard to particular farm types, location in the specific FADN region, or location in LFAs. Below are the findings from these analyses at a quite high aggregation level. The Graphs that show the changes to the structure and the amount of direct payments in the defined groups of farms werw included in the annex (Graphs 9-18).

Due to the non-uniform regional distribution of particular farm types, the changes to the level of support for particular production activities result also in changes to the amounts of aid paid in particular FADN regions (Table 8).

Table 8. Changes to the support level under the analysed direct payment schemes according to FADN regions (2014=100)

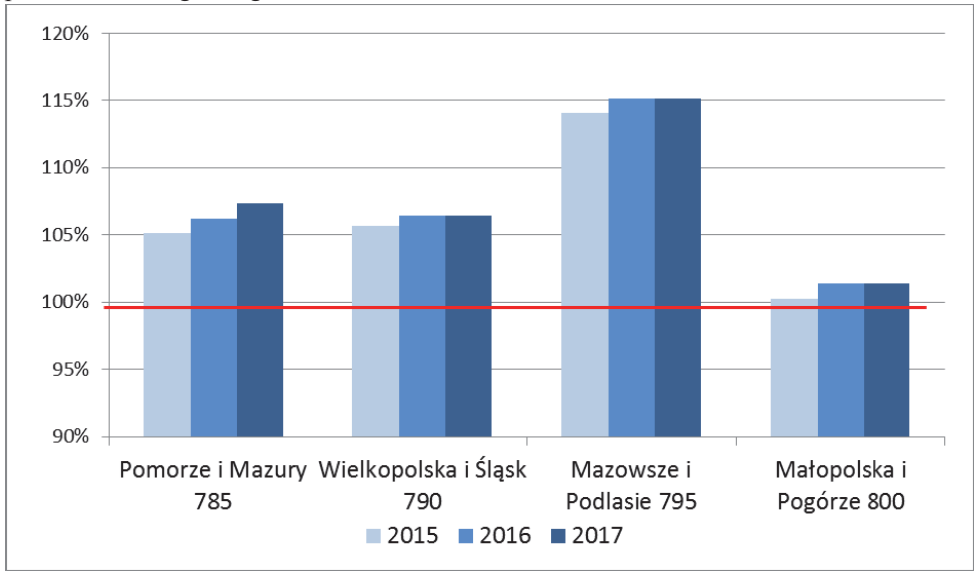
Farm types	2015	2016	2017	2015	2016	2017
	Small			Medium		
Pomorze i Mazury 785	105.1	106.4	108.0	111.7	112.9	114.4
Wielkopolska i Śląsk 790	104.1	105.2	105.8	110.9	111.6	112.0
Mazowsze i Podlasie 795	106.6	107.8	107.8	120.5	121.6	122.2
Małopolska i Pogórze 800	95.2	96.4	96.4	108.2	109.2	109.7
	Large			Total		
Pomorze i Mazury 785	97.4	98.3	98.7	105.1	106.2	107.3
Wielkopolska i Śląsk 790	99.3	99.9	99.2	105.7	106.4	106.5
Mazowsze i Podlasie 795	111.5	112.5	110.6	114.0	115.1	115.1
Małopolska i Pogórze 800	96.1	97.0	96.2	100.2	101.4	101.4

Source: own elaboration.

The region that benefited the most from the 2015 reform is "Mazowsze i Podlasie" (Graph 5). The average amount of payments in this region increased by 15% compared to 2014. At the same time, it should be noted that 2017 changes to the payment system result in a slight decrease in the level of support in "Mazowsze i Podlasie", which is beneficial for farms in "Pomorze i Mazury".

This results primarily from the restrictions on support for large cattle farm (>20 cows in the herd) and reallocation of funds thus saved to smaller farms that keep from 3 to 20 cows.

Graph 5. Change to the support level under the analysed aid schemes in the analysed period according to regions

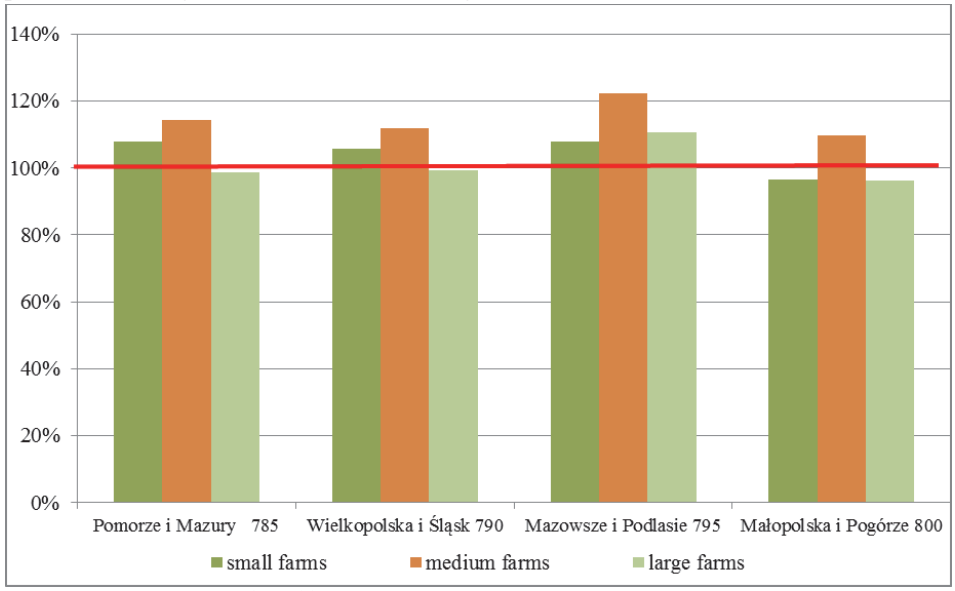


* 2014 payments = 100% – the red line

Source: own elaboration.

If we take account of the changes to the level of payment in farms grouped according to their economic size, we can observe that, though the farms in "Mazowsze i Podlasie", benefit the most, the increase in the amount of payments affects medium farms, which gained over 20% of aid funds compared to 2014 (Graph 6). In the remaining regions, medium farms also benefit the most, but the differences between the 2014 and the 2017 aid are not that significant. In the case of large farms in all regions except "Mazowsze i Podlasie", we may observe slight decrease in the payments. The impact of the CAP reform on payments for the lowest farms was somewhat different. What may be quite surprising is the reduction in the amounts received by small farms in the "Małopolska i Pógórze" region. Due to the small scale of their activity, a portion of small farms in the region may not apply for the redistributive payment. The cattle payment, which constituted a notable portion of payments in this region in 2014, are reduced in the following years due to the insufficient size of herds kept by farms in this group.

Graph 6. Change to the support level under the analysed aid schemes in the studied period according to economic size and regions



* 2014 payments = 100% – the red line

Source: own elaboration.

The comparison of average amounts of payment divided according to the location in LFAs also indicates the difference in the scale of the change to aid levels resulting from the 2015 CAP reform.

In the observed period, the average payment for farms located in lowland LFAs increased by over 13% (Table 9). It is easy to explain, if we take account of the significant proportion of cattle farms in those areas (Table 9). It is particularly visible in the case of medium farms, as explained above.

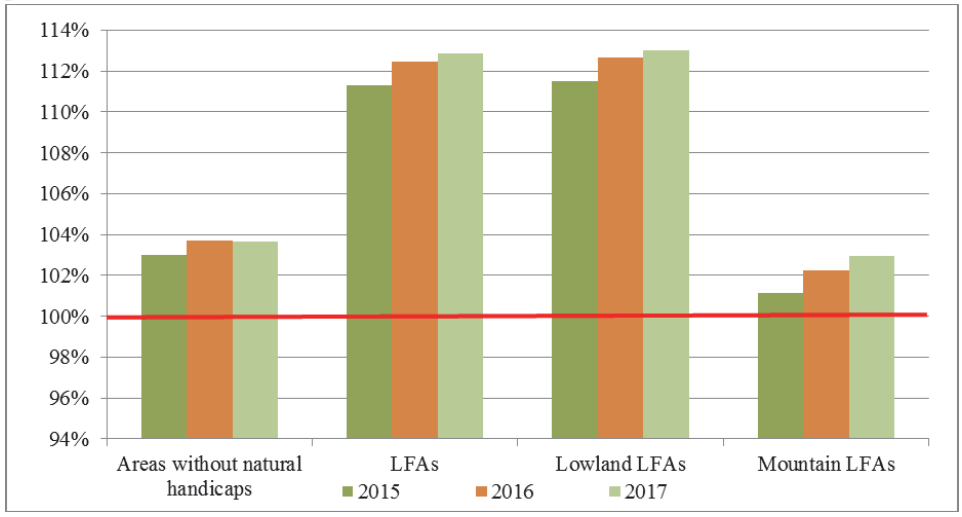
In areas outside LFAs, the increase in the average payments growa only minimally in the analysed period. It can be explained e.g. by larger proportion of plant producing farms, particularly large ones, which are present mainly in areas where soils are better, and which receive smaller payments due to the reform. This dependence is observed in all economic size classes, but it is most visible in the case of large non-LFA farms, which lost the most due to the 2015 reform. In 2017, a slight reduction in the level of aid for non-LFA farms can be observed (Graph in appendix). This results from the fact that the average size of cattle herds is larger outside the LFAs, which causes the reduction in aid resulting from the newly introduced changes to dairy cow payments.

Table 9. Changes to the support level under the analysed direct payment schemes according to location in LFAs (2014=100)

Farm types	2015	2016	2017	2015	2016	2017
	Small			Medium		
Areas without natural handicaps	100.7	101.9	101.8	108.1	108.8	109.1
LFAs	105.0	106.2	106.7	118.9	120.0	120.9
Lowland LFAs	105.6	106.7	107.2	118.9	120.0	120.9
Mountain LFAs	89.6	90.6	91.6	119.2	120.4	120.9
	Large			Total		
Areas without natural handicaps	96.3	96.7	95.9	103.0	103.7	103.7
LFAs	105.1	106.2	105.5	111.3	112.5	112.8
Lowland LFAs	105.1	106.2	105.5	111.5	112.6	113.0
Mountain LFAs	111.3	112.6	112.0	101.1	102.2	102.9

Source: own elaboration.

Graph 7. Change to the support level under the analysed aid schemes in the analysed period in LFAs

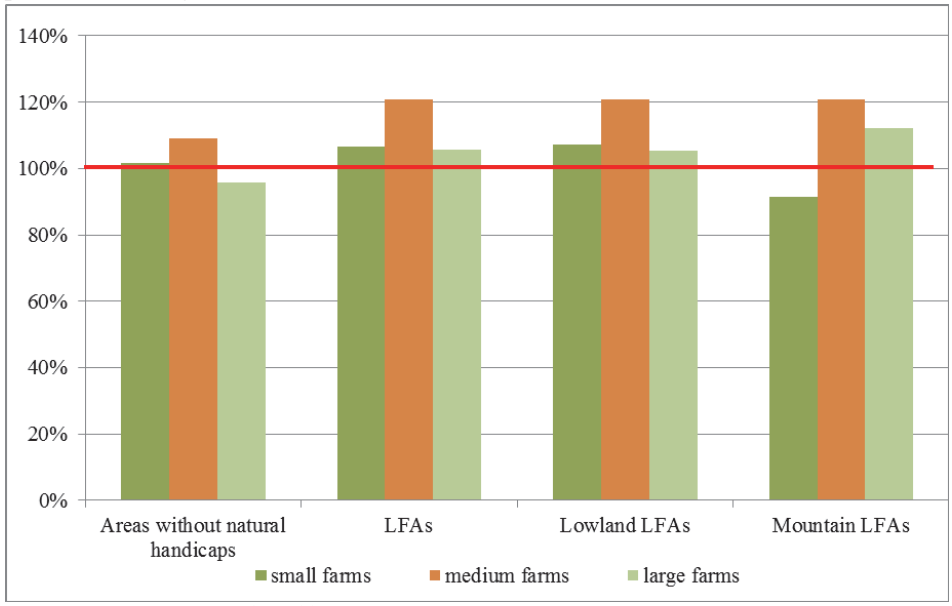


* 2014 payments = 100% – the red line

Source: own elaboration.

A specific phenomenon could be observed in the case of small farms situated in mountain LFAs (Graph in appendix). Though the LFA payment has been included in the analysis, in 2017, these farms will receive a bit over 90% of payments they received in 2014. The change to the payment system, particularly the reduction of the single area payment, the largest one and the easiest one to obtain, and the simultaneous introduction of a number of payments related to additional requirements does not make it easier to obtain payments for small farms run on a hobby basis and located on poor soils, which usually cannot state that they keep cattle or do not have adequate land resources to apply for the redistributive payment.

Graph 8. Change to the support level under the analysed aid schemes in the studied period according to economic size in LFAs



* 2014 payments = 100% – the red line.

Source: own elaboration.

The presented reduction in the payments affects only a relatively small group of farms (about 10,000 – supposed that the FADN sample is representative with regard to LFAs) represented by the FADN, but it can be supposed that the change may go in the similar direction among the smallest farms outside the FADN population. In terms of absolute amounts, this means the reduction in the annual payment by about PLN 700 per farm. Such a change may result in the increased pressure to consolidate small inefficient farms in mountain LFAs, but due to the existing difficulties, it is also possible that the proportion of farms that do not cultivate the land will increase.

3.4. Summary

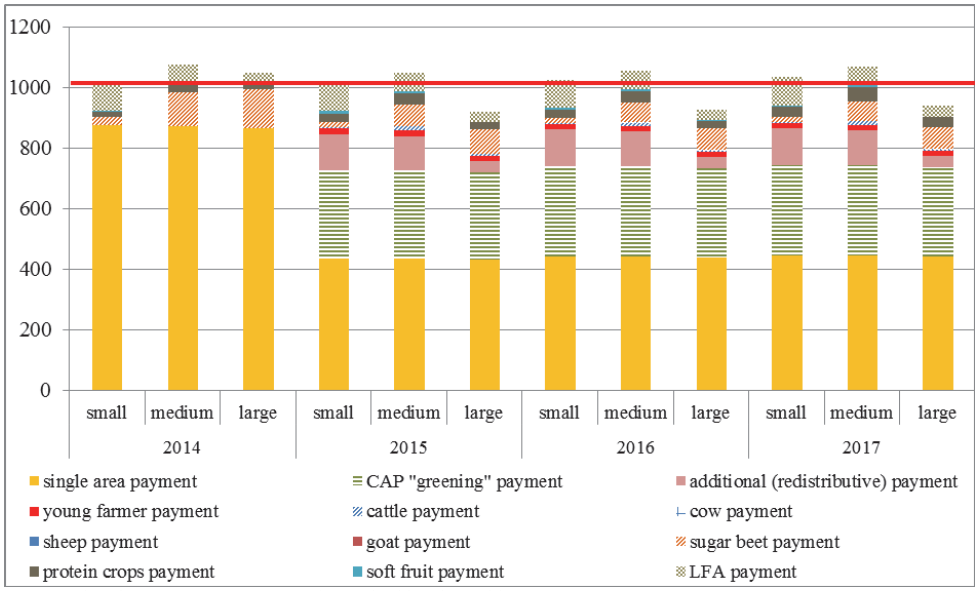
As mentioned in the introduction, the direct payment system in Poland undergoes modifications which have started in 2004, which makes it more and more complicated. These changes are partially forced by external conditions, e.g. introduction of the greening of CAP and the related payments, and partially result from national regulations. The effects of the national regulations include cattle, cow, sheep and legume payments, which are related to numerous access criteria that have to be verified both during the preparation and the evaluation of payment applications. This indubitably means increased expenditure on both the preparation and the evaluation of the applications.

The changes proposed in 2015, however, did not only affect the manner of completion of the application for direct payments. The introduction of the redistributive payment (additional payment) and dairy cow, cattle, sheep and goat payments, etc., and the relevant boundary conditions resulted in shifts in recipients of a portion of funds. It turned out that the main beneficiaries of those changes were medium farms, particularly cattle and mixed production farms, which took place at the expense of large farms, particularly plant producing ones. At the same time, it should be noted that the introduction of the minimum output criterion for eligibility for support under certain aid schemes resulted in reduced rates of payments for the smallest farms, particularly those located in mountain LFAs, and, as a result, for the "Małopolska i Pogórze" region. For those farms, some solution to this problem is the transition to the small farm payment and calculation of payments based on the historic records concerning the received payments. However, this required farmers to take appropriate action.

The increase in payments related to selected types of production that took place in 2015 meant a relative reduction in the payments for other types of farms. Such a restriction on the level of support can be observed in the case of large pig or plant producing farms or small farms in mountainous areas. Due to the exchange rate of the Polish zloty used to determine the amounts of payments in the national currency, which has been increasingly weaker since 2014, the changes did not lead to a drastic drop in amounts of aid expressed in zloty. Despite that, the reform led to changes in the proportions between amounts paid to particular types of farms compared to the situation in 2014, when all farms received similar payments per 1 ha of agricultural land. We may suppose that this will be noticed by the farmer after the zloty grows stronger in the near future. The proposed changes to the 2017 payment system are not as significant as the 2015 reform. We should not expect that they will affect the distribution of funds among the particular types of farms to a significant extent in the years to come. They are just the necessary adjustment resulting from external conditions.

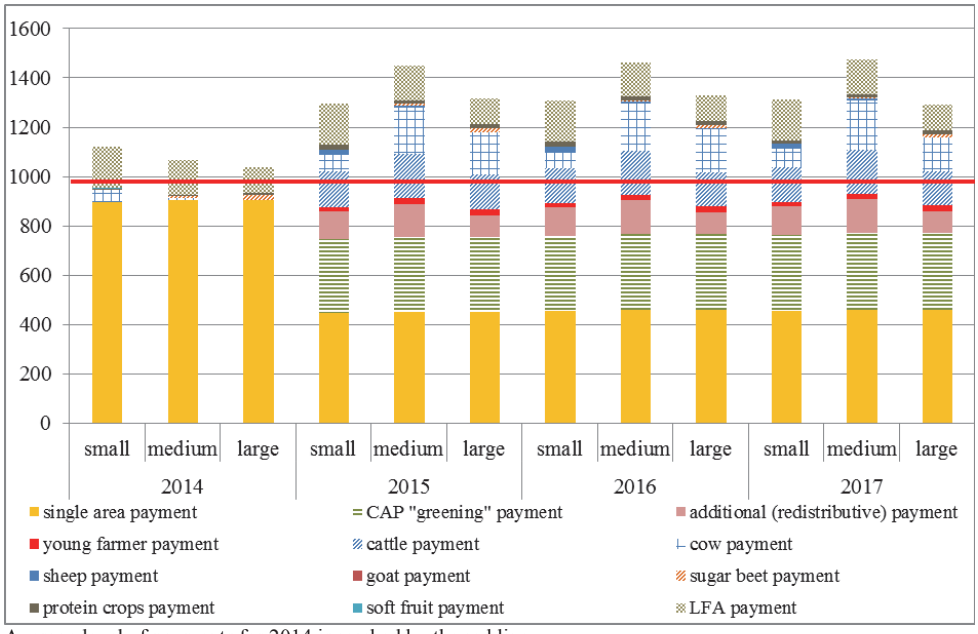
Appendix

Graph 9. Average amount of payment per 1 ha of agricultural land (UAA) for the plant farms



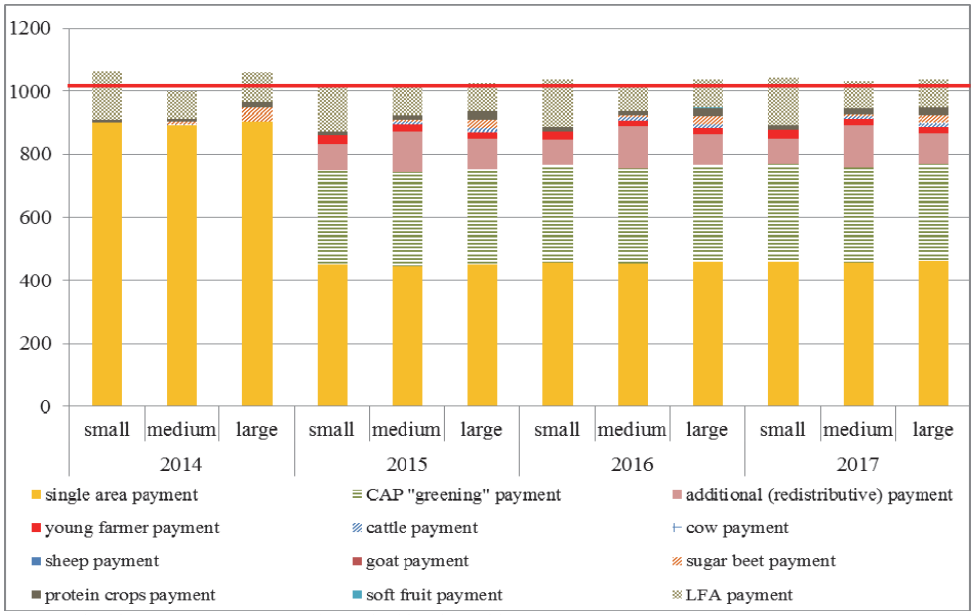
Average level of payments for 2014 is marked by the red line.
Source: own calculations.

