

Original scientific paper

EFFICIENCY OF AGRICULTURAL INVESTMENTS IN THE REPUBLIC OF SERBIA



ISSN 2466-4774

<https://www.contagri.info/>

DRAGAN MILIĆ , BOGDAN JOCIĆ *, TIHOMIR NOVAKOVIĆ ,
DRAGANA NOVAKOVIĆ , DANICA GLAVAŠ-TRBIĆ 



Faculty of Agriculture, University of Novi Sad, Trg Dositeja Obradovića 8, 21 000 Novi Sad, Serbia

*Corresponding author: bogdan.jocic@polj.uns.ac.rs

Submitted: 15.09.2023.

Accepted: 02.10.2023.

SUMMARY

The research analyzes the efficiency of investments in the agricultural sector of the Republic of Serbia. The data used in the research were sourced from the Statistical Office of the Republic of Serbia and the Directorate for Agrarian Payments. Over the period from 2012 to 2021, there was an increase in the efficiency of agricultural investments. The results point to a significant increase in investments per hectare compared to the previously analyzed period (1996-2005). The data were processed using standard statistical instruments of descriptive statistics. Additionally, regression analysis was employed to show the impact of investments on the gross value added in this sector. It was established that over the period from 2012 to 2021, the effect of investments on the gross value added in agriculture was not statistically significant.

Key words:

investments, gross value added, agriculture, regression, efficiency

Abbreviations:

DAP - Directorate for Agrarian Payments; GDP - gross domestic product; GVA - gross value added; RAH - registered agricultural household; SORS - Statistical Office of the Republic of Serbia

INTRODUCTION

Agriculture constitutes an important sector in the economy of the Republic of Serbia, despite a decline in its contribution to the gross domestic product (GDP), gross value added (GVA) and employment in recent years. Milić et al. (2023a) note that, in absolute terms, GDP generated from agriculture (as well as GVA) in the Republic of Serbia has a growth trend which is, however, subject to certain fluctuations influenced by global inflation rates, weather conditions, etc. The same authors observe that GDP is constantly increasing and that economic activities in the secondary and tertiary sectors have assumed greater significance in GDP composition, while the relative participation of the primary sector is reduced to a single-digit rate. Analyzing the foreign trade balance of agri-food products by individual countries in the Western Balkans, Zekić et al. (2022) observe that the Republic of Serbia is the only country with consistent positive foreign trade balance for these products, with an average annual growth rate of 3.7%. The export and production structure is dominated by primary agricultural products with low added values and low degree of processing. Apart from its economic function, agriculture also has social, cultural and ecological functions (Kijek et al., 2019).

Agriculture and its development in a country or region are influenced by a range of factors, including climate and weather conditions, soil quality, water supply, capital market, socio-economic factors, agrarian policies, infrastructure, technological advancements, agricultural product market, labor force, etc.

Nowadays, most economic theorists, regardless of their economic school of thought, agree that investments serve as the primary drivers of economic activities. Additionally, investments, as an economic category, can be significantly stimulated at the macroeconomic level. The focus of this research is to assess the efficiency of investments in agriculture over the period from 2012 to 2021 in the primary sector of the Republic of Serbia. Furthermore, the paper aims to determine the potential effect of investments on the gross value added in agriculture, starting with the hypothesis that increased investments create opportunities for achieving a higher value added.

MATERIAL AND METHODS

Milić & Pejanović (2008) presented the efficiency of investments as the ratio of the investments to the arable land and the number of active farmers.

Based on the available data and the previously defined research objectives, the following indicators of investment efficiency have been identified:

1. Efficiency of investments per hectare of used agricultural land, calculated as the ratio of total investments in agriculture to total area of used agricultural land,
2. Efficiency of investments per person engaged in agriculture, calculated as the ratio of total investments in agriculture to the number of people engaged in agricultural activities, and
3. Efficiency of investments per agricultural household, determined as the ratio of total investments in agriculture to the total number of agricultural households.

The previously defined indicators of investment efficiency will be analyzed based on data provided by the Statistical Office of the Republic of Serbia (SORS) and the Directorate for Agrarian Payments (DAP) as the leading institution managing public incentives in agriculture. An important feature of the data management practice of SORS is that relevant agricultural data (e.g. workforce engaged in agriculture, the number and structure of farms, farm demographics, etc.) are obtained through periodic data collection (censuses and surveys). It is only the statistics related to arable agricultural land that is collected annually in the national accounts. As this approach to data management requires valid resources, the databases are out-of-date. Furthermore, it is important to differentiate between agricultural households and registered agricultural households. Namely, if an agricultural household is in rural area and is engaged in agricultural production, it does not mean that its income is exclusively derived from this activity. On the other hand, there are registered agricultural households (RAH) that have voluntarily signed up to be registered as agricultural producers with the relevant agricultural ministry (with the Directorate for Agrarian Payments). They sell agricultural products on the market and are eligible to obtain state incentives and subsidies.

