CAP support as a source of capital and labour productivity – analytical considerations

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Abstract

The level of internal generation of financial funds, i.e. savings, is limited by the achieved productivity and profitability of production. As aside not, it appears easier to overcome the income problem as the basis for that generation of savings by means of interventionism and the underlying transfer of funds from other fields of operation through the national and EU budget to the agricultural holdings. This is a supplementation of the internally generated funds. In the paper, the authors will signal the basic relations between the savings (and external subsidies), investments and increase in production capital of an agricultural producer and an increase of its labour productivity as a basis of growth of income. The goal is to demonstrate the following relations in this respect that form an intrinsic circuitous movement with mutual interdependencies. For the proof of legitimacy, an analytical model with empirical illustrations will be used.

Keywords: agricultural producers, income, efficiency, transfers, subsidies and support for agriculture

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1. Introduction

Producers operating on a competitive market seek possibilities for maximization of expected profit by increasing production (Bezat-Jarzębowska & Rembisz, 2013). Nevertheless, in the present conditions of equilibrium and competition on the food and agricultural markets, and with the decreasing index of the share of agricultural raw materials in the food product, agricultural producers cannot count on the increase in their incomes through the increase of the prices of food products, and, as a consequence, of agricultural products, and cannot count on the increase in their incomes through the increase in production (Rembisz & Bezat-Jarzębowska, 2013). It is due to the fact that on most of markets in countries with a high GDP per capita (eg. countries of Western Europe or North America) the rate of production growth in a sector is determined by low demand increment. Researches confirm that a given growth of demand for agri-food products, occurring at a specific time, determines also the output growth in the agri-food sector (Figiel & Rembisz, 2009). It is therefore stated that the main source of increasing the income of producers is the increased productivity of labour and capital factor and some external sources as subventions and other intervention transfers.[1]

The practical problem which must be resolved on the basis of theoretical analysis is the efficiency and cost of assistance (subsidies) through prices or direct payments in the context of budgetary constraints and issues of social justice and the policy objective function (of the state). However, this goes beyond the scope of our discussion.[2]

The objective of the study is to present a concept of dependencies occurring between the external sources of increasing the income of agricultural producers (like subventions and other transfers) and the these endogenous sources like improving the productivity of capital and labour production factors. Thus, within the framework of the paper, the first stage of agri-food supply chain, namely the agricultural producers, is taken into consideration.

The considerations based on microeconomic analytical formulas describing the choices of the agricultural producer has been subjected to a preliminary empirical verification. The data collected from national statistics (within the FADN Public database) are mainly to illustrate regularities or conclusions derived from the model and the selected analytical formulas. This is only an outline of the problem, nevertheless it plays an important role in determining the incomes of agricultural producers in agriculture of countries of European Union.

2. Supporting farmers' incomes

We assume income to be a basis of the objective function of the agricultural produce. We can express the objective function of the agricultural producer as follows:

$$\max E\{D_R\} \tag{1}$$

where:

D_R – an income of the agricultural producers,

E – expected value.

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[1] The sources of this increase in the productivity, however, are varied. In the scale of the whole agriculture the source of increased labour productivity is above all a decrease in employment. In the scale of an individual farm this source is mainly a growth in production through concentration and increased share of this farm's production in the market, which is covered by the term "structural change". The process of concentration in agriculture can be analyzed based on the example of grain-producing farms in Poland, Germany and France. In the year 2010, in the structure of Polish grain-producing farms, the largest percentage (approx. 90%) was represented by those with up to 20 ha and in Germany this group was at approx. 40%, and in France 20% only, for more details see: Bezat (2012).

[2] An example of such analysis is the work by Munk (2001).

Two fundamental sources of this income were included in the study. The first one is efficiency of production, in particular the productivity of labour and capital production factors. The second source is agricultural policy income effects.[3] We leave out relations of prices received and paid as surface sources, and we use them as data on the basis of the ceteris paribus principle. This is a certain simplification, because of the multi-criterion objective function of the producer where the decision problem of the agricultural producer is shown, using the multicriterion approach, as a space of assessing decision options (Sielska, 2012).

Income, recognized in the literature mainly as a function of the remuneration of factors of production and the difference between revenue from operations and the costs incurred to obtain specific results at given price relations, is treated in the paper as depending also on the specific decisions made in the field of agricultural policy (and therefore on specific solutions to agricultural policy, creating conditions for the producers) (Bezat-Jarzębowska, Rembisz & Sielska, 2012).

