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SUBSIDIES AND PROFITABILITY IN THE AGRICULTURAL SECTOR: EXAMINING THE RELATIONSHIP IN BULGARIA

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Abstract

The article examines the impact of subsidies on agricultural holdings of different economic sizes in Bulgaria for the period 2014-2020. The objective is to dissect the dispersion and repercussions of these subsidies on the gross and net earnings of these enterprises. The research is rooted in a thorough exploration of existing literature and utilizes a spectrum of analytical techniques, including comparative analysis, regression analysis, and fixed effects models. The findings underscore the substantial role of subsidies in shaping the revenue of Bulgarian agricultural producers. This validates the primary hypothesis that subsidies bolster the financial health of enterprises and foster the resilience of the agricultural sector overall. Nonetheless, it's crucial to note that the magnitude and efficacy of the subsidies' impact fluctuate based on the economic scale of the enterprises. This underscores the need for a differentiated approach in determining subsidy policies, taking into account the specific needs of different groups of agricultural producers.

Key words**:** *subsidies, farms, Bulgaria, income, sustainability, environment*

INTRODUCTION

Agricultural producers in Bulgaria, as well as throughout Europe, receive significant support through various forms of subsidies from national and European institutions. The subsidies aim to strengthen agricultural farmers, ensure the sustainability of rural farming, and guarantee food security.

Despite this, the effectiveness of these subsidies is the subject of lively discussions, due to several main reasons. First, there are differences in the type and size of subsidies provided to agricultural farmers in different countries and regions. This can lead to discrepancies and imbalance in competition, complicating the assessment of the effectiveness of subsidies. Second, questions arise about the ability of subsidies to achieve their goals, such as sustainability of farms, food security, and environmental protection. Some studies show that despite significant amounts spent on subsidies, they do not always succeed in achieving these goals. Thirdly, there are concerns about the effectiveness of subsidies as a tool for maintaining farmers' incomes. In many cases, subsidies can lead to economic distortions, such as excessive dependence on state aid or reduction of incentives for innovation and efficiency.

Literature Review

The question of the effectiveness of subsidies for the current activities of agricultural farmers is complex and multi-layered, including both economic and social and environmental aspects. It is the subject of research by many authors. Subsidies can be a useful tool for financing agriculture, but they need to be used carefully and with consideration of their potential negative impacts [28]. More research is needed on the effectiveness of subsidies, and the design of subsidies needs to ensure that they achieve planned goals. Direct payments are provided to farmers based on the size of the farm and the land cultivated, to ensure stable incomes and encourage environmentally friendly practices [6]. Westhoek et. al. [27] argue that agricultural support programs should focus not only on direct financial assistance to farmers but also on promoting sustainable practices beneficial to society as a whole.

A study in Sweden [18] found that subsidies have a significant positive impact on farm productivity, likely by helping farmers adopt innovations that increase productivity. Kravcakova and Kotulic's [15] findings align

with these conclusions, demonstrating that subsidies significantly enhance farm productivity and profitability in Slovakia, particularly benefiting smaller and less efficient farms. Bezlepkina and Lansink [2] examine the effects of debt and subsidies on Dutch agriculture. They find that debt has a negative effect, while subsidies have a positive impact. Moreover, the impact of subsidies is greater for smaller farms and those with lower debt levels. Biagini et al. [3] analyze the impact of CAP subsidies on the productivity of cereal farms in six EU countries - France, Germany, Hungary, Italy, Poland, and Spain. The authors suggest that subsidies positively influence productivity, although this effect is less pronounced for larger farms. They note a more significant impact on farms that are more efficient and have higher human capital.

Kleinhanß et al. [12] corroborate the beneficial influence of subsidies on livestock farming efficiency, but observe a diminished effect for larger farms. They advocate for policies that are customised to cater to the requirements of diverse farm types, fostering both efficiency and environmental sustainability. Zhu et al. [31] investigate the influence of the Common Agricultural Policy (CAP) subsidies on technical efficiency and productivity disparities among dairy farms in three EU nations - Hungary, Slovenia, and Slovakia. They deduce that while subsidies enhance technical efficiency and productivity, the impact is less pronounced for larger farms. The impact is greater for more efficient farms with higher human capital. The same conclusions are reached by studies on the technical efficiency of farms in three other European countries - Germany, Netherlands, Sweden [30], as well as Slovakia [29].