Graph 10. Average amount of payment per 1 ha of agricultural land (UAA) for the cattle farms



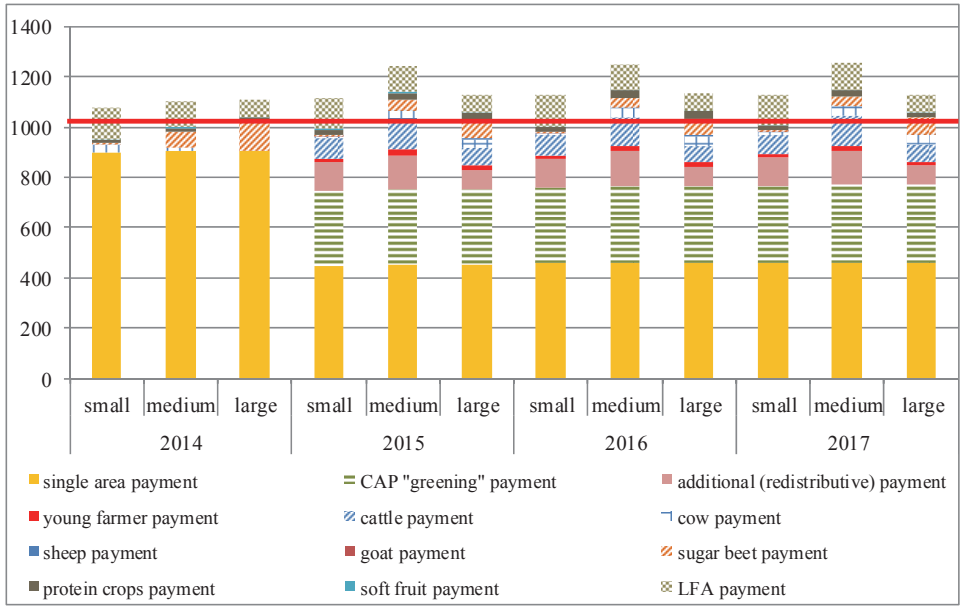
Average level of payments for 2014 is marked by the red line.
Source: own calculations.

Graph 11. Average amount of payment per 1 ha of agricultural land (UAA) for the pig farms



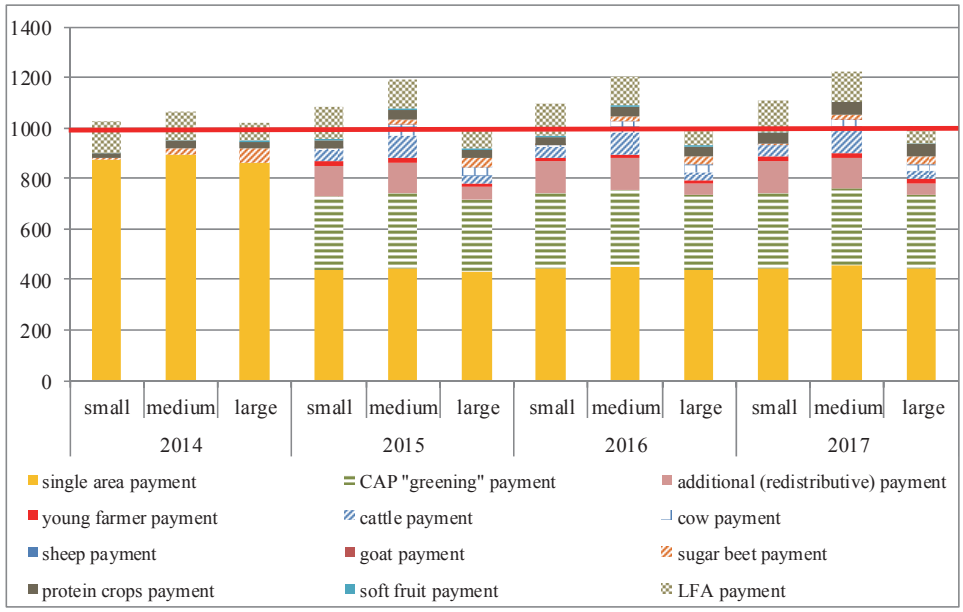
Average level of payments for 2014 is marked by the red line.
Source: own calculations.

Graph 12. Average amount of payment per 1 ha of agricultural land (UAA) for the mixed farms



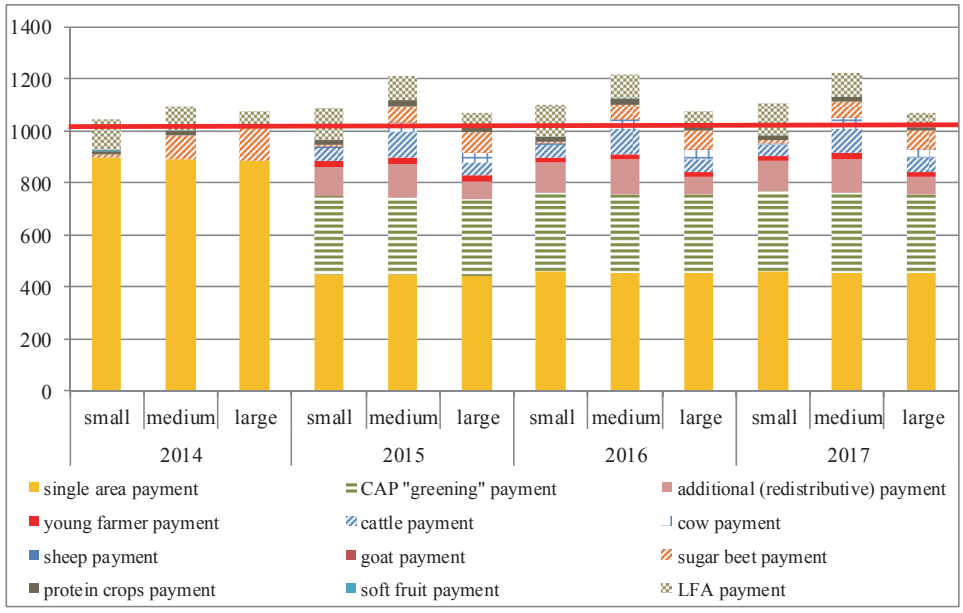
Average level of payments for 2014 is marked by the red line.
Source: own calculations.

Graph 13. Average amount of payment per 1 ha of agricultural land (UAA) for farms from the FADN region 785 " Pomorze i Mazury"



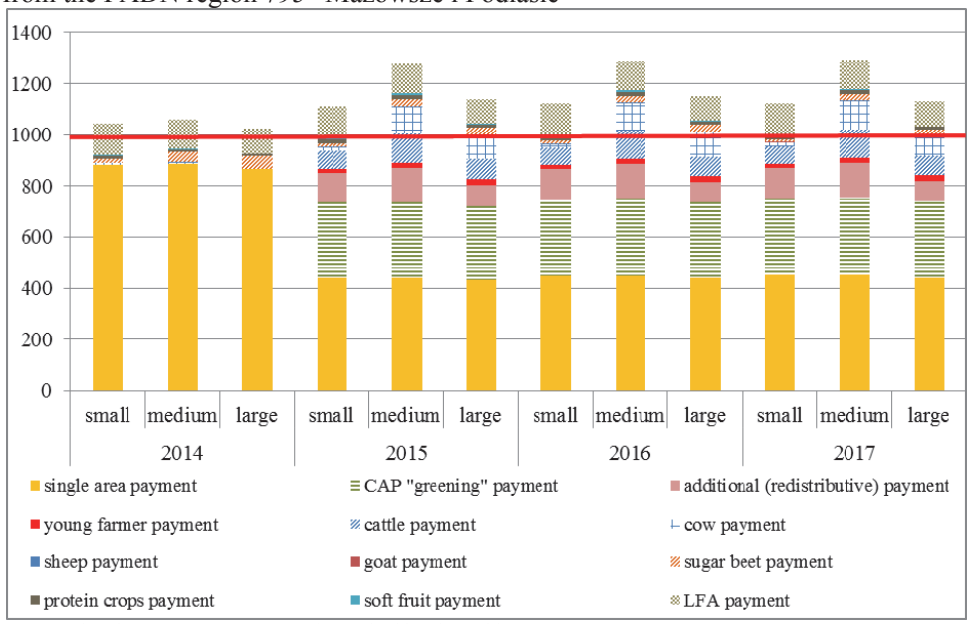
Average level of payments for 2014 is marked by the red line.
Source: own calculations.

Graph 14. Average amount of payment per 1 ha of agricultural land (UAA) for farms from the FADN region 790 "Wielkopolska i Śląsk"



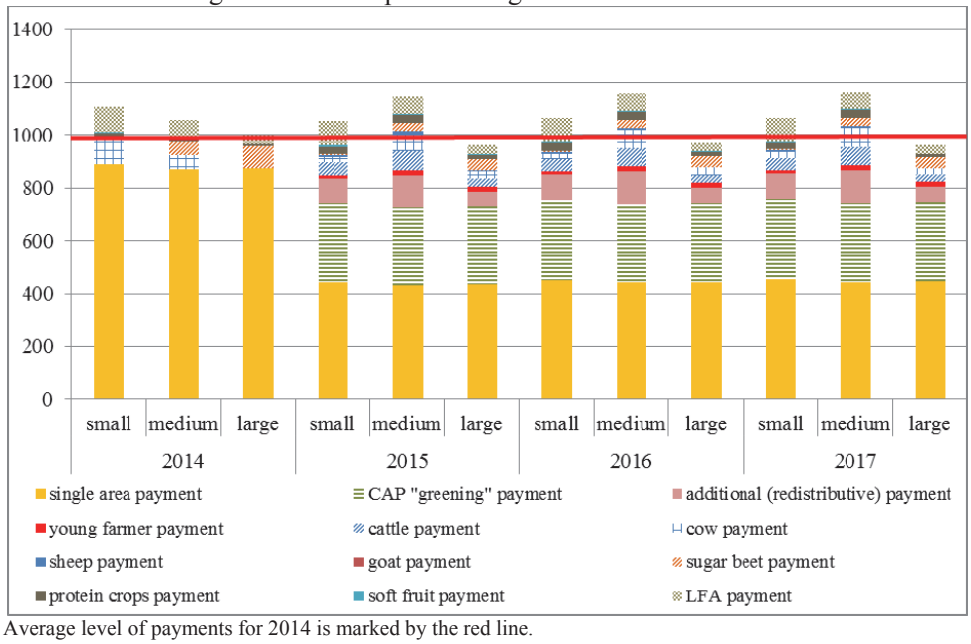
Average level of payments for 2014 is marked by the red line.
Source: own calculations.

Graph 15. Average amount of payment per 1 ha of agricultural land (UAA) for farms from the FADN region 795 “Mazowsze i Podlasie”



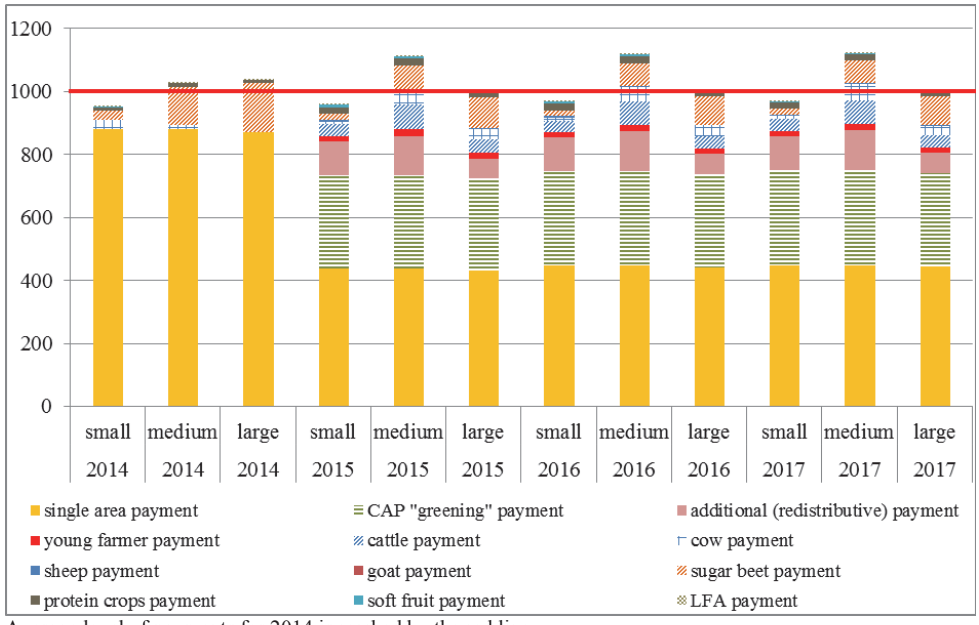
Average level of payments for 2014 is marked by the red line.
Source: own calculations.

Graph 16. Average amount of payment per 1 ha of agricultural land (UAA) for farms from the FADN region 800 “Małopolska i Pogórze”



Average level of payments for 2014 is marked by the red line.
Source: own calculations.

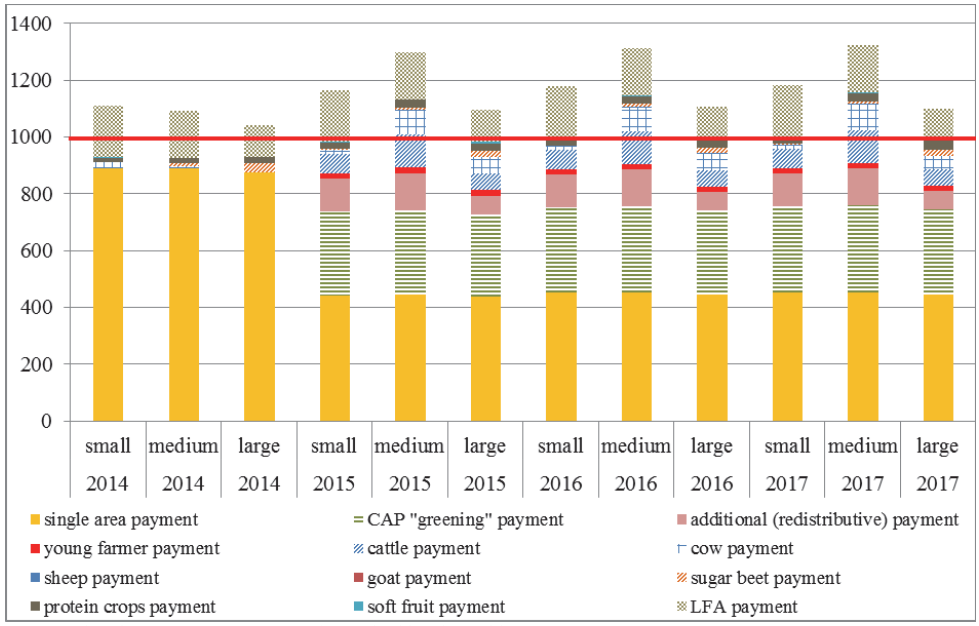
Graph 17. Average amount of payment per 1 ha of agricultural land (UAA) for non-LFA farms



Average level of payments for 2014 is marked by the red line.

Source: own calculations.

Graph 18. Average amount of payment per 1 ha of agricultural land (UAA) for farms on LFA areas



Average level of payments for 2014 is marked by the red line.

Source: own calculations.

4. Value management and assessment of the financial situation of family farms in Poland – selected aspects

4.1. Introduction

The Common Agricultural Policy (CAP) of the European Union (EU) clearly accentuated the role of farms in the management of natural areas in the countryside. As the CAP evolved, the environmental aspect of the sustainability of agriculture as a sector or of single farms has been emphasised even more[41]. Though the fundamental aim of the agri-environmental payments is to "provide compensation for additional costs and income foregone resulting from applying those environmentally friendly farming practices"[42], in the case of the less-favoured areas (LFA) payments, we should speak only of partial intention to "stimulate" farms to provide more public goods. The LFA payments under the RDP were initiated to pursue the following objectives: ensuring continuity of agricultural production and thus maintaining the minimum population level, and protecting the rural landscape. This form of aid was addressed primarily to farms located in areas where the natural conditions are not favourable for intensive production (primarily plant production)[43]. In the EU, there are no uniform assumptions with regard to monitoring and assessment of benefits from the agri-environmental scheme or the LFA payments (both at the sector and the single farm level). Numerous (usually pilot) empirical studies are usually placed within the framework of methodological assumptions of proposed ratios and indicators.

The first part includes a review of empirical studies using ratios and indicators for monitoring of agri-environmental goals of economic entities (taking account of the specific nature of the agricultural sector) by referring to the theoretical and methodological basics of the concept of value management. Then, the EVA measurement with regard to family farms was carried out based on the division (1) between farms that receive the agri-environmental payment and farms that do not receive such aid, (2) between farms that receive the LFA payments and farms that do not benefit from this measure[44].

[41] The need to improve the methodological apparatus used to evaluate agri-environmental or strictly environmental measures is natural. Cf. OECD, *Evaluation of Agri-Environmental Policies: Selected Methodological Issues and Case Studies*, OECD Publishing, Paris 2012.

[42] European Commission, *Agri-enviroment measures*, http://ec.europa.eu/agriculture/envir/measures/index_en.htm (retrieved on: 13/09/2016).

[43] See Institute for European Environmental Policy, *Evaluation of the Less Favoured Area Measure in the 25 Member States of the European Union*, A report prepared by the Institute for European Environmental Policy for DG Agriculture, November 2006, pp. 1,11.

[44] The classification criteria concern the payments granted to farms: such an approach is applied in the annual statistical analysis of the impact of the EU subsidies on the financial situation of family farms from the FADN sample (in fact, the "payments granted" category is identical to the "payments received" for the definite majority of farms), cf. *Subsydia a ekonomika, finanse i dochody gospodarstw rolniczych [Subsidies versus economics, finances and income of farms] (1)* (J. Góral, ed.), Monografie Programu Wieloletniego, No. 4, IERiGŻ-PIB, Warszawa 2015. In order to make the analysis more subtle, the following divisions were also used: (a) division according to production type (TF8) and (b) division according to economic

The second part contains the verification of the model inequality (ROE > ROA), and the third includes an analysis of the results of DuPont decomposition for the above-mentioned entities.

The aim of this chapter is to evaluate the financial situation of family farms (narrowed down for the purpose of the research problem presented above) divided between those that receive and those that do not receive the aid in the form of the agri-environmental and LFA payments, respectively.

4.2. Management of value taking account of the environmental goals

The maximisation of value is considered the primary goal of economic organisation. As noted by J. Czekaj and Z. Dresler[45], the use of the category of value to make many financial decisions depends on the "existence of transparent ownership". This refers to the Polish agricultural sector, which is dominated by the "private sector farms" including "individual holdings"[46]. From the perspective of the use of value to make financial decisions (e.g. formulating a financial strategy or appraising farms), the absence of separation between the function of the owner and the function of the manager leads to numerous difficulties, involving such issues as lack of control of mutual compliance between the manager's decisions and the goal function of the farm.

Empirical corporate finance developed sound theoretical basis and methodology for measurement and monitoring of the generated value of an economic organisation (particularly corporations, including those active on capital markets). However, the specific economic and organisational nature of agricultural holdings and their relation to the social and market environment, preclude the application of certain methods. As shown by economical practice, the constraints on the use of EVA (Economic Value Added) with the ratios and derived indexes (even in the micro-, small and medium enterprise sector)[47] or CVA (Cash Value Added) result primarily from the absence of the registration and accounting obligation and the difficulties related to the estimation or appraisal of equity cost[48]. As a consequence, there is a need for numerous simplifications.

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size (ES SO). The *ex-post* analyses concern 2010 and 2014, and in the case of the dynamic of change in the model inequality, the period of 2010-2014 was used.

[45] J. Czekaj, Z. Dresler, *Podstawy zarządzania finansami firm*, Wyd. Naukowe PWN, Warszawa 1995, pp. 15-16.

[46] According to the 2013 data of the Central Statistical Office, individual holdings "constituted 99.7% of the total number of farms", what is more, they had 91% of the total agricultural land area at their disposal; Główny Urząd Miar [Central Statistical Office of Poland], *Charakterystyka gospodarstw rolnych w 2013 r.,* Informacje i Opracowania Statystyczne, Warszawa 2014. http://stat.gov.pl/files/gfx/portalinformacyjny/pl/defaultaktu-alnosci/5507/5/4/1/rl_charakterystyka_gospodarstw_rolnych_2013.pdf (retrieved on: 01/09/2016).

[47] See Stern Value Management, *Proprietary Tools*, http://sternvaluemanagement.com/intellectual-property-joel-stern/proprietary-tools-value-creation/ (retrieved on: 02/11/2015); A. Holler, *New Metrics for Value-Based Management. Enhancement of Performance Measurement and Empirical Evidence on Value-Relevance*, Gabler, GWV Fachverlage GmbH, Wiesbaden 2009.

[48] J. Franc-Dąbrowska, P. Kobus, *Koszt kapitału własnego – dylematy wyceny*, "Zagadnienia Ekonomiki Rolnej", 2012, No. 1, pp. 77-89.

The specific nature of micro-entity appraisal (including micro-enterprise appraisal[49]) requires an appropriate methodological approach to the accumulated assets[50]. It has its implications related to the possibility of using three groups: (1) determination of book value of assets, (2) income-based method of discounted cash flow, (3) comparable transactions method. There is a rather limited possibility to use the method based on the excess earnings over capital expenditure to appraise the entities. Its first stage, namely the determination of net cash flow by the owner of the business (in the case of a farm, this would concern persons involved in non-hired labour, i.e. the farm manager, their spouse and adult children) is particularly important[51]. The net cash flow would constitute the difference in the operational outturn (e.g. the gross value added in simple terms) of the farm and the alternative/hypothetical salary earned by those persons outside the farm.

The overview of empirical studies aimed at analysing the relation between the application of environmental practices and the economic outturn of enterprises shows that the impact of such practices on the general financial or economic situation is quite ambiguous. J. Céspedes-Lorente and E. Galdeano-Gómez[52], who referred to numerous examples of empirical studies, point to long-term benefits of the investment in environmental technology on the one hand, but on the other, from the perspective of the resource approach, environmental practices are a worthy and valuable capability. The findings from the panel model estimation of a sample of Andalusian horticultural companies (which participated in the RDP) showed positive impact of environmental investment on labour value added, the overall efficiency of the enterprise, or, which is very important, its financial outturn. What deserves attention, however, is the possibility to adapt the methodological approach used in the field of the so-called empirical corporate finance to the specific nature of family farms. This is illustrated by the empirical studies by N. Guenster's team[53], whose aim was to analyse relations between the eco-efficiency and the financial condition of stock-listed companies. What was important here was the market appraisal of the environmental aspect.

