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CAP support policy impact on Bulgarian agriculture

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Abstract

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The main objective of the study is to identify the main areas of impact of the CAP in Bulgarian agriculture and to analyze the impact that subsidies on areas and livestock in certain industries. The development of agriculture during the years of EU membership shows a high dependency and relationship between subsidies and production, which is revealed by the size of the area in particular crops and the number of livestock. This influence is different in the different sectors, with much stronger connection and effect in certain productions, while in others the impact is insignificant. By estimating the coefficient of determination, the impact and the extent to which subsidies affect and drive the development of certain industries is judged. Through causality analysis, the explanation is outlined, both upon ongoing processes in the analyzed sectors and on the identification of the development trends. The results of this study are complemented by a descriptive analysis of the current situation and trends in the productions observed, which shows the extent to which the different agricultural support policy contributes to changes in agricultural industry development. This allows better understanding for the effects and processes that are taking place in Bulgarian agriculture since the accession to the EU.

Keywords: CAP; determination; subsidies; areas; livestock number; Bulgaria

Introduction

The Common Agricultural Policy (CAP) of EU is the largest EU policy in terms of common budget, which reached 60% in 30-40 years ago, whereas its share has fallen to 36-37% in the last programming period. The CAP goal has evolved over time, but nevertheless, supporting the competitiveness of agriculture is a key priority during all time. The CAP is also tied and influenced by the larger changes that occur and go in global scale boosted by international relationships. Globalisation and market orientation are an important factor that co-shape agricultural policies, reflected in international agreements concerning World Trade Organization (WTO), the regular UNFCC Conference of the Parties (COP) and the corresponding UN agreements on the Millennium and, since 2015, the Sustainable Development Goals (SDGs) (European Parliament, 2018). It turns out that countries, which implement the high public support to agriculture (mainly OECD states) in the period 2015-2017 out of 229 billion producers' support, 54% are the price support schemes and 46% are allocated as decoupled and farm support (European Parliament, 2018). EU with the CAP contributes significantly to latter higher share and aiming to shift the focus of support to environmental care agriculture and fostering the socio-economic viability of rural areas.

Through the accession of Bulgaria to the EU, the agriculture has become a recipient of significant support from the European budget, which goes mainly through the I Pillar of the CAP – direct payments and the II Pillar, aiming investment support and agri-environmental achievements. Direct payments represent about 50% of the total support budget in the program period 2007-2013 and about 70% in the period 2014-2020, are allocated chiefly under the Single Area Payment Scheme (SAPS), where payments follow the eligible area equally per hectare regardless occupancy of the land. This model of support is universal across the European Union and is known as a decouple support model. It is believed that this model does not directly support production

and thus interferes less in production decision making. At the same time, indirect payments through the influence they exert on yield levels affect production decisions and farmers' attitudes. According to Galluzzo (2018), "the impact of subsidies allocated by the Common Agricultural Policy has been very positive", which significantly heighten farm incomes but did less on the production point of view?

Farmers have a specific production specialization and different production structure, thus the level of subsidizing and the share of subsidies in factor income or net income is divergent. It makes different groups of farmers to receive different support. Principally the farm have different specialization hence the production they produce is affected distinctively in respect to their production costs, as the greater is the share of subsidies in their income, so greater are the opportunities and role these payments have for fostering production and for improving farm performance. It is deemed that agricultural output depends on the different factors, as agricultural land, fixed assets and labour are some of them (Zwolak, 2016). It is found out that classical coefficient of determination (R2) was the highest in terms of stimulating net final output by mentioned factors in Poland (Zwolak, 2016), which is not always case for Bulgaria.

Oppositely, as much lower is the level of subsidies in the revenues and incomes of farms as less are sequences and effects on production outcomes. It is turned out that subsidies (indirectly through creation of a better economic environment and safeguard for producers) contribute to increasing competitiveness through increased production, market realization and added value. In the period of membership, agricultural Gross Value Added remains at around 5%. However, it is found out a low utilization of land resources, which is an indicator for the general competitiveness. Bulgaria has less than 4% of EU resources and produces merely less than 1% of GVA from agriculture. The productivity of the land (GVA per unit of agricultural land) in Bulgaria is 300 euro / ha, compared to the EU average of 880 euro / ha. The productivity of GVA/AWU in Bulgaria is three times lower than in the EU. The agricultural workforce in Bulgaria has been steadily declining over the last 15 years. The ratio of land / capital factors is 2 times lower in Bulgaria than in the EU, which is an indicator of low labour efficiency. According to Minviel&Latruffe (2016) "total subsidies are related in a non-significant way to farms 'technical efficiency, while investment subsidies and coupled subsidies are significantly positively related to farms 'technical efficiency (coupled subsidies increase the probability of obtaining significant positive impact)".

