

# IMPACT OF SUBSIDIES IN AGRICULTURAL INCOME AND CROP PRODUCTION: THE CASE OF GREECE

**Zisis C. Mandanas<sup>11</sup>, Dimitrios P. Petropoulos<sup>12</sup>,  
Nikolaos Apostolopoulos<sup>13</sup>**

## ВЪЗДЕЙСТВИЕ НА СУБСИДИИТЕ ВЪРХУ СЕЛСКОСТОПАНСКИЯ ДОХОД И РАСТЕНИЕВЪДСТВОТО: СЛУЧАЯТ НА ГЪРЦИЯ

**Зисис К. Манданас, Димитриос Петропулос,  
Николаос Апостолопулос**

### Abstract

Subsidies are an important element in supporting agricultural income and expanding production. This element is typical for the case of Greece in terms of crop production, which is fragmented, with the majority of farmers owning small rural areas. The purpose of this paper is to study the relationship between the amount of agricultural income and the value of agricultural production and the level of subsidies on products. The research data refer to the period 1993 to 2020 for Greece. All data were drawn from the Eurostat database and are annual. The results of the study showed a significant reduction in the level of subsidies, especially after 2004, which, however, is not associated with a corresponding reduction in agricultural output in the long run. On the contrary, the reduction of subsidies is related to a reduction of agricultural income.

**Key words:** Subsidies, agricultural income, agricultural production

**JEL:** Q13

### Introduction

The European Union spends annually around €50 billion on the Common Agricultural Policy (CAP), with the primary objective of supporting farmers' income and improving the environmental impact of agricultural production (Rizov et al., 2013). The majority of CAP subsidies are disbursed in the form of decoupled direct payments from the EU budget, which are not linked to current and future amounts of agricultural production. Under CAP there are also subsidies, linked to the production of specific crops or livestock products, or are available for rural development projects.

---

<sup>11</sup> PhD (c), School of Agriculture and Food Science, University of Peloponnese.

<sup>12</sup> Doctor, Associate Professor, School of Agriculture and Food Science, University of Peloponnese.

<sup>13</sup> Doctor, Assistant Professor, School of Business Administration, Neapolis University Pafos.

The impact of subsidies on agricultural output, allocation of inputs and the distribution of farm income, as well as on farm productivity, has been widely documented in the existing literature (Femenia et al., 2010; Weber. Key, 2012; Latruffe et al., 2017). The results obtained are mixed, as a positive impact of subsidies on the level of agricultural output is observed, and on the other hand a negative impact on the overall productivity of agriculture sector is detected, given the expansion of the quantity and quality of production factors (Ciaian, Swinnen, 2009). Keeney (2000) concluded that the introduction of direct payments through the MacSharry reform contributed to the balanced income distribution of rural households. Also, Mishra et al. (2009), Moreddu (2011) and Benni Finger (2012) also conclude that subsidies contribute to reducing income inequality of rural households.

In contrast, Schmid et al. (2006) conclude that direct payments have little effect on the level of absolute farm household incomes. Furthermore, the authors emphasize that direct payments and agri-environmental subsidies increase absolute income inequality, due to the fact that they are mainly linked to the size of agricultural holdings and therefore the corresponding payments increase according to their size. The use of science and technology in production and combined production systems (production chains) are related to the rise of productivity increase along with the size of production (Oosting et al., 2014). Thus, larger agricultural enterprises have a competitive advantage in terms of the level of subsidies they receive in both relative and absolute terms compared to smaller ones but especially compared to individual farmers, alongside with the strengthening of the tendency for verticalization (Hedoui et al., 2019).

Aim of the present study is to examine the relationship of agricultural subsidies, output and income in the short and long run, with reference to the Greek agricultural sector. Therefore, focuses on the influence exerted by subsidies on the level of agricultural output and economic efficiency of agricultural households, in order to clarify their role as an element of ensuring the rational development of agricultural production and ensuring a satisfactory standard of living for the agricultural population by boosting its income.