Some authors [19, 21, 26] find that direct payments have a small positive effect, but this varies depending on the crop and region. Harkness et al. [7] establish the positive impact of agri-environmental schemes, providing payments to farmers who adopt environmentally friendly practices such as cover cropping, reduced soil tillage, and maintaining living fences. These schemes improve the viability of farms while reducing environmental impact. Severini et al. [20] find that direct CAP payments can help stabilize the income of Italian farms, especially for smaller, more vulnerable operations. However, the income stabilization effects vary depending on the type of farm and region. Ciliberti and Frascarelli [4] highlight the problems with income concentration on Italian farms, as larger farms still receive a significant share of subsidies.

Uzunova [25] found that direct payments and national top-ups stabilize producer incomes in Bulgaria, encourage good agricultural practices and support expanded reproduction. Sokolova [23] examined the impact of direct payments on income distribution in mountain farms and inequality in Bulgaria. It was found that the payments have a limited impact on reducing income inequality, as larger and more profitable farms continue to receive a disproportionate share of support. Kaneva et al. [9] state that the CAP-related support plays an important role in the development of livestock farms in Bulgaria. Beluhova et al. [1] study direct payments and their impact on Bulgarian agriculture, finding that they support financial stability and recommend a differentiated subsidy policy approach to meet the specific needs of different agricultural groups. Koteva et al. [13] discover that while CAP subsidies significantly contribute to the advancement of larger and more efficient farms, smaller farms and rural households are often overlooked. Kirechev [11] sees subsidies as an important factor for net income for Bulgarian agricultural holdings. Koteva and Ivanov [14] and Turlakova [24] establish the uneven distribution of direct payments among Bulgarian farms.

There is also a group of authors who dispute the positive effect of subsidies. Key [10] finds that decoupled payments in the US may have limited impact on supply responses. Laborde, et al. [16] argue that reducing agricultural subsidies is an important step in addressing climate change. By reducing the impact of greenhouse gas emissions in agriculture, we can help preserve our planet for future generations. Damania et al. [5] believe that redirecting environmentally harmful subsidies could be a powerful tool for promoting

sustainable development. Heyl et al. [8] contend that subsidies might adversely affect the environment, potentially leading to an increase in greenhouse gas emissions and a reduction in biodiversity. A Slovenian study [22] found that agricultural payments have a significant positive impact on nitrate concentrations in groundwater, probably because payments encourage higher use of fertilizers and nitrate leaching.

The objective of this study is to augment and broaden the findings of prior research on the correlation between subsidies and agricultural incomes. It does this by offering an exhaustive analysis of the influence of subsidies on the financial success of Bulgarian farms from 2014 to 2020.

Purpose of the article

The purpose of this article is to analyze the distribution and impact of subsidies on farms of differing economic sizes in Bulgaria during the period from 2014 to 2020. This article will examine how subsidies influence the gross and net income of these farms, assessing their level of dependence on these subsidies, and the potential variation in net income that may be caused by the size of the subsidies.

Research tasks

-To analyze the dynamics and trends in the distribution of subsidies among farms of differing economic sizes in Bulgaria during the period from 2014 to 2020;

-To analyze the relative share of current subsidies as a source of revenue for agricultural holdings of differing economic sizes, and to assess their dependence on these subsidies for maintaining their incomes;

-To scrutinize the correlation between current subsidies and the gross income of farms in different economic groups (small, medium, and large), to quantify the extent to which subsidies account for variations in gross income, and to ascertain if this relationship varies among the different economic groups;

-To investigate the impact of subsidies on the net income of farms and to determine the strength of this relationship and its statistical significance.

MATERIALS AND METHODS

The study analyses data from the Agricultural Accounting Information System (AAIS), provided by the Ministry of Agriculture and Food of Bulgaria, for the period 2014-2020. Six categories of farms have been studied, divided by economic size: up to 8,000 euros, 8-25,000 euros, 25-50,000 euros, 50-100,000 euros, 100-500,000 euros and over 500,000 euros. The representative sample of AAIS includes the following number of farms: 2,229 for 2014; 2,272 for 2015; 2,261 for 2016; 2,253 for 2017; 2,241 for 2018; 2,252 for 2019; and 2,235 for 2020.