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[49] From the legal perspective, family farms are not part of the micro, small and medium enterprise sector, but as from the economic point of view, industrial farm production has all characteristics of business activity, typical e.g. of family businesses.

[50] P. Szczepankowski cites the collection of factors necessary for a reliable appraisal listed by the American Society of Appraisers: "the purpose of appraisal, its addressee, key financial parameters required for appraisal of the enterprise and its valuation (e.g. its strengths and weaknesses, business risk, debt and financial liquidity, the utilisation of assets ratio, the structure, ownership, quantity, character and value of assets, development plans, strength of the competition, factors limiting growth and development, income, cost, generated revenue and cash flow, methods of financing and cost of capital" (important elements underlined by the paper's author – M.S.), P. Szczepankowski, *Wycena i zarządzanie wartością przedsiębiorstwa*, Wyd. Naukowe PWN, Warszawa 2007, p. 300.

[51] Ibidem, p. 303.

[52] J. Céspedes-Lorente, E. Galdeano-Gómez, *Environmental practices and the value added of horticultural firms*, "Business Strategy and the Environment", 13, 2004, pp. 403-414.

[53] N. Guenster, R. Bauer, J. Derwall, K. Koedijk, *The Economic Value of Corporate Eco-Efficiency*, "European Financial Management", Vol. 17, Issue 4, September 2011, pp. 679-704.

J. Finn et al.[54] presented quite an interesting concept of the Agri-Environment Footprint Index (AFI), which was intended to be used for evaluating the environmental impact of agri-environmental schemes under the CAP. However, these evaluations were intended only for the regional level. The application of AFI is related to the use of multi-criteria analytical methods. The methodological framework can be adapted to the specific situation in individual Member States. The AFI can be used to measure changes to the environmental performance assigned to the agri-environmental schemes: then, the average results of farms benefiting from the agri-environmental schemes are compared to results of farms not participating in the schemes (and representing the same production type and geographical location). The pilot studies that took place (using a sample of 20 British farms) show that the prospects for the use of AFI in the EU countries are promising. S. van Passel et al.[55] observed that the measurement of generation and monitoring of Sustainable Value are less important than identification of differences in sustainable efficiency between specific types of economic entities. The researchers refer to the approach proposed by F. Figgi and T. Hahn in a cycle of articles[56]. This methodological approach uses a very broad range of the definition of capital and the microeconomic concept of opportunities costs. Findings from the research by van Passel's team showed that farms with larger areas were characterised by higher sustainable efficiency. What is more, the farm manager's age and the subsidy rate (understood as the value of subsidies to total sales revenue ratio) were variables that explained significant differences in the integrated efficiency[57].

M. Epstein and D. Young[58] presented quite an interesting proposal to use the EVA ratio to improve the environmental efficiency of enterprises. They provided examples of the use of EVA instead of the traditional discounted cash flow (DCF). Following the example of P. Corell, they pointed to the important relation between the future value for shareholders (and stakeholders in the broad sense in the case of agricultural holdings) and the environmental responsibility. The reduction in the environmental impact led to the decrease in long-term costs. Based on a systematic review of

[54] J. Finn, A.L. Mauchline, S.R. Mortimer, J.R. Park, *Measuring Environmental Performance and Value Added Using the Agri-environmental Footprint Index,* Proceedings 16th International Farm Management Congress Vol. 1, http://ifmaonline.org/wpcontent/up-loads/2014/07/07Mauchline_etal.pdf (retrieved on: 01/09/2016), pp.706-711.

[55] S. Van Passel, F. Nevens, E. Mathijs, G. Van Huylenbroeck, *Measuring farm sustainability and explaining differences in sustainable efficiency*, "Ecological Economics", 62(1), April 2007, pp. 149-161.

[56] See F. Figge, T. Hahn, *Value-oriented impact assessment: the economics of a new approach to impact assessment*, "Journal of Environmental Planning and Management", 47(6), 2004, pp. 921-941; F. Figge, T. Hahn, *The cost of sustainability capital and the creation of sustainable value by companies*, "Journal of Industrial Ecology", 9(4), 2005, pp. 47-58.

[57] S. Van Passel, F. Nevens, E. Mathijs, G. Van Huylenbroeck*., Measuring farm sustainability…,* op. cit.

[58] M. Epstein, D. Young, *Improving Corporate Environmental Performance Through Economic Value Added,* INSEAD Working Paper Series, 98/15/AC, INSEAD, Fontainebleau, France.

literature, P. Kaval[59] proposed a collection of nearly 20 systems, ratios and indicators useful for monitoring of environmental objectives that are good to implement. From the perspective of family farms benefiting from agri-environmental or LFA payments, it is possible to use (after certain adjustments) the Balanced Scorecard approach (as e.g. in the sustainable development perspective[60]), the Sustainable Value ratio, and the Triple Bottom Line reporting. However, a sensible adaptation of the second one seems most promising[61].

To sum up, the application of EVA or similar ratios and indicators to the implementation of a bundle of objectives of family farms[62] is related to numerous adjustments. Taking account of the fact that entities in the agricultural sector may participate in rural development programmes (RDP) and, as a result, they are granted agri-environmental or LFA payments if they meet defined requirements, there is a need to emphasise the issue of the impact of a farm on the environment or the ecosystem under the value management system (e.g. under the Balanced Scorecard). At the sector level, the evaluation of the efficiency of the above programmes (which is useful for the shaping of both the CAP and the national agricultural policy) may include a comprehensive assessment of the financial and economic situation of farms benefiting from those payments compared to entities that do not receive such aid. This is the approach presented later in this study.

The methodological assumptions related to the EVA calculation are a continuation of the approach proposed in 2015[63]. It is worth restating that the so-called basic method of EVA calculation (which takes account only of non-adjusted values of operating profit and invested capital) was used. Table 1 shows the estimates of cost of equity (and explanation of the applied methodological approach) for 2010 and 2014.

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[59] P. Kaval, *Measuring and valuing environmental impacts. A Systematic Review of Existing Methodologies. Measuring and Valuing Environmental Impacts*, University of Waikato, Network for Business Sustainability, 2011, http://nbs.net/wp-content/uploads/NBS-Systematic-Review-Impacts1.pdf (retrieved on: 01/09/2016).

[60] As in the BSC proposal presented by T. Jaworski and T. Kondraszuk. Cf. J. Jaworski, T. Kondraszuk, *Ramy koncepcyjne zastosowania strategicznej karty wyników w gospodarstwie wiejskim*, "Zeszyty Teoretyczne Rachunkowości", Vol. 74 (130), SKwP, Warszawa 2013, pp. 45-63.

[61] See F. Figge, T. Hahn, *Sustainable Value Added: Measuring Corporate Contributions to Sustainability Beyond Eco-Efficiency*, "Ecological Economics", 48(2), 2004, pp. 173-187, F. Figge, T. Hahn, *Value-oriented impact assessment: the economics of a new approach to impact assessment*, "Journal of Environmental Planning and Management", 47(6), 2004, pp. 921-941; F. Figge, T. Hahn, *Looking for Sustainable Value*, "Environmental Finance", 7(8), 2006, pp. 34-35.

[62] Bundles of goals of family farms (before the accession to the EU) are discussed in a study by E. Majewski and W. Ziętara. Cf. E. Majewski, W. Ziętara, *System celów w rolniczych gospodarstwach rodzinnych*, "Zagadnienia Ekonomiki Rolnej", 1997, No. 6.

[63] M. Soliwoda's methodological concept was presented in the chapter titled: *Zarządzanie wartością i ocena sytuacji finansowej – wybrane problemy zarządzania finansami rodzinnych gospodarstw rolniczych* [Value management and assessment of financial sitation – Selected problems of family farm finance management] [in:] *Subsydia a ekonomika, finanse i dochody gospodarstw rolniczych (1)* (J. Góral, ed.), Monografie Programu Wieloletniego No. 4, IERiGŻ-PIB, Warszawa 2015.

Table 1. Estimates of cost of equity and factors contributing to its size on farms from the FADN sample

Category	2010 [%]	2014 [%]
Long-term expected rate of risk (global)*	3.90	3.60
National risk premium**	-0.15	1.75
Risk-free rate; rate of return on 10-year treasury bonds in Poland***	5.80	3.56
Beta coefficient of equity	0.65	0.92
Cost of equity ****	8.24	8.48

Explanations: * The adopted rate is the global rate for the period from 1900 to 2010 and 2014, respectively; Credit Suisse Global Investment Returns Yearbook; ** Adopted on the basis of the expert's estimate provided by A. Damodaran in *Equity Risk Premiums (ERP): Determinants, Estimation and Implications – The 2010 Edition i the 2014 Edition,* http://people.stern.nyu.edu/adamodar/pdfiles/papers/ERP2010.pdf (retrieved on: 15/08/2016); ** After the Global Financial Crisis (GFC) and its consequences in Europe, reference to the risk-free rate is doubtful even in the case of treasury bonds; the adopted values are the averages calculated by the module at: *Dane historyczne dla dochodów z obligacji Polska 10-letnie*, http://pl.investing.com/rates-bonds/poland-10-year-bond-yield-historical-data (retrieved on 15/08/2016); **** Calculated in the following way: risk-free rate + beta coefficient x (long-term expected rate of risk + national risk premium).
Source: own elaboration.

Following the example of W. Patena[64], certain adjustments was made to the CAPM model due to the consequences of the 2007/8+ financial crisis (the "classic" CAPM algorithm from before the financial crisis[65] was adjusted to match more unstable financial markets). The estimated beta coefficient for the farming/agriculture sector on the so-called emerging markets was taken from A. Damodaran[66]. The so-called global long-run risk premium was used. Then, the national risk premium according to Damodaran's Country Risk Premiums was added to this value. The model used to estimate the cost of equity can be expressed as follows[67]:

$$k_e = r_{rf} + \beta_i (k_m - r_{rf}) \quad (1)$$

where:
k_e – cost of equity(estimated);
r_{rf} – risk-free rate (e.g. rate of return on treasury bonds);
$k_m - r_{rf}$ - national risk premium (here: global risk premium + national risk premium).

[64] See W. Patena, *Zastosowanie technik iteracyjnych w wycenie przedsiębiorstwa – wycena Emcinsmed S.A.,* Finansowy Kwartalnik Internetowy "e-Finanse", 2010 (special issue), pp. 15-27, http://www.e-finanse.com/artykuly/164.pdf (retrieved on: 24/11/2015).
[65] The traditional approach to the calculation of the risk-free value in the CAP method was shown in: W. Cwynar, A. Cwynar, *Model wyceny aktywów kapitałowych – problemy stosowania w praktyce*. *Rynkowa premia za ryzyko*, "Przegląd Organizacji", No. 9, 2007, pp. 31-36.
[66] Beta coefficient based on A. Damodaran's study; see A. Damodaran, *Data*, http://pages.stern.nyu.edu/~adamodar/ (retrieved on: 15/08/2016).
[67] Table 2 includes the basic components and values necessary for calculating the cost of equity.

Tables 2 and 3 show the basic EVA descriptive statistics for the farms from the FADN set[68] according to the two standard approaches to classification (e.g. according to the TF8 production type and the ES6 SO economic size) both in 2010 and 2014. Just like in the case of the previous year's *ex-post* analysis for 2013, more than a half of farms specialising in plant production (except for the permanent crops type) generated positive added value. The type that requires the most attention is the mixed production type, where both the median and the average economic value added were the lowest in the sample. In 2014, there were more difficulties in generating economic value added, which is shown by the overall descriptive statistics for the sample. It is worth adding that fieldcrop and granivore type farms that received LFA and agri-environmental payments generated higher EVA that their counterparts that did not benefit from such aid. In the case of the classes ranging from medium-small to large, an increase in the economic added value was observed both in 2010 and 2014. What is more, farms receiving LFA or agri-environmental payments generated higher EVA than entities belonging to the same economic size class that did not receive the said aid[69]. An analysis using the Mann-Whitney nonparametric U test showed that the decision to grant the agri-environmental payments significantly differentiates the EVA statistically (0.05) in the case of fieldcrop and mixed production farms (2010 only) and the general farm samples. On the other hand, fieldcrop and horticultural farms that respectively receive and do not receive LFA payments, differed significantly as regards the generated EVA. Taking account of the agri-environmental payments as a variable which divides farms into groups and the classification according to the economic size, significant differences ($p<0.05$) in EVA distributions were noted in the case of the entire sample, the small-medium (C) and the large-medium farms. For both years, the fact whether farms received LFA payments or not (as a variable that divided farms into groups) significantly differentiated EVA for large-medium and large entities, but also for the entire sample.

[68] This set included entities (agricultural holdings owned by natural persons) whose accounting data was collected in the FADN system in the years of the analysis (i.e. 2010 and 2014). The empirical sample is purposive. The descriptive statistics of the key ratios and indicators were shown in Table 1A in the Appendix. Entities with negative equity were removed from the sample (and for analysis of meeting the model inequalities andthe DuPont decomposition, also an entity with extremely high rates of return).

[69] Studies by German agri-economists showed that an increase in the area of organic crops was stimulated by aid in the form of subsidies (including the agri-environmental payments) and also resulted from the increase in intensity of animal production. Growth of farms (in the output approach) was measured using the area of the farm, its equipment with other production factor, and the intensity of animal production. Cf. Th. Brenes-Muñoz, S. Lakner, B. Brümmer, *What Influences the Growth of Organic Farms? Evidence from a Panel of Organic Farms in Germany*, "German Journal of Agricultural Economics", 65(2016), No. 1, 2016, pp. 1-11.

Table 2. EVA descriptive statistic for farms according to production types

Breakdown (PLN thousand)	Fieldcrops (1)	Specialist horticulture	Permanent crops (4)	Grazing livestock (5;6)	Granivores (7)	Mixed (8)	Total
2010							
Farms receiving agri-environmental payments							
Number	851	27	46	559	216	1293	2992
Minimum	-493.8	-78.2	-197.3	-391.1	-170.4	-301.3	-493.8
Median	15.7	21.2	-7.7	4.0	8.0	-3.4	2.3
Maximum	1375.0	574.3	116.8	608.7	1556.5	1245.7	1556.5
Arithmetic mean	46.8	78.2	-6.0	14.3	48.7	4.7	22.1
Standard deviation	140.9	128.7	51.9	70.1	177.7	76.2	109.2
Farms not receiving agri-environmental payments							
Number	1623	346	354	1889	642	3157	8012
Minimum	-1219.1	-465.8	-329.8	-367.5	-571.1	-646.8	-1219.1
Median	3.1	24.7	-2.8	1.4	5.4	-9.4	-3.1
Maximum	1709.0	2403.9	1441.8	557.0	1762.4	977.2	2403.9
Arithmetic mean	24.7	99.0	13.2	14.1	48.2	-6.5	14.5
Standard deviation	124.7	245.0	131.5	67.3	176.5	59.8	109.8
p-value	**0.001/0.001**	0.257/0.514	0.307/0.613	0.406/0.812	0.168/0.336	**0.001/0.001**	**0.001/0.001**
Farms receiving LFA payments							
Number	850	136	151	1768	467	2279	**5651**
Minimum	-493.8	-78.8	-197.3	-391.1	-571.1	-329.3	**-571.1**
Median	12.4	22.3	4.3	3.5	9.5	-7.4	**-0.7**
Maximum	1375.0	975.3	1210.2	608.7	1762.4	977.2	**1762.4**
Arithmetic mean	44.2	74.6	19.9	16.1	51.6	-1.4	**17.7**
Standard deviation	138.0	149.5	122.3	67.8	185.1	61.4	**100.0**
Farms not receiving LFA payments							
Number	1623	237	249	680	392	2172	5353
Minimum	-1219.1	-465.8	-329.8	-300.6	-249.7	-646.8	-1219.1
Median	5.8	25.8	-8.5	-1.4	2.0	-8.4	-2.9
Maximum	1709.0	2403.9	1441.8	557.0	1247.1	1245.7	2403.9
Arithmetic mean	26.0	110.5	5.2	9.1	44.6	-5.2	15.4
Standard deviation	126.7	276.3	126.5	68.1	166.2	68.8	119.1
p-value	**0.001/0.001**	0.377/0.755	**0.018/0.037**	**0.005/0.011**	0.145/0.291	**0.010/0.019**	**0.001/0.001**
2014							
Farms receiving agri-environmental payments							
Number	1008	18	46	615	159	1114	2960
Minimum	-984.3	-99.1	-221.8	-319.2	-252.7	-665.4	-984.3
Median	-12.3	5.5	-14.9	-15.4	-14.1	-23.3	-17.5
Maximum	1089.6	131.7	377.4	895.8	736.2	756.6	1089.6
Arithmetic mean	-6.5	1.9	-4.5	-9.2	-3.2	-26.8	-14.4
Standard deviation	125.4	61.0	90.4	86.9	127.0	83.6	103.2
Farms not receiving agri-environmental payments							
Number	2334	336	383	2460	656	2993	9162
Minimum	-843.9	-599.0	-1745.3	-936.2	-2599.2	-516.8	-2599.2
Median	-23.2	8.2	-31.1	-10.1	-21.1	-24.8	-19.9
Maximum	2417.0	5429.2	419.8	1049.6	2288.0	561.8	5429.2
Arithmetic mean	-23.2	77.4	-42.2	-5.8	6.7	-30.2	-15.7
Standard deviation	131.5	361.1	127.7	86.6	247.0	68.8	135.1
p-value	**0.001/0.001**	0.127/0.254	**0.005/0.010**	0.089/0.177	0.397/0.794	0.061/0.123	**0.001/0.001**
Farms receiving LFA payments							
Number	1122	147	153	2105	426	2075	6028
Minimum	-686.0	-258.3	-1745.3	-936.2	-2599.2	-665.4	-2599.2
Median	-17.7	2.1	-32.6	-10.2	-18.6	-24.8	-18.7
Maximum	2417.0	1939.9	297.1	1049.6	2288.0	756.6	2417.0
Arithmetic mean	-8.3	33.5	-46.0	-5.8	4.5	-29.4	-13.7
Standard deviation	138.4	205.3	158.7	86.6	274.2	74.6	123.6
Farms not receiving LFA payments							
Number	2220	207	276	970	389	2032	6094
Minimum	-984.3	-599.0	-491.6	-449.5	-497.2	-516.8	-984.3
Median	-20.9	19.0	-25.7	-13.9	-21.9	-24.1	-19.8
Maximum	1089.6	5429.2	419.8	895.8	1058.9	502.7	5429.2
Arithmetic mean	-23.1	101.9	-33.8	-7.9	5.2	-29.1	-17.1
Standard deviation	125.1	425.4	101.2	86.8	165.1	71.6	132.4
p-value	**0.009/0.019**	**<0.001/0.001**	**0.137/0.274**	0.240/0.480	0.361/0.722	0.137/0.274	**0.022/0.044**

Explanation: p-value from the Mann-Whitney U test refers to the differences in distributions/median values between groups (farms receiving specific type of payments vs farms not receiving them); values of the test statistic in the one tail/two tail convention were provided, p-value below the traditional statistical significance of 0.05 is given in bold.

Source: own calculation based on FADN data.

Table 3. EVA descriptive statistic for farms according to economiz size

Breakdown (PLN thousand)	Very small (A)	Small (B)	Medium-small (C)	Medium-large (D)	Large (E; F)	Total
2010						
Farms receiving agri-environmental payments						
Number	35	805	931	783	438	2992
Minimum	-29.4	-311.2	-197.3	-251.0	-493.8	-493.8
Median	-5.1	-7.3	-1.1	23.2	77.0	2.3
Maximum	21.3	199.3	262.4	411.3	1556.5	1556.5
Arithmetic mean	-5.6	-7.5	2.2	28.6	109.8	22.1
Standard deviation	11.3	28.0	48.7	77.1	232.8	**109.2**
Farms not receiving agri-environmental payments						
Number	111	2312	2567	2000	1022	8012
Minimum	-278.1	-1219.1	-571.1	-646.8	-300.6	-1219.1
Median	2.0	6.9	-7.2	-6.4	2.2	-3.1
Maximum	662.5	2403.9	1762.4	673.8	427.0	2403.9
Arithmetic mean	22.7	35.4	5.5	0.2	16.7	14.5
Standard deviation	103.4	156.1	98.0	63.8	67.7	109.8
p-value	0.064/0.128	**0.010/0.021**	**0.008/0.017**	**0.001/0.001**	0.230/0.459	**0.001/0.001**
Farms receiving LFA payments						
Number	70	1615	1849	1394	723	5651
Minimum	-32.1	-311.2	-197.3	-233.5	-571.1	-571.1
Median	-9.9	-9.5	-1.8	17.9	74.5	-0.7
Maximum	58.5	119.4	491.2	1210.2	1762.4	1762.4
Arithmetic mean	-6.9	-9.6	0.8	24.6	110.9	17.7
Standard deviation	15.0	25.1	47.3	82.0	216.7	**100.0**
Farms not receiving LFA payments						
Number	76	1502	1649	1389	737	5353
Minimum	-65.6	-145.1	-329.8	-307.6	-1219.1	-1219.1
Median	-7.9	-8.2	-5.5	9.6	54.2	-2.9
Maximum	29.7	261.5	413.2	491.8	2403.9	2403.9
Arithmetic mean	-8.9	-7.2	-1.5	13.7	104.7	15.4
Standard deviation	14.6	30.6	56.2	83.3	266.9	119.1
p-value	0.474/0.948	**0.035**/0.070	**0.009/0.019**	**0.001/0.001**	**0.008/0.017**	**0.001/0.001**
2014						
Farms receiving agri-environmental payments						
Number	46	773	897	778	466	2960
Minimum	-76.7	-221.7	-526.9	-362.9	-984.3	-984.3
Median	-11.9	-16.8	-22.5	-19.3	14.0	-17.5
Maximum	83.8	337.1	315.9	502.7	1089.6	1089.6
Arithmetic mean	-17.7	-19.3	-24.6	-20.8	24.2	-14.4
Standard deviation	27.2	33.6	58.7	91.4	208.4	**103.2**
Farms not receiving agri-environmental payments						
Number	191	2565	2898	2346	1162	9162
Minimum	-149.7	-195.4	-491.6	-444.1	-2599.2	-2599.2
Median	-16.1	-20.8	-21.9	-20.9	8.1	-19.9
Maximum	52.0	314.9	409.7	460.9	5429.2	5429.2
Arithmetic mean	-19.0	-23.1	-25.2	-24.1	41.5	-15.7
Standard deviation	22.3	33.7	58.5	91.6	335.0	135.1
p-value	0.393/0.786	**<0.001 / <0.001**	0.371/0.743	0.348/0.695	0.202/0.403	0.041/0.083
Farms receiving LFA payments						
Number	132	1681	1879	1519	817	6028
Minimum	-149.7	-221.7	-526.9	-409.3	-2599.2	-2599.2
Median	-15.4	-20.6	-20.9	-18.3	14.9	-18.7
Maximum	52.0	337.1	409.7	423.9	2417.0	2417.0
Arithmetic mean	-19.5	-23.0	-23.8	-20.0	41.3	-13.7
Standard deviation	23.1	32.5	54.4	87.2	293.3	**123.6**
Farms not receiving LFA payments						
Number	105	1657	1916	1604	812	6094
Minimum	-143.6	-195.0	-491.6	-444.1	-984.3	-984.3
Median	-16.8	-19.0	-23.3	-22.3	5.8	-19.8
Maximum	83.8	192.7	404.2	502.7	5429.2	5429.2
Arithmetic mean	-17.8	-21.5	-26.2	-26.3	31.6	-17.1
Standard deviation	23.6	34.9	62.4	95.5	314.8	132.4
p-value	0.471/0.941	0.062/0.124	0.095/0.190	**0.023/0.046**	0.061/0.122	**0.022/0.044**

Source: own calculation based on FADN data.