It implies and shows down the inefficient role of agricultural subsidies in terms of productivity and economic results, which are key factors to maintain competitive level and foster the farm stability and resilience. The main purpose of the analysis is to investigate the impact direct payments have on the development on agricultural sectors, in terms of changes in livestock and the size of area in the crop sectors.

Goal and Methodology

This analysis will lead to a better understanding of the various effects of direct payments, which predominantly are allocated as decoupled area payments and to study to what extent these payments have contributed to the exposed situation and changes. The impact of direct payments will be demonstrated by coefficient of determination that shows how much of the observed changes in the dependent variable (area or livestock herd) are due and can be explained by the implementation and changes in the support policy. The estimation of the determination is carries out through deriving the coefficient of determination (*CD*), which can be done in several ways. The method of Pearson for estimating the correlation R thereof R^2represents the coefficient of determination, which is the most widespread method used for numerical variables. This coefficient ranges in the scale between 0and 1, where 0 spells for lack of determination, whereas1 indicates perfect determination of dependent variable (*Y*) from independent (*X*). The Pearson *R* is the first formulated correlation function and it is the most applied method for relationship analysis. On that basis further modifications and different correlation equations appear (Rogers & Nicewander, 1988), which estimate the relationship between collated variables and reveal the determination and effects independent variable cause on dependent one.

$$R = \frac{\sum(X_i - \bar{X})*(Y_i - \bar{Y})}{\sqrt{\sum(X_i - \bar{X})^2}*\sqrt{(Y_i - \bar{Y})^2}}. \quad (1)$$

From the above equation for calculating the correlation coefficient is processed to deriving coefficient of determination, where:

$$CD = R^2. \quad (2)$$

In the study, the calculation of coefficient of determination is carried out by applying the same principles of correlation between one dependent variable and another independent variable (*X*). The Pearson's method is further evolved, and using the dispersion method (Solnik et al., 1996), modification and correction are done to draw attention not to gap in covariance but to related covariance. Basically, the measurement of correlation and determination is made by considering the gap between individual values of independent

(X) and independent (Y) variables with the corresponding means $\overline{X}$ and $\overline{Y}$. In the applied method, the determination is considered as related-covariance, where instead of the differences between the individual values (X) and (Y) with variable means, their relations are used – $\frac{X-\overline{X}}{\overline{X}}$ and respectively $\frac{Y-\overline{Y}}{\overline{Y}}$. This can be coined by the equation:

$$ICD_i^1 = \sum_{i=1}^{n}\left[\frac{PrS_I - \overline{PrS_i}/\overline{PrS_I}}{DP_I - \overline{DP_i}/\overline{DP_I}}\right]. \quad (3)$$

The above equation is designated to estimate coefficient of determination (CD) between two variables –subsidies and either area size or livestock number, which are production variables as the estimation algorithm goes through different steps, where the initial is (ICD_i^1) represented by the equation (3). These relations show and measures how annual direct payments per hectare or per livestock head in certain sector (DP_I) related against the mean payments for the observed data series ($\overline{DP_I}$) impact and correspond to the production variable denoted as (PrS_I and $\overline{PrS_I}$). The sum of annual coefficients of determination (CD) is divided to numbers of observational years (N), which represents to average the coefficient of determination estimated at annual way. The CD ranges from 0–1, where the qualitative interpretation is similar with that of the classic Pearson correlation and determination. As closer the coefficient value is to 1 as stronger is thought the determination and impact of direct payments on production. In qualitative terms, the following areas of interpretation of results can be defined: from 0 to 0.2 – lack of determination and relationship between the dependent and independent variable, 0.21–0.4 – low determination between the direct payments and production; 0.41–0.6 – moderate determination of production by direct payments; 0.61–0.8 – high determination and above 0.81 – very high determination and influence of the independent on the dependent variable. The value of the coefficient of determination is always in the interval between 0 and 1, which is an indicator of the presence or absence of relationship and dependence, but in what direction is that relationship needs to look at the vector of the data set of observed variables. When the two variables have parallel vectors, then the dependence is straightforward and vice versa for opposite vectors of the annual variables' numbers, then the dependence and impact are counter-proportional.

