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Assessing The Impact Of Modernization Initiatives Through Measure 121 As A Strategic Tool On Agricultural Holdings: Financial Outcomes And The Role Of Agricultural Advisory

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Abstract

The "modernization of agricultural holdings" is an important element in preparing the farms for market participation. The EU's Rural Development Program (RDP) aims to improve competitiveness in the agricultural sector by supporting farm investment and agricultural advisory as strategic tools. This study aims to explore the influence of investment assistance as a strategic tool on gross margin, gross revenue, labor productivity, and profit. The results show that the farm-investment support program has proven to be highly beneficial in boosting the competitiveness of farms. Moreover, subsidized farms show positive labor productivity, as well as they are profitable. Our findings will provide insight into the EU's financial assistance to agricultural enterprises in Greece, where most of the farms are small-scale and suffer from credit constraints.

Keywords: *Modernization of agriculture holdings, Measure 121, Financial economics, Agricultural Advisory, strategy.*

INTRODUCTION

Sustainability and growth are the primary objectives of every economic entity operating under continuous market stres[1]s. To achieve this goal, investment-driven growth is essential. Farming farms rely heavily on capital, influenced by previous investment decisions, to determine their current and future output, economic success, living and working conditions.

A strategic investment involves the deliberate use of capital to augment resources and increase income. An investment's sustainability depends on its cost-effectiveness, which means that the returns on the investment outweigh the initial cost. Furthermore, low investment levels lead to higher costs and less efficient production, reducing the competitiveness of agricultural production (Zdeněk and Lososová, 2020). Countries with substantial fixed assets invested in agriculture tend to have higher productivity levels. Therefore, strategic, and sufficient investments are crucial to enhancing agricultural performance and competitiveness.

Agricultural investment is riskier than other sectors, because of the sector's unique characteristics. As farming generally isn't profitable, farmers must make substantial capital expenditures at once, which is one of their major challenges. Agricultural investment policies rely heavily on government intervention policies due to farmers' limited ability to gather their funds. A significant barrier to farm investments is the challenge of accessing external capital (Guariglia, 2008). In addition to decreasing product prices and rising input costs, the lack of external financing options can further strain farm finances. Limited capital access disrupts the agricultural sector's capacity to invest, potentially reducing productivity and profitability (Bojnec and Latruffe, 2011).

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Agricultural development in many countries relies on various intervention instruments (Czubak, W., & Piotr Pawłowski, 2020). A major way for the government to intervene in the agricultural sector in the European Union is through the Common Agricultural Policy (CAP). CAP supports farms through social, economic, and environmental objectives, promoting sustainable agricultural development (Lazíková et al., 2019). The CAP is structured around two main pillars. The first pillar aims to boost farm incomes and support environmental sustainability and animal welfare at the same time. In the second pillar, structural measures focus on investment support tailored to each EU member state's specific needs and development goals (Zolin et al., 2019).

Under the Common Agricultural Policy (CAP), farm investments are encouraged to motivate enterprises to embrace technology. Modern machinery, equipment, and buildings are typically acquired to accomplish this goal. As a result of such investments, the farm's production capacity will be increased, production processes will be improved technically, and overall production volume, quality, and efficiency will also be improved. As a result of these improvements, the farm's output increases, and its ability to adapt to market demands is greatly improved.

Farm investments significantly affect the value of farm products (Ferto et al., 2019). European agriculture's development depends on technological progress, which is only possible through such investments (Blandford et al., 2010). These investments are vital for maintaining a technological and infrastructure base for continued success and adaptability in the agricultural sector to maintain a competitive edge.

The “modernization of agricultural holdings” was an important element in preparing the farms for market participation. In the farm sector, two fundamental projects were introduced related to investing in fixed assets, machinery, and renewable energy (Balomenou et al., 2021). A basic pre-accession program support tool has been in place since 2002. Then comes two other programs: 2007-2013 and 2014-2020. Through investments in agricultural production and food processing between 2007 and 2013, the European Union allocated a substantial amount of 11 billion euros from its budget to enhance competitiveness. In the programming period 2014 - 2020, EU Rural Development Programs continued to support investments in farms and processing companies. Similar assistance is anticipated during the upcoming programming period of 2021 – 2027 (Sadowski et al., 2021).

