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Subsidies versus economics, finances and income of farms (4)

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Edited by
dr inż. Michał Soliwoda

Authors:
dr inż. Michał Soliwoda
prof. dr hab. Jacek Kulawik
dr hab. Adam Wąs, prof. IERiGŻ-PIB
dr Paweł Kobus
mgr Grzegorz Konat
dr Agnieszka Kurdyś-Kujawska
dr Agnieszka Sompolska-Rzechuła
mgr inż. Renata Płonka
dr inż. Dariusz Osuch

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Dr Agnieszka Kurdyś-Kujawska (ORCID No. 0000-0002-6024-2947) is affiliated with the Koszalin University of Technology, whereas dr Agnieszka Sompolska-Rzechuła (ORCID No. 0000-0002-0647-1570) – West Pomeranian University of Technology and dr Paweł Kobus (ORCID No. 0000-0003-2289-2305) – Warsaw University of Life Sciences – SGGW.

Dr inż. Michał Soliwoda (ORCID No. 0000-0003-4207-4641), prof. dr hab. Jacek Kulawik (ORCID No. 0000-0001-8731-1765), dr hab. Adam Wąs (ORCID No. 0000-0001-8643-5985), mgr Grzegorz Konat (ORCID No. 0000-0002-1162-5714), mgr inż. Renata Płonka (ORCID No. 0000-0002-3192-8595) and dr inż. Dariusz Osuch (ORCID No. 0000-0002-4696-8602) are the researchers from the Institute of Agricultural and Food Economics – National Research Institute.

This monograph was prepared under the task **Financial and fiscal factors in the improvement of efficiency, sustainability and competitiveness of the Polish agriculture**, in the topic *Subsidies versus economics, finances and incomes of farms*.

The main objective of this monograph is to identify theoretical and methodological foundations for measuring, assessing and optimising public aid granted to farms (at the level of EU countries and individual farms in Poland), along with an attempt of empirical verification. The auxiliary objective of the monograph is to update the *ex-post* analysis of the impact of subsidies on the economic, income and financial situation of these entities.

Reviewer
Dr hab. Andrzej Parzonko, Associate Professor of Warsaw University of Life Sciences – SGGW

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Joanna Gozdera

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Summa Linguae S.A.

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Leszek Ślipski

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Instytut Ekonomiki Rolnictwa i Gospodarki Żywnościowej
– Państwowy Instytut Badawczy
ul. Świętokrzyska 20, 00-002 Warszawa
tel.: (22) 50 54 444
fax: (22) 50 54 636
e-mail: dw@ierigz.waw.pl
http://www.ierigz.waw.pl

TABLE OF CONTENTS

Introduction 7

Michał Soliwoda, Ph.D.

1. **Measurement, assessment and optimization of public aid granted to agricultural holdings – selected issues** 9

Grzegorz Konat, M.A.

2. **Public support for agriculture of EU countries under the CAP. Scale, dynamics and trends of changes** 31

Agnieszka Kurdyś-Kujawska, Ph.D., Agnieszka Sompolska-Rzechuła, Ph.D.

3. **Implications of the direct payment degressivity mechanism in the CAP 2020+ in Poland** 59

Dr hab. Adam Wąs, Assoc. Prof. at IAFE-NRI, Paweł Kobus, Ph.D.

4. **Subsidies and other external sources of financing activity on farms – farmers' opinions** 89

Michał Soliwoda, Ph.D.

5. **Subsidies vs. finance and economics of farms managed by natural persons** 105

Prof. dr hab. Jacek Kulawik, Renata Płonka, M.Sc., Dariusz Osuch, Ph.D.

Introduction

Government expenses for agriculture can be aimed at supporting the development of this sector of economy, improving the profitability of farms and prosperity in rural areas. The Neo-Classical theory justifies interventionism in the agricultural sector, referring firstly to the unreliability of the market, secondly, to lower financial wealth of the poorest groups in the society (including rural residents). In particular, the concept of fiscal incidence as an example of incidence of economic policy gives a basis for determining the division of costs and benefits of a given policy, including the agricultural policy.

The main objective of this monograph is to identify theoretical and methodological foundations for measuring, assessing and optimising public aid granted to farms (at the level of EU countries and individual farms in Poland), along with an attempt of empirical verification. The auxiliary objective of the monograph is to update the ex-post analysis of the impact of subsidies on the economic, income and financial situation of these entities. The implementation of the objectives formulated in this way entailed the comprehensive literature studies (also with elements of meta-analysis) and empirical studies using the modern quantitative methods.

The monograph is composed of five chapters. In the first chapter the reasons for financial interventionism in the agricultural sector were presented and also the methods of measuring and assessing public aid granted to farms were reviewed. It contains also the concept of fiscal (budget) incidence as an instrument supporting the optimisation of the financial interventionism policy in agriculture. An empirical illustration of the theoretical considerations is an econometric analysis of the impact of subsidies on the economic situation of farms in the European Union countries in the years 2004-2016. In the second chapter the changes in public aid to agriculture of the EU countries under the CAP were identified and evaluated and also the impact of various budget subsidies on income, value of assets and investment activity of farms in the years 2005-2015 was determined. The third chapter includes the *ex-ante* analysis of changes in the agricultural policy related to the direct payment degressivity mechanism under the Common Agricultural Policy after the year 2020 (CAP 2020+) in Poland. The fourth chapter defined, based on farmers' opinions, the importance of other (in addition to EU subsidies) external financing sources for the activity of farms. The last chapter contained the empirical analysis of the

impact of EU subsidies on the economics, income and finance of family farms, being a continuation of the research in the previous years (carried out since the year 2011).

Each chapter can be treated as an integral study dedicated to the issues of financial interventionism in agriculture, although from various perspectives. A common feature of the monograph of the Multi-annual Programme 2015-2019 in the series "Subsidies and economics, finance and income of farms" is the adoption of methodological eclecticism with various areas of analysis (e.g. EU countries, farms).

This monograph is addressed to policy makers, employees of government and local government administration, scientists involved in the issues of broadly understood economics and finance of agribusiness as well as representing institutions of agricultural environment (e.g. advisory services, financial sector).

Michał Soliwoda, Ph.D., IAFE-NRI (Editor)

Grzegorz Konat, M.A., IAFE-NRI

1. Measurement, assessment and optimization of public aid granted to agricultural holdings – selected issues

1.1. Public aid for agriculture – some theoretical justifications

Public expenditure on agriculture is one of the most important tools to support development of this sector of the economy and improve the profitability of entities operating in rural areas. The basic categories of governmental support instruments for agriculture include: (1) market price support (including buying--in, target prices, reference prices), (2) production control ("quotas"), (3) subsidies for producers, (4) demand support (consumption subsidies, subsidies for biofuels), (5) trade regulations (customs duties, import quotas, etc.) as well as others which do not fall into the above categories (e.g. support for insurance against natural disasters, research and development subsidies, subsidies for young farmers, etc.) (Butault, Bureau, Witzke and Heckelei, 2012).

The basic justification for the fact that public funds are channelled to the agricultural sector results directly from the reasoning underlying the state's involvement in the economy. The neoclassical theory of economics provides two basic premises for such intervention[1], relating to two phenomena: market failures which can be corrected by involving the public sector (e.g. subsidies, provision of public goods or regulations) and too low level of material well--being, compared to the desired one, among the poorest groups of the society, which can also be corrected through public policy (Zawojska, 2013).

Looking at the problem in more detail, we can distinguish three basic categories of justifications for the use of state aid in agriculture: economic, social and political. The former, on the basis of the mainstream theory of economics, includes: (1) the need to repair/correct market malfunctioning (e.g. through public investment in infrastructure or expenditure on research and development), (2) the need to manage externalities (e.g. by financing

[1] Due to the limitations of this work in terms of subject and volume, we omit the justifications based, for example, on the specificity of agricultural activity, including the biological nature of this form of farming, and those taking into account the need to use a specific production factor, such as land (see, e.g.: Czyżewski, 2007; Wilkin, 2008; Zegar, 2018). We also omit the justifications which can be found in heterodox literature, presenting positions often diametrically opposed to the mainstream, and going both in the direction of pointing to the need for a very strong intervention of the state in the economy (e.g. post-Keynesianism) or even systemic change (radical political economy) or, on the contrary, rejecting any need for such intervention (e.g. Austrian economics). See: Karpińska-Mizielińska, Kloc, Konat and Smuga (2016).

environmental projects, including in particular agro-ecological research), (3) the need to limit information asymmetry, in particular to close the information gap (e.g. in the form of subsidising insurance and loans for agriculture or investment in meteorological systems), (4) the need to limit the reach of imperfect competition (e.g. by creating and developing antitrust offices), (5) imperative of supplying public goods (e.g. by investing in solutions ensuring high water quality), (6) tendency to ensure optimal allocation of resources and efficiency (e.g. in the form of investments in geodetic systems or through direct payments for agriculture), and (7) the need to fulfil the social, redistributive function by public authorities (e.g. through direct transfers for low-income agricultural families)[2] (Zawojska, 2013).

The last of the above-mentioned "economic" justifications for granting state aid to agriculture at the same time constitutes the key social justification. Literature discusses a number of factors in this respect which can be classified as social, socio-economic or socio-political, while – it is worth noting – in principle they refer to support for small, family agricultural holdings.

The first one is the view that financial support for family farms, whose characteristic feature is a relatively weak bargaining position in the economy, is the necessity to protect them from stronger agricultural enterprises and foreign competition (Zawojska, 2013). Another social justification for public aid granted to agricultural holdings may be the desire/need to provide food security for the society/economy, resulting from objective reasons or, for example, from lack of confidence in international markets' ability to provide food in all possible circumstances (Butault *et al.* 2012). Interestingly, such quite controversial theoretical justification finds some confirmation in the empirical data: the 2008 World Development Report emphasises that in the poorest countries food insecurity is closely correlated with the lack of support for agriculture and public investment in this sector of the economy (World Bank, 2007). Yet another "social" justification may be the need to ensure social cohesion and development (strengthening) of human capital by limiting the scale of poverty and social inequality (Mogues, Yu, Fan and McBride, 2012).

[2] Of course, in this context, it is also important to bear in mind the malfunctioning of the state and its actions. First of all, many public policies cause the formation of rents and, as a consequence, raise the problem of their active seeking by potential beneficiaries of public funds. The second possible cause of failure of the government's activity is the lack of sufficient knowledge of the citizens about public policies (especially when their effects on a person are small), which results in the potential interception of control over the state's intervention in the economy by groups of special importance (lobbies). Finally, another often observed problem are the "stowaways" in the use of public funds (Zawojska, 2013).

The tendency of the authorities to pursue the policy of supporting agriculture may also be influenced by "political" factors. For example, in this context Zawojska (2013) refers to empirical studies showing that the beneficiaries of subsidies for agriculture in the United States showed a greater tendency to participate in elections than those who did not receive such assistance, thus indicating that such a situation could constitute an incentive for the government to carry out the policy of "turnout buying". On the other hand, the same author notes that state aid programmes for agriculture often find justification in the concepts of traditional (family-based) agriculture, being part of culture and heritage with a long history which the government may want to preserve.

Of course, the above-mentioned division into economic, social and political issues is largely artificial as they are not strictly separate – on the contrary, in the vast majority of cases they seem to be very strongly related. Hence, in particular, the possibility of justifications for public aid in agriculture which should be defined as its "political economics," combining the premises of all three categories. For instance, Butault *et al.* (2012) indicate that the government's inclination to subsidise agriculture may be influenced by changes in the account of political benefits and costs resulting from the progressing changes in the structure of the economy (e.g. decreasing share of food in consumer spending, decreasing share of employment in agriculture in total employment in the economy, etc.).

However, the concepts presented above, designed to justify state aid in agriculture, require a confrontation with empirical studies in this area. In this context, Kulawik, Płonka and Osuch (2017, p. 103) point to the fact that theoretical papers in particular on the impact of public subsidies on agricultural efficiency "...do not bring definitive solutions, mainly because agriculture is very diverse internally, and individual holdings operate in an extremely diverse environment, which researchers are unable to capture in conceptual models. Thus, the subsidy-effectiveness dependence becomes a thoroughly empirical issue"[3]. This justifies the review of empirical studies in this area, broken down into statistical measures/indicators (primarily for measuring the scale of public aid granted to agricultural holdings), model approaches (though not only, we mean all approaches used to assess the effects of such aid to a greater extent and

[3] These authors, referring to the study by Minviell and Latruffe (2016), note very large variation in the results of previous research in this regard. Minviell and Latruffe determined that about a quarter of papers analysed by them show a positive impact of subsidies on effectiveness, over a half – a negative impact, and the other empirical studies subject to meta-analyses find no statistically significant connections in this regard.

to indicate measures conducive to optimisation) and an alternative approach to the problem, strongly related to the issues of optimisation of public aid for agriculture, which is the application of the concept of fiscal incidence (or budget incidence) to the assessment of the effects of granting state aid to agricultural holdings.

One should bear in mind that the division of analyses of support for agricultural holdings into its measurement, assessment and optimisation adopted in this study is largely arbitrary, because in literature all three of the above problems are often examined and evaluated simultaneously, often with the use of one and the same tool (mostly: a model). One of many examples of areas on which such connections are revealed is the dispersion of support for agriculture which, on the one hand, is treated in literature as an issue in the area of measurement (using indicators such as the Gini coefficient or Theil index, see: Butault *et al.*, 2012) but, on the other hand, substantively speaking, is also ranked among the issues of fiscal policy incidence.

1.2. Methods for assessing the level and efficiency of using public funds in agriculture

In addition to the necessity to learn about the size of state aid granted to agriculture, the need to make the most accurate measurements of such support arises from at least several reasons. One of them is the desire to make comparisons: on an international scale (e.g. to verify whether a given country is fulfilling commitments in this respect to international organisations and other countries) but also on a national scale (e.g. of costs and benefits of supporting agriculture to identify real beneficiaries and net contributors of this policy). Another important premise in this respect is the need to maintain the transparency of economic policy, *inter alia*, through its close monitoring, if possible (Butault *et al.*, 2012).

The level of support for agriculture is monitored primarily by international organisations, although the governments of individual countries are also active in this area. The majority of measures are constructed in such a way as to use simple and easily accessible data. More complex/advanced solutions, typically based on modelling of the economy, usually cannot be the basis for international comparisons.

The typology of the most commonly used indicators is presented by Butault *et al.* (2012). These are: (1) the so-called conceptual points of reference: producer and consumer surplus, compensating variation (CV) and equivalent variation (EV), Harberger's triangle, Trade Restrictiveness Index (TRI) and Mercantilistic Trade Restrictiveness Index (MTRI), (2) indicators developed as

a result of empirical modelling of the economy, (3) indicators of the OECD (PSE, SCT, CSE, TSE – see their descriptions below), (4) indicators of the WTO (including the AMS – see below), (5) indicators of the spread between domestic and global prices (indicators of protectionism – nominal, real and effective, rate of nominal aid for producers, domestic resource cost – DRC) and (6) dispersion indicators (Gini coefficient, Theil index).

Numerous authors point out that the most popular, most frequently used indicators are those used by the OECD and the WTO (see e.g. Wise, 2004; Przygrodzka, 2006; Cahill and Martini, 2010; Effland, 2011; Butault *et al.*, 2012).

Cahill and Martini (2010) distinguish a total of 18 indicators in the OECD methodology (including derived indicators, e.g. percentage transformations of numerical indicators) classified into four groups: (1) support for producers, (2) support for general services for agriculture, (3) support for consumers, and (4) total support for agriculture. These indicators are currently calculated for 52 countries, including 28 EU countries calculated as a single entity (OECD, 2017). However, "the most well-known and widely used are the PSE – producer support estimate – and the CSE – consumer support estimate" (Cahill and Martini, 2010, p. 11).

As explained by Przygrodzka (2006, p. 189), the producer support estimate (PSE) (or the indicator of the producer support level) is "...an indicator of annual cash transfers from consumers and taxpayers to agricultural producers, measured at the level of agricultural holdings, resulting from the policy of supporting agriculture, regardless of its nature, objectives or impact on the production or income of farms. Generally, this indicator informs about the amount of transfer of funds from taxpayers and consumers to agricultural producers as a result of a specific agricultural policy". Similarly, the consumer support estimate defines the annual value of total transfers to consumers of agricultural products.

Cahill and Martini (2010, p. 14) explain that "the PSE is basically a measure of transfer. Agricultural policy can provide farmers with direct payments. It may also maintain domestic agricultural prices above foreign prices or grant tax reliefs and credit privileges to farmers. All these potential sources of transfer or support are included in the PSE. In other words, the support covers not only budget payments appearing on government accounts but also support for market prices, as well as other concessions which are not necessarily associated with actual budget expenditure, such as the tax reliefs. A common element of all these policies is that they generate transfers to agriculture".

In addition to the presentation and detailed analysis of the PSE and the CSE, in the analyses for individual countries the OECD attaches considerable

importance to several other indicators from its instrumentarium: (i) the share of transfers in gross farm income (% PSE), (ii) the share in the PSE of support with the greatest potential to disrupt the operation of the market mechanism, (iii) the producer nominal protection coefficient (NPCp), which measures the ratio between the average price received by producers, including payments based on production volume, and export prices, (iv) the general services support estimate (GSSE), which is the sum of transfers to institutions involved in activity in the field of agriculture, especially research and development, education and consulting, as well as, among others, to the veterinary and control services, institutions involved in supporting technical infrastructure, etc., and (v) the share of the annual total value of cash transfers from taxpayers and consumers and budget resulting from the application of agricultural policy instruments, in GDP (percentage total support estimate, % TSE) (Przygrodzka, 2006; OECD, 2017).

Compared to the OECD measures, the index applicable to the countries negotiating within the framework of the World Trade Organisation – the aggregate measurement of support (AMS) – has a narrower scope and is less frequently published (Effland, 2011). The AMS is defined as the level of annual support granted to producers, expressed in monetary terms, other than support provided through instruments classified as the "green box" (Brink, 2007). The key here is, of course, to identify the referent of this last term. Gorter and Ingco (2002, p. 2) explain that "[in] the WTO's terminology, 'boxes' which have been given the colours of traffic lights in general define subsidies: green (allowed), amber (slow down! – i.e., reduce them) and red (forbidden). ...there is also a blue box for subsidies which are associated with programmes limiting production".

In the WTO methodology, the distinction between the AMS and Total AMS, which – by definition – is the sum of all aggregate measurements of support, seems relevant. Brink (2007, p. 8) explains this the following way: "Definition of Total AMS is closely related to the distinction between 'aggregate' and 'total.' 'Aggregate' refers to the aggregation of support in various policies or remedies, such as direct payments, input subsidies or market price support. 'Total' in the case of Total AMS refers to summing up many AMS into one...".

Both methodical approaches to measuring the scale of support for agriculture – of the OECD and the WTO – are widely used also in analyses of government offices of individual countries, including Canada and the USA. Effland (2011), however, points out how much, due to the differences in the construction of the PSE and AMS indicators, their indications may differ, even for the same economy and period. This author points out an example

that in the case of the United States, the annual national support for agriculture according to the WTO in 1995-2007 was only from 68 to 90% of that indicated by the OECD.

Insofar as the relative simplicity and the ability to conduct international comparisons with measures are one of the greatest advantages of using them, they have also disadvantages well known in the literature. Criticism (more often, but not exclusively, referring to the AMS than the PSE) focuses in particular on issues such as the fact that the indicators not so much measure as rather estimate the support (among other, due to the use of the concept of support in market prices) and on theoretical assumptions of the methodology of their calculation (see e.g. Wise, 2004).

As noted by Medonos, Hruška and Ratinger (2014, p. 76), "...a simple comparison of the result measures (such as production or gross value added) ...is methodically problematic because it ignores the fact that the level of these measures is influenced by a number of different factors. Moreover, support instruments are oriented at or used only by certain groups of producers or regions. In order to deal with these facts, a more precise approach is needed to examine what would happen if the producers who benefited from the support provided in the framework of the programme did not receive it...". These and other authors try to meet the problem formulated this way using more advanced methods of analysing policies of support for agriculture than those discussed in the previous part of this text. At the same time, their aim, in addition to measuring, is to enable the assessment of the impact of such policies, especially subsidies, on agricultural holdings, agriculture and the economy in general.

It seems that currently the type of models most often used in the mainstream of economics describing the functioning of the economy are economic models (mathematical and theoretical). Piech (2008) points out that such models used in evaluating the impact of economic policy, in particular in assessing the impact of the EU cohesion policy, can be divided into three main groups according to the techniques used in them: (i) real business cycle (RBC) models, (ii) computable general equilibrium (CGE) models, and (iii) dynamic stochastic general equilibrium (DSGE) models.

Their general popularity, especially of the last two categories, is undoubtedly proven by the fact that at least a few studies assessing support for agriculture with their use have been made only for Poland. For example, Zawalińska (2009) analysed the impact of the Rural Development Programme for 2004-2006 and the Sectoral Operational Programme using the general equilibrium model RegPOL, while the Institute for Structural Research (IBS, 2011) assessed the impact of the RDP for 2007-2013 using the DSGE class

model – EUImpactMOD III. Studies for Czech agriculture using a similar class of models (Rural-ECMOD, CZNATEC models) can be found, e.g., in Wieliczko (2013). At this point, however, it is worth noting the growing criticism of this type of research tools, in particular the fact that they are based on the assumption of a representative agent, and – therefore – the postulate, met in practice more and more often, of replacing such models with multiagent models (see e.g. Colander, Howitt, Kirman, Leijonhufvud and Mehrling, 2008).

Another popular category of models used to evaluate the impact of subsidies on the economy are hybrid models (first and second generation, cf. Pagan, 2005). An example of an application (albeit without a direct reference to agriculture) of the second generation hybrid model can be found in Karpińska-Mizielińska *et al.* (2006). Analyses based on more modest models than the constructions which are to take into account the entire economy can be found even more often. Many works use, for example, the production function in various ways, most often in the Cobb-Douglas formula (Chopeva and Nikolov, 2014; Wieliczko, 2013). Finally, conventional econometric models of various types and sizes, from structural models to solutions with a much narrower scope, aimed at addressing a specific single issue, find a wide range of applications in the discussed area. An example of the former – what is important: used in the past to assess the impact of subsidies on Polish agriculture – is the HERMIN model (Zaleski, Tomaszewski and Zembaty, 2007), while the latter group includes, for example, a panel model for Norway, presented in the study by Kumbhakar and Lien (2010).

In addition to the use of econometric modelling of the economy, at least two other ways of using methods of mathematical statistics to assess the impact of subsidies on agriculture can be found in literature. For instance, Wieliczko (2014) uses for this purpose grade data analysis (GDA), which is ranked among data mining methods. Interestingly, the author acknowledges that the main advantage of the method she uses is "...twofold presentation of research results: in numerical form and in an accessible graphic form" [pp. 40-41]. Another method used is the so-called "propensity score matching" (PSM) (Medonos *et al.*, 2014; Sielska and Pawłowska, 2016).

Still another method of assessing the impact of subsidies on agriculture which can be found in the literature is the application of fiscal multipliers. As explained by Wieliczko (2015, p. 98), "fiscal multiplier is a measure of the impact of public finance sector spending on GDP and it is the ratio of GDP growth to exogenous change in the budget deficit ... Stimulation of the economy by increasing public spending is based on the assumption that the stimulation effect of this spending is greater than the effect of possible tax cuts".

Importantly, there are at least three ways to examine the fiscal multiplier: (i) direct – based on empirical data, (ii) based on structural models of the economy, and (iii) narrative – a method based on document analysis (Wieliczko, 2015, p. 99).

In addition to the above-discussed mostly modelled approaches to the problem, at least four categories of methods, which can be used to assess the effectiveness of subsidising agriculture and which, it seems, are rarely applied in this area, are worthy of notice. The first one is a descriptive method, using in particular literature studies and descriptive statistics – such approach is adopted, among others, by Stoeva and Haytova (2014). Another method is social research, using tools such as surveys or in-depth interviews (along with – most often used to quantify their results – econometric models of the qualitative variable). This trend includes, for example, works by Sibande, Bailey and Davidova (2017) and Xu, Zhao, Tan and Yin (2017). The third type of methods rarely used to assess public support for agriculture is econometric analysis of cointegration and causality (in Granger's sense). One of the few such works is the study by Mishra, Moss and Erickson (2008). At this point, it is worth noting that these methods have already been used, with some success, e.g., to analyse the impact of EU funds on the Polish economy, but without a specific reference to agriculture (see, e.g., Karpińska-Mizielińska, Konat, Skowronek-Mielczarek and Smuga, 2014; Konat and Ważniewski, 2015). The author's attempt to apply them in this area will be presented in the last part of this chapter. Finally, the last type of method worth considering in this context is based on the assumptions of the effective demand theory of the Stock-Flow Consistent (SFC) model, so far used mainly to analyse the impact of fiscal policy on the entire economy (e.g. Augustinski, 2016).

A good summary of the use of such diverse quantitative methods to assess the impact of fiscal subsidies on agriculture is provided by Wieliczko (2013, p. 35): "As shown by the results of various types of studies of the impact of EU funds on development... of agriculture and rural areas, it is difficult to unambiguously, quantitatively assess the actual role of these measures". Therefore, this author's observation that "more complex policy assessments usually combine methodology, the level of detail and geographical levels by adopting a hierarchical structure of the modelling method" is worthwhile and valid (Wieliczko, 2013, p. 105).

This is in line with the observation of Butault *et al.* (2012, p. 33) who – in this context also pointing to the need to combine methods – noted that "...two models predicting exactly the same change in prices and quantities may still take on a different measure of well-being, and thus indicate other benefits...".

Accordingly, the fact that in the case of models used only or primary to assess support it is not possible to use the basic metacriterion of their evaluation, i.e. the values of forecasts provided by them, the proposal to combine different methodological approaches in the study of the same issue takes on particular value, is particularly worthy of notice.

1.3. The fiscal (budget) incidence concept as an example of the method to optimise public aid for agriculture

The third key factor of the theoretical and empirical analysis of public aid for agriculture is the need to optimise it. In itself, the need for optimisation does not seem to require justification, however, it is worth noting the existence of its two main levels. The first one is the international level. Analyses in this area focus on issues such as foreign trade (especially the problem of barriers in it), types of development policies (e.g. import substitution vs. export promotion) or inequalities – see e.g. Anderson (2006). The second level of optimisation is the level of a single national economy. The fiscal (budget) incidence concept turns out to be a very important methodical instrument supporting the optimisation of such policies in the analysis of the impact of public aid on agricultural holdings and enterprises[4].

As explained by Kulawik *et al.* (2017, pp. 98-99), the concept of fiscal incidence "...tries to answer the question of who ultimately bears tax burdens or makes use of budgetary spending. In other words, fiscal incidence tries to identify entities which benefit from and/or incur costs due to the application of a specific regulation and budget instruments". This proposal is, therefore, a special case of a more general concept – incidence of economic policy, which is trying to answer the question about the distribution of costs and benefits of a given policy between different interest groups, in particular defined by their roles in the economy – consumers, taxpayers, producers, etc. (Alston and James, 2002).

The most general division in deliberations about the incidence can be found in Gemmell and Morrisey (2005) who distinguish the formal and legal (or "statutory") incidence, i.e. the analysis of fiscal burdens and benefits which given entity or social group incurs/obtains in the light of the regulations in force, and the economic incidence which corresponds to practice, that is, who ultimately bears the burden of taxation or benefits from subsidies.

Another typology is presented by Kulawik *et al.* (2017, p. 99). They distinguish four types of incidence: (i) formal ("...major approach determined

[4] In Polish literature, it is referred to as "fiscal/budget scope (range)," "fiscal/budget burden", "distribution of fiscal/budget burden" or "fiscal/budget incidence". The latter is analogous to tax incidence, which has already caught on in Polish literature as *incydencja podatkowa*.

based on a specific theory"), (ii) effective (economic, factual), essentially corresponds to the economic incidence in Gemmell and Morrisey, (iii) absolute (specific), referring to the effects of using a single fiscal instrument, and (iv) net (holistic) incidence which, in their opinion, should be understood as "...a net position towards the budget resulting from a comparison of the burdens born for its benefit with all benefits and services it provides".

Alston and James (2002) point out that two main types of research can be identified in literature on incidence of agricultural policy. The first one is a detailed study of specific policies or events. The second main type is the papers presenting a more general view, trying to capture economic phenomena in a model way. These authors emphasise that insofar as theoretical studies in this area are quite numerous and recognise the problem well, in their opinion – insufficient number of empirical studies are conducted.

As far as more general research, mathematical models of the functioning of the agricultural sector or the entire economy are frequently used in literature on the subject (e.g. Chambers, 1995; Alston and James, 2002; Alston, 2010). Harding, Warren and Lloyd (2007) point out that these works usually attempt to compare the distribution of economic prosperity before and after specific actions of the government. Therefore, such studies usually adopt the "alternative scenario *zero state in the economy*", assuming that the difference between the income of an individual or a group after the application of the fiscal instrument by the government and the original income represents the redistributive influence of the government. In this context, these authors draw attention to an important methodological issue: although there is no doubt that public spending and taxes change household income – through changes in employment and production, and through the impact on the location and scale of private sector activities – in the majority of studies on fiscal incidence such factors are not taken into account, which may limit their cognitive value.

As for empirical research in this area, it usually focuses on the distribution of fiscal burdens/benefits measured using inequality measurements: quantiles, Lorenz curve, Atkinson indexes, etc. (Aziz, Gemmell and Laws, 2013). However, as noted by Kulawik *et al.* (2017, p. 100), "specification of the fiscal scope in the [specific] case of agricultural subsidies is the problem of their distribution among owners of land and other material assets and persons leasing them. This leads us directly to the issue of capitalisation of budget support in lease rent rates". The theory distinguishes here subsidies coupled with agricultural production and support decoupled from the production. More on this subject can be found in the works by: Kirwan and Roberts (2016) and Kulawik *et al.* (2017).

The review of literature on the impact of decoupled subsidies on production is included, for example, in: Bhaskar and Beghin (2009) and Weber and Key (2012). The last two studies lead to the conclusion that empirical studies of fiscal incidence in agriculture use very different methods, from descriptive statistics (e.g. Williamson, Durst and Farrigan, 2013) to econometric modelling (e.g. Roberts, Kirwan and Hopkins, 2003), most often included in the set of methods discussed in the previous parts of this study.

1.4. Impact of subsidies on the economic condition of farms in European Union countries in 2004-2016 – econometric analysis

As already explained above, econometric analyses of cointegration and causality (in Granger's sense) are methods very rarely used to assess public support for agriculture. Thus, it seems reasonable to try to use analysis tools of cointegration and causality in this area. Especially that, as Gruszczyński (2018) explains, studies using applied econometrics based on regression methods often make the mistake of assigning an alleged cause-and-effect relationship of a relation which only indicates the relationship of variables, without specifying its character or direction. This analysis is an attempt to meet the demand for this type of study. The aim of the presented study was to determine whether in the EU Member States in 2004-2016 subsidising of agriculture showed a long-term relationship with or had an impact on the economic condition of agricultural holdings.

1.4.1. Method

In the presented study, it was decided to examine the occurrence of cointegration and Granger causality between three selected variables representing the scale of subsidising agriculture in individual countries of the European Union and the economic condition of agricultural holdings. Due to the nature of the data used (stack of time series), spatial econometric methods were used in the analysis. First, the possibility of cross-sectional dependence (CSD) in the data was examined using the method proposed by Pesaran (2004, 2015). Due to the insufficient length of the series (13 observations), it was not possible to reliably check the occurrence of a structural break. After obtaining the results of the CSD test, unit root tests were carried out, suitably selected from among the available first and second generation tests of this type, and taking into account possible correction of the CSD effect. The following first generation tests were used for this purpose (selected taking into account their suitability in the analysis of small panels, in particular with low T value): Im, Pesaran and Shin (2003), Levin, Lin and Chu (2002), Harris and Tzavalis (1999), and

Breitung (2000) – all allowing to deduct cross-sectional means to account for the CSD effect – and second generation test proposed by Pesaran (2003). When the degree of integration of the variables was determined, cointegration (using method proposed by Westerlund, 2007) and causality tests were carried out – using the method presented in paper by Dumitrescu and Hurlin (2012).