As we know, the income of agricultural producers (income in agriculture) is currently being increased as a result of the effects of existing agricultural policy solutions (Common Agricultural Policy, CAP). We will denote this with the symbol: T_B. It is, i.e., revenue, also being reduced, although to a small extent by imposing tax and other burdens, which is denoted as: P_T. Therefore, we define the income of the agricultural producer:

$$D_R = \{C_R \cdot R - N \cdot C_N(R) + (T_B - P_T)\} \tag{2}$$

where:
$C_R \cdot R$ – the revenue (production value) of the agricultural producer (agriculture sector) as the product of the volume of production (supply) and the prices of products,
$N \cdot C_N(R) \rightarrow C_K \cdot K + C_L \cdot L$ – the cost of using manufacturing factors i.e. the factor of capital and the labour factor for a given level of agricultural production (on a producer or sector scale),
C_K, K – remuneration (price) of the capital factor and the involvement of capital factor,
C_L, L – remuneration (price) of the labour factor and the involvement of the labour factor,
T_B – value of different forms of transfers, subsidies and support for agriculture producing the income effect (direct payments, maintaining prices, quotas on prices, quotas on import and other regulations, production and intervention activities),
P_T – value of different tax burdens and other payments imposed on the agricultural holdings.

As we mentioned, we might indicate two sources determining the increasing of income in agriculture, namely internal (endogenous) and external (exogenous) ones.

The involvement of the capital, K, and labour, L, factors depends on the agricultural producers.[4] Thus, the improvement in the efficiency of using of production factors (improvement in the technical, economic, allocation and structural efficiency) is the endogenous condition. The speed of the improvement in the efficiency of production is determined by the speed of changes in the productivity of the capital factor and by the labour productivity growth rate. In particular, this is the maximisation of production from the given resources of productive factors, with the specific production function and available technologies. The theoretical basis is here the issue of technical progress, expressed by the improvement of efficiency (Bezat-Jarzębowska & Rembisz, 2015).

The factor T_B is the kind of institutional, i.e. regulatory, not market-related factor affecting the income of the agricultural producers within the European Union. This institutional factor is an external (exogenous) conditioning for analysis based on assumptions of market regulation and competitive equilibrium. The use of income support for agricultural producers either through product prices or

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[3] We call economic rent the first source associated with efficiency. The second - related to the agricultural policy is policy rent. These concepts known in economics were introduced to agricultural economics by Wilkin (2005).

[4] An important element distinguishing between the production processes in agriculture and production processes in other sections and branches of the economy, and generally expressed in economics, is the use of the land factor in the agricultural sector.

through direct payments, currently area payments in fact, is not much different when it comes to trigger enforcement of labour productivity growth as a source of increasing income of agricultural producers. In both cases, this support resulting in raising the incomes of agricultural producers at the same time weakens the efficiency constraint as a primary source of income. Thus, the agricultural policy in this approach is the basis of one of the sources, through which agricultural producers can maximize their objective function, i.e. the income. This source is referred to as the "political rent", as opposed to the "economic rent", related to the efficiency of production.

We indicate the possibilities of substitution between the two sources, i.e. improvement of efficiency and income effects of agricultural policy, in the presence of differences between the costs relating to the use by the manufacturer of one of these sources of income. In accordance with the principle of rationality, in this case the decision-maker seeks to replace a more expensive and less useful source in terms of growth potential with less expensive source of income, i.e. the political rent. This is determined by the marginal utility of the two rents. Assuming that the marginal income utility of economic rent is lower than in the case of political rent, the agricultural producer may be inclined to draw from the latter, and consequently to reduce or abandon improvement of production efficiency.[5]

3. External financial support and productivity of production factors

It should be pointed out that the contemporary microeconomics and macroeconomics theory, but also the theory of agricultural economics does not provide a clear clarification of where the differences in income level come from, as well as the differences in their growth rates, between agricultural producers on the national or international scale. However, in the growth models, the differentiation of the product's growth rate per person involves the international differentiation of the savings rate and the resultant investments (Rembisz & Bezat-Jarzębowska, 2013). The consideration of these issues requires the construction of an appropriate analytical model.