This paper analyzes the impression of support provided to Greek farms within the Rural Development Program from 2014 to 2027 and the role that agricultural advisory must play to disseminate the above results. We examine the influence of investment assistance on the farms' gross margin, gross revenue, labor employment, productivity, and profit.

LITERATURE REVIEW

The primary objective of the EU's Rural Development Program (RDP) is to enhance the competitiveness of the farms by supporting investment. A few studies have explored the impact of EU investment subsidies on farm economic variables.

Czubak et al. (2021), investigate the impact of EU Common Agricultural Policy (CAP) funds on agricultural investments. They analyze and compare data from 5,839 Central and Eastern European farms from 2004–2015, using unpublished microdata from the Farm Accountancy Data Network (FADN). Using public funds for agricultural investment and the breadth of the investments, the research categorized farms. According to the study, a farm's initial production potential is crucial when it comes to making effective strategic investments and undertaking comprehensive modernization. Farm efficiency was improved faster and without overinvestment due to these mechanisms. In addition, only farms that pursued extensive investments over the observed period improved their technical efficiency.

Brinaru and Dona (2015), examined how NPRD funds affected agricultural operations' performance. This study focused on the economic, financial, and technical efficiency post-project as compared to the funding application process. The analysis found that accessing investment funds significantly affected the financial performance of agricultural operations, with many of them experiencing a decline in profitability. Additionally, a decrease in technical efficiency was observed, especially in large operations and their overall function.

Nowak et al. (2018), examined Measure 121 of the RDP 2007-2013, modernization of agricultural holdings. A key objective of the study was to examine the regional absorption of aid funds utilizing this measure and examine the relationship between the level of use of these funds and agriculture labour productivity. Results showed that labour productivity in agriculture varied greatly by region and that EU funds were used for modernizing agricultural holdings. A correlation exists between the scale of labor factor efficiency and measures 121 of the RDP.

In another study, Sadowski et al. (2021), studied the utilization of EU investment support agricultural programs and how this relates to the socioeconomic, natural, and agricultural structural conditions. Findings indicated that the local agrarian structure and the execution of co-funded investments were significantly correlated, with other factors having less of an impact. This suggests that agricultural growth may occur independently of socioeconomic and environmental conditions.

Svinous (2020), in a relative article, represented a structured system for capitalizing and modernizing production potential, using organizational and financial components to promoting investment in agricultural enterprises. Results showed that investment activity had a positive influence on economic efficiency.
Another paper examines climate-smart agriculture investment programs from a cost-benefit perspective. The benefits to society of such a program are analyzed, taking into account both private and public costs. Farmers and society benefit from climate-smart agriculture investments when returns are higher than opportunity costs under both pathways (Branca et al., 2021).

The purpose of the paper written by Kirchweger and Kantelhardt (2012) was to examine the agricultural investment support program effects on farm income using econometric models. According to the results, the farm income per year increased by roughly 7,000 Euros for each farm.

Medonos et al. (2012), examined the economic and other consequences on Czech farms of Measure 121 “Modernization of Agricultural Holdings,” part of the Rural Development Program 2007-2013. According to the analysis, investment support was significantly beneficial to business expansion and productivity.

Another paper studied the impact of capital subsidies on Italian firms. Compared to unsubsidized businesses, subsidized firms saw a greater increase in output, employment, and fixed assets but lower growth in total factor productivity. Subsidies for regional development hurt productivity and growth over the long term (Bernini and Pellegrini, 2011).

Moreover, several studies have been conducted on how agricultural subsidies affect farm productivity (Ciaian and Swinnen, 2009). The results showed that subsidies can positively or negatively affect farm productivity and production (Rizov et al., 2012). Other studies showed that subsidies tied to production had a negative impact on the technical efficiency of crop farms (Zhu and Oude Lansink, 2010).

Previous studies referred to the impact of agricultural subsidies on the productivity or efficiency of farms. There is no study referred to the impact of the Modernization of agricultural holdings on the economic results of farms. Moreover, no study refers to the Greek agriculture sector. In light of the above discussion, this study aims to explore the influence of investment assistance on gross margin, gross revenue, labor productivity, and profit. Our findings will provide insight into the EU's financial assistance to agricultural enterprises in Greece, where most of the farms are small-scale and suffer from credit constraints.