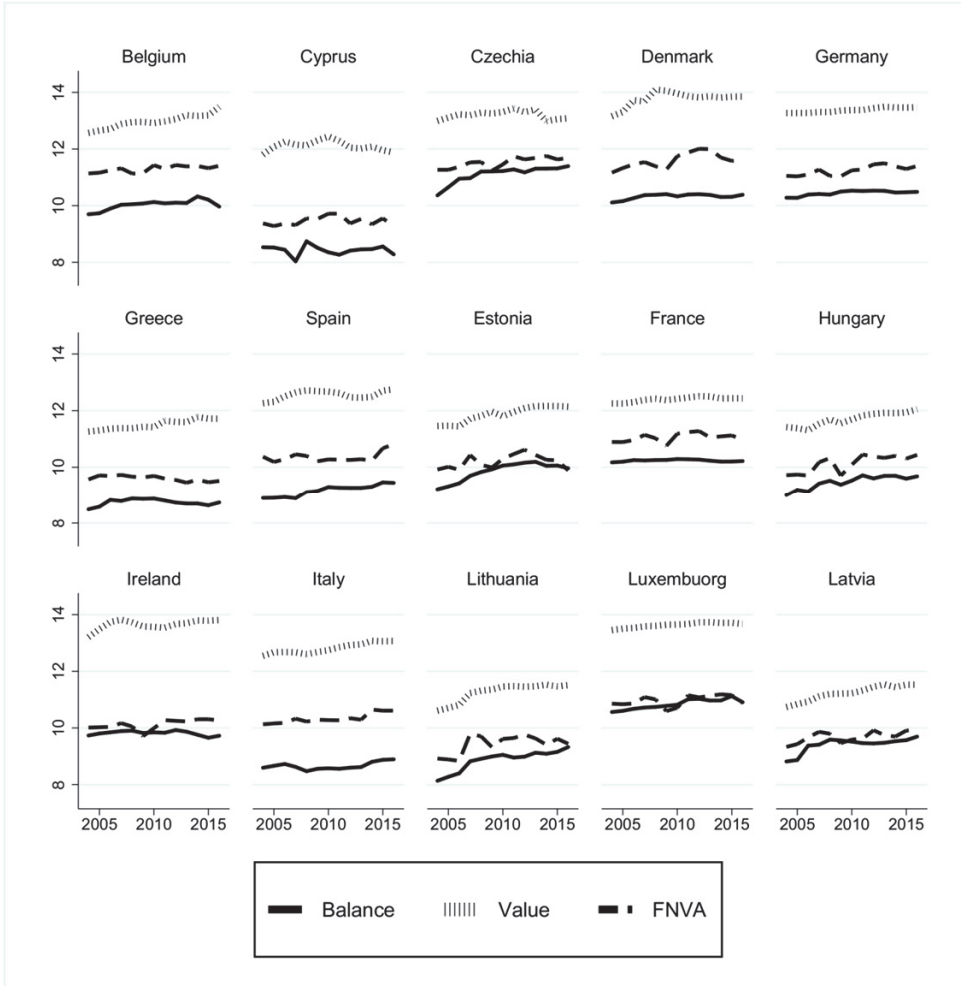
1.4.2. Data

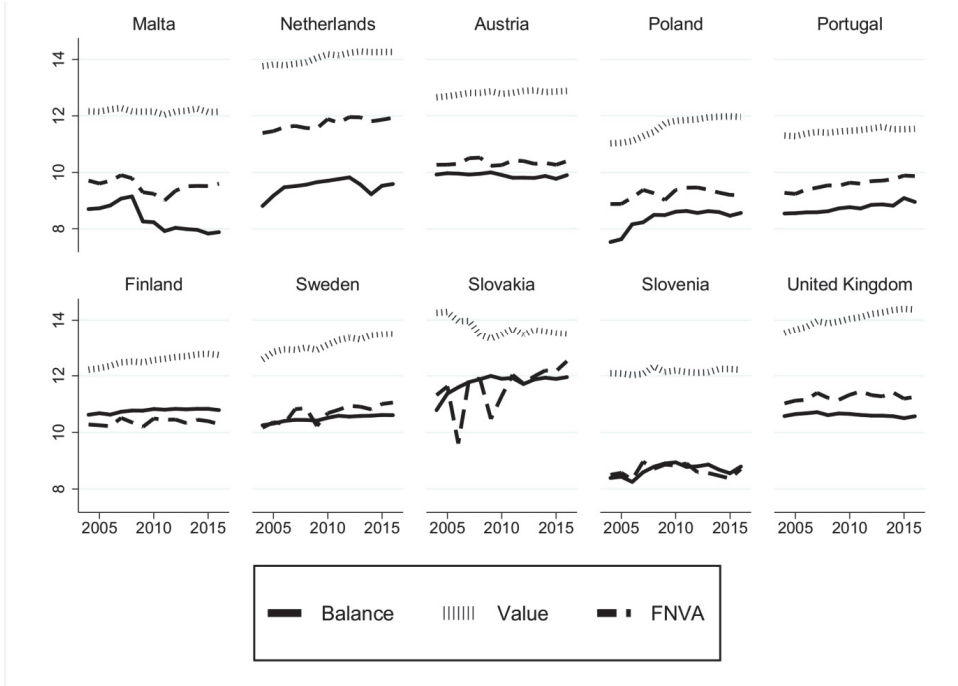
All data used in the study comes from the FADN Public Database and include observations for 25 EU Member States (excluding Bulgaria, Croatia and Romania, due to data gaps which would result in the imbalance of the panel) for 2004-2016 (annual data). It includes the following variables:

- BALANCE: the natural logarithm of the balance of current subsidies and taxes resulting from current production activities in the accounting year; the use of this category, and not, for example, the value of subsidies for agricultural holdings, results from the need to include differences in taxation systems between the analysed countries in the presented study;
- VALUE: the natural logarithm of the net value of agricultural holdings, i.e. the difference between the value of their total assets and liabilities;
- FNVA: the natural logarithm of the farm net value added – a category used by the FADN corresponding to the remuneration of fixed production factors (labour, land and capital), regardless of whether they are external or family factors.

Values of variables are presented in diagram 1.

Figure 1. **Values of the Balance, Value and FNVA variables**





Source: own study.

1.4.3. Obtained results

As a result of tests on the occurrence of the cross-sectional dependence in data, it was determined that this problem exists in all three variables (see Table 1). Therefore, the unit root tests made allowances for this circumstance.

First generation tests were performed first, with deduction of cross--sectional means to account for the CSD effect. Due to the very small number of observations in the series, 2 lags was accepted as the maximum lag order. Optimal orders were selected using the Bayesian Information Criterion (BIC). The results of four different tests (with different null hypothesis, although in each case it was a non-stationarity test), carried out with or without deterministic component, for levels and then the first differences, are ambiguous (Table 2). The only coherent conclusion which can be drawn from them is that the examined variables are panels of series with a degree of integration of $I(1)$ at the most.

Therefore, the second generation test proposed by Pesaran was carried out (zero hypothesis: all series are non-stationary), in variants for the order of lag of 0 or 1, with constant or with constant and trend. The results of this test (Table 3)

are also ambiguous but generally they support the conclusion that series in panels are stationary in the first differences. Therefore, for the purpose of further analysis, it was assumed that the examined variables are not stationary in levels but that the series are integrated at the *I*(1) degree.

Table 4 presents the results of the cointegration test carried out with the Westerlund method for all variables (pairwise and for three jointly), in variants with constant and with constant and trend. Due to the occurrence of the CSD phenomena in the data, the critical values of the tests were obtained by bootstrapping. As the presented results indicate, there is only doubt about the occurrence of cointegration between the Balance and FNVA variables in the case of the test with constant. Other results indicate quite clearly the existence of cointegrating vectors, meaning the occurrence of long-term relationships between the variables studied.

Finally, Granger causality tests were carried out for the first differences in the values of variables using the method proposed in the work by Dumitrescu and Hurlin. Due to the occurrence of the CSD phenomenon, critical values were bootstrapped (1000 draws), and the appropriate orders of lags for tests were determined using the BIC criterion. As shown by the results presented in Table 5, the occurrence of Granger causality was not demonstrated in any of the pairs of variables.

1.4.4. Summary

The results obtained in the study suggest that while – in the analysed 25 countries of the European Union – there is a fairly close relationship between the balance of subsidies for agriculture and the economic condition of agricultural holdings, it is impossible to indicate the sense of the vector cause-and-effect relationship between these categories, i.e. no Granger causality between them was found. However, these results should be approached with great caution, mainly due to the small length of the time series examined (13 years).

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Annex

Table 1. Results of test on the occurrence of the cross-sectional dependence phenomenon

	Balance	Value	FNVA
z	21,505	30,679	24,572
p	0,0000	0,0000	0,0000

Source: own study.

Table 2, Results of unit root tests (1st generation)

		Balance	ΔBalance	Value	ΔValue	FNVA	ΔFNVA
Im, Pesaran, Shin	no trend	0,0000	-	0, 1957	0,0000	0,0032	-
	trend	0,0027	-	0,0012	0,0000	0,0000	-
Levin, Lin, Chu	no trend	0,0000	-	0,0000	-	0,0000	-
	trend	0,0000	-	0,0000	-	0,0000	-
Harris, Tzavalis	no trend	0,0250	0,0000	0,3048	0,0000	0,0000	-
	trend	0,0721	0,0000	0,6793	0,0000	0,0000	-
Breitung	no trend	0,7390	0,0000	0,8775	0,0000	0,0000	-
	trend	0,5309	0,0000	0,0693	0,0000	0,0033	-

Source: own study.

Note: *p*-values are shown in the table (α = 0,05), The first differences are marked with the Δ sign.

Table 3, Results of unit root tests (2nd generation)

		Balance	ΔBalance	Value	ΔValue	ΔΔValue	FNVA	ΔFNVA	ΔΔFNVA
lag = 0	constant	0,011	0,000	0,032	0,000	0,000	0,074	0,000	0,000
	constant and trend	0,032	0,000	0,228	0,000	0,000	0,423	0,000	0,000
lag = 1	constant	0,261	0,000	0,112	0,001	0,000	0,972	0,110	0,000
	constant and trend	0,173	0,000	0,288	0,651	0,000	1,000	0,771	0,000

Source: own study.

Note: *p*-values are shown in the table (α = 0,05), The first differences are marked with Δ and the second differences with ΔΔ sign.

Table 4, Results of cointegration tests

	constant				constant and trend			
	Gt	**Ga**	**Pt**	**Pa**	**Gt**	**Ga**	**Pt**	**Pa**
Balance/Value	0,290	0,070	0,220	0,110	0,840	0,970	0,680	0,660
Balance/FNVA	0,390	0,050	0,010	0,000	1,000	0,790	0,320	0,160
Value/FNVA	0,680	0,490	0,220	0,260	0,950	1,000	1,000	1,000
Balance/Value/ FNVA	0,560	0,760	0,850	0,650	0,000	1,000	1,000	1,000

Source: own study.

Note: *p*-values are shown in the table ($\alpha = 0,05$), Drawing in the bootstrapping process was carried out 100 times, except for the pair of variables: Value/FNVA in the variant with constant and trend (40 times) and the set of variables: Balance/Value/FNVA, where the bootstrap was not used – limitations resulting from the low *T* value.

Table 5. Results of Granger causality tests

	Order of lags	**Z-bar**	**Z-bar tilde**
Value → Balance	1	0,437	0,919
Balance → Value	1	0,214	0,475
Balance → FNVA	2	0,554	0,716
FNVA → Balance	1	0,843	0,446
Value → FNVA	2	0,821	0,384
FNVA → Value	1	0,220	0,446

Source: own study.

Agnieszka Kurdyś-Kujawska, Ph.D., Koszalin University of Technology,
Agnieszka Sompolska-Rzechuła, Ph.D., West Pomeranian University of Technology in Szczecin

2. Public support for agriculture of EU countries under the CAP. Scale, dynamics and trends of changes.

2.1. Introduction

The EU policy for supporting the rural development plays an important role in the development of EU regions. Its objectives have evolved over time, adapting to the ever-changing needs of rural entities, as defined by socio--economic changes, such as migration of the population, changes in the availability and quality of production factors, differences in income among farms in the EU as well as increased concerns related to the sustainable development (European Commission 2015). The objective of recent CAP reforms is to help farmers meet new challenges faced by modern agriculture. These changes are a response to the food security problems, growing disproportion in the labour productivity on farms and in the case of entities pursuing non-agricultural activity, price volatility, growing production costs, deteriorating position of farmers in the food supply chain, protection of environmental resources and depopulation and reallocation of enterprises in rural areas (European Commission 2013). For many years, both theorists and practitioners have been involved in discussion on whether and how to subsidise agriculture so as to create conditions for the permanent and sustainable development. The level of subsidies and other forms of support is dependent on decisions of authorities at the EU level (Poczta-Wajda 2017) and is diversified in the individual Member States. Farmers receive public support by means of various types of subsidies. Annually, the EU spends about EUR 50 billion on financing the CAP. Most subsidies are distributed in a form of decoupled direct payments. There are also subsidies which are coupled to the production of specific crops or livestock production or are allocated for the rural development (Rizov, Pokrivcak, Ciaian, 2013). The objective of the paper is to identify and assess changes in public support for EU agriculture under the CAP and to determine the impact of various budget subsidies on income, assets value and implementation of investment activity of farms in the years 2005-2016.

2.2. Changes in the system of support for EU agriculture

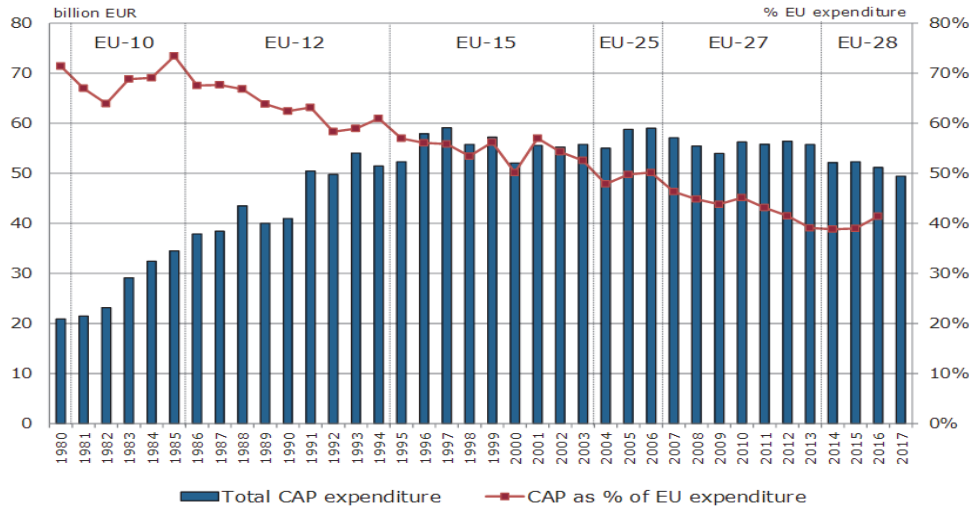
The Common Agricultural Policy was established pursuant to the Treaty of Rome of 1957. In the initial period of functioning, its major objective was the provision of self-sufficiency and food security, increase in the productivity of agricultural production, market stabilisation, significant increase in agricultural income and export expansion. Support instruments had a form of guaranteed prices and unlimited purchase guarantees (intervention purchases), production quotas and export subsidies, levies and customs duties (Stelmachowski, 1997). The emerging growing food production surpluses and increased costs of financing agriculture initiated CAP reforms. Price support has been reduced, by introducing a rule of automatic price reduction after exceeding the production ceiling, thus partially limiting the production intensity (Wieliczko, Kurdyś-Kujawska, Herda-Kopańska, 2017). In addition, structural instruments have been introduced. Another CAP reform of 1992, called the MacSharry Plan, changed the existing direction of agricultural support. Aid for farmers was decoupled and agriculture extended its existing interests by non-agricultural functions related to the rural development, environmental protection, improvement in safety and life quality (Bieluk, Doliwa, Malarewicz-Jakubów, Mróz, 2012). The price protection system was replaced with the system of compensatory support for income. Direct payments were introduced which were to maintain farmers' income despite lower price support (Pelucha 2006). The initiated process of reforming the CAP has been deepened by the so-called "Agenda 2000". It was aimed at, *inter alia*, equalising EU prices with global prices, introducing a requirement to observe environmental conditions, strengthening structural measures on the rural development and abandoning support for the agricultural production itself (production volume) (www.europarl.europa.eu).

However, the agricultural policy was still dominated by direct support instruments (first pillar). Therefore, further CAP reforms were needed, which introduced new rules and mechanisms of redistribution of funds. In 2003, changes in the CAP area comprised mainly decoupling of direct payments and increasing funds for the rural development. According to F. Fischler, this reform was a strong signal to the world that the objectives of the new EU agricultural policy are trade-friendly, by departing from the former system of subsidies which significantly distorted international trade and were harmful to developing countries (www.euroactiv.fr). In 2008, as part of the Health Check, the framework of the reform of 2003 was consolidated, as a consequence of which aid was completely decoupled, funds were partially transferred from the first pillar to the second pillar and the rules of public intervention and supply control

were made more flexible (www.europarl.europa.eu). The last CAP reform carried out in 2013 is a continuation of the trend of agriculture's market orientation initiated in 1992. It assumed, *inter alia*, complete decoupling of area subsidies, creation of maintenance of special financial support for specific parts of the agricultural sector, the reduction in area subsidies to the largest recipients and transferring these subsidies to financing rural development programmes as well as the full and absolute introduction of the cross-compliance of the agricultural production with the environmental and consumer safety requirements (Kmieć, 2012). A consequence of the CAP reforms and growing part of expenses for other EU policy areas is a downward trend which has been maintained for several years and applies to the share of CAP expenses in the EU budget. The share of CAP expenses in the EU budget has declined over the past 25 years from 73% in 1985 to 41% in 2016 (Fig. 1). Despite this large decline in the share of CAP expenses in the EU budget, agriculture still remains largely dependent on public support.

Figure 1

CAP expenses in total EU expenses

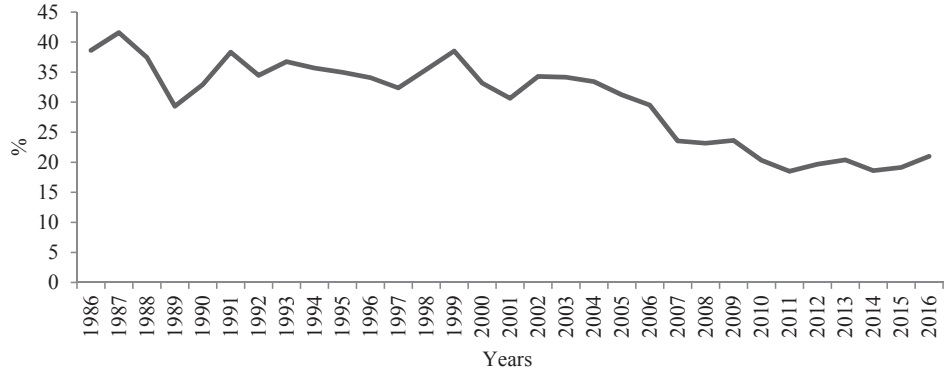


Source: CAP expenditure: European Commission, DG Agriculture and Rural Development (Financial Report).EU expenditure: European Commission, DG BUDG-2008 EU Budget Financial Report for 1980-1999, DG BUDG-2015 EU Budget Financial Report from 2000. Annual expenditure in 2011 constant prices by applying a 2% yearly constant deflator/inflator.

The reforms of the EU agriculture support policy are confirmed in the changed level of the PSE index in percentage terms, as published by OECD. As shown by the data, the average level of support for agricultural producers is characterised by a downward trend (Fig. 2). The European Union has gradually decreased support for agriculture since the mid-90s. New instruments, in particular subsidies, became more important. Since the beginning of the second decade of the 21st century, the level of support for EU farmers has been relatively constant and its small fluctuations result mainly from changes in prices of agricultural products in the global market (Poczta-Wajda, 2017).

Figure 2

Level of support for agriculture in the EU countries in the years 1986-2016 (level of the PSE index in %)



Source: own study based on the OECD data, 2018.

2.3. Material and study methods

To identify and assess changes in public support for agriculture of the EU countries under the CAP, the FADN data has been used. This data is average values for the specific countries and applies to an average farm in the individual countries. The study period covered the years 2005-2015. The study took account of the following types of subsidies to farms: a) subsidies on rural development (SE624); b) subsidies on crops and livestock (SE610+SE615); c) subsidies on intermediate consumption (SE625); d) decoupled payments (SE630); and e) subsidies on investments (SE406). The intensity of changes in the phenomenon has been assessed using the measure of an average rate of changes in the phenomenon estimated according to the formula $(\bar{\imath} - 1) \cdot 100\%$, where $\bar{\imath} = \sqrt[n-1]{\frac{y_n}{y_1}}$, $y_1, y_{2,\ldots,} y_n$ are realisations of the variable observed in time *t*.

What was also assessed, were the regression lines showing relationships of farm income (SE420); fixed assets (SE441) and gross investments (SE516) with respect to individual types of subsidies. The level of matching the assessed regression lines with empirical values of analysed variables has been determined using the determination coefficient R^2.

To identify the individual EU Member States, characterised by similar trends of changes, the hierarchical cluster method – Ward's method – has been used. This method, at each stage of division of objects, attempts to optimise the obtained division by combining two elements, using the criterion of minimum increase in the total within-cluster sum of squared variances of all variable values for each object from their cluster averages, provided that a starting point of the agglomerative process is the squared Euclidean distance matrix. Therefore, it guarantees the homogeneity within clusters and heterogeneity among clusters thus it is considered very effective (Ward, 1963). The Ward's method is by nearly 40% more effective when compared to the farthest neighbour method, which is ranked second in terms of effectiveness (Malina 2004). The Ward's method tends to create clusters with approximately the same number of objects. If the object has the same distance from centroids of two clusters with different numbers of objects, it will be included into the cluster with the lower number of objects. Therefore, clusters with low numbers of objects attach new objects faster than clusters with the higher number of objects and no chains can be formed (Balicki, 2009). This property can be considered an advantage of the method.

The general formula to set the distance of the newly created group G_r formed due to merging the groups G_p, G_q from other groups is as follows:

$$d_{pj} = a_p d_{pj} + a_q d_{qj} + b d_{pq} + c\left|d_{pj} - d_{qj}\right|,$$

where: a_p, a_q, b, c – parameters of transformation, characteristic of various methods of forming clusters. The above formula has been proposed by Lance and Williams (Lance, Williams 1963; Lance, Williams, 1968) and the Ward's method is within this scheme provided that it will be based on the squared Euclidean distance. In the Ward's method, the individual parameters are set as follows:

$$a_p = \frac{n_i + n_p}{n_i + n_p + n_q},\ a_q = \frac{n_i + n_q}{n_i + n_p + n_q},\ b = -\frac{n_i}{n_i + n_p + n_q},\ c = 0,$$ where n_i, n_p and n_q mean the numbers of objectives in relevant groups.

An important disadvantage is the absence of the obvious "stop" criterion for determining the number of relatively homogeneous clusters. In order to determine the number of classes, we may use some procedures making this task

easier. One of them consists in analysing the tree of connections in terms of differences in distances between subsequent stages of clustering objects. The large difference in these distances points to the merging of the group of objects which are relatively not similar to each other (Panek, 2009).

2.4. Analyses of changes in the amount of subsidies for EU agriculture

Differences in the amount of subsidies received by farmers in the years 2005-2015 as part of public support significantly vary among the individual Community countries. The highest subsidies were received by farmers due to decoupled payments and subsidies on rural development. Definitely, the lowest amounts of subsidies were related to the subsidisation of intermediate consumption. The studies prove that in the years 2005-2015, the highest amount of subsidies on rural development was received by farms from Slovakia (EUR 46 251,64 on average), Finland (EUR 23 023,45 on average), Luxembourg (EUR 19 595,27) and Czech Republic (EUR 16 849,18) (Table 1). The amounts of subsidies in those countries in the analysed period were characterised by the average diversity (the coefficient of variation for the individual countries was from 12,58 to 25,05%). The greatest span of subsidies was recorded in Slovakia. In this country, the minimum amount of subsidies on rural development was, on average, EUR 30 629 while the maximum amount was EUR 65 562. On the other hand, the lowest span of subsidies was characteristic of Finland and Luxembourg. Farms from Romania, Spain and Cyprus received the lowest amounts of subsidies on rural development. These amounts were, respectively, EUR 107,25, 807,91 and 851,82, on average. The large diversity between the highest and lowest amount of subsidies was recorded in Cyprus while the lowest – in Romania.

Subsidies which are to support the specific type of production, both crop and livestock, in the individual EU countries, were characterised by the very large diversity (coefficient of variation 158,33%). In the half of EU countries, the amount of production subsidies was more than EUR 1 210,68. The highest amounts of production subsidies were recorded in Slovakia (EUR 18 941), Finland (EUR 13 303,01) and France (EUR 7 099,64). In those countries, there was also the greatest span in subsidies received. The high coefficient of variation was characteristic of subsidies in Czech Republic, Ireland, the Netherlands, Romania and Slovenia. The lowest diversity of the amounts of subsidies was recorded in Belgium and Portugal. Beneficiaries from Romania, Ireland and Croatia received the lowest amounts of subsidies on the crop and livestock production.

Table 1

Average amount of subsidies in the EU countries in the years 2005-2015 (EUR/farm)

Member country	Specification				
	Subsidies on rural development	Subsidies on crops and livestock	Subsidies on intermediate consumption	Decoupled payments	Subsidies on investments
Belgium	2372,64	3951,55	0,00	14653,55	1855,45
Bulgaria	1226,78	478,27	215,78	3703,22	258,22
Cyprus	851,82	1215,73	0,00	2058,73	445,45
Czech Republic	16849,18	5158,64	5276,55	33401,36	3687,82
Denmark	1290,00	1102,09	0,00	31463,36	395,18
Germany	4581,55	401,18	2055,27	26327,27	439,18
Greece	824,09	1092,82	4,73	4465,91	68,27
Spain	807,91	2465,91	80,64	5792,82	191,64
Estonia	7238,27	1512,55	32,55	9125,82	3049,55
France	3118,00	7099,64	117,82	18746,36	1325,64
Croatia	332,00	192,00	20,67	3511,67	8,67
Hungary	2279,82	1759,82	1043,55	8146,82	867,09
Ireland	5403,82	187,09	8,45	13621,36	1189,36
Italy	992,27	501,82	20,91	4898,18	193,73
Lithuania	1922,45	952,09	19,73	4011,82	2461,55
Luxembourg	19595,27	-399,64	1162,27	21133,09	14108,36
Latvia	4007,18	2704,00	583,55	3763,73	1741,18
Malta	1204,64	2319,45	0,00	1100,09	700,27
Netherlands	2194,45	1835,36	126,00	12572,82	481,36
Austria	9288,18	1205,64	625,82	7057,91	1442,82
Poland	982,73	160,18	164,36	2552,55	205,73
Portugal	1846,55	1993,36	36,91	2749,18	791,27
Romania	107,25	216,64	64,33	901,78	34,78
Finland	23023,45	13303,91	8,91	10563,45	843,27
Sweden	11549,45	3064,73	0,00	21231,55	31,00
Slovakia	46251,64	18941,00	344,18	70469,36	11310,18
Slovenia	2874,82	754,18	297,00	2421,09	1173,45
United Kingdom	8550,91	314,55	9,91	32485,36	1173,73

Source: own study based on the FADN data.

The highest subsidies on costs and expenses incurred as part of the operating activity of farms were recorded in the Czech Republic (on average EUR 5.276.55), Germany (EUR 2.055.27), Luxembourg (EUR 1.162.27) and Hungary (EUR 1.043.55). In many countries, these subsidies did not exist (Belgium, Cyprus, Denmark, Ireland, Malta, Finland, Sweden). In Greece, Estonia, France, Portugal and Romania, the amount of subsidies on intermediate consumption was most diversified.

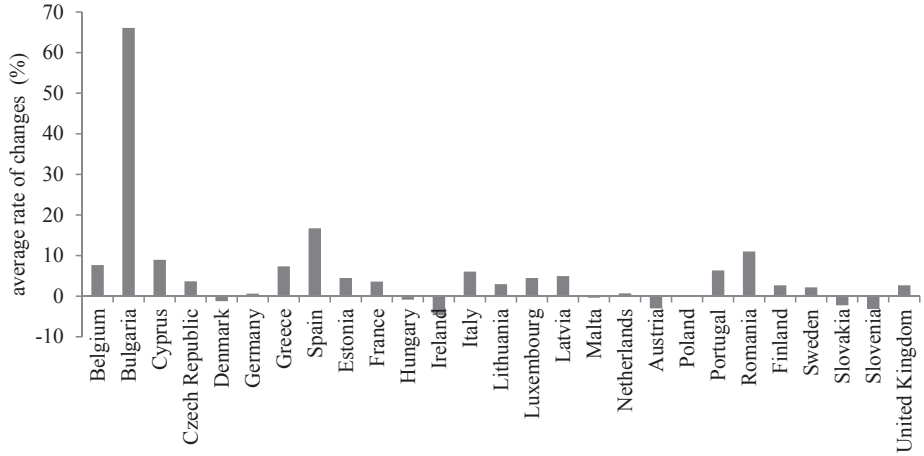
The highest value of decoupled payments was recorded in Slovakia (EUR 70 469,36), Denmark (EUR 31 463,36), Czech Republic (EUR 33 401,36) and the United Kingdom (EUR 32 485,36). In these countries, the coefficient of variation was respectively 37,40, 7,04, 31,59 and 6,47%, which shows the low diversity of these payments. The lowest decoupled payments were received by farmers in Romania (EUR 901,78), Malta (EUR 1 100,09) and Cyprus (EUR 2 058,73). In all EU countries, the amount of decoupled payments during the analysed period was characterised by the low diversity. The highest coefficient of variation of decoupled payments was recorded in Malta and amounted to 65,78%.

Another type of subsidies addressed to EU farmers was subsidies on investments. The highest average amounts of subsidies on investments were recorded in Luxembourg (EUR 14 108,36) and Slovakia (EUR 11 310,18). In Luxembourg, subsidies on investments in the period 2005-2015 were characterised by the low diversity (coefficient of variation amounted to 19,69%). In Slovakia subsidies on investments were characterised by the large diversity (coefficient of variation of 53,58%). The lowest subsidies on investments were received by farmers from the countries such as Sweden and Romania. The largest diversity in subsidies on investments was recorded in the Netherlands, Sweden, Romania, Ireland, Cyprus and Malta. To a small extent, subsidies on investments were diversified in France (coefficient of variation of 8.14%).

In 2015, when compared to 2005, most EU countries recorded an increase in subsidies on rural development. The highest percentage increase in this value was recorded in Bulgaria. In this country, the value of subsidies on rural development increased by 66% on average on a year by year basis. In the countries such as Denmark, Hungary, Ireland, Malta, Austria, Slovakia and Slovenia, the amount of subsidies on rural development decreased year by year. This decrease ranged from 0,3% in Malta to 4,7% in Ireland (Fig. 3).

Figure 3

Average rate of changes in subsidies on rural development

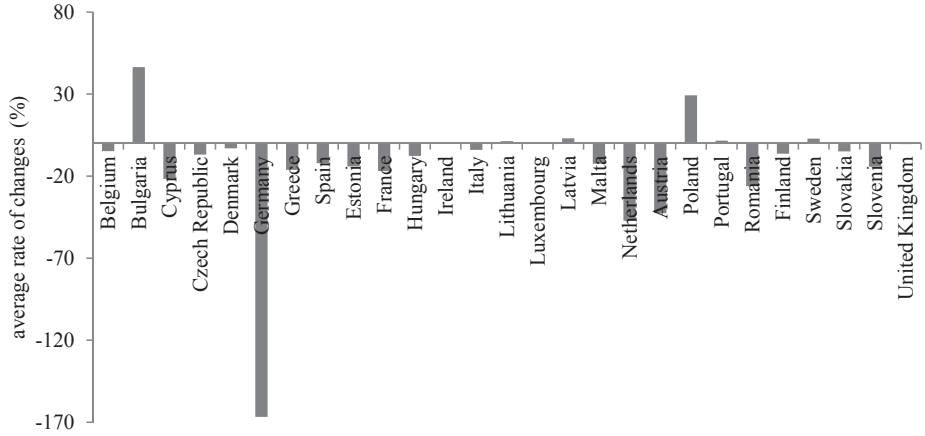


Source: own study based on the FADN data.

The average rate of changes in subsidies on the crop and livestock production, estimated for the years 2005-2015, shows that in most Community countries these values declined from a few to several dozen percent a year (Figure 4). The highest percentage decrease in production subsidies was recorded in Germany. In this country, the amount of subsidies per farm decreased on an annual average by 166%. In Bulgaria, Poland, Latvia, Lithuania, Portugal and Sweden, on average, the value of subsidies for farms increased year by year. The highest percentage increase in production subsidies was recorded in Bulgaria and Poland 46,41% and 29,26% respectively.

Figure 4

Average rate of changes in subsidies on the crop and livestock production

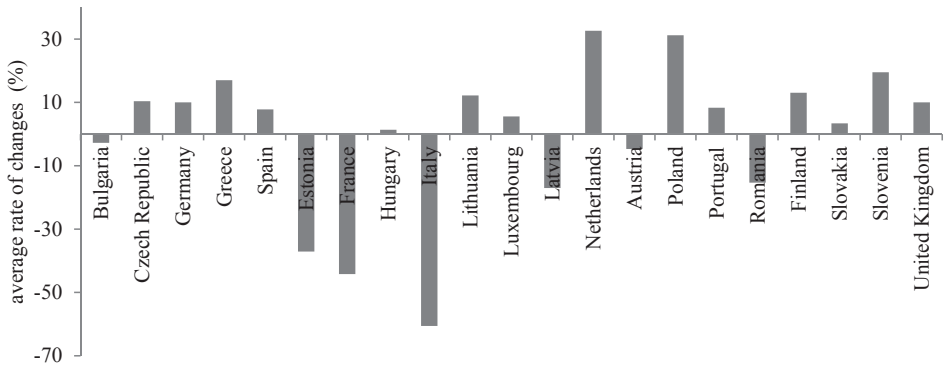


Source: own study based on the FADN data.

The value of subsidies on costs and inputs incurred as part of operating activity increased year by year most rapidly in the countries such as the Netherlands (32,59%) and Poland (31,20%). The lowest increase in the value of subsidies on intermediate consumption was recorded in Hungary (1,37%) and Slovakia (3 395). Year by year, there was a reduction in subsidies on intermediate consumption in Bulgaria, France, Italy, Latvia, Austria and Romania. The greatest decreases were recorded in Italy and France. In these countries, in the analysed period, year by year, on average, subsidies on intermediate consumption decreased by 60 and 44,20% (Fig. 5).