Given the endogenous factors, the agricultural producers' income should be linked to the labour productivity. The increased labour productivity is linked to the relation: productive capital assets and fixed and current technological productive assets and land) to the labour factor (the number of the employed).

$$\frac{K_{t+1}}{L_t} \rightarrow \frac{R_{t+1}}{L_t} \qquad (3)$$

where:

K_{t+1} – capital factor in the period *t+1*,

R_{t+1} – volume of production in the period *t+1*,

L_t – labour factor in the given period,

$\frac{K_{t+1}}{L_t}$ – technical equipment in the period after the investment,

$\frac{R_{t+1}}{L_t}$ – labour productivity in the period after the investment.

As we can see in the Fig. 1., the technical equipment in selected countries of European Union was raising in the years 2005-2014. The highest and continuously increasing value of analysed ratio was observed in the Netherlands. In other countries the increasing trend was also reported.

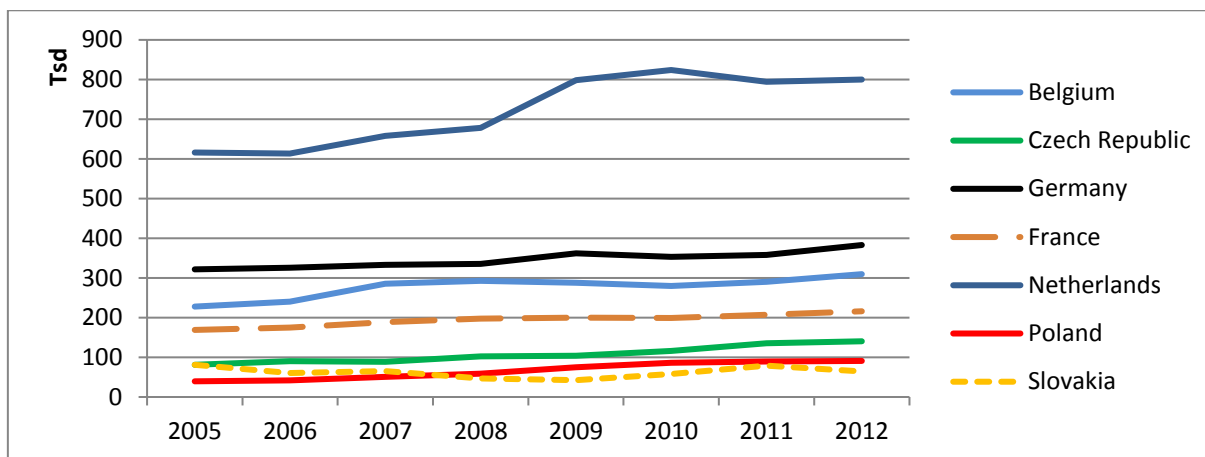[5] Such analysis were conducted in the paper by Bezat-Jarzębowska and Rembisz (2013).

Figure 1. Technical equipment $\frac{K_{t+1}}{L_t}$ in selected countries of European Union in years 2005-2012

In case of labour productivity (Fig. 2) we can observe the same trend as in Fig. 1. (technical equipment). The highest increase in this value was noted in the Netherlands. The other countries are also characterised by the increasing labour productivity. The observations described on base of Fig. 1. and Fig. 2. confirm the links presented in relationship (3).
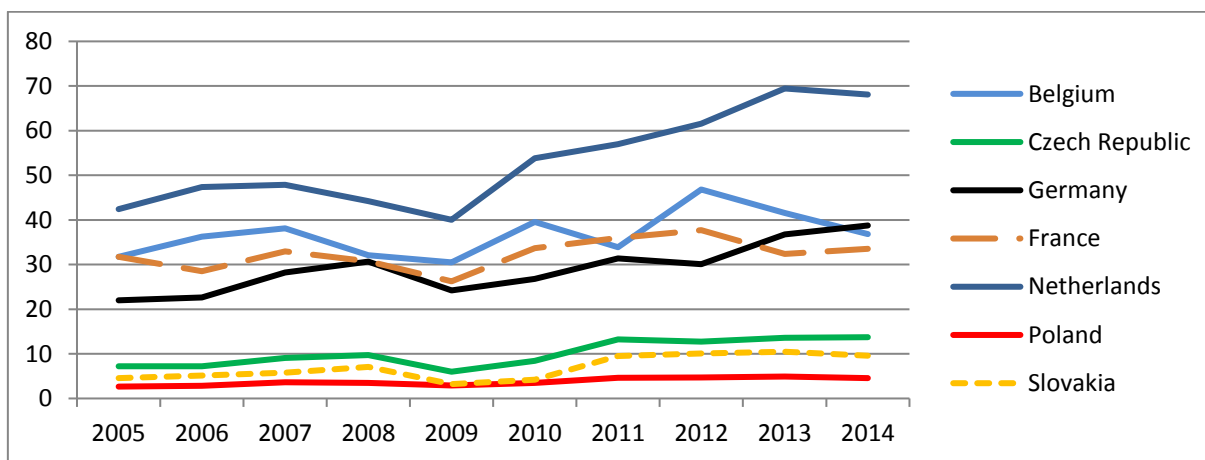