4.3. Monitoring compliance with the standard inequality

The *ex-post* analysis of meetingthe fundamental model inequality (ROE>ROA) concerned the period of 2010–2014 because the aim was to illustrate the dynamic of change more profoundly. In the statistical assessment, particular attention was paid to 2010 and 2014 (see Tables 1B and 1C in the Appendix). The analysed model inequality concerning profitability (ROE>ROA) was on average true for over 40% of the total number of farms benefiting from the agri-environmental payments in the first and the final year of the period (Tables 4 and 5). As far as the model inequality is concerned, the farms in a more favourable situation included primarily field crop farms (statistically significant differences with regard to the model inequality between the entities receiving agri-environmental payments in 2010 and 2014 were noted – cf. Table 1B) and specialist granivore farms (2014 only). Entities that did not receive such aid experienced more difficulties. Statistically significant differences with regard to whether the model inequality between field crop farms receiving LFA payments and farms not receiving them were observed. The Mann-Whitney U test showed the significance of the difference for mixed production type entities only with regard to 2014 (see Table 1B in the Appendix). Field crop farms are primarily beneficiaries of payments under the 1st pillar of the CAP (e.g. SAP – Single Area Payment and CAP – Complementary Area Payment). These subsidies stabilise their financial outturn, which in consequence is favourable with regard to compliance with the model inequality.

The analysis of data in Tables 6 and 7 shows that the return on equity did not exceed the return on assets on about 1/4 of agricultural holdings in the group of large farms (according to their economic size). The entities that receive the agri-environmental payments took advantage of the beneficial effects of the financial leverage in all economic size classes. Apart from such payments, they also benefited from the instruments under the 1st pillar of the CAP. The LFA payments they received were significant for the compliance with the model inequality on medium-small and medium-large farms (see Table 1B in the Appendix). The presented findings should be compared with the ROE and ROA descriptive statistics (see Table 1C in the Appendix). It can make it possible to identify the potential "warning signs" for the analysis of the set of agricultural holdings[70].

[70] ROE and ROA descriptive statistics are shown in Table 1C in the Appendix.

Table 4. Model inequality on farms in the FADN sample

Breakdown	Farms not receiving agri-environmental payments			Farms receiving agri-environmental payments		
	N	% of compliance with the inequality	Dynamic of compliance with the inequality (y/y)	N	% of compliance with the inequality	Dynamic of compliance with the inequality (y/y)
2010						
Fieldcrops	1623	38.1%	1.000	850	51.9%	1.000
Specialist horticulture	346	28.0%	1.000	27	22.2%	1.000
Permanent crops (4)	354	29.1%	1.000	47	17.0%	1.000
Grazing livestock (5;6)	1889	38.2%	1.000	559	37.2%	1.000
Granivores (7)	641	44.8%	1.000	216	51.4%	1.000
Mixed (8)	3158	19.3%	1.000	1293	29.8%	1.000
Total	**8011**	**30.4%**	**1.000**	**2992**	**38.7%**	**1.000**
2011						
Fieldcrops	1778	35.5%	1.021	828	52.3%	0.982
Specialist horticulture	334	24.3%	0.835	20	45.0%	1.500
Permanent crops (4)	360	33.3%	1.165	40	30.0%	1.500
Grazing livestock (5;6)	1891	38.3%	1.003	515	40.8%	1.010
Granivores (7)	594	46.0%	0.951	162	58.0%	0.847
Mixed (8)	3219	20.1%	1.066	1148	30.1%	0.896
Total	**8176**	**30.3%**	**1.017**	**2713**	**40.7%**	**0.952**
2012						
Fieldcrops	1929	37.4%	1.142	749	55.0%	0.952
Specialist horticulture (2)*	341	21.7%	0.914			
Permanent crops (4)	372	29.3%	0.908	40	27.5%	0.917
Grazing livestock (5;6)	2004	32.7%	0.906	515	34.8%	0.852
Granivores (7)	614	47.1%	1.059	147	57.8%	0.904
Mixed (8)	3162	19.4%	0.946	1022	32.3%	0.957
Total	**8422**	**29.2%**	**0.994**	**2487**	**41.1%**	**0.927**
2013						
Fieldcrops	2112	28.5%	0.832	1078	42.7%	1.117
Specialist horticulture (2)	342	24.0%	1.108	20	30.0%	
Permanent crops (4)	383	24.5%	0.862	48	27.1%	1.182
Grazing livestock (5;6)	2302	32.0%	1.122	686	33.5%	1.285
Granivores (7)	638	38.1%	0.841	187	50.3%	1.106
Mixed (8)	3039	15.7%	0.778	1282	28.0%	1.088
Total	**8816**	**25.3%**	**0.907**	**3301**	**35.2%**	**1.136**
2014						
Fieldcrops (1)	2334	33.1%	1.286	1008	47.1%	1.033
Specialist horticulture (2)	336	19.6%	0.805	18	27.8%	0.833
Permanent crops (4)	383	10.4%	0.426	46	23.9%	0.846
Grazing livestock (5;6)	2461	37.1%	1.242	615	39.0%	1.043
Granivores (7)	656	36.9%	0.996	159	51.6%	0.872
Mixed (8)	2993	17.1%	1.075	1114	29.0%	0.900
Total	**9163**	**27.8%**	**1.141**	**2960**	**38.4%**	**0.978**

Explanation: N – number of farms, * due to the fact that the number did not reach 15 entities (in the case of the specialist horticulture (2) farms receiving agri-environmental payments in 2012), the data could not be published, this also concerns the related "Dynamic of compliance with the inequality (y/y)" indicator for 2013.

Source: own calculation based on FADN data.

Table 5. Compliance with model inequality of FADN sample farms according to production types and the LFA payments

Breakdown	Farms not receiving LFA payments			Farms receiving LFA payments		
	N	% of compliance with the inequality	Dynamic of compliance with the inequality (y/y)	N	% of compliance with the inequality	Dynamic of compliance with the inequality (y/y)
2010						
Fieldcrops (1)	1623	40.8%	1.000	850	46.8%	1.000
Specialist horticulture (2)	237	30.4%	1.000	136	22.8%	1.000
Permanent crops (4)	249	28.5%	1.000	152	26.3%	1.000
Grazing livestock (5;6)	680	36.2%	1.000	1768	38.7%	1.000
Granivores (7)	391	43.0%	1.000	466	49.6%	1.000
Mixed (8)	2172	23.3%	1.000	2279	21.4%	1.000
Total	**5352**	**32.2%**	**1.000**	**5651**	**33.1%**	**1.000**
2011						
Fieldcrops (1)	1699	40.3%	1.033	907	42.0%	0.957
Specialist horticulture (2)	226	28.8%	0.903	128	19.5%	0.806
Permanent crops (4)	241	34.0%	1.155	159	31.4%	1.250
Grazing livestock (5;6)	738	37.0%	1.110	1668	39.6%	0.966
Granivores (7)	359	46.2%	0.988	397	50.6%	0.870
Mixed (8)	2157	24.6%	1.049	2210	20.9%	0.949
Total	**5420**	**33.2%**	**1.044**	**5469**	**32.5%**	**0.951**
2012						
Fieldcrops (1)	1785	42.9%	1.118	893	41.3%	0.969
Specialist horticulture (2)	221	25.8%	0.877	134	17.2%	0.920
Permanent crops (4)	252	27.0%	0.829	160	32.5%	1.040
Grazing livestock (5;6)	840	32.3%	0.993	1679	33.6%	0.853
Granivores (7)	366	45.1%	0.994	395	52.9%	1.040
Mixed (8)	2130	24.6%	0.987	2054	20.4%	0.907
Total	**5594**	**33.1%**	**1.027**	**5315**	**30.8%**	**0.919**
2013						
Fieldcrops (1)	2118	32.5%	0.901	1072	34.7%	1.008
Specialist horticulture (2)	212	27.8%	1.035	150	19.3%	1.261
Permanent crops (4)	264	25.8%	1.000	167	23.4%	0.750
Grazing livestock (5;6)	866	31.4%	1.004	2122	32.7%	1.230
Granivores (7)	376	38.0%	0.867	449	43.2%	0.928
Mixed (8)	2075	21.2%	0.840	2246	17.6%	0.945
Total	**5911**	**28.3%**	**0.903**	**6206**	**27.8%**	**1.054**
2014						
Fieldcrops (1)	2220	39.1%	1.260	1122	33.9%	1.022
Specialist horticulture (2)	207	24.2%	0.847	147	14.3%	0.724
Permanent crops (4)	276	12.0%	0.485	153	11.8%	0.462
Grazing livestock (5;6)	971	39.6%	1.415	2105	36.5%	1.108
Granivores (7)	389	39.3%	1.070	426	40.1%	0.881
Mixed (8)	2032	21.9%	1.014	2075	18.8%	0.985
Total	**6095**	**31.7%**	**1.158**	**6028**	**29.0%**	**1.015**

Source: as in Table 4.

Table 6. Compliance with model inequality of FADN sample farms according to economic size and agri-environmental payment

Breakdown	Farms not receiving agri-environmental payments			Farms receiving agri-environmental payments		
	N	% of compliance with the inequality	Dynamic of compliance with the inequality (y/y)	N	% of compliance- with the inequality	Dynamic of compliance with the inequality (y/y)
2010						
Very small (A)	111	0.9%	1.000	35	0.0%	1.000
Small (B)	2312	5.5%	1.000	805	7.1%	1.000
Medium-small (C)	2567	23.4%	1.000	931	32.0%	1.000
Medium-large (D)	2000	49.2%	1.000	783	59.8%	1.000
Large (E;F)	1021	70.9%	1.000	438	76.7%	1.000
Total	**8011**	**30.4%**	**1.000**	**2992**	**38.7%**	**1.000**
2011						
Very small (A)	134	0.0%	0.000	27	0.0%	-
Small (B)	2385	4.9%	0.921	714	7.1%	0.895
Medium-small (C)	2621	25.1%	1.093	824	32.9%	0.909
Medium-large (D)	1998	49.4%	1.003	740	60.3%	0.953
Large (E;F)	1038	69.1%	0.990	408	82.1%	0.997
Total	**8176**	**30.3%**	**1.017**	**2713**	**40.7%**	**0.952**
2012						
Very small (A)	136	1.5%	-	24	0.0%	-
Small (B)	2499	5.0%	1.068	660	9.4%	1.216
Medium-small (C)	2647	21.8%	0.878	754	32.1%	0.893
Medium-large (D)	2044	48.3%	1.001	671	61.1%	0.919
Large (E;F)	1096	70.3%	1.075	378	81.7%	0.922
Total	**8422**	**29.2%**	**0.994**	**2487**	**41.1%**	**0.927**
2013						
Very small (A)	214	0.0%	0.000	53	3.8%	-
Small (B)	2597	3.8%	0.784	837	4.9%	0.661
Medium-small (C)	2782	19.4%	0.936	1027	28.1%	1.194
Medium-large (D)	2144	41.9%	0.909	886	51.9%	1.122
Large (E;F)	1079	64.6%	0.904	498	74.3%	1.197
Total	**8816**	**25.3%**	**0.907**	**3301**	**35.2%**	**1.136**
2014						
Very small (A)	191	0.0%	-	46	4.3%	1.000
Small (B)	2565	3.1%	0.806	773	6.1%	1.146
Medium-small (C)	2898	19.9%	1.070	897	29.7%	0.920
Medium-large (D)	2346	47.6%	1.244	778	60.0%	1.015
Large (E;F)	1163	66.6%	1.110	466	76.0%	0.957
Total	**9163**	**27.8%**	**1.141**	**2960**	**38.4%**	**0.978**

Source: as in Table 4.

Table 7. Compliance with model inequality of FADN sample farms according to economic size and LFA payment

Breakdown	Farms not receiving LFA payments			Farms receiving LFA payments		
	N	% of compliance with the inequality	Dynamic of compliance with the inequality (y/y)	N	% of compliance with the inequality	Dynamic of compliance with the inequality (y/y)
2010						
Very small (A)	76	1.3%	1.000	70	0.0%	1.000
Small (B)	1502	6.7%	1.000	1615	5.2%	1.000
Medium-small (C)	1649	25.6%	1.000	1849	25.8%	1.000
Medium-large (D)	1389	49.5%	1.000	1394	54.8%	1.000
Large (E;F)	736	69.8%	1.000	723	75.5%	1.000
Total	**5352**	**32.2%**	**1.000**	**5651**	**33.1%**	**1.000**
2011						
Very small (A)	71	0.0%	0.000	90	0.0%	-
Small (B)	1483	6.4%	0.950	1616	4.5%	0.869
Medium-small (C)	1709	26.9%	1.088	1736	27.0%	0.983
Medium-large (D)	1419	50.2%	1.036	1319	54.6%	0.942
Large (E;F)	738	72.4%	1.039	708	73.2%	0.949
Total	**5420**	**33.2%**	**1.044**	**5469**	**32.5%**	**0.951**
2012						
Very small (A)	63	1.6%	-	97	1.0%	-
Small (B)	1570	7.1%	1.179	1589	4.7%	1.027
Medium-small (C)	1744	25.2%	0.956	1657	22.9%	0.810
Medium-large (D)	1432	50.2%	1.008	1283	52.9%	0.943
Large (E;F)	785	73.8%	1.084	689	72.7%	0.967
Total	**5594**	**33.1%**	**1.027**	**5315**	**30.8%**	**0.919**
2013						
Very small (A)	118	1.7%	2.000	149	0.0%	0.000
Small (B)	1640	4.5%	0.661	1794	3.6%	0.867
Medium-small (C)	1873	22.2%	0.948	1936	21.3%	1.087
Medium-large (D)	1521	43.9%	0.929	1509	45.7%	1.016
Large (E;F)	759	67.3%	0.883	818	68.0%	1.110
Total	**5911**	**28.3%**	**0.903**	**6206**	**27.8%**	**1.054**
2014						
Very small (A)	105	1.0%	0.500	132	0.8%	-
Small (B)	1657	4.8%	1.081	1681	2.7%	0.708
Medium-small (C)	1916	24.0%	1.106	1879	20.4%	0.930
Medium-large (D)	1605	51.2%	1.229	1519	50.2%	1.106
Large (E;F)	812	70.6%	1.121	817	67.9%	0.998
Total	**6095**	**31.7%**	**1.158**	**6028**	**29.0%**	**1.015**

Source: as in Table 4.

4.4. Financial situation monitoring using the DuPont model

Tables 8 and 9 show the results of the modified (based on methodologically and methodically elaborated A.K. Mishra's concept[71]) DuPont decomposition for farms in the FADN sample according to the adopted approaches to classification[72], which was done in a simplified manner (departing from the traditional graphic conventions). All the presented ratios were calculated as average values of individual data from entities in relevant production types (Table 8), economic size classes (Table 9), and in the case

[71] See A. Mishra, Ch.B. Moss, K.W. Erickson, *Regional differences in agricultural profitability, government payments, and farmland values: implications of DuPont expansion*, "Agricultural Finance Review", Vol. 6, No. 1, 2009, pp 49-66.

[72] Attention was paid to the direct determinants of the ROE without presenting the lower decomposition levels.

of indicators, weighted averages were used. The basic assumption of the simplified DuPont decomposition is the treatment of the ROE (return on equity), i.e. the indicator of profitability of equity), as a product of the following components:

PM *(profit margin; net income/sales):*

$$\frac{\textit{family farm income – cost of own labour}}{\textit{production – intermediate consumption}}$$

S/A *(sales/assets)* - indicator of asset rotation (production less intermediate consumption/ total assets – annual average);
and
A/E *(assets/equity)* – equity multiplier (total assets/total equity – annual average).

The analysis of ROE indicator decomposition shows that nearly all farms classified as very small (A) according to their economic size could not generate positive income from the family farm. From the perspective of agricultural policy, ROE profitability assessment can be a premise for the reform of agrarian structure. The factors that are decisive for the compliance with the model inequality are factors related to the shaping of farm profitability. In the case of both horticultural and granivore type farms, the need for external capital was relatively high (as a result, high values of the A/E equity multiplier were observed). In general, as the economic size grew, the return on equity improved, which was influenced primarily by the so-called profit margin[73]. This concerned both entities that received payments and those that did not benefit from such instruments.

The Mann-Whitney U test showed statistically significant ($p<0.05$) differences in the ROE decomposition as a financial category which is (potentially) an object of particular interest for farm managers (see Table 1B in the Appendix). In the case of the agri-environmental payments, this concerned the fieldcrop and mixed type entities and farms that belonged to economic size classes ranging from small (B) to medium-large (D). Taking account of the LFA payments as a grouping variable, the findings were not that coherent: statistically significant differences were noted in the case of fieldcrop farms (only the period until 2010) and in the mixed production type (2014 only). On the other hand, statistically significant differences were observed in the case of the medium-large and large farms (but only in 2010).

[73] Profit margin is in fact the ratio of the adopted economic surplus (here: income from the family farm less the own labour cost) to sales revenue.

Table 8. Findings from the modified DuPont decomposition for farms by production type

Breakdown	ROE	P/M	S/A	A/E
2010				
Farms receiving agri-environmental payments				
Fieldcrops (1)	6.9%	90.2%	0.068	1.129
Specialist horticulture (2)	8.7%	33.6%	0.198	1.304
Permanent crops (4)	2.0%	44.4%	0.042	1.099
Grazing livestock (5;6)	3.6%	48.1%	0.065	1.133
Granivores (7)	6.8%	66.9%	0.088	1.160
Mixed (8)	2.6%	42.3%	0.056	1.095
Total	4.7%	64.5%	0.065	1.120
Farms not receiving agri-environmental payments				
Fieldcrops (1)	5.3%	58.2%	0.082	1.105
Specialist horticulture (2)	9.6%	32.9%	0.232	1.254
Permanent crops (4)	2.2%	17.3%	0.116	1.105
Grazing livestock (5;6)	3.8%	39.8%	0.085	1.114
Granivores (7)	6.9%	57.9%	0.105	1.141
Mixed (8)	1.0%	14.3%	0.066	1.067
Total	3.7%	38.7%	0.086	1.103
Farms receiving LFA payments				
Fieldcrops (1)	6.6%	83.2%	0.071	1.128
Specialist horticulture (2)	10.1%	36.8%	0.217	1.266
Permanent crops (4)	2.1%	18.0%	0.104	1.130
Grazing livestock (5;6)	3.9%	43.8%	0.078	1.122
Granivores (7)	7.0%	63.3%	0.097	1.148
Mixed (8)	1.5%	24.4%	0.057	1.080
Total	4.0%	48.2%	0.075	1.114
Farms not receiving LFA payments				
Fieldcrops (1)	5.5%	62.3%	0.080	1.107
Specialist horticulture (2)	9.3%	31.6%	0.234	1.253
Permanent crops (4)	2.3%	18.6%	0.112	1.089
Grazing livestock (5;6)	3.4%	35.8%	0.085	1.107
Granivores (7)	6.7%	55.7%	0.105	1.143
Mixed (8)	1.5%	20.9%	0.068	1.073
Total	4.0%	42.2%	0.086	1.102
2014				
Farms receiving agri-environmental payments				
Fieldcrops (1)	4.2%	68.0%	0.055	1.128
Specialist horticulture (2)	1.0%	8.6%	0.092	1.267
Permanent crops (4)	2.8%	38.1%	0.068	1.065
Grazing livestock (5;6)	3.1%	43.8%	0.065	1.087
Granivores (7)	4.4%	52.9%	0.074	1.119
Mixed (8)	1.4%	26.2%	0.049	1.072
Total	3.0%	48.4%	0.056	1.100
Farms not receiving agri-environmental payments				
Fieldcrops (1)	2.8%	39.8%	0.064	1.105
Specialist horticulture (2)	6.2%	22.9%	0.219	1.249
Permanent crops (4)	-2.9%	-40.1%	0.069	1.059
Grazing livestock (5;6)	3.1%	33.0%	0.086	1.077
Granivores (7)	4.3%	41.7%	0.094	1.089
Mixed (8)	-0.7%	-12.8%	0.054	1.063
Total	1.9%	24.2%	0.074	1.086
Farms receiving LFA payments				
Fieldcrops (1)	3.7%	58.1%	0.057	1.114
Specialist horticulture (2)	3.6%	20.0%	0.145	1.236
Permanent crops (4)	-2.7%	-41.8%	0.060	1.058
Grazing livestock (5;6)	3.1%	36.2%	0.079	1.079
Granivores (7)	4.3%	45.2%	0.086	1.103
Mixed (8)	-0.3%	-6.2%	0.046	1.064
Total	2.2%	30.9%	0.066	1.086
Farms not receiving LFA payments				
Fieldcrops (1)	3.0%	43.5%	0.063	1.111
Specialist horticulture (2)	7.5%	23.4%	0.253	1.260
Permanent crops (4)	-2.1%	-27.0%	0.074	1.061
Grazing livestock (5;6)	3.0%	31.9%	0.087	1.079
Granivores (7)	4.3%	42.3%	0.093	1.088
Mixed (8)	0.2%	2.7%	0.058	1.067
Total	2.2%	28.4%	0.072	1.093

Explanation: ROE – return on equity [%], PM – profit margin (understood as net income to sales revenue ratio) [%]; S/A – asset rotation (sales revenue/assets)[-], A/E – capital multiplies (assets/equity)[-]/.