Figure 5

Average rate of changes in subsidies on intermediate consumption

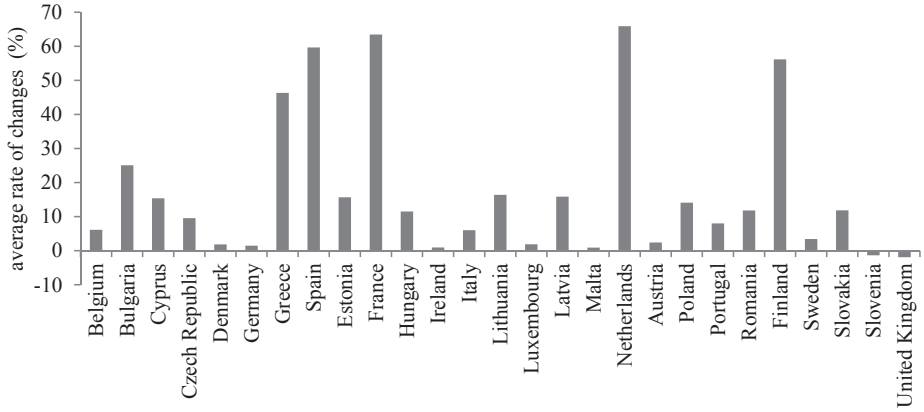


Source: own study based on the FADN data.

In all EU countries exclusive of Slovenia and the United Kingdom, the changes occurring within 10 years covered by the study consisted in an increase in decoupled payments (Fig. 6). In Spain, France, the Netherlands and Finland, year by year, on average decoupled payments increased by more than 50%. The lowest increases in decoupled payments were recorded in Malta (0,90%) and Ireland (0,94%). In most countries where decoupled payments increased year by year, the average growth rate was around 15%.

Figure 6

Average rate of changes in „decoupled" payments

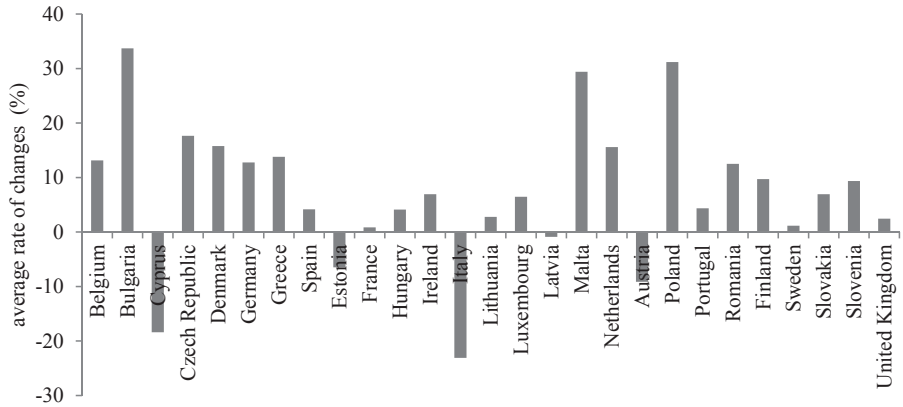


Source: own study based on the FADN data.

Subsidies on investments increased year by year on average from 0,85% (France) to 33,70% (Bulgaria). The highest percentage increase in subsidies on investments was recorded in Bulgaria, Poland and Malta. On average, year by years, subsidies on investments in these countries increased by more than 30% (Fig. 7). In Cyprus and Italy, subsidies on investments decreased year by year by 18,40% and 23,10% respectively. Furthermore, the decrease in subsidies on investments was also visible in the countries, such as Estonia (6,48%), Austria (9,13%) and Latvia (by 0,88%).

Figure 7

Average rate of changes in subsidies on investments



Source: own study based on the FADN data.

Using the cluster analysis, the EU Member States were divided into 4 groups which in the period 2005-2015 were characterised by similar trends in changes in the amount of subsidies received (Fig. 8).

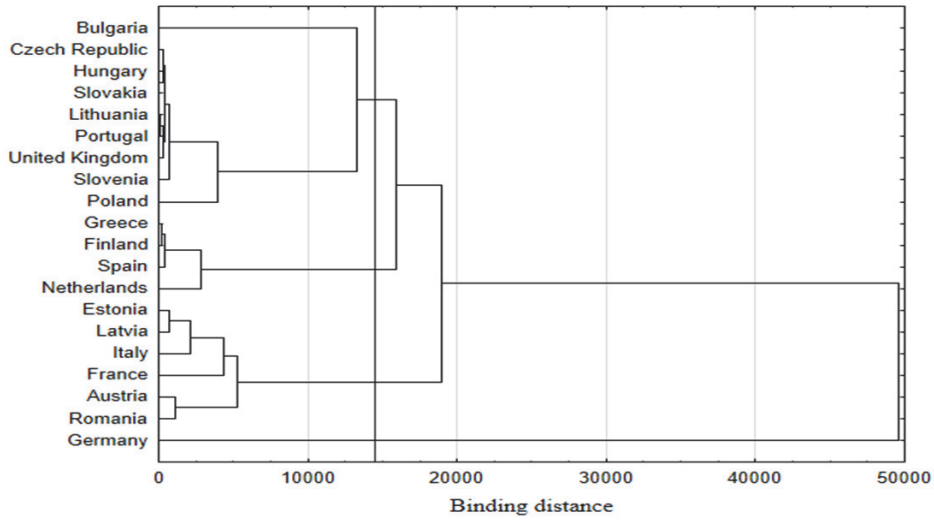
Group 1 (Bulgaria, Czech Republic, Hungary, Lithuania, Poland, Portugal, Slovakia, Slovenia, the United Kingdom), in which the average rate of changes in subsidies on rural development, crop and livestock production, intermediate consumption, investments and in decoupled payments is similar to the EU average and increases during the analysed period. The highest average rate of change in this group was recorded for subsidies on investments (12,50%). In this group, the average rate of changes in subsidies on rural development is 8,83% and is highest compared to other groups and compared to the overall average of all analysed classes. On the other hand, the average rate of changes in subsidies on intermediate consumption and decoupled payments was at the level

of 10,40 and 10,34% respectively. The annual average increase in production subsidies in Group 1 amounted to 4.92%.

Group 2 (Greece, Spain, the Netherlands, Finland) has the slightly lower rate of increase in subsidies on rural development (6,85%) and subsidies on investments (10,81%) than Group 1. In this group we observed the highest average rate of increase in decoupled payments (57,03%) and subsidies on costs and inputs incurred as part of the core activity (17,60%). The production subsidies in the group of these countries decreased by more than 20% annually.

Figure 8

Dendrogram of the average rate of changes in the value of subsidies in the EU countries



Source: own study based on the FADN data.

Group 3 (Estonia, France, Italy, Latvia, Austria, Romania) are the countries where the average rate of change in subsidies on rural development and decoupled payments increased year by year. This increase was 4,51% and 19,21% respectively. The average rate of changes in production subsidies indicates that these subsidies decreased, on average, by 16,80% year by year. In turn, subsidies to costs and inputs incurred as part of operating activity decreased on an annual average basis by 29,82%. This is a group of countries which is also characterised by a decrease in subsidies on investments (a decrease by 4,37% annually).

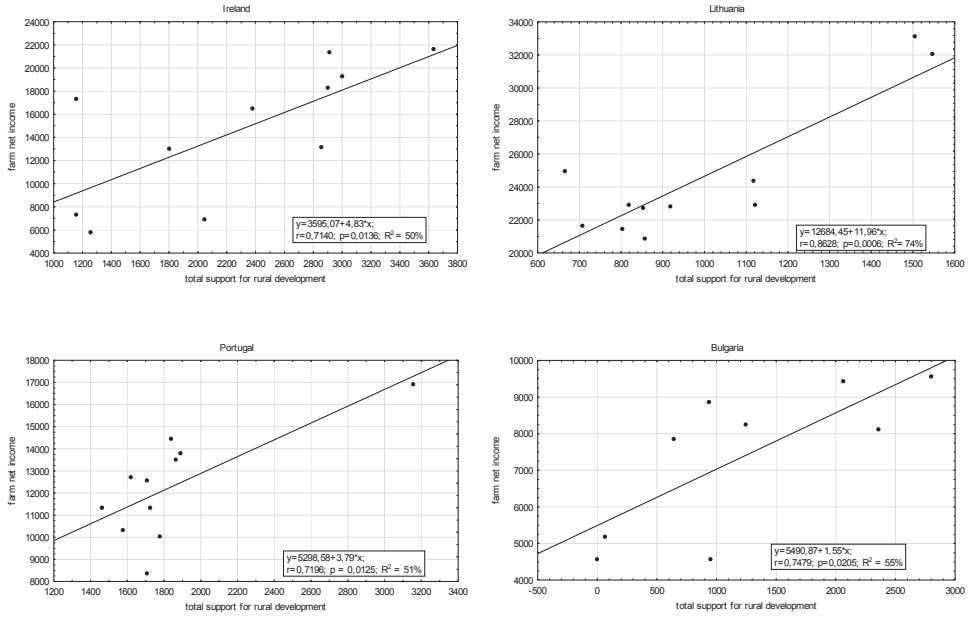
Group 4 (Germany) is characterised by the more than average decrease in production subsidies (166%) and the small increase in subsidies on rural development (0,62%) and decoupled payments (1,48%).

2.5. Assessment of the impact of public aid on the economic situation of farms in the EU countries

By assumption, public aid addressed to farmers is intended to improve the competitiveness of European agriculture in global markets. This improvement should be manifested as an increase in farm income, increase in their wealth or increased investment. An analysis of the dependence of individual factors on various types of subsidies showed significant differences in the EU countries. Given subsidies for rural development, it should be noted that the dependence of farm income on these subsidies took place in the countries such as Bulgaria, Ireland, Lithuania and Portugal. In Bulgaria, the increase in subsidies on rural development by EUR 1 increases farm income by EUR 1,53, in Ireland by EUR 4,83, in Lithuania by EUR 11,96 and in Portugal by EUR 3,79 (Fig. 9).

Figure 9

Estimated regression lines for the farm income variable in relation to subsidies on rural development

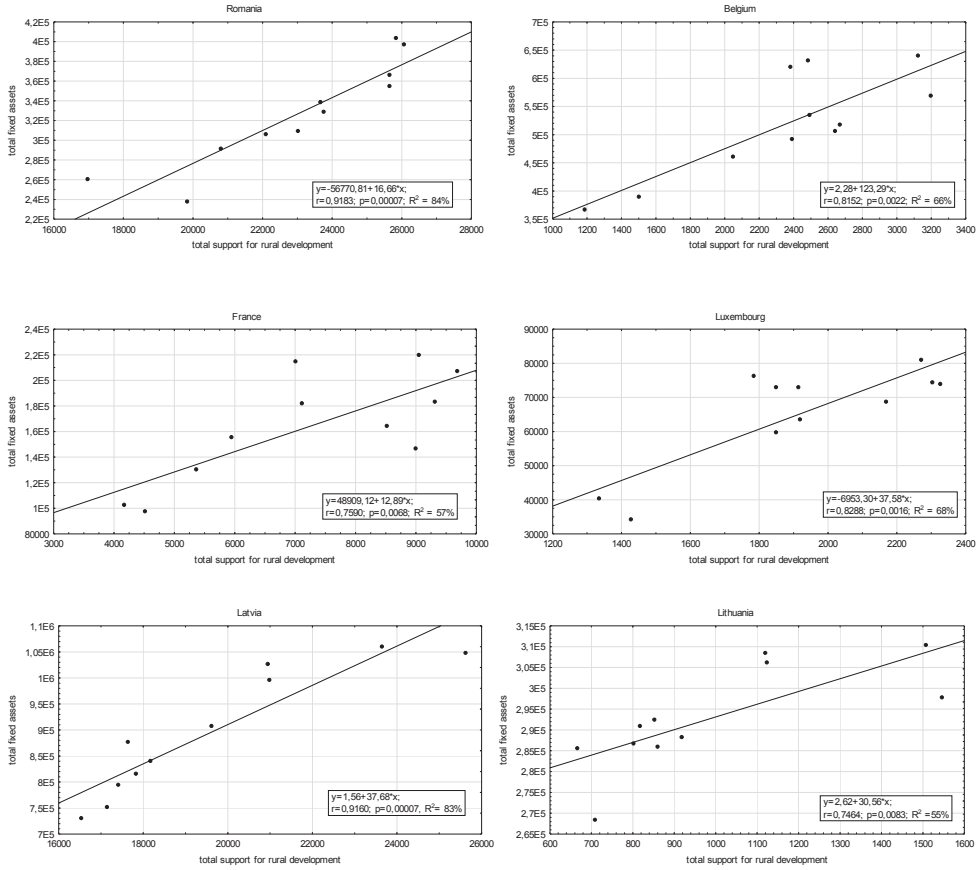


Source: own study based on the FADN data.

Subsidies on rural development in addition to increasing farmers' income also have an impact on increasing the value of fixed assets on farms. This dependence has been recorded in Belgium, France, Luxembourg, Romania and Lithuania and Latvia (Fig. 10). Subsidies on rural development have the greatest impact on the increase in the fixed assets of farms in Belgium. In this country the increase in subsidies for rural development by EUR 1 increases the value of fixed assets by EUR 123,29. The degree of matching of empirical results with the estimated regression lines is 66,45%, which means that changes in subsidies on rural development determine a slightly more than 66% of changes in the value of fixed assets of Belgian farmers. In other countries, the increase in fixed assets due to changes in subsidies on rural development was from EUR 15,89 to EUR 37,68. In these countries from 55 to 84% of changes in the value of fixed assets can be explained by the change in subsidies on rural development.

Figure 10

Estimated regression lines for the fixed assets variable in relation to subsidies on rural development

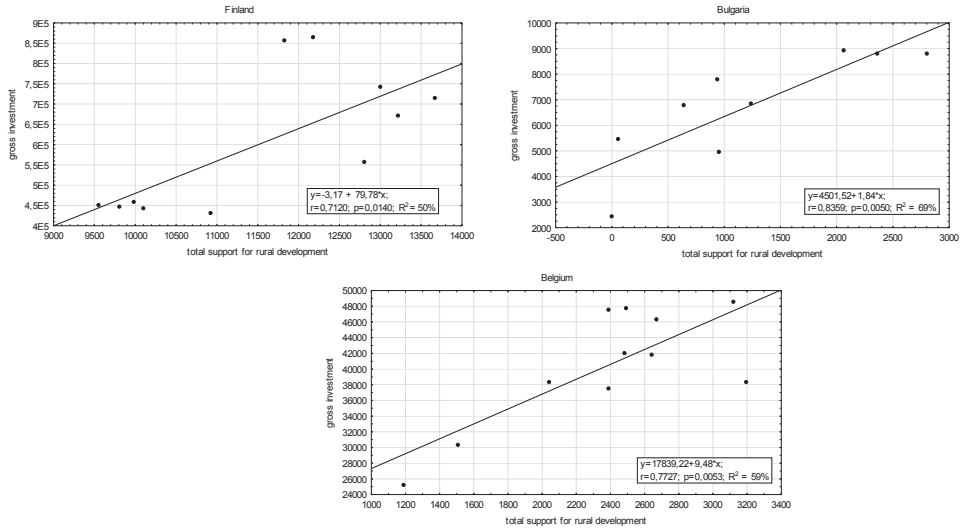


Source: own study based on the FADN data.

The dependence of gross investments on subsidies on rural development is visible in Belgium, Bulgaria and Finland (Fig.11). In Finland, the increase in subsidies on rural development by EUR 1 increases the gross investments value by EUR 79,78. On the other hand, in Belgium and Bulgaria the increase in subsidies on rural development by EUR 1 increases the gross investments value by EUR 9,48 and EUR 1,84 respectively. In all other countries the degree of matching of empirical results with the estimated lines was at a low level (less than 50%).

Figure 11

Estimated regression lines for the gross investments variable in relation to subsidies on rural development

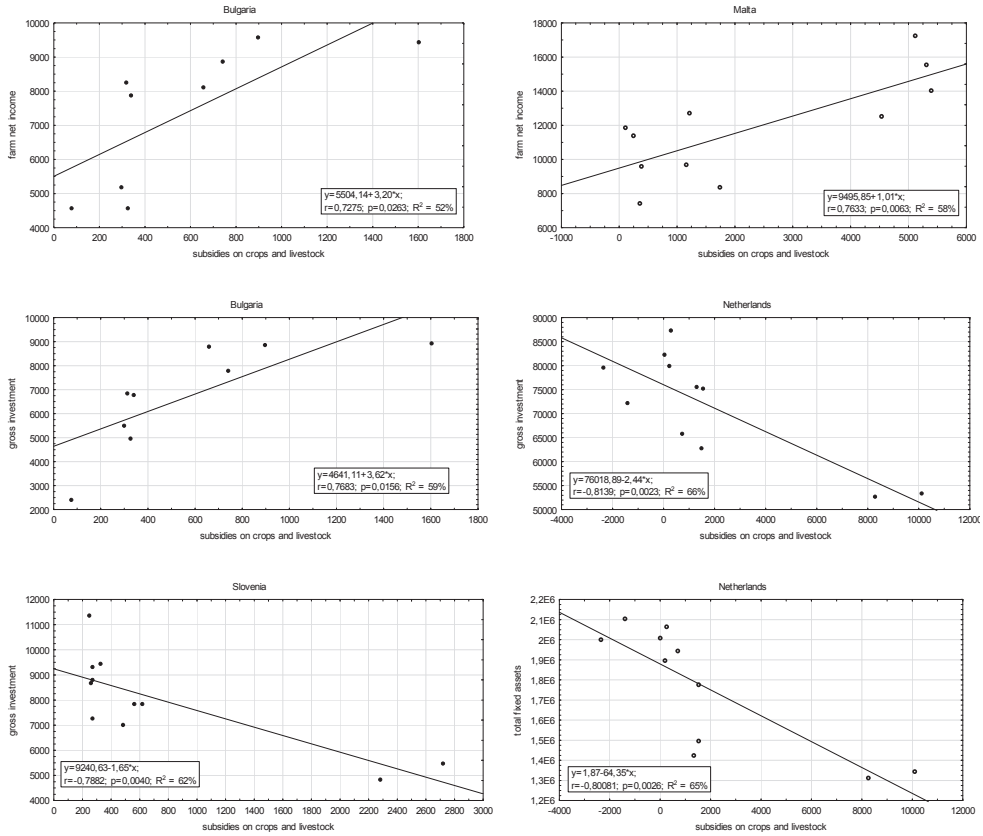


Source: own study based on the FADN data.

The increase in production subsidies had an impact on changes in farm income, fixed assets and gross investments in only a few EU countries. These were Bulgaria, the Netherlands, Malta and Slovenia (Fig. 12). The increase in production subsidies by EUR 1 increased farm income in Bulgaria and Malta. In Bulgaria this increase of income was by EUR 3,20. The significant increase in farm income depending on production subsidies was recorded in Malta. In this country the increase in production subsidies by EUR 1 increases farm income by EUR 58,26. The dependence of the value of fixed assets on production subsidies is only visible in the Netherlands and this dependence is negative. This means that the increase in production subsidies by EUR 1 decreases the value of fixed assets by EUR 64,35. In turn, the dependence of gross investments on production subsidies was only recorded in Bulgaria, the Netherlands and Slovenia. Only in Bulgaria, is this dependence positive. This means that the increase in production subsidies by EUR 1 increases the value of gross investments in that country by EUR 3,62. By contrast, in the Netherlands and Slovenia, the increase in production subsidies by EUR 1 decreases the gross investments value by EUR 2,44 and EUR 1,65 respectively.

Figure 12

Estimated regression lines for the farm income, fixed assets and gross investments variable in relation to production subsidies



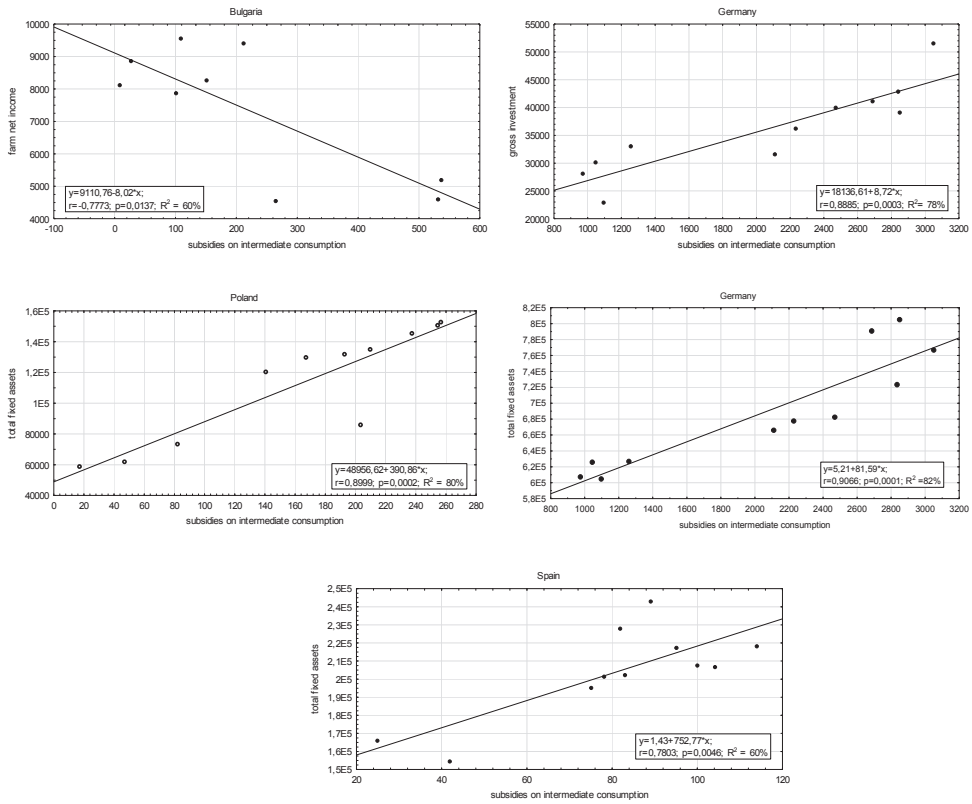
Source: own study based on the FADN data.

From among all EU countries, only in Bulgaria, Germany, Spain and Poland subsidies on intermediate consumption had an impact on farm income, the value of fixed assets and gross investments (Fig. 13). In Bulgaria, the increase in subsidies on intermediate consumption of EUR 1 decreases farm income by EUR 8,02. The degree of matching of empirical results with the estimated regression lines is 60,41%, which means that changes in subsidies on intermediate consumption determine slightly more than 60% of changes in farm income in Bulgaria. The dependence of the value of fixed assets on subsidies on intermediate consumption was only recorded in Germany, Spain and Poland. Increasing subsidies on intermediate consumption by EUR 1 in these countries increases the value of fixed assets by EUR 81,59, EUR 752,77 and EUR 390,86 respectively. In turn, the dependence of gross investments on subsidies on

intermediate consumption occurred only in Germany. In this country, the increase in subsidies on intermediate consumption by EUR 1 increases the gross investments value by EUR 8,72.

Figure 13

Estimated regression lines for the farm income, fixed assets and gross investments variable in relation to subsidies on intermediate consumption



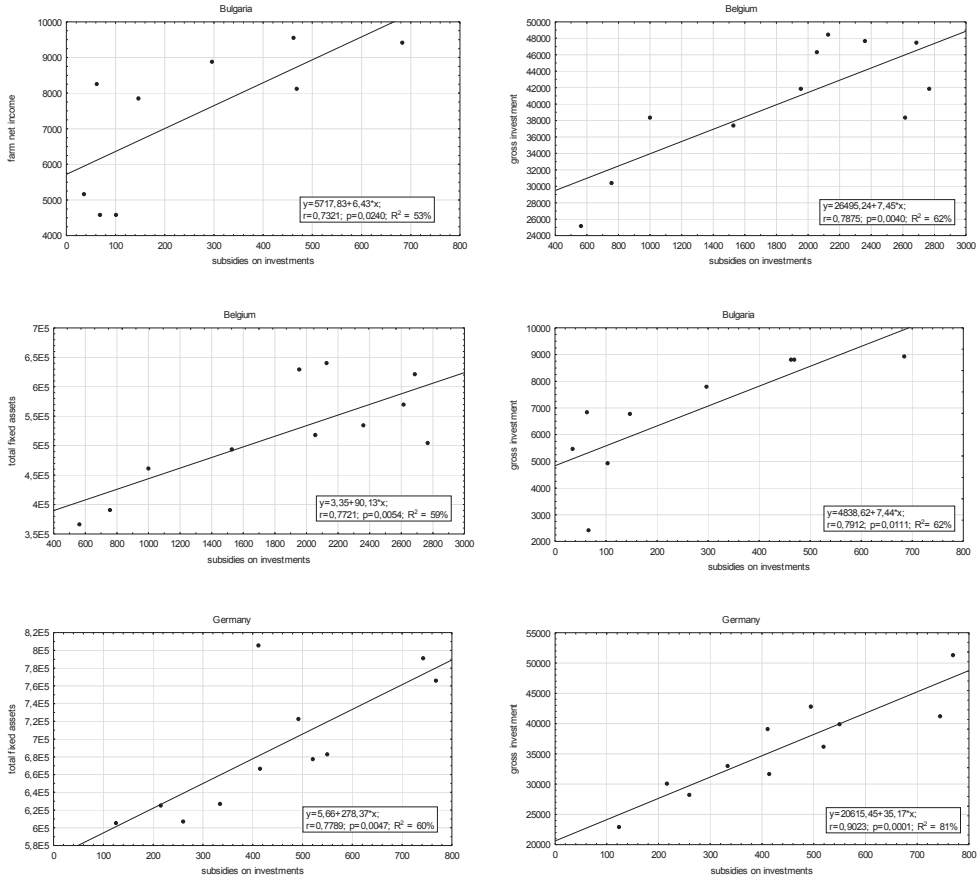
Source: own study based on the FADN data.

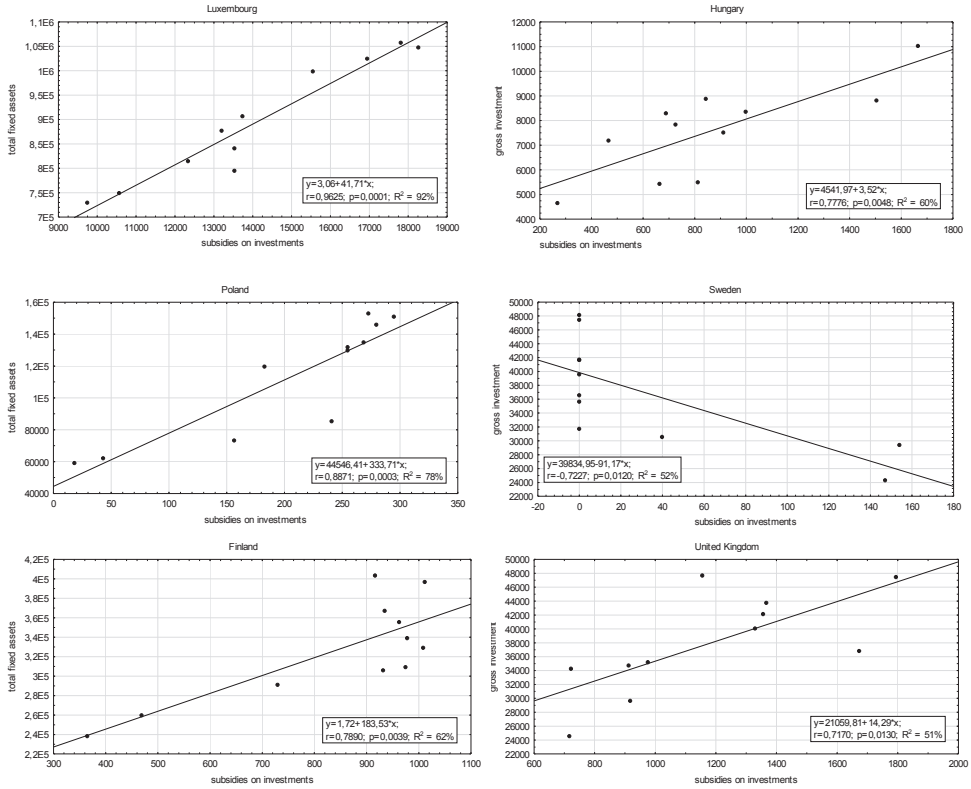
Subsidies on investments had an impact on farm income only in Bulgaria. Increasing subsidies on investments by EUR 1 meant the increase in farm income in this country by EUR 6,43. The dependence of fixed assets on subsidies on investments was recorded for the countries, such as Belgium, Germany, Luxembourg, Poland and Finland (Fig. 14). In these countries from 59 to 92% of changes in fixed assets can be explained by changes in subsidies on investments. Increasing subsidies on investments by EUR 1 means the increase in fixed assets by EUR 90,13 in Belgium, EUR 278,37 in Germany, EUR 41,71 in Luxembourg, EUR 333,71 in Poland and EUR 183,53 in Finland.

On the other hand the dependence of gross investments on subsidies on investments was recorded in Belgium, Bulgaria, Germany, the United Kingdom, Hungary and Sweden. In Germany, increasing subsidies on investments by EUR 1 increases the gross investments value by EUR 35,17, while in the United Kingdom increasing subsidies on investments by EUR 1 increases the gross investments value by 14,29 EUR. In Belgium, Bulgaria and Hungary the amount of subsidies on investments slightly increased the gross investments value on farms. Increasing subsidies on investments by EUR 1 in these countries increased the gross investment value by EUR 7,45, EUR 7,44 and EUR 3,52 respectively. In Sweden, the increase in the investment subsidy by EUR 1 results in the decrease in the gross investment value by EUR 91,17.

Figure 14

Estimated regression lines for the farm income, fixed assets and gross investments variable in relation to subsidies on investments



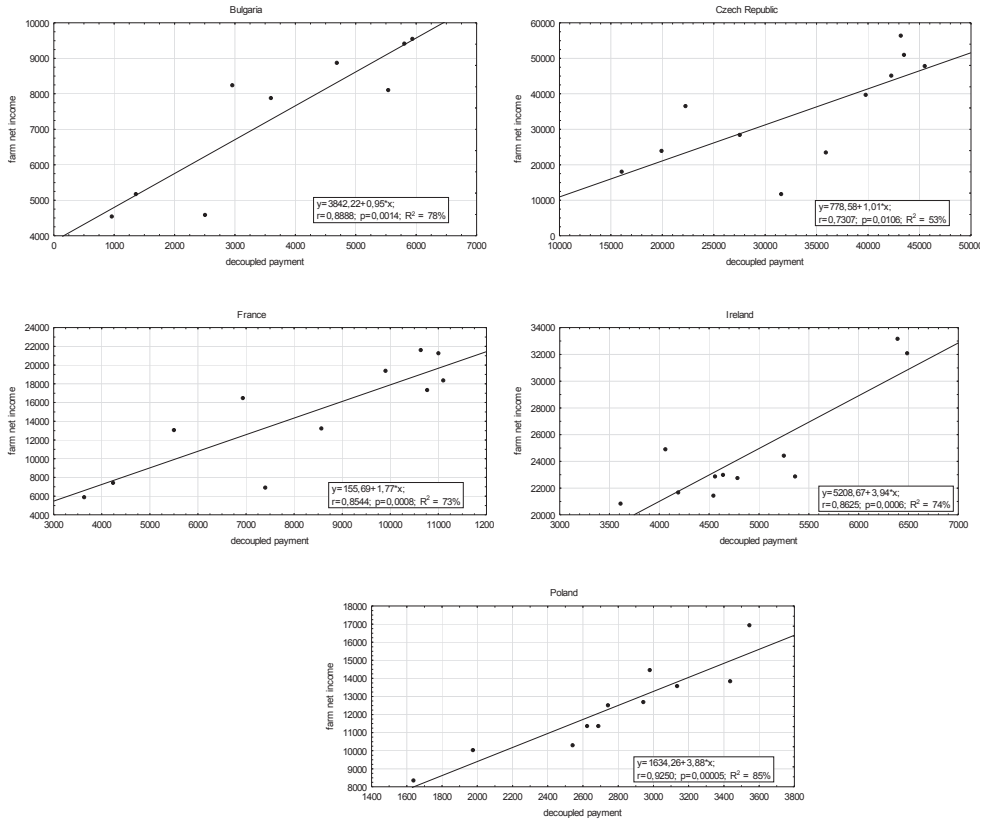


Source: own study based on the FADN data.

The decoupled payments – direct payments decoupled from production and introduced by the CAP reform in 2003. Their primary objective is to support agricultural income by targeting production to the actual market demand and competitive advantage of farms. Direct payments have an impact not only on farm income but also on the value of fixed assets of farms and gross investments. The dependence analysis showed that the decoupled payments had an impact on farmers' incomes in Bulgaria, the Czech Republic, France, Ireland and Poland (Fig. 15). The increase in direct payments by EUR 1 increases farm income in Bulgaria by EUR 0,95, in the Czech Republic by EUR 1,01, in France by EUR 1,77, in Ireland by EUR 3,94, while in Poland by EUR 3,88. The degree of matching of empirical results with the estimated regression line ranges from 73% (France) to 85% (Poland).