Figure 2. Labour productivity $\frac{R_{t+1}}{L_t}$ in selected countries of European Union in years 2005-2014

The investments resulting from savings, excluding the internal supply in the form of subsidies and transfers, are the obvious basis for occurring dependencies shown in relation (3). Of course the savings and resulting from them investments depend on the remuneration (price) of the labour factor (ΔC_L) before the investment (period t-1). A simplified scheme of the relationships can be presented as follows:

$$\Delta C_L \rightarrow S_t \rightarrow I_t \rightarrow (\Delta K_{t+1} - \alpha K_t) \rightarrow \frac{K_{t+1}}{L_t} \rightarrow \frac{R_{t+1}}{L_t} \qquad (4)$$

where:

ΔK_{t+1} – increase in the capital factor in the period *t+1*,

αK_t – depreciation of productive assets in the period *t*,

I_t – investment in a given period,

S_t – savings in a given period.

After a simplified dynamization of relation (4) we have:

$$\Delta C_L \rightarrow \Delta S \quad \rightarrow \Delta I \quad \rightarrow (\Delta K \quad - \alpha K \quad) \rightarrow \frac{\Delta K}{\Delta L} \rightarrow \frac{\Delta R}{\Delta L} \tag{5}$$

and:

$$\frac{\Delta R}{\Delta L} \rightarrow \Delta C_L \tag{6}$$

where:

ΔS – increase in savings from an increase in remuneration (price) of the labour factor (ΔC_L),

ΔI – increase in investments.

In the Fig. 3. and Fig. 4., we can observe that the investments were increasing continuously in some of the countries included in the study in years 2005-2012, eg. France, Germany. Some changes in the value of investments was observed in the Netherlands and in Czech Republic. Strong fluctuations in investment value was stated in case of Slovakia.
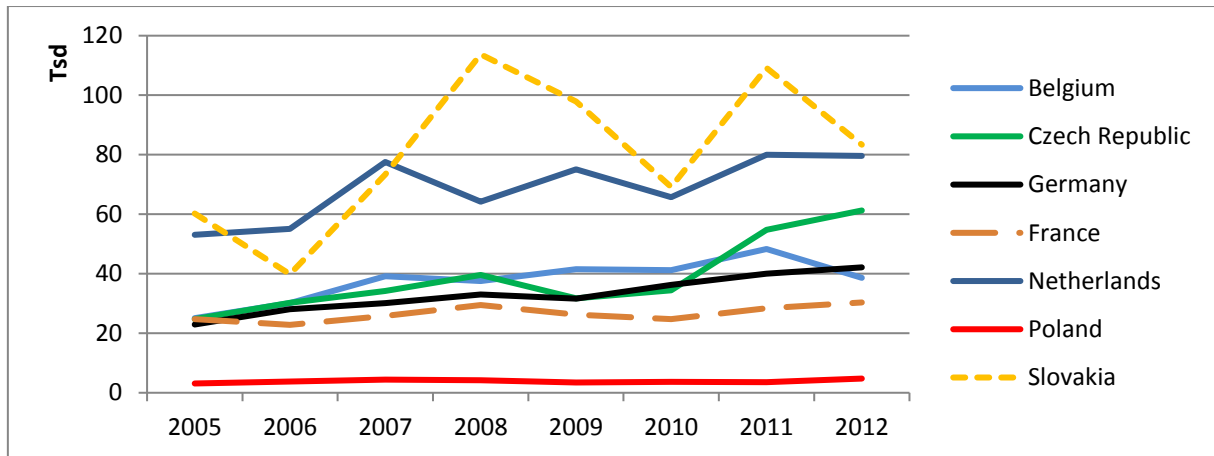

