INSTITUTE OF AGRICULTURAL AND FOOD ECONOMICS
NATIONAL RESEARCH INSTITUTE

Agricultural policy and the decisions of agricultural producers as to income and investment

Włodzimierz Rembisz
Agata Sielska
Agnieszka Bezat-Jarzębowska

no 102.1
Warsaw 2014

MULTI-ANNUAL PROGRAMME 2011 - 2014

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Authors:
prof. dr hab. Włodzimierz Rembisz
dr Agata Sielska
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This publication was prepared as a contribution to the research on the following subject: **Application of economic modelling in the analysis of the premises of competitive development of the agri-food sector** within the framework of the research task: *Equilibrium of the growth of the national agri-food sector and its competitiveness in the EU and global dimensions*

The purpose of this research was to present the impact of agricultural policy on choices of agricultural producers regarding income and investment. The issue of substitution between political and economic rent, which are sources of income of agricultural producers, as well as relationship between the political rent and investment are analysed.

Reviewer
dr Mirosław Drygas

Proofreader
Joanna Gozdera

Technical editor
Joanna Gozdera

Translated by
Summa Linguae

Cover Project
AKME Projekty Sp. z o.o.

ISBN 978-83-7658-478-2

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

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Introduction

Income effects of agricultural policy are expressed in raising them above the level resulting solely from market regulation. This, of course, has impact on the choice of the sources of such income. All actions (e.g. in terms of progress, technology, management, marketing) leading to improved production efficiency and price relations of prices received (purchase prices) to prices paid (prices for means of production) to improve the profitability of production are the second source. The agricultural producer of course selects the most useful and effective sources, comparing their usefulness to the cost of their achievement. These income effects of agricultural policies, that is political rent, also influence the choice of the producer as to investment. They reduce the negative correlation between savings (*ex-post* and *ex-ante* loans) and investment needs, increasing the ability of credit and investment and reducing risk. This results in maintained in a sense complementary relationship between political rent and investment of agricultural producers. It has an important impact on the development of the basis for the technical relationship changes, including adding the capital factor to labour factor, which forms a stable base for revenue. The catalysing effect of rent on investments of agricultural producers is expressed therein. This is the reasoning subject and axis of this monograph. The issue of political and economic rent is approached more analytically than empirically, as if outlining a new area of interest in agricultural economics.

In the first chapter, we attempt to present the impact of agricultural policy on choices of agricultural producers. The choice refers to the objective function of maximization of their income. The variables in this choice are the agricultural policy and improvement of the efficiency of production, including labour productivity, as a source of such income. We do not contemplate the meanders of agricultural policy instruments, currently the Common Agricultural Policy. We assume that regardless of the complexities and multiplicity of instruments and programs of this policy, they must ultimately have an impact on the objective function of agricultural producer. The final result is a given income effect, positive one, i.e. realized income is higher than when the policy would not be implemented. This affects the aforementioned choice of income sources. We use the simple analytical approaches related to microeconomics and agricultural economics. First of all, we apprehend realized income as determined by the productivity of labour at a given level of product prices and income derived from solutions of the agricultural policy, CAP. We show the relationships existing in this respect.

In the second chapter, based on the analysis of the first chapter, we raise the issue of substitution between political and economic rent, which are sources of income of agricultural producers. Assuming rationality of choices of agricultural producers, we assume that they will refer to the cheaper and more useful source with respect to its objective function which is to maximize income. It seems that political rent meets these criteria. It is a source of income whose cost of obtaining is lower than the improvement of production efficiency. In turn, the utility in terms of income is the same. Hence, the marginal income utility, as defined in the chapter, of both political and income rent is different, less favourable to the latter. This may make the producer strive more for political than economic rent. As a result, it may also weaken the need to improve production efficiency.

Chapter three is devoted to the presentation of the results of empirical studies in the form of graphical visualization. They refer to the assumed hypothesis of the substitution ratio between political and economic rent or its alternatives – of a complementary relationship between the two rents. Graphical presentations for the analysed groups of FADN farms do not give a definite answer as to the substitutability of the two rents, however, they show additional characteristics associated with the level of production efficiency.

In the fourth chapter, we assume that political rent, that is income effects resulting from the agricultural policy by, among others, an increase in savings, can contribute to increasing investment of agricultural producers. It is about increasing savings and subsequent investments above the level that would have been possible if there was no rent. The positive, or as we call it – catalysing, effect of political rent neutralizing its less desirable substitution effect in relation to economic rent can be expressed there. We assume that the goal of the investment is to improve the production efficiency, especially the labour productivity factor as a long-term fundamental source of income in agriculture. Improving the labour productivity factor results, as it is known, in large part from the increase in equipment of labour factor in the capital factor. In other words, this is due to the improvement of the technical relationships, i.e. the increasing relationship of physical capital factor to labour factor. Political rent may increase both the level of investment and consumption of producers above the level that would result from the accumulated savings (including loans, which are – as it is known – the inverted form of savings). We show these dependencies analytically by introducing appropriate indicators of propensity to savings and consumption due to the income effect of rent. We show a possible catalysing effect of political rent on these processes. We show a simplified mechanism of the producer's choice regarding investments and we refer to

specific models of investment of producers. We also present the relationship of savings and investment and of labour productivity incrementally.

The last, fifth chapter is an empirical illustration of the relationship between income obtained from political rent and other characteristics describing individual farms. In light of the considerations in the previous chapters in this section, we present the changes of capital expenditures, the amount of investment and the amount of income received from political rent in recent years in the selected European Union countries. The chapter also examined the formation of investment depending on the income resulting from the political rent and liabilities (*ex-post* and *ex-ante*), comparing two potential sources of investment in individual farms. In the last step of the analysis, comparison of the rate of changes (increase) in investments and income resulting from the political rent, subsidies for investments, income and liabilities for farms in Poland was conducted. The study was conducted in groups listed by voivodeships in which farms are located and by the economic size classes.

I. Agricultural producers' income, and political and economic rent

1.1. Components of income, defining assumptions

Actually realized level of income of agricultural producers (income in agriculture) is now increased as a result of a variety of solutions of the Common Agricultural Policy (CAP), for example, most clearly in the form of direct payments. They have certain effects on income. As we assume, first of all direct transfers (payments) are carriers of these effects. It is denoted by the symbol: T_B. Incomes of agricultural producers are also reduced (to a small extent) by tax and other charges, which is denoted as P_T. Thus, the income of agricultural producers can be recognized as:

$$L \cdot C_L + (T_B - P_T) = D_R \tag{I.1}$$

where:

T_B – the value of different forms of transfers, subsidies and agricultural support giving the income effect (direct payments, price support, production quotas, import quotas and other regulations – intervention) $T_B = \sum_i^n T_i$,

P_T – the value of various taxes and other charges imposed on a farm $P_T = \sum_i^n P_i$,

D_R – incomes of agricultural producers (agriculture).

We assume that income defined in such a way is the maximized objective function of an agricultural producer. This is an oversimplification because the producer's objective function has multiple criteria[1]. However, it is necessary for extracting the essence of the problem, i.e. the possible substitution of two sources of income for the agricultural producer, that is – as far as achieved income effects of agricultural policy weaken the need to improve the efficiency. This need, of course, involves market regulation.

[1] Cf. Sielska A., *Decyzje producentów rolnych w ujęciu wielokryterialnym – zarys problemu*, IERiGŻ-PIB, Warsaw 2012, p. 28 and further, where the problem of agricultural producer's decision-making is showed in multi-criterion terms as a space of assessment of decision variants.

This fact relates directly to the question of whether the producers respond to market needs and submit to its productivity regime, or fight for grants and subsidies. It is debated or contested in a part of the latest economic literature where it is noted that "economic organizations, like the European Union, are moving away from the market regulation methods by introducing ... many administrative instruments. The best example of this is direct payments", which "implies that agricultural markets can exist in the world, but not in Europe". These methods "interfere with the operation of natural market forces ..., the flow of economic information between consumers and producers is distorted, making it impossible to take informed production decisions. Instead of responding to the needs of consumers, the producers are fighting for grants. This raises the need to ... regulations, the administrative machine continues to grow". Then, "receiving money only for the ownership of land leads to demoralization of farmers ... moral decline of this group can be easily extended to the whole of society". Finally: "moving away from market mechanisms makes the European Union more and more conformed to the centrally planned economy"[2]. Of course it is a question in itself for a separate theoretical study. Here we referred to that because it implicitly affects the choices of agricultural producers as to the sources of income and investment decisions.

1.2. Substitutability and complementarity of economic and political rent

To address the issue of substitutability and complementarity of both rents as a source of income[3], or indeed variables for maximizing objective function of agricultural producer, we first address it analytically and then graphically. Therefore, let us distinguish, according to the above formula, the two primary sources of income growth. Firstly, improvement of the efficiency of production (at a given price relations obtained for the products to the prices paid for inputs), or economic rent[4], is the source. Secondly, the source is also

[2] A. Jakimowicz, *Podstawy interwencjonizmu państwowego*, PWN, Warsaw 2012, pp. 475-476.
[3] Rent means any benefit which an entity (individual, group or institutional) can obtain from activities in which it involves any means having alternative use, cf. R.D. Tollison, *Rent seeking: a survey*, Kyklos, v. 35, 1982, pp. 575–602. On the basis of this understanding rent-seeking is a natural form of human activity, A. Zybertowicz, B. Pilitowski, *Polityczna pogoń za rentą: peryferyjna czy strukturalna patologia polskiej transformacji?*, [in:] M.G. Woźniak (ed.), *Nierówności społeczne a wzrost gospodarczy*, Uniwersytet Rzeszowski, from no. 14, Rzeszów 2009, pp. 110-132.
[4] Economic rents are the "forms of income that result from the use of production resources for the production of goods and services", J. Wilkin, *Pogoń za rentą przy pomocy mechanizmów politycznych*, [in:] Wilkin (ed.), *Teoria wyboru publicznego: Wstęp do ekonomicznej analizy*

means obtained from solutions of agricultural policy CAP, or political rent[5]. We can also define it as[6]:

$$D_t = \max_R f\{(EP) + g(B)\} \tag{I.2}$$

where:

EP – production efficiency in its technical basis as the ratio of the size of the resulting production to involved production factors: $\frac{y}{K+L}$, which follows directly from the occurrence of the production function,

$g(B)$ – income effect of the agricultural producer support associated with the implementation of various programs and mechanisms of the CAP, direct payments and other services performed by the paying agencies (in Poland are: the Agricultural Market Agency, the Agency for Restructuring and Modernisation of Agriculture) from EU and national funds, that is, $B \approx (T_B + T_P..T_K) - P_T$.

Using $\{(EP) + g(B)\}$ as a component of the above objective function, we can build the following dilemma of reasonably progressive agricultural producers. Will they be more oriented to the income benefits related to agricultural policy CAP (political rent), or the benefits of improving the production efficiency (economic rent). According to popular belief, the former seem to be easier to obtain than the latter. Regardless of whether this view is true or not, there is a different mechanism of investigation into both income benefits. This is an interesting question as such, which we leave for another occasion.

Let us note that production efficiency is determined by the production function of a given agricultural producer (manufacturing technology) $R_t = f(K_t, L_t)$ as a source of income growth depends on the producer and is an endogenous determinant. In turn, the benefits of agricultural policy, as well as

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polityki i funkcjonowania sfery publicznej, Wydawnictwo Naukowe Scholar, Warsaw 2005, pp. 204–219.

[5] "Political rent is a form of benefit associated with the use of scarce resources (labour and capital) for activities not increasing products improving social welfare. The benefits occurring in the form of political rent is merely a form of income transfer from one to the other entity through the mechanisms of political power", J. Wilkin, *Pogoń za rentą*..., op cit.; S. Sztaba, *Wstęp*, [in:] M. Raczyński, S. Sztaba, A. Walczykowska, *W pogoni za rentą*, READ ME, Warsaw 1998, p. 36; Kosiec K., Raczyński M., *Rynki polityczne. Strategie firm państwowych w rywalizacji rynkowej*, Universitas, Kraków 1998, p. 33.

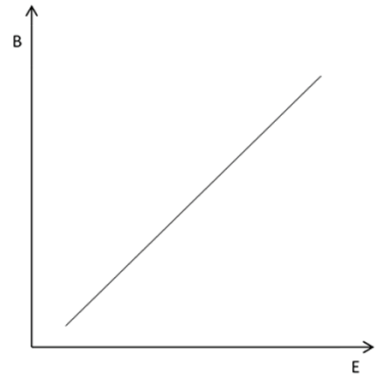
[6] The assumption of additivity adopted here will be repeated later.

changes in ratios of prices received to prices paid, is a conditioning producer-independent, so it is an exogenous factor.

In the context of these patterns, the analysed issue can be presented graphically as an alternative:

a) Payments - the income effect of agricultural policy is complementary to the production effectiveness, so political rent supports increasing the production efficiency of agricultural producers, which can be pictorially illustrated as below, without specifying the correlation relationship (regression)[7]:

Figure 1. Complementarity of political and economic rent

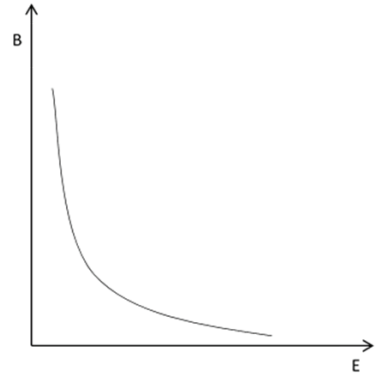


Source: own elaboration.

b) Income effect of agricultural policy is in substitution relation with production efficiency, which may mean that the resulting income effects of agricultural policy weaken the compulsion to improve the production efficiency in agricultural producers, which resulted from the analysis contained in the earlier, so we have a relationship as illustrated below:

[7] We can adopt, for example, the following linear function: $EP_t = D_t + a(B_t)$, which seems unlikely.

Figure 2. Substitutability of political and economic rent



Source: own elaboration.

The latter hypothesis, as shown previously and we confirm further on, seems to be more congruent to reality, because usually negative rate of substitution is derived. In a few cases, however, their positive values were obtained, which may indicate complementary relationships. As we will show later in the relevant visualizations, substitution is stronger in the case of agricultural producers having lower than higher production efficiency. The image becomes complicated in the case of producers of negative production efficiency, here the rent compensates for management irrationality.

1.3. Definition of economic rent

The first element of the equation (I.2) – economic rent, production efficiency is defined – for convenience of the conducted thinking – in value as the difference between revenues and costs of involvement of production factors:

$$EP = (C_R \cdot R - N \cdot C_N)_R \tag{I.3}$$

Of course, fixed prices occur here, hence technical relationships are reflected[8], because they imply from the technical data described, for example, by the production function.

When we assume the volatility of prices (the price scissors), i.e.:

[8] Therefore, the literature also implements the concept of technical efficiency.

$$c = C_R / C_N \tag{I.4}$$

this record expresses the indicator of production profitability:

$$OP = (C_R^t \cdot R_t - N_t \cdot C_N^t)_R \tag{I.5}$$

It is an indicator observed on the surface of phenomena, of course the most important for the current functioning, but it has an output and direct character for income. However, it does not explain their foundations.

In the TFP (*Total Factor Productivity*) convention the production efficiency can also recognized as:

$$EP = \frac{R \cdot C_R}{N \cdot C_N} = \frac{R \cdot C_R}{K \cdot C_K + L \cdot C_L} \tag{I.6}$$

With the assumption of fixed price relations, i.e. prices received to prices paid (price scissors), in a dynamic approach relevant for *TFP*, we can define it as:

$$\frac{\Delta EP}{EP} = \frac{\Delta R}{R} - \frac{\Delta N}{N} \approx \frac{\Delta R}{R} - (\frac{\Delta K}{K} + \frac{\Delta L}{L}) \tag{I.7}$$

and:

$$\frac{\Delta EP}{EP} > 0 \Rightarrow TFP \uparrow \tag{I.8}$$

when:

$$\frac{\Delta R}{R} > (\frac{\Delta K}{K} + \frac{\Delta L}{L}) \tag{I.9}$$

We can also express the growth rate (essentially logarithmic derivatives) of labour productivity as the difference between the rate of production growth and the rate of decline in employment of labour[9]:

[9] The drop in employment contributes of course to an increase in productivity.

$$\frac{\Delta W_L}{W_L} = \frac{\Delta R}{R} - \frac{\Delta L}{L} \tag{I.10}$$

Assuming that there are no data about income effects of agricultural policy, the rate of labour productivity growth should, somehow exclusively, shape the growth rate of labour wages, that is – the rate of growth of agricultural producers' income in the following way:

$$\frac{\Delta W_L}{W_L} \Rightarrow \frac{\Delta C_L}{C_L} \tag{I.11}$$

It is known that this is not like that in practice. The rate of growth of agricultural producers' income usually differs *in plus* from the rate of the growth of labour productivity factor:

$$\frac{\Delta C_L}{C_L} > \frac{\Delta W_L}{W_L} \tag{I.11a}$$

Due to the nature of production in agriculture, the growth rate of labour productivity is also expressed as the difference between the rate of growth of land factor productivity and the rate of change in the employment of labour. That is as:

$$\frac{\Delta W_L}{W_L} = \frac{\Delta Q_Z}{Q_Z} - \frac{\Delta L}{L} \tag{I.12}$$

where:

$\frac{\Delta Q_Z}{Q_Z} = \frac{\Delta R}{R} - \frac{\Delta Z}{Z}$ – means the rate of growth of land productivity factor as the difference of the rate of production growth factor and the use of land factor $\frac{\Delta Z}{Z}$.

We will not elaborate on the matter of sources and measuring the improvement of production efficiency, limiting to the above characteristics of the process of improving the efficiency in terms of changes in the *TFP* index which simultaneously takes into account a lot of production factors. We only note that the improvement in efficiency is the source of income growth, triggering of which

concerns a long period in which technical changes are possible (manufacturing techniques in the above formula of changes in relationship: $\frac{\Delta K}{K} / \frac{\Delta L}{L}$) as a result of investment. It is a source invisible on the surface of phenomena, as opposed to changes in relationships of product prices and production factors. It should be noted that the change in the efficiency relationships based on the incorporation of new technical solutions in the production process is associated with capital investment, which will be the subject of attention further in this paper.

The relationship of income to labour productivity in the mainstream economic literature is recognized as unit labour costs. It is one of the most important determinants of competitiveness indicators of the producer, sector or economy. It is important whether unit labour costs increase. If so, the wages grow faster than productivity. In our nomenclature, these indicators are as follows: $\frac{C_L}{W_L}$ and $\frac{\Delta C_L}{\Delta W_L}$. As it seems, these indicators are not observed in Polish agriculture.

1.4. Income vs labour productivity and price level

For further analysis, let us make the following assumptions. We can assume, in accordance with the theory of microeconomics, that the income of agricultural producers is essentially dependent on the labour factor efficiency and on a certain level of product prices under the principle of *ceteris paribus*[10]. Thus, we can express it as:

$$C_L = W_L \cdot C_R \tag{I.13}$$

and:

$$W_L = \frac{R_t}{L_t} \tag{I.14}$$

where:

C_L – an agricultural producer's income as remuneration of labour factor,

[10] Labour productivity reflects the impact of other sources and circumstances discussed at another, lower level of horizontal aggregation and abstraction. We can refer to such factors as: market position, the efficiency of organizations and finance, sales volume, different types of progress, knowledge, qualifications, collections, etc.

R_t – production (sold),

L_t – employment of labour (full-time, AWU or other type),

C_R – level of agricultural prices at a given time.

Labour productivity is of course internal source of income dependent on the agricultural producer, at least in the range allowed by the manufacturing technique and used technology. In turn, the level of prices of agricultural products (but also prices of purchased inputs, which we take here under the principle of *ceteris paribus*) is an exogenous source because it is shaped regardless of the agricultural producer[11].

Empirical illustration. The rate of income growth in agriculture in selected countries of the European Union is shown in Table 1. As we can see, when not taking subsidies into account, the rate of remuneration growth of labour factor is negative, which is due to the declining rate of labour productivity. The rate of labour productivity, accordingly ($\frac{\Delta W_L}{W_L} = \frac{\Delta Q_Z}{Q_Z} - \frac{\Delta L}{L}$) should be connected with the rate of land factor productivity growth and changes in labour factor inputs. In the absence of practically any changes in employment of labour factor, the de facto lack of progress in the concentration, the rate of remuneration depended on changes in land factor productivity, which is showed in the following table.

[11] Prices of agricultural products can be formed in at least two ways. Firstly, these could be market prices without considering the impact (support) of agricultural policy. This is the classical assumption that the market, market balance and the consequent and determining balance prices are the basis of the key mechanism regulating the choices or the behaviour of agricultural producers. Secondly, these could be intervention (minimum) prices, and thus containing support (subsidies) and having a strong income effect because, by definition, the level of these prices is higher than market prices. The literature concerning market intervention in agriculture is usually devoted mostly to that. This includes a whole range of methods – we will not elaborate on that – of support where the prices are the support transfer channel. From the point of view of this reasoning, it of course does not change the fact that the prices of agricultural products, regardless of the basis of their formation, is an exogenous source of income for the producer.

Table 1. Rate of growth of labour remuneration $\frac{\Delta C_L}{C_L}$ in agriculture in selected countries of the European Union in 2000-2010

Countries	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Belgium	-0.01	0.00	0.00	-0.03	-0.01	-0.03	-0.03	-0.03	-0.02	-0.03	-0.02
Czech Republic	-0.06	-0.02	-0.02	-0.07	-0.04	-0.04	-0.05	0.04	-0.14	-0.05	-0.05
Germany	-0.04	-0.04	-0.04	-0.04	-0.03	-0.02	-0.03	-0.02	-0.02	-0.02	0.00
Greece	-0.01	-0.01	-0.01	0.08	-0.01	-0.01	-0.03	-0.03	0.00	0.00	0.00
Spain	-0.01	0.00	-0.03	-0.05	0.01	-0.01	0.00	-0.02	0.01	-0.10	0.00
France	-0.01	-0.03	-0.03	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Italy	-0.01	0.01	-0.03	-0.05	0.00	-0.03	0.01	-0.03	-0.03	-0.03	0.02
Hungary	-0.07	-0.05	0.01	-0.11	-0.05	-0.06	-0.04	-0.10	-0.07	0.03	-0.01
The Netherlands	-0.01	-0.04	-0.02	-0.02	-0.05	0.00	-0.02	-0.02	-0.02	-0.01	-0.01
Poland	0.00	0.01	-0.11	0.01	0.00	0.00	0.00	0.00	0.00	-0.04	-0.05
Sweden	-0.01	-0.01	-0.01	-0.01	-0.01	-0.02	-0.01	-0.09	-0.04	-0.04	-0.06
Great Britain	-0.04	-0.03	-0.03	-0.05	-0.01	-0.01	-0.02	-0.02	-0.01	-0.02	0.00

Source: own calculations based on data from FAO, EUROSTAT.

Table 2. Rate of growth of land productivity in selected countries of the European Union in 2000-2009

Year / Country	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Belgium	0.6	2.7	3.2	4.2	2.3	1.4	0.7	-0.5	0.1	-0.9
Czech Republic	0.3	-2.1	-2.6	1.5	2.2	2.7	-0.8	2.4	2.5	1.7
France	-1.4	-0.5	-3.2	1.8	-0.6	1.8	-1.5	0.6	1.4	0.9
Germany	0.3	-1.1	-0.9	2.4	2.3	2.4	-1.2	0.9	0.1	0.6
Greece	-0.3	-0.6	6.9	1.4	9.9	-7.1	3.0	-12.4	-1.2	-6.7
Hungary	3.4	0.8	-0.6	3.9	3.5	4.0	-8.0	3.3	0.5	6.3
Italy	0.2	-0.7	-0.2	2.7	3.0	4.0	1.8	1.2	1.9	0.2
The Netherlands	-1.2	-1.6	-1.5	-5.8	-5.1	-4.8	2.4	2.4	2.5	1.0
Poland	2.2	3.2	4.7	6.7	6.2	4.3	1.5	0.6	3.4	1.1
Spain	2.7	6.1	3.9	2.9	-2.9	-2.2	1.5	4.5	3.1	-0.6
Sweden	0.8	0.9	-0.5	0.4	0.3	0.5	0.0	0.2	0.5	-0.2
Great Britain	-0.8	0.1	0.6	0.5	0.4	-2.8	-2.5	-1.4	0.3	1.4

Source: own calculations based on data from FAO, EUROSTAT.

Table 3. Changes in labour input (AWU) in selected countries of the European Union in 2005-2009 (year t-1 = 1)

Year / Country	2005	2006	2007	2008	2009	Average change
Belgium	0.995	1.000	1.010	1.052	1.044	1.99%
Czech Republic	0.911	0.972	0.987	0.892	0.992	-5.01%
France	1.000	0.985	0.990	0.990	1.000	-0.70%
Germany	1.005	1.027	1.004	1.000	0.996	0.63%
Greece	0.992	0.952	0.975	1.034	0.959	-1.80%
Hungary	1.011	0.995	0.984	1.064	0.889	-1.31%
Italy	0.993	0.993	1.060	0.979	0.957	-0.42%
The Netherlands	1.000	1.081	1.041	0.989	1.026	2.69%
Poland	1.000	1.000	0.989	1.011	0.994	-0.12%
Spain	0.965	0.963	1.038	1.037	1.035	0.70%
Sweden	0.993	1.071	0.993	0.980	1.007	0.83%
Great Britain	1.035	1.004	1.000	0.966	1.000	0.08%

Source: own calculations based on data from FADN.

1.5. Concept of political rent

The function of these effects of agricultural policy, or political rent: $g(B)$ expressed in the formula (I.2) can be written down as follows:

$$g(B) = \bar{T_R} + T_B \cdot Z_t \tag{I.15}$$

where:

$\bar{T_R}$ – means the income effects associated with market intervention in the framework of the organization of common markets, expressed as the average level of income support per farm;

$T_B \cdot Z_t$ – expresses direct area payments per unit of area and the total area of the agricultural land within the farm at a given time, which has a direct impact on the income of agricultural producers.

We can assume that the expected income effects (payments) of agricultural policy are expressed by the following function:

$$E[g(B)] = p(t) \cdot (T_B \cdot Z_t) \tag{I.16}$$

where:

$p(t) = p(f(R_{t-1})) = p(f(K_{t-1}, L_{t-1}))$ – payments linked to production obtained in the previous base period.

The income effect of agricultural policy presented in the formula (I.16) expresses the essence of a political rent. It is associated with the expectation of support, somehow due by definition, which is associated with rational expectations.