Figure 15

Estimated regression lines for the farm income variable in relation to „decoupled" payments



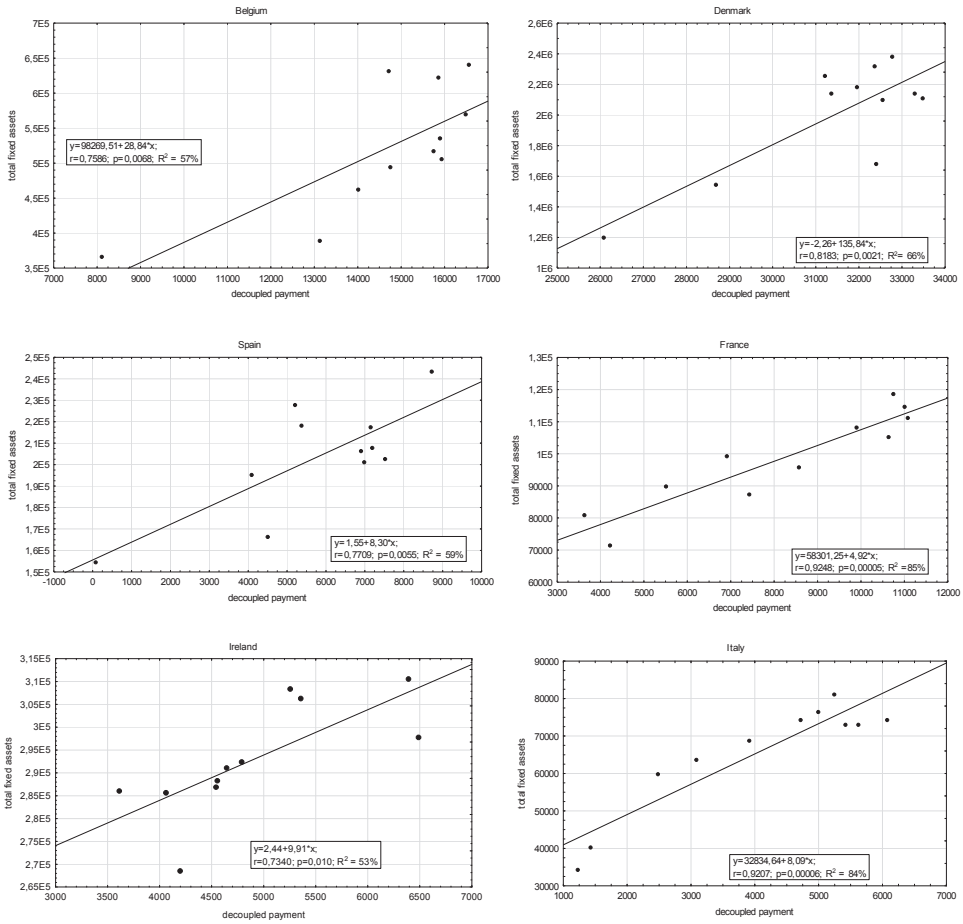
Source: own study based on the FADN data.

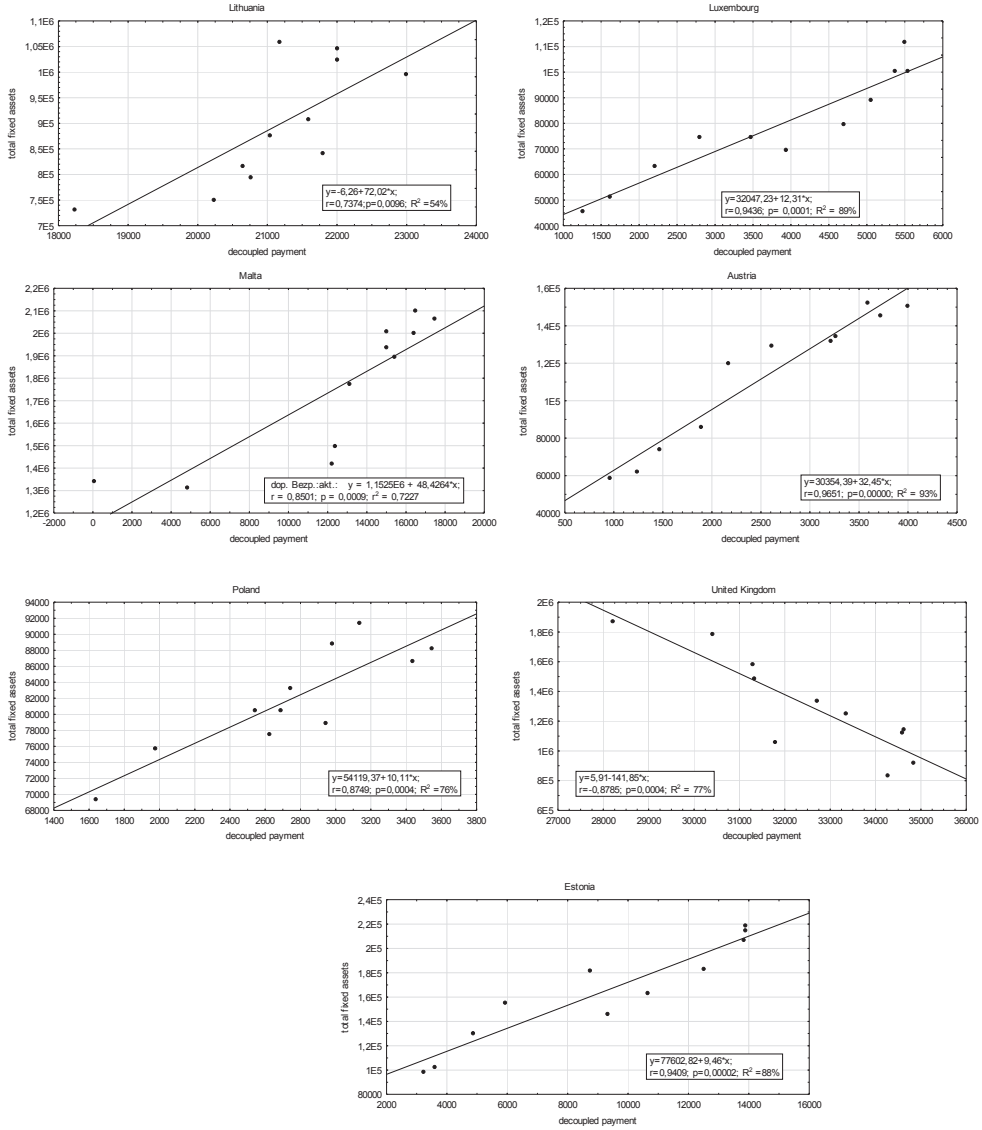
The dependence of fixed assets on the decoupled payments was recorded in Belgium, Denmark, Spain, Estonia, France, Ireland, Italy, Lithuania, Luxembourg, Malta, Austria, Poland and the United Kingdom (Fig. 16). In those countries, from 53% (Ireland) to 93% (Austria) of changes in the gross investments value can be explained by changes in direct payments. The increase in direct payments by EUR 1 in these countries means the increase in the value of fixed assets from EUR 4,92 to EUR 135,84. The highest positive correlation between the decoupled payments and the value of fixed assets on a farm was recorded in Denmark and Lithuania, where increasing the decoupled payments by EUR 1 increases the value of fixed assets by EUR 135,84 and EUR 72,02 respectively. The dependence of fixed assets on the decoupled payments is much smaller in Spain (EUR 8,30), Estonia (EUR 9,46), France (EUR 4,92), Ireland

(EUR 9,91), Luxembourg (EUR 12,31), Poland (EUR 10,11) and Italy (EUR 8,09). On the other hand, in Malta, Belgium and Austria increasing the decoupled payments by EUR 1 increases the value of farm assets by EUR 48,42, EUR 28,84 and EUR 32,45 respectively. In the United Kingdom increasing the decoupled payments by EUR 1 results in the decrease in fixed assets by EUR 141,85. The degree of matching of empirical results with the estimated regression line is 77%, which means that changes in the decoupled payments determined slightly more than 77% of changes in the value of fixed assets on farms in the United Kingdom.

Figure 16

Estimated regression lines for the fixed assets variable in relation to the decoupled payments



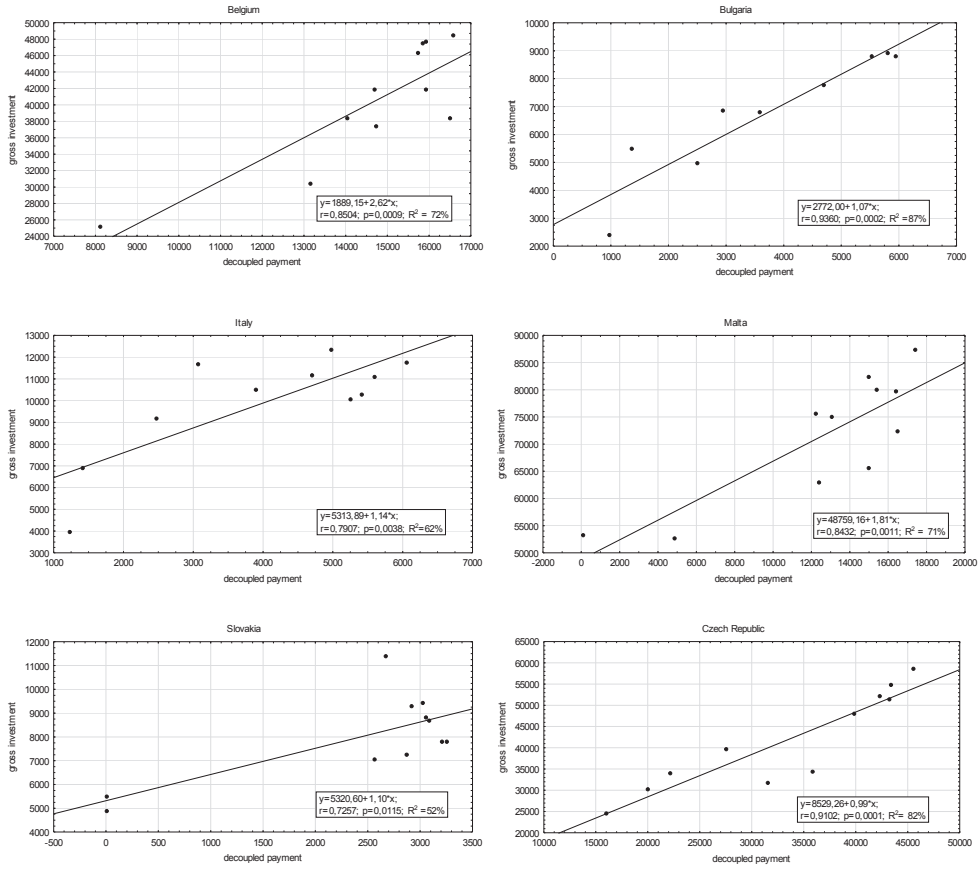


Source: own study based on the FADN data.

In Belgium, the Czech Republic, Slovakia, Italy and Malta there was the dependence of gross investments on the decoupled payments (Fig. 17). In these countries, from 52 to 87% changes in gross investments value can be explained by changes in direct payments. The increase in the decoupled payments by EUR 1 meant the increase in the gross investments value in Belgium by EUR 2,62, in Bulgaria by EUR 1,07, in the Czech Republic by EUR 0,99, in Italy by EUR 1,14, in Malta by EUR 1,81 and in Slovakia by EUR 1,10.

Figure 17

Estimated regression lines for the gross investments variable in relation to „decoupled" payments



Source: own study based on the FADN data.

2.6. Summary

Public support is an important element for increasing the efficiency of farming and competitiveness of farms in the EU countries. As a result of the CAP reform, the nature of this support has changed over several decades. The level of subsidisation of farms in the EU countries in the years 2005-2015 is characterised by a large diversity. The highest subsidies were received by farmers in a form of direct payments and subsidies on rural development. The lowest average amounts of subsidies were related to the subsidisation of costs incurred as part of operating activity of a farm. The average value of subsidies on rural development increased year by year in most EU countries. At the same

time the average amount of production subsidies decreased. In Bulgaria, Estonia, France, Italy, Austria, Romania and Latvia the annual average decrease in subsidies on intermediate consumption in the analysed period ranged from a few to several tens of percent. The average rate of changes in the decoupled payments was from 0,94% (Ireland) to 65,91% (the Netherlands). The average amount of these subsidies increased year by year in all EU countries exclusive of Slovenia and the United Kingdom. The average annual decrease in direct payments in those countries accounted for 1,36 and 1,92% respectively. As in the case of the decoupled payments, subsidies on investments also increased in most EU countries. An exception was the countries such as Cyprus, Estonia, Italy and Austria. The largest average rate of changes in subsidies on investments was recorded in Bulgaria and Poland. Taking into account the average rate of changes in the amounts of subsidies the EU countries were divided into four groups. More than average values of the average rate of changes in the amounts of subsidies were reached by the countries of Group 1 including Bulgaria, Czech Republic, Hungary, Lithuania, Poland, Portugal, Slovenia, Slovakia and the United Kingdom.

Subsidies received by farmers in the years 2005-2015 had a significant impact on their incomes, the value of fixed assets and gross investments. Subsidies which has the greatest impact on the economic situation of farms are the decoupled payments, subsidies on rural development and subsidies on investments. These subsidies mainly influence the increase in fixed assets on farms. In 14 EU countries, there was a relationship between the increase in the decoupled payments and the increase in the value of fixed assets on farms. In addition, in 6 countries (Belgium, Bulgaria, the Czech Republic, Italy, Malta, Slovenia), the relationship between the decoupled payments and the gross investments growth was demonstrated, while in 5 (Bulgaria, Czech Republic, France, Ireland, Poland) the relationship between the decoupled payments and farm incomes was demonstrated. Subsidies on rural development significantly affected the value of fixed assets in 6 EU countries (Belgium, France, Lithuania, Luxembourg, Latvia, Romania) in 3 countries (Belgium, Bulgaria, Finland), these subsidies had an impact on the amount of gross investments and in 4 countries (Bulgaria, Ireland, Lithuania, Portugal) – on the amount of incomes. In turn, subsidies on investments had an impact on gross investments in Belgium, Bulgaria, Germany, Luxembourg, Poland and Finland, as well as on the value of fixed assets in Belgium, Germany, Hungary, Sweden and the United Kingdom.

Summing up, the degree of public support for farms in EU countries is diversified mainly due to the diversity of calculating subsidies and to their structure.

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Dr hab. Adam Wąs, Associate Professor of IAFE-NRI,
Paweł Kobus, Ph.D., Warsaw University of Life Sciences - SGGW

3. Implications of the direct payment degressivity mechanism in the CAP 2020+ in Poland

3.1. Introduction

Since its establishment in 1957, the Common Agricultural Policy (CAP) has been based on three basic principles:

- Common market which guarantees equal treatment of producers from all Member States of the Community by lifting internal tariffs and quantitative restrictions on the movement of agricultural and food products;
- Community preferences – preference for products originating in the Member States of the Community takes precedence over imported products;
- Financial solidarity, in the sense of joint participation of each Member State in financing the Common Agricultural Policy and of guaranteeing the higher level of financial security for agriculture through the possibility of obtaining financial aid from the Union budget in the case of random events (e.g. BSE crisis in the UK).

These principles still remain valid. However, as stated by Majewski and Malak-Rawlikowska (2018) "occurring internal tension among the EU Member States as well as external pressures, which mainly lead to a reduction in the level of protection of the Union market, kept on undermining the scope of compliance with the individual rules, consequently stimulating the process of CAP transformation".

These conditions make the CAP become a subject of further reforms aimed at, *inter alia*, increasing the market orientation of agriculture, while providing income support for agricultural producers, increasing environmental requirements and taking action to accelerate the rural development throughout the EU.

The MacSharry reform, which took place in 1994, was crucial in the process of the CAP evolution. It constituted a fundamental change – the transition from a strongly protectionist policy of protecting the EU market to liberalised conditions of international trade, based on the traditional system of customs duties (which were progressively reduced). It took place under the influence of external, international pressure which, in seeking to eliminate distortions in international trade in agricultural products and food and to empower agriculture from developing countries, resulted in the GATT Uruguay Round agreements (General Agreement of Tariffs and Trade). The shape of the

MacSharry reform was also determined by social awareness of „rising costs of the protectionist agricultural policy and adverse phenomena such as the presence of production surpluses or environmental risks" (Majewski and Malak, 2018).

Radical changes in the Common Agricultural Policy were continued through another reform – Agenda 2000. One of the major changes it introduced was a transition from product support to producer support, with the assignment of existing direct payments to farmland owned by the farmer. This intention was, in principle, implemented, but in the individual countries it has been implemented differently. Specific differences occurred here between the EU-15 countries, in which different transition systems have been applied from those applicable prior to the payment reform to single payment scheme and the EU-12 countries, newly adopted after 2004, in which, since the moment of accession, the single area payment scheme has been implemented.

At the same time, direct payments were detached from production (so--called decoupling), which was assumed to reduce the impact of farm income support on the artificially stimulated agricultural product production level, which distorted the functioning of agricultural and food markets. What was also introduced, was the principle of modulation (Regulation... 73/2009 of 19 January, 2009) of direct payments and the requirement to respect specific conditions of environmental protection and animal welfare.

At the further stage of the CAP reform, the so-called CAP greening was introduced in which a much stronger emphasis has been placed on achieving the CAP environmental goals. For the first time in EU's history, the decision on implementing the CAP reform has been made jointly by the EU Council and the European Parliament, whose role for previous reforms was limited to consultation only.

The assessment of CAP greening results is usually critical. Some authors indicated that in the process of arrangements between the European Commission and the European Parliament, the primary version of reform which was to set more ambitious environment-oriented challenges for farmers has been watered down which resulted in its low efficiency (Pe'er et al., 2017).

In Poland, CAP greening introduced in 2014 did not result in any major changes as regards organisation of the farm sector. This may be explained by the large share of farms adapted to the final version of requirements and by the high percentage of small farms (with an area of less than 10 ha) which, in order to reduce administrative costs, have been exempted from the condition of meeting new requirements (Czekaj, Majewski and Wąs, 2013; Wąs and Jaroszewska, 2017). In addition to more restrictive environmental requirements, the reform of 2013 introduced more severe regulations with regard to the degressivity of direct

payments, by introducing the limitation of the maximum single area payment amount of EUR 150 000.

3.2. CAP reform plan for the years 2021-2027

Since the last CAP reform, there have been major changes in agriculture, in particular (European Commission 2017a) the volatility of prices of agricultural products has increased, the nature of trade negotiations has changed from multilateral to bilateral agreements and the EU has obliged itself to take new international commitments, especially those on climate change.

The awareness of necessary adaptations to the ever-changing macroeconomic conditions and climate change resulted in a vivid public debate. In this context, the European Commission took wide-ranging consultations so as to simplify and modernise the CAP (European Commission 2017b). Their effect was a proposal for the reformed CAP presented in the draft Regulation of the European Parliament and of the Council (Regulation COM(2018) 392).

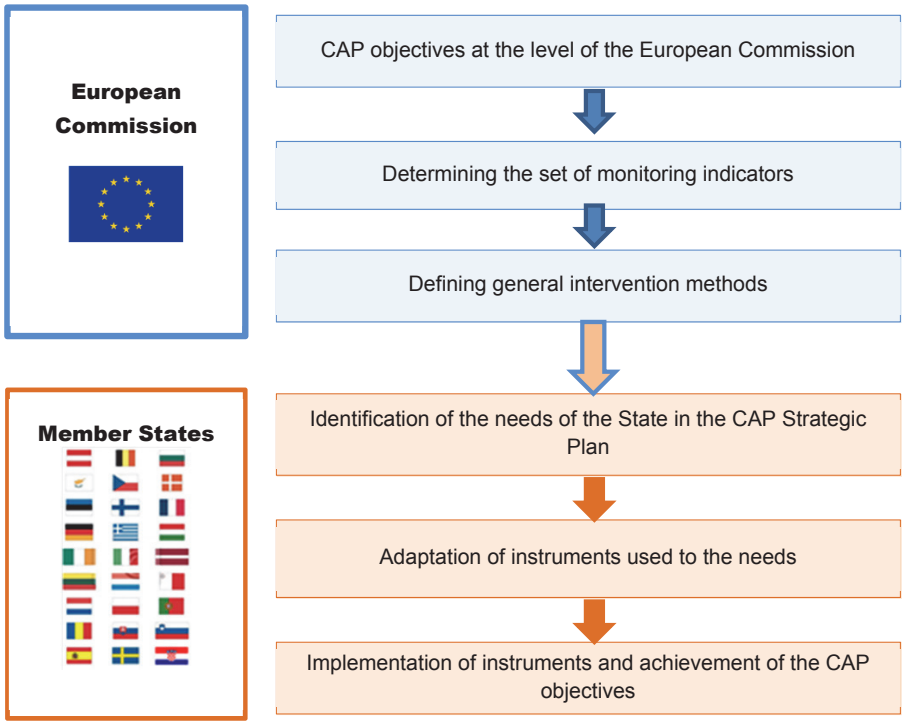
The CAP reform planned for the years 2021-2027 sets the objectives which are much more developed and specified when compared to previous ones. The objectives implemented so far, related to supporting decent farm income, increasing farm competitiveness and market orientation have been complemented with issues related to implementing research results and progressive digitisation, moreover, the environmental goals and climate protection issues have been strongly emphasised. In addition, social issues have been highlighted, in particular, those related to guaranteeing handing over farms to young farmers and to guaranteeing the rural development, *inter alia*, through the promotion of employment, growth, social inclusion and local development in rural areas (Regulation COM(2018) 392).

Together with the development of the new CAP objectives, the European Commission proposed a new scheme to implement the proposed solutions, defined as the "New Delivery Model" (Hogan, 2018). The new proposal gives the EC the role of a guard of the CAP principles, such as the community nature of the policy, creation of European added value, respect for the principles of the level playing field for all farmers in the EU.

By assumption, this mechanism gives the Member States much more freedom (while respecting the CAP principles) in shaping the agricultural policy, while imposing on them much higher responsibility for achieving the objectives assumed (Kulawik, Pawłowska-Tyszko, Wieliczko, Soliwoda, 2018). The schematic distribution of responsibility for the individual stages of programming and implementing the individual CAP stages is presented in Fig. 1.

Figure 1

General scheme of creating and implementing the CAP post-2020



Source: own study based on (Haniotis, 2018).

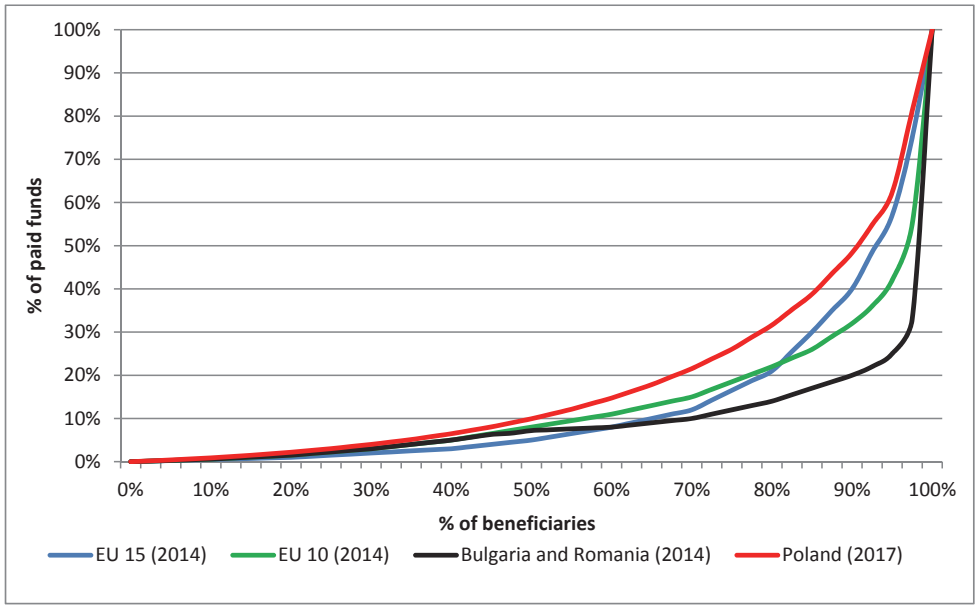
At the time of work on the study, the process of preparing the new policy has not been started yet. The transition to the stage of preparing strategic plans in the Member States will be possible after the final approval of proposed solutions by the European Commission and European Parliament.

3.3. Degressivity of direct payments

One of the frequently raised aspects of the CAP functioning in the EU countries is a problem of significant concentration of subsidies paid to farmers. In connection with the occurring concentration processes, development of large and competitive farms, support is concentrated (Fig. 2). The support concentration process takes place in the individual countries with various degrees of intensity, as shown in Fig. 2.

Figure 2

Lorenzo curves – distribution of direct payments among beneficiaries in the selected EU countries



Source: own study based on the DG AGRI (2014; after Matthews, 2017) and MARD data (2018).

The figures presented in the figure come from various periods (Poland 2017, other countries and the EU 2014). This does not allow to compare directly the situation in Poland with other countries. Nevertheless, the problem of payment concentration is very clear in all cases. The vast majority of beneficiaries of direct payments receive a small percentage of funds allocated for this purpose.

It can be observed that even in the EU-15 countries, where there are no huge "post-Communist" farms which are an effect of transformation of former state-owned farms, 90% of beneficiaries must make do with 40% of paid funds. In the new Member States (EU-10), payments are more concentrated and the specific leaders in this competition are agricultures of Bulgaria and Romania where more than half of funds go to a very narrow, even elite, group of beneficiaries.

It can be argued that the largest farms, by producing a large part of production, guarantee food security and manage vast areas and through

implementing requirements determining the receipt of support (e.g. cross-compliance, CAP greening requirements) they act as a provider of environmental public goods generated by agriculture, e.g. agricultural landscape, biodiversity (Małażewska and Wąs, 2015). On the other hand, progressive concentration of large farms may be a threat to the existence of smaller entities for which received support should, by assumption, provide a possibility of continuing their activity. It must be stressed that smaller farms are a place of work for many European farmers who are necessary to maintain the development and viability of rural areas. It can also be argued that the existence of smaller farms is an important factor of providing social (e.g. viability of rural areas) public goods generated by agriculture.

The situation in which there is a gross inequality in the distribution of direct payments points to a deficit in implementing one of basic and primary CAP functions i.e. sustainability of farmers' incomes. This situation may be a basis for taking actions aimed at the more proportionate distribution of payments among CAP beneficiaries. Such actions, as already mentioned, have been taken on the occasion of previous CAP reforms. A proposal to make changes with regard to the degressivity of payments for the years 2021-2027 is significantly more restrictive with respect to beneficiaries receiving the highest amounts of payments.

In accordance with the guidelines contained in Article 15(1) of the proposal (Regulation COM (2018) 392), the Member States reduce the amount of direct payments to be paid to the farmer for a given calendar year and which exceeds EUR 60,000, as follows:

a) by at least 25% in a tranche between EUR 60,000 and EUR 75,000;

b) by at least 50% in a tranche between EUR 75,000 and EUR 90,000;

c) by at least 75% in a tranche between EUR 90,000 and EUR 100,000;

d) by 100% for the amount exceeding EUR 100,000.

However, it should be noted that in order to determine the amount of reduction, the Member States should at first deduct the following amounts from the total amount of direct payments to be granted to the farmer in a given calendar year (Article 15(2)):

a) remunerations related to agricultural activities declared by the farmer, including taxes and social security contributions related to employment;

b) equivalent cost of permanent unpaid labour relating to agricultural activities and performed by persons employed on a given farm, who are not remunerated or their remuneration for their services is lower than the amount normally paid for such services but are remunerated from economic results of the farm.

In accordance with the provisions of the Regulation (Article 15(3)), amounts "saved" in this way can be used by the Member States to implement interventions under the EAFRD (European Agricultural Fund for Rural Development).

The above-mentioned provisions are a significant change in relation to the currently applicable regulations. Therefore, we can ask whether their implementation in Poland brings desired results and what will be the budget effects of implementing the new mechanism.

3.4. Objective of the study

The objective of this study is to define the scope and direct results of implementing the new regulation. In particular, the number of farms potentially covered by the reduction in the level of support and the amounts of reductions in paid funds on the farm, voivodeship and national scale will be determined. In addition, the impact of the proposed instrument on the level of concentration of the distribution of direct payments on the voivodeship and national scale will be determined.

3.5. Methodology of calculations

The estimate of effects of reducing direct payments has been prepared based on the CAP beneficiaries' database published annually on the website of the Ministry of Agriculture and Rural Development (MARD, 2018). The data provided by the MARD covers the general population of CAP beneficiaries and contains the information about granted payment amounts broken down by individual types of aid. In order to select the direct payment amounts from the database, for each entity only payments granted pursuant to the Regulation of the European Parliament and of the Council EU 1307/2009 have been summed up and adopted as a total amount of direct payments received over the analysed years by each beneficiary. In view of a possibility of accidental deviations and atypical values, the analysis used the data from two consecutive years. In 2016, 1,429,569 beneficiaries were identified in the database while in 2017 the total number of entities which received aid was 1,394,491. Not all identified CAP beneficiaries received direct payments, therefore, finally payments were analysed for 1,344,486 entities in 2016 and 1,346,906 in 2017, respectively.

In addition, to make the analyses more detailed, CAP beneficiaries have been assigned to the voivodeships based on postal codes contained in the database available on the MARD website. For this purpose, the database of postal codes has been used (P.P. S.A 2016).

The data prepared in this way was used to estimate potential effects of implementing the payment reduction instrument described in Article 15 of the

published draft Regulation of the European Parliament and of the Council laying down a legal basis for the CAP post-2020 (Regulation COM (2018) 392).

The estimation of effects of the relatively simple mechanism described in the above-mentioned regulation (Article 15 (1)) complicates the need to reduce the payment amount subject to deduction of the costs of farmer's unpaid labour and the costs of employing paid workers. For this reason, after determining the payment amount of EUR 60,000 or more, for individual beneficiaries, it should be reduced by the cost of on-farm labour and then it is required to determine a potential amount which could be deducted as a result of applying the degressivity mechanism.

Due to the data availability, the studies determined the effects of implementing new regulations by assuming that the proposed regulations for the years 2021-2027 would be applied in 2016 and 2017. For converting the amounts into PLN, the exchange rate used to determine direct payment rates published on the ARMA websites has been applied. The exchange rate adopted for 2016 was 4,3192 PLN/EUR (ARMA, 2016) and for 2017 4,3042 PLN/EUR (ARMA, 2017).

In order to analyse the effects of the direct payment degressivity mechanism, designed in the regulation, it was necessary to determine the costs of labour on farms potentially covered by new regulations. The estimate of inputs and labour costs has been made based on the FADN data of 2015 (most recent data available at the time of carrying out the analyses). From among farms in the FADN sample, those receiving direct payments of more than EUR 60,000 have been selected.

The amount of received direct payments was determined by reducing the variable SE605 (subsidies on operating activity) by the value of the variables SE624 (subsidies on rural development), SE625 (subsidies on intermediate consumption) and SE626 (subsidies on costs of external factors) and converted to EUR according to the exchange rate of 4,2448 PLN/EUR from 2015 published by ARMA (2015).

From the FADN sample, all farms which in 2015 received direct payments of more than EUR 60,000 have been selected. Based on information from the FADN data (variable SYS 02), it has been estimated that they represent 416 farms from the FADN general population. Due to the adopted selection criteria, i.e. the total amount of received direct payments, the selected sample included mainly crop farms (type TF 15 and TF 16) complemented by much less numerous mixed and cattle farms. For this sample, the following have been determined: the amount of received direct payments, total labour input (SE010), paid labour input (SE020), costs of paid labour (SE370). Based on the above

data, the following have been determined: total employment (paid and unpaid labour) per each PLN 1,000 of received direct payments [AWU/thousand PLN of direct payments] and the cost of paid labour per full-time employed worker [PLN/AWU]. On this basis, the average labour cost in relation to received payments has been calculated.

Alternatively to the costs of employment based on the FADN data the amount of labour costs has been determined, by adopting the average gross remuneration in the economy according to the CSO communications, amounting to, respectively, PLN 4,047.21/month (CSO 2016) in 2016 and PLN 4,271.51/month (CSO 2017) in 2017. Then, analogously as in the case of the FADN database data, the average share of total labour costs (paid and unpaid labour) in the amount of received direct payments has been estimated, respectively, for 2016 and 2017. The estimates assumed that the cost of employing the AWU unit is equal to 12 monthly remunerations. It should be stressed here that this assumption is of estimative nature. On the one hand, we may notice that the labour costs defined in this way are understated as the account did not include the difference in terms of hours (AWU is equal to 2,120 worked hours; FTE is estimated at about 2,000 hours) and additional costs of employment for paid labour force (CSO publishes the average gross remuneration which is lower than the employer's costs, *inter alia*, due to the mandatory social security contributions paid by the employer, etc.). On the other hand, it can be argued that the adoption of the average labour cost from the CSO communication results in overstatement of the remuneration as the published amounts of the gross remuneration include income tax which would not be paid in the case of the cost of unpaid labour in agriculture, thus obtaining the net salary at the same level as in other sections of the economy would mean the lower burden on the farm's budget. The estimated values of indicators describing the ratios of labour costs to the amount of received payments were shown in Table 1.

Table 1

Values of parameters used to estimate labour costs on farms subject to the degressivity of direct payments in 2015

Specification	Values
Number of FADN sample farms	46
Number of farms represented	416
Total labour input [AWU/farm]	4.75
Average farm area [ha/farm]	391.2
Average animal population [LU/farm]	34.4
Average stocking density [LU/100 ha of UAA]	8.8
Amount of received direct payments [thousand PLN/farm]	356.2
Amount of received direct payments [thousand EUR/farm]	83.9
Paid labour input [AWU/farm]	2.93
Paid labour cost [thousand PLN/farm]	79.8
Paid labour remuneration [thousand PLN/AWU]	27.3
Total labour input per PLN 1,000 of direct payments [AWU/PLN 1,000]	0.01335
Total labour costs in relation to received direct payments	
- by labour cost from FADN	36.37%
- by average remuneration in 2016	64.83%
- by average remuneration in 2017	68.42%

Source: Own study based on the FADN database and CSO data.

Using the estimated values and the data of beneficiaries from the MARD database, the effects of introducing degressivity have been estimated, adopting the following calculation variants:

- Without labour costs – this variant assumes the introduction of degressivity of payments without deducting labour costs. Assuming that the scale of degressivity contained in the Regulation is maintained (Member States may increase the level of payment reduction), this variant points to the maximum effects of implementing the regulation in the proposed form,
- FADN rate – this variant assumes that unpaid and paid labour on farms will be valuated based on the costs of paid labour on farms receiving more than EUR 60,000 in the FADN database,
- CSO rate – this variant assumes that the labour costs on farms subject to payment degressivity will be determined based on the average remuneration published by the CSO.

For actual amounts of payments and for amounts estimated according to the above variants, the totals of reductions in direct payments for individual

groups of farms (according to the amount of received payments), regions and the country have been determined. In addition, the unevenness (concentration) of distribution of direct payments on the regional and national scale has been determined using the Gini index (Gini, 1921).