CD in equation (3) is a product of individual values of variables by years, where the coefficient of determination denoted as CD_I. CD_I always have values from 0 to 1. The estimations by equation (3), which is initial coefficient of determination reveals the dispersion between dependant and independent variables and might take values beyond 1. In those cases are undertaken additional iterations in order to assure that CD_I is in range (0–1). For the sake to achieve it, the following iterations are done:

$$ICD_I^2 = \frac{ABS\left(\frac{(ICD_I^1 - 1)}{ABS(ICD_I^1 - 1)} - 1\right)}{2}. \quad (4)$$

$$CD_i = ICD_i^2 + \left(\frac{ICD_I^1 - 1}{ABS(ICD_I^1 - 1)}\right) * \left(\frac{ICD_I^1 - 1}{ABS(ICD_I^1 - 1)} * ICD_I^1\right). \quad (5)$$

$$CD = \frac{\sum_{i=1}^{N} CD_i}{N}. \quad (6)$$

The estimation of CD_I passes through several iterations, which are bound to derive ICD_i and ICD_I^2, whose estimation has the purpose to fulfil determination assessment, which to be ranged in the interval from 0 to 1. In the carried out estimations are used two variables, as the dependent variable (Y) in multiple cases depends on more than one independent variable. Between those independent variables (X) exists in multiple cases relationship and multicollinearity, which imposes to make corrections to insulate that multicollinearity. The way to deal with multicollinearity in the study is presented by the equation below:

$$CD_{AD} = \frac{CD}{1 + \frac{\sum_{k=1}^{n} k*(N_k - 1)}{N_k}}, \quad (7)$$

where CD_{AD} is the corrected coefficient of determination that is treated of multicollinearity and cumulative effects. This part of the calculations is not applied in the particular analysis because two-factor relationships are assumed and studied. The main sources of data series are Payment Agency for distribution of funds under the different support schemes – decoupled and coupled and from MAFF with agro statistics-data on crop areas and number of livestock. The data series cover the period 2007 to 2017.

Results

The arable land occupied by cereals accounts for largest part in Bulgaria, which has expanded even further during the years of EU membership and distribution of direct payments per area. In 2013, the areas with the main grains grown in Bulgaria reached a peak. The total area harvested reaches almost 2.1 million ha (66% of arable land). In the coming years, this size notes an expansion and in 2017 there was a reduction – 1.85 million ha were harvested. The observed

reduction in the area amounts to around 12%, as reasons can be attributed to market situation, production and economic issues – global prices, serious competition in the grain market from the countries in the Black Sea region and the implementation of support schemes that phase in requirements on the agricultural supported area (i.e. Ecological Focus Areas and some schemes designated to support competitive production). At the same time, due to the way in which the direct payments under the SAPS scheme are applied and because of the progressive increase in the budget of direct payments from 25% in 2007 to the full amount of 100% in 2016, the amount received per hectare and as a total amount of support reaches 800 million EURO in the recent years. The single payments, which include a basic, green and redistribution payments, amount to approximately EUR220 / ha at the end of the period considered.

The calculation of the coefficient of determination shows that the subsidies have low effect on the described development of areas in grain production. To a large extent, this seems surprising because the prevailing view is that subsidies have largely contributed to the upward development of this sector. The results show that subsidies have an essential impact, but there are other factors that also foster the growing development of grain production. Some of these factors also belong to the agricultural support policy, as investment and other measures where grain producers are among the main beneficiaries. What reduces the coefficient of determination of direct payments (DP) concerning the area and the production in the sector is the requirement introduced after 2014 to diversify farm cropping and set aside 5% of arable land to green practices. This caused an intangible decrease in cereals, which went in the opposite direction regardless the increase of public payments, which eventually diminishes the result in terms of determination calculation.