Source: own calculation based on FADN data.

Table 9. Findings from the modified DuPont decomposition for farms by economic size

Breakdown	ROE	PM	S/A	A/E
2010				
Farms receiving agri-environmental payments				
Very small (A)	-7.3%	-238.8%	0.030	1.017
Small (B)	-3.2%	-74.2%	0.041	1.038
Medium-small (C)	1.9%	32.3%	0.055	1.078
Medium-large (D)	5.4%	73.4%	0.065	1.130
Large (E;F)	8.3%	91.2%	0.079	1.164
Total	4.7%	64.5%	0.065	1.120
Farms not receiving agri-environmental payments				
Very small (A)	-3.9%	-85.3%	0.044	1.027
Small (B)	-2.1%	-35.1%	0.059	1.030
Medium-small (C)	-0.2%	-1.9%	0.076	1.064
Medium-large (D)	1.2%	13.5%	0.083	1.102
Large (E;F)	4.5%	36.3%	0.107	1.164
Total	1.5%	15.6%	0.086	1.103
Farms receiving LFA payments				
Very small (A)	-8.7%	-240.3%	0.036	1.007
Small (B)	-3.8%	-82.4%	0.045	1.030
Medium-small (C)	1.3%	18.6%	0.064	1.072
Medium-large (D)	4.9%	59.1%	0.074	1.120
Large (E;F)	8.7%	78.3%	0.094	1.178
Total	4.0%	48.2%	0.075	1.114
Farms not receiving LFA payments				
Very small (A)	-10.0%	-212.0%	0.045	1.042
Small (B)	-3.4%	-50.0%	0.065	1.035
Medium-small (C)	1.4%	17.0%	0.077	1.064
Medium-large (D)	4.3%	48.6%	0.081	1.100
Large (E;F)	7.9%	67.0%	0.102	1.152
Total	4.0%	42.2%	0.086	1.102
2014				
Farms receiving agri-environmental payments				
Very small (A)	-7.1%	-486.4%	0.014	1.015
Small (B)	-3.9%	-124.4%	0.030	1.029
Medium-small (C)	0.3%	7.3%	0.043	1.057
Medium-large (D)	3.4%	54.2%	0.057	1.102
Large (E;F)	6.4%	78.6%	0.071	1.147
Total	3.0%	48.4%	0.056	1.100
Farms not receiving agri-environmental payments				
Very small (A)	-10.8%	-444.7%	0.024	1.007
Small (B)	-5.4%	-127.5%	0.042	1.019
Medium-small (C)	-0.8%	-12.4%	0.060	1.046
Medium-large (D)	2.5%	32.4%	0.073	1.081
Large (E;F)	6.5%	58.1%	0.097	1.148
Total	1.9%	24.2%	0.074	1.086
Farms receiving LFA payments				
Very small (A)	-9.5%	-553.6%	0.017	1.007
Small (B)	-5.2%	-163.3%	0.031	1.020
Medium-small (C)	-0.6%	-11.0%	0.052	1.046
Medium-large (D)	2.9%	39.2%	0.067	1.081
Large (E;F)	6.7%	67.0%	0.088	1.147
Total	2.2%	30.9%	0.066	1.086
Farms not receiving LFA payments				
Very small (A)	-10.8%	-367.6%	0.029	1.011
Small (B)	-4.9%	-102.4%	0.046	1.023
Medium-small (C)	-0.4%	-6.7%	0.060	1.052
Medium-large (D)	2.7%	35.6%	0.069	1.091
Large (E;F)	6.2%	59.3%	0.090	1.149
Total	2.2%	28.4%	0.072	1.093

Explanation and source: as for the previous Table.

4.5. Summary

The value management system of family farm uses the EVA ratio or a set of similar ratios and indicators (e.g. Sustainable Value). The more indepth monitoring of the set of goals of family farms involves the need to adapt methodological approaches from the field of corporate finance. The justified need to emphasise the issue of farm impact on the environment or the ecosystem, as part of the value management system (e.g. as part of the Balanced Scorecard), induces to improve (or even construct *ex nihilo*)

methods for monitoring and assessment of the benefits folloeing from the use of the agri-environmental or LFA schemes. This concerns both the sectoral level and the level of individual farms.

The fact whether agri-environmental payments were paid or not significantly differentiated EVA of the fieldcrop and mixed production type farms. Whereas the fact of obtaining the LFA payments by farms resulted in a significant difference EVA distribution only for crop farms specialised in horticultural or permanent crops. The farms whose situation with regard to the compliance with the fundamental inequality was favourable were primarily fieldcrop farms and specialist granivore farms (but only in 2014). It should be stressed that the granting of SAP and CAP helps fieldcrop farms to comply with the model inequality (difficulties in compliance can occur in years when situation on agricultural markets is unfavourable). The fact whether farms received LFA payments or not was significant for the compliance with the model inequality on medium-small and medium-large farms. The relatively favourable situation with regard to rate on equity was observed in the case of fieldcrop and granivore farms (which includes family poultry farms). It was observed that the situation of entities benefiting from the agri-environmental payments (compared to their counterparts that did not receive such aid) in the fieldcrop and mixed production types as well as in economic size classes ranging from small (B) to medium-large (D) was better. Such relations were not observed in the case of the LFA payments whose purpose is not to stabilise agricultural income but primarily to contribute to environmental goals, which leads to improved sustainability at the sector level. What is more, financial effect of subsidies can be noticed after a year or even after two or three years due to the delay between the administrative decision to grant payments and the use of the payments[74].

The impact of the agri-environmental and LFA payments on the economic and financial situation of agricultural holdings is not limited to the compensation for lost profit or increase in public good provision respectively. The reception of these forms of aid under the RDP increases the subsidy rate of family farms. As a result, the complex mechanism starting from better stabilised income leads to the improved credit scoring and improvement in the development capability of these entities[75]. This explains better financial condition (which is illustrated by EVA, compliance with the model inequality or the ROE indicator) e.g. of fieldcrop farms that received agri--environmental payments.

[74] See M. Soliwoda, *What determines investment rate of Polish large-sized farms?*, "Business & Economic Horizons", 11(3), July 2015, pp. 183-194.

[75] See J. Góral, *Oddziaływanie dopłat bezpośrednich na wyniki ekonomiczne gospodarstw rolnych*, [in:] *Subsydia a ekonomika, finanse i dochody gospodarstw rolniczych (1)* (J. Góral, ed.), Monografie Programu Wieloletniego Nr 4, IERiGŻ-PIB, Warszawa 2015, p. 131.

Appendix

Table 1A. Descriptive statistic for variables uder for EVA calculation

Specification	Unit	Minimum	Median	Maximum	Mean	Standard Deviation
2010						
Assets (annual average)	PLN thou.	16.9	782.7	26,982.5	1,108.5	1,150.1
Equity (annual average)	PLN thou.	1.0	726.3	24,844.6	1,000.4	1,013.3
Share of debt in financing of assets	%	-1.65%	3.15%	99.81%	6.99%	9.74%
Net value added	PLN thou.	-485.1	57.4	2,763.8	100.3	149.4
Total output reduced by intermediate consumption	PLN thou.	-184.0	50.7	3,199.7	88.9	138.2
ROA	%	-121.8	1.1	284.9	1.1	9.6
ROE	%	-121.8	0.9	44,128.6	5.4	420.8
Total asset turnover	times	-0.19	0.07	3.51	0.08	0.09
Equity multiplier	times	0.98	1.03	538.88	1.14	5.13
WACC	%	0.8%	8.1%	11.8%	7.9%	0.6%
2014						
Assets (annual average)	PLN thou.	6.3	955.4	30,070.8	1,346.9	1,387.2
Equity (annual average)	PLN thou.	6.3	904.6	28,425.5	1,236.1	1,227.8
Share of debt in financing of assets	%	0.0%	0.8%	96.3%	5.4%	9.2%
Net value added	PLN thou.	-1460.5	50.2	6,351.2	91.3	1,56.0
Total output reduced by intermediate consumption	PLN thou.	-1115.0	50.5	7,679.9	93.3	160.5
ROA	%	-227.9	-0.7	406.6	-0.8	9.9
ROE	%	-350.8	-0.7	406.6	-0.6	11.6
Total asset turnover	times	-0.24	0.05	9.15	0.07	0.12
Equity multiplier	times	1.00	1.01	27.32	1.08	0.35
WACC	%	2.1%	8.5%	11.8%	8.2%	0.5%

Note: the sample does not contain research objects characterised by negative equity, thus in 2010; N= 11 004, whereas in 2014, N = 12 122.

Source: own calculations based on the FADN data.

Table 1B. Testing statistical significance of differences by means of the Mann-Whitney U test for ROE and fulfillment of inequality ROE>ROA

Specification	2010		2010		2014		2014	
	AE payments		LFA payments		AE payments		LFA payments	
	ROE	ROE>ROA	ROE	ROE>ROA	ROE	ROE>ROA	ROE	ROE>ROA
Production types								
Field crops (1)	**<0.001/ <0.001**	**<0.001/ <0.001**	**<0.001/ <0.001**	**0.007/0.014**	**<0.001/ <0.001**	**<0.001/ <0.001**	0.229/0.458	**0.007/0.013**
Specialist horticulture (2)	0.300/0.599	0.308/0.616	0.453/0.907	0.129/0.258	0.393/0.787	0.281/0.562	0.299/0.599	0.057/0.113
Permanent crops (4)	0.380/0.759	0.089/0.179	0.089/0.178	0.356/0.712	**<0.001/ <0.001**	0.068/0.136	0.123/0.247	0.487/0.974
Herbivores (5; 6)	0.192/0.384	0.358/0.716	0.208/0.416	0.168/0.355	0.179/0.359	0.236/0.472	0.333/0.666	0.079/0.158
Granivores (7)	0.464/0.928	0.075/0.151	0.075/0.150	**0.045**/0.090	**0.042**/0.084	**0.002/0.004**	**0.186/0.372**	0.421/0.842
Mixed (8)	**<0.001/ <0.001**	**<0.001/ <0.001**	0.292/0.584	0.133/0.266	**<0.001/ <0.001**	**<0.001/ <0.001**	**<0.001/ <0.001**	**0.004**/0.008
Classes of economic size								
Very small (A)	**0.024/0.047**	0.469/0.938	0.261/0.522	0.446/0.892	0.008/0.017	0.324/0.648	0.065/0.129	0.490/0.980
Small (B)	**<0.001/ 0.001**	0.251/0.502	0.472/0.943	0.241/0.482	**<0.001/ <0.001**	0.103/0.205	0.061/0.122	0.148/0.295
Medium-small (C)	**<0.001/ <0.001**	**<0.001/ <0.001**	0.335/0.671	0.456/0.916	**<0.001/ <0.001**	**<0.001/ <0.001**	0.165/0.330	0.028/0.057
Medium-large (D)	**<0.001/ <0.001**	**<0.001/ <0.001**	**0.014/0.028**	**0.008/0.016**	**<0.001/<0.001**	**<0.001/ <0.001**	0.231/0.462	0.322/0.644
Large (E; F)	0.173/0.346	**0.038**/0.075	**0.003/0.005**	**0.028**/0.056	0.208/0.415	0.001/0.003	0.250/0.500	0.179/0.357
Total	**<0.001/ <0.001**	**<0.001/ <0.001**	0.428/0.857	0.211/0.422	**<0.001/ <0.001**	**<0.001/ <0.001**	**0.024/0.048**	**0.005/0.009**

Note: abbreviations used – AE payments – agri-environmental payments, LFA – less-favoured areas payments; ROE>ROA as binary variable (1 – if this inequality is fulfilled, 0 – otherwise); the first p-value refers to one of tails, the second one applies to the two tails of the distribution; p-values less than the traditionally accepted level of significance (0.05) are bolded.

Source: own calculations based on FADN data.

Table 1C. Descriptive statistics for ROE and ROA for farms in 2010-2014

Specification	2010	2011	2012	2013	2014
ROE [%]					
Total number of farms	11,003*	10,889	10,909	12,117	12,122
Minimum	-121.8	-252.5	-186.6	-302.2	-350.8
Median	0.9	1.1	0.9	0.3	-0.7
Maximum	316.2	218.2	287.7	301.3	406.6
Mean	1.4	1.3	1.2	0.4	-0.7
Standard Deviation	11.1	11.0	11.5	10.4	11.6
ROA [%]					
Total number of farms	11,003*	10,889	10,909	12,117	12,122
Minimum	-121.8	-252.5	-186.6	-302.2	-227.9
Median	1.1	1.2	1.1	0.5	-0.7
Maximum	284.9	218.2	287.7	301.3	406.6
Mean	1.1	1.1	1.1	0.3	-0.8
Standard Deviation	9.5	10.0	10.0	9.5	9.9

Note: * a farm characterised by extremely high profitability wa removed (thus, in 2010 N = 11 003).

Source: own calculations based on FADN data.

5. Subsidies versus finances and economics of farms owned by natural persons

5.1. Introduction

The reflection presented below is a continuation of studies aimed at identification of key relations between various subsidies and the economic and financial outturn of farms owned by natural persons belonging to the Polish FADN network that the Institute of Agricultural and Food Economics – National Research Institute conducted in previous years[76]. It will still be based on the panel of farms, but the analysis will cover year 2014. Before we proceed to the detailed comment on the findings for 2010-2014, there will be a synthetic review of the most important problems related to subsidies for family farms.

The determination of the impact of subsidies on farms is still a serious challenge. This is so due to the fact that they are a very diverse stream in terms of their exogeneity in relation to the production, investment and financial decisions made by farmers, they affect farms via multiple channels, they are capitalised in the form of the value of land and other fixed assets and the rent rates, they aim at multiple objectives that are mutually complementary and competitive. In the last mentioned case, what is particularly important is the determination of the extent to which the subsidies are a pure income transfer and the extent to which they are part of the security network in agriculture. In practice, the issue is much more complicated because the subsidy policy, which in technical terms is not even oriented towards the farmers' actions, has in practice important behavioural implications, usually indirect in nature[77]. This leads to the conclusion that the signals originating from it affect farmers' expectation concerning risk, particularly financial risk. This stimulates the channel of influence through debt, which in turn determines liquidity, solvency and stability of farms. At some point, these signals reach institutions providing credit to agriculture, which affects their policy towards farmers. As a consequence, there is feedback between farmers' financial decisions and banks and decisions with regard to production and allocation in

[76] *Dopłaty bezpośrednie i dotacje budżetowe a finanse oraz funkcjonowanie gospodarstw i przedsiębiorstw rolniczych* (J. Kulawik, ed.), Program Wieloletni 2011-2014, No. 20, IERiGŻ-PIB, Warszawa 2011; *Dopłaty bezpośrednie i dotacje budżetowe a finanse oraz funkcjonowanie gospodarstw i przedsiębiorstw rolniczych* (J. Kulawik, ed.), Program Wieloletni 2011-2014, No. 46, IERiGŻ-PIB, Warszawa 2012; *Dopłaty bezpośrednie i dotacje budżetowe a finanse oraz funkcjonowanie gospodarstw i przedsiębiorstw rolniczych* (J. Kulawik, ed.), Program Wieloletni 2011-2014, No. 82, IERiGŻ-PIB, Warszawa 2013; *Dopłaty bezpośrednie i dotacje budżetowe a finanse oraz funkcjonowanie gospodarstw i przedsiębiorstw rolniczych* (J. Kulawik, ed.), Program Wieloletni 2011-2014, No. 120, IERiGŻ-PIB, Warszawa 2014; *Subsydia a ekonomika, finanse i dochody gospodarstw rolniczych* (1), (J. Góral, ed.), Program Wieloletni 2015-2019, No. 4, IERiGŻ-PIB, Warszawa 2015.

[77] A.M. Featherstone, C.B. Moss, T.G. Baker, P.V. Preckel, *The theoretical effects of farm policies on optimal leverage and the probability of equity losses*, "American Journal of Agricultural Economics", Vol. 70, No, 3, 1988; A. Bekkerman, E. Belasco, E. Watson, *Decoupling direct payments: potential impacts of the 2014 farm bill on farm debt*, "Agricultural Finance Review", Vol. 75, No. 4, 2015.

agriculture itself, which usually manifests itself only after a long period[78]. Therefore we deal with internalisation and externalisation of agricultural subsidy policy at the same time. What is equally important, the direction of causality can lead either from subsidies to debt or the other way round. In empirical research, this is followed by both negative and positive correlation between the said categories. The key issue here is the way the researchers will cope with the issue of endogeneity.

As opposed to farms owned by legal entities, which are under the accounting obligation pursuant to the relevant act or standard, farms owned by natural persons do not directly establish their financial outturn from purely market transactions, i.e. the outturn that does not include any subsidies. However, the gross margin to agricultural production ratio was used to monitor such outturn in the previous period. Currently, it has been replaced with the sales profitability indicator. It is worth considering the application of the market outturn, which is recommended in Western literature. It is estimated by subtracting direct payments received in the particular year from income or profit of the farm[79].

The analysis of the impact of subsidies on farm economics, finance and organisation is also difficult due to the issue of their scope and capitalisation. The first notion, which English-language literature commonly refers to as the *economic incidence* focuses on the formal (i.e. one that is included in official regulations) and final division of budget aid between various stakeholders, if the theoretical assumptions concerning the significant scale of adjustment processes with regard to their past, present and future actions following the granting of the aid are loosened[80]. The scope of subsidies is usually studied in convention of their final distribution between users and owners of production factors, i.e. the distribution after all adjustments were made. In reality, the environment of agriculture also benefits from agricultural subsidies. For example, Alston and Kirwan estimate that about 20% of the nominal budget funds allocated for farmers in the USA is transferred to enterprises that provide them with means of production[81]. This is a convincing proof of the so-called leakage.

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[78] C. O'Toole, T. Hennessy, *Do decoupled payments affect investment financing constraints*? *Evidence from Irish agriculture*, "Food Policy", Vol. 56, 2015.

[79] N. El Benin, R. Finger, *The effect of agricultural policy reforms on income inequality in Swiss agriculture – An Analysis for valley, hill and mountain regions*, "Journal of Policy Modeling", vol. 35, no. 4, 2013; H. Hansen, F. Offermann, *Direktzahlungen in Deutschland-Einkommens – und Verteilungswirkungen der EU-Agrarreform 2013*, "German Journal of Agricultural Economics", vol. 65, no. 2, 2016; M. Keeney, *The distributional impact of direct payments on Irish farm incomes*, "Journal of Agricultural Economics", Vol. 51, No. 2, 2000; S. Severini, A. Tantar, *The impact of agricultural policy on farm income concentration of the CAP direct payments in Italy*, "Agricultural Economics", Vol. 44, No. 3, 2013.

[80] P.N. Hendricks, P.J. Janzen, C.K. Dhuyvetter, *Subsidy Incidence and Inertia in Farmland Rental Markets: Estimates from a Dynamic Panel*, "Journal of Agricultural and Resource Economics", Vol. 37, No. 3, 2012.

[81] J.M. Alston, *The Incidence of U.S. Farm Programs*, [in:] V.E. Ball, R. Fanfani, L. Gutierrez, (eds.), *The Economic Impact of Public Support to Agriculture*, Vol. 7, New York, 2010; B.E. Kirwan, *The Incidence of U.S. Agricultural Subsidies. In the 2007 Farm Bill and Beyond*, Working Papers, American Enterprise Institute, 2007.

A definite majority of theoretical works on the effects of agricultural subsidies usually uses simple constructs. The aid is divided into coupled and decoupled aid. The former leads to an increase in agricultural inputs, mostly capital and labour, thus also production, and to a growth in their prices. The order of these dependencies reflects the rational actions taken by farmers, who want to maximise the subsidies they receive, which the literature describes as "the farming subsidy"[82] or "the farming subsidy culture"[83].