The calculations were made using the R software package with R Studio and the relational database management system MySQL with the Heidi overlay.

3.6. Results

Based on the prepared CAP beneficiaries' databases for 2016 and 2017, the number of farms and amounts of payments potentially subject to reduction (without deducting the labour costs) has been determined. In accordance with the adopted methodology, payments paid pursuant to the Regulation of the European Parliament and of the Council have been analysed. The amounts of aid paid, the number of beneficiaries and the maximum values of payments to individual entities broken down by individual types of payments are presented in Table 2. Attention should be paid to the significant share of farmers using payments to small farms in the number of beneficiaries. More than half of CAP beneficiaries in Poland receive payments in the amount of less than PLN 5-6 thousand.

Table 2

Paid amounts of direct payments in the years 2016 and 2017 broken down by individual instruments

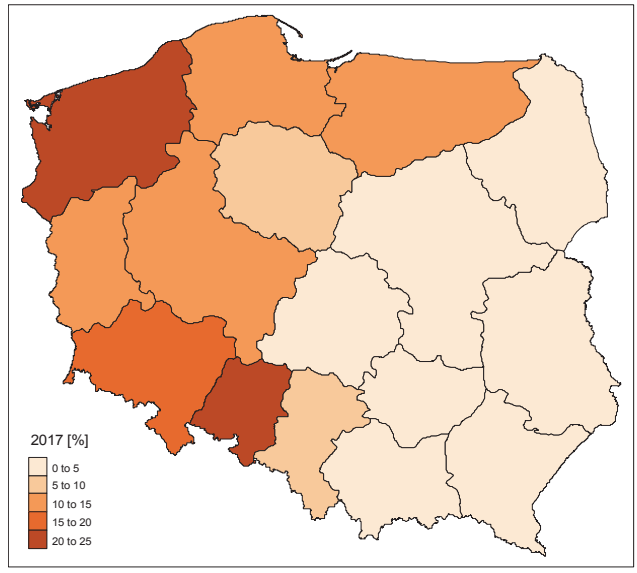
Specification	2016			2017		
	Paid amount [million PLN]	Number of beneficiaries [thousand]	Largest payment [thousand PLN]	Paid amount [million PLN]	Number of beneficiaries [thousand]	Largest payment [thousand PLN]
Single Area Payment Scheme	5 251	595.3	627.9	5 489	655.2	646.3
Redistributive payment	1103	588.4	9.1	1 132	616.0	9.2
Payment for „greening"	3 552	594.3	3 720.2	3 711	655.3	3 723.6
Payment to young farmers	242	59.0	24.1	290	82.9	24.2
Coupled payments	1 994	368.6	1 740.6	2 071	383.6	2 075.2
Payments to small farms	1 794	748.2	5.3	1 685	699.9	6.6
Return of funds of 2016				105	392.7	138.9
Total	13 937	1 344.5	5 334.3	14 483	1 346.9	5 825.3

Source: own calculations based on the MARD data.

Special attention with regard to the objective of the paper should be paid to the maximum amounts paid to individual beneficiaries. The currently applicable degressivity mechanism limits the amounts of payments under the single area payment scheme to EUR 150 thousand. However, the remaining payments are not limited in this regard. Consequently, the largest beneficiaries of direct payments received the amounts substantially exceeding PLN 5 million. The share of farms potentially subject to degressivity of direct payments is strongly diversified regionally. The share of farms receiving payments of more than EUR 60 thousand in the total number of farms in 2017 was presented on the map (Fig. 3). Attention should be paid to the relatively small percentage of farms receiving payments in the amount pointing to a possibility of using degressivity. The share of such farms usually does not exceed 1% of the total number of entities. Such farms are present mostly in the north-western part of the country. The percentage of farms potentially eligible for the reduction in payments is relatively small, however, the amounts they receive have a relatively high share in the total amount of direct payments (Fig. 4).

Figure 3

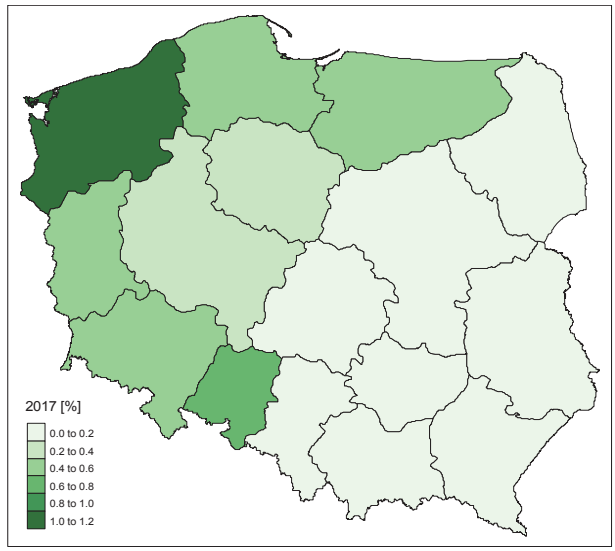
Share of farms receiving direct payments of more then EUR 60 thousand in the number of farms



Source: own study based on the database of CAP beneficiaries (MARD, 2018).

Figure 4

Share of direct payments granted to farms receiving more than EUR 60 thousand in the total number of payments



Source: own study based on the database of CAP beneficiaries (MARD, 2018).

Despite the relatively low number of beneficiaries potentially subject to degressivity of direct payments, the share of funds consumed for payments can be considered significant. On the national scale, farms potentially subject to degressivity have the average share of less than 0.2% in the total number of farms, however, they receive more than 8% of the amount spent every year on direct payments. The precise figures describing the number of beneficiaries and amounts of payments according to the category from Article 15(1) of the Regulation as well as amounts of payments they receive are included in Annex.

The indicator of the uneven distribution of payments can also be the average amount of payments received by farms in the individual voivodeships. The average amounts of payments obtained in the years by farms divided into groups according to the level of received payments in the individual voivodeships are presented in Table 3.

Table 3

Average amounts of direct payments in the individual groups of farms identified according to the level of received payments, by voivodeships [thousand PLN]

Voivodeship	2016				2017			
	up to EUR 60 thou-sand	EUR 60-100 thou-sand	more than EUR 100 thou-sand	TOTAL	up to EUR 60 thou-sand	EUR 60-100 thou-sand	more than EUR 100 thou-sand	TOTAL
Dolnośląskie	11.6	325	732	14.1	12.0	332	750	14.7
Kujawsko-pomorskie	15.3	323	755	16.9	15.8	324	764	17.4
Lubelskie	7.7	328	670	7.9	8.0	327	694	8.2
Lubuskie	15.9	335	664	18.1	16.4	337	685	18.9
Łódzkie	7.9	338	885	8.0	8.1	324	850	8.3
Małopolskie	3.7	307	1037	3.8	3.9	319	1079	4.0
Mazowieckie	9.4	332	679	9.6	9.6	328	663	9.8
Opolskie	13.0	332	745	16.6	13.4	335	792	17.3
Podkarpackie	4.0	310	689	4.1	4.2	312	657	4.3
Podlaskie	14.0	330	632	14.2	14.4	337	598	14.6
Pomorskie	15.1	328	742	17.4	15.9	329	774	18.2
Śląskie	6.5	332	683	7.0	6.8	327	713	7.3
Świętokrzyskie	5.6	356	491	5.7	5.8	290	505	5.9
Warmińsko-mazurskie	18.9	329	738	21.7	19.5	330	765	22.4
Wielkopolskie	12.7	332	906	14.3	13.2	326	903	15.0
Zachodniopomorskie	20.1	325	795	26.2	20.9	325	819	27.1
Poland	9.5	328	767	10.37	9.9	328	785	10.75

Source: own calculations.

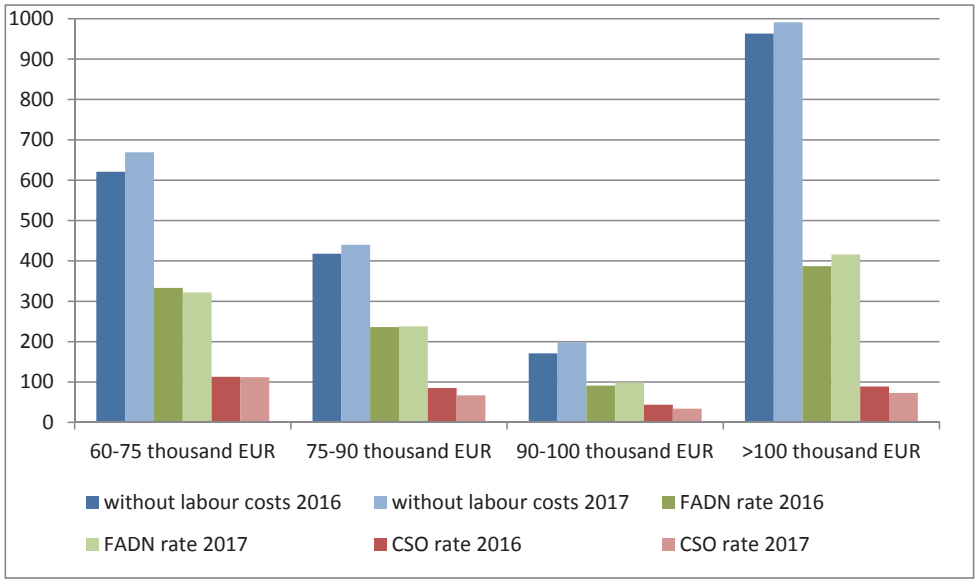
The greatest diversification of values among the voivodeships can be observed in the extreme groups. Due to the high dependence of the amount of received payments on the area of farms, it is obvious that in the voivodeships with the greatest fragmentation of farms (Małopolskie or Podkarpackie), the amounts paid in the group of farms receiving less than EUR 60 thousand will be relatively low. In the Małopolskie Voivodeship, the average farm from this group received direct payments of PLN 3.7 thousand a year. On the other hand, the average amounts of payments received by farms from this group in the northern and western voivodeships are several times higher. Yet, it can be observed that the average values in the first group are not close to the central value of the range (~EUR 30 thousand) but definitely closer to the minimum value. This attests to the significant dominance of smaller farms in this group. In the group of farms of more than EUR 100 thousand, the average values also

show a large diversification from about PLN 600 thousand to even more than a million in the Małopolskie voivodeship. Nevertheless, due to the relatively low number of the largest farms, the amounts of payments they receive have a small impact on the average values in most voivodeships. However, in the Zachodniopomorskie voivodeship we can observe the significant influence of farms receiving high payments on the average for the entire voivodeship.

In accordance with the proposed provisions included in the draft regulation, farmers receiving payments will be able to deduct labour costs from the amount of received payments prior to determining the amount of reduction in direct payments. In order to determine the number of farms subject to degressivity of direct payments, the values of payments reduced by labour costs according to the FADN and CSO rates have been determined for the years 2016 and 2017. Then, the number of farms has been determined for the ranges of amounts as referred to Article 15 of the Regulation. The results were presented in the chart (Fig. 5).

Figure 5

Number of farms covered by the degressivity mechanism broken down by classes according to the amounts of received payments.



Source: own calculations.

In both analysed years, the number of farms, in which payments could be reduced, is similar. Definitely, the largest group are farms receiving payments of more than EUR 100 thousand. In all groups of farms, the prior inclusion of

labour costs results in the decrease in their number, and thus limitation of the potential impact of degressivity of payments on the sector of farms.

Despite the relatively small number of farms covered by degressivity, the reduction in the amount of payments results in a noticeable reduction in the average amount of payments received. The amount of received payments in the groups determined according to the state in the analysed years is presented in Table 4.

Table 4

Average amounts of direct payments in the analysed variants in the groups of farms by amounts of payments [in thousand PLN]

		Payment for labour	up to EUR 60 thousand	EUR 60-75 thousand	EUR 75-90 thousand	EUR 90-100 thousand	more than EUR 100 thousand	Poland, on average
2016	Without degressivity		9.5	288	355	408	767	10.37
	With degressivity	CSO rate 2016		288	355	408	733	10.34
		FADN rate		288	355	408	606	10.25
		without labour costs		281	323	345	351	10.05
2017	Without degressivity		9.9	287	356	406	785	10.75
	With degressivity	CSO rate 2017		287	356	406	758	10.73
		FADN rate		287	356	405	613	10.63
		without labour costs		280	323	344	350	10.41

Source: own calculations.

In the variant not including labour costs, the degressivity of payments covers all farms receiving more than EUR 60 thousand. A particular high reduction in the amounts of payments can be observed in farms from the last group which in this variant received the maximum amount of payments of about EUR 350 thousand which is a reduction at the level of 54-55%. Due to a possibility of including, prior to reducing payments, the labour costs estimated according to the FADN database rates, the reduction in payments would apply only to those farms which originally received more than EUR 100 thousand. This relationship is maintained when rates in estimating the payment for labour are increased to the amount of average remuneration in Poland. In this variant, the average reduction in the amount of payments is slightly more than PLN 30 thousand (~4.4%). When assessing the impact of the degressivity mechanism at

the national level, it can be noticed that the proposed mechanism has a small impact on the average amount of payments received by farms in Poland. The introduction of the instrument in its current form leads to reducing the average payment by about PLN 300 per an average farm.

One of the goals set for the CAP is to guarantee the proper level of living of the total farming population, mainly by increasing their private income. One of the more important instruments for achieving this goal are undoubtedly direct payments. Naturally, now, due to numerous transformations, individual payments have other tasks assigned (e.g. payment for "greening"). An important feature of direct payments, shaped as a result of subsequent reforms, is their link with the cultivated area. This link is particularly strong in the new Member States where the Single Area Payment Scheme is applicable. The derivative of this relationship is the increase in the amounts of aid received by beneficiaries as the concentration processes in agriculture proceed. The introduction of the increasingly severe conditions with regard to the degressivity of payments is to prevent the deepening of the uneven distribution of aid funds. Based on the data from the CAP beneficiaries' database, the Gini indices have been calculated for the amounts of direct payments distributed among farmers. The results of calculations for payments of 2017 are shown in Table 5.

Table 5

Uneven distribution of direct payments and its changes in the analysed variants for 2017 [Gini index]

Voivodeship	Without degressivity	Changes in the index in the analysed degressivity variants		
		without labour costs	according to the FADN rate	according to the CSO rate
Dolnośląskie	0.72	-0.020	-0.007	-0.001
Kujawsko-pomorskie	0.61	-0.014	-0.005	-0.001
Lubelskie	0.57	-0.004	-0.001	0.0
Lubuskie	0.72	-0.012	-0.003	0.0
Łódzkie	0.54	-0.003	-0.001	0.0
Małopolskie	0.53	-0.005	-0.002	-0.001
Mazowieckie	0.56	-0.003	-0.001	0.0
Opolskie	0.72	-0.030	-0.011	-0.002
Podkarpackie	0.57	-0.004	-0.001	0.0
Podlaskie	0.52	-0.002	0.0	0.0
Pomorskie	0.65	-0.018	-0.006	-0.001
Śląskie	0.66	-0.007	-0.002	0.0
Świętokrzyskie	0.52	-0.001	0.0	0.0
Warmińsko-mazurskie	0.63	-0.020	-0.007	-0.001
Wielkopolskie	0.63	-0.020	-0.008	-0.002
Zachodniopomorskie	0.72	-0.029	-0.011	-0.002
Poland	0.64	-0.012	-0.004	-0.001

Source: own calculations.

The average Gini index for the country at the level of 0,64 points to the occurrence of significant unevenness in the distribution of payments. However, it must be stressed that there is a strong differentiation in the values of the index among the voivodeships. The greatest unevenness is observed in the western voivodeships (Zachodniopomorskie, Opolskie, Dolnośląskie). Much lower unevenness is noticeable in the voivodeships with fragmented agriculture (Podkarpackie, Małopolskie, Łódzkie). Nevertheless, it should be noticed that even in the voivodeships with the relatively large average area of farms, the distribution of payments may be relatively uneven (Warmińsko-Mazurskie, Podlaskie).

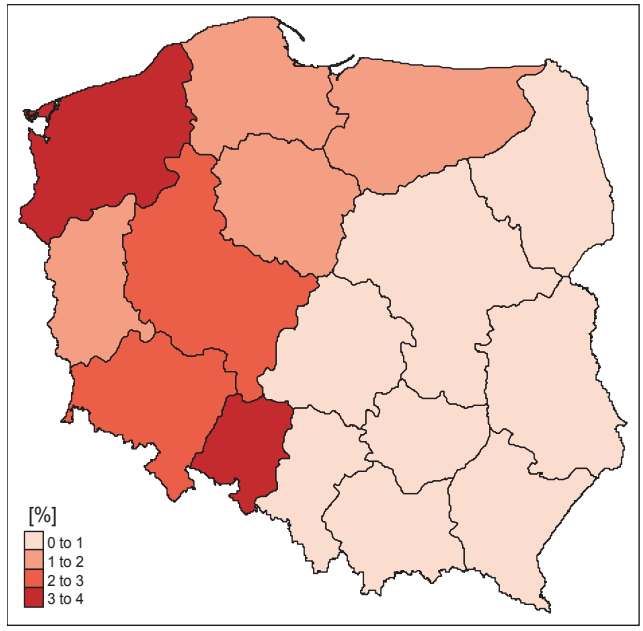
The important issue is the efficiency of the proposed degressivity of direct payments in reducing the unevenness. Here, it should be noticed that the introduction of the proposed regulation, even in a very restrictive form, i.e. without deducting the labour costs, does not lead to any significant changes in the Gini index. It may be supposed that due to the small number of Polish farms

covered by degressivity, this instrument will not determine significantly the reduction in the unevenness of distribution of support.

Another issue related to the proposed degressivity of direct payments is transfers of budget funds. Pursuant to the provisions of the regulation, „saved" funds may be provided for implementing goals supported currently under the RDP, without restrictions applicable in this regard. Due to the differences in the agrarian structure of farms among the voivodeships, the effects of implementing the degressivity will not be the same in all voivodeships. The following map (Fig. 6) presents the share of funds which would not be paid as a result of applying the degressivity in relation to the total amount of direct payments. The presented results have been calculated for the variant according to the FADN rate for 2017. The results of calculations clearly point to the voivodeships where the effects of the mechanisms will be more sensible. For the Opolskie and Zachodniopomorskie voivodeships, it will be possible to transfer even 4% of the amount of direct payments to the second pillar of the CAP.

Figure 6

Share of reduction in direct payments due to degressivity in the total amount of direct payments – variant according to the FADN rates 2017

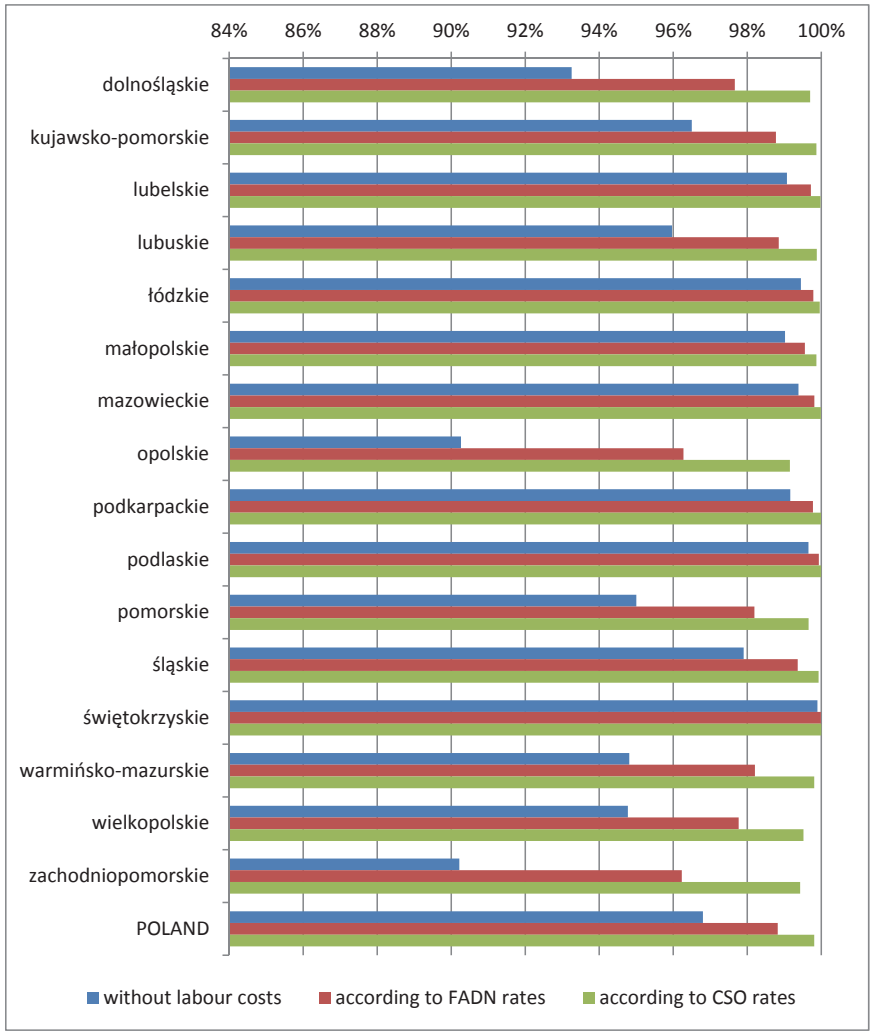


Source: own calculations.

In the case of the variant assuming the labour cost valuation according to the CSO rate, transfers among the regions will be much smaller and in some voivodeships (Świętokrzyskie) funds will be paid in the full amount (Fig. 7). In the case of more restrictive variant (without deducting the labour costs), losses in the individual regions can be much higher and reach even 10% of actual payments.

Figure 7

Reduction in the amount of direct payments due to the application of the degressivity mechanism [without degressivity = 100%]



Source: own calculations.

The precise results of calculations pointing to the number of farms affected by the mechanism and the amounts of payments they finally received in all analysed variants are presented in Annex.

Finally, the amount of reduction in direct payments has been determined, on the national scale for 2016 and 2017, by assuming the application of the mechanisms without the labour costs, with the labour costs according to the FADN rates and with the labour rate according to the CSO data (Table 6).

Table 6

Total amount of reduction in direct payments due to the application of the degressivity mechanism [million PLN/year]

Based on the data from	Without deducting the labour costs	With deducting the labour costs according to the FADN rates	With deducting the labour costs according to the CSO rates
2016	429.15	154.80	32.70
2017	463.38	170.60	27.57

Source: own calculations.

It can be noticed that the potential amount of reduction, when omitting the labour costs, is higher in 2017 in relation to 2016. On this basis, we may conclude on the progressive concentration processes in agriculture, although the short observation period limits the power of such conclusion. In the variant assuming the impossibility of deducting the labour costs, the annual reduction in payments is about PLN 450 million. This amount is not crucial in terms of funds allocated annually for direct payments (~PLN 14 billion/year). Nevertheless, the transfer of this amount to financing measures under the Rural Development Programme, which budget for the years 2014-2020 is slightly above PLN 13.5 billion, would be substantial support for the broadly understood rural development. This variant should be, however, considered purely theoretically as the draft regulation clearly points to a need to deduct the labour costs from payments prior to the application of the degressivity mechanism. Including the labour costs based on the FADN data shall result in a significant reduction in deductions in payments for large farms, however, on the scale of the whole 7--year period the total amount, which could be "saved" in this way and transferable to measures under the RDP, would be about PLN 1 billion. Due to the valuation of farmers' labour at the level of the average remuneration in the national economy the amount of deductions in payments for degressivity is radically lowered and the effects of degressivity are limited to less than 400

Polish farms. It is worth noticing that the valuation of labour in farms according to the CSO rates makes the dynamics of estimated values for 2016 and 2017 different than in the case of omitting the labour costs or adopting remunerations at the level in FADN farms. This can be explained by the relatively rapid growth of remunerations in the national economy.

3.7. Summary

Summing up, it can be concluded that the impact of the potential introduction of mandatory degressivity of direct payments (document COM(2018) is a proposal and its contents can be modified) can have a moderate impact on the level and distribution of direct payments on the national scale. Naturally, ultimate effects of implementing degressivity are largely dependent on the adopted methodology of determining the labour costs on farms and on finally adopted direct payment rates (analyses were based on the data of 2016 and 2017). Nevertheless, with the budget allocated for direct payments at the level of PLN 14 billion a year, the deduction of the amount of about PLN 170 million (assuming the valuation of labour based on the FADN data) should not contribute to changing the general situation of the agricultural sector.

The changes proposed do not contribute to a significant change in the level of uneven distribution of direct payments (concentration) in Poland. Even the implementation of the variant most repressive towards the largest farms and not including the labour costs results in a change in the Gini index at the level of 1 pp (from about 64 to about 63%).

However, it should be noticed that on the scale of individual farms, particularly those receiving much more than EUR 100 thousand, reductions in granted payments may significantly affect the amount of received payments and thus the financial result of these farms. The number of such farms is slightly more than 2,000 all over the country and is unevenly distributed among the voivodeships. Probably, at least in some cases holders of these farms will take steps to limit negative effects of the regulation. This may translate into increased employment, which will be to some extent financed from direct payments. Nevertheless, it cannot be ruled out that holders of large farms will make use of other opportunities to avoid the reduction in support, such as the division of the farm among family members of increasing the number of "employed" household members.

We should also highlight the regional aspect of the analysed regulations. In the case of shifting funds „saved" due to degressivity to the implementation of tasks under the second pillar, there may be a transfer of support from the voivodeships with more concentrated agriculture to the regions with the higher

fragmentation of farms. In this case, funds from the voivodeships with large farms such as Zachodniopomorskie or Opolskie would be shifted to the implementation of the future RDP-like programme all over the country. The share of reduction in payments due to degressivity could be in some voivodeships even up to 4% of amounts allocated for direct payments. Any analysis of such shifts will be possible after determining an appropriate methodology of reducing the amounts of direct payments and indicating measures to be financed from these funds.

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ANNEX

Table I

Amount of direct payments and the number of beneficiaries in groups by amount of payments – data for 2016

Voivodeship	Farms by amount of received direct payments									
	< EUR 60 thousand		EUR 60-75 thousand		EUR 75-90 thousand		EUR 90-100 thousand		> EUR 100 thousand	
	total amount [million PLN]	number of farms	total amount [million PLN]	number of farms	total amount [million PLN]	number of farms	total amount [million PLN]	number of farms	total amount [million PLN]	number of farms
Dolnośląskie	645	55365	24	83	16	44	9	21	91	124
Kujawsko-pomorskie	982	64025	18	62	16	46	4	9	66	87
Lubelskie	1354	175009	6	20	5	15	2	6	23	34
Lubuskie	314	19797	9	33	11	30	5	13	22	33
Łódzkie	957	121045	2	8	2	5	3	7	7	8
Małopolskie	434	118563	3	10	1	3	0	1	6	6
Mazowieckie	1933	205841	8	29	5	15	4	9	21	31
Opolskie	355	27319	12	41	11	32	5	12	74	99
Podkarpackie	462	115841	5	18	2	5	1	2	8	11
Podlaskie	1135	81127	4	14	4	11	2	5	9	15
Pomorskie	559	37093	13	46	12	35	5	12	59	80
Śląskie	308	47016	3	10	4	10	2	4	12	17
Świętokrzyskie	477	84414	0	0	0	1	0	0	1	3
Warmińsko-mazurskie	814	43187	19	65	19	55	7	18	82	111
Wielkopolskie	1501	118303	26	90	19	53	13	32	131	145
Zachodniopomorskie	572	28368	27	92	20	58	8	20	126	159
Poland	12801	1342313	179	621	148	418	70	171	739	963
Structure [Poland = 100%]	91.851%	99.838%	1.285%	0.046%	1.063%	0.031%	0.501%	0.013%	5.299%	0.072%

Source: own study based on the MARD data (2018).

Table II

Amount of direct payments and the number of beneficiaries in groups by amount of payments – data for 2017

Voivodeship	Farms by amount of received direct payments									
	< EUR 60 thousand		EUR 60-75 thousand		EUR 75-90 thousand		EUR 90-100 thousand		> EUR 100 thousand	
	total amount [million PLN]	number of farms	total amount [million PLN]	number of farms	total amount [million PLN]	number of farms	total amount [million PLN]	number of farms	total amount [million PLN]	number of farms
Dolnośląskie	662	55051	24	84	18	50	13	33	95	126
Kujawsko-pomorskie	1004	63716	20	69	19	53	4	11	66	87
Lubelskie	1387	174356	7	26	5	15	3	8	24	35
Lubuskie	325	19841	9	33	10	28	6	15	27	39
Łódzkie	982	120644	3	11	1	4	2	5	9	10
Małopolskie	465	119687	2	7	2	5	1	2	6	6
Mazowieckie	1987	206133	7	26	6	17	3	7	24	36
Opolskie	366	27273	12	42	14	38	6	15	78	99
Podkarpackie	480	115453	5	19	2	5	1	3	8	12
Podlaskie	1167	81215	4	15	2	6	3	8	8	13
Pomorskie	609	38447	14	49	14	40	6	14	60	77
Śląskie	320	46828	3	12	4	11	1	3	13	18
Świętokrzyskie	489	83913	1	4	0	1	0	0	2	3
Warmińsko-mazurskie	847	43466	19	66	20	55	7	17	87	114
Wielkopolskie	1591	120126	31	107	21	59	13	31	146	162
Zachodniopomorskie	596	28459	29	99	19	53	11	26	126	154
Poland	13276	1344608	192	669	157	440	80	198	778	991
Structure [Poland = 100%]	91.663%	99.829%	1.326%	0.050%	1.081%	0.033%	0.555%	0.015%	5.375%	0.074%

Source: own study based on the MARD data (2018).

Table III

Amount of direct payments and the number of beneficiaries in groups by amount of payments — simulation result, variant according to the FADN rate based on the data of 2016

Voivodeship	Farms by amount of received direct payments									
	< EUR 60 thousand		EUR 60-75 thousand		EUR 75-90 thousand		EUR 90-100 thousand		> EUR 100 thousand	
	total amount [million PLN]	number of farms	total amount [million PLN]	number of farms	total amount [million PLN]	number of farms	total amount [million PLN]	number of farms	total amount [million PLN]	number of farms
Dolnośląskie	645	55503	24	43	16	27	9	14	74	50
Kujawsko-pomorskie	982	64140	18	24	16	18	4	5	53	42
Lubelskie	1354	175049	6	14	5	8	2	2	19	11
Lubuskie	314	19867	9	15	11	10	5	4	19	10
Łódzkie	957	121062	2	6	2	0	3	1	5	4
Małopolskie	434	118577	3	2	1	0	0	1	4	3
Mazowieckie	1933	205886	8	16	5	8	4	2	18	13
Opolskie	355	27400	12	36	11	26	5	10	59	31
Podkarpackie	462	115865	5	3	2	3	1	1	6	5
Podlaskie	1135	81154	4	5	4	5	2	5	8	3
Pomorskie	559	37181	13	26	12	24	5	8	48	27
Śląskie	308	47038	3	7	4	4	2	2	10	6
Świętokrzyskie	477	84415	0	2	0	1	0	0	1	0
Warmińsko-mazurskie	814	43317	19	32	19	29	7	10	66	48
Wielkopolskie	1501	118460	26	59	19	30	13	7	95	67
Zachodniopomorskie	572	28525	27	43	20	43	8	19	99	67
Poland	12801	1343439	179	333	148	236	70	91	584	387
Structure [Poland = 100%]	92.883%	99.922%	1.300%	0.025%	1.063%	0.018%	0.500%	0.007%	4.190%	0.029%

Source: own study based on the MARD data (2018).

Table IV

Amount of direct payments and the number of beneficiaries in groups by amount of payments — simulation result, variant according to the FADN rate based on the data of 2017

Voivodeship	Farms by amount of received direct payments									
	< EUR 60 thousand		EUR 60-75 thousand		EUR 75-90 thousand		EUR 90-100 thousand		> EUR 100 thousand	
	total amount [million PLN]	number of farms	total amount [million PLN]	number of farms	total amount [million PLN]	number of farms	total amount [million PLN]	number of farms	total amount [million PLN]	number of farms
Dolnośląskie	662	55205	24	45	18	28	13	14	76	52
Kujawsko-pomorskie	1004	63846	20	22	19	20	4	9	53	39
Lubelskie	1387	174403	7	8	5	14	3	1	20	14
Lubuskie	325	19911	9	16	10	10	6	6	22	13
Łódzkie	982	120662	3	5	1	1	2	1	6	5
Małopolskie	465	119701	2	1	2	1	1	1	4	3
Mazowieckie	1987	206178	7	18	6	8	3	2	20	13
Opolskie	366	27363	12	31	14	30	6	6	61	37
Podkarpackie	480	115478	5	5	2	4	1	1	7	4
Podlaskie	1167	81239	4	9	2	4	3	4	7	1
Pomorskie	609	38543	14	26	14	21	6	9	47	28
Śląskie	320	46853	3	3	4	6	1	4	11	6
Świętokrzyskie	489	83918	1	2	0	1	0	0	1	0
Warmińsko-mazurskie	847	43595	19	27	20	30	7	11	70	55
Wielkopolskie	1591	120310	31	60	21	28	13	14	106	73
Zachodniopomorskie	596	28626	29	44	19	32	11	16	97	73
Poland	13276	1345831	192	322	157	238	80	99	608	416
Structure [Poland=100%]	92.756%	99.920%	1.342%	0.024%	1.123%	0.018%	0.576%	0.007%	4.362%	0.031%

Source: own study based on the MARD data (2018).