As for vegetable-growing, the dynamics of the planted area is greater due to the nature of the crops and their seasonal characteristics. Vegetable areas have been declining throughout the restructuring period of Bulgarian agriculture as long as this decline continues after 2007. The decline in vegetable area is due to the very small impact and presence that direct payments have on the production costs per hectare of vegetable production. Producers' behaviour in terms of decision-making is shaped up as not seeking maximizing profit equilibrium but on achieving optimization between gross revenues and costs. The unilateral neoclassical approach of explicating the producers' decisions "based on acost-(forgone) benefit-decision is too limited for full understanding of compliance behaviour" and Herzfeld &Jongeneel (2011) argue that alongside this utility framework the contributions from the psychological, sociological and institutional aspects should also be acknowledged. It envisages the farmers' decision making is quite more complex story and the utility mechanism is working but it can't be only considered as profit maximizing. It can be perceived as optimizing, i.e. seeking optimization between total revenues and total costs (Figure 1).

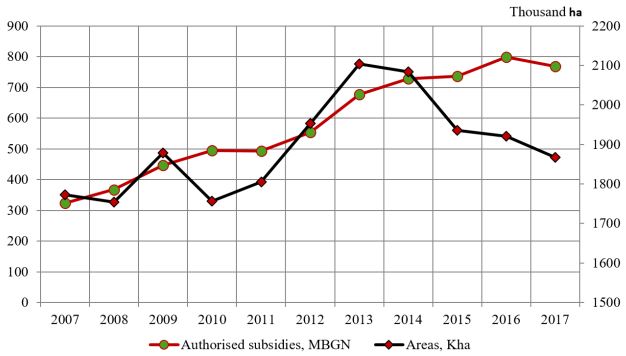

Fig. 1 Determination between areas and subsidies in cereal sectors, MBGN/Kha

Source: MAFF, Department „Agrostatistics" – BANSIK, Payment Agency and own calculations

Taking into account there is large production costs in vegetable production and area subsidies do not tackle those costs, gross revenues are tallied to be in absolute terms surpassing many other crop sectors but in proportional way estimating amount outcome to amount input, they lag compared to cereal and some other sectors. In a research by Bachev (2012), "the impact of CAP on a significant part of farms is either insignificant of neutral. Moreover, the implementation of CAP is related with adverse effects on economic results and incomes of a not little group of farms specialized in horticulture and permanent crops".

Measurement of the coefficient of determination in horticulture shows that the levels are around 0.43 for the period considered, which indicates a moderate determination impact of subsidies on the area. This relationship can be judged as significant, which is explained by great extent to the introduced increased coupled support in vegetable production. It is the coupled payments that make the tangible change and the sharp jump in the area of vegetables, resulted in elevated levels of the coefficient of determination. Besides, looking at the period before the introduction of the coupled support, the relationship between subsidies and areas was quite low despite the rising subsides. It is explained by market optimizing efficiency of farmers, when they set up their production behaviour (Figure 2).

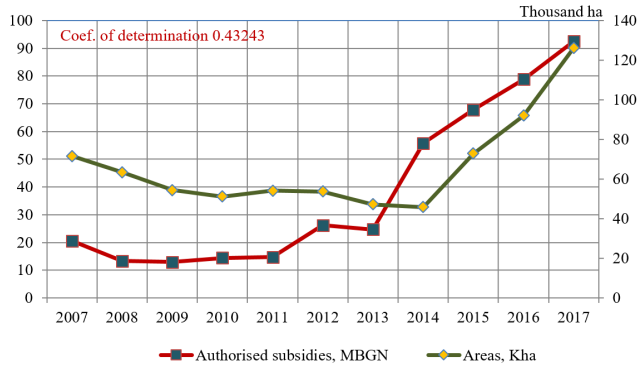

Fig. 2 Determination between areas and subsidies in horticulture, MBGN/Kha

Source: MAFF, Department „Agrostatistics" – BANSIK, Payment Agency and own calculations

The first thing that makes an impression in fruit-growing areas is the divergence of the land occupied by fruits and harvested plantations. The reason for this is the existence of orchards that are not maintained and harvested for various reasons – lack of interest, subdued productivity, depreciation or lack of economic benefits. As a result of these features, fruit plantations in the country do not change significantly, despite the progressive increase in support coming from SAPS and coupled payments. Under the coupled support scheme for the fruit (core group), which includes apples, pears, apricots, peaches, nectarines, cherries, sour cherries, strawberries and raspberries, the referent size of area with these varieties, in 2010, is put to 27 669 ha. The coupled support has resulted in stabilization of harvested areas and a halt in declining production trends. The harvested area in orchard sector varies from year to year, but does not reach the maximum referent size.