### **Methodology**

The primary data that are used for the purposes of the present paper include annual data, which were drawn from the Eurostat database and concern Greek the Economic Accounts for Agriculture for a period of 28 years (1993 – 2020). Data refer to crop production value at producer and basic prices, agricultural revenue and product subsidies. The econometric tools used to examine the nature of the relationship between the level of agricultural subsidies, output and income in the short and long run are Ordinary Least Squares regression and Engle – Granger cointegration

analysis. Additionally, time trend plots and Spearman's linear correlation coefficients are presented. To study the effect of subsidies on the level of the output of crop production and agricultural income, the following OLS models are estimated:

$$lpv_t = a + b \times lsubs_t + e \quad (1)$$

$$lrev_t = a + b \times lsubs_t + e \quad (2)$$

where:

$lpv_t$ : Natural logarithm of crop production value at producer prices;

$lrev_t$ : Natural logarithm of agricultural revenue;

$lsubs_t$ : Natural logarithm of product subsidies;

$e_t$ : The disturbance term.

As previously mentioned, in order to detect the existence of a long-term equilibrium relationship between the volume of product subsidies and crop production output and agricultural revenue, the Engle-Granger cointegration method is used. For the existence of a cointegration relationship, this specific method assumes as a prerequisite that the residuals of the OLS regression of the variables under examination, are integrated of zero order ( $I(0)$ ), with the basic condition of the existence of  $I(1)$  process in them. Stationarity is examined with the use of ADF (Augmented Dickey – Fuller) unit root test, with the inclusion of a constant term and trend, while the appropriate number of time lags is selected through Akaike Information Criterion (AIC).

## Results

Figure 1 shows the overtime trend in crop production value at producer prices and product subsidies. Also, production value at basic prices yielding by the sum of the two aforementioned quantities and the level of agricultural revenue resulting from the difference between the producers' operating surplus and the land rent payable and land lease expenses are presented. It is observed that the production value at producer and basic prices show a common movement, with an upward trend until 2005, where the level of subsidies is also increased. Subsequently, there is a decrease in production value both in producers and basic prices and a simultaneous decrease in the level of subsidies, to show an increasing trend with small fluctuations until 2020, where they reach the pre – 2005 levels. In contrast, the amount of product subsidies is consistently low after 2007 relatively to the period 1993 – 2006. Also, the level of agricultural income shows relative stability, despite its fluctuations after 2006, a result that can be attributed to the crisis phenomena that affected the Greek economy and the relative uncertainty that characterized it.

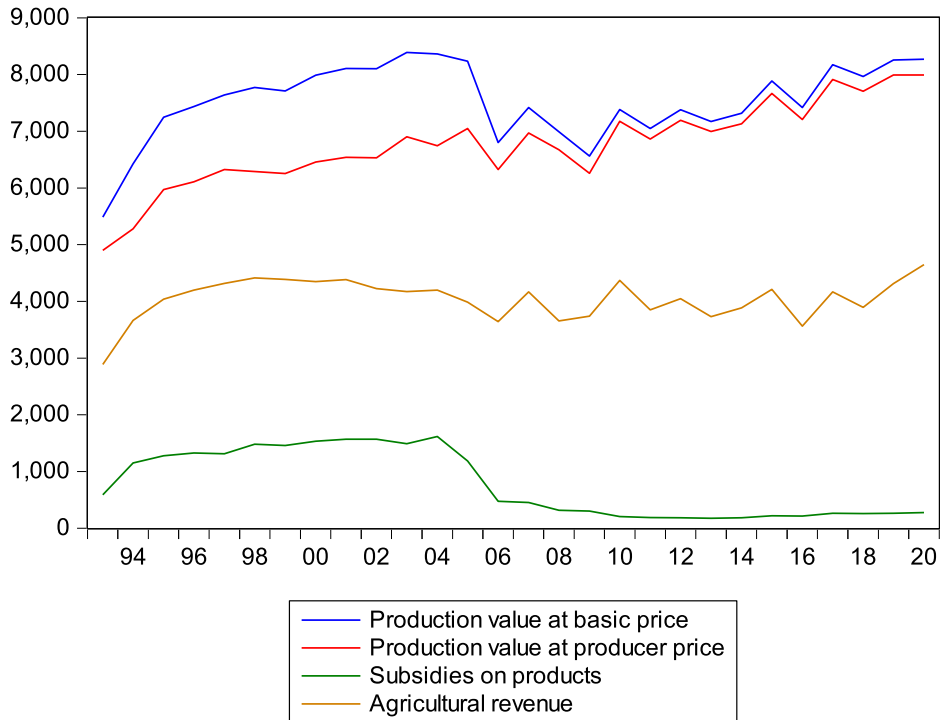


Figure 1. Time trend in subsidies, crop production value and agricultural revenue

The reduction in the level of subsidies is more clearly perceived when they are presented as a percentage of agricultural revenue and of production value at producer and basic prices. As shown in Figure 2, there is a significant reduction in subsidies after 2005, especially as a percentage of agricultural income, until 2010, while the relative ratio stabilizes after 2011. Similar are the results regarding the level of the ratio of subsidies to crop production value at producer and basic prices.