Before using the data provided by SORS (2012-2021a, 2012-2021b, 2012-2021c), the observed values in dinars were according to NBS (2012-2021) divided by the average exchange rate of the euro for the respective year, thereby converting them into €. Subsequently, all current prices were transferred to the base ones (2021 year -100%).

The data were processed using standard statistical instruments (Milić et al., 2023b):

1. Arithmetic mean $\bar{X}$,
2. Range (minimum and maximum),
3. Coefficient of variation (CV),
4. Average annual rate of change in % (r).

The average rate of change is calculated according to the formula:

$$r = (G - 1)$$

$$G = \left(\frac{Y_n}{Y_1} \right)^{\frac{1}{n-1}}$$

where are:

r – annual rate of change

G – constant relative change in value

Y_n – absolute value of the last member of the series

Y_1 – absolute value of the first member of the series

n – total size of the series (Tekić et al., 2019).

The method of simple linear regression is used to determine the potential effect of investments on the gross value added in agriculture. Regression analysis can be defined as the process of estimating the value of the dependent variable based on one or more independent variables (Mutavdžić & Đorić-Nikolić, 2018).

The applied regression model has the following form:

$$\hat{Y} = \alpha + \beta_1 X_{1i} + \varepsilon_i$$

where are:

$\hat{Y}$ – the value of the dependent variable

X_i – the value of the independent variable

β – the regression coefficient, which shows the change in the dependent variable for a unit change in the independent variable

α – represents the average initial level of the dependent variable

ε_i – the random error of the model (Hadživuković, 1991).

Analysis of variance was conducted to ascertain the statistical significance of the defined regression model.

The data were statistically processed on an annual basis covering the period from 2012 to 2021. The data sources for this paper include the official announcements issued by SORS (2012, 2018, 2012-2021a, 2012-2021b, 2012-2021c) related to national account statistics as well as the data provided by the Directorate for Agrarian Payments. The statistical analyses were performed using STATISTICA program package.

RESULTS AND DISCUSSION

According to the methodology of SORS (2012-2021a), investments in fixed assets refer to the value of effectively completed constructions, construction or procurement of facilities, equipment and other accessories within a year, regardless of the completion status or payment status of these investments.

The efficiency of investments is presented in Figure 1 as the ratio of total investments in agriculture and used agricultural land.

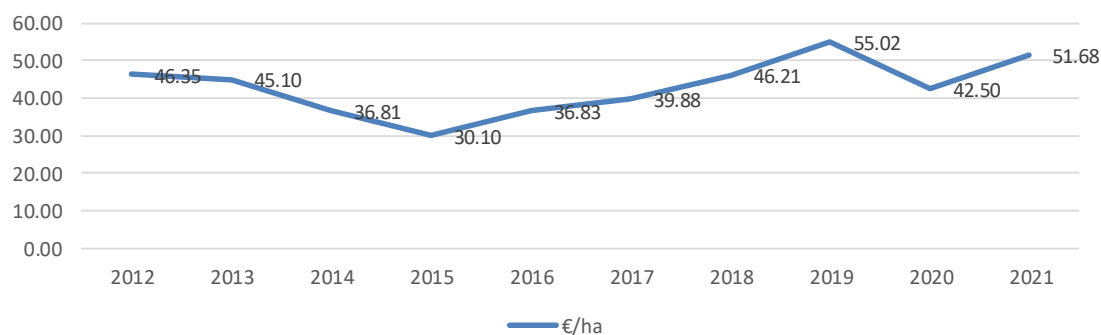


Figure 1. Efficiency of investments in agriculture of the Republic of Serbia according to SORS (2012-2021a, 2012-2021b)

Figure 1 demonstrates a slight upward trend. The initial investment/ha was 46.35€, while in the final year of the analysis it was 51.68€ of investment/ha. The average annual rate of change over the observed period amounted to 1.22%. The highest value of investments was in 2019 (55.02€ investment/ha), while the lowest value was in 2015 (30.10€ investment/ha).