The article presents a comparative analysis of the subsidies received by farms of different economic sizes during the period from 2014 to 2020, examining how they change over time. A comparison is also presented of the percentage distribution of revenue, including current subsidies, for the different economic sizes of farms is also presented.

A fixed effects model was used to analyze the relationship between gross income and current subsidies. Analyzing this relationship can provide insight into the effectiveness of subsidies as a stimulating mechanism for growth and development. In this way, it can be determined whether subsidies are achieving their goals of supporting the respective sector. The main idea behind fixed effects models is that they control for time-invariant unobserved characteristics of each subject (agricultural holding) that could influence the outcome (gross income). This is done by including a catch-all term for each group of agricultural holdings that absorbs these effects. For example, factors like soil quality, climate, managerial skills, etc. may differ across holdings and affect incomes but are not observed in the data. The fixed effects capture all these time-invariant factors in the farm-specific intercepts. This helps isolate the effect of the time-varying predictor (subsidies) on the outcome (gross income) while avoiding bias from the unobservable.

A regression analysis has been executed, designating net income as the dependent factor and current subsidies as the independent factor. This method can offer insights into the societal influence of subsidies, especially when they are directed

towards lower-income brackets and vulnerable communities. Analyzing net income in the context of subsidies can help determine whether they are achieving their goals of reducing social inequalities and improving incomes. There are several reasons why using net income in the regression analysis is better. First, net income is a more stable measure of the financial condition of an agricultural enterprise than gross income. This is because net income is not influenced as much by fluctuations in market prices or production costs. As a result, net income is a better indicator of the long-term financial health of the agricultural holding. Second, net income is a more accurate measure of the impact of subsidies on the income of agricultural producers.

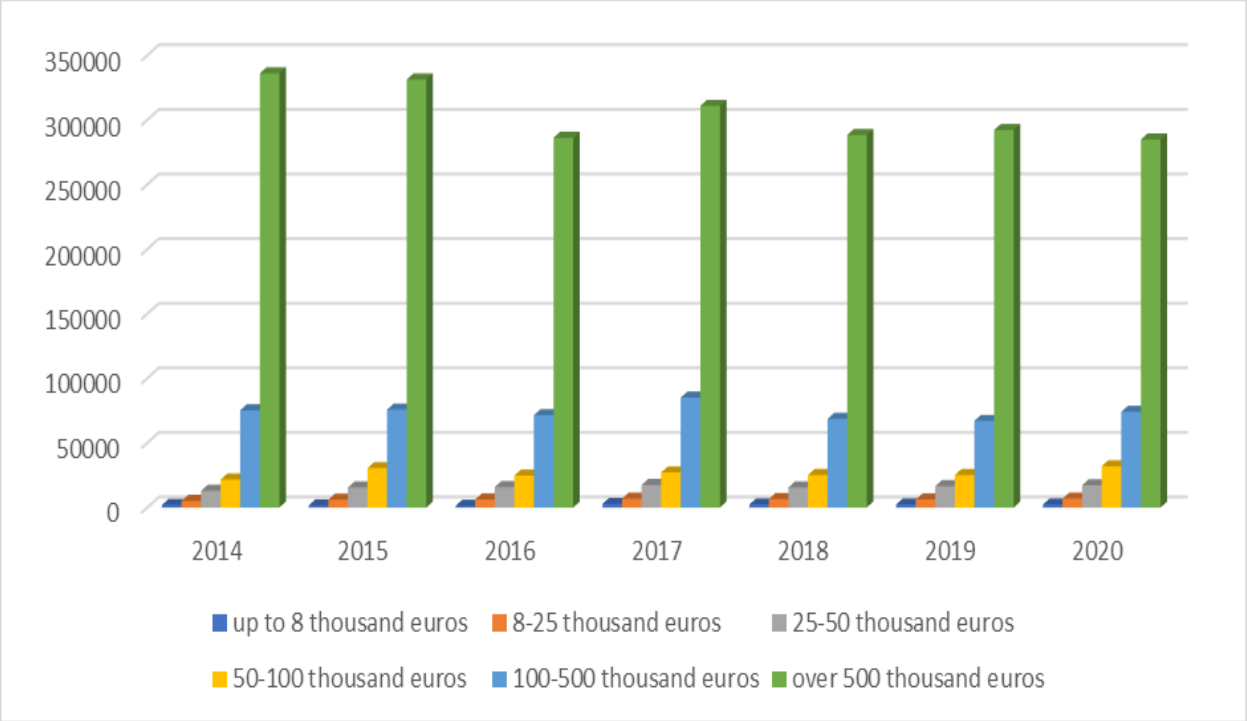

Fig. 1. Received current subsidies in euro by the studied population by economic size in the period 2014-2020
Source: Own calculations based on AAIS data [17].