As demonstrated above, producers can be represented as a result of labour productivity and the level of prices of agricultural products, namely as:

$$C_L = (\frac{R_t}{L_t}) \cdot C_R^t = W_L \cdot C_R^t \tag{I.17}$$

and:

$$C_L = W_L \cdot C_R^t \tag{I.18}$$

The actually realized income of producers must of course take into account the political rent B_t, so:

$$C_L^R = C_L + B_t \tag{I.19}$$

What is evident, the income actually realized result, firstly, from the labour productivity at given prices (endogenous source) and, secondly, are the result of direct payments (exogenous source). The above formula can also be written as:

$$C_L^R \approx W_L \cdot C_R + B_t \tag{I.20}$$

Realized income is determined by the rate of labour productivity, the level of prices of agricultural products (purchase prices) and level of support and transfers.

The formula (I.20) can be presented in a different way, i.e. by expressing separately producer-dependent factors – labour productivity (at given prices) – and independent ones – support under the CAP. Hence we have (I.21):

$$B_t + C_L^R \approx W_L \cdot C_R \tag{I.21}$$

Assuming there is no change in labour productivity, agricultural producers' incomes depend on: a) the level of prices received – purchase prices; b) the level of direct payments – area payments. This is a breakdown of the sources: market and policy-related (*transfer-seeking*). It is an obvious confirmation of the factual state. This approach is the basis for agricultural policy, especially income policy. The income effect of the policy can in fact be achieved either by prices or by direct transfers. The effect of the two solutions is essentially the same. We can only point to the different sources and effects of support through prices or direct support. Subsidies through prices charged consumers more, direct payments more affect taxpayers. However, in fact it is the same.

Shares (in % or in the range of 0-1) of these sources of income can be expressed as follows:

$$1 = \frac{C_L}{C_L^R} + \frac{B_t}{C_L^R} \tag{I.22}$$

The level of the second component of the right side of the above formula, i.e. the share of payments in income, is already within the range of 50 to 80%. This applies to agriculture of most EU Member States, including the Polish agriculture, also in the system of area groups and the regional system.

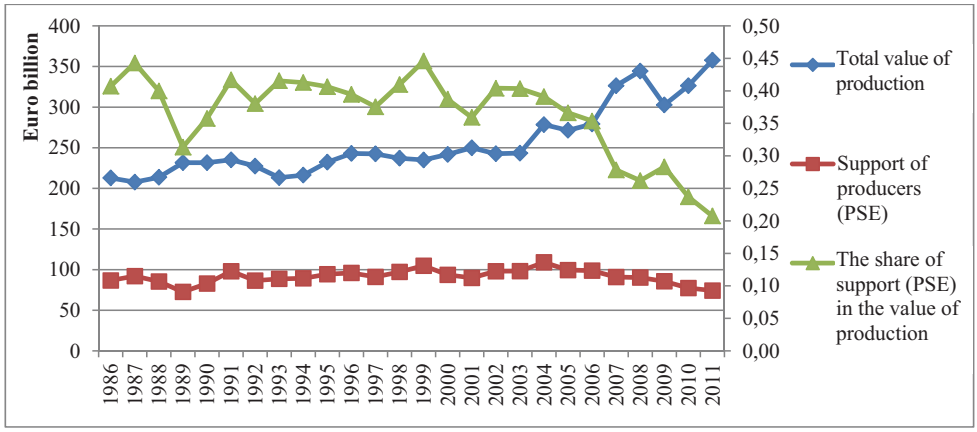
Empirical illustration. For the evaluation of the discussed political rent, i.e. income effects associated with support in the form of direct payments and other transfers, we show the cost and value of production, and the share of support in the value of production (Table 4, Figure 3, Figure 4). The evaluation was performed in individual groups of agricultural producers, i.e. with predominant livestock production (group a), with predominant crop production (group b), and without a specific type of production (group c) in the years 2004-2011. In each of the analysed groups, there is a noticeable increase in the share of support in the value of production (the average level of income support per farm is increasing), which confirms the achievement of positive income effects.

Table 4. Share of support in the value of production in selected EU countries in 2005-2009

Year / Country	2004	2005	2006	2007	2008	2009
Belgium	9.13%	9.83%	11.40%	11.65%	12.22%	12.64%
Czech Republic	13.63%	18.18%	23.13%	21.43%	25.14%	30.04%
France	20.83%	21.28%	22.03%	18.82%	18.84%	20.89%
Germany	18.01%	17.93%	18.55%	15.52%	16.81%	19.27%
Greece	23.79%	22.89%	34.00%	30.73%	32.13%	33.95%
Hungary	16.53%	19.52%	21.44%	19.31%	17.68%	24.91%
Italy	10.14%	10.91%	11.80%	9.69%	9.78%	10.65%
The Netherlands	3.33%	4.66%	4.65%	4.22%	4.01%	4.28%
Spain	15.16%	16.81%	16.59%	13.01%	16.64%	19.92%
Sweden	24.56%	24.82%	25.55%	22.38%	23.39%	27.94%
Great Britain	23.53%	23.48%	23.38%	20.41%	19.14%	21.41%

Source: own calculations based on data from FADN.

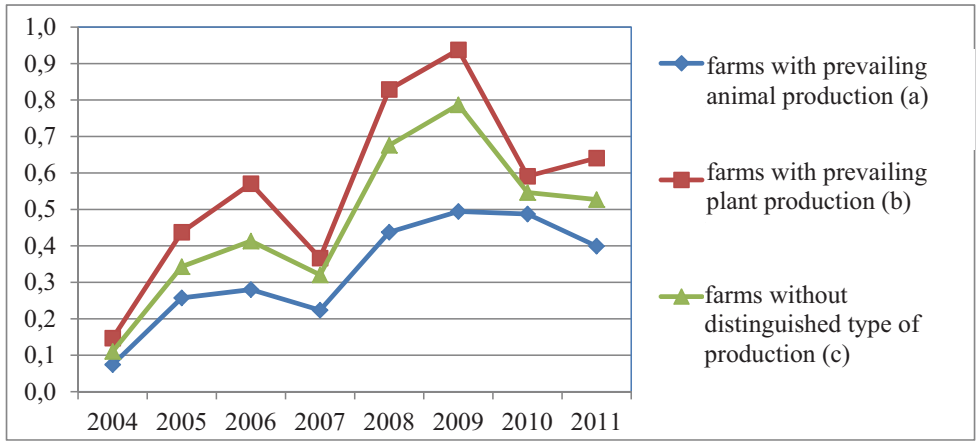
Figure 3. Value of agricultural production and support of producers (PSE) in the EU in 1986-2011



Source: own calculations based on OECD Stats.

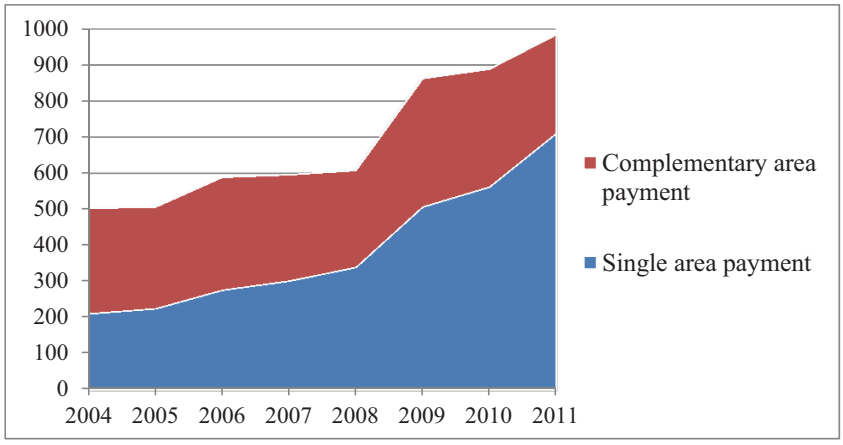
As indicated by the analysis of the data presented in Table 5, in most of the countries of the EU the share of support in the production value increases or remains at a relatively constant level. The value of manufactured production in Great Britain is a notable exception, which has a decrease in the share of support. This may indicate an increase in management efficiency in the agricultural sector. In other cases, the increase of support in the production value, may be evidenced by comments on the relative substitution of progress in production efficiency.

Figure 4. Share of subsidies in income of family farms in Poland in 2005--2011 for groups of farms with prevailing livestock (a), plant production (b) and without a separate type of production (c)



Source: own calculations based on data from FADN.

Figure 5. Changes in the rates of area payments (in PLN) in Poland in the period 2004-2011



Source: Bułkowska M., Efekty WPR w odniesieniu do rolnictwa, [in:] Analiza efektów realizacji polityki rolnej wobec rolnictwa i obszarów wiejskich, Program Wieloletni, no. 26, Publ. IERiGŻ-PIB, Warsaw 2012, pp. 56-78, p. 76.

Table 5. Changes in the rates of payments in the period 1999-2011 (year t-1=1)

Specification \ Year	2005	2006	2007	2008	2009	2010	2011
Single area payment	1.069	1.228	1.091	1.125	1.494	1.109	1.264
Complementary area payment	0.964	1.110	0.941	0.913	1.324	0.918	0.839
Total	1.008	1.172	1.185	1.209	1.716	1.767	1.957

Source: own elaboration based on Bułkowska M., Efekty WPR..., p. 76.

The analysis of data presented in such a way is obvious and strengthens the comments and conclusions of analytical reasoning and the preceding empirical illustration. Payments, also in unit dimension, are becoming more significant. Moreover, this is accompanied by a steady increase in purchase prices. These considerations on the one hand do not force improvement of production efficiency and labour productivity as sources of income, on the other hand they may be a reflection of the lack of progress in this regard, which results from the analytical formulas and conclusions derived above. The increase in direct payments and maintaining product prices is a very favourable management condition for agricultural producers. This relative flexibility or softness of conditions and financial constraints, next to the positive effects, may have some negative consequences. It may, however, be a dangerous phenomenon in the long term because it undermines the preparation of agricultural producers to confrontation in terms of efficiency in an open global market with other producers in the face of the abolition of this type of support. They may, however, be neutralized due to the catalysing influence of political rent on implemented investment of agricultural producers, which is the theme of the last chapters of this monograph.

II. Substitution between economic and political rent

The agricultural producer, following the terms of rational choice (also the mentioned rational expectations), uses more the source which is more favourable and less expensive for him. Improving the utilization of efficiency of used production factors at given pricing relationships is always difficult. Utilization of income effects of agricultural policy does not take place without effort either, but it seems to be cheaper. Therefore, we uphold the thesis that the producer, behaving rationally, may be willing to reach for cheaper and more effective solutions, the effects of agricultural policy, rather than the more expensive but more durable which is to improve efficiency. This will especially concern shorter periods, which in economics refers to periods in which technical changes are not possible or their results do not emerge.

2.1. Marginal rate of substitution of both rents

To prove the aforementioned, let us assume that there is full and continuous substitutability of these two sources of income changes in an agricultural producer which we derived in the first chapter. Furthermore, we assume that we consider this phenomenon for a given level of the agricultural producer's income, or a fixed level of income in a given unit of time. Increasing the use of a single source (factor) without changing the level of income must therefore be made at the expense of reducing the use of another. As a result of these assumptions, the complete differential of agricultural producer's income in a given time:

$$D = f(EP, B) \Rightarrow \max \tag{II.1}$$

is zero, so we have:

$$dU_R = \Delta EP \frac{\partial U_R}{\partial EP} + \Delta B \frac{\partial U_R}{\partial B} = 0 \tag{II.2}$$

where:

$\Delta EP \frac{\partial U_R}{\partial EP}$ – means the income effect of improving the efficiency of production, that is, economic rent;

$\frac{\partial U_R}{\partial EP}$ – can be defined as the marginal utility of improving the efficiency of agricultural producer incomes, that is from the point of view of the fulfilment of its objective functions;

$\Delta B \frac{\partial U_R}{\partial B}$ – means the income effect of increasing the scope of agricultural producer support under the CAP, that is political rent;

$\frac{\partial U_R}{\partial B}$ – can be defined as the marginal income utility of support under the CAP for the realization of the objective function of agricultural producer.

The agricultural producer therefore optimizes his choice (reaches equilibrium)

$$\pm \Delta EP \frac{\partial U_R}{\partial EP} = \mp \Delta B \frac{\partial U_R}{\partial B} \tag{II.3}$$

that is when the benefits of measures meant to improve the production efficiency with respect to actions for the use of intervention benefits and any support get equalized. The producer equalizes the marginal utility of these two sources to improve his objective function[12]. This condition means that the agricultural producer is in equilibrium, which means that he maximizes his objective function, that is income, when the income effect of the policy is equal to the loss of income effect as a result of deterioration in the production efficiency. This decrease in production efficiency stems from the fact that, as a result of support, the need to improve the efficiency decreased when compared to what it would be if this support was not there[13]. We should also bear in mind that these are the relative and individual sizes because they are referred to the given level of production (at a given isoquant).

An agricultural producer, behaving rationally, will choose the easier solution even though he may get dissuaded by more and more bureaucratic and cumbersome procedures (generating increasingly higher transaction costs) associated with obtaining a transfer within the agricultural policy tools. Furthermore, on the

[12] Minus sign was omitted in this place not to suggest the direction of substitution between these two sources of improving income of the agricultural producer.

[13] The direction of substitution discussed on the basis of the above formula can also be reversed, i.e. increasing income effects of efficiency improvement replace the need of support from the agricultural policy. However, it seems less likely.

basis of rational expectations, he can always expect matching the level of support to the deteriorating economic situation in agriculture, to decrease in profitability etc. usually, he gets great political, journalistic and scientific support here.

Formally, the condition of substitution between these two sources of realization of the agricultural producer's objective function can be written as:

$$s_{EP/B} = \frac{\Delta EP}{\Delta B} = -\frac{\frac{\partial U_R^{EP}}{\partial EP}}{\frac{\partial U_R^{B}}{\partial B}} \tag{II.4}$$

This rate of substitution is determined by the relation of utility of these two sources of income maximization for agricultural producers, utility understood as a source of obtaining this income. This approach can be called an attempt to describe the mechanism of behaviour or choice of agricultural producer in the conditions of the occurrence of an active agricultural policy focused on income goals[14].

2.2. Substitutability of effects of the policy and labour productivity

Based on the above considerations, we can narrow the hypothesis and assume that income effects of agricultural policy substitute the need to improve the labour productivity. To put it illustratively, assuming that the complete differential of income:

$$dC_L = 0 \tag{II.5}$$

so that refers to the same level of income for the producer, and the lack of increase in prices:

$$\Delta C_R = 0 \tag{II.6}$$

for we have:

$$-\Delta W_L = +\Delta B_t \tag{II.7}$$

[14] In fact, there is no other agricultural policy unless by agricultural policy one wants to pursue more general objectives as currently in the CAP objectives related to environmental protection, which is fashionably referred to as a matter of greening the CAP.

Then determining marginal gains of income against labour productivity and terms of payments to income, properly solving for the given level of income in the equation:

$$C_L = \bar{W}_L \cdot \bar{C}_R^t + B_t$$

and putting the above as marginal profitability of both of these sources, we obtain:

$$\Delta W_L \frac{\partial C_L}{\partial W_L} = \Delta B_t \frac{\partial C_L}{\partial B_t} \tag{II.8}$$

As a result, we can get the following rate of substitution between the two sources of income growth (implicitly for the their level):

$$\frac{\Delta W_L}{\Delta B_t} = \frac{\frac{\partial C_L}{\partial B_t}}{\frac{\partial C_L}{\partial W_L}} \tag{II.9}$$

The marginal rate of substitution of labour productivity by the effects of agricultural policy depends on the marginal impact of productivity performance and the effects on income, i.e. the relationship of marginal profitability. It is obvious that rationally behaving agricultural producers must be more focused on this source which has more, as defined in this way, marginal profitability. It can be assumed that the marginal impact of agricultural policy on income (their growth) is higher than the effect of improving labour productivity in this field:

$$\frac{\partial C_L}{\partial W_L} < \frac{\partial C_L}{\partial B_t} \tag{II.10}$$

It seems that estimates confirm this because: $\frac{\partial C_L}{\partial B_t}$ amounted in 2010/2009 to 1.6; that is one unit (one PLN) of subsidy growth corresponded to income growth by 1.6 PLN, while the indicator: $\frac{\partial C_L}{\partial W_L}$ was indefinite because labour

productivity did not increase (decreased), which also indicates a lack of association between changes in remuneration and labour productivity.

2.3. Cost of obtaining income effects of both rents

This rate of substitution conditioned, as shown above, by the relation of marginal utility of improving the production efficiency (economic rent) and agricultural policy (political rent) for income needs to be compared with the costs of obtaining these utilities. However, it is not easy with this because it is difficult to establish a limit on these costs as a condition for the objective function of the manufacturer due to these two factors discussed. It would be easier to determine the cost of the marginal utility of improving the efficiency than the cost of obtaining this utility under policy (participation in the specific programs or mechanisms). This requires additional analysis and studies. Here, only to outline the direction of reasoning, we can assume as follows. The total "cost" associated with the release of these sources of income can be defined as:

$$kd = EP \cdot kd_{EP} + B \cdot kd_B \tag{II.11}$$

where:

kd_{EP} – costs of obtaining the income effects from economic rent,

kd_B – costs of obtaining the income effects from political rent.

Assuming that costs of using both rents defined in that way have a size given in advance (a limit at a given time t), their complete differential is equal to zero, i.e.:

$$d(kd) = \Delta EP \cdot kd_{EP} + \Delta B \cdot kd_B = 0 \tag{II.12}$$

Thus, the cost of marginal rate of substitution of income effect of economic and political rents will be as follows:

$$s_{EP/B} = \frac{\Delta EP}{\Delta B} = -\frac{kd_{EP}}{kd_B} \tag{II.13}$$

It is a condition of the optimum producer's choice due to the two analysed factors for maximization of income as the objective function.

It is easy to assemble these marginal rates of substitution to get the idea about the mechanism of producer's choice in the field of rents discussed here as sources of income and its maximization. We can probably assume that:

$$kd_{EP} > kd_B \tag{II.14}$$

As we can assume, this prejudges the direction of substitution in the analysed range of both rents. It can be interpreted as the situation in which political rent somehow displaces the economic rent.

2.4. Elasticity of substitution of economic and political rent

We can deepen the analysis of the issue of substitution of both rents by introducing the elasticity of substitution. We can assume for a given level of earned income $D_R = f\{EP, B) = D_R^*$ certain shares of both analysed rents, i.e. political rent and economic rent, and cost, respectively as:

$$\frac{EPk_{EP}}{D_R^*} \tag{II.15}$$

and

$$\frac{Bk_B}{D_R^*}\,\pi_t = D(L, Z) + G(gD^E, \varepsilon_G) \tag{II.16}$$

Thus, the relationship between shares of both rents and the cost will be as follows:

$$\frac{\frac{EPk_{EP}}{D_R^*}}{\frac{Bk_B}{D_R^*}} = \frac{EPk_{EP}}{Bk_B} = \frac{\frac{EP}{B}}{\frac{k_B}{k_{EP}}} \tag{II.17}$$

These relations of both rents in the producer's income are determined by the relationship of costs to obtain them. This indicates that the substitutability of the two rents is reported against the cost of obtaining them.

This formula has essentially the same importance as the ratio of substitution elasticity, in this case the economic and political rent to achieve the same level of income in relation to changes in the cost of obtaining them. If the marginal rate of substitution is put as above, substitution rate of both rents is equal to the inverse of the cost of obtaining them. Thus, the above expression in the convention of substitution elasticity (arc or at intervals) can be written as:

$$\delta = \frac{\frac{\Delta(EP/B)}{Ep/B}}{\frac{\Delta(k_B/k_{EP})}{k_B/k_{EP}}} \tag{II.18}$$

The share of both rents in the forming income is flexible or varies with respect to changes in the cost of obtaining them. It can be assumed that the cost of obtaining income effects from economic rent, i.e. to improve the production efficiency is higher than the cost of obtaining the effects of political rent. Hence the elasticity of substitution of economic rent by political rent is high. The direction of substitution of economic rent by political rent as a source of income is easy to predict. This is showed in the following transformation of the above formula of elasticity substitution:

$$\frac{\Delta(k_B/k_{EP})}{k_B/k_{EP}} = \frac{1}{\delta} \cdot \frac{\Delta(EP/B)}{EP/B} \tag{II.19}$$

The direction of changes in the share of both rents in shaping income is determined by changes in the relationship of costs of obtaining income effects of both rents. This follows from the relationship, and the rate of cost substitution shown above. The elasticity of substitution costs and effects is inversely proportional.

2.5. Demand and costs of obtaining income effect from both rents

At the given cost limit for a given income, it can be assumed that the producer's choice of the discussed rents as a source of income will create his "demand" on these rents. In the corresponding transformation of the cost equation, we have:

$$kd = EP \cdot kd_{EP} + B \cdot kd_B \tag{II.20}$$

where:

kd – total cost of obtaining the income effect from economic and political rents,

kd_{EP} – total cost of obtaining the income effect from improvement of production efficiency – from economic rent,

kd_B – total cost of obtaining the income effect from political rent – with solutions and mechanisms of agricultural policy.

Hence we obtain the equation of agricultural producer's demand for alternative – in a sense, which results from the limitations of this equation – income sources which are the discussed income effects of increasing efficiency and agricultural policy. So we have:

$$B = \frac{kd}{kd_B} - \frac{kd_{EP}}{kd_B} \cdot EP \tag{II.21}$$

This means that the demand for income effects of agricultural policy is determined by the relative cost of obtaining these effects, i.e. in relation to the total cost of obtaining income and in relation to the alternatives (substitution) costs of obtaining income effects from efficiency improvements at its given level. In fact, it expresses the discussed contemporary decision-making dilemma of agricultural producer of how many income benefits there are of the solutions of agricultural policy in relation to the efforts to improve efficiency. The analysis of the following equation, only in the opposite direction, has a similar nature.

$$EP = \frac{kd}{kd_{EP}} - \frac{kd_B}{kd_{EP}} \cdot B \tag{II.22}$$

The dependencies described with the abovementioned formulas which affect the producer's choice are substitutable. This can be interpreted in the following way. An increase in the cost of obtaining income effects due to improvement of production efficiency in relation to the costs of obtaining income effects in relation to the total cost as limitations will of course make producers to orient themselves and increase the demand for the solutions of agricultural policy as a source of income, and will reduce the demand for pro-efficiency action. The conclusion is in accordance with the intuitive perception and explanation of real economic phenomena. It is also consistent with the assumption of rational adaptive behaviour of the

agricultural producer. The conclusions imply from deductive reasoning based on the converted formulas, so they results from analytical approach.

The slope of these lines resulting from these demand equations is defined by the ratio of:

$$-\frac{kd_{EP}}{kd_B} \tag{II.23}$$

and

$$-\frac{kd_B}{kd_{EP}} \tag{II.24}$$

This relationship is the ratio of the cost of obtaining income effects from political and economic rent. They only confirm substitutability of the cost of obtaining these two sources of income. It is highlighted more by the following transformation of costs shown above associated with the two sources defined by the equation: $kd = EP \cdot kd_{EP} + B \cdot kd_B$.

After its dynamization, we obtain the growth rate of the cost of using both rents:

$$\frac{\Delta k_{EP}}{k_{EP}} = \frac{\Delta EP \cdot kd_{EP}}{EP \cdot kd_{EP}} \quad \text{and} \quad \frac{\Delta k_B}{k_B} = \frac{\Delta B \cdot kd_B}{B \cdot kd_B} \tag{II.25}$$

that is

$$\Delta k_{EP} = \Delta EP \cdot kd_{EP} \tag{II.26}$$

and:

$$\Delta k_B = \Delta B \cdot kd_B \tag{II.27}$$

Then, dividing their sides, we obtain the proportions of changes in the costs associated with obtaining income effects from political and economic rent:

$$\frac{\Delta k_{EP}}{\Delta k_B} = \frac{\Delta EP}{\Delta B} = \frac{kd_{EP}}{kd_B} \tag{II.28}$$

which is an extension of the condition shown above, in a sense the optimum choice of the agricultural producer because of these two arguments, namely political and economic rent due to minimization of cost of yielding income effect.

It is also easy to demonstrate that this relationship is the reference point for the condition of minimizing the cost of obtaining income. Putting income again in terms of realized economic and political rent, but as a general function, which is as follows:

$$D_t = f\{EP, B) \tag{II.29}$$

we have a condition when the agricultural producer obtains his income in the most economical or rational way:

$$\frac{\partial D_R / \partial B}{kd_B} = \frac{\partial D_R / \partial EP}{kd_{EP}} \tag{II.30}$$

and

$$\partial U_R^B = \frac{\partial D_R^B}{\partial B},\ \partial U_R^{EP} = \frac{\partial D_R^{EP}}{\partial EP} \tag{II.31}$$

This means that an agricultural producer, acting rationally, minimizes the cost of obtaining income in relation to economic and political rent when the income effect resulting from a single PLN (cost) spent on both rents will have the same effect. This is important because it implies high rationality of agricultural producer maximizing the effect that every PLN spent on one or the other source of income. Of course, this is one more piece of evidence confirming the thesis. There can be only one analytical result. The effectiveness of one PLN (cost) spent on the use of political rent must be higher than in the case of a PLN spent on improving the production efficiency. Fulfilment of this condition seems to be obvious.

III. Empirical illustration of formation of the substitution of both rents

To illustrate empirically the dependences shown in analytical reasoning in the two previous chapters and the adequacy of mathematical formulas given there, we have conducted a study for the FADN farms with prevailing animal production (a), plant production (b) and without a distinguished type of activity (c). First, we calculated the marginal rate of substitution of economic rent by political rent, then the scope and nature of substitution. We showed that in a graphic layout for the given isoquants.

3.1. Empirical values of marginal rates of substitution of both rents

It can be noted that in most of the analysed years (2005-2011) negative index of the marginal rate of substitution was recorded according to the analytical approach to the analysed issues. This confirms the occurrence of substitution between the two rents. This is consistent with the assumptions of the above analytical reasoning referred to a given level of production. Their high values indicate a broad scope of this substitution of economic rent by political rent. In particular, the high negative values of the marginal rate of substitution are related to the so-called negative income of agricultural producers in some periods and total dependence on income from subsidies. This is not good news, however, from the point of view of economic rationality and the prospects of agriculture.