On the other hand, agricultural extension services play an important role in increasing agricultural productivity by providing support, information, and assistance to farmers. Agricultural consulting can improve a farm's financial results by improving productivity, better cost management, new marketing strategies, risk management, sustainable farm practices, network opportunities and access to finance through measures as the examined one (Measure 121), (Kountios, 2022; Tsiouni et al., 2022; Kourtiati et al. 2021; Fielke et al., 2020; Fabregas et al., 2019; Elahi et al., 2018).

METHODOLOGY

Study Area

Measure 121 was once one of the most popular measures among farmers in Greece, due to its high participation rate. Based on the final beneficiary list, 4348 plans were approved for this measure from 2014 to 2020. The research was carried out in Central Macedonia, located in the northern part of Greece. Central Macedonia accounted for 35.1% of all beneficiaries in Greece, with 1528 beneficiaries. The Ministry of Agriculture and Rural Development provided us with the accountancy data of farms. The data used in this document encompasses the period of one year before the commencement of the investment support (2014) and one year after its conclusion. (2021). Four different factors are considered: farm gross margin, farm gross revenue, farm profits, and labour productivity.

We utilize the average treatment of the treated (ATT) approach, which is a usually used methodology for analyzing the counterfactual effects of policies. The variable Y represents the average difference between farms that have received investment support (D=1) and those that have not (D=0). Farms receiving investment support have a greater potential outcome than farms not receiving investment support: Y0: Y1 - Y0. Farms applying for the investment grant self-select, making selection bias especially relevant. Considering the probability distribution of observed covariates, we define the average treatment on the treated (ATT) as:

$$\mathrm{ATT(Z)} = \mathrm{E}(\mathrm{Y_1} - \mathrm{Y_0} = \mathrm{Z}, \mathrm{P(Z)} = \mathrm{p}, \mathrm{D} = 1) \quad (1)$$

Where X denotes a collection of variables that represent the pre-exposure covariates of farms. Z, refers to a subset of X that represents a specific set of observable covariates. Lastly, P represents a probability distribution that pertains to the observed covariance Z. The use of balancing scores, can significantly reduce the dimensionality of the conditioning problem when implementing matching methods. A propensity score refers to the likelihood of receiving treatment based on pre-treatment characteristics Z, for random variables Y and Z, and a discrete variable D. As stated by Rosenbaum and Rubin, if the treatment is random given Z, it is also random given the balancing score p(Z).

$$\mathrm{E}[\mathrm{D} \,|\mathrm{Y}, \mathrm{Pr}\,(\mathrm{D} = 1 \,|\mathrm{Z})] = \mathrm{E}[\mathrm{E}(\mathrm{D} \,|\mathrm{Y}, \mathrm{Z} \,|\mathrm{Y}, \mathrm{Pr}\,(\mathrm{D} = 1 \,|\mathrm{Y})] \quad (2)$$

This suggests that the conditional expectation of D given Y and Z, denoted as E(D|Y,Z), is equal to the conditional expectation of D given Z, denoted as E(D|Z), which is also equal to the probability of D being 1 given Z, denoted as Pr(D = 1|Z). Consequently, the conditional expectation of D given Y, Pr(D = 1|Z), denoted as E[D|Y, Pr(D = 1)|Z)], is equal to the conditional expectation of D given Pr(D = 1|Z), denoted as E[D|Pr(D= 1|Z)].

In this context, Pr(D = 1|Z) represents the propensity score.

The estimator for the Average Treatment Effect on the Treated (ATT) using Propensity Score Matching (PSM) can be expressed as:

$$\tau^{PSM} = E[p(Z) \mid D = 1 \mid E(Y_1 D = 1, p(Z)] - [E(Y_0 D = 0. p(Z)] \quad (3)$$

The mean difference between outcomes over the common support is accurately weighted by the propensity scores of PO members.
Estimating the Difference-in-Differences Propensity Score Matching (PSM) method.
Based on comparisons between comparable treated farms (D=1) and control farms (D=0) before and after the implementation of investment support, the PSM-DID measures the impact of support:

$$\text{PSM - DID} = \{\sum_i [Y_{it}|(D = 1) - Y_{it}|(D = 0)] - \sum_i [Y_{it'}|(D = 1) - Y_{it'}|(D = 0)]\}/n \quad (4)$$

where $Y_u|(D=1)$-$Y_u|(D=0)$ is the difference between the average results of the farm with investment support and the farm without investment support in the previous period prior to the implementation of the program.

