FACTORS AFFECTING THE SIZE OF AGRICULTURAL FARMS IN GREECE

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Abstract

Farm size in Greek agriculture is considered as one of the main determinants of the efficiency of Greek farm enterprises. This paper presents the results of a time series analysis of some determinants on the changes in farm size in Greece, during the period 1961-1990. The resource abundance, the significance of agriculture, the factor proportions, terms of trade in agriculture, istitutional policy, were used as independent variables in a specified mathematical model to estimate their effects on farm size. The estimates indicate that the effect of all factors on farm size over a long time period was found to be rather small. An implication of the findings of this study is that farm size increased as a response to dynamic socioeconomic changes associated with the agricultural sector which were not accompanied by the application of any national policy. Based upon the results of this research some policy measures are suggested.

Résumé

La dimension des exploitations agricoles en Grèce est parmi les déterminants principaux de leur efficience. Ce travail présente les résultats d'une analyse temporelle de certains déterminants sur les changements de la dimension de l'exploitation agricole en Grèce, dans la période 1961-1990. L'abondance des ressources, l'importance de l'agriculture, le rapport entre les facteurs, les échanges commerciaux en agriculture, la politique institutionnelle, ont été pris en tant que variables indépendantes dans un modèle mathématique utilisé pour estimer leur effet sur la dimension de l'exploitation agricole. Les estimations indiquent, sur une longue période, un très faible effet de tous les facteurs sur la dimension de l'exploitation agricole. D'après cette étude, il résulte que la dimension de l'exploitation agricole a augmenté à la suite des changements socio-économique dynamiques associés au secteur agricole qui n'ont pas été accompagnés par l'application d'une politique nationale. L'auteur avance des propositions de politique.

It is generally argued that small farmers use their limited resources and knowledge efficiently via their traditional farming systems. Among these limited resources, farm size plays an important role both in the level of their income and in their welfare. Farm size varies from one country to another and is a phenomenon primarily determined by non-economic variables, such as laws of inheritance, social conditions, historical consequences, nature of the land, or government policies (Dillon and Hardaker 1980).

In addition, it is recognized that farm size changes very slowly over many years under the influence of both political and social forces; however the influence of economic factors should not be neglected.(Bachman and Christensen, 1967). Such factors appear to play an important role in the case of farm size in Greece.

In the new Greek State that was created after the 1821 Revolution, the main political and social issue was the distribution to landless farmers of national and of large private estates of a feudal type. So, about 3,000,000 stremmas ([1]) were distributed up until 1911, and 17,000,000 stremmas to nearly 300,000 families up until 1936, including about 150,000 refugee families from Asia minor. The distribution of land continued after World War II using national land, large private estates, land belonging to churches and monasteries, and drained areas, which constituted about 5,500,000 stremmas. It is estimated that from 1920 to 1950 about 22,500,000 stremmas were distributed to about 850,000 families, i.e. 26.5 stremmas to each family (Rokos, 1981 ch.3).

The conclusion to be drawn from the above short historical retrogression is that the size of Greek farms was determined over the 1821-1950 period. After 1950 the Greek economy entered into a period of rapid growth associated with both a population redistribution and an intensive internal emigration. This event created economic and social forces that may have affected farm size.

This paper evaluates some social and economic factors affecting farm size in Greece during the study period 1961-1990. This involves the determination and measurement of variables, the model specification and interpretation of the results.

Farm size in Greece

The size of a farm can be measured in various ways. Choosing a measure of farm size is somewhat arbitrary even assuming that all appropriate information is available. Alternative criteria such area cultivated, output, or input levels may all be used depending upon the propose of the study. The most common criterion for measuring farm size in various countries is the area cultivated (Huang, 1973, Dillon and Hardaker, 1980)). Because of the limitation of detailed data for Greek agriculture, farm size is measured in terms of area cultivated. This concept of farm size for Greek agriculture arises from the total cultivated area (in stremmas), divided by the total number of agricultural holdings. The measure gives the annual average farm size and it comes close to the normal concept of farm size, generally referred to in the literature.

Table 1 shows the average farm size in Greek agriculture for the period 1961-1990, showed a marginal increase. Indeed, it has increased by about 29.1 stremmas - from 32.6 to 61.8, over the whole period.

This increase shows that farm size in Greek agriculture is a variable which changes very slowly.

Also, farm population declined dramatically and mechanization of agriculture increased at an impressive rate. The same table shows also, the cultivated land, the agricultural population, the number of farms and the number of tractors from 1961 to 1990.

Table 1 ***Cultivated area, agricultural population, number of farms, number of tractors and farm size in Greece (1961 -1990).***

Year	Cultivated area (stremmata)	agricultural population	number of farms	number of tractors	average farm size (stremmata)
1961	37,745,000	3,675,000	1,156,172	23,400	32.65
1971	39,095,000	3,082,000	1,047,260	110,600	37.33
1981	39,511,000	2,610,000	883,986	238,100	44.70
1990	47,140,000	2,146,000	763,325	349,200	61.76

Source: NSSG, Agricultural Census of corresponding years.