Complete dependence on income from payments proves irrational technical relations and zero or negative labour productivity. The question arises whether the absence of positive labour productivity and thus the dependence on income from payments is due to the fact that they are in place or maybe that payments must be transferred because the performance is negative. Nevertheless, the negative marginal rate of substitution indicates that the income effects of policy, political rent is displacing economic rent, so the effects may be accompanied by deterioration of production efficiency, which has already been pointed out and illustrated. In the case of positive value of the marginal rate of substitution, with certain simplifications, we can treat this as a complementarity of both rents.

Table 6. Changes in economic and political rent, and substitution rate between rents among farms in Poland in 2005–2011 (year t-1 = 100, ΔEP and ΔB in PLN) for group (a)

Farms with prevailing animal production (a)							
Specification	2005	2006	2007	2008	2009	2010	2011
ΔEP	-2445	22651	-3425	-26560	-5981	10494	21135
ΔB	11063	9798	-6670	10880	2322	13749	2460
substitution rate	-0.22	2.31	0.51	-2.44	-2.58	0.76	8.59

Source: own calculations based on data from FADN.

Table 7. Changes in economic and political rent, and substitution rate between rents among farms in Poland in 2005–2011 (year t-1 = 100, ΔEP and ΔB in PLN) for group (b)

Farms with prevailing plant production (b)							
Specification	2005	2006	2007	2008	2009	2010	2011
ΔEP	-10534	-2833	21642	-36165	-7532	-31436	-2497
ΔB	15375	14446	-7783	21540	16122	-882	4833
substitution rate	-0.69	-0.20	-2.78	-1.68	-0.47	35.66	-0.52

Source: own calculations based on data from FADN.

Table 8. Changes in economic and political rent, and substitution rate between rents among farms in Poland in 2005–2011 (year t-1 = 100, ΔEP and ΔB in PLN) for group (c)

Farms without a prevailing type of production (c)							
Specification	2005	2006	2007	2008	2009	2010	2011
ΔEP	-5215	7902	6703	-29295	-6777	25678	8755
ΔB	12592	11206	-5757	16751	8332	7289	3929
substitution rate	-0.41	0.71	-1.16	-1.75	-0.81	3.52	2.,23

Source: own calculations based on data from FADN.

3.2. Empirical values of the elasticity of substitution of both rents

Similar inferences regarding the first and second hypothesis should result from the analysis of elasticity of substitution of both analysed rents, political and economic one. Elasticity of substitution of both rents (without consideration of cost flexibility) determined based on the relationship $\frac{\Delta(EP/B)}{EP/B}$ is presented in Table 6.

Table 9. Elasticity of substitution of changes in relation of political rent to economic rent against the relation of political rent to economic rent among farms in Poland in 2005-2011 (year t-1 = 100, EP and B in PLN)

Farms with prevailing animal production (a)							
Specification	2005	2006	2007	2008	2009	2010	2011
Δ(EP/B)	-9.514	-0.297	0.833	-2.274	-0.290	0.014	0.466
EP/B	3.059	2.762	3.595	1.322	1.032	1.046	1.512
Substitution elasticity	-3.110	-0.107	0.232	-1.720	-0.281	0.014	0.308

Source: own calculations based on data from FADN.

Table 10. Elasticity of substitution of changes in relation of political rent to economic rent against the relation of political rent to economic rent among farms in Poland in 2005-2011 (year t-1 = 100, EP and B in PLN)

Farms with prevailing plant production (b)							
Specification	2005	2006	2007	2008	2009	2010	2011
Δ(EP/B)	-4.862	-0.710	0.981	-1.515	-0.205	0.478	-0.080
EP/B	1.628	0.919	1.899	0.385	0.180	0.658	0.578
Substitution elasticity	-2.986	-0.773	0.516	-3.935	-1.139	0.726	-0.138

Source: own calculations based on data from FADN.

Table 11. Elasticity of substitution of changes in relation of political rent to economic rent against the relation of political rent to economic rent among farms in Poland in 2005-2011 (year t-1 = 100, EP and B in PLN)

Farms without a prevailing type of production (c)							
Specification	2005	2006	2007	2008	2009	2010	2011
Δ(EP/B)	-6.337	-0.566	0.687	-1.694	-0.243	0.505	0.075
EP/B	2.166	1.600	2.287	0.594	0.351	0.855	0.931
Substitution elasticity	-2.925	-0.354	0.300	-2.853	-0.693	0.590	0.081

Source: own calculations based on data from FADN.

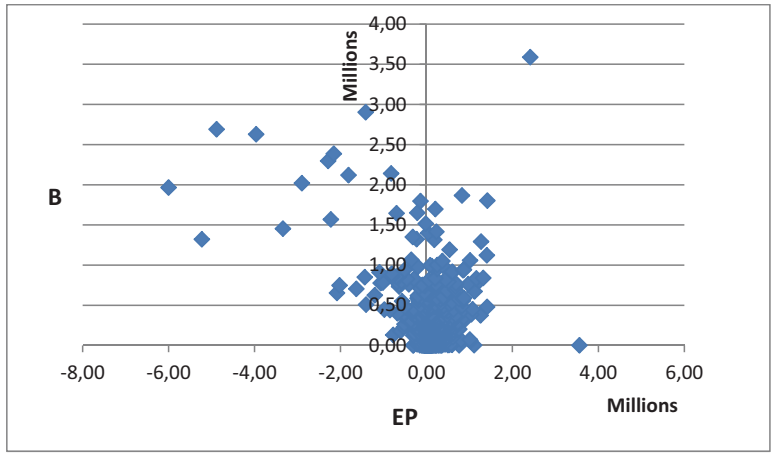
Elasticity of substitution (in most of the analysed years) tends to be negative. This obviously confirms earlier observations that political rent displaces economic rent. The relationships of economic rent to political rent are decreasing, as well as the increments of these relationships. The former show, of course, a growing share of political rent in relation to economic rent in shaping income. The latter are not expressed so unambiguously although the trend is positive. The values are not regular due to the absence of data smoothing. However, in

most of the analysed years, there is negative substitution elasticity, indicating validity of the second hypothesis about the substitution relationship between the two rents, which means that economic rent is displaced by political rent. This does not apply, however, the recent years of analysis, where the results may indicate a complementary relationship.

3.3. Graphic illustrations of substitution of analysed rents

The following graphic illustrations based on data from empirical FADN for different types of farms are important for inference regarding the issue of substitutability of economic rent by political rent. These graphic illustrations somehow synthesize the above inference and are an illustrative premise to accept the hypothesis of substitutability.

Figure 6. Relationship between the level of efficiency (EP) and the level of support (B) for all farms from the group with prevailing plant production (b) at EP <0 and EO >0 (regardless of the level of production efficiency), but at B>0 in 2011



Source: own elaboration based on data from FADN.

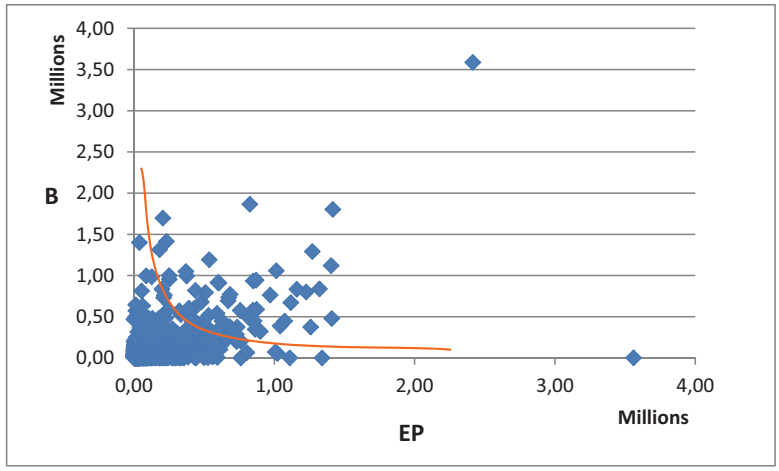
A number of conclusions can be drawn from the analysis of the graphic image for all farms regardless of the level of production efficiency. The most important conclusion, however, is that the effects of political rent are implemented in complete isolation from production efficiency, i.e. economic rent. Moreover, the deepening of inefficiency does not affect the decrease in the use of political rent.

It is showed by the data for the interval EP <0. From the arrangement of points for this interval, we can also have converse conclusions that political rent was a necessary condition for obtaining positive income at such negative production efficiency. In this situation, one can think whether political rent leads to such inefficiency or vice versa – in fact, the income effects, it is necessary because there is such inefficiency. We can assume that it is one of the reasons for maintenance of this type of farms. However, this requires a separate study, e.g. on technical relationships in the analysed farms. In this range EP <0, we can see that there is no relationship between political rent and economic rent, i.e. neither there is a clear substitutional nor complementary relation, more the latter, as evidenced by the position and slope of straight lines for EP <0. Political rent is likely to be treated as a certain receivable, but in light of the hypothesis of substitutability between the two rents, the outline does not confirm it. Political rent is here some compensation of negative offset effectiveness petrifying irrationality of management or fulfils distinct social functions.

The dependencies are arranged differently and more in accordance with the reasoning based on analytical formulas if we distinguish a group of farms with positive production efficiency, that is somehow pursuing economic rent (EP> 0). In this case, for lower values of EP and B, a clear substitutional link between the obtained support (political rent) and improved efficiency (economic rent) is noticeable – in most presented years (2006-2011). For higher values of EP, i.e. more efficient producers, there is no substitute relationship between political rent and economic rent. This is an important observation for agricultural policy oriented towards efficient producers and not the policy of a social nature. Also in the case where the dependencies are tested simultaneously for EP <0 and EP> 0, the one for the latter quarter is dominated by substitution curves.

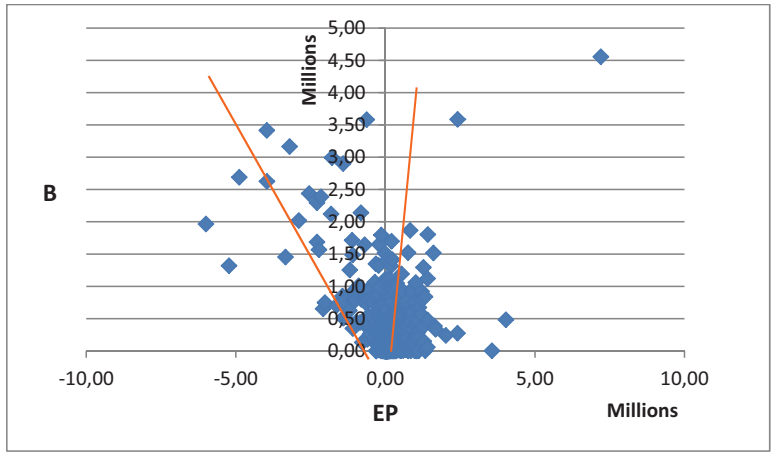
If the line, regardless whether for EP> 0 or EP <0, is almost vertical, it means no relationship between the rents, which can be interpreted as a receivable collected by agricultural producers in complete isolation for production efficiency. It is not a negative connotation, it is somewhat related with the essence of such direct payments detached from production.

Figure 7. Relationship between the level of efficiency (EP) and the level of support (B) for all farms from the group with prevailing plant production (b) at EP>0 and B>0 in 2011



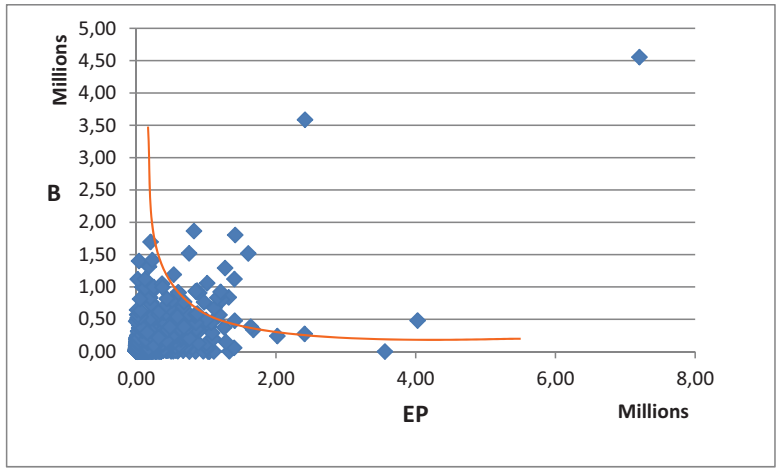
Source: own elaboration based on data from FADN.

Figure 8. Relationship between the level of efficiency (EP) and the level of support (B) for all farms from the group (c) without a prevailing type of production for EP >0 and EP <0 at B>0 in 2011



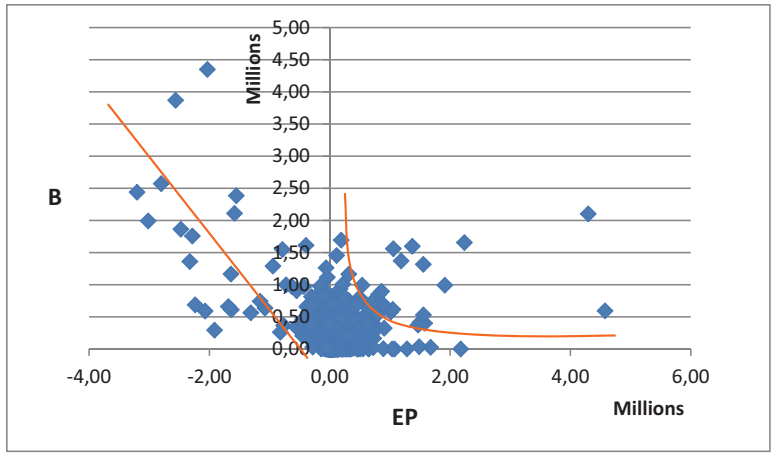
Source: own elaboration based on data from FADN.

Figure 9. Relationship between the level of efficiency (EP) and the level of support (B) for all farms from the group (c) without a prevailing type of production at EP>0 and B>0 in 2011



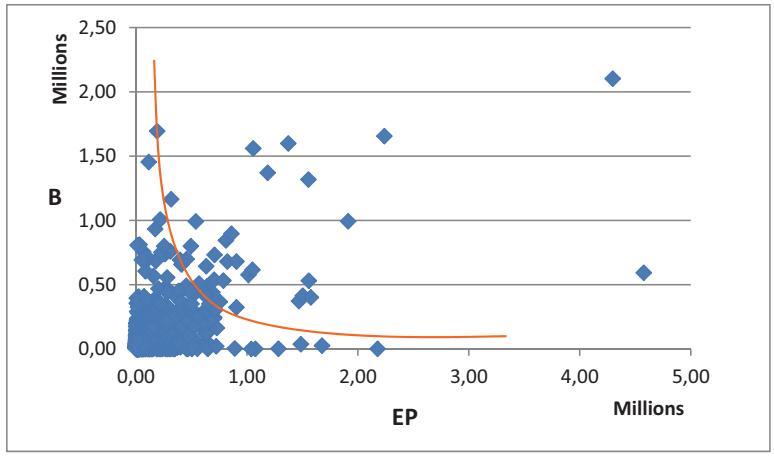
Source: own elaboration based on data from FADN.

Figure 10. Relationship between the level of efficiency (EP) and the level of support (B) for all farms from the group with prevailing plant production (b) for EP <0 and EP >0 at B>0 in 2010



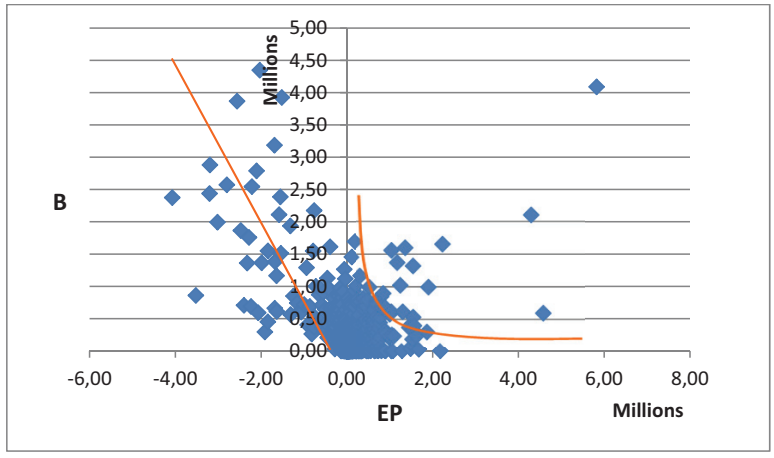
Source: own elaboration based on data from FADN.

Figure 11. Relationship between the level of efficiency (EP) and the level of support (B) for all farms from the group with prevailing plant production (b) at EP>0 and B>0 in 2010



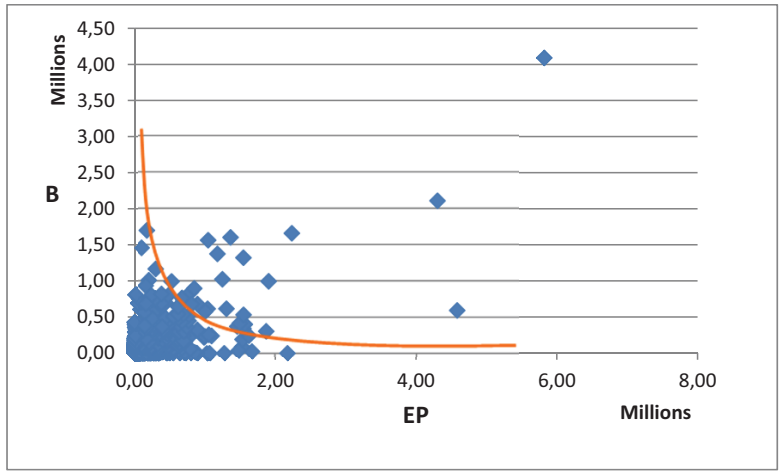
Source: own elaboration based on data from FADN.

Figure 12. Relationship between the level of efficiency (EP) and the level of support (B) for all farms from the group (c) without a prevailing type of production for EP<0 and EP>0 and B>0 in 2010



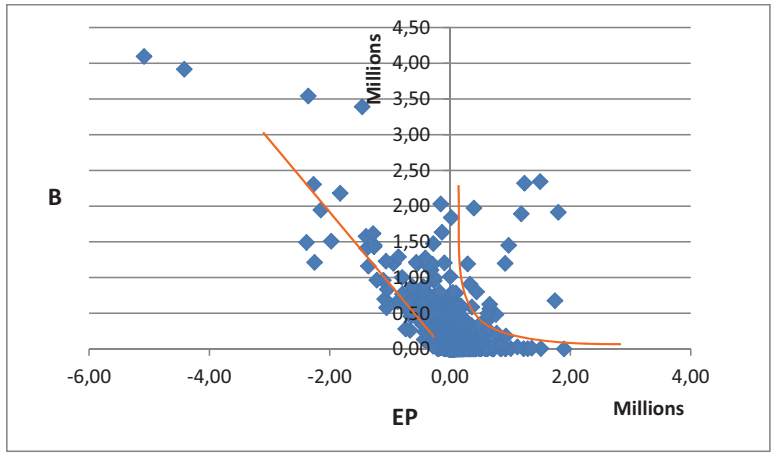
Source: own elaboration based on data from FADN.

Figure 13. Relationship between the level of efficiency (EP) and the level of support (B) for all farms from the group (c) without a prevailing type of production at EP>0 and B>0 in 2010



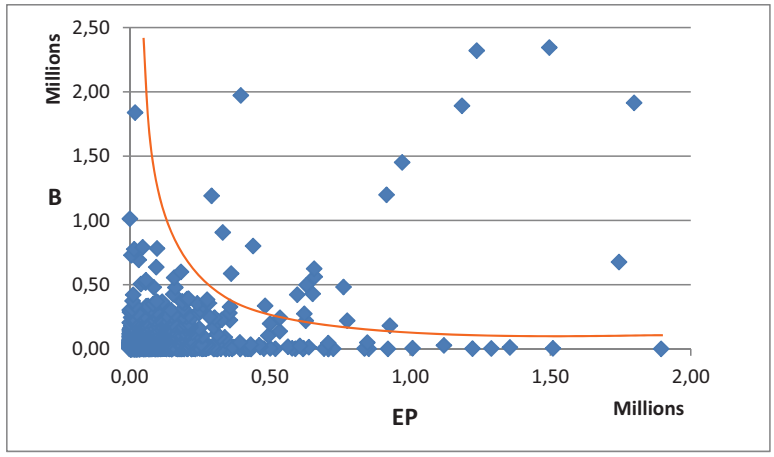
Source: own elaboration based on data from FADN.

Figure 14. Relationship between the level of efficiency (EP) and the level of support (B) for all farms from the group with prevailing plant production (b) for EP>0 and EP <0 at B>0 in 2009



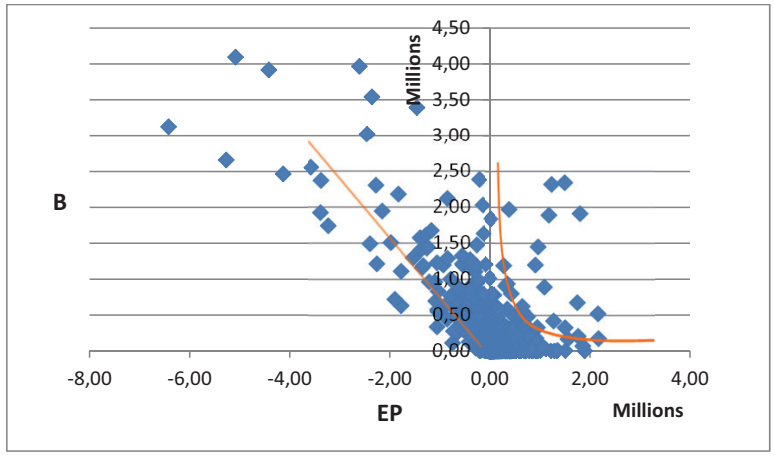
Source: own elaboration based on data from FADN.

Figure 15. Relationship between the level of efficiency (EP) and the level of support (B) for all farms from the group with prevailing plant production (b) at EP>0 and B>0 in 2009



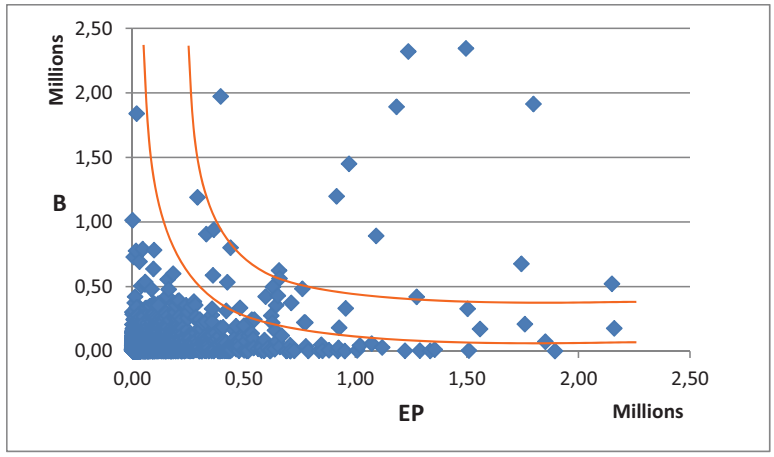
Source: own elaboration based on data from FADN.

Figure 16. Relationship between the level of efficiency (EP) and the level of support (B) for all farms from the group (c) without a prevailing type of production for EP>0 and EP<0 at B>0 in 2009



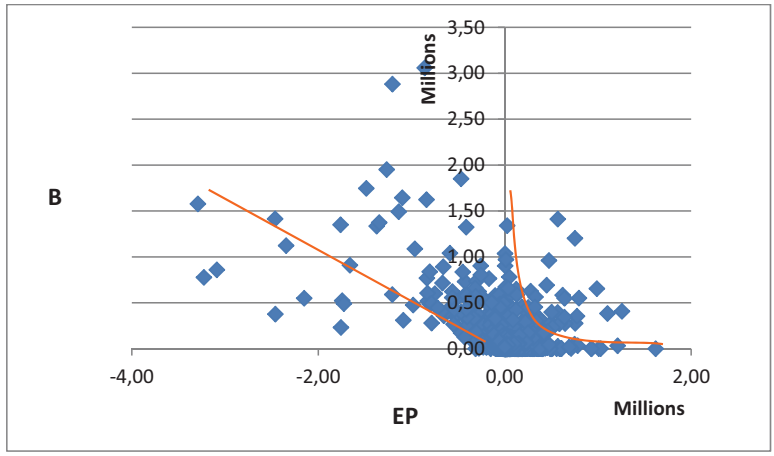
Source: own elaboration based on data from FADN.

Figure 17. Relationship between the level of efficiency (EP) and the level of support (B) for all farms from the group (c) without a prevailing type of production at EP>0 and B>0 in 2009



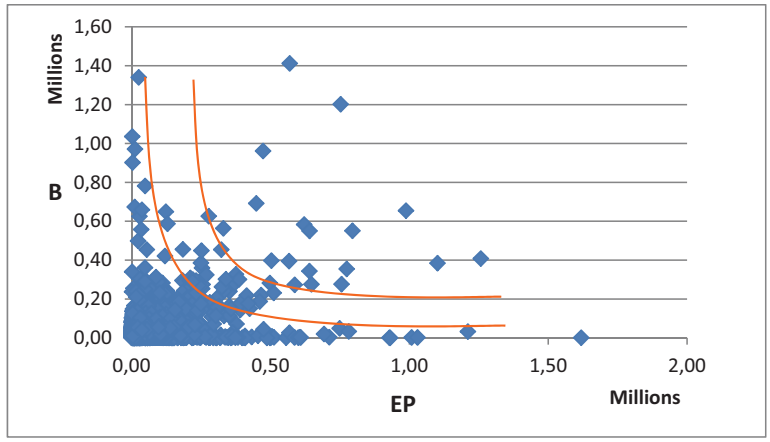
Source: own elaboration based on data from FADN.