The coefficient of determination for occupied areas with fruits is 0.11, which is in the range below 0.2 indicating no impact of direct payments on the area. The calculation of the same coefficient on the basis of harvested areas yields values of 0.21, which is an indicator of the presence of impact, but its impact is rather weak. The reason for these relatively low levels of determination of direct payments on arable land is in the characteristics of the production, which are perennial crops and annual changes in support cannot produce a robust and reciprocal production response. If the analysis of the impact of policy support is directed into effects on production and the domestic sufficiency of consumption and domestic demand, it can be seen that local supply set back behind the human consumption. The largest shortage of local production to satisfy the domestic demand is identified in peaches, nectarines (from 87% to 58%) and strawberries (100% to 75%), where there is a regress between 2010 and 2017. This implies that work on improving the implementation of coupled support schemes must continue in order not only to stabilize production but also to link it with public expectations for domestic consumption (Figure 3).

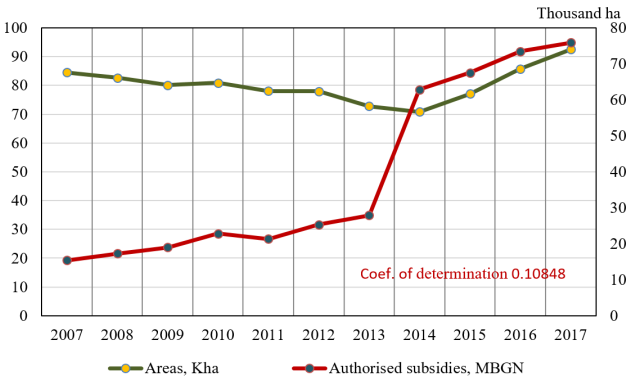

Fig. 3. Determination between areas and subsidies in fruit-growing, MBGN/Kha

Source: MAFF, Department „Agrostatistics" – BANSIK, Payment Agency and own calculations

The results of the analysis on dairy farming illustrate an interesting fact of a negative coefficient of determination. It is in the range of -0.2, which means that despite direct payments, there is an inverse relationship and the dairy herd is decreasing. It cannot be claimed that direct payments lead to a decrease in the number of dairy herds, but in any case direct payments (coupled and decoupled support) fail to retain the shrink in the sector. In this case, the measured negative determination cannot be interpreted as counter-proportional of determination of subsidies on the livestock, but rather demonstrates the inadequacy and inefficiency of this support, which goes per head, while economic rationality imposes a reduction in the dairy herd to heighten efficiency of production (Figure 4).

It is alleged that subsides affect less the farm from horticulture and dairy industries because due to their structure and specificities receive limited support under Single Area Payment Scheme (Sokolova, 2014). It is inferred that direct payments in those productions render little impact on their production decisions, which to some extent is demonstrated by coefficient of determination in dairy industry. In livestock husbandry, the need for coupled support is proven by the conditions of low profitability of farms and the need to boost up farms' incomes. This disadvantage leads to a decrease in the dairy herd and the gross milk production shrinks. In recent years, gross milk production accounts for about 9% of total agricultural production. Value added from the dairy