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([1]) 1 stremma = 1000 m^2 = 0.1 ha.

Time series analysis of farm size in Greece

In Greece, farm size was determined by 1950, or a little later, as a result of a policy of land redistribution which took place over a period of a century. This redistribution of land was a political decision taken under political and social pressures. After 1950, and especially at the beginning of the '60s, the Greek economy experienced rapid economic growth which had profound effects on agricultural production, agricultural employment and the technology of farm production. The result of these changes was the slowing down of the tendency of farm sizes to increase.

In the period from 1961 to 1990, the Greek State did not impose any policy measures affecting farm size. This was mainly due to an ownership regime protected by the Greek Constitution. So, the increase in farm size was affected by factors which caused more land availability, direct or indirect, for the remaining farm population. Such factors are related to the social and economic changes that take place in a context of development, and they affect farm size as has been shown in across-country study (Huang, 1973, Lianos and Parliarou, 1986). These factors are the following:

(i) **Resource abundance**. The abundance of land as a natural resource has meaning only in relation to total population within the whole economic system of the country. As the population increases relative to available land a competition appears among the population for the scarce resource which is the agricultural land in this case. The strength of this competition for agricultural land would depend on the significance of agricultural production. The greater the population land ratio, the poorer the availability of land and the smaller the average farm size.

(ii) **Significance of agriculture**. In countries where the early stages of development depends on agriculture and the percentage of GNP which originates from the agricultural sector is high, the majority of the population economically depends on the land. When industrialization begins the significance of the agricultural sector declines, job opportunities are created in the nonagricultural sector and emigration out of agriculture will occur. This emigration will release land to be used by remaining farmers, thus increasing farm size.

(iii) **Relative factor proportions**. As development proceeds, and agricultural labor declines, agriculture becomes more capital intensive. This occurs due to changes in relative factor prices. As the cost of capital relative to labor falls the use of capital become more efficient. More intensive use of capital inputs increases both the total fixed costs in farming and the optimum farm size determined by the minimum point on the average cost curves (Cardner and Pope, 1978). As a measure of differences in relative factor proportions the ratio of tractor to the agricultural labor force is used.

Other factors which seem to affect farm size are welfare in agriculture and institutional structural policies. Each of these is analyzed as follows:

(iv) **Terms of trade in agriculture**. As is known from production economics, for each size or scale of operation, individual farms have a new set of average total cost curves. As farm size increases, fixed costs remaining constant- tractor, combine, operator's labor- total product increases, fixed costs spread over more units of output and average total cost reduces (Sjo, 1976). This improves the welfare of the farmer. The increase in farm size up to optimum size improves the welfare of producers. Welfare is also measured by the ratio of the index of prices received by producers to the index of prices paid by producers which is known as «terms of trade in agriculture» (FAO, 1986 pp. 164). Changes in terms of trade can measure changes in farm economic welfare or incentives to produce more or to increase farm size.

(v) **Institutional factor**. This factor is related to the nature of the public structural policies which encourage changes in the size or organization of farm enterprises and other organizations associated with them (Oustapassidis, 1992). These policies in the broad sense cover the adaptation of farm structures to changes which necessitate larger farms, fewer farmers and the wider social and environmental consequences of the above (Hallett 1981, p. 225). Structural policies are imposed by national or international institutions for a concrete time period when drastic changes occur in the agricultural economy. It is appreciated that such policies are better than other support policies. These policies affect the organization of production and farm size as well (Butcher and Whittlesey, 1966).

The effects of the Institutional factor on farm size can be expressed in the form of a dummy variable and can be incorporated directly into the model to give information about the effects on farm size in the period of the study. This dummy takes value 1 for the period in which structural policies are imposed and 0 for any other period (Gujarati, 1988)

As mentioned above, the Greek economy entered into rapid growth at the end of the 50s. At the same time, rapid industrialization took place in Western Europe. These events caused a significant movement in the agricultural population, especially in the active labor force, from rural to urban areas and to Western European countries, where the opportunities for alternative employment were more readily available. This emigration continued after Greece's accession to the EEC. This decline in the active labor force of the agricultural sector made more land available to the rest of the farm population.

Also, it caused a tendency, through the land market mechanisms, to increase the overall farm size.

The terms of trade in Greek agriculture were improved during the period 1961-1990 (**Table 2**). This was a result which was mainly due to either increases in product prices or to an increase in productivity, based on the use of new technologies. Both reasons were associated with an increase in the value of the total product.