Interpreting the results of the Spearman correlation matrix of Table 1, it is initially observed that a negative and statistically significant relationship emerges between the level of subsidies and production value at producer price ( $r=-0.583$ ,  $p=0.001$ ). This particular result indicates that an increase in subsidies is associated with a decrease in the value of crop production and vice versa. At the same time, the positive correlation between subsidies on products and production value at basic price ( $r=0.389$ ,  $p=0.041$ ), confirms the important role of subsidies in determining the level of crop production. Additionally, an increase in the value of subsidies is associated with increased agriculture revenue and vice versa with the associated correlation coefficient also being positive and statistically significant ( $r=0.409$ ,  $p=0.031$ ).

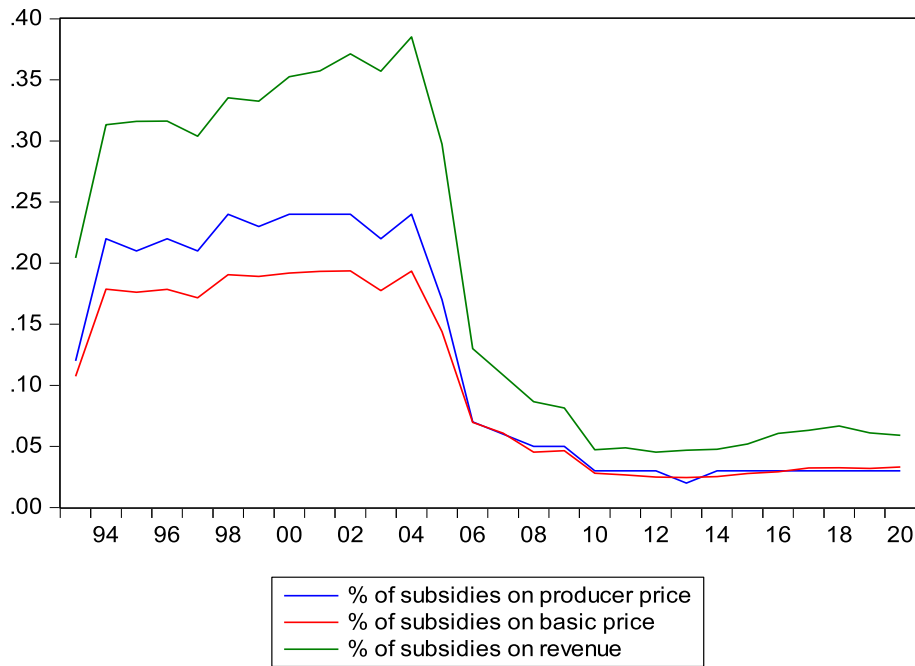


Figure 2. Time trend of subsidies to crop production value and agricultural revenue ratio

Table 1. Spearman correlation matrix

		Subsidies on products	Production value at producer price	Production value at basic price	Agricultural revenue
Subsidies on products	rho	1			
	p	-			
Production value at producer price	rho	-0.583	1		
	p	0.001	-		
Production value at basic price	rho	0.389	0.483	1	
	p	0.041	0.009	-	
Agricultural revenue	rho	0.409	0.137	0.669	1
	p	0.031	0.487	0.000	-

By studying the effect of subsidies on the volume of agricultural production and agricultural revenue, OLS regressions are applied. As observed (Table 2), subsidies show a negative impact on the level of production ( $b=-0.070$ ,  $p=0.003$ ), as an increase in subsidies by 1% leads to a corresponding decrease in production value at producer prices by 0.07% and vice versa. On the contrary, there is a positive effect of subsidies on agricultural revenue ( $\beta=0.028$ ,  $p=0.040$ ), with a change in subsidies

by one percentage point leading to a corresponding change in agricultural revenue by 0.028%.