Figure 3. Gross investments I_t in selected countries of European Union in years 2005-2012
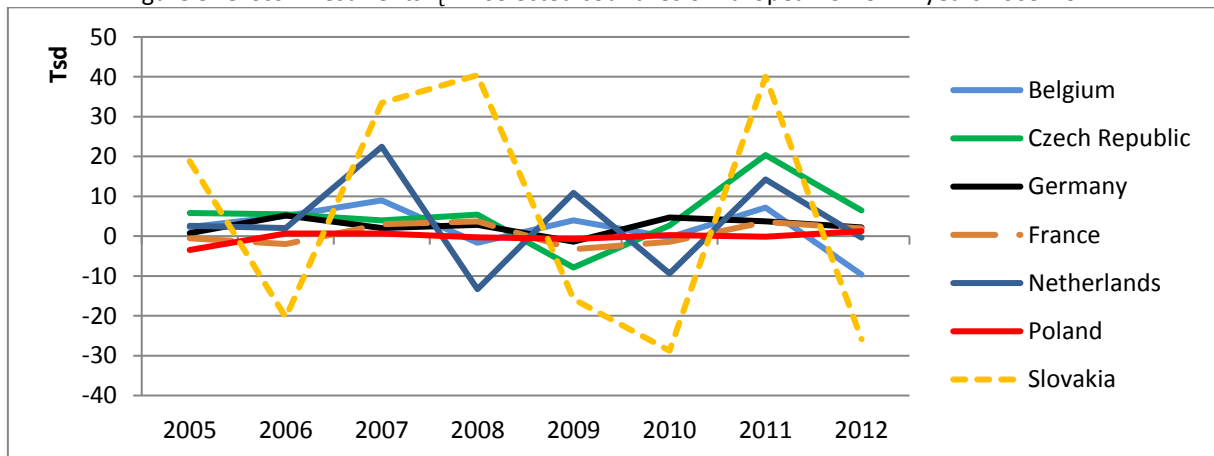

Figure 4. Increase in gross investments ΔI_t in selected countries of European Union in years 2005-2012

The changes in investments had an effect in form of the increase of capital factor, expressed as total assets, Fig. 4. The highest fluctuations of increase in capital factor were observe in case of Slovakia. In the Netherlands and Czech Republic some changes in increase in capital factor were also noted (similar as in case of investments).
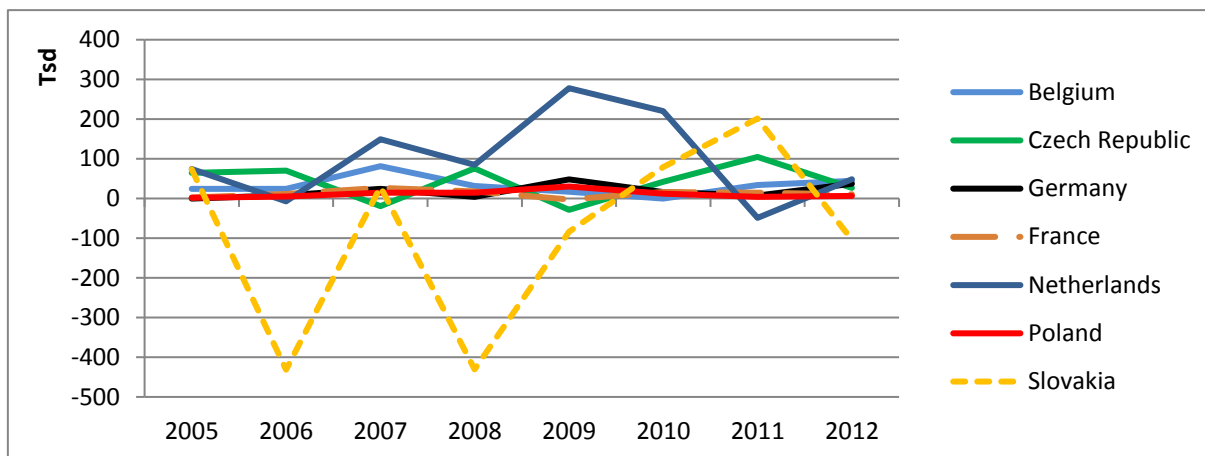

Figure 5. Increase in the capital factor ΔK_{t+1} expressed as total assets in selected countries of European Union in years 2005-2012