Table V

Amount of direct payments and the number of beneficiaries in groups by amount of payments — simulation result, variant according to the CSO rate based on the data of 2016

Voivodeship	Farms by amount of received direct payments									
	< EUR 60 thousand		EUR 60-75 thousand		EUR 75-90 thousand		EUR 90-100 thousand		> EUR 100 thousand	
	total amount [million PLN]	number of farms	total amount [million PLN]	number of farms	total amount [million PLN]	number of farms	total amount [million PLN]	number of farms	total amount [million PLN]	number of farms
Dolnośląskie	645	55595	24	16	16	10	9	4	88	12
Kujawsko-pomorskie	982	64194	18	13	16	9	4	7	64	6
Lubelskie	1354	175074	6	3	5	5	2	1	22	1
Lubuskie	314	19898	9	5	11	1	5	1	21	1
Łódzkie	957	121069	2	2	2	0	3	0	7	2
Małopolskie	434	118580	3	2	1	0	0	0	6	1
Mazowieckie	1933	205914	8	4	5	7	4	0	21	0
Opolskie	355	27477	12	11	11	9	5	0	70	6
Podkarpackie	462	115872	5	4	2	0	1	1	7	0
Podlaskie	1135	81169	4	2	4	1	2	0	9	0
Pomorskie	559	37244	13	6	12	8	5	2	57	6
Śląskie	308	47054	3	0	4	2	2	0	11	1
Świętokrzyskie	477	84418	0	0	0	0	0	0	1	0
Warmińsko-mazurskie	814	43395	19	16	19	13	7	5	80	7
Wielkopolskie	1501	118561	26	13	19	11	13	12	121	26
Zachodniopomorskie	572	28641	27	16	20	9	8	11	121	20
Poland	12801	1344155	179	113	148	85	70	44	706	89
Structure [Poland = 100%]	92.067%	99.975%	1.288%	0.008%	1.063%	0.006%	0.501%	0.003%	5.065%	0.007%

Source: own study based on the MARD data (2018).

Table VI

Amount of direct payments and the number of beneficiaries in groups by amount of payments — simulation result, variant according to the CSO rate based on the data of 2017

Voivodeship	Farms by amount of received direct payments									
	< EUR 60 thousand		EUR 60-75 thousand		EUR 75-90 thousand		EUR 90-100 thousand		> EUR 100 thousand	
	total amount [million PLN]	number of farms	total amount [million PLN]	number of farms	total amount [million PLN]	number of farms	total amount [million PLN]	number of farms	total amount [million PLN]	number of farms
Dolnośląskie	662	55310	24	14	18	4	13	6	92	10
Kujawsko-pomorskie	1004	63909	20	8	19	13	4	2	65	4
Lubelskie	1387	174431	7	3	5	5	3	0	24	1
Lubuskie	325	19948	9	6	10	0	6	1	26	1
Łódzkie	982	120670	3	2	1	0	2	1	8	1
Małopolskie	465	119704	2	2	2	0	1	0	6	1
Mazowieckie	1987	206210	7	6	6	2	3	1	24	0
Opolskie	366	27447	12	8	14	5	6	0	74	7
Podkarpackie	480	115489	5	2	2	1	1	0	8	0
Podlaskie	1167	81256	4	0	2	1	3	0	8	0
Pomorskie	609	38608	14	11	14	2	6	2	57	4
Śląskie	320	46869	3	1	4	1	1	0	13	1
Świętokrzyskie	489	83921	1	0	0	0	0	0	2	0
Warmińsko-mazurskie	847	43686	19	15	20	7	7	5	85	5
Wielkopolskie	1591	120425	31	14	21	14	13	9	138	23
Zachodniopomorskie	596	28737	29	20	19	12	11	7	122	15
Poland	13276	1346620	192	112	157	67	80	34	751	73
Structure [Poland = 100%]	91.838%	99.979%	1.329%	0.008%	1.123%	0.005%	0.577%	0.003%	5.387%	0.005%

Source: own study based on the data from the MARD website http://beneficjenciwpr.minrol.gov.pl/.

Michał Soliwoda, Ph.D., IAFE-NRI

4. Subsidies and other external sources of financing activity on farms – farmers' opinions

4.1. Introduction

Studies on risk balancing[1] (RB) have a relatively long history, taking into account the fact that their theoretical framework was established in the mid-20th century. The complex mechanism of the impact of agricultural policy effects on the financial structure of farms was presented in the mid-80s of the 20th century (Collins, 1985). Agricultural policies, reducing the level of operating risk of farms, may at the same time lead to increasing their level of financial risk (Gabriel and Baker, 1980). Trade-offs between financial risk and business risk are characteristic of decisions made by farm managers towards risk. As an application implication of a relationship between debt and the farm subsidisation rate, we can perceive the concept of safety net[2] which was adopted (after some modifications) from studies on financial institutions (cf. Soliwoda, 2016)[3]. Despite quite numerous studies on the issue of trade-off between operating risk and financial risk resulting from debt (cf. Ifft, Kuethe and Morehart, 2013, Uzea et al., 2014, De Mey et al., 2014, Wauters et al., 2015, Du et al., 2016; Zhao, Barry and Schnitkey, 2008), this problem has not been properly reflected in the Polish literature on the subject.

The objective of the chapter was to determine the importance of other (apart from EU subsidies[4]) external financing sources in the activity of farms[5].

[1] According to the author of the chapter (M.S.), it is reasonable to use the expression "risk balancing" in English, as no Polish equivalent is able to illustrate the essence of this term.

[2] This farming safety net is treated by the USAD as a set of programmes and other forms of support to protect farmers from the loss of income, restriction in access to credits/loans, losses resulting from natural disasters. The complexity of safety nets is growing and this causes problems related to the complementarity and substitutability of their components (cf. Soliwoda, 2016).

[3] The theoretical framework of the concept of safety nets in the agricultural sector refers to the achievements developed by many schools/streams of economics and finance, inter alia, economics of prosperity and its continuators, institutional economics. In the USA and Canada, safety nets have been developed which are characterised by the most complex architecture of "safety nets" in the world (cf. Soliwoda, 2016).

[4] It should be added that in the case of some repayable support instruments (eg. from RDP 2014-2020 "Modernisation…"), the rules of financing consist in refunding expenses incurred and in own contribution.

[5] Detailed methodological issues were presented in the further part of the chapter.

4.2. Review of literature

In modern finance of agriculture or more broadly: agribusiness, a special role is played by sustainability paradigms including the sustainable growth rate paradigm which can be regarded as determining the type of studies on the capital structure of farms. This paradigm integrates study concepts within empirical finance of the agricultural sector (in particular, USA and Canada – second half of the 20th century).

Operating (business) risk is a relatively broad category, as it includes various components (i.e. price, production and institutional risk). By the 1980s business risk was treated quite wrongly in economics of agriculture, as independent from the financial structure of farms. An analysis of this structure assumes considering an additional risk element, i.e. resulting from service of debt. The already mentioned RB hypothesis and its operationalisation take into account the sum of business and financial risk which is defined as total risk at the level of the entire farm, both in its production and household part. However, when exogenous factors (beyond control of the farm manager) significantly distort the equilibrium of total risk by the increase (decrease) of business risk, the level of financial risk of the farm decreases (increases) (Collins, 1985). Farmers identify the maximum level of admissible total risk of their farm which is treated as a risk constraint.

According to Uzea et al. (2014), agricultural economics literature on the RB issue indicates quite unanimously that government support programmes may influence farmers' decisions which, as a consequence, may increase the risk of managing the farm. As a result, exogenous shocks affecting farms and their level of business risk may change the level of financial risk (offsetting). Uzea et al. (2014) referred to the work by Featherstone et al. of 1988 and by Cheng and Gloy of 2008, who proved that the agricultural policy oriented towards reducing operating risk may result in an increased financial leverage and total risk (the so--called risk balancing paradox). In addition, Yan, Katchova and Barry (2004) suggested to include the limitation of expected utility maximisation, taking into account the given financial structure of the farm. The original RB model assumptions have been extended by the household level. Changes in the level of business risk, induced by exogenous factors, may also induce changes in buffering strategies, available for farms, which straighten the level of total income, including, as recognised in American studies: (1) generating off-farm income; (2) searching for and implementing off-farm investments; (3) reducing the level of consumption by household members (De Mey et al., 2014; Wauters

et al., 2015). It should be added that in practice the RB approach may mean the integrated use of buffering strategies, both at the level of a production farm and strictly at the level of a household (including off-farm level risk strategies)[6].

It should be stressed that the pyramidal structure conceptualising holistic risk management is underpinned by a layer of on-farm risk management (OECD, 2009). The operationalisation of the RB hypothesis covers, in the area of the public policy, the structure of farm safety nets[7].

The basis of this structure of the so-called "Layered risk management model" are layers of normal risk which should be managed by farmers themselves (through risk retention, crop diversification and livestock production; diversification of agreements with processors; implementation of marketing strategies or use of the market of futures contracts and options for agricultural products). The second layer corresponding to market risk should be supported by various forms of public-private partnership. However, it must be

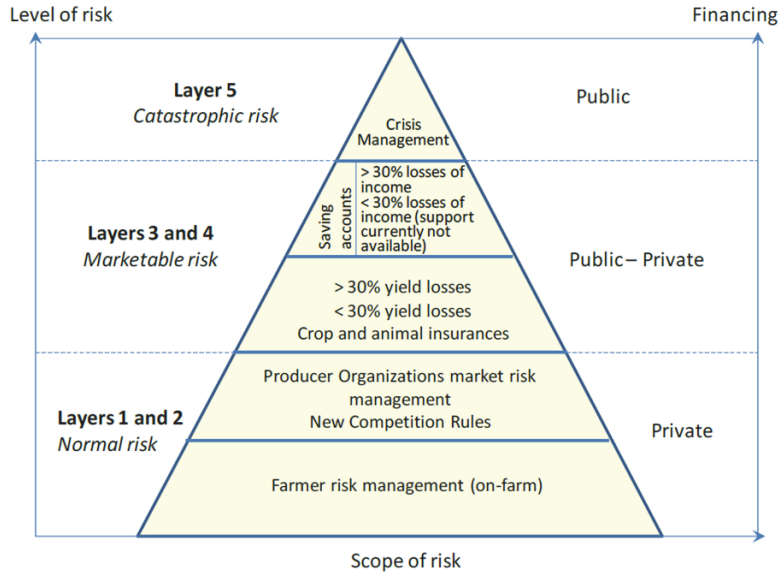
[6] It is worth stressing that Escalante and Barry (2001) used a risk programming model to illustrate the "risk balancing" behaviour of a typical farm. The results of their studies showed a greater „attractiveness" of risk-related benefits to diversification practices. This may belittle the role of RB behaviour. From the correlative analysis, Escalante and Barry (2003) concluded that more than 50% from the sample of 82 farms applied RB behaviour. The in--depth analysis based on empirical data demonstrated that correlation coefficients significantly "responded" to, *inter alia*, the use of crop insurance or crop diversification index at the end of the 90s of the 20th century.

[7] The relationship between the risk level and the degree of subsidisation is referred to in the studies by O'Donoghue et al. (2005) and also Ferto and Stalgiene (2016). O'Donoghue et al. (2005) identified the impact of the increased federal crop insurance subsidies on the area and decisions regarding diversification. The results of the studies by three American agri-economists confirmed that the increased insurance subsidies induced the greater scope of crop protection. As a consequence, this reduced the level of financial risk of farmers. The American agri-economists looked for an answer to the question whether the change in the risk environment may lead to changes in production decisions. For their studies, they used combined datasets of 1992 and 1997. To build econometric models, they used the approach „Difference-in-Difference" (DiD) in which unobservable heterogeneity is controlled. The results showed that changes caused by public policies induced the development of larger (in terms of area) farms, while small farms started decreasing the scale of their activity. Empirical analyses confirmed additionally the positive role of diversification as a risk reducing method. A different study approach was applied by the European agri-economists, Ferto and Stalgiene (2016, pp. 351-358), who empirically verified the impact on subsidies on the variability of income of Lithuanian dairy farms. To build coefficients of variation of five-year gross income of farms from 2010 to 2014, they used panel data of Lithuanian farms participating in the FADN system. The results showed that agricultural subsidies and liquidity had a positive impact on the level of income risk. The age of farmers had a negative impact on this type of risk. The researchers demonstrated a non-linear nature of dependences between the size of a farm and income risk, which is highly important from the point of view of shaping the Common Agricultural Policy instruments and national agricultural policy tools (however, to a limited extent).

stressed that there is no unanimous border between normal risk and market risk, from the point of view of the sector. Establishing this "demarcation line" is quite sensitive socially and politically and is also subject to evaluation by decision makers in agricultural risk management systems. The concept of holistic risk management (HRM) demanded by OECD (2009) has many advantages but some disadvantages can be found as well. They result from the methodological foundations of the HRM concept. They apply to, for example, approaching various types of risk *a priori*, without exploring the risk perception of decision makers, i.e. farm managers, e.g. considering differences resulting from psychological conditions of risk perception.

Figure 1

Holistic risk management within layered model of agricultural risk management vs. the issue of financing



Source: Bardají i Garrido (ed.), 2016, p. 92.

4.3. Characteristics of the study sample and methodological assumptions of studies

The study sample comprised in total 64 farms, participating in the Polish FADN system. The diagnostic survey was addressed to farmers who managed family farms (so-called "farms of individual persons") in the FADN macroregion Mazowsze and Podlasie (covering the voivodeships: Mazowieckie, Łódzkie, Lubelskie and Podlaskie).

The selection of farms for the sample should be deemed purposive (arbitrary)[8], and the selection criteria should include:

- entities representing the mixed type only (TF8 in the TF classification);
- farm managers who used credits and loans at least once in 2012-2015;
- farms covered by the study sample which did not belong to extreme classes of economic sizes (according to the ES economic size);
- farms from the sample which were not neighbours within a given commune[9].

These studies were conducted in the second half of 2017, but the financial situation of the farm at the end of 2015 was treated as a benchmark for study participants. Study material was collected using an interview questionnaire addressed to farm managers. The interview was conducted by an interviewer (FADN coordinator) by phone or – less often – in person, which made it easier to explain any potential doubts expressed by surveyed farmers. Source material collected was subject to a comparative analysis and presented in a tabular and descriptive form. Taking into account the objective of the studies, the major criterion for dividing the analysed farms was a ratio of total subsidies to total output[10]. The additional division criterion was the area of UAA. The sample of farms was divided using the median value into subsamples/groups (I – lower than the median value; II – higher or equal to this value).

Table 1 shows descriptive statistics for basic production categories (i.e. UAA, share of leased farmland), economic categories (family farm income, total assets value), including also variable being a basis for division into two groups (subsidies/total output and above-mentioned area of UAA).

Taking into account central measures, an average farm had an area of 25.5 ha of UAA, while half of entities had an area of at least 21.9 ha of UAA. This is

[8] The arbitrary selection is applied in social pilot studies where it is possible to determine preferences on the use of new public policy instruments. This justifies the use of this selection to implement the objective set in this part of the monograph. Nevertheless, taking into account the above-mentioned specific nature of selection of farms for the sample, the conclusions from the studies do not authorise us to generalise them at the level of the commercial farm population in Poland.

[9] This assumption is very important due to the specific nature of materialisation of some risks (e.g. ground frost, hailstorms). For example, exposure to the risk of drought has a quite significant spatial range as evidenced by the statistical data of e.g. ISSPC-NRI on drought in Polish agriculture in 2018.

[10] This index (i.e. adopted subsidisation rate) is of greater informative value than the total value of subsidies. However, we should expect that there may be similar values of the subsidisation rate (I – low production value, low value of subsidies; II – high production value, high value of subsidies). Therefore, the area of UAA has been adopted as an additional criterion.

indicated by the distribution with a slight right-sided asymmetry. The distribution of farm income was characterised by a small left-sided asymmetry (mean PLN 46.7 thousand, median PLN 47.7 thousand). Given the coefficient of variation (CV), i.e. a ratio of a standard deviation to the arithmetic mean, the differentiation of the distribution for the sample of farms was higher for the area (42.1%) than for farm income (22,1%). The distribution of the share of leased UAA in total UAA was characterised by a quite high interval attesting to the high empirical variation.

Table 1

Basic characteristics of the study sample of farms – statistical description

Specification	Area of UAA [ha]	Subsidies/total output [%]	Value of assets [PLN]	Share of leased UAA in total UAA [%]	Farm income [PLN]
Mean	25.50	36.7%	886 795	26.8%	46 739
SD	10.74	23.3%	471 514	21.7%	48 946
Min.	9.01	7.6%	196 130	0.0%	-66 550
Median	21.89	30.4%	833 294	23.7%	47 771
Max.	47.98	116.2%	2 586 241	70.8%	215 786
CV [%]	42.1%	63.4%	53.2%	81.2%	22.0%

Source: own study based on empirical studies.

The vast majority (as many as 90,6%) of respondents were male, although often it was a person declared as manager – owner of the farm (Table 2). Only 12,5% of the respondents held the diploma of higher education and the educational background of less than 2/3 (precisely 61%) of the respondents was of agricultural nature. Slightly over half (51,6%) of farm managers were in the mobile age (i.e. from 18 to 44 years of age).

Table 2

Socio-demographic characteristics of farm managers

Specification	Share in the study sample [%]
Sex	
Male	90.6
Female	9.4
Education	
Higher education	12.5
Less than higher education	87.5
Agricultural type of education	
Profile (agricultural) education	64.1
General education	35.9
Mobile age	
Mobile age (18-44 years)	51.6
Non-mobile age (over 44 years)	48.4

Source: as in Table 1.

The data contained in table 3 shows that the farm manager was, on average, 43,6 years old. A slight difference in the mean value and median value indicates the distribution close to normal.

Table 3

Age of farm manager – statistical description

Specification	Age
Mean	43.6
SD	9.6
Min.	23.0
Median	43.0
Max.	61.0

Source: as in Table 1.

4.4. Study results and discussion

According to the Table 4, the respondents most often declared an "average" or "weak" interest in preferential loans, credit sureties and guarantees (respectively: 48,4 and 32,8% of the answers). In the subsample of farms with a higher subsidisation rate, an interest was indicated (12,5% of the answers). It is worth stressing that a „strong interest" in above-mentioned financial instruments was declared by farmers from the subsample with a lower subsidisation rate (as much as 15,6% of this group). Given the area of UAA as a sample division criterion, only 15,6% of the respondents from the subsample of large farms declared a strong interest in preferential forms of loans. This may be surprising, given the relationship between investment efficiency and the size of farms. The zero or weak interest in debt instruments or credit guarantees or sureties has been declared by the subsample with a higher subsidisation rate.

Table 4

Interest in preferential loans, sureties, credit guarantees

Specification	By subsidisation rate [%]		By area of UAA [ha]		Total
	With a lower subsidisation rate (<30.4%)	With a higher subsidisation rate (30.4% and more)	Smaller (<21.9 ha of UAA)	Larger (21.9 ha of UAA and more)	
Not interested at all	0.0	12.5	6.3	6.3	6.3
Weak interest	31.3	34.4	34.4	31.3	32.8
Average interest	53.1	43.8	50.0	46.9	48.4
Strong interest	15.6	9.4	9.4	15.6	12.5

Explanation: significance of differences in the respondents' answers in the individual groups (by subsidisation rate and area of UAA) has been verified using the chi-square independence test – in the case of p-value < 0.05 the values in the cells would be marked in bold.

Source: as in table 1.

It should be stressed that support in a form of Union subsidies is the most preferred form of financing, which is highlighted by the ratings presented in Table 5. It is worth adding that managers of larger farms rated highest "lines of preferential loans" (on average 3,62/5), in turn, financing by means of EU subsidies was rated slightly lower (3,56)[11]. Farmers rated lowest state support in a form of subsidised contributions to crop and livestock insurance (on average for the study sample – 2,44). This is probably due to associating the insurance system with only a few insurance companies offering these risk management instruments. Slightly higher ratings were given to national support, i.e. in a form of agricultural tax and social security[12] (on average, 2.70).

Table 5

Rates given to existing forms of support for farms

Specification	By subsidisation rate [%]		By area of UAA [ha]		Total
	With a lower subsidisation rate (<30.4%)	With a higher subsidisation rate (30.4% and more)	Smaller (<21.9 ha of UAA)	Larger (21.9 ha of UAA and more)	
European Union subsidies	3.59	3.53	3.56	3.56	3.56
National support – preferences in a form of agricultural tax and social security	2.62	2.83	2.41	3.00	2.70
State-subsidised system of crop and livestock insurance	2.35	2.56	2.33	2.55	2.44
Lines of preferential loans	3.50	3.30	3.15	3.62	3.39

Explanations and source: as in Table 1.

From the data summarised in Table 6, it appears that the dominant group (less than 80%) among managers of farms included in the study sample (mixed type) were those "avoiding financial risks" (showing risk aversion). As expected, it should be noted that the larger share of "risk-prone" farmers was in the sub-sample of farms "with a lower subsidisation rate" and "larger". This is a rather expected relationship, according to which in rent-seeking, with many

[11] Parzonko and Hornowski (2017, p. 420) expressed an opinion that as part of the agricultural support system under the RDP 2014-2020 in Poland: there was "evident promotion of small and medium-sized farms" while expressing their "concerns about the economic rationality of this approach". This opinion may raise controversy depending on the preferences as to the level and scope of financial interventionism in agriculture.

[12] These parafiscal burdens are of quite preferential nature in relation to farmers and may be treated in this context as "national support".

constraints, a high chance of success is held by farmers declaring themselves as "risk-prone" (cf. Binswanger, 1980). These results coincide with the results of empirical studies on the determinants of insurance demand, or preferences of farm managers as to risk (Pawłowska-Tyszko (ed.), 2016, Sulewski and Kłoczko-Gajewska, 2014).

Table 6

Attitudes of farm managers towards financial risk

Specification	By subsidisation rate [%]		By area of UAA [ha]		Total
	With a lower subsidisation rate (<30.4%)	With a higher subsidisation rate (30.4% and more)	Smaller (<21.9 ha of UAA)	Larger (21.9 ha of UAA and more)	
Avoiding risk	71.9%	87.5%	87.5%	71.9%	79.7%
Risk neutral	15.6%	6.3%	9.4%	9.4%	10.9%
Risk prone	12.5%	6.3%	3.1%	15.6%	9.4%

Explanations and source: as in Table 1.

Table 7 shows basic descriptive statistics on acceptable debt ratio (total liabilities/total assets in percentage terms). The following conclusions can be drawn from the analyses of the results presented: (1) managers of larger farms declared a higher value of total debt ratio; (2) lower empirical volatility was characteristic of the value of acceptable debt claimed by managers of entities with a lower subsidisation rate. While the first relationship can be explained by a need to look for the sources of financing necessary for implementing the investment processes, the explanation of the other relationship requires more in-depth empirical exploration.

Table 7

Acceptable debt ratio [%]

Specification	By subsidisation rate [%]		By area of UAA [ha]		Total
	With a lower subsidisation rate (<30.4%)	With a higher subsidisation rate (30.4% and more)	Smaller (<21.9 ha of UAA)	Larger (21.9 ha of UAA and more)	
Mean	21.66	23.16	15.91	28.91	22.41
Standard deviation	14.96	20.73	11.27	20.99	17.95
Minimum	0.00	0.00	0.00	0.00	0.00
Median	20.00	17.50	12.50	30.00	20.00
Maximum	68.00	80.00	50.00	80.00	80.00
Statistics of the U-Mann Whitney test	z = 0,272, Prob > |z| = 0,7852		z = -2,514, Prob > |z| = 0,0119		

Source: own studies.

In the family farm a bundle of objectives is implemented (Gasson and others, 1988, Ziętara and Majewski, 1996, Gołębiewska, 2010, Franc-Dąbrowska, 2010). According to the neo-classical approach, the agricultural producer seeks to maximise profit. This applies, however, to agricultural enterprises in a form of companies with legal personality. The objective of managing the family farm is to "ensure family prosperity" (average rating 4,38/5) or "achieving a satisfying level of income"[13] (4.11). In the subsample of farms with a lower subsidisation rate, the ratings which farm managers declared for "resulting" objectives, i.e. "achieving a satisfying level of income" (4.28) and "making the farm more profitable"[14] (3.91) were slightly higher than for more subsidised farms (respectively: 3.94 and 3.78). From the answers out of cafeteria (only 4 of 64 respondents), a need for "farm development" can be indicated (see Table 8).

Table 8

Objectives of managing the farm

Specification	By subsidisation rate [%]		By area of UAA [ha]		Total
	With a lower subsidisation rate (<30.4%)	With a higher subsidisation rate (30.4% and more)	Smaller (<21.9 ha of UAA)	Larger (21.9 ha of UAA and more)	
Achieving a satisfying level of income	4.28	3.94	4.09	4.13	4.11
Making the farm more profitable	3.91	3.78	3.75	3.94	3.84
Ensuring family prosperity	4.41	4.34	4.38	4.38	4.38
Persistence of the farm and handing the farm over, in good condition, to a successor	3.61	3.47	3.59	3.38	3.48
Care for nature and environment	3.81	3.31	3.50	3.63	3.56
Other objective*	3.33 (N=3)	2.00 (N=1)	3.50 (N=2)	2.50 (N=2)	3.00 (N=4)

Explanation: Respondents could select several objectives among which there may be correlative relationships. (*) Only one respondent determined this objective as the „farm development".
Source: as in Table 1.

[13] The notion of satisfying income is present in the Anglo-American literature in the field of economics of farms and usually means generating income whose amount is consistent with expectations.
[14] The point here is the total profitability (total output/total costs) and sales profitability (total sales/total costs – costs of seeds and own feed), cf. chapter 5 of this monograph.

Table 9 summarises the respondents' ratings (scale 1-5) of factors that "justify the use of credits". The highest rating (2.97 for the sample) was given to the "Decrease in support for agriculture on the part of the EU and the country in the future". Managers of farms with the lower subsidisation rate (2.71) and of larger entities (3.06) paid attention to the greater role of the "perspective of limiting support in a form of preferential loans" than compared to the other groups (2.66 and 2.22, respectively). The limited role of self-financing was pointed out by managers of farms with the lower subsidisation rate (2.91) and with the larger area of UAA (3.09). The assignment of the highest rating to the factor called "Decrease in support for agriculture on the part of the EU and the country in the future" points to a potential substitution dependence between support in a form of subsidies, at least for mixed-type commercial farms[15].

Table 9

Factors which justify the use of credits

Specification	By subsidisation rate [%]		By area of UAA [ha]		Total
	With a lower subsidisation rate (<30.4%)	With a higher subsidisation rate (30.4% and more)	Smaller (<21.9 ha of UAA)	Larger (21.9 ha of UAA and more)	
Decrease in support for agriculture on the part of the EU and the country in the future	2.91	3.03	2.59	3.34	2.97
Absence of own funds and insufficient funds from subsidy	2.91	2.59	2.41	3.09	2.75
Perspective of limiting support in a form of preferential loans	2.71	2.66	2.22	3.06	2.64
Other farm	3.88 (N=8)	4.00 (N=6)	3.78 (N=9)	4.20 (N=5)	3.93 (N=14)

Explanation and source: as in table 1.

4.5. Final remarks

The issue of interchangeability between debt and the level of subsidisation of farms has a broad theoretical and methodological context. It is advisable to analyse production and financial decisions made at the same time (or not at long time intervals). It is particularly important from the point of view of the

[15] Quite interesting observations on „small" dairy farms are presented by Parzonko (2016, p. 75): these entities "are quite unwilling to use EU funds for the construction of livestock buildings, i.e. due to much higher formal requirements (higher risk of investment than in the case of purchase of machinery or tractors)".

countries pursuing the agricultural policy, which contains many various risk management instruments, often directly supported by the central budget.

The preferences of farmers (managing mixed type farms in the macroregion "Mazowsze and Podlasie") were identified as regards the sources of financing or risk attitudes depending on the degree of subsidisation, and, additionaly, on the area of UAA. The existing forms of support in a form of Union subsidies (CAP) were most preferred by managers of farms with the high subsidisation rate[16]. The assignment of the highest rating to the factor called "Decrease in support for agriculture on the part of the EU and the country in the future" points to a potential substitution dependence between support in a form of subsidies, at least for mixed-type commercial farms. Farmers who manage larger farms pointed to the higher value of the total acceptable debt ratio. This dependence requires greater attention and confrontation with the results of estimation of econometric models constructed based on data from individual agricultural farms. The reasons for the lower empirical variation of the acceptable debt ratio declared by managers of entities with the lower subsidisation rate could be found in a more "thought-out" and prudent attitude of these farmers towards the farm's financial policy. This requires, however, in--depth qualitative studies and also, as we should expect in the near future, economic experiments.

What should be indicated are limitations as to the sample size and also as to the criteria related to the purposive selection of farms. Nevertheless, the results obtained are of a certain cognitive value, taking into account the issues of conditions for the development of mixed type farms, located in the FADN macroregion "Mazowsze and Podlasie". Entities of this type constitute the majority of farms in this region as well as in our country.

The prudent construction of more sublime non-subsidy instruments requires taking into account the risk attitudes of farm managers, as well as the bundle of objectives of pursuing agricultural activities. Important are also heuristics and cognitive biases, e.g. aversion to loss (cf. Zaleśkiewicz, 2012), as recognised by economic psychologists and behavioural economists.

[16] Nevertheless, the in-depth statistical analysis of results of the surveys conducted did not show the significance of differences in answers among the individual subsamples, which resulted, inter alia, from the purposive selection of farms.

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Prof. dr hab. Jacek Kulawik (ed.), Renata Płonka, M.Sc., Dariusz Osuch, Ph.D., IAFE-NRI

5. Subsidies vs. finance and economics of farms managed by natural persons

5.1. Introduction

The analysis presented in this chapter is a continuation of the monitoring of changes in the economic and financial situation of farms of natural persons included in the Polish FADN, which started in 2011 (Kulawik (ed.), 2011; Kulawik (ed.), 2012; Kulawik (ed.), 2013; Kulawik (ed.), 2014; Góral (ed.), 2015; Góral (ed.), 2016; Soliwoda (ed.), 2017)[1]. The network is based on panel data from 6 300 units for 2010-2016. Before proceeding to the proper analysis, the results of research on agricultural subsidies, which were obtained after the publication of the Multi-Annual Programme report no. 59 of 2017, are reviewed.

While examining the effectiveness of using agricultural subsidies, for some time we have been referring to the concept of their fiscal scope which attempts to identify channels through which they reach real land users in agriculture or are taken over by its owners in the form of higher prices of this factor or higher rent levels, which generally is described as the capitalisation of budget support (Alston, 2010; Alston, 2002). In this context, the fiscal scope of subsidies may be full (perfect), when they are fully capitalised, or partial (imperfect), when they are shared by land users and landowners (Abler, 2001; OECD, 2008). Theoretically speaking, this scope may exceed even the amount of support, if there is large intensification of failures in the credit market in a given agriculture (Ciaian and Swinnen, 2009). Precise measurement of the scope is of fundamental importance for the level of effectiveness of subsidies as a transfer affecting agricultural income. In sectoral terms, this largely depends on the significance of agricultural land lease in a given country.

[1] As an introduction, it has to be explained that this chapter of the monograph has had the same content layout for years. First, a synthetic discussion on the results of the most interesting research, published after the release of the previous report on task 4402 as part of the Multi-annual Programme, is presented. They form the background for the second component of the chapter, i.e. continuation of the monitoring of the economic and financial situation of farms of natural persons belonging to the Polish FADN, with the simultaneous display of subsidies in its formation. Such a construction is a kind of compromise and has its advantages as well as defects. However, it was chosen consciously, after a period of separate review of research results and monitoring of the condition of farms of natural persons, when it turned out that this is also not the best solution.

E.J. Floyd is commonly regarded as the pioneer of research on the scope of agricultural subsidies (Floyd, 1965). Based on a model with two inputs (land with capital in aggregate terms and labour) and one output, this researcher proved that this scope depends mainly on the flexibility of demand for agricultural products, the flexibility of substitution between production factors and the flexibility of their supply. Further significant methodological progress in this area was made by M.J. Alston and S.J. James. They came to the conclusion that, among others, budget support for agricultural production is shared between landowners, farmers – land users, suppliers of other means of production to agriculture and consumers. However, the matter is much more complicated when the supply of agricultural land is perfectly inflexible in terms of its prices but the supply of other inputs is characterised by perfect price flexibility or there is no possibility of replacing the land with other inputs. Then it may happen that all subsidies go to landowners.

A lot of subsidies, and direct payments in particular, is at least indirectly related to the factor of agricultural land. Their scope is determined to the greatest extent by the price flexibility of supply of this production factor. If there was perfect inflexibility here, the scope could be practically perfect. However, if the landowners were able to make it non-agricultural quite freely, they could use a kind of arbitrage, i.e. they would be able to react to changes in the price of renting it for different applications, although the overall supply of this production factor in regional terms would remain relatively constant. Together with its increasing price flexibility, the scope would become less and less perfect, even though its numerical dimension would still be a derivative of the price flexibility of demand for agricultural products and the flexibility of substitution between production factors in agriculture.

The majority of the empirical research regarding the scope of agricultural subsidies carried out so far have shown that their results, sometimes very significantly, differ from theoretical predictions. In general, its low estimates predominate. For example, after analysing 21 empirical studies, L. Latruffe and Le Mouël found that only in four of them the scope exceeded 50% (Latruffe and Mouël, 2009). In turn, in a meta-analysis of 26 articles, P. Feichtinger and K. Salhofer determined the average scope between 25% and 36%, i.e. more or less this total amount of subsidies capitalised in the prices of agricultural land sold (Feichtinger and Salhofer, 2013). For the USA, the measurements are ranging between 12% and 28% (Hendricks, Janzen and Dhuywetter, 2012; Kirwan and Roberts, 2016). In the EU, the diversity of results is even greater. For example, G. Guastella *et al.* achieved a zero-level scope in Italy, similarly to J. Karlsson and P. Nilsson in Sweden (Guastella, Moro, Sckokai and Veneziani,

2013). On the other hand, P. Ciaian *et al.* stated that in the EU 70-80% of direct payments ultimately go to farmers who actually use land (Ciaian, Kanscs and Paloma, 2015). For new EU members admitted to the community in 2004 and later, this rate was also around 80% (Ciaian and Kancs, 2012). The controversy, however, persists as to whether the length of the lease period affects the scope. E.B. Kirwan and J.M. Roberts obtained a positive correlation here, on the other hand, S. O'Neill and K. Hanrahan – a negative correlation (O'Neill and Hanrahan, 2016).