The efficiency of investments related to workforce and agricultural households cannot be graphically presented owing to the limited availability of the data provided by SORS (2012, 2018). The efficiency of investments per person shows that investment/person in 2012 was 111.24€ while this figure rose to 120.51€ of investment/person in 2018 a showing an increase of 8.33%. Investments per agricultural holding in 2012 amounted to 254.1€ and in 2018 to €285.4, showing an increase of 12.32%.

The effectiveness of investments in agriculture is presented according to the data provided by the Directorate for Agrarian Payments (Fig. 2).

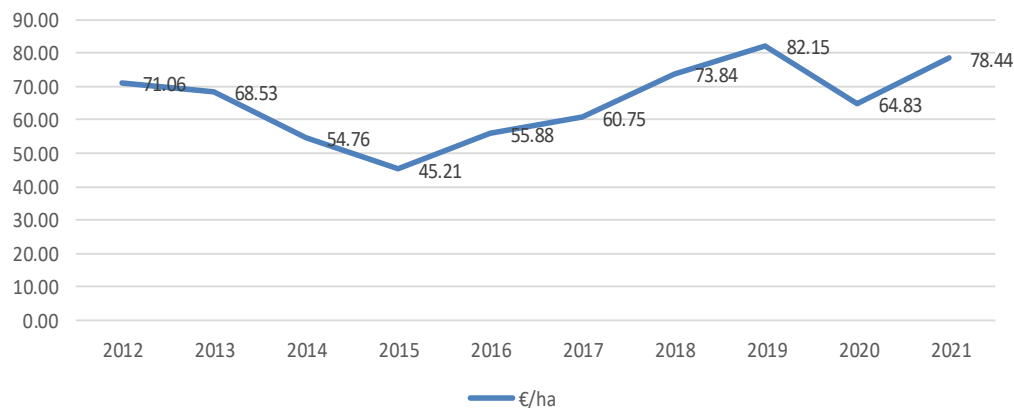


Figure 2. Efficiency of investments in agriculture of the Republic of Serbia according to DAP (2012-2021)

From the data in Figure 2, a slight upward trend is discernible. The initial investment was 71.06€ per hectare, while in the final year of the analysis, this figure rose to 78.44€ per hectare. The average annual rate of change over the observed period amounted to 1.1%. The highest level of investment was recorded in 2019, reaching 82.15€ per hectare, while it was the lowest in 2015, with 45.21€ per hectare.

The efficiency of investments about the workforce and RAH is succinctly elucidated based on available data. In 2018, an investment of 248.08€ per person was documented.

The efficiency of investments about the workforce and RAH is succinctly elucidated based on available data. In 2018, an investment of 248.08€ per person was documented. Investments per registered agricultural household in 2012 totaled 346.94€ and increased to 363.53€ by 2018, marking a 4.78% increase.

As previously outlined in the research methodology, there are disparities between the SORS and DAP databases. On one hand, there is certain population in villages that are not involved in agricultural production and activities. Accordingly, it would not be adequate to count them into calculations related to the evaluation of any indicators in agriculture. Additionally, it is worth noting that all land documented in agricultural censuses and statistical yearbooks may not be actively cultivated and should not be factored into any analyses. On the other hand, DAP maintains records of registered agricultural households seeking various state incentives. However, despite the database's greater up-to-dateness, numerous agricultural producers registered new RAHs to access different incentives and public support due to DAP restrictions. Consequently, there are currently a larger number of registered agricultural households than the actual count. Moreover, comparing the DAP and SORS databases, it is plausible that the agricultural land cultivated by registered producers surpasses the reported areas.

From the previous two charts, it can be concluded that the ultimate outcome is somewhere between the presented results and that both databases should be considered in calculations.

In terms of addressing the primary shortcomings of these databases, a significant step was taken in the current year with the introduction of the “E-agrar” system. All applications for public incentives and subsidies are now processed through this system, concurrently creating a database that can be edited by agricultural producers themselves. The efficacy of this internet platform, whose existence is undoubtedly justified, will become clearer over time.

The effect of investments on the gross value added in agriculture for the observed period is presented in Figure 3.