In the Fig. 6 and Fig. 7., we can observe that the level of fluctuations of increase in technical equipment and labour productivity is growing comparing to the level of fluctuations analyzed in case of increase in investment and increase in capital factor.
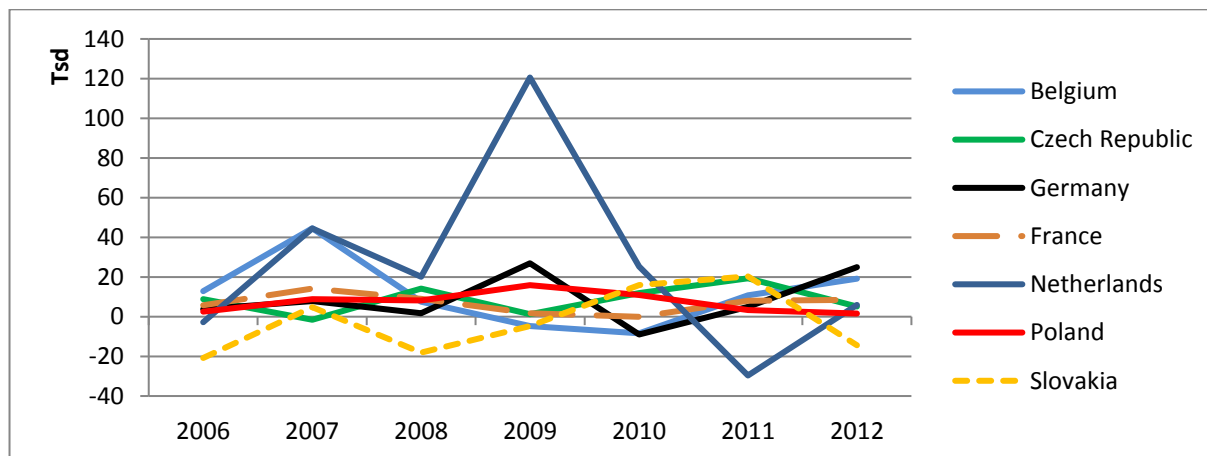

Figure 6. Increase in technical equipment $\frac{\Delta K}{\Delta L}$ in selected countries of European Union in years 2006-2012
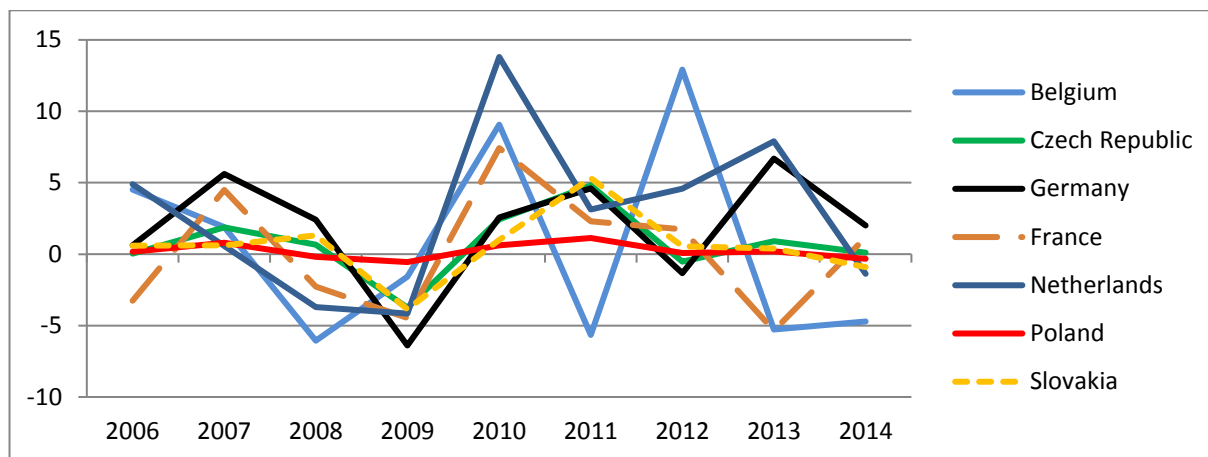
Figure 7. Increase in labour productivity $\frac{\Delta R}{\Delta L}$ in selected countries of European Union in years 2006-2012

As we can see, an increase in labour productivity as the basis of increase in income is primarily shaped by an increase in savings. The savings, on the other hand, result from an increase in the remuneration of the labour factor. Next, an increase in productivity results from an increase in investments and on consequence an increase in the productive assets per labour factor unit, which is expressed in an increase in technological equipment of labour. It is an obvious basis of increase in labour productivity, which in turn defines the opportunities for growth of remuneration of the labour factor, i.e., the income of an agricultural producer, etc., in this cycle in an intrinsic circuitous movement. It is nothing revelatory, but it shows a series of mutually determined relations, which are not always fully realised (Rembisz & Bezat-Jarzębowska, 2013).