Decoupled payments are directly or indirectly related to the land factor because the very fact of land ownership or title is enough to be granted such aid. Consequently, this leads to their capitalisation manifested in the increase in price of land and value of other fixed assets and rents. The theoretical neoclassical model explains the capitalisation of subsidies primarily by pointing to the very low elasticity of land supply against its price. Actually, it turns out that the capitalisation rate of subsidies is more loosely tied to the land or even independent of it, e.g. aid from the 2nd pillar of the CAP, is not necessarily lower than in the case of area-related payments. Of course, agricultural subsidies can be also capitalised in the form of rents. Regardless of whether the budget aid for agriculture leads to increase in the price of land and other fixed assets or rent bids are higher, the issue is the distribution of the benefits between the land owner and the user. In the short term, this results in the differentiation of agricultural income, and in the long run, it affects the assets. In practice, much depends on taxes on agriculture. For example, it may be the case that the tax on rent is fully paid by the owners of land and fixed assets. This means the the so-called negative capitalisation takes place. However, other farms must then consider that such taxes will result in additional cost and thus will be transferred by the original taxpayers to a smaller or greater extent. For the sake of completeness, it should be added that income earned by farmers due to purely market transactions, i.e. not involving any budget aid, are also subject to capitalisation. Partial regression coefficients for such independent variable are mostly close to those estimated for coupled and decoupled subsidies[84]. However, in case of financial loss on the product market, decapitalisation occurs, which is treated as anomaly because of subsidies, and in most cases results from the changes to the regime according to which they are granted. This makes it much more difficult to show this even in econometric models. It should be also remembered that the capitalisation/decapitalisation manifests itself in the accounts of economic entities in the form of capital profit and loss. The accounting principle of caution obliges us to reveal them only after they have materialised. Prior to this, they are just increases and drops in the economic value that exist only on paper. Capital profit and loss are also treated variously under the tax legislation.

[82] S. O'Neill, K. Hanrahan, *The capitalization of coupled and decoupled CAP payments into land rental rates*, "Agricultural Economics", Vol. 47, No. 3, 2016.
[83] R. McDonald, A. Macken-Walsh, K. Pierce, B. Horan, *Farmers in a deregulated dairy regime: Insights from Ireland's New Entrants Scheme*, "Land Use Policy", Vol. 41, 2014.
[84] S. O'Neill, K. Hanrahan, *The capitalization of coupled and decoupled CAP…, op. cit.*

Capitalisation of subsidies reduces their transfer efficiency and affects the redistribution of income and assets. This is particularly important when the declining fiscal situation in a country may also require reduction in budget aid for agriculture. If capitalisation rate of subsidies is high – which means that owners of agricultural production factors, particularly land owners, are privileged – then the budget cuts reduce their assets and running income. Otherwise, the only ones to suffer are the users of agricultural assets. As the small farms are the ones that depend on public funds the most virtually everywhere, which literature describes as the *subsidy crutch*, the tightening of the budget policy should in theory affect them the most. But this is a numerous group of beneficiaries, so their political strength is sufficient to protect subsidies, e.g. by reference to arguments from the field of social justice.

Empirical estimates of the agricultural subsidy capitalisation rate are characterised by huge dispersion of the results. This is caused by the large number of determinants, the multiple influence channels of the budget aid, inertia of the relations between them and the land price and rents, market failures and complex econometric problems[85].

Strong diversification of findings from empirical research concerning the impact of subsidies on farms results also from simplifications made by the economists, which are related to the goal functions and the actions taken by farmers themselves and their households. In the neoclassical economy, it is commonly assumed that agricultural producers also base their decisions on maximisation of their welfare, which is supposed to manifest itself in usability. This is a subjective category, so it is hard to compare it between persons and to aggregate it. Therefore, it is often replaced with monetary ratios, which leads simply to the assumption that farmers are fully rational and thus aim at maximisation of income or profit[86]. This convention usually contradicts the studies of actual farmer's actions, which prove that they are very complex, determined by socio-economic, cultural and psychological factors. As a consequence, financial objectives coexist with non-financial ones, and instead of maximising the former, there are attempts at balancing them with the latter and satisfaction at achieving some minimum level of it. Hence numerous farmers may use decoupled payments to fund activity which would be unprofitable under normal circumstances but are aimed at maintaining a particular lifestyle and prestige resulting from the conviction that they provide something material and socially useful. These actions are manifestations of the so-called cross-subsidisation of

[85] G. Breustedt, H. Habermann, *The incidence of EU per-hectare payments on farmland rental rates: a spatial econometric analysis of German farm level data,* "Journal of Agricultural Economics", Vol. 62, 2011; P.N. Hendricks, P.J. Janzen, C.K. Dhuyvetter, *Subsidy Incidence and Invertia in Farmland Rental Markets…,op. cit.;* S. Hüttel, M. Ritter, V. Esaulor, M. Odening, *Is there a term structure in land lease rates*?, "European Review of Agricultural Economics", Vol. 43, No. 1, 2016; A. März, N. Klein, T. Kneib, O. Musshoff, *Analysing farmland rental rates using bayesin geoadditive quantile regression*, "European Review of Agricultural Economics", No. 3, 2015; S. O'Neill, K. Hanrahan, *The capitalization of coupled and decoupled CAP…, op. cit*.

[86] P. Howley, J. Breen, O.C. Donogue, T. Hennessy, *Does the single farm payment affect farmers behaviour? A macro and micro analysis*, "International Journal of Agricultural Management", Vol. 2, No. 2, 2012.

deficit activities on farm, which in essence is also a form of budget aid leakage. The original source of the latter is the fact that the subsidies increase the overall liquidity of farms, and the funds thus obtained vary. In this context, it is not very surprising that a large number of empirical studies show that, contrary to expectations agricultural politicians who try to "marketise" the CAP more, farmers still react more to the current and future course of the subsidy policy than to signals from the markets[87]. However, it should also be added here that farms, whose financial position is strong and are business-oriented, often treat signals from the field of agricultural and economic policy and from the markets equally because they want to improve their competitiveness and stability.

The multiplicity of goals of farms and the complex rules of their valuation are well explained by the so-called behavioural theory of the firm. Its two assumptions: limited rationality of decision-makers and opportunist actions of the parties to countries are universal, and hence refer to various kinds of economic entities[88].

What is more, empirical studies of actual behaviour of family farms show that survival and smooth succession are very important among their goals and key values[89]. This reflects the farmers' highly emotional attitude towards the resources they use, but it also implies that they aim at reinforcing attributes of durability (sustainability), flexibility and adaptability. The above mentioned flexibility also refers to the expansion of sources of income by all family members, which is well reflected by the category of *pluriactivity*. The strategies related to the achievement of the above goals are a complex, holistic socio-cultural process that combines individual behaviours of particular farmers with practices and customs of local communities. The farmers behave in various ways, in some cases retroactive attitudes prevail, but some tend to be proactive. At the same time, they are the subject of agricultural policy but also the instrument for achieving its goals, which is best seen in the case of the young farmers. They most definitely display behaviour related to the income/profit maximisation paradigm more often, but this does not necessarily manifest itself in the short-term, and therefore the static, perspective. However, all economically active farmers should carefully monitor and manage risk. What becomes fundamentally important here is the skill of perceiving and balancing the risk from the perspective of the entire farm household. Nowadays, it is in fact the entire family that makes decisions or possibly maximises subjectively comprehensively seen usability of the resources at their disposal, manages debt and liquidity and attempts at smoothing consumption over time[90]. Unfortunately, the Polish FADN does not collect information that would make it possible to proceed from the agricultural activity level to household activity level.

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[87] C. O'Toole, T. Hennessy, *op. cit*.

[88] A. Peszko, *Behawioralna ewolucja koncepcji przewagi konkurencyjnej*, "Przegląd Organizacji", No. 6, 2016.

[89] C. O'Toole, T. Hennessy, *op. cit*.

[90] S.C. Gabriel, C.B. Baker, *Concepts of business and financial risk*, "American Journal of Agricultural Economics", vol. 62, no. 2, 1980; E. Wauters, Y. de Mey, F. Van Winsen, S. Van Passel, M. Vancauteren, L. Lauwers, *Farm household risk balancing: implications for policy from an EU perspective*, "Agricultural Finance Review", Vol. 75, No. 4, 2015.

There are still controversies concerning the extent to which the particular subsidisation instruments, primarily direct payments, which are in theory completelydecoupled, affect the current decisions made by farmers. This situation will also continue in the future, as essentially every form of budget aid is situated between full (100%) link to and complete separation from agricultural production. This is a direct result of their multilateral and mutlichannel impact on attitudes, behaviours and decisions of agricultural producers. In a detailed approach, this concerns, apart from the above-mentioned capitalisation, the opposed income and substitution effect, mitigation of financial and loan restrictions in agriculture, encouragement of more risky behaviour in agriculture and creation of the wealth effect. There are also cross-compliance and greening, which lead to use of marginal land. Add to this credit, land and rural labour market failures and the reverse impact of the agricultural product market deformation and conditions for competition resulting from subsidies. We also have to remember that stimuli for growth in agricultural production stem from farmers' expectations that the future support system will be based on the earlier achievements[91].

5.2. Methodological assumptions

Because the Polish FADN collects data systematically based on a methodology that is well-founded in theory and because it uses very advanced tools to verify it, which gives good guarantee that the estimates of the economic and financial efficiency and ratios describing liquidity, solvency and investment activity are very reliable. As in the case of previous years, the analysis in this chapter has followed the convention of key economic and financial ratios and indicators. The review of all ratios and indicators used in this chapter is shown on List 1. Its range is indubitably very broad and may even lead to the impression of excess. However, the decision was made to adopt such a solution because there is no uniform and commonly accepted standard in the traditional analysis. Researchers simply have very different preferences. What is more, another purpose was to present various aspects of the economic and financial situation of the studied forms and its changes over time. Compared to earlier years, some corrections were introduced. First, the gross margin to agricultural production ratio was abandoned as an indicator, which was reflected by the total and sales profitability indices. Second, the subsidy rate (3) was withdrawn from the set of ratios describing the dependence of farms on subsidies because the entrepreneurial profit in the denominator of the relevant procedure is very variable, which makes drawing conclusions very difficult.

[91] K. Urban, G.H. Jensen, M. Brockmeier, *How decoupled is the Single Farm Payment and does it matter for international trade*?, "Food Policy", Vol. 59, 2016.

List 1. Used indicators and measures related to farm finances

Item	Ratio/measure	Calculation formula
1	Profitability [%]: - equity (1)	$\frac{\text{family farm income} - \text{own labour costs}^{1)}}{\text{average annual value of equity}^{2)}} \times 100$
	- equity (2)	$\frac{\text{entrepreneurs' profit}^{1)}}{\text{average annual value of equity}^{2)}} \times 100$
	- total assets (1)	$\frac{(\text{family farm income} + \text{interest}) - \text{own labour costs}}{\text{average annual total value of assets}^{3)}} \times 100$
	- total assets (2)	$\frac{\text{entrepreneurs' profit}^{1)}}{\text{average annual total value of assets}^{3)}} \times 100$
1'	Alternatively [1)]: - cash return on equity	$\frac{\text{cash flows (1)}}{\text{average annual value of equity}} \times 100$
	- cash return on total assets	$\frac{\text{cash flows (1)}}{\text{average annual total value of assets}} \times 100$
2	share of gross margin in agricultural production	$\frac{\text{gross margin}^{4)}}{\text{agricultural production}^{5)}} \times 100$
3	Liquidity (multiplicity):	
	- current	$\frac{\text{current assets (EY)}^{6)}}{\text{short-term liabilities (EY)}}$
	- fast	$\frac{\text{current assets (EY)} - \text{reserves (EY)} - \text{current stock (EY)}}{\text{short-term liabilities (EY)}}$
4	Solvency (multiplicity):	
	- coverage of overall loans with cash flows (1)	$\frac{\text{cash flows (1)}}{\text{overall loans (EY)}}$
5	Investment coverage (multiplicity)	$\frac{\text{cash flows (1)}}{\text{gross investments}}$
6	Cash generating ratio (1)	$\frac{\text{cash flows (1)}}{\text{family farm income}} \times 100$

List 1 – continued

Item	Ratio/measure	Calculation formula
7	Cash generating ratio (2)	$\frac{\text{cash flows (2)}}{\text{family farm income}} \times 100$
8	Investment rate	$\frac{\text{gross investments}}{\text{depreciation}} \times 100$
9	Equity growth	$\frac{\text{equity (EY)} - \text{equity (BY)}}{\text{equity (BY)}} \times 100$
10	Working capital growth	$\frac{\text{working capital (EY)} - \text{working capital (BY)}}{\text{working capital (BY)}} \times 100$
11	Measures:	
	- change in the values of equity (PLN)	value of equity (EY) – value of equity (BY)[8)]
	- gross investments (PLN)	investment payments
	- net investments	gross investments – depreciation
	- cash flows (1)	balance of cash flows from operating activities – received subsidies to investments
	- cash flows (2)	balance of cash flows from investment activities + balance of net flows from financial activities + received subsidies to investments
	- family farm income	according to the diagram in the Individual Farm Report[9)]
	- working capital (EY)	equity (EY) + long-term liabilities (EY) – fixed assets (EY)
12	Dependencies on subsidies: - subsidy rate I:	$\frac{\text{subsidies to operational activities} + \text{subsidies to investments} + \text{compensation for milk}}{\text{vegetable production} + \text{animal production}} \times 100$
	- subsidy rate II (1):	$\frac{\text{subsidies to operational activities} + \text{subsidies to investments} + \text{compensation for milk}}{\text{family farm income}} \times 100$

List 1 – continued

Item	Ratio/measure	Calculation formula
	- subsidy rate II (2):	$\frac{\text{subsidies to operational activities + subsidies to investments + compensation for milk}}{\text{family farm income – own labour costs}^{1)}} \times 100$
	- subsidy rate II (3):	$\frac{\text{subsidies to operational activities + subsidies to investments + compensation for milk}}{\text{entrepreneurs' profit}^{1)}} \times 100$
	- decoupling rate I of subsidies to operational activities from production	$\frac{\text{"decoupled" payments + LFAs + agri-environmental programmes}}{\text{subsidies to operational activities}} \times 100$
	- decoupling rate II of grants and subsidies from production	$\frac{\text{"decoupled" payments + LFAs + agri-environmental programmes + investment subsidies}}{\text{subsidies to operational activities + subsidies to investments + compensation for milk}} \times 100$
	- share of subsidies to operational activities in all subsidies	$\frac{\text{subsidies to operational activities}}{\text{subsidies to operational activities + subsidies to investments + compensation for milk}} \times 100$

Explanation:

1) Own labour cost, farm profit and entrepreneurial profit were calculated based on the method developed by Goraj L., Mańsko S. (2011): Goraj L., Mańko S. (2011): Model szacowania pełnych kosztów działalności gospodarstw rolnych, "Zagadnienia Ekonomiki Rolnej", No. 3, IERiGŻ-PIB, Warszawa.
2) Annual average equity = (equity at the beginning of the year + equity at the end of the year)/2.
3) Annual average assets = (assets at the beginning of the year + assets at the end of the year)/2.
4) Gross margin = agricultural production less direct cost and direct cost of forestry production.
5) Agricultural production = plant production + animal production.
6) (SK) = value at the end of the year.
7) Gross investment = payments for investment activity. Ivestment spending means payments over PLN 3,500 made by an agricultural holding in a particular year for the purpose of investment activity.
8) (SP) = value at the beginning of the year.
9) See: http://fadn.pl/metodyka/raporty/raport-indywidualny-1/ and Smolik A.(2014): Jak rozumieć zawartość raportu indywidualnego gospodarstwa rolnego (wersja 2013). IERiGŻ-PIB, Warszawa.

Source: own elaboration.

5.3. Data sources

The object of the study includes individual holdings that continuously maintained agricultural accounting records under the Polish FADN system[92] in 2010-2014. Only the agricultural holdings that kept records in the Farm Accounting Books (FAB)[93] were selected for analysis, while the agricultural farms with legal personality where data was collected only through a special questionnaire were omitted. The sample of farms thus selected does not meet the representativeness criterion, which means that the presented findings concern only the specific sample and are published in the form of arithmetic means. The Polish FADN database contains many detailed records that were verified with regard to their correctness, processed in a unified manner, and which can be used for various types of economic analyses. Hence, this is a resource of unique value.

Calculation of specific indicators was based mainly on findings from the "Individual Report" and "Score Tables – ST". This is the preliminarily aggregated information from the FABs. Their scope is more detailed than the data in "Standard Results"[94].

Investment spending means payments over PLN 3,500 made by an agricultural holding in a particular year for the purpose of investment activity.

Two elements that have also been included in the set of indicators are the cash generation indicators (1) and (2). They were not calculated where the numerator and denominator were negative. This would lead to erroneous conclusions.

The awarded subsidies were used, which means that the payments are recorded when the farmer was granted the decision to award a subsidy and its value complies with the record in the Revenue and Expenditure Book in the FAB.

Calculation of return on equity and return on assets required estimating the cost of own labour. The method[95] developed in the Agricultural Accountancy Department was used for this purpose. The basis for estimation was the average wage per 1 AWU of hired labour in respective FADN regions and economic size classes (ES6). In addition, two total return on equity and return on assets indicators were introduced, where the formula utilises the entrepreneurial profit. This profit was also calculated according to the method developed in the Agricultural Accountancy Department, where the estimated cost of unpaid own factors was subtracted from the income of a family farm and the paid interest on farm liabilities was added.

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[92] Legal basis: Act of 29 November 2000 on collecting and using accounting data from agricultural holdings (Journal of Laws No. 3 item 20 of 2001, as amended). (Journal of Laws No. 3 item 20 of 2001, as amended). For more information on the Polish FADN see: www.fadn.pl, and more on FADN at: http://ec.europa.eu/agriculture/rica/.

[93] Farm Accounting Book forms are available at www.fadn.pl in the section Metodyka/Zbieranie danych/Gospodarstwa osób fizycznych.

[94] Documents: RI/CC 882 Rev.9.2 Definitions of Variables used in FADN standard results. European Commission, Brussels December 2014. Publications including "Standard Results" can be found at: www.fadn.pl in the tab Publications/Standard Results section.

[95] L. Goraj, S. Mańko, *Model szacowania pełnych kosztów działalności gospodarstw rolnych*, "Zagadnienia Ekonomiki Rolnej", No. 3, 2011.

In order to make findings for the analysed years comparable[96], farmers appraised their land, which has been the binding method since 2009. Land value is determined on the basis of the amount the farmer would be willing to pay for their own land.

Agricultural holdings included in the Polish FADN database differ in such aspects as production, area and also the economic size. Each farm observed by the FADN is classified according to its agricultural production type and the economic size class. In order to determine the economic situation of the studied farms and to identify the impact of subsidies on their financial efficiency, the analysed population were grouped according to agricultural production types (classification according to the TF8 typology) and according to the economic size classes (classification according to ES6). These are divisions that are used in the Standard Results published by the Institute of Agricultural and Food Economics – National Research Institute[97].

Until 2009, the basic parameter used to classify agricultural holdings in the European Union was the Standard Gross Margin (SGM)[98]. However, since 2010 the Community Typology for Agricultural Holdings (CATH) has changed[99]. The SO_2010 Standard Output is the parameter classifying farms[100]. This typology is used e.g. to describe the agricultural holding sector, selection of sample for representative research and to determine weights so findings from the sample could be extrapolated to the entire sector[101]. These are the newest standard output parameters that have been used to plan selection of farms in 2016[102]. Differences between the classification of farms according to SGM coefficients and the classification using the SO coefficient have been described in a publication by the Agricultural Accountancy Department[103].

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[96] More information necessary for the interpretation of the Polish FADN findings can be found in: R. Płonka, A. Smolik, I. Cholewa, M. Bocian, E. Juchnowska, D. Osuch(2016): *Najważniejsze informacje niezbędne do interpretacji wyników Polskiego FADN*, IERiGŻ-PIB, Warszawa. (http://fadn.pl/wp-content/uploads/metodyka/Na-wazniejsze-informacje.pdf).

[97] See: www.fadn.pl in the tab Publications/Standard Results.

[98] Commission Decision No. 85/377/EEC establishing a Community typology for agricultural holdings and amending decision No. 2003/369/EC of 16 May 2003.

[99] The currently binding documents: Commission Regulation (EC) No. 1242/2008 of 8 December 2008 establishing a Community typology for agricultural holdings as amended by: Commission Regulation (EC) No. 867/2009 of 21 September 2009.

[100] Regulation (EC) No. 1166/2008 on farm structure surveys n 2010, 2013 and 2016 and Regulation (EC) No. 781/2009 on farm return to be used under FADN.

[101] More information on selection plan and its implementation can be found in the following publications: L. Goraj, D. Osuch, M. Bocian, I. Cholewa, B. Malanowska, *Plan wyboru próby gospodarstw rolnych Polskiego FADN od roku obrachunkowego 2014*, IERiGŻ-PIB, Warszawa 2013 and Z. Floriańczyk, D. Osuch, B. Malanowska, M. Bocian, *Opis realizacji planu wyboru próby gospodarstw rolnych dla Polskiego FADN w 2014 r.*, IERiGŻ-PIB, Warszawa 2014.

[102] Z. Floriańczyk, D. Osuch, B. Malanowska, M. Bocian, *Plan wyboru próby gospodarstw rolnych Polskiego FADN od roku obrachunkowego 2016*, IERiGŻ-PIB, Warszawa 2015.

[103] L. Goraj, I. Cholewa., D. Osuch, R. Płonka, *Analiza skutków zmian we Wspólnotowej Typologii Gospodarstw Rolnych*, IERiGŻ-PIB, Warszawa 2010.

In order to ensure comparability of findings, the farm classification using the SO_2010 standard output coefficient was used for the analysed period. As mentioned above, the farms were grouped according to TF8 typology (see Table 1).