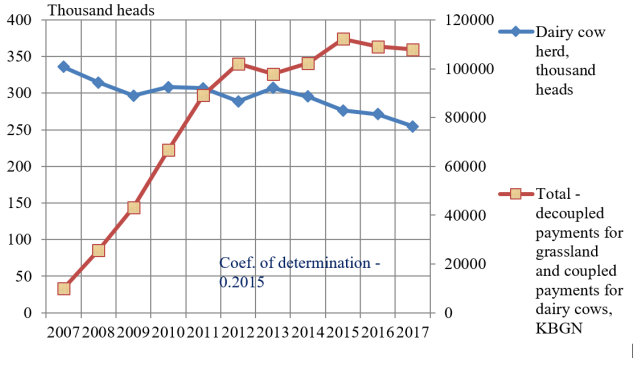

Fig. 4. Determination between dairy herd and subsidies, MBGN/K Number

Source: MAFF, Department „Agrostatistics", Payment Agency and own calculations

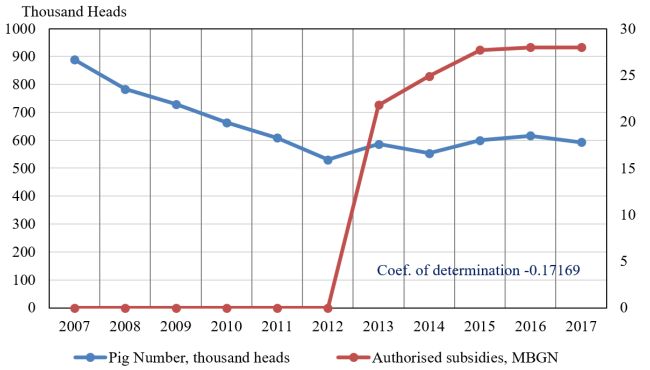

Fig. 5. Determination between herds and subsidies in pork industry, MBGN/K Number

Source: MAFF, Department „Agrostatistics", Payment Agency and own calculations

sector is estimated at around 7% of that in the whole industry. This confirms that the dairy sector has underestimated returns, poor economic outcomes, which justify the need to seek additional support instruments.

Pork farming in the country, like other livestock sectors, is affected by economic changes and the collapse of value chain links. The lack of sufficient integration in the industry leads to significant market difficulties for producers, which operates in the market with strong competition within the EU. After the country's accession to the EU, the decline in the number of feeding pigs in sows for breeding continues, as the reasons are sought into absence of a policy to support this production and to dominating model of farming to direct investments in industries where there is high optimization between earning and accomplished investments. As a result of the negative downward trends in 2013, State aid for pig welfare was adopted in the sector, which directs an important financial resource to pig industry. Afterwards, there is a slight revival, with deferring the decline in pig herds and increasing the number of slaughtered pigs (Figure 5).

Stabilization also occurs in breeding sows, and from a decline in their numbers, it moves to a subtle growth. However, the progress is too weak to compensate for negative turnout for the period 2007-2016, where the average annual development rate is -4%. The coefficient of determination in pig farming is measured at levels of -0.17, which indicates the absence of a subsidy determination on livestock. The negative sign of the measured coefficient is due to the observed throughout the period a downward trend in pigs reared in conditions of lack of support in the industry until 2013, when the State Aid Scheme for Welfare was introduced. The negative sign of the coefficient of determination does not justify the claim that sector support leads to a decrease in pig number, but rather implies that the lack of support puts pig farming to rely on their market competitiveness, which apparently reveals for not stable market position of pig producers, which substantiates the needs for some support measures. If only the period of active state aid support in pig production were covered, the result would be much different and then the clear impact that these payments helped to reverse the downward trend towards a slight increase would be identified.

Conclusions

The policy support impact in Bulgarian agriculture reveals in most of analyzed cases a slight relationship between production as area and livestock number and allocated subsidies to agricultural sectors. The EU subsidies contribute to boost up the farmers' incomes but they do not convert the income growth in production growth. The production growth is important to reinforce the competitiveness and resilience of farmers. The dependency from subsidies makes farmers vulnerable and unable in prospective point of view to market realities and severe competition.

The subsidies have relatively little determination in terms of production, which is entailed by low effect as well on productivity hence on efficiency, which shows that the process of transformation in the industry could be completed, but EU membership cannot automatically solve the all problems and make the industry prosperous. These low values reveal the crucial problem in Bulgarian agriculture and explain why the low levels of production are due to the weaknesses of the industry, where subsidies incite farmers to have a behaviour pursuing economic optimization rather than profit maximi-

zation. The optimization behaviour followed by farmers is related to seeking a highest proportion between gross revenues and costs per area and animal head and because SAPS are distributed equally per hectare they have a significant effect on less cost-intensive sectors than to high cost-intensive ones.

Support through direct payments is fruitful for producers, but the efficiency of the results that are achieved must be increased and the negative effects associated with the distortions from the public interventions on the production decision-making by farmers should be prevented. The analysis of determination of direct payments and subsidies in the sector on the areas and the number of animals in certain sectors manifest that the support has a limited effect on the growth of production, especially in- meat production, fruit growing or the impact is rather seen on the area than on the production. It is considered in order to achieve sustainability and viability in the agriculture, it is important that direct payments leads to improvement in output, leading to a stabilization of market orientation, incomes, competitiveness of farms, value added from the activities, which further spreads in social benefits for the regions in respect to higher incomes and better job opportunities for the people.

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