Figure 18. Relationship between the level of efficiency (EP) and the level of support (B) for all farms from the group with prevailing plant production (b) EP>0 and EP<0 at B>0 in 2008



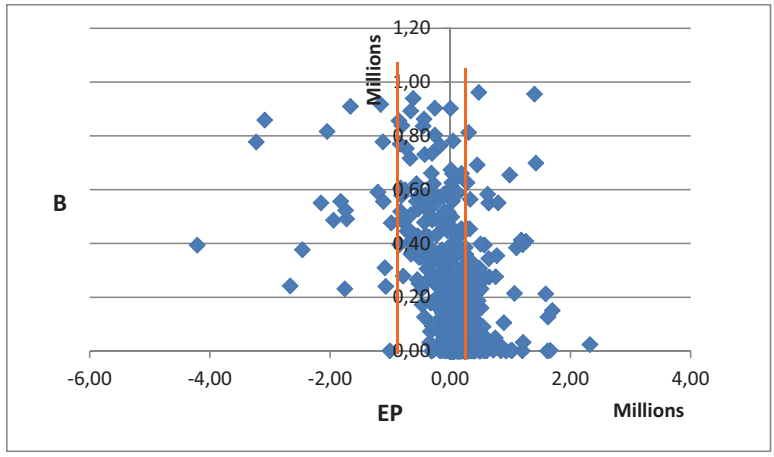
Source: own elaboration based on data from FADN.

Figure 19. Relationship between the level of efficiency (EP) and the level of support (B) for all farms from the group with prevailing plant production (b) at EP>0 and B>0 in 2008



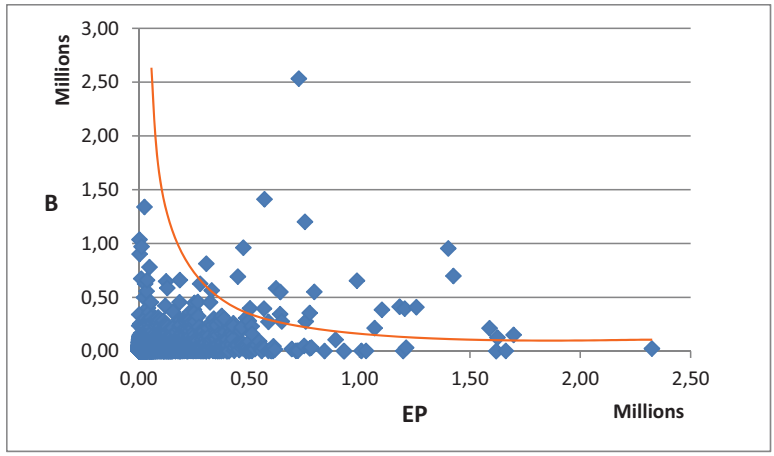
Source: own elaboration based on data from FADN.

Figure 20. Relationship between the level of efficiency (EP) and the level of support (B) for all farms from the group (c) without a prevailing type of production for EP>0 and EP<0 at B>0 in 2008



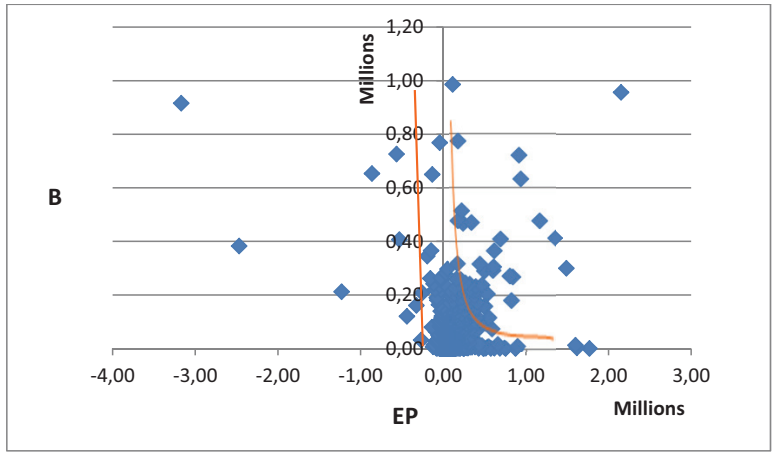
Source: own elaboration based on data from FADN.

Figure 21. Relationship between the level of efficiency (EP) and the level of support (B) for all farms from the group (c) without a prevailing type of production at EP>0 and B>0 in 2008



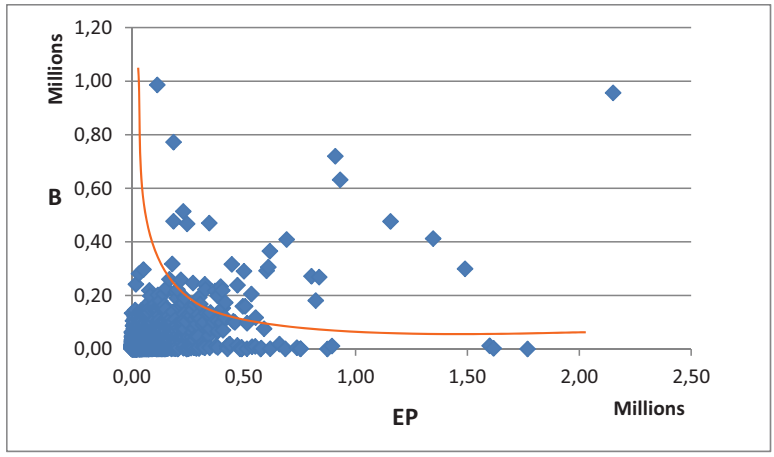
Source: own elaboration based on data from FADN.

Figure 22. Relationship between the level of efficiency (EP) and the level of support (B) for all farms from the group with prevailing plant production (b) for EP>0 and EP <0 at B>0 in 2007



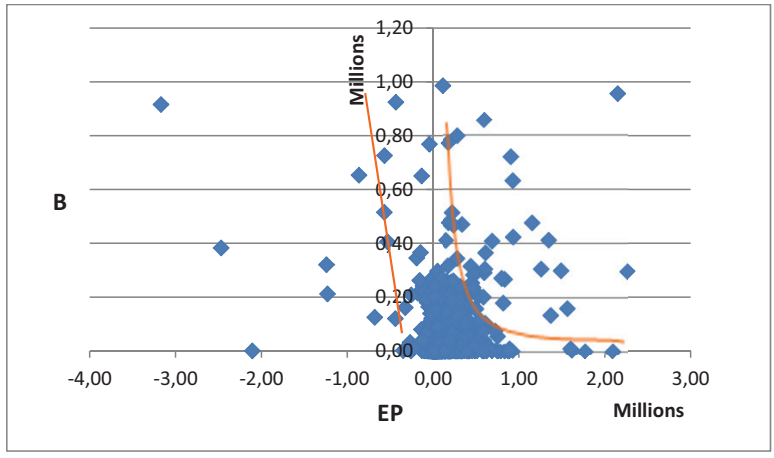
Source: own elaboration based on data from FADN.

Figure 23. Relationship between the level of efficiency (EP) and the level of support (B) for all farms from the group with prevailing plant production (b) at EP>0 and B>0 in 2007



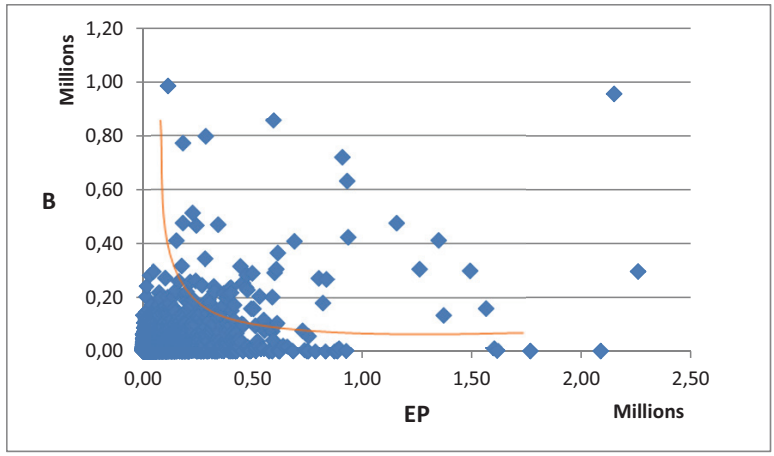
Source: own elaboration based on data from FADN.

Figure 24. Relationship between the level of efficiency (EP) and the level of support (B) for all farms from the group (c) without a prevailing type of production at EP <0 and EP>0 B>0 in 2007



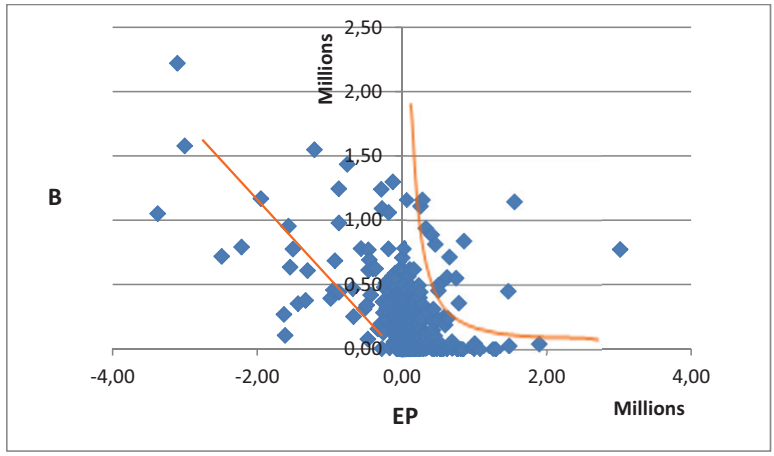
Source: own elaboration based on data from FADN.

Figure 25. Relationship between the level of efficiency (EP) and the level of support (B) for all farms from the group (c) without a prevailing type of production at EP>0 and B>0 in 2007



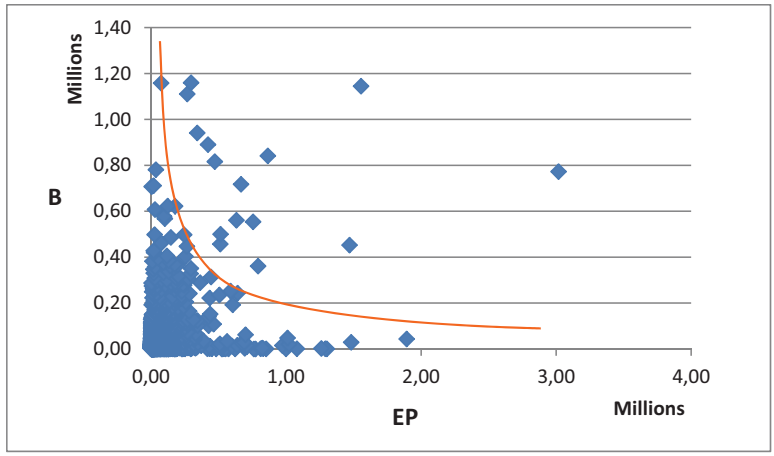
Source: own elaboration based on data from FADN.

Figure 26. Relationship between the level of efficiency (EP) and the level of support (B) for all farms from the group with prevailing plant production (b) EP <0 and EP >0 at B>0 in 2006



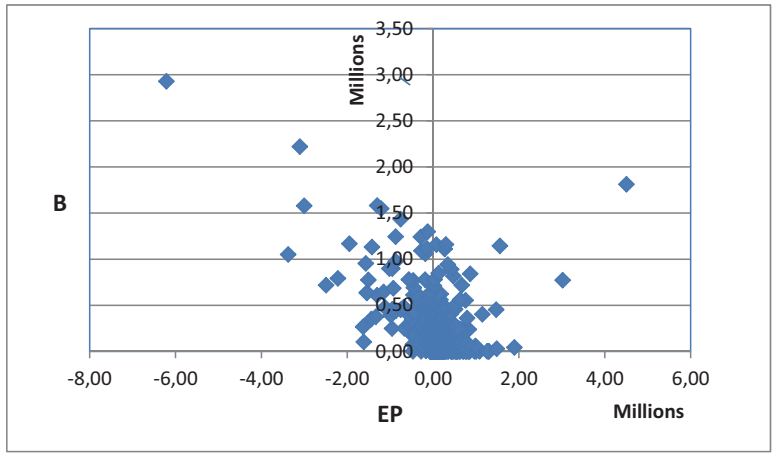
Source: own elaboration based on data from FADN.

Figure 27. Relationship between the level of efficiency (EP) and the level of support (B) for all farms from the group with prevailing plant production (b) at EP>0 and B>0 in 2006



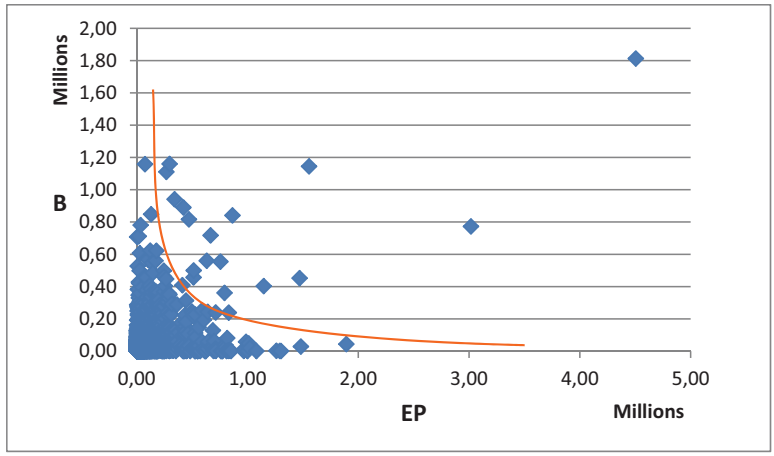
Source: own elaboration based on data from FADN.

Figure 28. Relationship between the level of efficiency (EP) and the level of support (B) for all farms from the group (c) without a prevailing type of production for EP>0 and EP <0 at B>0 in 2006



Source: own elaboration based on data from FADN.

Figure 29. Relationship between the level of efficiency (EP) and the level of support (B) for all farms from the group (c) without a prevailing type of production at EP>0 and B>0 in 2006



Source: own elaboration based on data from FADN.

Based on the charts in the figures, we can draw a conclusion about quite explicit substitution between the two rents as a source of income in the analysed groups of farms for EP> 0 in the period of observation. This confirms the hypothesis of a substitution relationship between the two analysed rents as a source of income. The share of efficiency seems to be relatively higher than the share of agricultural policy in shaping income in groups analysed and the given study period. It is a positive conclusion. This applies mainly to the farms of relatively dominant income level so to the most placed around their average, relatively low level, as shown by the outlines of income levels. In the higher income groups as moving away from the beginning of the coordinate system, the substitution relationship between analysed rents are not clear, i.e. they break down both on the side of the efficiency axis and on the side of effects of the policy without a clear outline. This indicates that agricultural producers achieving relatively higher income levels are less dependent on payments under the policy and no substitution between the two analysed rents is outlined here.

IV. Political rent and investment of agricultural producers

4.1. Hypotheses and problem outline

The question of the role of political rent as a catalyst for investment in fixed assets or physical capital of agricultural producers is the subject-matter of this chapter. In contrast to the considerations of the previous chapters, this applies to longer periods, i.e. those in which changes in technical relationships are possible. These changes are possible owing to investments in fixed productive factors, in case of a producer they are about machinery and equipment, and the land agent. These changes of technical relationships can or should lead to improvement of production efficiency, including the most important for our analysis – improvement of labour productivity. Of course, these processes must be accompanied, or conditioned, by structural changes including changes in the agrarian structure.

The level of investment expenditure is characterized by relatively high fluctuations, according to the fluctuations in the current and expected production, at greater stability of consumption spending, which of course is reflected in the changes of savings level. It can be assumed that direct payments and income effects of other agricultural policy's mechanisms (CAP) neutralize these fluctuations and contribute to increasing investment in agricultural producers. Their catalysing function is expressed in that. Speaking about the level of investment expenditures, we have in mind the higher one than that which would result from their natural relationship with the level of savings and investment loans or other returnable funding sources. Namely, political rent and the resulting income payments of agricultural producers increase the level of savings and may contribute to increasing investment in longer periods.

Moreover, in a typical situation for most producers in which investment needs are higher than the savings of political rent including direct payments, they can contribute to mitigating this inequality by reducing the need regarding the volume of loans. It may be taken as the basis for further reasoning and further hypotheses. This can express the positive economic effect of political rent neutralizing the aforementioned substitution effect in relation to the economic rent, or somehow reducing the compulsion to improve production efficiency, which we showed in previous chapters of this monograph. This would be an important dimension of the impact of agricultural policy on the choice (decisions) of agricultural producer. Of course, we assume that the purpose of

the investment is to improve production efficiency, especially labour productivity as a long-term fundamental source of income in agriculture [15].

We can look differently at the high share of political rent in shaping the income of agricultural producers. This positive approach will be true if we assume that the income effects of agricultural policy contribute to "ordinary" savings of agricultural producers and then their inversion spending increases on material or physical capital, and then in investment of agricultural producers [16]. Increasing investment of agricultural producers lead, as we can assume, to improvement of labour factor efficiency and generally is the basis for growth in production efficiency. Improving labour productivity results, as is known, in large part from the increase in equipment of labour factor in capital, that is from increasing the relationship of physical capital factor to labour factor. If these subsidies would contribute to this type of investment, then it would fulfil a similar role as the savings from the outside (regardless of the form) sourced as foreign investment in the whole economy. Foreign investment, financed from external savings, increases the level of domestic investment over domestic savings level.

Thus, the question may be raised whether political rent is complementary to investment of agricultural producers. This means making a working hypothesis that the realized political rent, payments and other income effects of agricultural policy over the mechanisms of subsidies to investment in fact somehow catalyse investment and is an important determinant of their achieved level. Positive verification and illustration of issues and hypotheses outlined in such a way, of course, will be about a positive impact of political rent on the formation of development basics, in particular of labour productivity growth. This establishes the basis for setting up an ever closer relationship between the income and labour productivity in agriculture. Speaking about the function of investments catalyst by political rent, we mean that without income effects of this political rent the reached level of investment, regardless of the CAP mechanisms aimed at investment targets, would be lower.

The catalysing functions of political rent are an easier chance to reconcile the reached level of consumption in a producer's farm and investment needs. These functions are also reducing the risks associated with investments

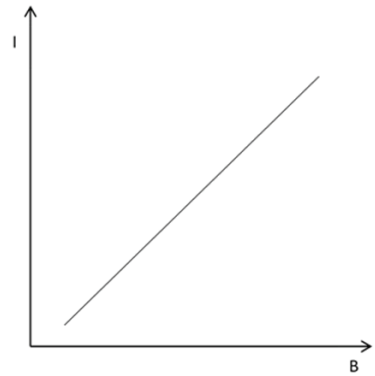
[15] A more theoretical approach to the issue is taken in the work by W. Rembisz, *Kwestie ryzyka, cen, rynku, interwencji i stabilności dochodów w rolnictwie*, Publ. Vizja Press & IT, Warsaw 2013.

[16] Such a relationship is evident in the mechanisms of the CAP targeted for investment purposes, what we assume under the principle of *ceteris paribus*.

and increasing the producer's income capacity, meaning a significant increase in the base to generate savings, which is also important considering the policy mechanisms aimed at stimulating investment. Not without significance is the fact that direct payments and other policy instruments enhance the creditworthiness of the agricultural producer. It has an evident impact on the complementarity of investments paid with bank funds (or any other savings).

The issue, i.e. that political rent is a catalyst for investments in agricultural producers (whether in connection with these complementary investments), outlined in such a way can be explained in the following illustrative manner:

Figure 30. Ideograph of relationship of investment and political rent

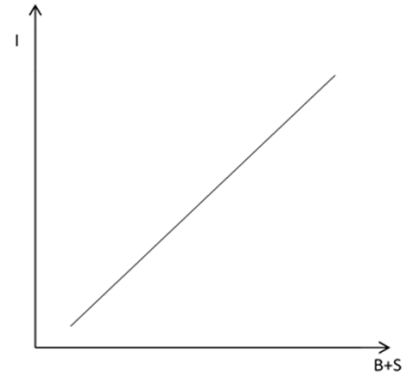


Source: own elaboration.

This ideogram will largely designate further analysis, particularly empirical analysis, because much indicates, in the literature and logical relation shown below and described with analytical models, that it should be this way.

Another ideogram, of relationship of the rent and investments savings of agricultural producers, as presented in the figure below may be some, or obvious, extension of this assumption.

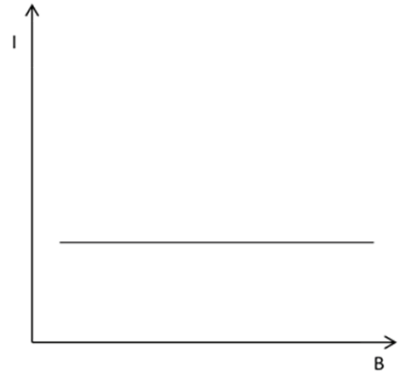
Figure 31. Ideograph of relationship of investment and savings, and political rent



Source: own elaboration.

We can also adopt a hypothesis that political rent and investment are independent processes, and it is not about the issues of correlation, while the assumption that direct payments and other media of political rent beyond pro-investment mechanisms do not affect the choices of producers concerning investment. The adoption of such a hypothesis can be illustrated by the following ideograph.

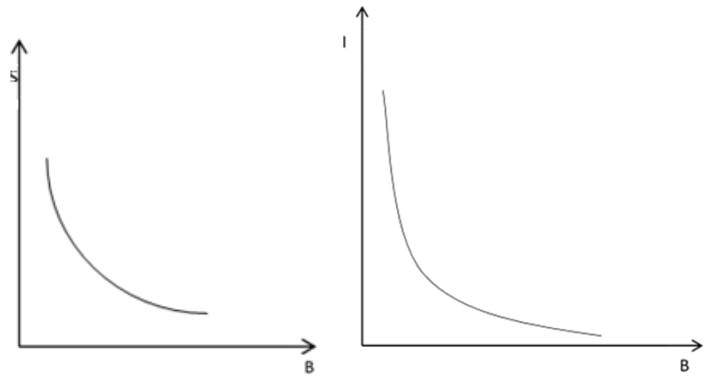
Figure 32. Ideograph of lack of relationship of investment and political rent



Source: own elaboration.

Adoption of such assumptions must mean that the occurrence of the following relationships is excluded when it comes to land, namely that political rent does affect the level of neither savings nor investment of agricultural producers.

Figure 33. Ideograph of relationship of savings and investment, and political rent



Source: own elaboration.

For obvious reasons, this means that the hypothesis that political rent is related substitutively to savings and investment of agricultural producers is rejected. So we cannot repeat here the reasoning and analysis as in the case of the relationship between the rent and efficiency as sources of income for the agricultural producer. That reasoning was referring to the issue of functioning, the one raised now – to the issue of growth. Of course the growth, or the implemented investment, provide a better basis for more effective operation and generate higher income on the basis of efficiency. Higher income is in turn a better basis for savings and investments. As we think, political rent plays an important role as a catalyst of this constant process of dependencies. First, we analyse the issues and hypotheses outlined like that logically based on specific mathematical records and they are subject to simplified empirical verification.

4.2. Political rent and consumption, savings and investments of agricultural producer

As mentioned before, political rent may be a factor catalysing investments in agricultural producer. In fact, political rent may contribute to increasing investment in two ways. First, as noted earlier, it is (next efficiency to increase) one of the possible sources of income growth. This obviously increases the basis for savings or increases them directly, reducing the negative difference between

the required level of investment and their source of financing from savings (whether savings are set aside, or future from a loan[17]).

Let us analyse this process from scratch. According to Hishleifer, "investment decisions of companies are in fact the decisions of their owners regarding the optimal distribution of consumption and savings in time, and investments in fixed assets are an alternative to saving on the financial markets allowing for the transfer of consumption over time."[18] This remark or assertion seems to be fully congruent with the situation of agricultural producer, when the identity of the owner is commonly known, i.e. a consumer or household, with the function of producer. Thus, the following quote refers in its entirety to the producer, "most investment decisions in modern economies are taken by companies, not households. Companies, however, are owned by households (consumers) and should act so as to maximize the utility of their respective owners."[19]

Here the agricultural producer is kind of a clinical case, maximization of his objective function – income (profit) as of the producer is essential to maximize his utility function as of a consumer (household). Hence, the issue of allocation in savings is important, and as a result investment against consumption, assuming at the same time, by virtue of the unity of the role of the consumer and the producer, that saving is only postponed consumption, of course assumed to be higher. It should be provided by investments and their effectiveness. Political rent, in our opinion, catalyses this process, i.e. facilitates decision-making on division into consumption and savings = investment, increasing the willingness to invest. The owner (a household, a consumer in terms of microeconomy) as the producer must decide not only how much to save and how much to consume. Most often, he does this in a two-step procedure. First, assuming rational behaviour, he chooses a level of investment that maximizes total wealth (during the period of the farm's operation – it lasts forever) and then, at its adopted level, how much to consume today and how much to save for tomorrow. In this process, payments obtained under the CAP are undoubtedly useful. This allows in some sense to separate these decisions as to consumption and investment.

If we assume that savings collected by the producers are the foundations of investment:

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[17] Savings as a source of investment financing can be written as S_{t-n}, that is, as the accumulated sum of previous years, or as updated sum of the loan (installment of its repayment) of future savings: S_{t+n}, we will further call it *ex-post* and *ex-ante* savings.

[18] Quoted after M. Brzozowski, A. Cieślik „*Przewodnik po zadaniach z makroekonomii – teorie, systemy, strategie w ekonomii*", Warsaw 2004, p.160.

[19] Ibidem, p. 164.

$$S_{t-1} \Rightarrow I_t, \tag{IV.1}$$

or as assumed in the microeconomic analysis:

$$D_{t-1} = S_{t-1} + C_{t-1} \tag{IV.2}$$

and:

$$C_{t-1} = cD_{t-1}, \tag{IV.3}$$

where:

c – is a constant that reflects the marginal willingness to consume,

D_{t-1} – stands for income,

then the increase in income will result in an increase in both consumption and savings. It is worth noting that the assumption of a constant marginal willingness to consume is a simplification of the analysis, adopted by us for the sake of clarity of presented considerations. In fact, the willingness to save (resulting directly from the willingness to consume) may change in accordance with the preferences of the decision-maker, i.e. the farm owner. The conditions of uncertainty under which the consumer, that is the farm owner, functions are associated with this. In fact, the decisions may also be the result of action in accordance with the principle of limited rationality, and not all (especially small and fluctuating) changes the amount of obtained income may be reflected in changes in consumption spending. Constraints related to liquidity and lack of access to loans also appear to be significant.