Table 1. Agricultural production types according to TF8 typology

Symbol	Typology according to TF8 grouping
1	Fieldcrops
2	Specialist horticulture
3	Wine
4	Permanent crops
5	Milk
6	Grazing livestock
7	Granivores
8	Mixed

Source: http://fadn.pl/wp-content/uploads/2012/12/typy_tf8.pdf and L. Goraj, M. Bocian, I. Cholewa, G. Nachtman, R. Tarasiuk: Współczynniki Standardowej Produkcji „2007" dla celów Wspólnotowej Typologii Gospodarstw Rolnych, IERiGŻ-PIB, Warszawa 2012.

In the analysis, the economic size of agricultural holdings has been characterised using the ES6 classification (Table 2). Apart from the digits, the letter symbols used in the analysis have been provided in parenthesis.

Table 2. List of sizes and ranges according to ES6 and ES

ES6 symbol	Name	ES symbol	Range in euro
		1	euro < 2,000
1 (A)	Very small	**2**	2,000 ≤ euro < 4,000
		3	4,000 ≤ euro < 8,000
2 (B)	Small	**4**	8,000 ≤ euro < 15,000
		5	15,000 ≤ euro < 25,000
3 (C)	Medium-small	**6**	25,000 ≤ euro < 50,000
4 (D)	Medium-large	**7**	50,000 ≤ euro < 100,000
5 (E)	Large	**8**	100,000 ≤ euro < 250,000
		9	250,000 ≤ euro < 500,000
6 (F)	Very large	**10**	500,000 ≤ euro < 750,000
		11	750,000 ≤ euro < 1,000,000
		12	1,000,000 ≤ euro < 1,500,000
		13	1,500,000 ≤ euro < 3,000,000
		14	euro ≥ 3,000,000

Source: based on: L. Goraj, I. Cholewa, D. Osuch, R. Płonka, Analiza skutków zmian we Wspólnotowej Typologii Gospodarstw Rolnych, IERIGŻ-PIB, Warszawa 2010.

The set of farms that continuously maintained accounting records in 2010-2014 has been limited due to the presence of the farms that were:

– atypical,
– not classified using the standard output coefficient,
– below the threshold according to the used classification, i.e. farms whose economic size was smaller than EUR 4,000,
– differed from the studied population.

A farm was recognised as atypical if:

– the value of its equity was negative,
– the value of current assets was equal to 0.

If the value of short-term liabilities approached or was equal to zero, liquidity indicators were not calculated. Division of any figure by a very small value results in values tending to infinity, and therefore such farms have been deemed to have no short-term liabilities. Where denominators were equal to zero, the values of other indicators have not been calculated.

As mentioned above, spending on investment was recognised as investment expenditure only if it exceeded PLN 3,500. If the amount was smaller, the farm was considered as a farm that did not invest in the specific year. Other farm selection criteria were also adopted, which included:

a) In the case of analysis of entities that stood out, all variables selected for comparison and calculation have been examined,
b) Their scopes have been studied with regard to all indicators. If some value significantly deviated for the specific population, such farms have been eliminated from further processing.
c) The next stage was the analysis using the XY scatter plot analysis.
d) If a farm has been eliminated in an analysis of a specific year, it was also omitted in an analysis of another year. The number of farms throughout the studied period is therefore the same.

5.4. Analysis of findings

Information shown in Table 3 confirm the generally known and accepted conclusion that the economic and financial situation of agricultural holdings varies very much. This results from the fact that the panel includes entities that vary very strongly with regard to production factors at their disposal, use very different production technologies, follow the optimality criterion but also the satisfaction criterion, are managed by older and younger persons both holding formal academic degrees but also persons who have completed only primary education, are usually managed by men but sometimes also by women, are located in the regions that follow their own development paths. Add to this price fluctuations and price scissors, changes to currency exchange rates and overall agricultural activity, budget policy concerning agriculture, including particularly the rules governing subsidies.

On the other hand, Table 3 shows that this diversity affects specific types of ratios and indicators in a variety of ways. These relations are relatively constant in time. And therefore, it turns out that standard deviations and coefficients of variation are higher in the case of return on assets and return on equity formulas where the denominator includes the very changeable entrepreneurial profit. The latter may also appear in the case of subsidy rates, which in turn leads to the increased dispersion than in the cases where the relations between subsidies and agricultural production or family farm income are examined. Definitely greater dispersion has also been observed in the variability of the dynamic liquidity, i.e. cash flow and cash generation, than in the case of static liquidity. Dispersion was also high in the categories related to the increase in equity, which is a derivative of the positive or negative family farm income. What is also unsurprising is the high dispersion of net investment because in this regard, the limits of the range are set by positive and negative values.

As shown in Table 4, on average, all 2014 rate of return, cash return and profitability indicators decreased compared to 2013. The case was identical with regard to static liquidity, and to large extent dynamic liquidity (cash generation and cash flows). The investment activity and the nominal equity base was also reduced, though, paradoxically, the equity creation rate improved. This partially stems from the fact that the previous EU budget perspective ended, and the new one was not yet completely implemented. It cannot be surprising, however, that the average family farm income, which was analysed on two-year basis, and family farm profit dropped, but the entrepreneurial profit dropped even more. What has to be alarming is the fact that the regression is even deeper if we compare the performance with the 2010-2012 averages. This may hint structural, as opposed to cyclic, problems.

If we look for the causes of these worrying trends, we must primarily point to the decline in the purchase prices of the basket of agricultural products (drop from 104.5 to 88.1) while the prices of the means of agricultural production barely decreased (the relevant 2014 index amounted to 98.2, while the earlier value was 99.7). As a consequence, the accumulated price scissors index reached 89.7 in 2014, while its value was estimated at 104.8 in 2013. It needs to be added here, that deflation appeared in 2014, while inflation, though small, was still observed in the previous year. Indubitably, the farmers' expectation that the deflation pressure and the unfavourable price scissors will continue, and to some extent the Russian embargo, discouraged any increased investment activity.

Subsidy rate I, i.e. the product of budget aid and agricultural production, clearly dropped in 2013-2014 and in relation to the 2010-2012 average. On the other hand, both subsidy rates II, where the point of reference is the family farm income (1), or its version that omits cost of own labour provided by a farmer family (2), grew and reached its historical maximum. Such character of relations results primarily from the regression in agricultural income. Agriculture was also negatively affected by the strengthening of the zloty in relation to euro, from 4.2376 zloty per 1 euro (September 2013) to 4.1901 a year later.

Table 3. 2014 descriptive statistics of farms owned by natural persons

No.	Breakdown	Unit	Number of farms	Average	Median	Min	Max	Standard deviation	Coefficient of variation
1	Return on equity (1)	%	7,709	2.7	1.9	-67.5	205.3	9	336
2	Return on equity (2)	%	7,709	0.9	0.2	-69.4	207.9	9	1,026
3	Total return on assets (1)	%	7,709	2.5	2.0	-67.5	141.4	8	314
4	Total return on assets (2)	%	7,709	0.6	0.2	-69.4	140.4	8	1,314
5	Cash return on equity	%	7,709	10.7	9.0	-13.0	223.3	10	89
6	Total cash return on assets	%	7,709	9.9	8.5	-11.0	186.7	8	80
7	Total profitability indicator	%	7,709	119.7	116.0	11.8	753.1	35	29
8	Sales profitability indicator	%	7,709	125.3	121.3	7.1	732.2	44	35
9	Current liquidity	multiplicity	3,949	9.3	5.0	0.0	195.5	15	157
10	Fast liquidity	multiplicity	3,949	2.5	0.9	0.0	99.3	6	219
11	Total loan coverage with cash flow	multiplicity	3,970	3.8	1.2	-6.1	199.0	11	290
12	Investment coverage	multiplicity	3,741	5.7	2.6	-19.1	125.4	9	155
13	Cash generation indicator (1)	%	7,028	0.0274	0.0138	0.0001	7.1593	0.1524	556
14	Cash generation indicator (2)	%	384	0.0121	0.0020	0.0000	0.3901	0.0382	315
15	Debt to equity ratio	%	3,852	8.5	4.8	0.0	128.5	11	134
16	Change to equity value	PLN thousand	7,709	32.0	-0.1	-3,173.4	4,226.9	181.8	568
17	Working capital growth	%	3,292	79.0	22.8	0.0	22,972.7	676	857
18	Working capital (SK)	PLN thousand	7,709	109.6	67.0	-1,057.8	4,671.9	168.9	154
19	Economic size	PLN thousand	7,709	252.0	164.5	17.3	17,448.9	364.4	145
20	Investment rate	%	7,707	117.8	0.0	0.0	11,572.6	387	329
21	Gross investment	PLN thousand	7,709	61.6	0.0	0.0	4,610.0	192.7	313
22	Net investment	PLN thousand	7,709	27.4	-8.5	-491.4	4,437.4	179.8	656
23	Equity to asset ratio	%	7,709	94.5	99.5	18.1	100.0	9	10
24	Fixed assets to current assets ratio	multiplicity	7,709	14.5	9.9	0.3	1,777.6	33	229

Table 3 – continued

25	Total payments	PLN thousand	7,709	44.2	24.9	0.0	717.2	60.5	137
26	Cash flow (1)	PLN thousand	7,709	128.0	76.0	-357.1	5,682.7	177.3	138
27	Cash flow (2)	PLN thousand	7,709	-49.7	-12.1	-4,424.6	1,000.7	124.1	*
28	Family farm income	PLN thousand	7,709	88.4	48.0	-2,466.3	4,433.9	148.9	168
29	Family farm profit	PLN thousand	7,709	55.0	15.8	-2,487.1	4,382.3	146.0	265
30	Entrepreneurial profit	PLN thousand	7,709	33.6	1.4	-2,717.8	4,219.5	135.0	402
31	Subsidy rate I	%	7,709	26.5	20.1	0.0	473.2	30	113
32	Subsidy rate II (1)	%	7,700	73.2	51.5	-18,647.2	21,368.8	640	874
33	Subsidy rate II (2)	%	7,678	34.6	35.9	-22,289.1	23,854.4	924	2,672
34	Degree of separation of operating subsidies from production I	%	7,463	76.6	83.2	0.0	100.0	24	31
35	Degree of separation of operating subsidies from production II	%	7,515	79.6	85.0	0.0	100.0	21	27
36	Operating subsidies to total subsidies ratio	%	7,515	90.6	100.0	0.0	100.0	19	21

* Due to the fact that the average cash flow (2) is negative, the coefficient of variation has not been calculated.

Source: own calculation based on Polish FADN data.

Table 4. Values of ratios and indicators in the panel of farms in 2010-2014

No.	Breakdown	Unit	2010-2012	2010	2011	2012	2013	2014	2014/2013
1	Return on equity (1)	%	5.9	5.2	6.0	6.4	5.5	4.5	82.5
2	Return on equity (2)	%	3.5	2.7	3.6	4.2	3.6	2.8	76.6
3	Total return on assets (1)	%	5.7	5.0	5.8	6.1	5.3	4.4	83.3
4	Total return on assets (2)	%	3.5	2.7	3.6	4.2	3.6	2.8	76.6
5	Cash return on equity	%	10.6	9.9	10.4	11.3	11.5	10.5	91.8
6	Total cash return on assets	%	9.7	9.2	9.6	10.4	10.4	9.6	91.4
7	Total profitability indicator	%	129.0	128.2	128.3	130.1	122.6	120.4	98.3
8	Sales profitability indicator	%	129.6	127.8	129.0	131.6	130.1	127.7	98.1
9	Current liquidity	multiplicity	3.98	3.67	4.04	4.20	3.92	3.50	89.3
10	Fast liquidity	multiplicity	1.08	1.04	1.10	1.11	1.06	0.91	85.5
11	Total loan coverage with cash flow	multiplicity	0.88	0.86	0.88	0.90	0.83	0.74	89.4
12	Investment coverage	multiplicity	1.30	1.27	1.36	1.27	1.34	1.42	106.0
13	Cash generation indicator (1)	%	0.012	0.012	0.012	0.012	0.014	0.014	101.9
14	Cash generation indicator (2)	%	0.004	0.004	0.003	0.004	0.006	0.004	73.5
15	Debt to equity ratio	%	8.0	7.7	8.0	8.2	7.3	8.2	112.1
16	Change to equity value	PLN thousand	44.3	29.6	57.0	46.3	39.3	32.0	81.5
17	Working capital growth	%	42.6	44.7	45.2	38.7	31.0	29.4	94.7
18	Working capital (SK)	PLN thousand	103.7	88.6	105.6	116.9	116.6	109.6	94.0
19	Economic size	PLN thousand	236.2	234.5	235.9	238.3	240.8	252.0	104.6
20	Investment rate	%	151.6	151.1	141.4	161.7	135.6	127.0	93.6

Table 4 – continued

21	Gross investment	PLN thousand	59.6	53.2	55.7	70.1	70.2	61.6	87.8
22	Net investment	PLN thousand	28.1	23.9	23.7	36.8	33.7	27.4	81.3
23	Equity to asset ratio	%	91.9	92.1	92.1	91.6	90.9	90.9	100.0
24	Fixed assets to current assets ratio	Multiplicity	8.5	9.3	8.4	7.9	8.3	8.9	108.1
25	Total payments	PLN thousand	46.4	45.7	47.1	46.4	48.8	44.2	90.6
26	Cash flow (1)	PLN thousand	115.0	103.4	113.0	128.7	134.9	128.0	94.9
27	Cash flow (2)	PLN thousand	-43.8	-40.6	-41.5	-49.2	-50.4	-49.7	*
28	Family farm income	PLN thousand	95.0	53.8	65.4	72.3	64.5	55.0	85.3
29	Family farm profit	PLN thousand	63.8	83.9	96.2	104.9	97.5	88.4	90.6
30	Entrepreneurial profit	PLN thousand	38.3	28.4	39.2	47.2	42.4	33.6	79.2
31	Subsidy rate I	%	17.2	18.7	18.1	15.3	17.9	16.7	93.5
32	Subsidy rate II (1)	%	44.2	46.7	46.1	40.4	50.2	50.9	101.4
33	Subsidy rate II (2)	%	65.7	72.7	67.8	58.6	75.9	81.6	107.6
34	Degree of separation of operating subsidies from production I	%	65.0	60.4	64.8	69.5	75.7	79.7	105.3
35	Degree of separation of operating subsidies from production II	%	67.6	62.8	67.3	72.2	77.8	81.8	105.1
36	Operating subsidies to total subsidies ratio	%	92.2	93.4	92.4	91.0	90.9	89.3	98.2

* Due to the negative value of cash flow (2) in the studied period, the 2014 value of this ratio in relation to 2013 was not presented.

Source: own calculation based on Polish FADN data.

The impact of the economic size of farms on the analysed set of ratios and indicators was characterised in Table 5. It shows that:

1. Subsidy rate I (the aid to agricultural production ratio) grew systematically and very clearly as we proceeded to the larger entities. In 2014, the ratio between the extreme groups was 1 to nearly 10. In 2010-2014, this rate clearly grew only in the case of the very small farms.
2. Degression was also observed in the case of subsidy rate II (1), i.e. the one where the total aid has been divided by the family farm income. However, the ratio between the two extreme values decreased in this case (to 1 to a bit over 5). In the five years from 2010 to 2015, the proportion of subsidies in income generation increased continuously in classes up to the medium-small farms.
3. Subtracting the cost of own labour of farmer family from the family farm income resulted in the negative average denominator of the subsidy rate II (2) for the very small and small entities. As a consequence, the same rate reached meaningful positive values only after we proceeded to the medium-small farms. Of course, it also underwent degression as we went up the sizes. In this case, the ratio between the minimum and the maximum rate was 1 to about 6.
4. The separation from production indicator I and II and the operating subsidies to total subsidies ratio provide unambiguous information that large and very large farms depend on the 1st pillar aid, i.e. primarily the direct payments, more than other groups.
5. Both versions of the total return on equity and total return on assets are positive only after we reaching the small-medium entities. In the case of the later, however, their 2014 values were between three and nearly eleven times lower compared to the very large farms. In all these groups, the return rates decreased throughout the 2010-2014 period. On the other hand, total cash returns on equity and assets were in each case positive and grew but only until reaching the large farms group. And not much dispersion can be observed in the dispersion of these indicators in the studied period. The total profitability indicator, i.e. the synthetic total efficiency measure, exceeded the border level (100) with small farms and then systematically grew until the large farms group. Within the groups themselves, this ratio decreased everywhere in 2010-2014. In general, we could see similar relations in the case of the sales profitability ratio, i.e. efficiency resulting from purely market operations, i.e. not involving any subsidies.
6. Meaningful values of the static liquidity indicators can be found after reaching the small farms, at the same time, observing that the current indicator does not show any significant variability between groups. Unfortunately, its average values declined in the analysed five years' period in all economic size classes. Despite this, their level seem secure. As regards the fast liquidity, the case is different. The situation of small entities seems the best, and the situation of the largest seems the worst. In the latter case, the level is dangerously low with the downward trend. What is alarming is the declining cash generation capability and the negative cash flow (2). As a consequence, a drop in the cash flow to credit ratio is observed. Let us also add that this is the group that is relatively the most in debt (the lowest equity to asset ratio), and therefore it faces the greatest financial risk.

Table 5. Values of ratios and indicators in the panel of farms according to their economic size in 2014

No.	Specification	Unit	Very small (A)			Small (B)			Medium-small (C)			Medium-large (D)			Large (E)			Very-Large (F)		
			Years 2010-2012	2013	2014	Years 2010-2012	2013	2014	Years 2010-2012	2013	2014	Years 2010-2012	2013	2014	Years 2010-2012	2013	2014	Years 2010-2012	2013	2014
1	Return on equity (1)	%	-4.9	-5.2	-5.4	0.0	-0.5	-1.6	3.8	3.5	2.3	6.2	5.7	4.8	9.0	8.2	7.3	10.5	13.0	8.2
2	Return on equity (2)	%	-7.3	-7.1	-7.0	-2.3	-2.3	-3.3	1.5	1.7	0.6	3.8	3.8	3.0	6.6	6.3	5.5	8.1	11.1	6.5
3	Total return on assets (1)	%	-4.8	-5.2	-5.3	0.1	-0.4	-1.5	3.8	3.5	2.4	6.0	5.5	4.7	8.3	7.5	6.7	9.6	11.9	7.4
4	Total return on assets (2)	%	-7.3	-7.1	-7.0	-2.3	-2.3	-3.3	1.5	1.7	0.6	3.8	3.8	3.0	6.6	6.3	5.5	8.1	11.1	6.5
5	Cash return on equity	%	5.3	6.2	5.8	7.5	7.9	6.9	9.3	10.0	9.3	10.6	11.2	10.5	12.5	13.4	12.3	13.2	19.5	11.8
6	Cash return on total assets	%	5.3	6.2	5.8	7.3	7.8	6.7	8.9	9.5	8.9	9.8	10.3	9.6	11.0	11.7	10.6	11.6	17.2	9.9
7	Total profitability index	%	112.6	99.4	94.4	119.6	113.0	107.0	129.9	121.2	118.2	131.1	123.7	122.1	129.7	124.2	122.8	121.0	120.9	116.4
8	Sales profitability index	%	96.8	98.1	91.3	114.2	115.2	109.1	127.2	126.6	124.0	130.3	129.7	127.8	133.2	133.4	131.7	127.4	138.0	128.1
9	Current liquidity	multiplicity	.*	.*	.*	4.13	4.05	3.98	4.24	4.39	3.99	3.97	3.82	3.49	3.82	3.79	3.37	4.84	5.26	3.46
10	Fast liquidity	multiplicity	.*	.*	.*	1.21	1.24	1.24	1.18	1.24	1.10	1.06	1.03	0.91	1.05	1.02	0.88	1.20	1.12	0.53
11	Coverage of total loans with cash flows	multiplicity	.*	.*	.*	1.09	1.10	1.01	1.07	1.03	1.01	0.94	0.88	0.80	0.78	0.74	0.68	0.89	1.07	0.46
12	Investment coverage	multiplicity	.*	.*	.*	1.19	1.69	1.42	1.34	1.44	1.69	1.28	1.37	1.40	1.29	1.25	1.37	1.83	2.21	1.43
13	Cash generating ratio (1)	%	.*	.*	.*	0.012	0.014	0.014	0.012	0.014	0.014	0.012	0.014	0.014	0.012	0.013	0.014	0.012	0.014	0.011
14	Cash generating ratio (2)	%	.*	.*	.*	0.007	0.007	0.006	0.004	0.006	0.004	0.003	0.004	0.003	0.003	0.008	0.007	.*	.*	.*
15	Equity growth	%	5.7	5.4	9.1	6.5	5.4	7.6	7.0	6.2	7.4	7.8	7.0	8.4	9.1	8.4	8.2	7.7	8.2	11.4
16	Change in the values of equity	PLN thousand	1.8	-3.4	-5.4	5.8	1.9	-0.4	22.9	15.7	9.6	57.6	53.3	45.7	148.8	140.6	112.4	313.9	238.0	231.6
17	Working capital growth	%	37.4	23.2	23.7	37.8	29.2	27.2	40.8	28.6	25.8	42.4	29.7	28.3	45.7	33.3	33.3	40.8	50.6	24.9
18	Working capital (EY)	PLN thousand	19.1	18.8	19.1	39.0	42.4	39.9	72.9	82.2	76.3	122.1	136.2	125.9	264.9	294.4	265.9	1 041.5	1 138.0	1 052.6
19	Economic size	PLN thousand	29.1	28.2	27.9	66.5	65.5	65.4	146.7	146.7	147.0	281.7	282.6	283.5	671.1	680.8	694.9	3 256.7	3 372.0	3 965.5
20	Investment rate	%	19.1	25.8	14.6	61.6	47.3	45.2	113.0	97.1	89.2	172.9	141.3	130.5	189.8	177.5	162.5	136.3	176.4	164.5
21	Gross investments	PLN thousand	2.8	1.9	3.2	9.2	7.2	6.8	29.6	32.2	25.6	80.3	86.9	76.5	196.9	248.0	206.5	328.2	433.2	424.7
22	Net investments	PLN thousand	-3.7	-5.2	-3.8	-3.2	-6.1	-4.9	7.4	7.4	3.4	41.2	41.5	35.0	119.8	156.4	120.5	101.7	200.2	201.9
23	Assets to equity ratio	%	99.1	99.8	99.3	97.8	98.0	98.3	95.2	94.9	95.4	92.1	91.3	91.5	87.8	86.4	86.4	88.1	88.4	84.0
24	Asset freezing ratio	multiplicity	11.7	12.5	13.1	9.7	9.4	10.2	9.0	8.5	9.2	9.0	8.6	9.3	7.7	7.8	8.5	5.1	4.4	5.3
25	Total payments	PLN thousand	7.7	11.0	10.5	16.8	18.2	16.4	32.1	35.4	31.1	61.2	61.3	53.8	114.5	118.8	106.9	204.0	152.5	133.2
26	Cash flows (1)	PLN thousand	13.0	16.1	16.0	32.7	36.5	32.0	73.7	83.7	78.7	144.6	163.1	153.7	321.5	383.3	355.3	903.7	1 209.9	819.9
27	Cash flows (2)	PLN thousand	-1.7	-1.4	1.9	-6.3	-6.2	-5.5	-21.9	-24.3	-21.7	-57.6	-61.8	-60.3	-144.7	-172.3	-168.2	-369.2	-442.0	-321.7
28	Family farm income	PLN thousand	10.5	9.5	8.4	25.2	24.9	19.8	60.2	60.6	51.7	118.4	118.1	106.3	273.1	280.4	253.7	751.4	844.5	611.4
29	Family farm profit	PLN thousand	-11.9	-13.6	-14.8	0.009	-2.3	-7.7	30.4	29.3	19.5	84.0	82.3	70.5	231.6	235.5	210.3	718.1	808.0	568.2
30	Entrepreneur profit	PLN thousand	-17.9	-18.5	-19.3	-10.0	-10.6	-15.7	12.1	14.0	4.7	52.1	55.4	44.7	169.5	180.4	158.9	553.1	686.4	451.2
31	Subsidy rate I	%	28.2	39.1	43.4	25.9	28.6	29.0	21.0	23.3	21.6	18.6	19.4	18.2	13.9	14.4	13.5	6.3	3.9	4.4
32	Subsidy rate II (1)	%	74.5	110.6	126.8	63.2	73.3	85.3	48.7	58.1	59.6	45.0	51.4	51.4	38.4	43.2	43.2	26.4	18.4	24.6
33	Subsidy rate II (2)	%	-65.5	-76.9	-72.2	171 482.6	-781.5	-219.0	96.3	119.6	157.2	63.4	73.6	77.4	45.3	51.5	52.1	27.6	19.3	26.4
34	Decoupling rate I of subsidies to operational activities from production	%	65.1	-56.7	-55.3	65.5	-171.0	-107.1	66.4	251.0	645.7	65.0	109.1	122.2	63.6	67.2	68.9	68.9	22.7	33.3
35	Decoupling rate II of subsidies from production	%	65.6	73.6	78.3	66.9	74.3	79.2	68.5	75.7	79.1	67.8	75.1	79.2	66.7	76.3	80.3	70.8	85.4	86.1
36	Share of subsidies to operational activities in all subsidies	%	98.5	74.0	78.7	95.6	75.5	80.3	93.5	77.4	80.8	91.5	77.9	82.0	90.9	78.6	82.5	94.1	86.9	87.8