Differences between the theoretical and empirical scope of agricultural subsidies are explained first of all by the existence of imperfections of competition on agricultural land markets (Breustedt and Habermann, 2011; Herck, Swinnen and Vranken, 2013). This is expressed, *inter alia*, in the fact that the properties of agricultural land, and here mainly its immobility and location as well as diversification in space, all in all result in a large stability of its supply, especially in the short term and at the local level. As a consequence, the common assumption that farmers, in their vast masses, are price-takers in the markets for products and production factors can be questioned. The spatial diversification of land and the location of the farms generate costs of distance and of transport in particular. As a consequence, farmers prefer, in other permanent conditions, plots of land located closer to their economic centres.

Spatial diversification of land, and consequently demand and supply on its markets, as well as farms and the existence of distance costs are the source of the emergence of market power at the local level, the most easily observed on the lease market. Accordingly, large farms can even set the level of rent, so they are price-setting, while small ones usually function as a price-taking. Market power is also the strongest determinant of the distribution of political rents. Its mechanism consists in the fact that, having local market power, and thus bargaining power, farmers can set the rent levels in the phase of negotiating them below marginal income and income or land rents from a given plot, or refer to techniques of spatial differentiation. Hence, already at the beginning of the last decade, agricultural economists began to be interested in these issues which in fact lead to empirical studies, not preceded by any comprehensive theory (Patton and McErlean, 2003). This gap was recently filled by M. Graubner (Graubner, 2018).

There are other explanations for the incompatibility of theoretical and empirical scopes of agricultural subsidies. Certainly, the disconnection of direct payments from current production decisions of farmers reduces their capitalisation in land prices and rent levels. In specific circumstances, however, this mechanism may be modified by increasing the risk and uncertainty and

undertaking non-agricultural activities by farmers. The issues of asymmetry of information between parties negotiating land purchase or lease transactions, cultural norms and customs as well as imperfections and incompleteness of labour, credit and insurance markets may also play a role. An interesting trail may also be the low transmission of prices between products and rent levels (McCorriston, 2002).

The aforementioned M. Graubner created a spatial theoretical model of the agricultural land lease market, referring directly to the work by H. Hoteling from 1929 *Stability in competition* and the concept of "Main Street" included in it, as well as the model of monopolistic spatial competition of J.E. Hoover, presented in the article *Spatial price discrimination* from 1937. Of course, Graubner also studied the work of other researchers, general economists: R.D. Capozzy and R. Van Order (1978), T. Gronberg and J. Meyer (1981) and C.S. Salopa (1979), as well as agricultural economists (including Patton and McErlean – 2003; Breustedt and Habermann – 2011; Karlsson and Nillson – 2014; Storm *et al.* – 2015; Hennig and Latacz-Lohmann – 2017).

The category of absolute and relative importance of space plays a central role in all models of spatial competition. Formally, it is the product of the distance between an economic centre and a given plot of land or another farm, and the unit cost of transport. With the increase of this parameter, market competition is decreasing and two farms can then function as separate monopolists on the land and lease market. Further in his article, Graubner refines and rigorously formalises this problem, distinguishing two types of local competition (cooperative and non-cooperative), two schemes for determining rent levels (the farm is not a monopsonist and uniform) and three levels of importance of space (low, moderate and high). For each of the combinations of these parameters he determines the scope later. The final results are presented in Breakdown 1. It clearly shows that the lack of capitalisation of subsidies, here only direct payments, in rent levels is definitely dominating. However, a perfect scope appears only with low importance of space and non-cooperative competition.

Breakdown 1

The scope of direct payments

Competition	Setting rent levels	The importance of space		
		low	moderate	high
• non-cooperative	the farm is not a monopsonist	1	0	0.5
	uniform	1	0	0
• cooperative	the farm is not a monopsonist		0	
	uniform		0	

"1" – perfect (full) scope; "0" – no scope.

Source: own study based on: Graubner (2018).

Following the reform of the CAP of 2013, all Member States applying direct payments in the form of the Single Payment Scheme (SPS) were obliged to harmonise them by the end of 2019, so that the regional model would become common in them. Its essence is that all entitlements to receive direct support have the same value based on the payment history in a specific region. However, at the time of the introduction of the SPS (2005), countries could still choose between the historical model (initial distribution of the value of entitlements was based on the history of payments on farms) and the hybrid model (combination of historical and regional variant). Additionally, the hybrid model could be implemented in both the static and dynamic form (approaching the regional model gradually).

Among the consequences of SPS harmonisation, the issue of the impact of this process on the capitalisation of subsidies in land prices and rent levels is of importance. Researchers dealing with these dependencies generally agreed that, on a purely theoretical basis, the regional model should stimulate capitalisation to a greater extent than the historical model (Klaiber, Salhofer and Thompson, 2017; Kilian and Salhofer, 2008; Kilian, Anton, Salhofer and Röder, 2012). They justified this by the fact that rents are determined by marginal relations. Therefore, if there are low and high values of entitlements, as in the historical model, and the owners of these entitlements compete for the same physical area of farmland, the maximum willingness of owners of entitlements valued low to pay will determine the market lease rent levels. On the other hand, in the regional model, the value of entitlements is fixed but on average higher level in the marginal approach. The same result should be achieved when we refer to the

asymmetric structure of information. In the regional model, the value of entitlements is known both to landowners and land users. However, it is different in the historical model, which weakens the bargaining position of the owners, and this ultimately results in lower lease rent levels.

So far, there has not been enough empirical studies devoted to the impact of the SPS harmonisation on their capitalisation in rents. This gap was filled by H.A. Klaiber *et al.*, publishing an article in 2017 in which this problem was analysed on the basis of data from the FADN system for Bavaria. In total, the panel comprised 2663 holdings, and the analysis period was 2005-2011. Panel regression with constant effects was used for the estimation of the empirical model. In general, the aforementioned theoretical argumentation that the transition to the regional model will result in a higher capitalisation was confirmed. On average, it was 37% in the entire period, which means that from one euro of the additional payment of the SPS 37 eurocents increased the rental rate. However, in the last year of the analysis (2011), this rate increased to 57%. If the same effects were also observed in other countries harmonising the SPS, we would have evidence that the landowners are the largest beneficiaries of this process. Because of this, the income of farmers who actually use the land may be under pressure.

Capitalisation also covers subsidies other than direct payments, and so, for example, those related to the provision of environmental goods, specified in the relevant programmes. However, usually this form of capitalisation requires a much more time and an adequate measurement of spatial dependencies in order to capture the spillovers (Ohler and Blanco, 2017). Time has an impact through the following three mechanisms:

1. all economic actors need to understand the essence of a given public good for the average and final willingness of private entities to pay for using it to be ultimately revealed or for the rules for subsidising their delivery to be clarified;
2. changing characteristics of the good itself and its offering so that it becomes more common, and so it takes the network nature;
3. beneficiaries in their preference functions will place the quality of the natural environment and the comfort of life higher and higher, which is to a large extent a consequence of their wealth.

Usually, an expression of the capitalisation of environmental goods are the growing prices of real property and building plots. Typically, they are examined using the hedonic pricing function, and the determinants of land and real property prices are estimated in the simplest case with multiple regression models. However, in order to take into account the above three mechanisms of

the influence of time and spatial dependencies on the capitalisation dynamics, we need to reach for much more advanced econometric and statistical tools.

Direct payments constitute basic support for EU farmers and have almost universal reach. This circumstance complicates the assessment of their effectiveness because it is very difficult for researchers to construct a control group, i.e. a set of farms which do not receive this support. Fortunately, the continuous progress in the econometric methodology allows us to deal with this problem. A good example is the article by R. Esposti (Esposti, 2017).

Esposti placed his analysis in the trend called the treatment effects (TE) in econometrics and in the economics of decoupling. The former, in the simplest terms, boils down to a comparison of the results obtained by the collectivity of units which are the subject of interaction/intervention with a group of objects, called control group, where there was no such an intervention. In essence, it is a kind of random experiment which is, therefore, subject to the rigour of calculus of probability and mathematical statistics. In turn, the economics of decoupling deals with the explanation of logic, mechanisms and determinants of the response to the transition from support coupled with agricultural production to decoupled support (Anton, 2005). These reactions can be twofold:

(1) decrease/increase in inputs, in particular of cultivated land, which implies a decrease/increase in agricultural production;
(2) a shift in the production structure towards activity previously supported with coupled payments. Due to the diversity of agricultural technologies and their rigidity, the functioning of the supply and sale markets, the objectives of farming families, their expectations and attitudes to risk and its tolerance in practice, there is a multiplicity of reactions of agricultural holdings. Generally, it must be assumed that they will be slower than many people assume. The reason for this are the costs of adjustments which reflect technological, production and management barriers caused, *inter alia*, by an earlier policy of supporting agriculture. Together they lead to the phenomenon of path dependence. In addition, many farms may already be close to their limit of allocation efficiency, so they have adapted well to the signals coming from the markets. Finally, the spillovers effects need to be mentioned here as well. They consist in the fact that the reaction of one farm brings about the response of other farms. The second form of spillovers is the impact of the sale of agricultural holdings on the supply markets. Regardless of the form, the spillovers effects lead to a reduction in the effectiveness of interventions, although some of the opposite reactions of farms and markets balance out.

Esposti, following the work by D.M. Cattaneo from 2010, approached the assessment of the effectiveness of decoupled single farm payments (SFP), introduced in the EU in 2005, in an innovative way. In principle, Cattaneo's methodology makes it possible to omit the difficulties of creating a control group of farms, which is understandably justified if we take into account almost universal access to direct payments. This method takes into account at the same time the diversity of their beneficiaries and their short-term responses measured by changes in agricultural production and is very strongly focused on the maximum use of information on farms. The consequence is the multivalued nature of the treatment effects (mTE). This also implies the same nature of its average treatment effect (ATE) and a quantile treatment effect (QTE). The latter was determined on the basis of the treatment intensity (TI). In accounting terms, it is the quotient of the SFP and agricultural production. As you can see, this indicator is a type of subsidy rate, which we also use in our monitoring.

Esposti made the empirical verification of the theoretical model on the basis of data from 5430 Italian farms belonging to the FADN of that country for 2003-2007. In general, he managed to confirm the hypothesis that the introduction of the SFP in 2005 resulted in a deeper market reorientation of the beneficiaries of this subsidy. However, it was very diverse and quickly decreased as the TI increased. In other words, adjustments in holdings less dependent on support from the first pillar were positive and statistically significant. This probably results from the above-mentioned fact that a large part of farms was already operating on the verge of their allocation efficiency and a kind of closure of the long-term path of growth and development of highly subsidised entities (path dependence). These findings should be carefully studied by researchers who prefer simulation methods because their estimates of support effects seem to be overstated.

5.2. Methodological assumptions

The next edition of monitoring of budget support and economic and financial condition of farms of natural persons was again based on the resources of the Polish FADN, collecting data in a systematic manner based on a well-established methodology and using very advanced verification tools, which gives a solid guarantee that the estimates of economic and financial efficiency and relations describing liquidity and solvency and investment activity are highly reliable. As in previous years, the analysis presented in this chapter was prepared in the convention of a traditional comparison of key indicators and economic and financial measures. An overview of all indicators and measures used in the chapter is included in Breakdown 2. Without a doubt, it is very wide

and can even give the impression of abundance. However, such a solution has been chosen because traditional analysis has no uniform, widely accepted standard. Researchers just have very different preferences. In addition, the point was to also present in a comprehensive way various aspects of the economic and financial situation of the analysed farms and its changes over time.

Breakdown 2

Used indicators and measures related to finance of farm households

No.	Ratio/measure	Calculation formula
1	Return on [%]: - equity, ROE (1)	$\frac{\text{family farm income – own labour costs}^{1)}}{\text{average annual value of equity}^{2)}} \times 100$
	- equity, ROE (2)	$\frac{\text{entrepreneurs' profit}^{1)}}{\text{average annual value of equity}^{2)}} \times 100$
	- assets, ROA (1)	$\frac{\text{(family farm income + interest) – own labour costs}}{\text{average annual total value of assets}^{3)}} \times 100$
	- assets, ROA (2)	$\frac{\text{entrepreneurs' profit}^{1)}}{\text{average annual total value of assets}^{3)}} \times 100$
1’	Alternatively [1)]: - cash return on equity	$\frac{\text{cash flow (1)}}{\text{equity (averaged)}} \times 100$
	- cash return on total assets	$\frac{\text{cash flow (1)}}{\text{total assets (averaged)}} \times 100$
2	Total profitatability index	$\frac{\text{total output}^{4)}}{\text{total costs}} \times 100$
3	Sales profitability index	$\frac{\text{total sales}}{\text{total costs – costs of own seeds and own feed}} \times 100$

Breakdown 2 (cont.)

No	Ratio/measure	Calculation formula
4	Liquidity (multiplicity):	
	- current ratio	$\frac{\text{current assets (EY)}^{6)}}{\text{short-term liabilities (EY)}}$
	- quick ratio	$\frac{\text{current assets (EY)} - \text{reserves (EY)} - \text{current stock (EY)}}{\text{short-term liabilities (EY)}}$
5	Solvency (multiplicity):	
	- coverage of overall loans with cash flows (1)	$\frac{\text{cash flows (1)}}{\text{overall loans (EY)}}$
6	Investment coverage (multiplicity)	$\frac{\text{cash flows (1)}}{\text{gross investment}^{6)}}$
7	Cash generating ratio (1)	$\frac{\text{cash flows (1)}}{\text{family farm income}} \times 100$
8	Cash generating ratio (2)	$\frac{\text{cash flows (2)}}{\text{family farm income}} \times 100$
9	Investment rate	$\frac{\text{gross investments}}{\text{depreciation}} \times 100$
10	Equity growth	$\frac{\text{equity (EY) - equity (BY)}}{\text{equity (BY)}} \times 100$
11	Working capital growth	$\frac{\text{working capital (EY) - working capital (BY)}}{\text{working capital (BY)}} \times 100$
12	The coverage ratio of assets with equity	$\frac{\text{equity (EY)}}{\text{total assets (EY)}} \times 100$
13	Immobilization ratio (multiple)	$\frac{\text{fixed assets (EY)}}{\text{current assets (EY)}}$
14	Measures (PLN)	
	- economic size	calculated on the basis of the standard production coefficients SO'2010
	- change in the value of equity	equity (EY) - equity (BY)
	- gross invesment	investment payments
	- net investment	gross investments - depreciation

Breakdown 2 (cont.)

	- cash flow (1)	balance of cash flows from operating activities
	- cash flow (2)	balance of cash flows from investing activities + balance of cash flows from financing activities
	- total subsidies	subsidies for operating activities + investment subsidies + milk compensation
	- family farm income	according to the individual farm's report scheme (Individual Report)[8]
	- working capital (EY)	equity (EY) + long-term liabilities (EY - fixed assets (EY)
15	Dependencies on subsidies: - subsidy rate I:	$\frac{\text{subsidies to operational activities + subsidies to investments + compensation for milk}}{\text{crop production + livestock production}} \times 100$
	- subsidy rate II (1):	$\frac{\text{subsidies to operational activities + subsidies to investments + compensation for milk}}{\text{family farm income}} \times 100$
	- subsidy rate II (2):	$\frac{\text{subsidies to operational activities + subsidies to investments + compensation for milk}}{\text{family farm income - own labour costs}^{3}} \times 100$
	- decoupling rate I of subsidies to operational activities from production	$\frac{\text{"}\textit{decoupled}\text{" payments + payments for greening + additional payment + LFAs + agri-environmental programmes}}{\text{subsidies to operational activities}} \times 100$
	- decoupling rate II of grants and subsidies from production	$\frac{\text{"}\textit{decoupled}\text{" payments + payments for greening + additional payment + LFAs + agri-environmental programmes + investment subsidies}}{\text{subsidies to operational activities + subsidies to investments + compensation for milk}} \times 100$
	- share of subsidies to operational activities in all subsidies	$\frac{\text{subsidies to operational activities}}{\text{subsidies to operational activities + subsidies to investments + compensation for milk}} \times 100$

Note:

1) Costs of own labour and the entrepreneurs' profit were calculated on the basis of a method developed by: L. Goraj, S. Mańko: Model szacowania pełnych kosztów działalności gospodarstw rolnych (The estimation model of full operating costs of agricultural holdings), "Zagadnienia Ekonomiki Rolnej" ("Issues of Agricultural Economics"), No. 3, IAFE-NRI, Warsaw 2011.
2) Average annual value of equity = (equity at the beginning of the year + equity at the end of the year)/2.
3) Average annual value of total assets = (total assets at the beginning of the year + total assets at the end of the year)/2.
4) Total output= agricultural output + other output; agricultural output = crop input + livestock input
5) (EY) = refers to the state as at the end of year.
6) Gross investments = payments incurred on investment activities. Investment expenses are payments that the farm incurred in a given year on investment activities, amounting to more than PLN 3500.
7) (BY) = refers to the state as at the beginning of the year.
8) Cf. See: http://fadn.pl/metodyka/raporty/raport-indywidualny-1/ and Smolik A. (2017): Jak rozumieć zawartość raportu indywidualnego gospodarstwa rolnego (Understanding the content of the individual farm report) (version from 2016). IAFE-NRI, Warsaw.

Source: prepared by the author.

5.3. Data sources

The subject of the research consists of individual farms conducting continuous agricultural accounting under the Polish FADN (Legal basis: Act of 29 November 2000 on collection and use of accounting data of agricultural holdings…)[2] in the years 2010-2016. In total, there were 6300 such farms. The analysis covers only the farms that kept records in Books of Agricultural Accounts (BAA)[3], but omits farms of legal entities, from which data were collected by means of a special survey. Farms selected for analysis in this manner do not meet the representativeness criterion, which means that the presented results refer to a certain sample of farms and are published in the form of average arithmetic means. The database of the Polish FADN includes many detailed records of data, verified in terms of their correctness and uniformly processed, which may be used in various types of economic analyses. Thus, it is a uniquely valuable resource.

Calculations of particular ratios mainly made use of results from tables "Individual Report" and "Output Tables – OT". It is pre-aggregated information from the BAA. Their scope is more detailed than the scope of data contained in "Standard Outputs"[4].

Investment expenses are payments that the farm incurred in a given year on investment activities, the value of which exceeds PLN 3500.

Cash generating ratios (1) and (2) were introduced to the set of ratios. These ratios were not calculated in the case, when the nominator and the denominator were negative. It would lead to wrong conclusions.

Granted subsidies were used for the purpose of the research, which means that grants are recorded, if a farmer received a decision on granting the subsidy and the subsidy amount is consistent with the records in the "Book of Receipts and Expenditures in the BAA".

In the case of indicators:

– decoupling rate I of subsidies to operational activities from production and
– decoupling rate II of grants and subsidies from production, the calculation formula has been changed. In comparison to previous years, the formula has

[2] More information on the Polish FADN can be found at: www.fadn.pl, and on FADN: http://ec.europa.eu/agriculture/rica/.

[3] Forms of the Books of Agricultural Accounts are available at www.fadn.pl in section Metodyka/Zbieranie danych/Gospodarstwa osób fizycznych (not available in English).

[4] Documents: RI/CC RI/CC 882 Rev.9.2 Definitions of Variables used in FADN standard results. European Commission, Brussels December 2014. Publications with "Standard Results" are available at: www.fadn.pl in section Publications/Standard Results.

been adjusted for greening payments and for additional payment which are linked to a single area payment.

In order to calculate equity profitability and profitability of total assets, it was necessary to estimate own labour costs. For this purpose, the method (Goraj and Mańko, 2011) was used, prepared in the Agricultural Accountancy Department. The estimation was based on the average remuneration for work per 1 AWU of hired workforce in different regions of FADN and economic size classes (ES6). Furthermore, two ratios were introduced – return on equity and on total assets, where the entrepreneurs' profit was used in the calculation formula. This profit was also calculated on the basis of the method prepared in the Agricultural Accountancy Department, where the family farm income was reduced by the estimated costs of unpaid own factors and increased by paid interest on farm liabilities.

In order to ensure comparability of the results obtained in the analysed years (Płonka et al, 2018), land valuation according to the farmer was applied, which has been in force since 2009. It is determined on the basis of the amount declared by the farmer, for which he/she would be willing to buy his/her own land.

Farms stored in the database of the Polish FADN vary, among others, in terms of production, area, as well as economic size. Every farm surveyed by FADN is assigned to a certain type of farming and economic size class. In order to determine the economic situation of the examined farms, as well as the impact of subsidies on their financial effectiveness, the analysed group was divided according to types of farming (classification according to TF8 typology) and according to the economic size classes (classification according to ES6). These divisions were used in the "Standard Outputs" published by IAFE-NRI[5].

Parameters of standard output SO "2010" were used for classification of farms (Regulation (EC) No. 1166/2008…; Regulation (EC) No. 781/2009…). This typology is used, among others, to describe the sector of agricultural holdings, select a sample for representative surveys, as well as for weighting, so that the results obtained by farms could be compared to the whole sector (Floriańczyk, Osuch, Malanowska and Bocian, 2016). These are the latest parameters of standard output, which will constitute the basis for determination of the farm selection plan that will be in force from 2016 (Floriańczyk, Osuch, Malanowska and Bocian, 2015). As it has already been mentioned, typology according to TF8 was used for grouping farms (Table 1).

[5] See: www.fadn.pl section Publications/Standard Results.

Table 1

List of types of farming according to TF8 typology

Symbol	Typology according to TF8 grouping
1	Fieldcrops
2	Horticultural cultivations
3	Wine
4	Other permanent crops
5	Dairy cows
6	Other grazing livestock
7	Granivores
8	Mixed

Source: http://fadn.pl/wp-content/uploads/2012/12/TF8_eng.pdf and M. Bocian, I. Cholewa, R. Tarasiuk (2014).

In the analysis, the economic size of farms was characterised using ES6 classification (Table 2). Due to the small number of farms in the class of very large farms, for the purposes of the study, classes over 100 thousand euro were combined. This grup of farms was defined as „Large (E;F)" in the publication. The table, apart from digital symbols, provides in parentheses the letter symbols used in the analysis.

Table 2

List of sizes and ranges according to ES6 and ES

Symbol ES6	Name	Symbol ES	Limits in euro
-	-	**1**	EUR < 2 000
1 (A)	Very small	**2**	2000 ≤ EUR < 4000
		3	4000 ≤ EUR < 8000
2 (B)	Small	**4**	8000 ≤ EUR < 15 000
		5	15 000 ≤ EUR < 25 000
3 (C)	Medium-small	**6**	25 000 ≤ EUR < 50 000
4 (D)	Medium-large	**7**	50 000 ≤ EUR < 100 000
5 (E)	Large	**8**	100 000 ≤ EUR < 250 000
		9	250 000 ≤ EUR < 500 000
6 (F)	Very large	**10**	500 000 ≤ EUR < 750 000
		11	750 000 ≤ EUR < 1 000 000
		12	1 000 000 ≤ EUR < 1 500 000
		13	1 500 000 ≤ EUR < 3 000 000
		14	EUR ≥ 3 000 000

Source: prepared on the basis of: Goraj, Cholewa, Osuch, Płonka (2010).

The set of farms continuously keeping accounting records in the years 2010-2016 was limited, owing to presence of:

– non-standard farms,
– farms not classified with the use of the Standard Output coefficient,
– farms below the threshold, according to the applied classification, i.e. farms whose economic size was smaller than EUR 4 000,
– farms differing from the studied set.

Non-standard farms are farms, where the value of:

– equity was negative,
– current assets was equal to 0.

In the case, when the value of short-term liabilities was close or equal to zero, no liquidity ratios were calculated. Since dividing any number by a very small value gives values close to infinity, it was assumed that these farms do not have any short-term liabilities. The values of other ratios, where the denominator was equal to zero, also were not calculated.

As it has already been mentioned, investment expenses are payments within investment activities, the value of which exceeded PLN 3500. In the case, when this value was smaller, it was established that the farm did not invest in a given year. Other farm selection criteria were additionally adopted.

They are as follows:

a) in the case of analysis of farms in terms of differing facilities, the analysis covered all variables selected for comparisons and calculations;
b) their ranges were examined for all coefficients. If any value differed significantly from the studied set, then such a farm was excluded from further processing;
c) the next stage consisted in an analysis conducted by means of dispersion charts for points XY;
d) if a farm had been excluded from research in a given year, then it was also omitted in the next years. The number of farms in the examined period is thus the same.

5.4. Analysis of the results obtained

The Synthetic Indicator of Economic Conditions in Agriculture (SIECA) calculated in the Institute of Agricultural and Food Economics – National Research Institute only in February and May 2016 was below the limit of 100. This indicator, on average, per account balance looked better than in 2015. In the second half of 2016, the levelled index of potential demand had a definitely positive contribution to the formation of the SIECA. In the period given, the cumulative index of price scissors, all the time exceeding the threshold level

(100), exerted influence in the same direction. In 2016, these scissors were on average considerably more favourable than a year before. These circumstances must be taken into account when analysing a set of indicators and measures for the FADN collectivity. On the other hand, it should be clarified that 2016 was a difficult year in terms of full implementation of subsidy programmes within the current CAP financial perspective in Polish conditions. Certain group of farms received in it, among others, double direct payments which, following the FADN methodology, had to be registered as a good of 2016. As a consequence, some of the analysed categories were slightly overstated compared to 2015.

The analysed collectivity is not homogeneous as it includes units different in terms of natural and soil conditions, exposure to weather and climate risks, the nature and scale of activities, techniques and technologies used, market relation and reactions to signals from it, the level of subsidies and indebtedness, and socio-personality traits of persons running farms and their families. These factors must obviously translate into basic descriptive statistics of the monitored set of measures and indicators, which are summarised in Table 3. If we now concentrate only on the coefficient of variation, we will notice that it achieves particularly high values when the measure or indicator has an extensive formula for its calculation. First of all, this concerns indicators of financial efficiency and subsidy rates. As already signalled, a balanced panel composed of 6300 farms is analysed, but the calculation of meaningful indicators was based on a much smaller number.

Table 4 presents development of indicators and measures in the seven--year period in 2010-2016 and in two sub-periods: 2010-2012 and 2013-2015. In 2015-2016 all six analysed relations related to financial efficiency improved. However, the results for 2016 were not always better than in the three-year period in 2010-2012. The situation was slightly different in the case of both profitability ratios, i.e. measures which do not include any subsidies. Although the years 2015-2016 can be described as a period of stabilisation, comparison of data for 2016 with data for both sub-periods shows certain regression in profitability. This may be the result of differences in the market conditions, but it may also reflect a lack of progress in improving efficiency. To some extent, this is confirmed by data on agricultural production and costs in constant prices in the entire FADN collectivity in the analysed seven years. Since 2014, production almost did not change, but the total costs, starting from 2012, increased slightly. On the other hand, the direct costs were very stable between 2012 and 2016. As noted earlier, in 2016, some farms received double direct payments. This certainly translated into an increase in subsidy rates which this way reached their maximum in the analysed seven years. The same applies to

the amount of all subsidies per holding. However, the factor of receiving double direct payments should not be overestimated because even though in 2015-2016 income from family farms increased over 1/3, it was definitely lower compared to the two sub-periods distinguished. Also in the last two years, static liquidity improved slightly, but the cash flows (2) were still strongly negative. In general, the analysed farms do not show any significant progress in generating cash. What certainly must be worrying, 2016 brought a decisive decline in investment activity. The credit coverage with cash flow also slightly deteriorated.

Table 3

Descriptive statistics of the panel of farms of natural persons for 2016

No.	Detailed list	M.u.	Number of farms	Mean	Median	Min.	Max.	Standard deviation (SD)	Coefficient of variation (CV) [%]
1	Return on equity (1)	%	6 300	3.4	2.6	-115.1	93.2	8.60	254.58
2	Return on equity (2)	%	6 300	1.6	1.0	-98.5	91.2	8.62	524.91
3	Total return on assets (1)	%	6 300	3.2	2.6	-52.6	91.7	7.86	246.47
4	Total return on assets (2)	%	6 300	1.3	0.9	-54.9	89.6	7.87	585.22
5	Cash return on equity	%	6 300	11.6	9.8	-11.2	142.0	8.73	75.21
6	Cash return on total assets	%	6 300	10.8	9.3	-9.8	142.0	7.98	73.69
7	Total profitability ratio	%	6 300	117.7	113.5	6.8	491.4	35.40	30.08
8	Sales profitability ratio	%	6 300	122.1	116.9	4.1	498.2	43.49	35.62
9	Current liquidity	-fold	3 000	10.7	5.2	0.0	437.8	20.70	192.70
10	Quick liquidity	-fold	3 000	3.6	1.4	0.0	172.3	8.68	241.26
11	Total credit coverage with cash flows	-fold	3 020	4.2	1.3	-2.0	225.5	12.45	297.85
12	Investment coverage	-fold	2 643	7.5	3.5	-7.8	153.5	11.54	153.64
13	Cash generation ratio (1)	%	6 064	0.0178	0.0120	0.0001	2.1573	0.0488	274.58
14	Cash generation ratio (2)	%	276	0.0119	0.0029	0.0001	0.2971	0.0289	244.17
15	Increase in equity	%	3 239	5.1	3.2	0.0	156.0	6.99	135.77
16	Change of equity value	thous. PLN	6 300	12.5	0.8	-1 757.4	3 719.8	141.2	1 130.86
17	Working capital growth	%	3 841	64.5	30.1	0.0	12 021.1	274.97	426.55
18	Working capital (SK)	thous. PLN	6 300	120.5	78.1	-1 411.6	8 389.1	194.2	161.11
19	Economic size	thous. PLN	6 300	249.8	167.0	17.3	7 576.8	311.4	124.64
20	Investment rate	%	6 296	72.5	0.0	0.0	7 299.4	249.03	343.66

cont. of Table 3

21	Gross investment	thous. PLN	6 300	42.2	0.0	0.0	8 131.1	193.4	458.86
22	Net investment	thous. PLN	6 300	6.6	-11.2	-835.1	7 941.1	186.4	2 838.52
23	Equity to assets ratio	%	6 300	94.9	100.0	2.4	100.0	9.18	9.67
24	Assets immobilisation ratio	-fold	6 297	11.7	8.8	0.4	1 165.4	21.63	184.17
25	Total subsidies	thous. PLN	6 300	65.7	46.9	0.0	871.7	67.2	102.29
26	Cash flows (1)	thous. PLN	6 300	136.3	86.4	-239.6	4 713.7	174.9	128.35
27	Cash flows (2)	thous. PLN	6 300	-40.9	-10.3	-4 661.3	3 734.5	124.8	*
28	Income from a family farm	thous. PLN	6 300	107.9	68.2	-382.3	3 326.7	149.9	138.92
29	Profit from a farm	thous. PLN	6 300	65.0	22.9	-424.4	3 286.2	149.1	229.35
30	Entrepreneur's profit	thous. PLN	6 300	44.6	8.3	-513.2	3 073.1	137.0	307.03
31	Subsidy rate I	%	6 300	44.0	34.7	0.0	541.8	40.66	92.32
32	Subsidy rate II (1)	%	6 295	81.4	73.3	-11 988.4	8 769.7	420.27	516.41
33	Subsidy rate II (2)	%	6 271	76.6	73.8	-17 791.1	25 141.5	1 104.41	1 442.14
34	Separation level I of operating subsidies from production	%	6 222	78.7	80.1	0.0	100.0	15.55	19.75
35	Separation level II of subsidies from production	%	6 236	80.0	81.5	0.0	100.0	14.84	18.56
36	The share of operating subsidies in total subsidies	%	6 236	94.5	100.0	0.0	100.0	11.76	12.45

**Due to the fact that the average value of cash flows (2) is a negative value, the coefficient of variation was not calculated.*

Source: own calculations based on data from the Polish FADN.