Apart from the sources of growth of income of agricultural producers, defined by productivity and internally generated savings, there are the budgetary transfers implemented through the mechanisms of the Common Agricultural Policy, but also various forms of subsidies, etc. As included in the above-mentioned analytical formulas, it is a noticeable funding stream that increases the income and undoubtedly, which should be defined as a positive process, generates an increase in savings which form the basis for investment as a condition for an increase in productivity and next the income, etc.

Therefore, with no changes in the relationship (4) we the sum the total support and transfers to the savings. Hence, we obtain:

$$\Delta C_L + f(T_B - P_T) \to S_t + (1 - c)f(T_B - P_T) \to I_t \to (\Delta K_{t+1} - \alpha K_t) \to \frac{K_{t+1}}{L_t} \to \frac{R_{t+1}}{L_t} \quad (7)$$

where:

$f(T_B - P_T)$ – the sum of the funding stream to an agricultural producer (value of different forms of transfers, subsidies and support for agriculture producing the income effect) diminished by the value of different tax burdens and other payments imposed on the agricultural holdings.

(c) – indicator of willingness to consume the funds from transfers and support (relation of those amounts to the actual investments).

After a simplified dynamization of relation (7) we have:

$$\Delta C_L + \Delta f(T_B - P_T) \to \Delta S \quad \pm \Delta(c)f(T_B - P_T) \to \Delta I \to (\Delta K \quad - \alpha K \quad) \to \frac{\Delta K}{\Delta L} \to \frac{\Delta R}{\Delta L} \quad (8)$$

where:

$\Delta f(T_B - P_T)$ – increase in the sum of the funding stream to an agricultural producer, meaning other savings, hence the designation,

$\Delta(c)$ – increase in the indicator of willingness to consume the funds from transfers and support (relation of those amounts to the actual investments).

In Fig. 8. and Fig. 9., the value of subsidies minimised by the taxes were presented. The stable level of subsidies is observed in Poland and France. Some small changes in the level of subsidies are stated in case of Germany, the Netherland, Belgium. Relatively strong fluctuations in the level of subsidies occur in Slovakia and Czech Republic.
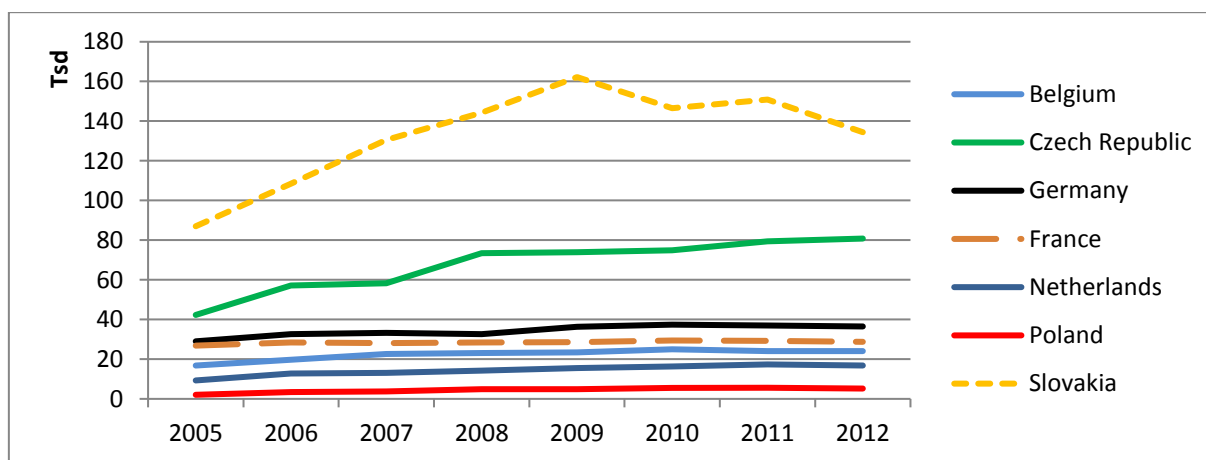