* The value of an indicator has not been calculated if the value of cash flow or family farm was negative, and the average has not been presented if the number of farms in a specific group was lower than 15.

Source: own calculation based on Polish FADN data.

Fortunately, the very large farms are characterised by the lowest fixed assets to current assets ratio, i.e. they are the least risky from the operational perspective, and thus the most flexible with regard to changes in their environment. It should be explained, however, that the largest farms include e.g. poultry farms, which benefit from direct payments to small extant.

In 2010-2014, the equity generation rate improved in all groups, and it was the most favourable in the case of the largest holdings. Unfortunately, in 2014, its growth decreased in terms of amount virtually everywhere. The same was observed in the case of the working capital. What is also worrying is the clear decrease in investment activity, which should not be surprising in the context of the declining agricultural market situation and increase in the general uncertainty and risk throughout the Polish economy.

Table 6 shows the impact of production type on the economic and financial situation of the studied agricultural holdings. The efficiency seems interesting at this point. At one end of the spectrum, there are fieldcrop farms with permanent crops, where 2014 is dominated by drops in cash return rates and profitability indicators compared to earlier years. On the other hand, these ratios in general improved in the case of horticultural and dairy farms in 2014. In other types, the situation varied, but we do not seem the regression everywhere. However, there is still much dispersion of maximum and minimum efficiency between types. Indubitably, the results were the best in the case of horticultural farms, whose advantage over permanent crops farms ranged from 32 to 92 times with regard to return on equity and on assets if the remuneration for family labour was not subtracted from the income. Horticulturalists have also clear advantage over the granivore and mixed type farms. It is worth noting that the condition of fieldcrop farms definitely declined in 2014, as this type had previously been inferior only to the horticultural farms and sometimes they were even the best of all. As far as efficiency of the dairy cow and granivore farms is concerned, the situation was stable and quite good. It should also be noticed that the total and sales profitability indicators are definitely less varied between types compared to return rates, which in general results from the way they are constructed.

As regards subsidy rates, the situation has been stable for years. All the analysed minimum values in this area were observed among the horticultural farms. On the other end of the spectrum, there were granivore farms (Subsidy rate I) or permanent crops (two other rates). In the latter case, the compensation for losses pn account of the embargo on exports to Russia might have had some impact on the situation. Granivore farms also used relatively little budget aid. Farms that focus on plant production are still traditionally strongly subsidised. Differences between subsidy rates between types are still very high. For rate I, the ratio was 1:15, for the second type, it was 1:9, and in the case of the latter, it was even 1:63. The cause of this was the situation where the subtraction of remuneration for family labour from family farm income gave negative results.

Logically, higher subsidy rates should translate into more favourable situation with regard to liquidity, solvency and financial stability. Empirical studies, however, force us to nuance this intuition. Without question, static liquidity is the worst in the case of horticulturalists, i.e. in the least subsidised category. At the other end of the spectrum, there are the following types: fieldcrops, granivores, and mixed production, i.e. the ones funded by the budget aid to a relatively large extent (fieldcrop farms) and to a moderate extent (the two other types). It is also not very surprising that the loan coverage ratio was the lowest with the horticulturalist. To a large extent, this results from their greatest use of external capital (the lowest external capital to total assets ratio). Add to this the fact that the horticulturalists' fixed asset to current asset ratio was inferior only to the value for the dairy farms, we find out that they were the most exposed to financial and operational risk. This logically requires such farms to manage their finance very professionally. And this was actually the case. Their situation with regard to the equity generation rate and investment rate and cash generation rate (2) was the best. As far as the cash generation rate (1) is concerned, these farms and the fieldcrop farms were inferior only to the permanent crop type. In the case of the remaining types, the link between high subsidy rates and favourable situation with regard to liquidity, solvency, financial stability and intensity of investment was observed only in the plant production farm type.

Table 6. Values of ratios and indicators in the panel of farms according to their production type in 2014

No.	Specification	Unit	Field crops (1)			Horticultural crops (2)			Permanent crops (4)			Dairy cows (5)			Herbivorous animals (6)			Garnivores (7)			Mixed (8)		
			Years 2010-2012	2013	2014	Years 2010-2012	2013	2014	Years 2010-2012	2013	2014	Years 2010-2012	2013	2014	Years 2010-2012	2013	2014	Years 2010-2012	2013	2014	Years 2010-2012	2013	2014
1	Return on equity (1)	%	7.6	6.6	4.9	9.6	10.2	10.9	5.0	3.8	-0.3	5.5	5.7	6.1	3.0	2.6	2.1	8.1	7.8	6.2	3.8	3.5	2.6
2	Return on equity (2)	%	5.7	4.9	3.3	6.2	7.3	9.0	2.4	1.5	-2.1	2.8	3.3	4.2	0.3	0.2	0.1	5.3	5.3	4.2	1.5	1.4	0.8
3	Total return on assets (1)	%	7.3	6.3	4.7	8.4	8.7	9.1	4.9	3.8	-0.1	5.3	5.5	5.9	3.0	2.6	2.2	7.6	7.4	5.9	3.8	3.5	2.6
4	Total return on assets (2)	%	5.7	4.9	3.3	6.2	7.3	9.0	2.4	1.5	-2.1	2.8	3.3	4.2	0.3	0.2	0.1	5.3	5.3	4.2	1.5	1.4	0.8
5	Cash return on equity	%	11.4	11.1	9.9	21.2	22.2	23.4	11.6	11.3	9.2	10.9	11.3	12.0	8.3	8.1	8.1	12.0	12.6	12.9	8.6	8.8	8.8
6	Cash return on total assets	%	10.4	10.1	8.9	17.0	17.5	17.7	10.9	10.6	8.6	10.0	10.4	11.0	7.7	7.5	7.4	10.8	11.4	11.7	8.1	8.3	8.2
7	Total profitability index	%	134.2	127.2	117.8	130.2	130.6	129.9	146.7	134.7	102.3	137.2	136.5	136.6	112.5	108.4	107.6	121.7	120.3	116.6	123.1	120.0	114.2
8	Sales profitability index	%	126.8	123.1	116.5	129.3	129.7	129.2	137.2	132.3	112.8	136.2	137.3	139.7	106.3	106.4	108.2	136.5	139.6	144.4	123.3	123.7	122.4
9	Current liquidity	multiplicity	4.19	3.95	3.43	1.65	1.43	1.04	4.10	3.67	2.45	2.71	2.79	2.94	3.78	3.45	3.25	4.78	4.74	4.44	4.78	4.73	4.36
10	Fast liquidity	multiplicity	1.33	1.26	1.08	0.83	0.71	0.50	1.35	1.20	0.83	0.76	0.76	0.76	0.58	0.48	0.45	1.03	1.00	0.90	1.09	1.06	0.90
11	Coverage of total loans with cash flows	multiplicity	0.85	0.76	0.60	0.69	0.62	0.51	1.16	1.05	0.76	0.93	0.94	0.96	0.69	0.63	0.61	0.84	0.90	0.96	0.92	0.89	0.80
12	Investment coverage	multiplicity	1.20	1.17	1.19	1.62	1.31	1.37	1.57	1.59	1.26	1.43	1.53	1.73	1.22	1.19	1.20	1.37	1.57	1.92	1.24	1.30	1.37
13	Cash generating ratio (1)	%	0.012	0.013	0.014	0.014	0.014	0.014	0.013	0.015	0.019	0.012	0.013	0.013	0.012	0.012	0.013	0.011	0.012	0.013	0.012	0.012	0.014
14	Cash generating ratio (2)	%	0.004	0.004	0.005	0.007	0.007	0.012	0.006	0.006	0.004	0.003	0.003	0.003	0.005	0.005	0.002	0.004	0.004	0.002	0.004	0.005	0.005
15	Equity growth	%	9.2	9.3	10.3	11.3	11.7	12.4	8.6	8.2	7.6	7.4	7.1	6.3	8.7	8.6	9.5	8.2	7.8	7.0	6.8	6.7	6.9
16	Change in the values of equity	PLN thousand	68.1	65.8	68.1	10.3	12.3	6.8	30.1	13.9	-21.3	51.3	49.5	38.1	31.6	28.9	26.2	60.0	45.2	-1.0	27.3	23.8	14.3
17	Working capital growth	%	50.0	44.2	32.8	42.1	39.1	31.5	67.4	56.2	38.0	45.4	40.2	33.0	35.0	31.2	27.3	36.0	32.6	24.1	36.2	32.4	25.1
18	Working capital (EY)	PLN thousand	144.1	143.9	137.7	42.5	40.7	34.6	104.3	101.6	82.5	61.0	66.4	75.1	73.8	75.1	77.7	194.4	202.8	202.9	90.3	94.8	99.7
19	Economic size	PLN thousand	246.6	243.4	239.6	338.7	357.5	397.8	153.3	154.4	157.4	228.6	235.9	252.0	151.4	170.4	238.3	540.9	551.8	578.3	181.3	184.2	192.8
20	Investment rate	%	171.4	158.9	134.3	118.3	154.8	151.7	99.4	97.7	99.3	172.4	159.1	143.2	105.8	107.5	128.9	162.5	143.4	115.3	128.4	120.4	108.7
21	Gross investments	PLN thousand	91.9	94.3	84.5	54.1	76.3	86.7	52.8	52.5	52.0	64.7	66.7	69.3	29.9	31.8	34.9	75.9	71.6	61.9	36.7	38.0	39.8
22	Net investments	PLN thousand	53.8	54.6	44.1	10.5	31.8	43.1	5.1	4.9	6.4	32.2	32.0	32.1	8.4	9.8	13.0	34.5	28.9	19.5	13.2	13.6	14.9
23	Assets to equity ratio	%	90.8	90.0	89.2	80.4	78.4	75.2	93.9	93.9	93.8	91.9	91.8	91.7	93.1	92.7	92.3	89.9	90.3	90.9	94.1	93.8	93.2
24	Asset freezing ratio	multiplicity	7.9	8.2	8.9	9.5	9.9	10.6	7.8	8.1	9.5	13.5	13.3	13.1	8.7	8.8	8.8	5.7	5.6	5.7	8.2	8.0	8.1
25	Total payments	PLN thousand	73.9	73.0	67.0	13.1	12.8	14.7	21.6	23.5	31.0	42.3	40.7	36.2	45.6	46.2	44.3	44.9	43.5	38.8	36.3	36.9	35.7
26	Cash flows (1)	PLN thousand	158.9	160.1	150.7	145.1	156.5	174.7	117.8	116.0	94.9	119.2	130.5	151.4	64.8	66.3	69.4	167.5	180.4	191.8	76.3	81.1	87.0
27	Cash flows (2)	PLN thousand	-61.6	-64.7	-66.8	-52.5	-59.9	-67.6	-46.2	-45.2	-42.6	-50.0	-53.2	-60.0	-23.7	-25.6	-29.2	-61.6	-60.7	-53.6	-26.4	-27.8	-30.1
28	Family farm income	PLN thousand	135.0	125.1	104.5	98.4	104.9	115.9	79.3	67.8	27.5	94.9	101.9	114.7	53.1	51.8	50.9	147.5	146.8	128.6	64.0	63.4	58.4
29	Family farm profit	PLN thousand	106.1	95.5	74.1	65.8	71.5	81.1	51.2	38.8	-2.8	60.0	66.0	77.2	23.4	21.0	18.2	113.3	111.7	92.4	33.7	32.2	25.4
30	Entrepreneur profit	PLN thousand	25.5	69.8	50.5	2.7	51.2	67.2	8.1	15.1	-21.3	15.9	38.3	52.5	43.2	1.8	1.2	6.7	76.0	62.8	19.1	13.0	8.2
31	Subsidy rate I	%	51.1	25.9	25.3	10.7	2.6	2.6	20.4	10.1	18.0	38.0	15.2	13.4	82.7	43.9	39.8	27.2	6.5	6.3	51.7	19.4	19.1
32	Subsidy rate II (1)	%	65.0	56.0	64.3	16.0	10.2	10.5	31.5	28.4	96.8	60.1	37.2	34.0	186.8	88.2	88.4	35.4	28.0	31.3	97.9	55.1	62.1
33	Subsidy rate II (2)	%	79.0	73.3	90.5	42.4	15.0	15.1	24.3	49.4	-935.0	30.4	57.4	50.5	2.6	216.4	246.5	74.3	36.7	43.5	13.3	108.1	142.5
34	Decoupling rate I of subsidies to operational activities from productio	%	63.0	100.2	132.7	45.9	20.9	18.0	83.5	127.0	-124.8	67.8	98.7	74.1	73.9	2 522.2	3 614.1	66.0	54.0	64.2	64.9	267.3	441.0
35	Decoupling rate II of subsidies from production	%	64.9	68.6	77.6	52.8	55.3	65.2	86.0	78.7	66.8	71.6	73.4	84.4	75.4	79.0	87.0	70.2	70.8	80.5	67.1	70.0	80.3
36	Share of subsidies to operational activities in all subsidies	%	94.3	70.4	79.3	86.8	62.2	71.4	85.0	82.0	71.6	88.0	77.0	87.1	94.4	80.3	87.8	87.1	74.8	83.8	93.3	72.2	82.2

Source: own calculation based on Polish FADN data.

5.5. Summary

The above analysis entirely confirms the general conclusion that the impact of subsidies on agricultural producers' attitudes, behaviour and decisions is multilateral and multichannel. This concerns capitalisation, the opposed income and substitution effect, mitigation of financial and loan restrictions in agriculture, encouragement of more risky behaviour in agriculture and creation of the wealth effect. There is also cross-compliance and greening, which lead to the use of marginal land. Add to this credit, land and rural labour market failures and the reverse impact of the agricultural product market deformation and conditions for competition resulting from subsidies. We also have to remember that stimuli for growth in agricultural production stem from farmers' expectations that the future support system will be based on the earlier achievements.

2014 was theoretically the first year of the new EU budget perspective. Actually it was a transitory year between the two subsequent perspectives. In the case of agriculture, this meant certain restrictions on access to budget aid. This perhaps to some extent contributed to the decline in the financial and economic performance, liquidity, solvency and financial stability and investment activity in the studied panel of farms. It seems however, that it was more of a result of the unfavourable market situation for economy and the starting deflation pressure. The drop in the allocation efficiency, however, should be worrying because it was observed for the second year in a row. The lasting character of this phenomenon will be evidence for some structural problems in our agriculture.

The analysis again confirmed that there is a negative correlation between the dependency on subsidies and the economic size of farms. As we proceeded up the economic size scale, the studied entities were more and more dependent on 1st pillar aid, i.e. primarily direct payments. In the other hand, the economic and financial efficiency started to improve after reaching the small or medium-small farms and in most cases grew until reaching the very large ones. This clearly shows that some minimum scale of activity is necessary for the rational use of budget aid offered to agricultural holdings.

The differences between subsidy rates and economic and financial condition of family farms are very clear and unambiguous as far as the production types are concerned. These relations are relatively constant in time. On the one hand, there are types that depend primarily on income from the market (horticultural, granivore and permanent crops farms), where the efficiency and investment activity is usually high and is improving with regard to certain aspects, and at the other end of the spectrum there are entities that cannot generate satisfactory income, not to mention profit, without extensive and lasting subsidisation (permanent crops, grazing livestock and fieldcrop production types). The latter group cannot be therefore deemed fully sustainable even if the farms in this type are sometimes environmentally friendly.

CONCLUSIONS

Integration with the EU caused a number of changes in agriculture, in the field of production and the economy. The aid directed to the agricultural sector is one of the factors influencing the economic situation of farms.

An important premise for intervention in the field of agriculture is providing public goods and limiting the risks to the environment posed by this sector of the economy. This is reflected in the environmental and compensatory payments.

There are only few studies in the literature (except for those cited in this publication) dedicated to evaluation of the impact of these payments on revenues of different groups of farms. These publications are mostly fragmented and gaps existing therein are filled by this monograph. The main conclusions from the research can be summarized as follows:

1. The proposed (in 2015) changes introduced not only a change in the method of completing applications for direct payments. The introduction of subsidies redistribution (additional payment) and subsidies for maintaining herds of dairy cows, cattle, sheep, goats (and other livestock) resulted in shifts in groups of beneficiaries. The beneficiaries of these changes proved be to primarily medium-sized farms, especially cattle and mixed. This took place at the expense of large-scale farms, mainly plant farms. Moreover, there is the criterion of minimum production volume to receive support under certain aid schemes, which reduced the payment rates for the smallest farms, in particular located on LFA-mountain zone.
2. The main beneficiaries of agri-environmental programme were large-scale farms. In addition, these farms more dynamically increased the acreage of UAA than the other farms. Beneficiaries of environmental funds were farms with greater efficiency. Direct payments and agri-environmental payments enabled faster development. In addition, it was easier to balance environmental and economic goals. In addition, compensatory and environmental subsidies had two important functions. First, they had the pro-investment effect. Secondly, agri-environmental payments (with other CAP transfers) were a kind of a buffer for worsening market situation.
3. Evolution of compensatory payments changed their original objectives – from social to environmental. Currently, payments are designed to preserve the landscape and biodiversity through sustainable environmentally friendly activities. The analysis shows that farms located on the lowland-LFA zone were in a different situation than non-LFA farms (prevalence of intensive production activity is not conducive to the sustainable management of the environment). Therefore, this group of farms requires the largest support. Undoubtedly, the biggest public aid is justified in the case of farms located on mountain-LFA zone. Such farms do not have sufficient resources to replace the fixed assets and invest in development. Their areas require complex support multiple programmes, simultaneously.

4. The analysis agrees with the general conclusion that the subsidies have multilateral, multi-channel influence on the attitudes, behaviours and decisions of agricultural producers. This impact includes the capitalization of opposing influences on income and substitution effects, alleviating the financial constraints and credit, encouraging risky decisions of farmers and creating a wealth effect. Then there are the cross-compliance and greening, which lead to the use of marginal land. It overlaps with the imperfections of credit markets, land and labour in rural areas and reverse impact deformation of the markets in agricultural products and the conditions of competition caused by subsidies. The analysis reaffirmed that between measures of farms depending on subsidies and their economic size is negative correlation. Increase in the economic size caused bigger involvement of the studied objects with support from the first pillar of CAP (mainly direct payments). The efficiency started to improve only from the group of small or medium-small farms, growing the most up to very large farms. Minimum scale of operations is essential to ensure that budgetary funds were reasonably used.

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