This is because subsidies can affect both gross revenues as well as costs.

RESULTS AND DISCUSSIONS

Analysis of the distribution and relative share of subsidies in revenues

Figure 1 presents the data on the current subsidies that farms of different economic sizes from the studied population receive during the period from 2014 to 2020. Farms with an economic size over 500,000 euro receive the largest amount of subsidies in all years.

However, there is a decreasing trend in the subsidies they receive from 2014 to 2020. Farms with an economic size from 100,000 to 500,000 euro also show a decreasing trend in received subsidies over the period.

For farms with an economic size from 8,000 to 100,000 euro, the subsidies vary, but the overall trend is towards an increase in received subsidies over the years.

Farms with an economic size up to 8,000 euro show variations in received subsidies, but the overall trend is stable or slightly increasing.

Figure 2 presents the percentage distribution of revenue for 2020 for agricultural holdings with different economic sizes from the studied population. The revenue of agricultural producers can be conditionally divided into operating revenue (revenue from sales of products and other revenue) and revenue from subsidies. Current subsidies have the largest relative share in revenue for holdings with an

economic size up to 8 thousand euros (31.19%). This means that the smallest holdings have the least own revenue and are therefore more dependent on external financing. It is obvious that agricultural holdings with an economic size of 25-50 thousand euro and 8-25 thousand euro the smallest relative share of current subsidies in total revenue (16.71% and 20.66%, respectively). They manage to generate a significant percentage of their revenue without current subsidies and are most independent of them. This shows that subsidies play an important role for agricultural holdings with an economic size above 50 thousand euro, the revenue from subsidies increases its relative share in their total annual revenue. The analysis important role in maintaining the income of the smallest agricultural holdings, while medium-sized holdings in economic terms have more opportunities to generate income without them.