The assumption of a constant marginal willingness to consume means that the change in consumption expenditure is proportional to the change in income, and the decision-maker does not allocate all the increased income on consumption. In this case, as noted above, savings will also increase, which, according to the formula (IV.1), will lead to an increase in investment. Then the positive effects of political rent will also occur in subsequent periods. The increase in savings and the consequent increase in investment will lead to an increase in capital resources available to the producer:

$$S_{t-1} \uparrow \Rightarrow I_t \uparrow \Rightarrow K_t \uparrow \tag{IV.4}$$

Adopting the assumptions of neoclassical production function, we can notice that:

$$\frac{\partial Y(L_t, K_t, Z_t)}{\partial K_t} > 0 \tag{IV.5}$$

where:

$Y(L_t, K_t, Z_t)$ – trifactor production function.

With the increase in available capital resources, the value of manufactured product increases, which in turn may lead to an increase in income, which is a function of this product:

$$R_t \uparrow \Rightarrow D_t \uparrow \tag{IV.6}$$

According to the reasoning presented above and preserving the existing assumptions, this will affect the re-growth of consumption and savings in the next period.

4.3. Investment and production techniques, and labour productivity

If we assume that the agricultural producer does not change the involvement of labour factor, keeping it constant at L_0, an increase in the use of capital factor will contribute to the growth of technical equipment of labour. This change, leading to a more modern and more capital-intensive production technique is illustrated by formula (IV.7). Clearly, it leads also to some increase in the labour productivity (IV.8).

$$K_t \uparrow \Rightarrow \frac{K_t}{L_0} \uparrow \tag{IV.7}$$

$$\frac{K_t}{L_0} \uparrow \Rightarrow \frac{R_t}{L_0} \uparrow \tag{IV.8}$$

The end result is, as can be seen, an increase in income – remuneration of labour:

$$\frac{R_t}{L_0} \uparrow \Rightarrow w_L \uparrow \Rightarrow C_L^{t+1} \uparrow \tag{IV.9}$$

Therefore, there is a positive long-term process in the presented situation, which in incremental categories creates simple relationships:

$$\begin{aligned} &\Delta S \Rightarrow \Delta I_t \Rightarrow (\Delta K - \Delta L) > 0 \\ &\Rightarrow (\Delta R - \Delta L) > 0 \\ &\Rightarrow w_L > 0 \Rightarrow C_L > 0 \end{aligned} \tag{IV.10}$$

So an increase in savings leads to growth of investment and enhancement of the relationship of labour factor to capital factor, that is, *de facto*, to a more modern, more capital-intensive production technique. The improved manufacturing technique leads directly to improved labour productivity (production increase faster than the growth of labour involvement – or reducing the involvement of this factor gives an even larger increase in labour productivity). The end result is, of course, an increase in income – remuneration of labour.

The problem is that we have:

$$S_t < I_t \quad \text{and} \quad \Delta S_t < \Delta I_t \tag{IV.11}$$

It is a situation similar to the investment problem of the scale of domestic economy, especially in less developed countries. Usually there is: $S - I < 0$ and therefore: $S - I = CA$ there is a deficit in the current accounts market, which means that the country borrows abroad or there are direct investments[20]. This is due to the low level of domestic savings. This very low level of domestic savings as a source of investment financing is a barrier to economic growth, not to mention economic development. The same applies to agriculture as a collection of producers and may relate to each of them. We can also assume here that the level of savings is too low and is a barrier to growth and development, primarily for raising labour productivity as the basis of income. Too low level of savings does not allow any appropriate investment for changes in production techniques as a condition of labour productivity growth. At a given level of available loans,

[20] It is described by: P.R. Krugman, M. Obstfeld *International Macroeconomics. Theory and Policy*, Pearson Education, 2003, referred to [in:] B. Gawrońska-Nowak, *Kryzysy walutowe w krajach rozwijających się*, [in:] R. Piasecki, *Ekonomia rozwoju*, PWE, Warsaw 2007, p. 200.

income effects of political rent appear to be a factor that reduces this limitation as a basis for investment since we can assume that the income effects of rent will also be reflected in savings.

It can be assumed that the household of agricultural producer's (the owner of the farm, which we will develop further) divides its income on consumption, savings and taxes, and increases income by adding the payments received from the agricultural policy. Therefore, we have:

$$B + m = C + S + T \tag{IV.12}$$

where:

m – income of consumer farm owner (agricultural producer) resulting from: a) remuneration of labour factor dependent on productivity of this factor and the level of product prices (prices received), that is: $C_L = \frac{Y}{L} \cdot C_L$; b) remuneration of capital factor dependent on its productivity and product prices, that is: $C_K = \frac{Y}{L} \cdot C_K$,

C, S, T, B – the level of consumption, the level of savings and the level of tax burden, income earned from political rent respectively.

Hence, consumption and savings will increase proportionally, depending on the distribution of income from political rent (assuming that there are no targeted subsidies to investment, which for obvious reasons determine the producer's choice). So we have:

$$m = (C + \frac{C_B}{B} \cdot B) + (S + \frac{S_B}{B} \cdot B) + T \tag{IV.13}$$

Let us add, therefore, savings from income effects of agricultural policy, hence we have

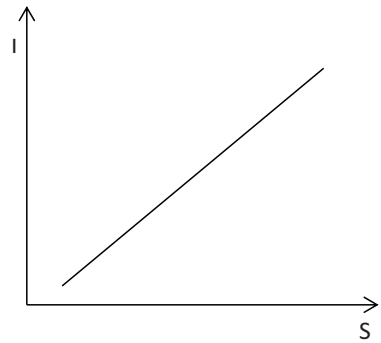
$$(S_{t-1} + B_t \cdot \frac{S_B}{B}) \uparrow \Rightarrow I_t \uparrow \Rightarrow \frac{K}{L} \uparrow \Rightarrow \frac{R}{L} \uparrow \Rightarrow w_L \uparrow \Rightarrow C_L^{t+1} \uparrow \tag{IV.14}$$

As we can see, the income effects of political rent may increase savings[21] of producers intended for investments. This is an important observation from this analytical reasoning to confirm the hypothesis of catalysing impact of political rent on investment for agricultural producers.

If this is true, the technical relations of agricultural producers are improved, in particular the relationship of capital factor to labour factor. It is also called improvement of production techniques towards modernization. Improvement of this relationship leads to a direct increase in labour productivity in agriculture as a sum of producers. As a result, it contributes to the growth of income of agricultural producers in subsequent periods. It is, as already emphasized, the basis for sustainable growth of income of agricultural producers[22], a very beneficial process for the society. Its effect is that the labour productivity is increasingly (or essentially) a source of shaping income of agricultural producers. An increase in these revenues does not burden consumers or taxpayers that much. In such a reasoning scenario, direct payments play a positive role, catalysing the process of investment by agricultural producers.

Illustrations or an ideograph of dependencies from the above equation (without time subscripts) is shown in the following figures.

Figure 34. Relationships of savings and investments

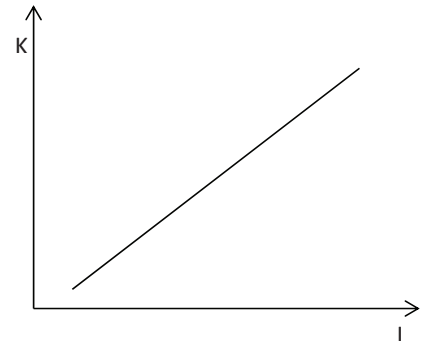


Source: own elaboration.

[21] Savings can be, as pointed out above, *ex post* or *ex ante*, i.e. be present in the form of loans and their repayment.

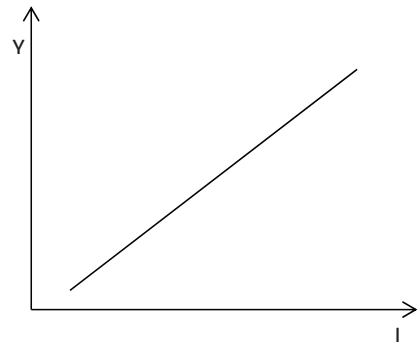
[22] Of course, this applies to all producers so it is characterized by regularity due to its general nature.

Figure 35. Technical relationships of capital factor against labour factor as a result of investment



Source: own elaboration.

Figure 36. Relationships of labour productivity as a result of technical relationships



Source: own elaboration.

In addition, for a better empirical illustration in the context of a set of empirical data shown below, we can show the following relationships associated with the development of the above formula and the above figures.

$$S_{t-1} + S_{t+1} \Rightarrow I_t$$

$$\left(S_{t-1} + S_{t+1}\right) + \left(B_{t-1} + B_{t+1}\right) \Rightarrow S_t \Rightarrow I_t$$

$$\Delta S_t \Rightarrow \Delta I_t$$

$$\Delta I_t > \Delta S_t \Leftarrow \Delta B_t$$

$$\Delta B_t \Rightarrow I_t$$

$$\Delta m_t > \Delta I_t$$
$$\Delta m_t < \Delta I_t \qquad \text{(IV. 14 a)}$$

If empirical studies, illustrated with figures in the next chapter, involve the last inequality, it indicates a catalysing effect of political rent on investments of agricultural producers.

4.4. Mechanism of agricultural producers' investment decisions

Fisher proposed a theory whose core in the context of our analysis is expressed in the fact that the agricultural producer aiming at maximization invests if the marginal rate of income from investments is equal to its cost. This concept in Fisher's terminology, interpreting it for our needs, means revenue growth generated by the increase in production resulting from larger resources of capital factor: $\frac{\Delta Y_{t+1}}{\Delta K_t}$. In turn, the cost of investment is the real interest rate r. This relationship may be present in our symbolism and taking into account the depreciation of capital factor δ as:

$$\frac{\Delta Y_{t+1}}{\Delta K_t} - \delta = r \qquad \text{(IV.15)}$$

One of the most famous models describing the investment behaviour of producers is an empirical model of accelerator. Its essence consists in the assumption of a stable relationship between the target resource of factor and the capital: K^* and production level: υ, which in obvious expression connects to the sense of the formula above. Therefore, we have:

$$K^* = \nu \cdot Y \qquad \text{(IV.16)}$$

Which can be juxtaposed with the previous formula and we have:

$$\frac{\Delta Y_{t+1}}{\Delta K_t^*} = r + \delta \qquad \text{(IV.17)}$$

At: $r+\delta \Leftrightarrow \nu$ where the parameter of proportionality is a function of the cost of capital, and the relationship between the target resource of capital factor and the level of production is stable, assuming that the cost, or the actual interest rate and depreciation is fixed. If the level of investment is equal to their amount necessary to maintain the target resource of capital factor, investments are proportional to changes in the production volume:

$$I_n = K^*_{t+1} - K^* = \nu(Y_{t+1} - Y_t) \tag{IV.18}$$

Therefore, the assumption of a faster rate of production growth must also mean acceleration of investments. In dynamic terms, after taking the logarithm and calculation of derivatives, we have the following growth rates:

$$\frac{\Delta I}{I} = \frac{\Delta K}{K} = \nu \cdot \frac{\Delta Y}{Y} \tag{IV.19}$$

This is an important observation for our analysis. This determines the required level of investment and the rate of its growth. Thus, it shows the necessary level of increase in savings and political rent's income effects catalysing the process. Therefore, we have:

$$(\frac{\Delta S}{S} + \frac{\Delta B}{B}) \Rightarrow \frac{\Delta I}{I} = \frac{\Delta K}{K} = \nu \cdot \frac{\Delta Y}{Y} \tag{IV.20}$$

The level of involvement of capital factor is of course the result of the accumulation of investments of previous periods and consumption (depreciation) of capital factor. Therefore, we have:

$$K_t = I_t + (1-\delta)K_{t-1} \tag{IV.21}$$

and, under certain assumptions about the level of involvement of capital factor in the initial period:

$$K_t = (1-\delta)K_0 + \sum_{i=0}^{t-1} I_{t-1}(1-\delta)^i \tag{IV.22}$$

Therefore, the level of involvement of capital factor influencing its current level is[23]:

$$K_{t-1} = \frac{I_t}{(\frac{\Delta R}{R} - \delta)} \tag{IV.23}$$

The process of investing, as above, can be represented in the following form:

$$K^* = \nu \cdot Y^e_{t+1} \tag{IV.24}$$

Hence, the need (demand) for investment is defined as follows:

$$I_{gt} = K^*_t - K^*_{t-1} + K_{t-1} \tag{IV.25}$$

and assuming that the level of production: Y^e_{t+1} results from production from the period: t, we have:

$$I_{gt-1} = \nu Y_t + (\delta - 1)K_{t-1} \tag{IV.26}$$

It follows from these equations that the level of investment is determined by the expected level of production for a given coefficient of proportionality between capital factor and production (productivity coefficient of capital factor). As can be assessed, this entirely applies to the agricultural producer. Unfortunately, there is no question of the sources of investment financing. Their level is reported only against the level of production and the desired level of capital factor resource[24].

[23] Cf. N. Badar, *Measuring Business Cycle and Inflation Forecast*, Lambert Academic Publishing, Sarsbrucken 2011, p. 34.
[24] Cf. M.C. Baddeley, *Investment in an Uncertain World*, Zagreb International Review of Economics & Bussines Vol 5. No. 2, pp. 1-21 and M. Brzozowski, A. Cieślik, *Przewodnik*..., op cit, pp. 160-162.

4.5. Savings and investment in division of agricultural producers' income

The division of incomes is also highly important for the considered impact of political rent on investment of agricultural producers. In fact, this division is made by owners of farms, i.e. *de facto* consumers (households). In this approach, the income is, of course, remuneration of labour and capital factor remuneration (profit), which is obvious in the case of agricultural producers. According to microeconomics, every consumer divides income between consumption and savings. The sum of the savings of consumers, at the macroeconomic level, is the basis of investment, because in the macroeconomic scale there is always S=I. In the case of agricultural producers, who are consumers and producers at the same time, we can assume that there is the same regularity. Therefore, we obtain:

$$L \cdot C_L + (T_B - P_T) = D_R = C + S \tag{IV.27}$$

Moreover, in agriculture, as the sum of the producers, we can further assume that there is:

$$S \cong I \tag{IV.28}$$

Of course it can be assumed that the volume of savings of agricultural producers includes the balance of transfers: S_T, if we assume that agricultural producers do not spend transfers on consumption, so we have:

$$S = S_R + S_T \tag{IV.29}$$

at:

$$S_T = (T_B - P_T) > 0 \tag{IV.30}$$

This means that transfers, income effects of agricultural policy outweigh fiscal burden of the producers. It is also some kind of definition of the essence of political rent.

4.6. Relationships of increase in savings and investment

More important, however, is to determine the relationship between the growth of investment and savings increase as the source of their funding. Dependencies can there be different. Firstly, the following may occur:

$$\Delta S \approx \Delta I \tag{IV.31}$$

that is, whether the increase in investment is solely due to the increase in savings of agricultural producers, which includes the increase of transfers balance higher than growth in consumption $(\Delta S_T > \Delta C)$. Assessment of this balance in terms of development prospects does not have to be positive, even on the grounds that if the growth rate of personal savings, usually too low, limits growth opportunities, including the modernization of manufacturing techniques and financing their changes due to changes in the agrarian structure. A more positive assessment of the development prospects of agricultural producers, while maintaining the assumption of investment efficiency, may refer to the following inequality:

$$\Delta S < \Delta I \tag{IV.32}$$

The increase in investment in this case is faster than the increase in savings, so the process is very positive as it gives the prospect of growth of labour productivity and incomes of agricultural producers. Equality is restored here by supplementing the increase in own savings by an increase in external funding, that is – in the macroeconomic sense – the use of savings of other socio-professional groups. As can be assumed, it may be mainly through the use of loans, i.e. ΔS_K (the source of which are the savings of others), so we have:

$$\Delta S_K + \Delta S = \Delta I \tag{IV.33}$$

We omit the financial costs of loan here, including the lowering of the cost of such loan through interest rate subsidies (preferential loans) and writing off debt repayments, which is obviously one of the forms of transfers to agriculture. When saving of agricultural producers are growing faster than their investment, it may be indicative of an economic regression (lack of faith in the prospects for development):

$$\Delta S > \Delta I \tag{IV.34}$$

The occurrence of this inequality in a given period is a serious warning signal for agricultural policy. It can mean inhibiting of the processes of modernization and reconstruction of farms and decline in manufacturing techniques, resulting in the weakening of the basis for growth in agricultural income, which may be due to various reasons. As we think, the dependencies described here are of large importance for sustainable growth, as its medium- and long-term basis. They are a kind of barometer of expectations of producers for long-term prosperity.

Finally, but what is also important in the context of the whole paper, let us consider the relationship between the growth of investment and growth of income effects of agricultural policy. We can define it as an investment multiplier of agricultural policy's income effect. We have:

$$m_I = \frac{\Delta I}{\Delta B} \tag{IV.35}$$

To speak about the positive growth effects of political rent, the ratio should be higher than one:

$$m_I > 1 \tag{IV.36}$$

This would mean that the income effects of agricultural policies contribute to investments of agricultural producers above the level resulting solely from market regulation, creating a durable basis for labour remuneration increase and – maintenance of a proper relationship between income growth and labour productivity growth: $\frac{\partial C_L}{\partial W_L}$. It is important because it forms the basis for agricultural producers to base their income on labour productivity, in a similar way as in the non-agricultural sectors, over longer periods, even after cessation of subsidizing agriculture in a way as it happens in the CAP. This may facilitate shaping of labour unit costs, i.e. the relation of labour remuneration, income, to his performance at a level that is competitive and comparable with other branches of the economy. However, it is a separate issue requiring separate research.

4.7. Dynamics of investment, technical equipment and labour productivity

Generalizing the above reasoning with regard to income and its sources related to economic and political rent and their division, the following sequence of dependencies known from microeconomics can be used.

$$EP + B \Rightarrow D \Rightarrow C + S + T \tag{IV.37}$$

According to the formula above, income of agricultural producers arising from both sources can be divided into consumption, savings and tax burden. Of course, the level of consumption and savings is somehow the result of the income effect or consumption of agricultural policy. We can consider the tax burden irrelevant. Thus, the level of income effects has an impact on the level of savings, and thus the level of investment (without specifying the share of this effect in savings and investment, which at this point does not matter because we only outline the problem). So we have:

$$S \Rightarrow I \quad \text{and} \quad d(kd) = \Delta EP \cdot kd_{EP} + \Delta B \cdot kd_{B} = 0 \tag{IV.38}$$

Therefore, under these assumptions, the effect of support also materializes in some parts of investments and their increment:

$$\Delta B \Rightarrow \Delta S \Rightarrow \Delta I \tag{IV.39}$$

In order to determine the dynamics of growth, because it expresses the sense of investment, we introduce a simple record, assumed for a long period:

$$\Delta D_R \Rightarrow \Delta S \Rightarrow \Delta I \tag{IV.40}$$

Implications of this relation are important. Fundamentally, the long-term growth of income of agricultural producers is the basis of the increase in savings and the resulting investment. Of course, it is easy to notice and prove, keeping the convention, that there is also an inverse relationship:

$$\Delta I \Rightarrow \Delta S \Rightarrow \Delta D_R \tag{IV.41}$$

Hence, it is not indifferent to the processes of long-term growth if there are additional sources of income growth (apart from the natural ones associated with the spread of the difference between income and costs of involvement of factors as we expressed them in the starting assumption, namely: $(C_R \cdot R - N \cdot C_N)$, associated with agricultural policy.

Next, for the direct linkage of this logic sequence and to show the primary determinant of income growth, certain feedback loop follows, allowing to explain where the first word of the formula came from (IV.39) and introducing changes in the involvement of labour ΔL gives:

$$\Delta I \Rightarrow \Delta K \Rightarrow \frac{\Delta K}{\Delta L} \Rightarrow \frac{\Delta R}{\Delta L} \Rightarrow \Delta D_R^{t+1} \tag{IV.42}$$

whereas:

$$\Delta K = \Delta K_{t+1} - aK_t \tag{IV.43}$$

where:

a – stands for depreciation

and:

$$\Delta D_R = \Delta D_R^{t+1} - \Delta D_R^t \tag{IV.44}$$

As we can see, by combining both of these records, we obtain a closed circle of causality when it comes to the base of income growth.

4.8. Selected models of savings and investment

In this section, we present and comment on selected models used to describe decisions on investments and savings. Due to the link between farm and household[25], we present both models describing the decisions taken by individu-

[25] The problem of defining the relationship between the household and the farm becomes particularly important when considering its objective function. In the related literature, it is often cited after Aereboe that the objectives of the entity consisting of combined household and farm mainly observe the goals of household, i.e. the farm's keeper and his family. In such

al consumers, which are influenced by individual characteristics expressed, inter alia, in behavioural variables [26], as well as those in which the decision-maker is an entrepreneur, which can be equated with the microeconomic category of producer. This approach can be justified because of the changes in preferences often cited in the literature – and selected on the basis of optimal solutions – taking place along the transition to the next stages in the farm's life cycle. This is a certain theoretical basis for the analysed issue of economic rent catalysing savings and investment of agricultural producers.

As believed, in the initial phases of the life cycle the income of households is relatively low and the households themselves spend a significant part of it on consumption. In subsequent phases, when the income is increasing, consumption can still grow but savings also increase. On the other hand, if you reduce labour in the later stages, income decreases and also the savings rate selected by the decision-makers decreases[27]. The issue of diversity of objectives, associated with the problem under consideration pursued by holdings in different phases of the life cycle is also referred to by Wallace and Moss[28]. With respect to the discussed issue, the question of income volatility also seems important. As noted in the work by Burfisher and Hopkins, the high diversity of income in subsequent periods is followed by investments under precautionary motif related to the decision-maker's striving to smooth consumption[29].

Although, as can be inferred on the basis of the above considerations, the variables underlying the savings that can be reflected in investment of entities operating on a basis consistent with microeconomic category of producer are behavioural, then, as noted in Catinat et al. [30], three basic factors being determinants of investment are as follows: demand, the relative cost of production fac-

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terms, reaching maximum income from agricultural activities is intended to meet the (mostly consumer) needs of household. Cf: E. Majewski, W. Ziętara, *System celów w rolniczych gospodarstwach rodzinnych*, Zagadnienia Ekonomiki Rolnej, No. 6, 1997, pp. 29-43.

[26] In the case of an entity being an individual consumer, the decisions on savings depend on, among others, interest rate and the rate of time preference. D. Laidler, S. Estrin, *Wstęp do mikroekonomii*, Gebethner i Ska, Warsaw, 1991.

[27] M.E. Burfisher, J. Hopkins (ed.), *Decoupled Payments: Household Income Transfers in Contemporary U.S. Agriculture*, Market and Trade Economics Division, Economic Research Service, U.S. Department of Agriculture. Agricultural Economic Report No. 822, 2003.

[28] M.T. Wallace, J.E. Moss, *Farmer decision-making with conflicting goals: A recursive strategic programming analysis*, Journal of Agricultural Economics, Vol. 53, 82-100, 2002.

[29] M.E. Burfisher, J. Hopkins (ed.), *Decoupled...* op cit.

[30] M. Catinat, R. Cawley, F. Ilzkovitz, A. Italianer, M. Mors, *Investment behaviour in Europe: a comparative analysis*, Recherches Économiques de Louvain / Louvain Economic Review, Vol. 54, No. 3, pp. 277-324, 1988.

tors and profit (income)[31]. These variables can be measured and expressed relatively easy it terms of volume, which facilitates their use in modeling and analysis, in contrast to some factors describing preferences. As emphasized by the authors of the cited work, however, most of the models explaining the formation of savings and investments focus on a selected determinant.

From a macroeconomic point of view, investments play a role in the national economy as a component of aggregate demand, and hence, they have an impact on economic growth opportunities[32]. In the scale, among the factors that may affect investment, the literature mentions the rate of return on investment, the degree of trade liberalization, debt, real exchange rate, uncertainty or various activities within the framework of fiscal policy.

Below, we present briefly presented selected approaches to modelling decisions related to savings and investments in the literature[33]. Gandhi[34] models investment based on the paper by Jorgenson and Stephenson, presenting the objective function as maximization of the current net value in decision-making. The author relies on empirical research by Yotopoulos and Nugent[35], according to which the behaviour of the majority of farms in areas surveyed by him can explain the principle of maximizing income, according to the basic theory of microeconomics. The objective function maximized by the producer is therefore given by the formula (IV.45)

$$\int_0^{\infty} e^{-rt} \left(\begin{array}{l} P(t)F(KP(t),KG(t).L(t),FR(t)) - W(t)L(t) - PF(t)FR(t) + \\ - PK(t)\left(\dfrac{\partial KP(t)}{\partial t} + \delta KP(t) \right) \end{array} \right) dt \rightarrow \max \qquad \text{(IV.45)}$$

where:

[31] The distinction is associated with the sector under consideration. In the case of farms, maximization of income, not profit, is usually assumed an objective function although both approches can be attributed to microeconomic category of producer.

[32] M. Salahuddin, M.R. Islam, *Factors Affecting Investment in Developing Countries: A Panel Data Study*, The Journal of Developing Areas, Vol. 42, No. 1, pp. 21-37, 2008.

[33] Due to the fact that we do not present the full sequences of commented models, focusing on the most important elements (from our point of view), including those associated with supplementation of the objective function of optimization tasks until the end of this chapter, we keep the designations originally used by the authors of the cited works.

[34] V.P. Gandhi, *Investment behavior in developing countries: the case of agriculture in India*, Food Research Institute Studies, Vol. 22.1990, 1, pp. 45-82, 1990. It is worth mentioning that the studies presented in the paper did not relate to the microeconomic scale.

[35] P.A. Yotopoulos, J.B. Nugent, *Economics and Development: Empirical Investigations,* Harper and Row, New York, 1976.

r – interest rate,
t – time index,
$P(t)$ – price received,
$F(\cdot)$ – production function,
$KP(t)$ – private capital resource,
$KG(t)$ – public capital resource,
$L(t)$ – labour involvement,
$FR(t)$ – inputs of fertilizers,
$W(t)$ – wages,
$PF(t)$ – price of fertilizers,
$PK(t)$ – price of capital,
δ – rate of depreciation.

Gandhi also assumes the existence of an interperiodic relationship between the desired and actual level of capital. This relationship has a form as in the formula below (IV.46).

$$KP_t - KP_{t-1} = b_t\left(KP^*_t - KP_{t-1}\right) \tag{IV.46}$$

where:

$KP^*(t)$ – desired private capital resources,
b_t – adjustment coefficient, dependent on savings and available loan.

Assuming that the production function is a non-linear form of Cobb-Douglas power function (with the previously mentioned production factors in the function of decision-maker), we obtain the gross investment function depending on the size of production, public capital resources, the price of capital adjusted to the rate of depreciation, inflation and interest rate, loans and private capital resources of the past. In his work, Gandhi presents the derivation of the optimal size of investment (which is a solution to the above maximization problem under certain circumstances)[36].