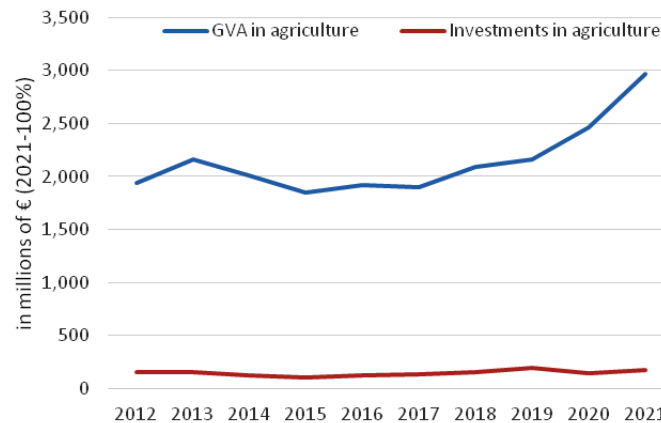


Figure 3. GVA and investment in agriculture of the Republic of Serbia according to SORS (2012-2021a, 2012-2021b)

Figure 3 illustrates the growth trend of GVA (Gross Value Added) alongside a marginal increase in agricultural investments. Notably, the rate of investment growth in agriculture does not align with the growth of GVA within the observed sector, which is corroborated by the data presented in descriptive statistics (Tab. 1).

Table 1. Descriptive statistics related to GVA and investments in agriculture

Variable	Mean	Maximum	Minimum	Coefficient of variation (%)	Annual rate of change (%)
GVA in agriculture	2,146.001	2,973.260	1,853.176	341.540	4.88
Investments in agriculture	149.766	191.546	104.766	25.983	1.28

Source: authors' calculation based on SORS (2012-2021a, 2012-2021b)

Over the observed period, the average GVA in agriculture amounted to 2,146 million €, while the average investment value was nearly 150 million €. It is worth noting that the coefficient of variation is significantly higher for GVA in comparison to investments (340% vs. 26%). Furthermore, the average annual growth rate for GVA surpasses that of investments (4.88% versus 1.28%). In an effort to evaluate the potential effect of investments on the gross value added in agriculture, a regression model was formed. Table 2 presents an insight into the regression variance analysis based on which the statistical significance of the evaluated model was tested. The initial hypothesis is $H_0 : \beta_1 = 0$, based on which it is assumed that the regression model is not statistically significant.

Table 2. Regression variance analysis for the regression model of GVA dependence on investments in agriculture for the period from 2012 to 2021

Effect	Analysis of Variance; DV: GVA in agriculture				
	Sums of Squares	df	Mean Squares	F	p-value
Regress.	364383	1	364383.4	4.288829	0.072123
Residual	679688	8	84961		
Total	1044072				

Source: authors' calculation

Based on the results of the regression variance analysis for the observed model, it can be concluded that the null hypothesis is accepted and that the regression model is not statistically significant ($p > 0.05$). Consequently, the conclusion is drawn that investments in agriculture do not exert a statistically significant influence on the fluctuations of GVA within the agricultural sector.

The estimated parameters of the regression model are shown in the Table 3.

Table 3. Regression model of GVA dependence on investments in agriculture for the period 2012-2021

Regression Summary for Dependent Variable: GVA in agriculture						
N=10	R= 0.59076414 R ² = 0.34900227 Adjusted R ² = 0.26762755					
	F(1,8)=4.2888 p<0.07212 Std. error of estimate: 291.48					
	b*	Std. Err. Of b*	b	Std. Err. Of b	t (15)	p-value
Intercept			985.8429	567.5718	1.736948	0.120602
Investments	0.590764	0.285263	7.7441	3.7394	2.070949	0.072123

Source: authors' calculation

CONCLUSION

The research findings indicate that higher values of investments per hectare were achieved in comparison to the previously analyzed period (1996-2005), during which Milić & Pejanović (2008) reported an interval of variation ranging from 10 €/ha to 20 €/ha. Nevertheless, it was established that investments in agriculture do not exert a statistically significant impact on GVA in agriculture, thereby refuting the underlying research assumption. However, Milić et al. (2023a) point out that investments do not represent the sole determinant of agricultural development; technological progress stemming from the adoption of innovative solutions plays a pivotal role in enhancing agricultural productivity. Additionally, it is imperative to acknowledge the intrinsic biological nature of agricultural production, where increased investments do not invariably translate into improved production outcomes.

Acknowledgements: This research was supported by the Provincial Secretariat for Higher Education and Scientific Research of the Autonomous Province of Vojvodina, the Republic of Serbia during the project Assessment of Economic Performance of the Agricultural and Food Sector of AP Vojvodina, grant number 142-451-2567/2021-01/2.

Conflict of interest: The authors declare that they have no conflict of interest.

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