Table 4

Development of the values of measures and indicators in the panel of farms in 2010-2016

No.	Detailed list	M.U.	Years 2010-2012	Years 2013-2015	2010	2011	2012	2013	2014	2015	2016	2016/2015 x 100
1	Return on equity (1)	%	5.8	4.6	5.1	6.0	6.3	5.4	4.5	3.9	5.2	134.5
2	Return on equity (2)	%	3.5	2.8	2.6	3.6	4.1	3.6	2.8	2.1	3.6	169.2
3	Total return on assets (1)	%	5.6	4.5	4.9	5.8	6.1	5.2	4.4	3.8	5.1	132.1
4	Total return on assets (2)	%	3.5	2.8	2.6	3.6	4.1	3.6	2.8	2.1	3.6	169.2
5	Cash return on equity	%	10.5	10.5	9.9	10.3	11.3	11.4	10.5	9.6	11.0	114.6
6	Cash return on total assets	%	9.7	9.5	9.1	9.5	10.4	10.4	9.5	8.7	10.0	114.7
7	Total profitability ratio	%	129.2	120.5	128.4	128.4	130.6	122.6	120.8	117.9	117.6	99.8
8	Sales profitability ratio	%	129.7	127.3	128.1	128.7	131.9	130.2	127.9	123.9	123.7	99.9
9	Current liquidity	-fold	4.00	3.55	3.71	4.07	4.20	3.90	3.44	3.33	3.51	105.4
10	Quick liquidity	-fold	1.06	0.92	1.03	1.08	1.08	1.05	0.89	0.85	1.07	125.4
11	Total credit coverage with cash flows	-fold	0.89	0.74	0.88	0.88	0.91	0.83	0.74	0.67	0.75	112.9
12	Investment coverage	-fold	1.29	1.36	1.28	1.33	1.27	1.32	1.43	1.34	1.88	140.8
13	Cash generation ratio (1)	%	0.012	0.014	0.012	0.012	0.012	0.014	0.014	0.014	0.012	90.1
14	Cash generation ratio (2)	%	0.004	0.006	0.004	0.003	0.004	0.006	0.004	0.008	0.007	90.7
15	Increase in equity	%	8.0	7.2	7.7	8.1	8.2	7.2	8.3	5.9	5.2	88.7
16	Change of equity value	thous. PLN	44.6	27.0	29.1	57.6	47.1	39.7	34.6	6.6	12.5	189.7
17	Working capital growth	%	42.9	30.8	44.4	46.2	38.6	31.2	29.6	31.4	36.8	117.1
18	Working capital (SK)	thous. PLN	102.5	111.5	87.5	104.7	115.3	115.5	108.9	110.0	120.5	109.5
19	Economic size	thous. PLN	231.8	244.5	229.8	231.4	234.2	236.9	248.6	248.0	249.8	100.7
20	Investment rate	%	156.3	127.2	152.7	147.8	167.8	139.2	127.5	115.1	77.7	67.5
15	Increase in equity	%	60.2	63.4	53.0	56.9	70.7	71.5	62.0	56.7	42.2	74.3
16	Change of equity value	thous. PLN	29.2	28.4	24.3	25.4	38.0	35.4	28.2	21.6	6.6	30.4

cont. of Table 4

21	Gross investment	thous. PLN	92.1	90.9	92.3	92.2	91.7	91.0	90.9	90.8	91.1	100.3
22	Net investment	thous. PLN	8.5	8.7	9.4	8.4	8.0	8.3	8.9	8.8	8.2	93.0
23	Equity to assets ratio	%	46.1	46.8	45.2	47.4	45.6	48.4	43.7	48.2	65.7	136.3
24	Assets immobilisation ratio	-fold	113.4	126.0	102.1	111.0	127.0	133.2	126.7	118.0	136.3	115.5
25	Total subsidies	thous. PLN	-43.9	-47.9	-40.3	-41.5	-49.9	-50.7	-49.3	-43.8	-40.9	*
26	Cash flows (1)	thous. PLN	93.7	89.1	52.4	64.0	71.2	63.5	54.7	48.0	65.0	135.5
27	Cash flows (2)	thous. PLN	62.5	55.4	82.4	94.8	103.7	96.5	88.0	82.8	107.9	130.3
28	Income from a family farm	thous. PLN	37.2	33.8	27.2	38.2	46.2	41.6	33.5	26.2	44.6	170.4
31	Subsidy rate I	%	17.3	17.6	18.7	18.4	15.1	18.0	16.7	18.2	27.2	149.2
32	Subsidy rate II (1)	%	44.2	52.1	46.7	46.5	40.0	50.4	50.4	55.9	64.8	115.9
33	Subsidy rate II (2)	%	66.1	83.7	73.4	68.8	58.2	76.5	81.0	96.3	107.3	111.4
34	Separation level I of operating subsidies from production	%	64.7	78.6	60.2	64.4	69.2	75.3	79.1	81.6	77.1	94.4
35	Separation level II of subsidies from production	%	67.4	80.8	62.7	67.0	72.1	77.6	81.4	83.6	78.7	94.1
36	The share of operating subsidies in total subsidies	%	92.1	89.7	93.4	92.3	90.6	90.7	88.9	89.4	93.1	104.2

**Due to the fact that the average value of cash flows (2) in the analysed years has negative values, the change in the value of this measure in 2016 compared to 2015 is not presented.*

Source: own calculations based on data from the Polish FADN.

Table 5 shows the impact of economic size on development of constructed measures and indicators. Due to the frequent occurrence of negative values in the denominators of formulas for calculating liquidity and the ability to service loans as well as coverage of investments with cash flows, they are not provided for very small farms in the majority of cases. The information can be summarised as follows:

1. Return on assets and equity is unequivocally positively correlated with the economic size. With the exception of medium-small objects, in other groups it was more favourable in 2016 than in 2015, and compared to medium-sized ones out of two distinguished sub-periods. Of course, positive values of these relations were observed only from medium-small units. In principle, cash returns from total assets and equity improved everywhere in the two-year period in 2015-2016, but in the group of medium-large and large objects in 2016 they were very similar to the average in both sub-periods. Positive correlation is commonly observed between the economic size and profitability ratios. In other words, larger farms are also more efficient in purely market operations. With the exception of large objects, in all other four groups, in 2016 the profitability was lower than in 2015 and two sub-periods.
2. All the time, static liquidity (current and quick) is at the level usually considered safe, although on average it is the lowest on large farms. It follows that their higher profitability is achieved at the expense of liquidity. What is important, however, cash-generating indicators, which are close to other groups and very stable over time, are not affected by that. The coverage of loans and investment with cash flows (1) is somewhat worse on large farms. It should be associated with the lowest coverage of assets with equity in them, which is equivalent to the largest debt support, and above all credit. On the other hand, their asset immobilisation ratio was lower. It is sometimes treated as a forecast of variable for liquidity, although in essence it is its opposite (El Benni, 2012; Barry, Hopkin and Baker, 1998). This indicator is usually positively correlated with the income risk of an agricultural holding, although not always statistically significant. This dependency is additionally transferred to the risk of the entire income of the farming family. In the case of some crops, sometimes farms with a larger area and production scale have lower production risk (Marra and Schurle, 1994; Finger, 2012). This is due to the fact that they can carry out production on plots diverse in terms of soil and weather conditions. What follows, crops are also different which, in total, translates into their smaller changeability on the level of whole units. Reduced yields in one field are simply compensated by their rise in others.

3. Income from a family farm, profit from a farm and entrepreneur's profit also show a positive correlation with the economic size. In 2016, all these measures were usually higher than in 2015, whereas income was even higher everywhere than in the two distinguished sub-periods. In the entire seven-year period, only on large farms all three measures improved. The fact that in the last year of the analysis, the tendency of improving financial potential, measured by cash flows, continued should be recognised as a positive phenomenon, although, on the other hand, almost universal decline in the equity creation rate and investment rate is worrying. Regression in the case of the latter is particularly visible, starting from the group of medium-small units. This situation, perhaps, is part of the nationwide decline in private investment.
4. Total subsidies per farm increased significantly everywhere. This had to translate directly into the widespread increase in the subsidy rates I and II(1), which reached historical peaks in the seven-year period in 2010-2016 in all five groups in the last year of the analysis. Of course, these two rates are still negatively correlated with the economic size. The same relations are also visible in the case of both rates of separation of subsidies from agricultural production, although their intergroup diversification is small compared to the subsidy rates. This diversification is even smaller when we analyse the share of operating subsidies in the amount of total support.

Table 5

The value of measures and indicators in the panel of farms depending on their economic size in 2016

No.	Specification	M.u.	Very small (A)				Small (B)				Medium-small (C)				Medium-large (D)				Large and very large (E;F)			
			Years 2010-2012	Years 2013-2015	2015	2016	Years 2010-2012	Years 2013-2015	2015	2016	Years 2010-2012	Years 2013-2015	2015	2016	Years 2010-2012	Years 2013-2015	2015	2016	Years 2010-2012	Years 2013-2015	2015	2016
1	Return on equity (1)	%	-4,9	-5,1	-4,9	-4,3	-0,04	-1,1	-1,1	-0,3	3,9	2,7	2,2	2,0	6,2	4,9	4,2	5,4	9,0	7,2	6,1	8,5
2	Return on equity (2)	%	-7,3	-6,8	-6,6	-6,1	-2,3	-2,8	-2,8	-2,0	1,6	1,0	0,4	0,3	3,9	3,1	2,4	3,8	6,6	5,4	4,3	6,8
3	Total return on assets (1)	%	-4,8	-5,1	-4,9	-4,2	0,1	-1,0	-1,1	-0,2	3,9	2,8	2,2	2,1	6,0	4,8	4,1	5,2	8,3	6,6	5,7	7,7
4	Total return on assets (2)	%	-7,3	-6,8	-6,6	-6,1	-2,3	-2,8	-2,8	-2,0	1,6	1,0	0,4	0,3	3,9	3,1	2,4	3,8	6,6	5,4	4,3	6,8
5	Cash return on equity	%	5,8	5,6	4,8	6,2	7,4	7,2	6,9	8,3	9,3	9,2	8,4	10,0	10,7	10,4	9,5	10,8	12,4	12,3	11,1	12,4
6	Cash return on total assets	%	5,7	5,6	4,8	6,1	7,3	7,1	6,7	8,2	8,9	8,8	8,0	9,6	9,9	9,5	8,7	10,0	10,9	10,6	9,6	10,7
7	Total profitability index	%	113,6	98,6	101,3	97,0	119,7	110,7	112,0	108,5	130,2	119,5	117,7	115,0	131,5	122,0	118,6	116,8	128,9	121,4	118,4	120,3
8	Sales profitability index	%	101,0	94,8	95,7	95,9	114,1	112,1	112,4	110,5	127,3	124,3	121,3	118,9	130,7	126,9	122,3	121,0	132,7	130,8	127,2	128,5
9	Current ratio	multiplicity	-*	-*	-*	-*	4,18	4,05	3,84	3,86	4,25	4,07	3,87	4,02	4,03	3,64	3,54	3,89	3,88	3,35	3,09	3,22
10	Quick ratio	multiplicity	-*	-*	-*	-*	1,22	1,29	1,29	1,42	1,18	1,12	1,07	1,34	1,08	0,96	0,93	1,25	1,01	0,84	0,74	0,91
11	Cash flow/total credit and loans	multiplicity	-*	-*	-*	-*	1,09	1,04	0,97	1,00	1,09	0,98	0,89	1,07	0,97	0,82	0,76	0,91	0,77	0,65	0,58	0,64
12	Investment coverage	multiplicity	-*	-*	-*	-*	1,15	1,40	1,16	1,77	1,33	1,49	1,29	2,02	1,27	1,38	1,33	2,09	1,31	1,31	1,37	1,75
13	Cash generating ratio (1)	%	0,012	0,014	0,013	0,012	0,012	0,014	0,013	0,012	0,012	0,014	0,013	0,012	0,012	0,014	0,014	0,013	0,012	0,014	0,014	0,012
14	Cash generating ratio (2)	%	-*	-*	-*	-*	0,006	0,007	0,009	0,005	0,004	0,006	0,007	0,008	0,003	0,005	0,007	0,004	0,003	0,006	0,008	0,009
15	Equity growth	%	6,0	5,7	2,7	2,1	6,5	6,3	6,0	3,7	7,1	6,4	5,5	4,3	7,8	7,2	5,8	4,8	9,2	7,7	6,1	6,2
16	Change in the values of equity	PLN thous.	2,2	-4,6	-7,0	-6,9	6,1	0,2	-2,2	-4,0	23,4	8,5	-2,8	0,8	59,2	38,1	8,8	14,5	153,6	98,7	38,4	62,3
17	Working capital growth	%	34,9	25,8	26,1	30,3	37,9	29,4	32,3	31,3	41,3	28,3	29,6	33,1	42,1	30,0	31,5	34,1	46,2	33,3	32,2	42,8
18	Working capital (EY)	PLN thous.	19,6	19,5	18,4	21,6	39,6	41,9	42,5	46,1	72,7	79,1	78,4	86,9	121,7	130,1	128,4	140,5	279,1	284,5	270,7	293,0
19	Economic size	PLN thous.	29,1	28,3	28,2	27,8	66,9	65,8	65,4	65,3	146,6	146,7	146,3	146,6	280,8	282,7	283,4	282,6	713,5	735,2	736,1	739,5
20	Investment rate	%	26,2	20,2	16,3	16,9	63,7	52,1	58,6	39,3	116,8	93,6	89,1	56,5	177,2	130,4	118,5	72,4	195,5	161,8	138,3	100,0
21	Gross investment	PLN thous.	3,9	3,0	2,5	1,1	9,7	8,0	9,1	6,3	30,2	28,6	26,7	19,0	81,7	78,1	70,8	45,3	204,3	219,1	182,3	148,2
22	Net investment	PLN thous.	-2,5	-3,7	-3,7	-4,7	-2,8	-4,3	-2,6	-5,2	8,1	5,6	4,4	-3,5	42,8	35,2	28,2	2,2	125,6	128,2	90,0	54,7
23	Assets to equity ratio	%	99,0	99,4	99,4	99,2	97,8	98,2	98,2	98,2	95,3	95,3	95,5	95,9	92,3	91,6	91,7	92,5	87,8	86,0	85,9	86,0
24	Asset freezing ratio	krotność	11,2	12,5	13,0	11,5	9,7	9,7	9,6	8,9	9,1	8,9	8,9	8,2	9,0	9,0	9,2	8,5	7,5	8,0	8,3	7,9
25	Total subsidies	PLN thous.	8,0	10,4	8,4	14,0	16,7	17,7	18,2	26,2	32,4	33,7	34,2	50,3	61,4	58,3	61,3	81,2	115,0	111,4	110,8	144,5
26	Cash flows (1)	PLN thous.	13,8	15,2	13,2	17,5	32,7	33,6	32,3	39,4	73,9	78,4	71,2	86,4	145,0	152,8	141,6	161,2	327,9	360,5	333,2	372,6
27	Cash flows (2)	PLN thous.	-2,1	0,5	-0,4	0,5	-6,8	-5,9	-5,1	-5,2	-22,4	-21,8	-18,2	-17,5	-58,3	-59,1	-53,9	-49,6	-151,4	-165,8	-150,3	-137,8
28	Family farm income	PLN thous.	11,0	9,0	8,2	12,6	25,2	22,5	22,7	30,2	60,6	55,2	51,1	68,7	118,9	109,0	100,1	127,4	277,9	256,8	230,4	297,0
29	Farm profit	PLN thous.	-11,7	-13,8	-13,5	-12,1	-0,2	-5,2	-5,4	-1,3	30,9	23,2	18,3	17,2	84,5	72,8	63,1	80,2	236,9	211,4	182,1	254,9
30	Entrepreneurial profit	PLN thous.	-17,7	-18,5	-18,1	-17,2	-10,3	-13,3	-13,4	-9,6	12,6	8,2	3,6	3,0	52,7	46,3	36,2	56,8	173,2	157,6	128,5	204,8
31	Subsidy rate I	%	28,9	40,0	35,4	60,2	25,4	28,9	29,3	46,0	21,0	22,9	23,5	38,8	18,6	19,3	20,7	31,9	13,2	13,2	13,5	18,6
32	Subsidy rate II (1)	%	73,0	113,0	104,2	111,3	62,7	77,8	76,2	87,9	48,6	59,6	62,7	76,0	44,6	52,9	58,1	69,2	37,6	43,7	47,5	52,3
33	Subsidy rate II (2)	%	-68,5	-73,6	-63,0	-114,9	-8 644,1	-335,4	-318,9	-1 969,0	95,1	141,4	174,3	302,5	62,7	79,1	92,2	109,9	44,2	53,1	60,1	61,0
34	Decoupling rate I of subsidies to operational activities from production	%	64,3	76,9	86,5	84,9	65,9	79,0	83,1	81,6	66,0	78,6	81,9	75,5	65,0	78,4	81,7	74,7	63,0	78,8	80,9	78,9
35	Decoupling rate II of subsidies from production	%	64,5	77,1	86,7	85,0	67,2	79,9	83,9	82,2	68,2	80,2	83,3	76,8	68,0	81,2	84,1	76,8	66,2	81,1	83,2	80,5
36	Share of subsidies to operational activities in all subsidies	%	99,6	99,0	98,8	99,1	96,0	95,2	95,3	96,8	93,3	92,5	92,4	95,0	91,2	87,0	86,8	91,7	90,7	88,7	88,3	92,2

** The average value of the indicator was not presented if the number of farms in a given group was smaller than 15.*

Source: own calculations based on data from the Polish FADN.

A set of monitored measures and indicators divided into seven production types is presented in Table 6. With the exception of "horticulture crops" and "permanent crops" in all other types in 2016 there was an improvement in the profitability of total assets and equity compared to 2015. Particularly spectacular progress was observed in the case of "granivores" and "dairy cows" in which profitability was more favourable than in two distinguished sub-periods. In general, livestock production, on average, was better than plant production. In turn, in the case of "field crops" there is probably an already permanent tendency that currently they achieve much lower profitability than in 2010-2013. Even though in the two-year period in 2015-2016 "horticulture crops" recorded some decline in profitability, it is still the highest on average in the cross-section of types. The opposite pole is represented by farms with permanent crops or keeping grass-eating animals. Generally, cash return on total assets and equity developed very similarly to profitability. In turn, both profitability ratios exceeded the threshold level, i.e. 100%, everywhere, in 2016 comparing favourably for horticultural farms (total profitability) and in the case of farms with granivores (sales profitability).

In the last two years, static liquidity – current and quick – worsened only in the "horticulture crops" type. As we remember, farms included in it achieved on average the highest profitability. As you can see, this was done at the expense of low ability to cover their short-term liabilities. Fortunately, however, in the case of horticulturists, two cash generation ratios were at the level close to other types. On the other hand, in the "horticulture crops" type cash flows (1) in relation to loans were at the lowest level but their comparison to investments placed them in the first place. The situation in terms of credit coverage with cash flows is even more worrying if we take into account that horticultural holdings were relatively the most heavily indebted (the lowest equity to total assets ratio). Let us add that these farms were characterised by the second asset immobilisation ratio, after "dairy cows" type, which proves their relatively low flexibility of reaction to changes. For the sake of completeness, let us add that in the two-year period in 2015-2016 in the case of horticulturists net investment decreased. The same phenomenon also occurred in the case of "grass-eating animals" type. Such a comprehensive assessment of the "horticulture crops" type was made mainly for cognitive purposes, to sensitise all analysts of the economic and financial condition in agriculture to the existing connections between various tools of its measurement.

If we exclude the "horticulture crops" and "permanent crops" types, in all other groups income from a family farm increased in 2015-2016. As a rule, in 2016 it was also higher than the average values for both sub-periods. On the

other hand, tendencies in the case of the profit from a farm and entrepreneur's profit were less explicit. In the two-year period in 2015-2016, both measures increased in five types, in four of them being at the same time higher than on average in 2010-2013. In the analysed two years, cash flows (1), as a measure of the financial potential, were usually growing and were most often also higher than in 2010-2012. In turn, cash flows (2) were negative everywhere, but their absolute value in 2016 in all types was lower than in the three-year period in 2010-2012. Therefore, there was a slight improvement in the situation. In all types, equity increased in the last year but in five cases these amounts were lower than at the beginning of the current decade. The situation regarding the working capital growth was slightly worse, as in 2016 its values were higher only in the "horticulture crops" and "granivores" type compared to 2010-2012.

In 2016, the nominal amount of subsidies and subsidies in thous. PLN per farm was higher than a year before in all types except for horticultural holdings and farms with permanent crops. Equally important, this measure reached its historical peak in 2016, and increased the most dynamically in the case of "dairy cows" and "granivores". In this context, development of subsidy rates cannot be surprising. And so, in the last year of the analysis in all types rate I reached its historical peak. The second rate (1) was almost the same. In the two-year period in 2015-2016, in four types, i.e. all three focused on livestock production and in the "mixed" type, rate II(2) decreased, although it was higher than in the three--year period in 2010-2012 also in them. In the last year of the analysis, the order of types with the highest and the lowest relative budget support changed slightly. Assessing this with the subsidy rate I, horticultural holdings still had the weakest support, and the strongest – the "grass-eating animals" type. The difference was like 1 : over 21. However, it should be noted that at the same time the return on assets and equity in the case of horticultural farms was 3.2-7.7 times higher than in the "grass-eating animals" type.

Table 6

The value of measures and indicators in the panel of farms depending on their production type in 2016

No.	Specification	M.u.	Fieldcrops (1)				Horticulture (2)				Uprawy trwałe (4)				Milk (5)				Other grazing livestock (6)				Granivores (7)				Mixed (8)			
			Years 2010-2012	Years 2013-2015	2015	2016	Years 2010-2012	Years 2013-2015	2015	2016	Years 2010-2012	Years 2013-2015	2015	2016	Years 2010-2012	Years 2013-2015	2015	2016	Years 2010-2012	Years 2013-2015	2015	2016	Years 2010-2012	Years 2013-2015	2015	2016	Years 2010-2012	Years 2013-2015	2015	2016
1	Return on equity (1)	%	7,5	5,1	4,6	4,9	10,0	13,0	14,2	13,4	4,7	2,9	4,9	2,1	5,5	5,4	4,1	6,2	2,8	1,7	1,3	3,4	8,0	6,5	5,3	9,8	3,8	2,7	1,9	3,5
2	Return on equity (2)	%	5,5	3,5	3,0	3,5	6,6	10,8	12,2	11,6	2,1	1,1	3,1	0,4	2,8	3,4	2,1	4,3	0,1	-0,4	-0,8	1,5	5,2	4,4	3,3	7,9	1,4	0,9	0,1	1,9
3	Total return on assets (1)	%	7,1	4,9	4,4	4,7	8,7	10,6	11,4	11,0	4,6	2,9	4,8	2,2	5,3	5,2	4,0	5,9	2,8	1,8	1,4	3,4	7,5	6,2	5,1	9,2	3,7	2,7	2,0	3,5
4	Total return on assets (2)	%	5,5	3,5	3,0	3,5	6,6	10,8	12,2	11,6	2,1	1,1	3,1	0,4	2,8	3,4	2,1	4,3	0,1	-0,4	-0,8	1,5	5,2	4,4	3,3	7,9	1,4	0,9	0,1	1,9
5	Cash return on equity	%	11,4	10,2	9,3	10,2	21,6	26,3	28,4	24,4	11,5	10,7	10,5	10,8	10,9	11,1	9,8	12,0	8,2	7,7	7,2	9,5	11,9	12,7	11,8	14,5	8,5	8,8	8,0	9,5
6	Cash return on total assets	%	10,4	9,1	8,3	9,1	17,4	20,0	21,2	18,5	10,7	10,0	9,8	10,2	10,0	10,3	9,0	11,0	7,6	7,2	6,8	9,0	10,7	11,6	10,7	13,0	8,1	8,2	7,5	8,8
7	Total profitability index	%	134,2	118,2	116,3	110,5	131,6	134,9	136,0	131,8	147,3	127,2	139,2	121,3	137,7	132,5	126,2	125,5	112,5	106,6	109,0	107,4	121,5	116,6	114,3	123,7	123,4	114,1	110,8	113,4
8	Sales profitability index	%	126,9	116,9	113,4	111,7	130,8	134,6	137,0	130,0	137,9	126,4	125,5	120,7	136,9	135,1	128,0	126,3	105,0	108,6	111,1	110,4	136,3	142,5	140,0	147,6	123,3	123,0	120,7	121,4
9	Current ratio	multiplicity	4,11	3,47	3,26	3,42	1,81	1,18	1,09	0,91	4,14	2,78	2,65	2,34	2,80	2,95	2,93	3,17	3,49	3,31	3,50	4,16	4,70	4,36	3,97	4,28	4,90	4,42	4,08	4,40
10	Quick ratio	multiplicity	1,29	1,05	0,90	1,15	0,85	0,62	0,65	0,48	1,30	0,89	0,80	0,83	0,80	0,78	0,79	1,03	0,55	0,51	0,61	0,92	0,94	0,89	0,88	1,10	1,08	0,94	0,86	1,13
11	Cash flow/total credit and loans	multiplicity	0,84	0,62	0,57	0,65	0,70	0,58	0,65	0,52	1,07	0,90	0,89	0,92	0,98	0,92	0,79	0,93	0,74	0,64	0,57	0,84	0,84	0,90	0,78	0,86	0,94	0,81	0,72	0,81
12	Investment coverage	multiplicity	1,20	1,15	1,20	1,75	1,60	1,28	2,41	3,33	1,45	1,62	1,77	1,97	1,44	1,66	1,62	2,06	1,26	1,26	1,03	2,65	1,35	1,66	1,28	1,57	1,22	1,35	1,22	1,89
13	Cash generating ratio (1)	%	0,012	0,014	0,014	0,013	0,013	0,014	0,014	0,012	0,013	0,015	0,012	0,014	0,012	0,013	0,013	0,012	0,012	0,013	0,013	0,011	0,011	0,013	0,015	0,012	0,012	0,014	0,014	0,012
14	Cash generating ratio (2)	%	0,003	0,007	0,010	0,006	0,005	0,003	0,003	0,005	0,006	0,007	0,011	0,005	0,003	0,004	0,006	0,003	0,006	0,004	0,005	0,005	0,003	0,004	0,007	0,020	0,004	0,006	0,007	0,005
15	Equity growth	%	9,2	8,4	6,2	5,6	11,8	11,2	9,3	10,4	9,2	7,4	7,4	5,7	7,5	6,2	4,8	4,6	7,7	6,8	5,0	5,6	8,3	7,1	6,5	7,3	6,9	6,1	5,6	4,3
16	Change in the values of equity	PLN thous.	68,6	54,1	31,8	14,3	11,8	9,4	-10,9	-4,6	26,1	4,3	19,2	-11,1	51,6	25,4	-16,2	18,5	28,1	10,5	-4,0	14,4	60,5	16,8	-0,8	24,8	27,7	13,4	2,3	8,2
17	Working capital growth	%	50,8	34,5	32,7	37,8	35,6	36,1	38,6	52,1	68,6	39,8	48,5	35,3	46,1	33,3	32,7	43,1	36,1	24,4	25,1	31,7	36,3	29,8	35,0	40,4	36,2	25,6	26,3	31,2
18	Working capital (EY)	PLN thous.	140,3	142,0	140,9	140,4	46,7	40,4	36,5	43,6	97,5	89,8	93,9	86,0	61,3	74,6	76,4	91,0	69,4	75,6	81,6	97,3	193,9	208,2	194,7	231,5	90,2	101,1	98,5	111,9
19	Economic size	PLN thous.	241,4	236,5	238,8	235,1	334,4	393,3	410,5	427,3	128,7	135,6	139,0	133,9	225,1	244,8	251,3	259,2	146,5	174,0	145,7	144,1	536,8	573,1	587,4	603,1	179,2	190,0	193,3	196,8
20	Investment rate	%	176,6	142,8	134,2	73,5	125,7	177,2	87,2	49,5	109,4	95,0	76,8	52,9	174,2	127,1	99,9	90,3	102,6	88,7	82,2	47,1	172,2	126,4	137,3	130,6	131,1	108,1	109,0	64,3
21	Gross investment	PLN thous.	92,1	94,4	82,9	51,3	54,4	95,5	48,4	29,8	52,0	46,7	39,6	30,6	64,7	64,5	54,9	49,7	27,7	26,5	27,0	12,8	79,4	69,5	74,5	82,5	37,3	39,3	37,7	26,4
22	Net investment	PLN thous.	54,5	52,6	41,0	9,5	13,5	51,5	2,6	-16,2	9,5	3,7	-3,3	-8,9	32,5	26,6	16,7	10,8	6,3	4,6	5,4	-8,8	38,5	25,2	29,8	36,0	14,0	13,6	12,4	0,6
23	Assets to equity ratio	%	90,8	89,0	89,0	89,7	80,8	75,0	75,1	76,5	93,5	93,6	94,0	94,3	92,3	92,0	91,9	91,9	93,5	93,6	93,2	94,7	90,3	90,8	90,4	89,7	94,2	93,3	93,2	93,4
24	Asset freezing ratio	krotność	8,0	8,6	8,7	8,6	9,0	9,7	9,7	8,7	7,6	8,1	7,7	7,8	13,5	13,0	12,8	11,2	9,1	8,7	8,2	7,1	5,7	5,6	6,1	5,3	8,1	7,9	8,1	7,3
25	Total subsidies	PLN thous.	72,5	71,7	73,0	87,3	13,2	12,8	10,1	12,3	19,9	25,2	25,2	24,2	42,1	37,9	37,9	67,9	44,2	41,1	37,5	65,1	46,5	43,2	44,7	57,6	36,0	38,4	41,0	54,7
26	Cash flows (1)	PLN thous.	156,4	155,1	146,1	156,9	142,7	190,0	208,3	179,1	105,7	102,9	100,5	100,7	118,8	138,2	123,6	152,7	63,0	63,6	60,9	80,6	165,3	190,3	179,6	226,5	75,4	85,3	78,8	94,9
27	Cash flows (2)	PLN thous.	-62,3	-67,2	-62,3	-54,3	-52,5	-67,6	-57,0	-46,1	-41,4	-40,8	-39,0	-33,9	-49,7	-52,5	-45,0	-45,0	-22,2	-21,5	-20,6	-17,2	-62,8	-58,9	-57,2	-52,5	-26,8	-29,2	-26,5	-26,4
28	Family farm income	PLN thous.	132,1	108,7	103,3	114,3	98,4	129,3	141,8	140,2	71,8	58,8	78,8	58,6	94,6	104,1	90,4	126,9	51,4	46,7	45,0	72,0	145,2	133,7	118,5	195,4	63,5	59,2	53,2	78,9
29	Farm profit	PLN thous.	103,2	77,9	71,7	75,6	65,9	93,5	104,5	98,4	43,2	27,8	46,8	19,4	60,0	66,6	51,8	78,3	21,5	13,8	10,5	28,9	111,0	96,7	80,0	153,9	33,2	25,8	18,7	35,1
30	Entrepreneurial profit	PLN thous.	76,2	53,8	47,0	53,6	43,5	78,2	89,4	84,9	19,2	10,6	29,9	3,3	30,8	41,9	26,9	54,5	0,9	-2,9	-6,3	12,5	72,0	66,2	50,0	124,1	12,8	8,4	1,3	18,7
31	Subsidy rate I	%	25,5	26,8	27,7	38,6	2,8	2,3	1,9	2,9	8,0	12,6	11,9	17,8	15,8	14,6	14,9	27,4	42,4	42,2	37,6	61,8	7,0	6,6	6,9	9,0	18,9	20,2	21,2	30,9
32	Subsidy rate II(1)	%	51,0	65,1	68,4	80,7	10,9	8,5	6,8	10,7	20,0	37,6	29,9	49,8	37,6	38,1	42,8	57,8	82,3	90,4	86,4	91,9	28,4	32,0	35,4	31,7	51,0	63,5	70,4	73,2
33	Subsidy rate II(2)	%	65,2	90,6	98,4	121,9	16,3	11,7	9,3	15,2	33,2	79,4	50,1	150,7	59,4	59,6	74,6	93,6	195,8	305,5	368,3	228,5	37,1	44,1	52,4	40,3	97,5	145,1	200,0	163,8
34	Decoupling rate I of subsidies to operational activities from production	%	62,7	77,2	80,3	82,4	47,1	72,0	79,8	89,9	80,5	74,4	77,0	88,4	67,8	81,7	83,6	67,1	73,0	84,9	87,2	74,1	65,4	79,3	82,8	81,3	64,7	78,6	82,1	76,0
35	Decoupling rate II of subsidies from production	%	64,7	78,8	81,9	83,4	52,2	77,1	84,6	91,6	83,6	79,1	81,8	90,4	71,8	84,7	86,2	69,7	74,5	85,9	88,2	75,1	69,5	82,6	85,7	83,3	67,0	80,5	83,8	77,6
36	Share of subsidies to operational activities in all subsidies	%	94,2	92,5	92,2	94,3	90,1	81,9	76,2	82,4	83,8	81,2	79,3	82,9	87,4	83,7	84,1	92,1	94,5	92,9	92,5	96,2	87,9	84,0	83,1	89,1	93,1	90,9	90,5	93,5

Source: own calculations based on data from the Polish FADN.

5.5. Summary

In 2016 the economic situation in the Polish agriculture improved significantly compared to 2015. This certainly had a positive effect on the economic and financial condition of the analysed 6300 farms under the Polish FADN. Unfortunately, on the other hand, earlier problems with implementation of support from EU programmes were reflected in 2016. As a consequence, that year some farms received double direct payments which, according to the FADN methodology, must be put on the year in which they were received. As a result, values of some measures and indicators somewhat increased. It seems, however, that this does not undermine the general conclusion that as a rule in 2016 the profitability and static liquidity improved compared to 2015. However, there is no clear progress, especially in terms of profitability and cash generation, if the basis for comparisons is the three-year period of 2010-2012. The general increase in subsidy rates adds to this, but due to their double entry at times in 2016, one should avoid the generalisation of this phenomenon until the budget support normalises.

The economic size of farms, as in previous years, is very closely correlated with their financial efficiency, and profitability and income. However, the mechanism leading to the highest profitability ratios on large farms is more complex and includes, among others, coupling of the scale with the level of asset debt and their structure, which reflects the flexibility of adjustments to changes in the environment and exposure to risk. Not less importantly, the economic size is on the other hand negatively correlated with the subsidy rates.

The impact of the production type on economic and financial efficiency, profitability, liquidity and financial stability as well as revenues and budget support contribution is relatively stable, although in 2016 a clear improvement in the situation of farms specializing in livestock production is observed. This should be associated with the market conditions and changes in the subsidy system. The latter, measured by means of appropriate ratios, was relatively the highest in the "grass-eating animals" type and the lowest in the "horticulture crops". The difference between these values was 1 : 21. In turn, horticulturists were able to achieve the profitability of assets and equity even up to 8 times higher than farmers conducting the "grass-eating animals" activity.

In the summary of the above-mentioned research, it should be pointed out that often huge diversity of their results, reaching contradictions, must unfortunately be considered a normal state. The problem lies in the fact that their authors are basing on different theoretical approaches which often end in a conclusion: "... as we can see, the theory does not give unambiguous solutions. The problem is, therefore, empirical". The empirical nature opens the field for

the emergence of another source of discrepancy in results, because researchers have many tools at their disposal which do not solve many problems with the lack of data, the method of sample selection, determining the nature and direction of causality, arbitrary of some assumptions or the resistance of final estimates to changes in key model parameters. Remedy may be sensitivity analysis and meta-analysis. However, looking realistically, the ambiguity of obtained results must also be expected in the future.

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