[36] An important part of the cited work is also the empirical study in which parameters of both linear and non-linear functions describing the private gross investment were estimated. The results indicate that a statistically significant contribution to the development of investment decisions may be of factors such as, prices received, production volume, savings, loans, cost of capital or private capital resources of the previous period.

Catinat et al.[37] present a model which uses the approach both in terms of relative cost (which corresponds to the issue of decision-making in a situation in which producers face restrictions on sales, preventing them to conduct business and production at the optimum point) in conjunction with the recognition of the problem using a model of profit (income). The inclusion of the latter factor is justified in the literature both with the existence, in the absence of equilibrium, of restrictions imposed on sales, and – alternatively – the uncertainty associated with shaping of demand in the future[38].

In the proposed terms, investments are influenced by factors such as expected profit (or income), expected demand, prices received, the cost of labour factor or cost of capital. A role is also played by the manufacturing technology used by the producer, which is reflected in the elasticity of substitution between production factors. It is worth noting that the role in shaping the investment profit differs in alternative approaches to the proposed model presented by the authors. This influence can be either a single shock, and may persist in the long term.

As in the previously cited work, also the models proposed by Catinat et al. were verified empirically on the basis of annual and quarterly data for selected countries, including France and the United Kingdom. Although the proposed model has an underlying decision problem of an individual producer, the empirical estimation has not used microeconomic data. The analysis of the results confirmed a quite good form of the model, capable to successfully reproduce the actual dependencies, while the statistical significance of the coefficients associated with the delayed values of the considered variables confirmed the long-term nature of the phenomenon of investment. The role of the examined determinants in some cases has evolved over time. In the simulation study, the authors also investigated the relative significance of the considered determinants of investment. The results demonstrate the generally short-term impact of demand which strongly affects the investment at the beginning of the investigated period, particularly at the time of shock, then decreases and is stabilized as a result of the need for investment for sufficiently

[37] M. Catinat et al., *Investment...* op cit.

[38] As stated in M. Salahuddin and M.R. Islam, *Factors...* op cit., in accordance with A.B. *Abel,, Optimal Investment under Uncertainty*, American Economic Review, Vol. 73(1), pp.228-233, 1983 "theoretical predictions about the relationship are rather ambiguous. Depending on underlying assumptions, some approaches predict a positive relationship while others predict a negative one. Following the convexity of profit function, higher price uncertainty raises the expected profitability of capital thereby increasing the desired capital stock and hence in vestment" (p. 24). The same authors also cite empirical studies in which the compound uncertainty and investment had a negative nature.

rapid increase in production capacity and to meet the increased reported demand on the market. The impact of income and relative prices is more structural in nature and manifests itself – in the case of profit – mainly in the medium and long term.

Behrman et al.[39] take the issue of formation of savings[40] and their modelling in agricultural areas. In the investigated process, they take into account the dynamic aspect, so decisions are taken in accordance with the different phases occurring in farming activity and related business activities, where the first phase is the phase of the crop, the other – the phase of the harvest. In this perspective, the financial situation of agricultural producer is different in the specified phases. Therefore, variations may also occur in relation to the savings made by the producers of these two periods. As indicated in the cited work, in the first phase, which is particularly evident in the case of farms located in developing countries, with no well-developed system of financial intermediation, the situation of the farm can be characterized by deficiencies related to high food prices. The cited authors note that there is also high return on equity (cost of loans) at that time. It is also the period in which the decision-makers incur significant expenses in connection with taking up production activities. In turn, in the phase of the harvest, the return on financial assets may be lower, while the demand for labour factor obviously increases. In both phases, both consumption and possible savings are financed from two sources: income from own work and profit from the farm's activities.

$$E_t \sum_{s=t}^{\infty} \beta^s U(C_s) \rightarrow \max \tag{IV.47}$$

where:

E_t – expected value estimated in the period t,

β – subjective discount rate,

$U(\cdot)$ – utility function,

C_t – consumption in the period t.

[39] J.R. Behrman, A. Foster, M.R. Rosenzweig, *Dynamic savings decisions in agricultural environments with incomplete markets*, Journal of Business & Economic Statistics, American Statistical Association, Vol. 15, No. 2, pp. 282-92, 1995.

[40] It is worth noting that the cited work takes into account the savings made by the decision-maker for each of the factors used on the farm.

Starting from the objective function, which is to maximize the expected discount utility, according to the formula (IV.47), the authors also present the decision rules describing the savings on the farm. These rules have a different structure depending on the phase in which the farm is. The reason is that profits in the second phase depend on decisions concerning expenditures of production factors taken in the past (in the phase of crop). We should not omit the occurrence in the manufacturing process of the stochastic nature of certain factors. Decision rules can be showed by formula (IV.48) and (IV.49), for the first and for the second phase respectively:

$$s_{i1} = S_{i1}(\mathbf{A_1}, F_1, \mathbf{p_1}, B_1, G_1, u_1) \tag{IV.48}$$

$$s_{i2} = S_{i2}(\mathbf{A_2}, \Pi_2, w_2, F_2, \mathbf{p_2}, B_2, G_2, u_2) \tag{IV.49}$$

where:

s_{ij} – savings due to factor no. i in phase no. j,
$S_{ij}(\cdot)$ – decision rule in phase no. j,
$\mathbf{A_j}$ – vector of factors,
$\mathbf{p_j}$ – vector of prices in phase no. j,
B_j – individual and local characteristics influencing access to financial intermediaries in phase no. j,
G_j – distribution of stochastic variables known to decision – maker in phase no. j,
u_j – shocks in phase no. j,
Π_2 – profit from other activities on the farm achieved in the second phase,
w_2 – rate of wages in the second phase.

In addition, an assumption is made according to which changes in the environment of the decision-maker do not occur quickly enough so that their impact would become apparent between the time of the decision in the first phase and making appropriate decision in the second phase from the point of view of the objective function. This means that, under the assumptions both individual and local characteristics that affect access to financial intermediaries ($B_1=B_2$), as well as the decision-maker known distributions of stochastic variables ($G_1=G_2$) remain constant.

Another cited work is by Weersink and Tauer[41]. In 1989, they presented a comparative analysis of two alternative models of investment, called in the paper "traditional" and "dynamic" models. The "traditional" model takes into account the socio-economic characteristics of the farm (the age of the holder – decision-maker and farm size approximated by labour), it also assumes the existence of inter-periodic relationship between the desired and actual capital level. The investment function in this model has the following form:

$$I_t^N = \lambda_1\beta_0 + \lambda_1\beta_1\Delta Q_t + \lambda_1\beta_2\Delta V_t + \lambda_1\beta_3 X_t - \lambda_1 K_{1-1} + \lambda_2 RNFI_t + \lambda_3\Delta TLIABI_t + \\ + \delta_1 AGE_t + \delta_2 WORKU_{t-1} + \delta_3 TECH_t \quad \text{(IV.50)}$$

where:

t – time index,
I^N – net investment,
X – value of outputo ver cost of capital (in case of Jorgenson's neoclassical model),
Q – production,
V – value of the farm (enterprise) expressed as expected profit,
$RNFI$ – actual net income from agricultural activity,
AGE – age of the farm holder,
$WORKU$ – labour inputs as a substitute variable which approximates the size of the farm,
$TECH$ – tendency measuring capital efficiency,
$TLIABI$ – liabilities in real terms, the level of debt,
$\lambda_1, \lambda_2, \lambda_3, \beta_0, \beta_1, \beta_2, \beta_3, \delta_1, \delta_2, \delta_3$ – parameters.

In turn, the model called "dynamic" is derived from the task of maximizing the net value of farm functions, similarly to the model presented by Gandhi as described above – see equation (IV.45). The investment function derived from this task can be put as in the formula (IV.51).

$$I_t^N = -0{,}5\left(r - \sqrt{r^2 - \frac{4b_{KK}}{qD}}\right)\left(-\frac{b_K + b_{TK}TECH + \sum_{i=1}^{n} b_{iK}W_i - q(r+\delta)}{b_{KK}} - K_{t-1}\right) \quad \text{(IV.51)}$$

where:

r – required rate of return,

[41] A.J. Weersink, L.W. Tauer, *Comparative Analysis of Investment Models for New York Dairy Farms*, American Journal of Agricultural Economics, Vol. 71, No. 1, 1989, pp. 136-146.

q – normalized price of the asset,
D – coefficient associated with the costs of adaptation,
δ – exponential rate of depreciation,
W_i – normalized price of i-th production factor,
$b_{\cdot}$ – stands for parameters related to the capital resource factor, prices of production factors and technological change.

Both models were estimated based on panel data taking into account 112 observations from 10 consecutive years. The results indicate a significant impact of the future profitability of business activity and the volume of production (for the "traditional" model) on shaping of investment. The "traditional" model has also been considered better from the point of view of forecasts. On the basis of conducted analyses, the authors also note that, for both used models, there is a significant delay between changes in the determinants of target capital level and incurred actual investment expenditures.

V. Empirical illustration of the relationship between political rent and investment of agricultural producers

The chapter aims to provide an empirical illustration of the relationships between investment and savings, in this those mainly related to income achieved from political rent, which can be considered as a factor that might play a role of determinant of agricultural producers' investment. The positive result of analysis may indicate that political rent catalyses investments of agricultural producers. The chapter is divided into two main parts. The first section includes the presentation of changes in the formation of selected variables in selected countries of the European Union in recent years. The public database FADN[42] is the source of data in this case. Subsequent sections focus on the results obtained by the analysis of individual data from the Polish FADN database. The relationships between income earned from political rent and the selected variables referring to the economic situation and investment opportunities for agricultural producers were discussed on this basis. The analysis was performed both in dynamic[43] and cross-cutting terms – with breakdown into voivodeships and groups listed on the basis of economic size[44].

[42] http://ec.europa.eu/agriculture/rica/database/database_en.cfm
[43] Data from 2004-2011 were used.
[44] Economic size expressed by SO (Standard Output) was used, according to classification ES6:

ES6			**ES**	
Economic size class **ES6**		Range in EUR (€)	Economic size class **ES**	Range in EUR (€)
			1	€ < 2 000
1	Very small	2 000 ≤ € < 8 000	2	2 000 ≤ € < 4 000
			3	4 000 ≤ € < 8 000
2	Small	8 000 ≤ € < 25 000	4	8 000 ≤ € < 15 000
			5	15 000 ≤ € < 25 000
3	Medium small	25 000 ≤ € < 50 000	6	25 000 ≤ € < 50 000
4	Medium large	50 000 ≤ € < 100 000	7	50 000 ≤ € < 100 000
5	Large	100 000 ≤ € < 500 000	8	100 000 ≤ € < 250 000
			9	250 000 ≤ € < 500 000
6	Very large	€ ≥ 500 000	10	500 000 ≤ € < 750 000
			11	750 000 ≤ € < 1 000 000
			12	1 000 000 ≤ € < 1 500 000
			13	1 500 000 ≤ € < 3 000 000
			14	€ ≥ 3 000 000

Source: Goraj L., Mańko S., Osuch D., Bocian M., Wyniki Standardowe 2011 uzyskane przez gospodarstwa rolne uczestniczące w Polskim FADN. Część I. Wyniki Standardowe, Warsaw 2012, p. 16.

5.1. Changes in capital, income from political rent and investment in selected countries of the European Union

The rate of growth of capital factor involvement[45] is presented in Table 12. As can be seen, in this case the differences calculated year to year are relatively high. Is this, in turn, one of the effects – positive – of political rent, especially payments? Undoubtedly, such relatively high growth rates of capital factor involvement are an expression of changes in manufacturing techniques and derivative of investments, and can be combined with political rent, or the income effects of agricultural policy.

Table 12. Changes in capital input in selected countries of the EU in 2005-2009 (year t-1 = 1)

Year / Country	2005	2006	2007	2008	2009	Average change
Belgium	0.969	1.068	1.102	1.096	1.066	5.91%
Czech Republic	1.101	1.078	1.164	1.08	0.992	8.16%
France	0.984	1.056	1	1.052	1.046	2.72%
Germany	1.005	1.092	1.033	1.041	1.008	3.53%
Greece	1.039	1.059	1.026	1.085	1.081	5.77%
Hungary	0.975	0.99	1.158	1.069	0.748	-2.22%
Italy	1.03	1.027	1.017	1.082	1.016	3.41%
The Netherlands	1.069	1.141	1.073	1.11	1.049	8.79%
Poland	1.169	1.024	1.057	1.231	0.837	5.45%
Spain	0.994	1.211	1.097	1.196	0.987	9.28%
Sweden	1.007	1.061	0.758	0.801	1.019	-7.95%
Great Britain	1.022	1.089	1.015	0.972	0.978	1.44%

Source: own calculations based on http://ec.europa.eu/agriculture/rica/database/database_en.cfm.

[45] In this statement, the variable K was adopted as depreciation. It is one of the methods of representing capital on farms (J. Fogarasi, *Efficiency and total factor productivity in post-EU accession Hungarian sugar beet production*, Studies in Agricultural Economics, No. 105 pp. 87-100, 2006). In addition to depreciation, variables reflecting the size of the costs incurred are also used (A. Bezat-Jarzębowska, W. Rembisz, A. Sielska, *Wybrane postacie analityczne funkcji produkcji w ocenie relacji czynnik-czynnik oraz czynnik-produkt dla gospodarstw rolnych FADN*, IERiGŻ-PIB, Warsaw 2012) and values of assets (A.N. Barczak, *Wykorzystanie metody mnożników Lagrange'a do oceny efektywności produkcji na przykładzie wybranych grup gospodarstw rolnych*, PhD dissertation defended in IERiGŻ-PIB, 2011).

Table 13. Changes in volumes of investment in selected countries of the EU in 2005-2009 (year t-1 = 1)

Year / Country	2005	2006	2007	2008	2009	Average change
Belgium	1.105	1.289	1.194	0.976	1.099	12.78%
Czech Republic	1.2	1.14	1.248	1.111	0.793	8.51%
France	0.943	0.946	1.092	1.114	0.9	-0.47%
Germany	1.024	1.347	1.08	1.057	0.874	6.59%
Greece	1.094	1.744	0.842	0.985	0.914	7.66%
Hungary	0.904	0.951	1.475	1	1.179	8.38%
Italy	3.544	0.331	0.67	0.678	2.322	4.35%
The Netherlands	1.197	1.041	1.419	0.784	0.963	5.95%
Poland	0.692	1.267	1.022	0.917	0.857	-6.77%
Spain	0.765	0.608	1.613	1.117	1.338	2.32%
Sweden	0.91	1.403	1.041	1.107	0.714	0.99%
Great Britain	1.02	1.186	1.184	0.94	1.034	6.84%

Source: own calculations based on http://ec.europa.eu/agriculture/rica/database/database_en.cfm.

Table 14. Changes in amounts of subsidies in selected countries of the EU in 2005-2009 (year t-1 = 1)

Year / Country	2005	2006	2007	2008	2009	Average change
Belgium	1.086	1.23	1.117	1.055	0.982	9.10%
Czech Republic	1.266	1.296	1.05	1.175	1.012	15.42%
France	1.01	1.074	0.957	1.019	0.992	0.97%
Germany	1.011	1.158	0.974	1.02	1.034	3.76%
Greece	1.063	1.354	0.969	1.088	0.986	8.39%
Hungary	1.097	1.074	1.164	1.098	0.965	7.76%
Italy	1.083	1.095	0.922	0.988	1.03	2.16%
The Netherlands	1.458	1.186	1.006	1.013	1.01	12.22%
Poland	1.128	1.658	1.043	1.314	1.02	21.19%
Spain	0.968	1.026	0.915	1.532	1	6.84%
Sweden	1.069	1.106	1.028	1.04	0.919	3.04%
Great Britain	1.083	1.058	0.984	0.918	1.031	1.31%

Source: own calculations based on http://ec.europa.eu/agriculture/rica/database/database_en.cfm.

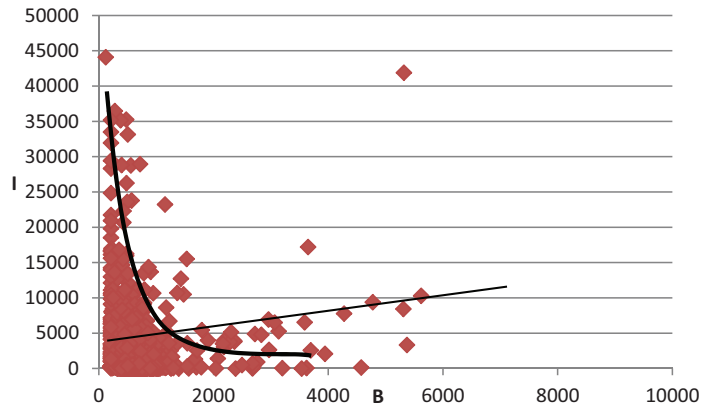
Table 13 presents changes in volumes of investment in selected countries of the European Union in recent years. We can notice a significant difference between the average rates of changes in the amount of investments in different

countries. The biggest average decline occurred in Poland, the biggest increase – in Belgium. In none of the countries shown in the table, investment increased throughout the examined period. As can be seen from the data in Table 14 the average income derived from political rent increased over the period 2005-2009 in all the countries concerned, and in most cases the average rate of growth remained higher than the growth rate of investment. The biggest difference between the two ratios is present in the case of Poland.

5.2. Relationships of investment and political rent

Figures 37-44 show formation of the amount of investment against the amount of income earned in respect of political rent. Figures 45-51, in turn, represent the relationship between the amount of income from political rent and the amount of investment in the next year[46]. The relevant variables are presented calculated as agricultural area of the farm.

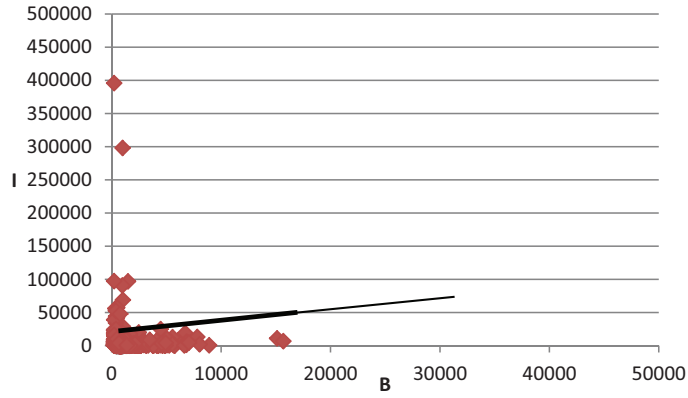
Figure 37. Income from political rent (B) and investment of farms (I) in 2004



Source: Own elaboration based on data from FADN.

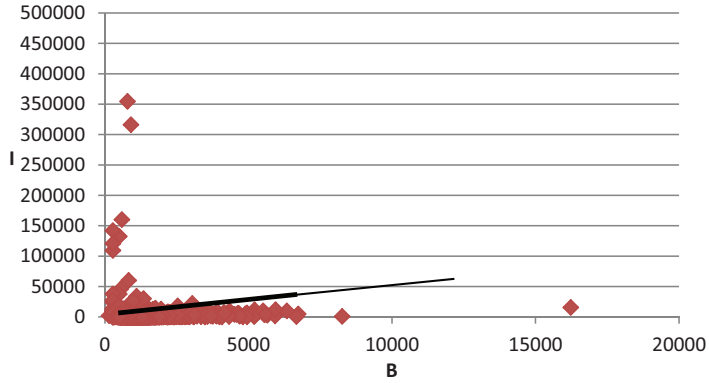
[46] The figures were created for a group of 5363 farms which kept agricultural accountancy within the Polish FADN throughout the period of 2004-2011. Observations significantly differing from the results obtained for the whole sample or observations characterized by zero values of the presented variables were not included.

Figure 38. Income from political rent (B) and investment of farms (I) in 2005



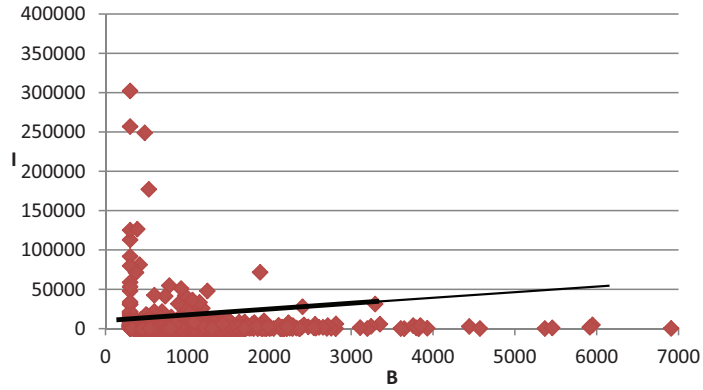
Source: Own elaboration based on data from FADN.

Figure 39. Income from political rent (B) and investment of farms (I) in 2006



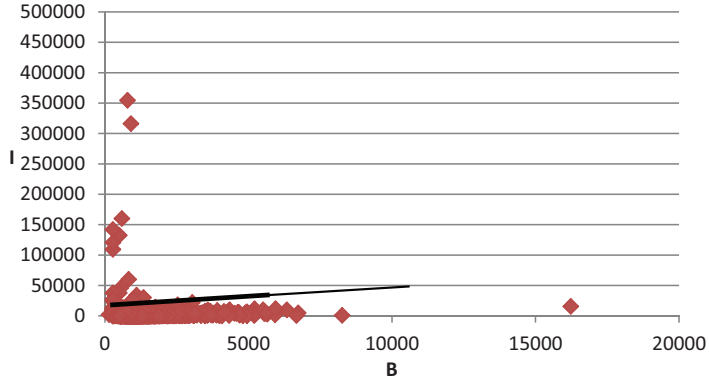
Source: Own elaboration based on data from FADN.

Figure 40. Income from political rent (B) and investment of farms (I) in 2007



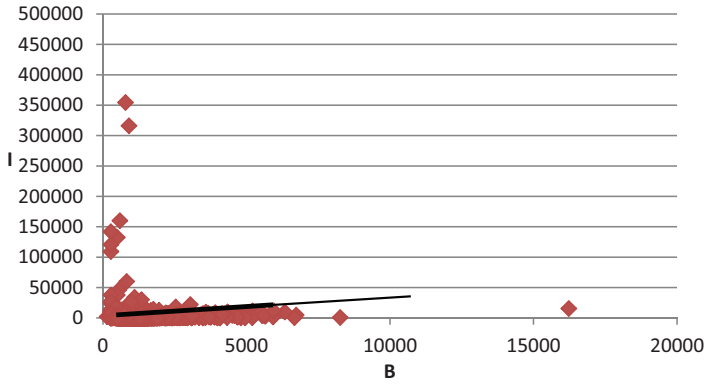
Source: Own elaboration based on data from FADN.

Figure 41. Income from political rent (B) and investment of farms (I) in 2008



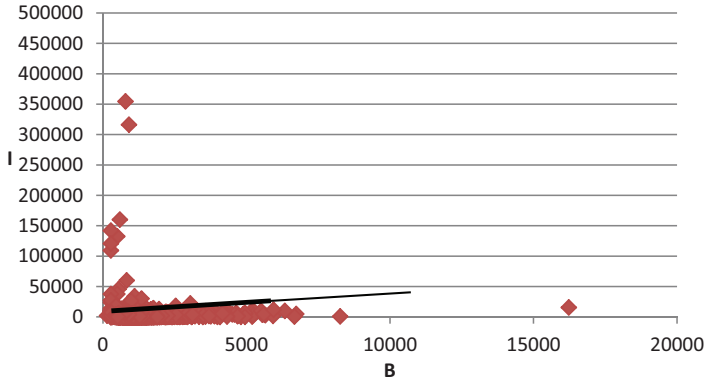
Source: Own elaboration based on data from FADN.

Figure 42. Income from political rent (B) and investment of farms (I) in 2009



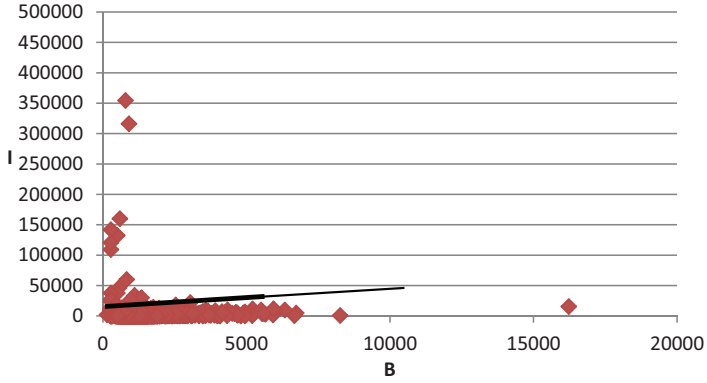
Source: Own elaboration based on data from FADN.

Figure 43. Income from political rent (B) and investment of farms (I) in 2010



Source: Own elaboration based on data from FADN.

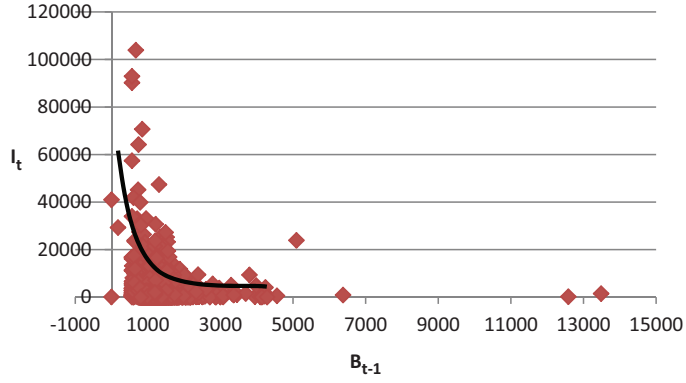
Figure 44. Income from political rent (B) and investment of farms (I) in 2011



Source: Own elaboration based on data from FADN.

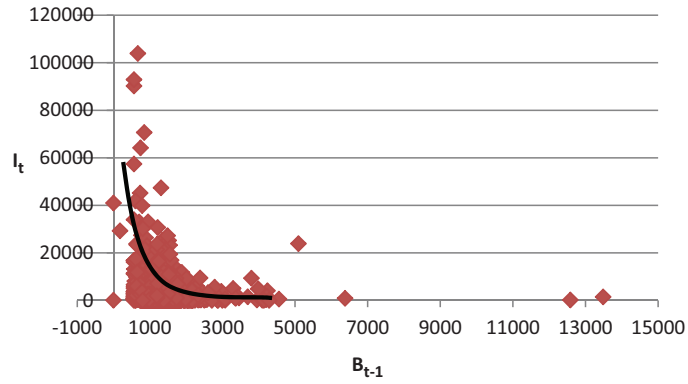
These visualizations show that the income from the political rent to some extent, although a small one, catalyses investment of agricultural producers. However, we cannot say that the catalysing impact of rent on investments agricultural producers in the studied years positively confirmed the hypothesis. It is even worse when we take into account time delays following the formulas of the previous chapter. According to the visualizations below, the level of investment is neutral with respect to political rent. This would suggest that income effects were rather consumed than invested.