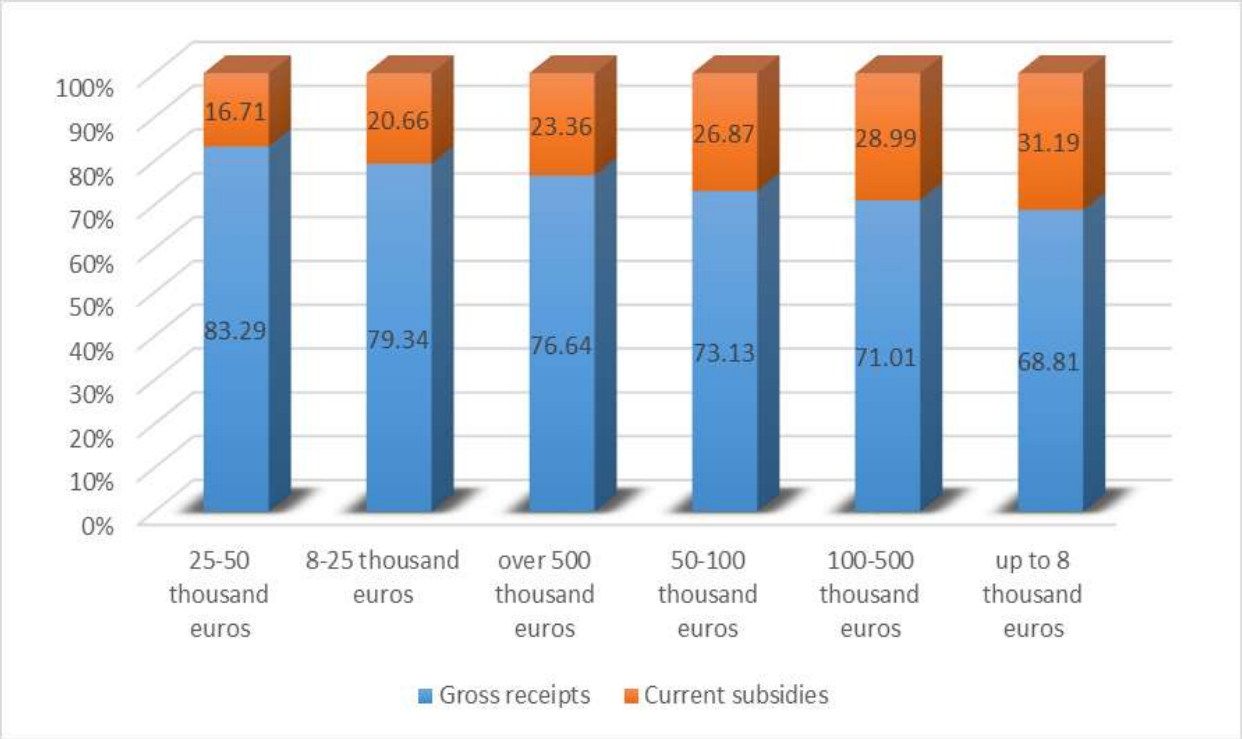

Fig. 2. Percentage distribution of income in the studied population of farms by economic size in 2020
Source: Own calculations based on AAIS data [17].

Fixed effects model

A fixed effects model is applied to study the relationship between gross income and subsidies. Based on the fixed effects panel data analysis, here are some key findings on the effect of subsidies on the income of farmers:

• For farms with an economic size up to 8,000 euros: The subsidy coefficient is positive and significant (0.754), indicating that subsidies are associated with higher incomes. But the fixed effect for this group is negative and large (-15,000), meaning that small farms have significantly lower income levels on average compared to other groups, even after controlling for subsidies. This suggests that small farms are more dependent on subsidies to maintain their incomes;

• For farms with an economic size between 8,000 and 50,000 euro: The subsidy coefficient is still positive (0.670) but smaller compared to small farms. The fixed effects are smaller and negative (-5,000) than in small farms, indicating higher base income levels. Subsidies still increase income, but these farms are less dependent on them compared to smaller farms;

• For farms with an economic size between 50,000 to 500,000 euro: The subsidy coefficient remains positive and significant

(0.510). The fixed effects are now positive (10,000), reflecting higher average income levels for these larger farms. But subsidies still increase income, although the marginal effect may be smaller than in smaller farms;

• For farms with an economic size over 500,000 euro: The positive subsidy coefficient (0.410) suggests increased income with higher subsidies. The fixed effect is the largest (100,000), indicating a very high base income for these largest farms. They still benefit from the subsidies, albeit with smaller marginal effects.

In summary, subsidies boost income levels for farms of all sizes. However, smaller farms rely more heavily on these subsidies and inherently have lower income levels. On the other hand, larger farms, despite having a higher base income, also gain from these subsidies. However, the incremental benefits tend to diminish for larger farms.

Multiple regression

Multiple linear regression models were evaluated to determine the most appropriate model for predicting net income based on current subsidies received and other financial variables. The model with the best balance of explanatory power, parsimony, and lack of multicollinearity includes current subsidies, output produced, depreciation, wages and salaries, land rents, interest expenses, investment subsidies, VAT balance(difference between VAT collected from customers and VAT paid to suppliers), fixed assets, and intermediate consumption (expenses on materials and services) as independent variables (Table 1). This model explains 99.9% of the variance in net income (R-squared = 0.999) and has statistically significant coefficients for all variables ($p<0.05$). While some collinearity diagnostics indicate potential issues, there is no definitive evidence of multicollinearity based on the condition index, variance proportions, and standard errors. The condition index is 335.44 and no individual predictor has variance proportions above 0.96.

Table 1. Regression Model Coefficients

Independent Variable	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	614.800	123.558		4.976	0.000
Current subsidies (EUR)	1.077	0.017	1.452	65.231	0.000
Production (EUR)	0.975	0.007	6.662	133.972	0.000
Depreciation (EUR)	-1.003	0.029	-0.969	-34.641	0.000
Wages and social contributions expenses (EUR)	-1.147	0.032	-0.898	-35.946	0.000
Land rent (EUR)	-952.623	25.630	-1.301	-37.169	0.000
Interest expenses (EUR)	-1.270	0.138	-0.165	-9.176	0.000
Subsidies on investments (EUR)	0.981	0.015	0.075	63.551	0.000
VAT Balance - Investment (EUR)	2.610	0.532	0.004	4.905	0.000
Long-term assets (EUR)	0.011	0.003	0.096	3.079	0.004
Intermediate consumption (EUR)	-0.993	0.012	-3.961	-82.804	0.000

Source: Own calculations using SPSS software.