Figure 8. Balance current subsidies & taxes $f(T_B - P_T)$ in selected countries of European Union in years 2005-2012
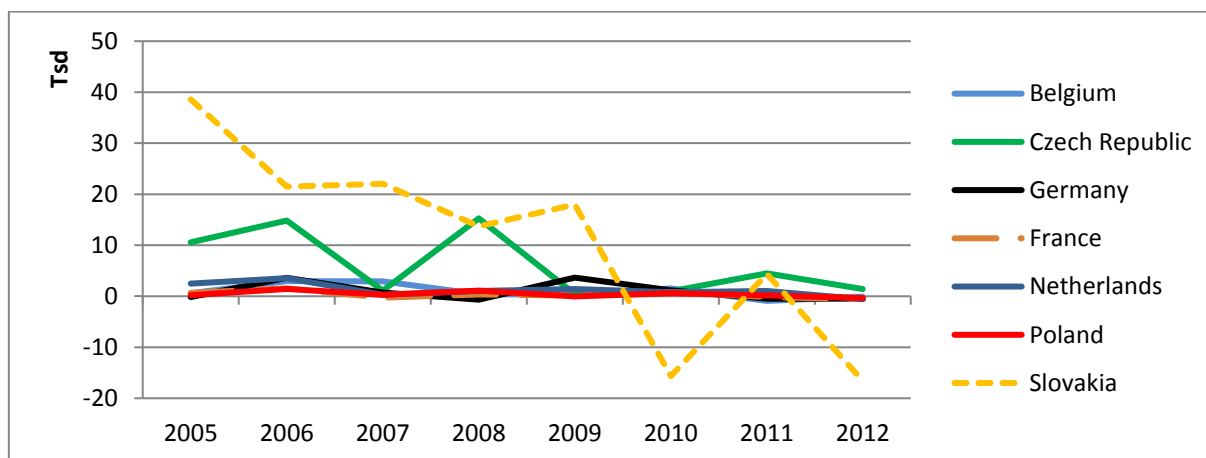

Figure 9. Increase in the balance current subsidies & taxes $\Delta f(T_B - P_T)$ in selected countries of European Union in years 2005-2012

Basing on the presented empirical analysis we can stated that there is some relation between the level of subsidies which influence the level of investment which is linked to the increase in capital factor. Nevertheless, we should take into account the indicator of willingness to consume the funds from

transfers and support (relation of those amounts to the actual investments). As we don't have reliable data on the indicator, a rather technical question arises about the proportions of these funding streams for the development process of agricultural producers. Nonetheless, it is a clear foundation of the growth of the future income on the basis of the improved labour productivity, which is obviously a positive process, which arises directly from the above-mentioned formulas.[6]

4. Conclusions

On the agricultural markets, the elasticity of demand is relatively low. This creates certain problems when it comes to the implementation of the objective function of agricultural producers. They cannot count on an increase in demand and, consequently, an increase in production and prices, as a source of growth of income. This source may be the improved production efficiency. Nevertheless, the agricultural producers are supported by other sources of income improvement, namely the policy transfers.

In the paper, the authors have signalled the basic relations between the subsidies within the CAP (including in the model as a part of savings) – which are linked to investments and increase in production capital of an agricultural producer and an increase of its labour productivity as a basis of growth of income. The goal was to demonstrate the following relations in this respect that form an intrinsic circuitous movement with mutual interdependencies. For the proof of legitimacy of that relations an analytical model were used.

Some empirical analysis and graphical illustrations, as well as specific trend functions of indicators included in the model, verify positively the assumptions and reasoning. Nevertheless, it was observed that small changes in the level of subsidies might strongly affect the changes in investment and depending on it changes in capital and labour productivity. It should be stated that funding stream that increases the income should be defined as a positive process, generates an increase in savings which form the basis for investment as a condition for an increase in productivity and next the income, etc. Nevertheless, when analysing the circuitous movement of subsidies (included in savings), investments, increase in capital actor, technical equipment and resulting from it labour productivity, one should take into account the indicator of willingness to consume the funds from transfers and support (relation of those amounts to the actual investments).

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[6] Some researchers asked the questions if the direct payments in Poland shouldn't be considered on the basis of allocation and distribution, which means that the amount of payments cannot be separated from the efficiency of the labour factor (Hamulczuk & Rembisz, 2009).

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