Results

Table 1. Effects of Measure 121 on Gross Margin

	Estimated effects of Measure 121 on Gross Margin	
Effect of Measure 121 per Farm	+24,13 €	
	Change (€)	Change (%)
Not- treated	-1,82	-2,36
Treated	+7,137	+4,41

According to table 1, Measure 121 has a positive impact on gross margin. On average, the investment support of Measure 121 led to a significant increase in the gross margin of farms, amounting to 24,13 EUR. In contrast, the gross margin of supported farms experienced a more modest average increase of 7,13 EUR. Conversely, non-supported farms witnessed a substantial decrease in gross margin, with an average decline of 1,82 EUR.

Table 2. Effects of Measure 121 on Gross Revenue

	Estimated effects of Measure 121 in Gross Revenue	
Effect of Measure 121 per Farm	+17,21	
	Change (€)	Change (%)
Not- treated	-5,16	-0,36
Treated	+20,14	+6,42

According to table 2, Measure 121 positively affects gross revenue. On average, the investment support of Measure 121 led to a significant increase in the gross revenue of farms, amounting to 17,21 EUR. In contrast, the gross revenue of supported farms experienced a more modest average increase of 20,14 EUR. Conversely, non-supported farms witnessed a substantial decrease in gross margin, with an average decline of 5,16 EUR.

Table 3. Effects of Measure 121 on labour productivity

	Estimated effects of Measure 121 on labour productivity	
Effects on labour productivity	+3,45 €/AWU	
	Change (€/AWU)	Change (%)
Not- treated	+6,72	+35,28
Treated	+3,41	+6,21

According to table 3, Measure 121 positively affects labour productivity. Both supported and unsupported farms increased in labour productivity, but that increase was greater among non-supported farms. There was a lower reduction in employment among supported farms than among non-supported farms.

Table 4. Effects of Measure 121 on Profit

	Estimated effects of Measure 121 on Profit	
Effects on profit	+32,47	
	Change (€)	Change (%)
Not- treated	-22,15	-14,18
Treated	+14,79	+9,25

According to table 4, Measure 121 has a positive effect on profit. On average, the investment support of Measure 121 led to a significant increase in the gross revenue of farms, amounting to 32,47 EUR. In contrast, the profit of supported farms experienced an increase of 14,79 EUR. Conversely, non-supported farms noticed a loss, with an average decline of 22,15 EUR.

DISCUSSION AND CONCLUSIONS

Investment is an integral part of agricultural enterprises' regenerative processes, which interact dynamically between their organization and economic content, influencing their development as well as the industry as a whole. As a result of this interaction, the entire industry's economic development is affected. To achieve high financial and economic results, the actions undertaken by the business entity of investment processes must guarantee the sustained functioning of the enterprise or farm. In the context of agricultural investment endeavors, these factors are intricately linked to the establishment of a comprehensive organizational and economic support system.

Many useful conclusions can be drawn from the implementation of Measure 121. Measure 121 was once one of the most popular measures among farmers in Greece, due to its high participation rate. Farm investments are actively promoted under the Common Agricultural Policy (CAP) to incentivize enterprises to adopt technological advancements. This objective is achieved through the acquisition of contemporary machinery, equipment, and infrastructure. These investments lead to an enhanced production capacity, improved technical processes, and overall advancements in production volume, quality, and efficiency. Consequently, the farm experiences an increase in output and significantly enhances its ability to meet market demands. The impact of investment assistance on the agricultural economy in Greece is clear.

The results show a positive effect on gross margin and gross revenue, and that means the farm-investment support program has proven to be highly beneficial in boosting the competitiveness of farms. Moreover, there was an increase in labour productivity. This can be attributed to the impact of investments and the substitution of labor with capital. Investments are undertaken to substitute human and animal labour with automated tasks. The primary objective of investing is to enhance labor productivity, which can be accomplished without altering or even augmenting employment. This strategy is especially warranted in agriculture, particularly in small-scale farming, which relies heavily on labour

resources but has limited opportunities for engagement in non-agricultural activities. At the same time, agricultural advisory services should act as an essential support system for farmers through the whole process of modernization, offering them the tools and knowledge needed to improve their operations' efficiency and profitability. Finally, this paper did not examine how quickly funding applications get their approvals nor the actual help do farmers get from advisory services through application progress, something that by all means will be a future research topic.

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