The regression equation is as follows:

$$y = 614.80 + 1.077\ x_1 + 0.975\ x_2 - 1.003\ x_3 - 1.147\ x_4 - 952.623\ x_5 - 1{,}270\ x_6 + 0.981\ x_7 + 2{,}610\ x_8 + 0.011\ x_9 - 0.993\ x_{10} \quad .....(1)$$

where:

y is the net income, x_1 is the current subsidies, x_2 is the produced output, x_3 is the depreciation, x_4 is the wages and social security contributions, x_5 is the rent for land, x_6 is the interest expenses, x_7 is the investment subsidies, x_8 is the VAT balance for current transactions, x_9 is the long-term assets, and x_{10}

is the intermediate consumption (expenses for materials, insurance, etc.).

The net income is expected to change based on each variable in the model, assuming that all other variables are constant as follows:

-*Current subsidies: Increasing current subsidies by 1 unit* is associated with an increase in net income by 1.077 units;

-*Produced production*: Increasing the produced production by 1 unit is associated with a 0.975unit increase in net income;

-*Depreciation*: Increasing depreciation by 1 unit is associated with a decrease in net income by 1.003 units;

-*Wages and insurance*: An increase in wages by 1 unit is associated with a decrease in net income by 1.147 units;

-*Land rent*: An increase in land rent by 1 unit is associated with a 952.623unit decrease in net income;

-*Interest expenses*: An increase in interest expenses by 1 unit is associated with a decrease in net income by 1.270 units;

-*Investment subsidies*: A 1unit increase in investment subsidies is associated with a 0.981unit increase in net income;

-*VAT balance*: A unit increase in VAT balance corresponds to a 2.610 unit increase in net income;

-*Long-term assets*: A unit increase in long-term assets correlates with a 0.011 unit increase in net income;

-*Intermediate consumption*: An increase in intermediate consumption by 1 unit is associated with a decrease in net income by 0.993 units. Higher operating expenses reduce net revenues.

Standardized coefficients allow us to compare the effects of different variables on net income directly, even though they are measured in different units. Based on the values of the standardized coefficients, the variables with the greatest influence on net income in the model are: Produced production (6.662); Intermediate consumption (-3.961); Current subsidies (1.452); Wages and insurance (-0.898); Depreciation (-0.969).

Produced production exerts the most substantial positive impact on net income - a surge by one standard deviation in its size corresponds to a rise in net income by 6.662 standard deviations. Conversely, intermediate consumption and depreciation exert significant negative impacts. An increase of one standard deviation in these factors correlates with a reduction in net income of 3.961 and 0.969, respectively.

Based on the multiple regression analysis, we can conclude the following about the relationship between current subsidies and net income:

-The current subsidies received during a given year have a significant positive relationship with net income, even when controlling for other financial factors such as produced production, expenses, assets, etc.;

-An increase in current subsidies by 1 unit is expected to increase net income on average by 1.077 units, with all other variables of the model being constant;

-The standardized coefficient for current subsidies (1.452) shows that subsidies have one of the largest positive impacts on net income compared to other financial indicators;

-The model assumes that while current subsidies do have a positive impact on net income as expected, they are not the only or main driver of profitability. Other factors such as produced production, expenses, and assets also play a very important role.

CONCLUSIONS

The analyses conducted in this study lead to several conclusions regarding the distribution and impact of agricultural subsidies in Bulgaria for the period 2014-2020:

-The analysis of the distribution shows that the largest farms (over 500,000 euro) receive the highest absolute amount of subsidies, but there is a trend of decline in subsidies received by these farms during the period 2014-2020. Smaller farms (under 25,000 euros) show a slight trend of increase in subsidies received over the period 2014-2020;

-The analysis of revenue sources shows that the smallest farms (under 8,000 euro) rely most heavily on subsidies, which make up 31% of their total revenues. Medium-sized farms (8,000-50,000 euro) generate a larger

share of revenues from their own activities and are least dependent on subsidies;
-The fixed effects model analyzing gross income suggests that subsidies increase the incomes of farms of all sizes, but smaller farms benefit more in terms of marginal effects. Larger farms have higher base levels of income;
-The regression model shows that current subsidies have a significant positive relationship with net income, but produced production, expenses, and assets also significantly stimulate profitability.

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