*Table 2. OLS regression results*

Independent variable:	Model (1)			Model (2)		
	lpv			lrev		
	Coefficients	t	p	Coefficients	t	p
Constant	9.257	68.394	0.000	8.123	62.330	0.000
lsubs	-0.070	-3.307	0.003	0.028	2.365	0.040
R <sup>2</sup>		0.296			0.167	
Adj. R <sup>2</sup>		0.269			0.131	

In order to apply the Engle – Granger cointegration test, unit root tests should be performed to determine the order of integration of the time series, which should be I (1). Table 3 presents the results of the Augmented Dickey–Fuller (ADF) unit root tests with constant term and trend. The critical values for the ADF test are equal to -4.374 for a 1% significance level and -3.603 for a 5% significance level. It is concluded that the variables are integrated of the same order, since their order of integration is I (1) in all cases. Given that the time series are first order integrated, the study of the existence of cointegration relationships between the level of subsidies and production value at producer prices and the level of subsidies and agricultural revenue is applied using the Engle – Granger test.

The results presented at Table 4, show that there is a cointegration relationship between the value of subsidies and agricultural revenue, as for critical values of -4.356 for a 1% significance level and -3.595 for a 5% significance level the residuals of the corresponding regression (2) are I (0) based on the ADF test ( $p=0.001$ ). Therefore, a long-term equilibrium relationship between the two variables is observed. On the contrary, the assumption of stationarity of the residuals at the level for regression (1), referring to the relationship between the value of subsidies and production at producer prices is rejected ( $p=0.144$ ) and is concluded that there is no long-term equilibrium relationship between the two variables.

*Table 3. ADF unit root tests*

	Level		1 <sup>st</sup> difference	
	t	p	t	p
lsubs	-2.304	0.418	-4.381	0.010
lpv	-1.286	0.620	-5.208	0.002
lrev	-1.916	0.617	-4.813	0.004

*Table 4. Engle – Granger cointegration tests*

	Level	
	t	p
Model (1) residuals	-3.028	0.144
Model (2) residuals	-5.239	0.001

## Conclusions

From the results of the analysis, it is concluded that the effect of the financial flows of the subsidies on the level of income of the Greek farmers cannot be considered negligible, as the relevant financial variables show a linear relationship, fact that was also confirmed through the use of the corresponding Spearman correlation tests. Also, through regression and cointegration analysis, it was observed that subsidies have a positive effect on agricultural revenue both in the short and long term. In addition, it is judged that the increase in subsidies leads to a decrease in agricultural output, which does not show long-term characteristics. The above indicate a clear contribution of subsidies to agricultural income, which may nevertheless discourage the productive performance of the agricultural sector.

## Bibliography

Ciaian, P., Swinnen, J. F. (2009). Credit market imperfections and the distribution of policy rents. *American Journal of Agricultural Economics*, 91 (4), 1124 – 1139.

Femenia, F., Gohin, A. (2010). *On the optimal implementation of agricultural policy reforms* (No. 959 – 2016-74868).

Hedoui, M. A., Natos, D., Mattas, K. (2019). EU agricultural integrated policies: the case of EU and Mediterranean countries. *New Medit*, 18 (3), 17 – 29.

Keeney, M. (2000). The distributional impact of direct payments on Irish farm incomes. *Journal of agricultural economics*, 51 (2), 252 – 265.

Latruffe, L., Bravo-Ureta, B. E., Carpentier, A., Desjeux, Y., Moreira, V. H. (2017). Subsidies and technical efficiency in agriculture: Evidence from European dairy farms. *American Journal of Agricultural Economics*, 99 (3), 783-799.

Moreddu, C. (2011). *Evaluation of agricultural policy reforms in the European Union*. OECD.

Oosting, S. J., Udo, H. M. J., Viets, T. C. (2014). Development of livestock production in the tropics: farm and farmers' perspectives. *Animal*, 8 (8), 1238 – 1248.

Rizov, M., Pokrivcak, J., Ciaian, P. (2013). CAP subsidies and productivity of the EU farms. *Journal of Agricultural Economics*, 64 (3), 537-557.

Schmid, E., Sinabell, F., Hofreither, M. F. (2006). *Direct payments of the CAP – distribution across farm holdings in the EU and effects on farm household incomes in Austria* (No. DP-19 – 2006). University of Natural Resources and Life Sciences, Vienna, Department of Economics and Social Sciences, Institute for Sustainable Economic Development.

Weber, J. G., Key, N. (2012). How much do decoupled payments affect production? An instrumental variable approach with panel data. *American Journal of Agricultural Economics*, 94 (1), 52-66.

**Contact person information:** Dimitrios P. Petropoulos, Associate Professor, School of Agriculture and Food Science, University of Peloponnes, e-mail: d.petropoulos@uop.gr