Figure 45. Income from political rent (B) w 2004 r. and investment of farms (I) in 2005



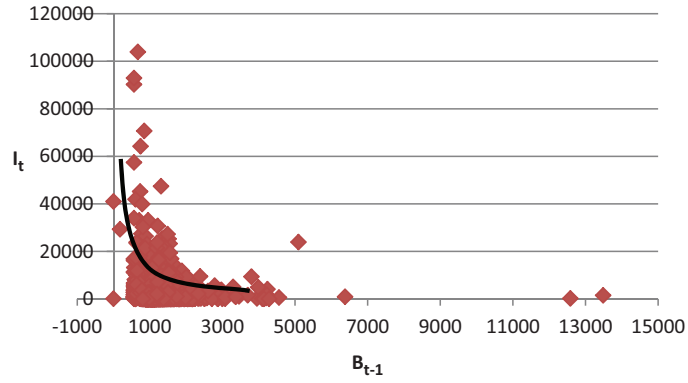
Source: Own elaboration based on data from FADN.

Figure 46. Income from political rent (B) in 2005 and investment of farms (I) in 2006



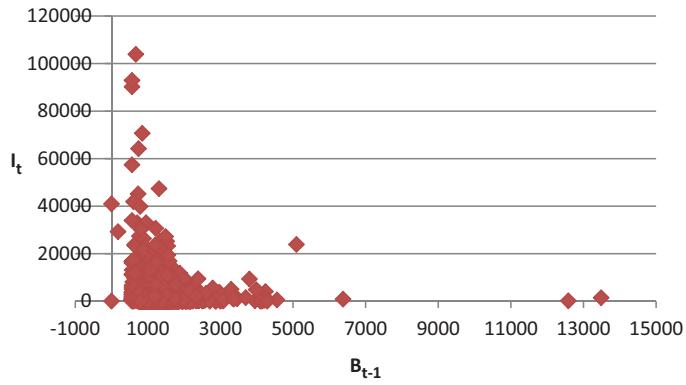
Source: Own elaboration based on data from FADN.

Figure 47. Income from political rent (B) in 2006 and investment of farms (I) in 2007



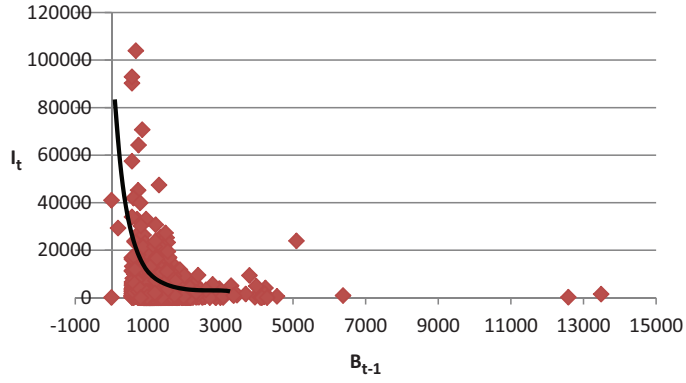
Source: Own elaboration based on data from FADN.

Figure 48. Income from political rent (B) in 2007 and investment of farms (I) in 2008



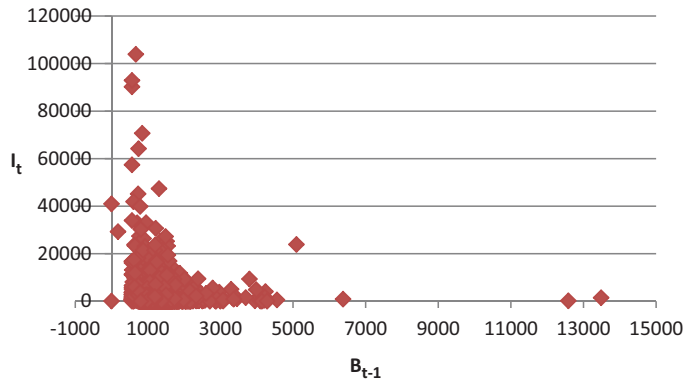
Source: Own elaboration based on data from FADN.

Figure 49. Income from political rent (B) in 2008 and investment of farms (I) in 2009



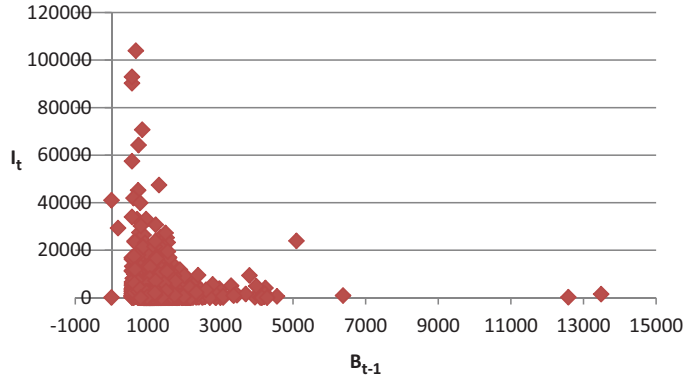
Source: Own elaboration based on data from FADN.

Figure 50. Income from political rent (B) in 2009 and investment of farms (I) in 2010



Source: Own elaboration based on data from FADN.

Figure 51. Income from political rent (B) in 2010 and investment of farms (I) in 2011



Source: Own elaboration based on data from FADN.

In view of results of the above visualization and the tested hypothesis, an attempt was made to assess the relationship of income from political rent and investment. To simplify the issue, attention was focused on the linear relationship.

For the 5,363 farms selected in the manner discussed above, analysis of regression was carried out. For each of the years (2005-2011), two models with the same dependent variable, which was the size of the investment in the individual farm, was estimated. In the first model, hereinafter referred to as M1, a set of explanatory variables was selected, taking into account: income from

political rent represented by the amount of subsidies (*B*), liabilities (*ZO*), income (*D*) and payments for investments (*BI*). For the second model (M2), political rent (again represented by the amount of subsidies – *B*) was the only explanatory variable. None of the models did take into account potential delays, focusing on the relationship between the values adopted by the variables in the same year.

The results of estimates of the model's parameters are given in Tables 15 and 16. Parentheses contain errors of estimates. There has been no elimination of statistically insignificant variables in an effort to provide clarity and comparability of the results obtained for each year and model types. It is worth noting that in all the cases intercept was statistically significant, which can be interpreted as reflecting the proportion of the investment independent of the values assumed by the explanatory variables used in the models. The value assumed by the constant initially increased, while in the later years of the period 2004-2011 a downward trend began. In all the years, liabilities had a significant impact on the investments, while income remained significant until 2009. Income from political rent had a significant impact on formation of investment since 2006, while subsidies for investments – from 2007. It is a positive conclusion, moderating the inference based on these visualizations and allows to accept the hypothesis of catalysing impact of political rent on investments of agricultural producers. This would be a beneficial observation for the evaluation of agricultural policy and political rent in shaping the choices of agricultural producers.

Table 15. Results of estimates of regression function parameters describing the amount of investment for years 2004-2007

	2004		2005		2006		2007	
	M1	M2	M1	M2	M1	M2	M1	M2
Const	2408** (78.67)	2793** (51.99)	2690** (87.82)	3138** (57.30)	4327** (112.6)	4909** (80.72)	4924** (119.4)	5272** (81.61)
B	-0.0028 (0.0098)	-0.0104 (0.0097)	-0.0024 (0.0099)	-0.0044 (0.001)	0.06** (0.0132)	0.0661** (0.0134)	0.02970** (0.01352)	0.0386** (0.0136)
ZO	0.0963** (0.0162)		0.1185** (0.0178)		0.2139** (0.0233)		0.1659** (0.02334)	
D	0.0318** (0.0084)		0.0384** (0.0091)		0.0362** (0.0120)		-0.01396 (0.0119)	
BI			16.02 (27.98)		1.840 (1.341)		0.6092** (0.0734)	
Adjusted R^2	0.0094	0.0000	0.0114	-0.0001	0.0221	0.0044	0.0246	0.0013

* - parameter significant at the level of 0.1

** - parameter significant at the level of 0.05.

Source: Own elaboration based on data from FADN.

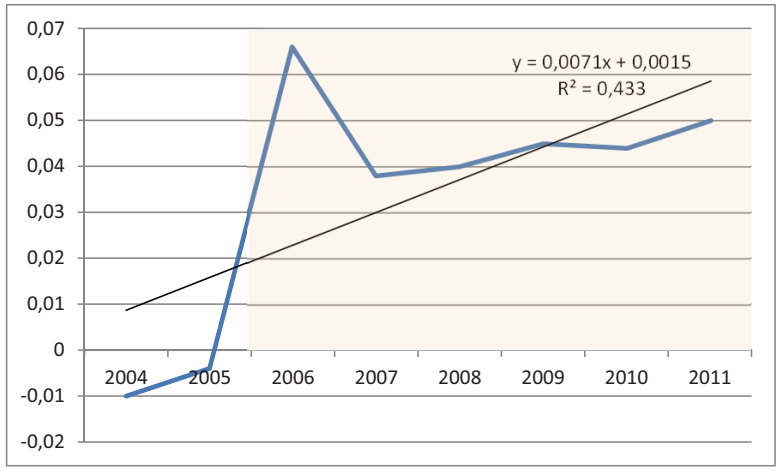
Table 16. Results of estimates of regression function parameters describing the amount of investment for years 2008-2011

	2008		2009		2010		2011	
	M1	M2	M1	M2	M1	M2	M1	M2
Const	4572** (113.9)	5094** (80.87)	4480** (110.4)	4943** (80.84)	4038** (101.2)	4353** (71.46)	4021** (102.4)	4274** (71.32)
B	0.0328** (0.013)	0.0403** (0.0131)	0.03016** (0.0129)	0.0459** (0.0128)	0.02955** (0.01242)	0.0449** (0.0124)	0.0377** (0.0124)	0.0506** (0.0124)
ZO	0.1637** (0.0229)		0.1460** (0.0228)		0.1729** (0.02315)		0.1166** (0.0242)	
D	0.03021** (0.0119)		0.03681** (0.0118)		0.006255 (0.01147)		0.00461 (0.0116)	
BI	0.2092** (0.0611)		0.1757** (0.0657)		0.2732** (0.05247)		0.3104** (0.0497)	
Adjusted R^2	0.0156	0.0016	0.0133	0.0022	0.0190	0.0022	0.0156	0.0029

* - parameter significant at the level of 0.1
** - parameter significant at the level of 0.05.
Source: Own elaboration based on data from FADN.

For the models of the form M2, we examined how directional coefficients reflecting the impact of political rent on investment changed in the period of 2004-2011. The changes are shown in Figure 52. Colour indicates the periods in which the estimates of the coefficients were statistically significant. As can be seen, the impact of political rent on investment of agricultural producers in the period tends to increase. Unfortunately, this trend did not characterize the coefficients determination of appropriate models.

Figure 52. Evolution of parameters associated with variable *B* in M2 models

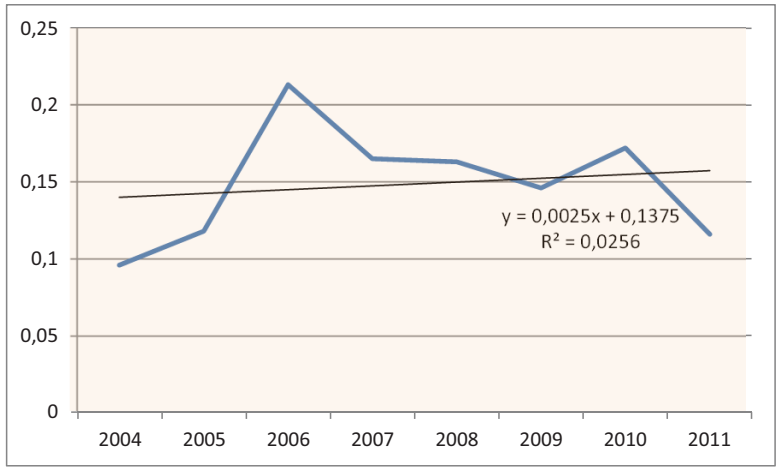


Source: Own elaboration based on data from FADN.

5.3. Relationships of investment and liabilities

As a complement to the above analysis, we also examined the relationship of investment taken up in the farms and liabilities. Fig. 53 presents the parameters placed at variable *ZO* in M1 models. It may be noted that in all the years the coefficients regression are statistically significant, and their values are varied to a moderate extent. At the beginning of the examined period, we could see an upward tendency, in later years, however, stabilization can be noted. It also can lead to a positive inference as to the adoption of hypothesis of catalysing impact of political rent on investment of agricultural producers. This in turn could also indicate that agricultural producers use their political rent's income effects to create the basis for labour productivity, according to the analytical models developed in the previous chapter. It also verifies the positive comments and conclusions drawn based on the analysis of point visualizations shown above (Fig. 37-44).

Figure 53. Evolution of parameters associated with variable *ZO* in M1 models



Source: Own elaboration based on data from FADN.

In the next step, a case in which it is assumed that investment depends only on liabilities was examined. Table 17 shows the results of estimates of regression function parameter describing the amount of investment depending on the amount of liabilities (M3 models). All parameters were statistically significant, while the impact of liabilities on investment during the period

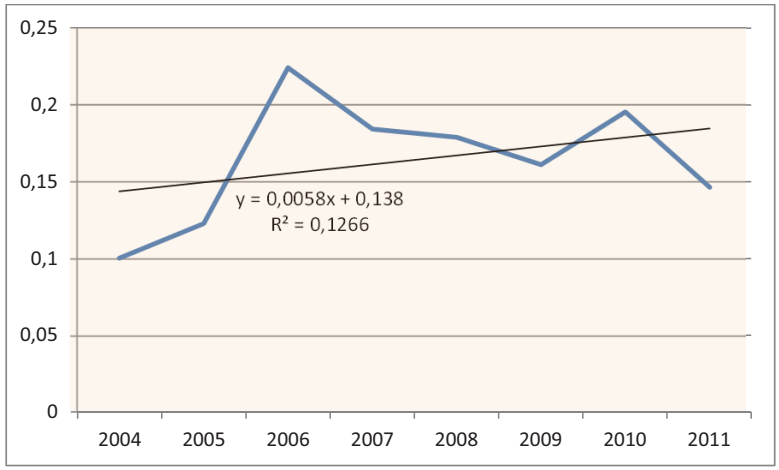
remained at a similar level (Fig. 54). This is consistent with the results of the M1 models in Tables 15 and 16 and in Figure 53.

Table 17. Results of estimates of regression function parameters describing the amount of investment depending on the amount of liabilities (M3) for the period of 2004-2011

	2004	2005	2006	2007	2008	2009	2010	2011
Const	2563.46 (38.9943)	2911.33 (41.8138)	4850.63 (58.3364)	5133.76 (59.6376)	4993.33 (57.5235)	4916.63 (56.569)	4300.38 (48.5451)	4333.77 (47.9698)
ZO	0.1005 (0.016)	0.1229 (0.0178)	0.2241 (0.0233)	0.1842 (0.0234)	0.1789 (0.0228)	0.1611 (0.0226)	0.1954 (0.0229)	0.1464 (0.0239)
Adjusted R^2	0.0071	0.0086	0.0168	0.0113	0.0112	0.0092	0.0132	0.0067

Source: Own elaboration based on data from FADN.

Figure 54. Evolution of parameters associated with variable *ZO* in M3 models



Source: Own elaboration based on data from FADN.

It should be added that for all the models the values of the adjusted determination coefficients are low, which should lead to examination of other functional forms of the analysed dependencies or consideration of additional determinants. Regardless of this methodological remark, it does not undermine the positive inference concerning the hypothesis of a catalysing impact of political rent on producers' investments.

5.4. Investment, political rent, liabilities – dynamics

According to the formulas of the previous section, the analysed hypotheses can be addressed through incremental volumes and the shares of farms for which these relationships are positive. The subsection presents and comments on selected dynamic dependencies occurring between the volume of investment, income earned from political rent, income and the volume of liabilities. The analysis aims to examine the relationship among the rate of changes of variables specified in the quoted formulas.

Four indicators have been defined (V.1-V.4).

$$m_1 = \begin{cases} 1 & if \quad \dfrac{\Delta I}{\Delta B} > 1 \\ 0 & if \quad \dfrac{\Delta I}{\Delta B} \leq 1 \end{cases} \tag{V.1}$$

where:

ΔI – increase in investment,

ΔB – increase in income from political rent;

$$m_2 = \begin{cases} 1 & if \quad \dfrac{\Delta I}{\Delta BI} > 1 \\ 0 & if \quad \dfrac{\Delta I}{\Delta BI} \leq 1 \end{cases} \tag{V.2}$$

where:

ΔBI – increase in subsidies for investment;

$$m_3 = \begin{cases} 1 & if \quad \dfrac{\Delta I}{\Delta D} > 1 \\ 0 & if \quad \dfrac{\Delta I}{\Delta D} \leq 1 \end{cases} \tag{V.3}$$

where:

ΔD – increase in income;

$$m_4 = \begin{cases} 1 & if \quad \dfrac{\Delta I}{\Delta ZO} > 1 \\ 0 & if \quad \dfrac{\Delta I}{\Delta ZO} \leq 1 \end{cases} \tag{V.4}$$

where:

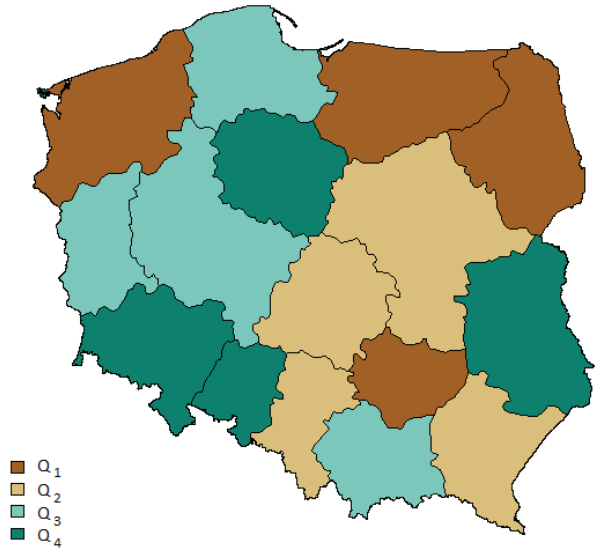
ΔZO – increase in liabilities.

According to formula (V.1), the indicator m_1 for the individual farm has the value 1 if the investment growth rate is higher than the growth rate of income from political rent (subsidies except subsidies for investments). The indicator m_2, defined by the formula (V.2), has the value equal to 1 for an individual farm if the investment growth rate is higher than the growth rate of subsidies for investment. This distinction is to take into account the situation in which the income effect caused by political rent occurs in agricultural producers. Similarly to the previously discussed indicators, m_3 indicator takes the value 1 for farms in which investments grow faster than income. In turn, m_4 indicator has unit values for farms for which investments grow faster than liabilities. Values of these indicators higher than 1 indicate a positive verification of the hypothesis of catalysing impact of political rent on investment. The share ratios of farms with indicators equal to more than 1 are a similar evidence expression of these indicators against the other.

Figure 55 presents a quartile breakdown of voivodeships made on the basis of the shares of farms for which the investment growth rate exceeds the growth rate of income from political rent (m_1=1). Such breakdown was selected because of the possibility of defining equal groups and simple interpretation. Q_i means the value belonging to the i-th quartile. Aggregated results for the entire period 2004-2011 were used.

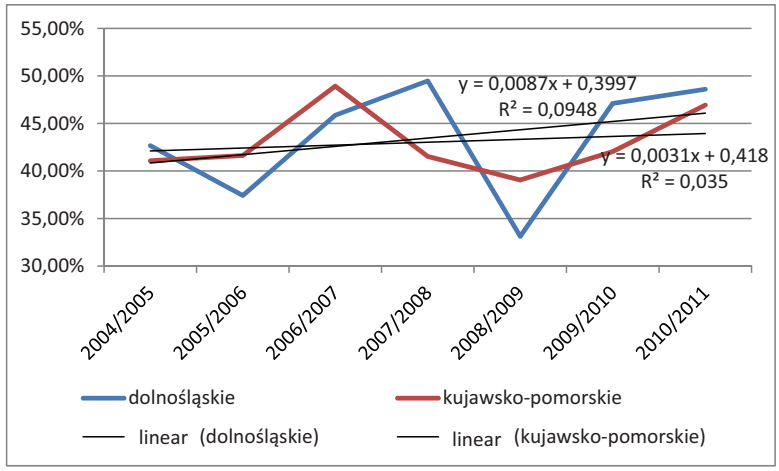
As can be noticed, the smallest share of farms increasing investment faster than income derived from political rent grew occurs in the following voivodeships: zachodniopomorskie, warmińsko-mazurskie, podlaskie and świętokrzyskie, the highest shares were recorded for the following voivodeships: lubelskie, dolnośląskie, opolskie and kujawsko-pomorskie. They show the shares of farms for which political rent in a sense catalyses investments.

Figure 55. Quartile breakdown of voivodeships based on the share of farms for which the rate of investment growth exceeds the rate of growth of income from political rent (m_1=1)



Source: Own elaboration based on data from FADN.

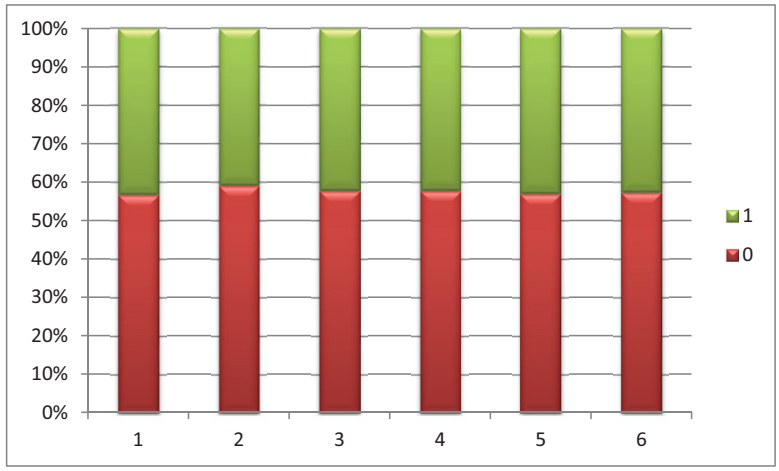
Figure 56. Shares of farms for which the rate of investment growth exceeds the rate of growth of income from political rent (m_1=1) for dolnośląskie and kujawsko-pomorskie voivodeships in 2004-2011



Source: Own elaboration based on data from FADN.

The shares in the studied period fluctuated in all voivodeships, recording a decline in 2008/2009. There are no clear tendencies, which can be seen in Fig. 56. For the sake of clarity, we have limited ourselves to present the changes in shares of only two voivodeships (dolnośląskie and kujawsko-pomorskie), but they reflect well the changes in the other ones. We cannot set a voivodeship in which the share of farms for which the rent of investment growth exceeds the rate of growth of income from political rights (m_1=1) was the highest or the lowest throughout the examined period. Despite these observations, the border level of significance test of independence chi-square equal to 0.005402[47] indicates a basis for claiming a statistically significant relationship between location and the share of farms for which the rate of investment growth exceeds the rate of growth of income from political rent. This means that in individual voivodeships there were noticeable differences in the relative number of farms increasing investments faster than their income derived from political rent grew. However, these shares are significant to verify the analysed hypothesis positively.

Figure 57. Shares of farms for which the rate of investment growth exceeds the rate of growth of income from political rent (m_1=1) by SO



Source: Own elaboration based on data from FADN.

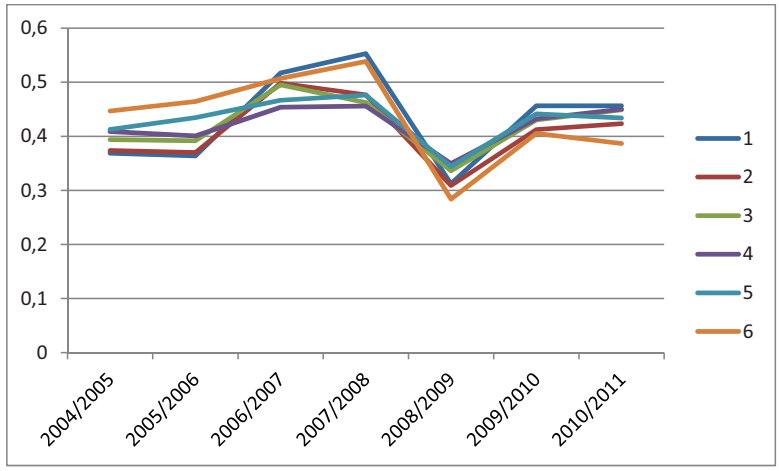
Figure 57 presents the shares of farms for which the rate of investment growth exceeds the rate of growth of income from political rent by economic size classes (ES6 classification). These shares, determined on the basis of ag-

[47] In all cases, the independence test was carried out upon aggregated results for the period of 2004-2011.

gregated results for the whole examined period, can be considered stable. They were also quite high – ranging from 40.87% to 43.25%. It is worth noting that for each group defined on the basis of economic size the shares of farms for which the rate of investment growth exceeds the rate of growth of income from political rent (m_1=1) evolved over time in a similar manner, reaching the maximum value in the period of 2006-2008, while the minimum ones in the period of 2008-2009 (Fig. 58). It also allows for positive verification of the analysed hypothesis.

Chi-square independence test was performed for the distribution of the shares of farms for which the rate of investment growth exceeds the rate of growth of income from political rent by economic size. Despite the seemingly close shares in each class, the limit value of the level of significance obtained in the test shows that these shares are differentiated according to economic size of farms.

Figure 58. Shares of farms for which the rate of investment growth exceeds the rate of growth of income from political rent (m_1=1) by SO

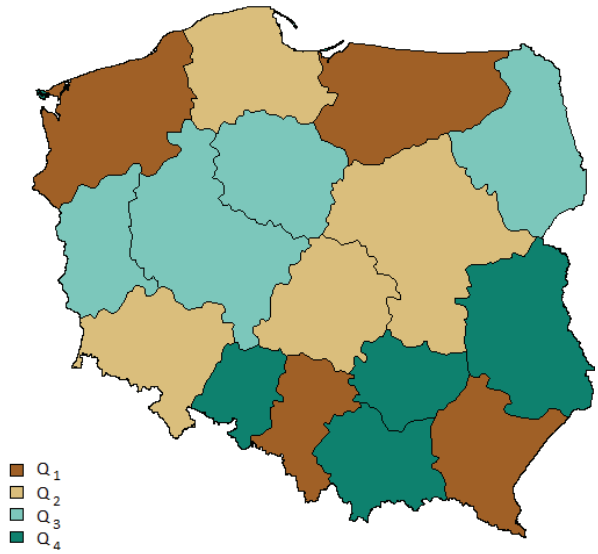


Source: Own elaboration based on data from FADN.

These results, of course, can also be the basis for a positive reference to the hypothesis of catalysing impact of political rent on investments of agricultural producers. The indicators from approx. 30 to 50% of farms in which investment grew faster than income derived from economic rent indicate that political rent was its source and, in accordance with the formulas of the previous chapter, its part allocated to savings as a catalyst for investment from *ex ante* and *ex post* savings of agricultural producers.

The relationship between the rate of investment growth and the rate of investment subsidies under the CAP mechanisms was also examined. The faster rate of investment than subsidies may also indicate the possibility of catalysing impact of political rent on this process.

Figure 59. Quartile breakdown of voivodeships based on the share of farms for which the rate of investment growth exceeds the rate of growth of subsidies for investment (m_2=1)

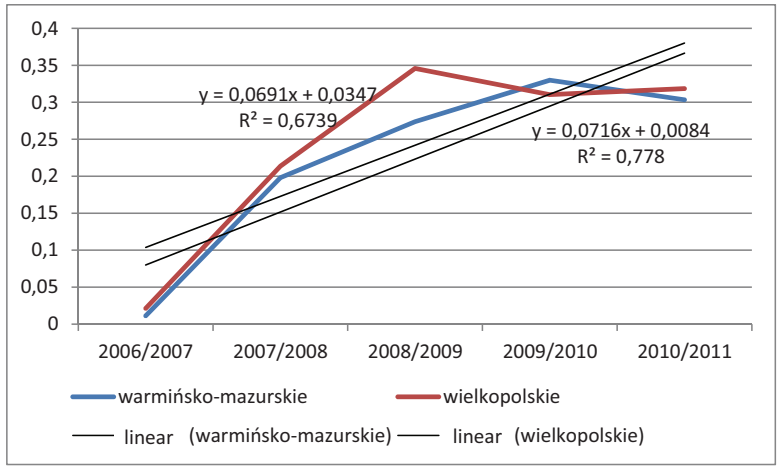


Source: Own elaboration based on data from FADN.

Figure 59 presents the quartile breakdown of voivodeships based on the share of farms for which the rate of investment growth exceeds the rate of growth of subsidies for investment. Similarly to the previous meter, aggregated results for the entire period of 2004-2011 were used.

It is worth noting that in the case of shares of farms for which the rate of investment growth exceeds the rate of growth of subsidies for investment (m_2=1) the largest diversity occurs in the southern part of the country. The voivodeships located in this area were characterized by both the relatively lowest shares (e.g. podkarpackie voivodeship) and those from the fourth quartile (małopolskie).

Figure 60. Shares of farms for which the rate of investment growth exceeds the rate of growth of subsidies for investment (m_2=1) for warmińsko--mazurskie and wielkopolskie voivodeships in 2004-2011

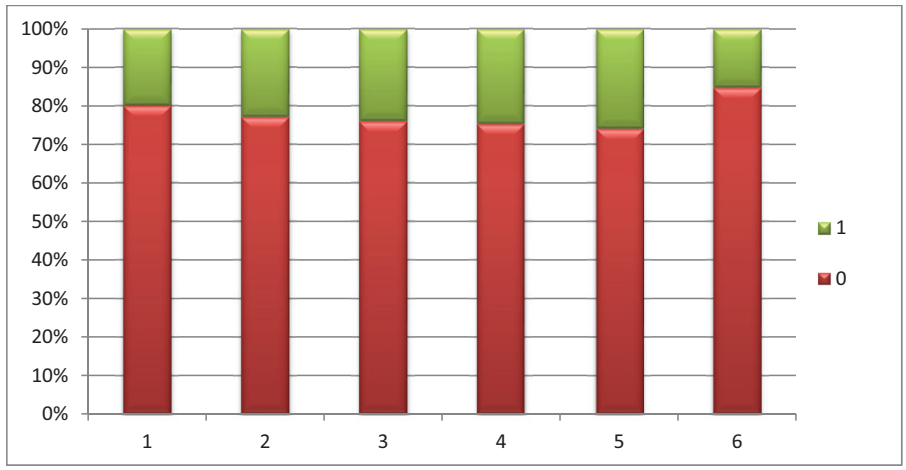


Source: Own elaboration based on data from FADN.

For some voivodeships, a downward trend may be noted in the later years of the period but it seems that this period is too short to be able to indicate a constant trend. However, in the second half of the considered period for most of them the growth rate of farms for which the rate of investment growth exceeds the rate of growth of subsidies for investment (m_2=1) decreased. Figure 60 shows examples of change for warmińsko-mazurskie and wielkopolskie voivodeships together with the designated estimates of the trend function. A linear function was used here as in order to preserve compliance with the analyses carried out for the other measures, but it is worth noting that there is a possibility that these changes are non-linear in the long run. This means that after the initial period of rapid growth of shares of farms faster increasing investment than subsidies further changes of the structure run increasingly slower. This is not good news for the assessment of the catalysing impact of political rent on investment.

The value of the limit level of significance for the test of voivodeship's independence and the share structure of farms for which the rate of investment growth exceeds the rate of growth of subsidies for investment (m_2=1) is 0.7787, which means that there is no basis to reject the null hypothesis of independence.

Figure 61. Shares of farms for which the rate of investment growth exceeds the rate of growth of subsidies for investment (m_2=1) by SO



Source: Own elaboration based on data from FADN.

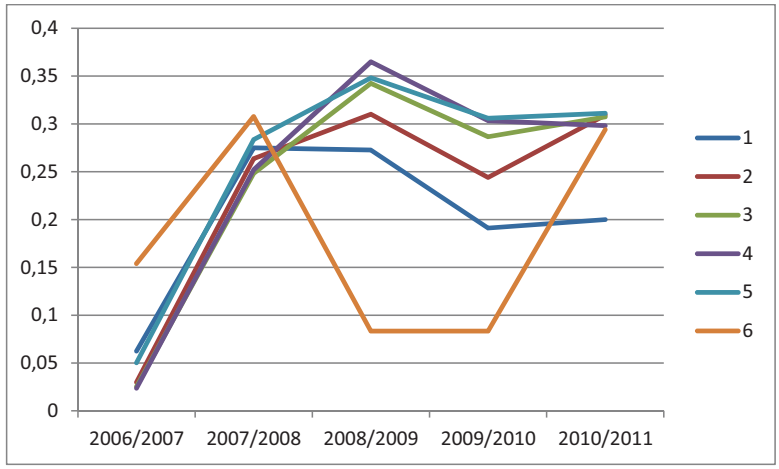
When analysing the rate of changes in volumes of payments directly for investment, and investment itself, we can see two basic relations. The first one is the fact that shares of farms for which the rate of investment growth exceeds the rate of growth of subsidies for investment (m_2=1) in this case are noticeably lower than for subsidies under consideration without consideration of subsidies for investment. They range from 15.24 to 25.9%. Based on the aggregate results for the entire period, we can notice that they are also relatively more differentiated between groups of farms designated on the basis of economic size than shares designated in the previous case (Fig. 61). It can be concluded that with the increase in the share of economic size of farms for which the rate of investment growth exceeds the rate of growth of subsidies for investment increases. The largest group of farms for which this share is the lowest is an exception. However, it is worth mentioning the relatively small size of this group, which may be the cause of that situation. In a general sense, it is also a contribution to the positive reference to the hypothesis of catalysing impact of political rent on investment of agricultural producers.

Over the years, the shares of farms for which the rate of investment growth exceeds the rate of growth of subsidies for investment vary in a similar manner for all groups, except – again – the group of the largest economic size (Fig. 62).

A chi-square test of independence also was carried out for the classification by economic size. The value of the limit level of significance (0.01787) indicates the existence of a relationship between the shares of farms for which the

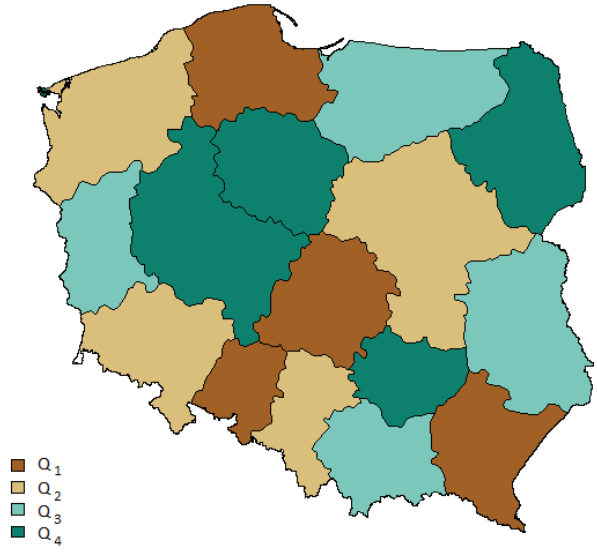
rate of investment growth exceeds the rate of growth of subsidies for investment and economic size.

Figure 62. Shares of farms for which the rate of investment growth exceeds the rate of growth of subsidies for investment (m_2=1) by SO



Source: Own elaboration based on data from FADN.

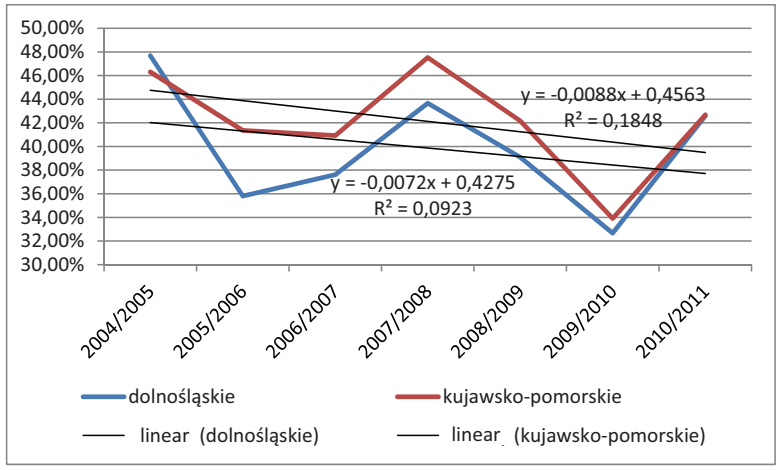
Figure 63. Quartile breakdown of voivodeships based on the share of farms for which the rate of investment growth exceeds the rate of growth of income (m_3=1)



Source: Own elaboration based on data from FADN.

Shares of farms for which the rate of investment growth exceeds the rate of growth of income (m_3=1) is at the average about 41%. The diversity of shares between the voivodeships is negligible, but it is worth noting that the results of the chi-square independence test indicate a significant relationship between the voivodeship and the structure of farms in terms of the relation of investment growth rate and the income growth rate (the borderline significance level for this test was 0.0008125). The highest share of farms for which the rate of investment growth exceeds the rate of growth of income (m_3=1) was recorded in podlaskie voivodeship (high values also characterized kujawsko-pomorskie, świętokrzyskie and wielkopolskie voivodeship). The lowest shares were in the following voivodeships: opolskie, łódzkie, pomorskie and podkarpackie. Figure 63 shows, as in previous cases, quartile breakdown of voivodeships according to the aggregated results for the period of 2004-2011. The shares in the examined period remained fairly stable in all voivodeships. In some cases, we may notice a slight downward trend. The examples of changes in the two selected voivodeships are shown in Fig. 64. They reflect in a good way the evolution of shares of farms for which the rate of investment exceeds the rate of growth of income (m_3=1) in all voivodeships. This indicates a positive verification of the analysed hypothesis.

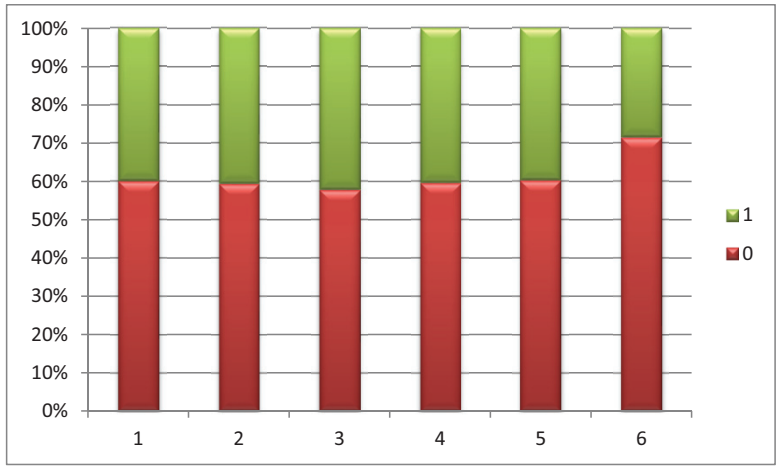
Figure 64. Shares of farms for which the rate of investment growth exceeds the rate of growth of income (m_3=1) for dolnośląskie and kujawsko-pomorskie in 2004-2011



Source: Own elaboration based on data from FADN.

Shares of farms for which investment exceeds the rate of growth of income were also examined in cross-section based on economic size. Figure 65 presents the shares of farms for which m_3=1 in six classes of economic size (aggregated results for the period 2004-2011). These shares can be considered relatively stable. For farms with an economic size from "very small" (1) to "large" (5), we can see that the shares remain at a similar level (from 39.78% for the "large" to 42.24% for farms belonging to the group "medium-small"). Again, the lowest share was reported for farms with the highest economic size (less than 29%). As can be inferred based on the results of the chi-square independence test, the shares are dependent on the economic size. This is some reference to the inference about substitution of political and economic rent, depending on the level of production efficiency of the analysed farms. Nevertheless, the observed relatively high shares of farms for which the analysed ratio is greater than 1 is another contribution to the positive inference on the hypothesis of catalysing impact of political rent on investments of agricultural producers.

Figure 65. Shares of farms for which the rate of investment growth exceeds the rate of growth of income (m_3=1) by SO

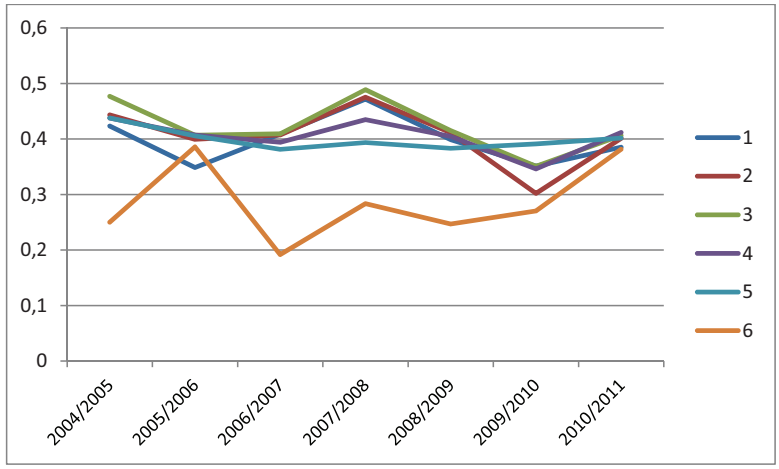


Source: Own elaboration based on data from FADN.

In the case of farms with an economic size from "very small" to "medium large", the share of farms for which the rate of investment growth exceeds the rate of growth of income (m_3=1) changed in a similar manner over the examined period (Fig. 66). Maximum values are achieved in the period of 2007/2008, after which there was a decline in 2009/2010. The situation looks

different in the groups of farms belonging to the class of "large" and "very large" economic size. The shares remain relatively constant throughout the considered period for economic size "large". In turn, marked fluctuations and – from 2006/2007 – an upward trend can be seen in the case farms belonging to the group of the greatest economic size ("very large"). Of course, it is not only about the analysis of these changes, but to show the share of these farms, as we can see significant, for which we can observe the catalysing effect of rent on investments.

Figure 66. Shares of farms for which the rate of investment growth exceeds the rate of growth of income (m_3=1) by SO



Source: Own elaboration based on data from FADN.

Figure 67 presents a quartile breakdown of Polish voivodeships based on the share of farms for which the rate of investment growth exceeds the rate of growth of liabilities (m_4=1). The aggregate results for the entire period were re-used. The lowest share can be observed for the małopolskie voivodeship, also relatively low for świętokrzyskie. In the case of defining the highest shares of farms for which the rate of investment growth exceeds the rate of growth of liabilities, the task becomes more difficult. For the aggregated results of the entire period, the highest value of the shares of farms for which the rate of investment growth exceeds the growth rate obligations can be observed in the following voivodeships: opolskie, podlaskie and zachodniopomorskie. Quite high shares are noted also for pomorskie and warmińsko-mazurskie. These relatively high shares of farms for which there is the effect

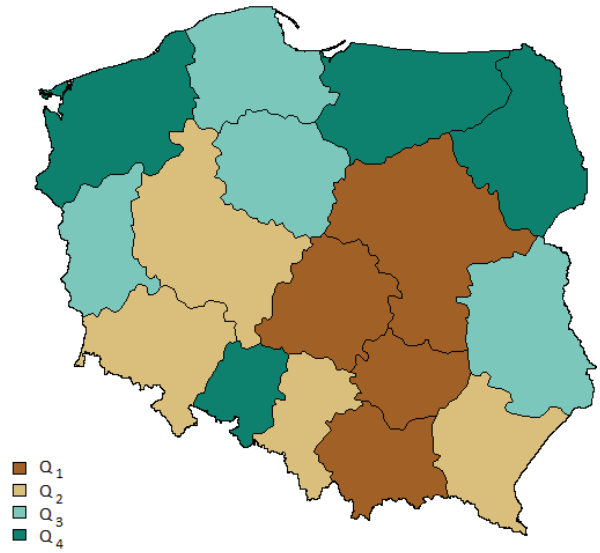
of investment catalysing by political rent obviously indicates the possibility of a positive verification of the analysed hypothesis.

It is worth noting significant fluctuations of share for some voivodeships occurring during the period, for example in lubuskie (change by 21 percentage points), śląskie (22 pp) and zachodniopomorskie (19 pp). For some voivodeships, we can also observe an upward trend. An example is shown in Fig. 68.

On the basis of the chi-square test independence, we can notice that there is a statistical relationship between the farm's location and the share of farms for which the rate of investment growth exceeds the rate of growth of income (m_4=1) (border significance level was approximately 0.000003).

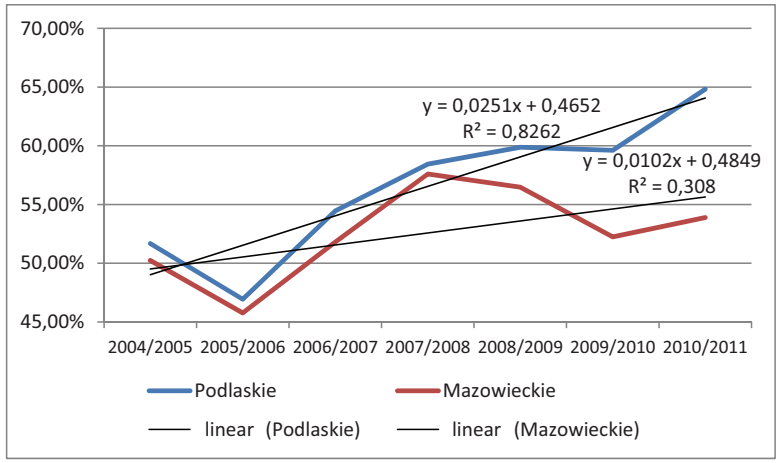
A similar analysis was performed in the breakdown of farms on the basis of economic size.

Figure 67. Quartile breakdown of voivodeships based on the share of farms for which the rate of investment growth exceeds the rate of growth of income (m_4=1)



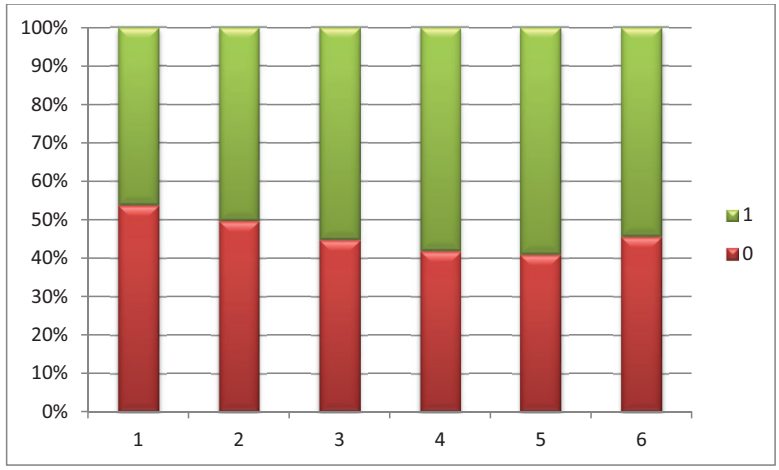
Source: Own elaboration based on data from FADN.

Figure 68. Shares of farms for which the rate of investment growth exceeds the rate of growth of income (m_4=1) for podlaskie and mazowieckie voivodeship in 2004-2011



Source: Own elaboration based on data from FADN.

Figure 69. Shares of farms for which the rate of investment growth exceeds the rate of growth of income (m_4=1) by SO



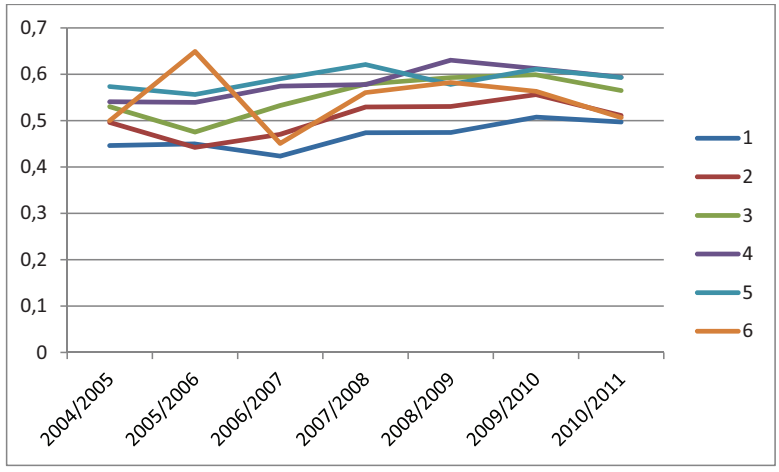
Source: Own elaboration based on data from FADN.

Differentiation of the shares of farms for which the rate of investment growth exceeds the rate of growth of income (m_4=1) is minor and the shares remain at a relatively high level (from 46.24% for the class of "very small" economic size to 59.04% for the class of "large" economic size – see Fig. 69

showing the shares designated for aggregated results throughout the period of 2004-2011). Again, the decline in the share of farms for which the rate of investment growth exceeds the rate of growth of income, despite the previous upward trend, can be seen in the group characterized by the highest ("very large") economic size.

Despite the aforementioned observations of little diversification of shares of farms for which the rate of investment growth exceeds the rate of growth of income (m_4=1) between individual classes of economic size, the border level of significance of the independence test indicates that the diversification is statistically significant. It is worth noting that the lowest share in almost whole period remained for the group of farms with the lowest economic size (Fig. 70). Finally, the highest one (also for the whole period of 2004-2011) was for groups of farms characterized by economic size "medium large" (4) and "large" (5). The general case of aggregated results for all the years also confirms this observation.

Figure 70. Shares of farms for which the rate of investment growth exceeds the rate of growth of income (m_4=1) by SO



Source: Own elaboration based on data from FADN.

Summarizing the above considerations, it can be concluded that the rate of change of investments, income from political rent, subsidies for investments, liabilities and income are dependent on the economic size. This may be associated with a different approach of farms from different classes to the conducted business activity. While small farms can manufacture primarily for their own use or as complementation to the professional work of farm's

members in another sector, larger farms operate as enterprises focused primarily on income derived from their operations and increasing their production capacity through development and investment contributing in the long term to improve production capabilities. This, of course, as the observations formulated above, suggests the possibility of adopting the hypothesis of catalysing impact of political rent on investments as a manifestation of rationality of choices made by producers. The share of these farms in the sample is relatively high despite some variations and with increasing economic size of farms. This creates a better basis to improve production efficiency and, therefore, to a more desirable relationship between political and economic rent as a source of income of agricultural producers.

Recapitulation

The monograph raises the issues of relations between political rent and economic rent outlining new fields of analysis and inquiry into the economics of agriculture. This is connected with the problem of reporting on the impact of agricultural policy and the market on choices of agricultural producers. In terms of application and practical utility, it is connected with the assessment of the impact of agricultural policy, currently CAP, on the real processes of management in agriculture. This has a more general and fundamental dimension than expert evaluations of the impact of CAP mechanisms on the economic and production outcomes of agriculture.

The hypothesis of substitutive or complementary relationship between both rents in terms of income and investments has been set. In the case of income, it was proved the hypothesis about the substitutive relationship, with regard to investments – about complementary one. In particular, the catalysing effect of political rent on investment of agricultural producers was pointed out, which forms the basis for the growth of labour productivity and further income. Verifications of both hypotheses were positive although not explicitly.

The issues of both rents are elaborated on in an analytical way. Original mathematical formulas describing the dependence of the two rents as sources of income of agricultural producers and a catalyst of investment of agricultural producers were developed. In the latter case, the relationships between savings, the effects of political rents and investments, and changes in technical relationships and increase in labour productivity were described. The mechanism of choice concerning investment in the context of *ex ante* and *ex post* savings, including the savings generated from political rent was described.

To verify the hypotheses and derived analytical reasoning, an empirical analysis based on FADN data for the period of 2006-2011 was carried out. The amounts obtained from the derived formulas and the resulting graphic illustrations were the basis of inference. The latter served as the basis for synthesizing and visualization of inference in the context of the hypotheses and assumptions.

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