The improvement in terms of trade had a significant impact on farmer's welfare, especially on small farm size owners. Thus, farmers were unwilling to leave their jobs, since they received a valuable income from farming. This situation pushed farmers to increase their farm size up to optimum size. After Greece's accession to the EEC, structural policy of the CAP was imposed on Greek agriculture. This policy was expressed by a number of Directives (159/72, 160/72, 161/72) (2), which aimed to improve the structure of agriculture. The structural policy of the Community was completed by Regulation 797/85 (3). This Regulation introduced a system of aid for investment in farm holdings in order to improve the efficiency of agricultural structures. This policy was expected to affect Greek farm size. In this analysis we attempt to determine the effects of the above factors on farm size in Greek agriculture. The regression model can be written as fallows:

$$A_t = a + bR_t + cS_t + dF_t + gW_t + fD + u_t$$

where:

A_t = The annul average farm size in stremmas, in year t. This is measured by the total annual cultivated area divided by the annual number of farms.

R_t = Resource abundance in year t, which shows the ratio of total population to the annual cultivated area.

S_t = Significance in agriculture in year t, measured as the total agricultural labor force over the total labor force in each year.

F_t = Relative factor proportions in year t, measured by the total number of tractors divided by the total agricultural labor force.

W_t = The terms of trade in Greek agriculture in year t, measured by the index number of prices received by producers divided by the index number of prices paid by producers (1970 = 100).

D = Dummy variable presenting EEC's structural policy, that takes value 0 from 1961 to 1980 and 1 from 1981 to 1990 (periods before and after the accession of Greece to the EEC).

(2) These Directives are referred to: (i) 159/1972: to the modernization of farm and providing investment aid for the implementation plans and for acquiring land that would be available under the second directive, (ii) 160/1972, to reallocating land by encouraging farmers operating non-viable farms to cease farming and release their land to other farms, or for other uses, (iii) 161/1972, to providing guidance for improving the occupational skills of those who choose to stay in agriculture and those who choose to quit farming.

(3) Regulation 797/1985 expresses the structural policy of the Community and aims to improve the efficiency of agricultural structures introducing a system of aid for investment to farm holdings where the farmer meets a specified criteria.

Tabella 2 ***Terms of trade in agriculture from 1961 to 1990. (Index of prices received by producers/index of prices paid by producers 1970=100).***

Year	1961	1965	1970	1975	1980	1985	1990
Terms of trade	1.090	1.006	1.000	1.079	1.310	1.420	1.590

Source: NSSG.

u_t = Error term.

According to the empirical evidence and to the theoretical specification that both were presented previously, the sign of the coefficients estimated are expected to be:

$$b<0,\ c<0,\ d>0,\ g>0,\ f>0.$$

The data for the measurement of the variables are time series data from 1961 to 1990, drawn from the relevant National Statistical Service of Greece (NSSG, 1961-1990).

Estimation of the model and interpretation of the results

The Ordinary Least Squares (OLS) and AR1 methods have been applied to the mathematical formulation of the specified model. Since there isn't a priori basis for predicting the exact form of the regressions the equation that appeared to fit better to the data was used. The best equation for the farm size, double - log, is:

a) OLS method

$$\log A_t = \underset{(-14.3)}{-9.16} \underset{(-20.6)}{-1.522\log R_t} \underset{(-2.8)}{-0.134\log S_t} + \underset{(3.00)}{+0.056\log F_t} \underset{(2.7)}{+0.167\log W_t} \underset{(12.6)}{+0.165D}$$

$$\bar{R}^2 = 0.953 \qquad D-W = 1.80$$

b) AR1 method

$$\log A_t = \underset{(-12.5)}{-9.00} \underset{(-18.2)}{-1.50\log R_t} \underset{(-1.92)}{-0.150\log S_t} + \underset{(2.56)}{+0.053\log F_t} \underset{(2.28)}{+0.141\log W_t} \underset{(12.1)}{+0.167D}$$

$$\bar{R}^2 = 0.974 \qquad D-W = 1.86$$

(t - statistic in parenthesis)

The Durbin - Watson (D-W) test has been used in testing for autocorrelation. The dummy variable was excluded from the logarithm form. The estimated mathematical formulation appears to fit the actual data quite well since all coefficients are significant and they have the proper signs. Also, the adjusted coefficient of determination is very high in both methods of estimation. But in the case of AR1 estimation the independent variable that refers to significance in agriculture turned out to be insignificant, maybe due to intercorrelation. Since the empirical results are explained by a large proportion of the variance in farm size it appears that both socioeconomic factors and policy variables are the main determinants of the farm size.

Conclusion and policy implication

This paper has considered the effects of changes in some socioeconomic factors and institutional policy on farm size in Greek agriculture. Within a «stage of development» framework, farm size determined by resource availability, which was changed with population growth, increases in nonagricultural employment opportunities and changes in factor proportions over time. Also, the improvement in welfare in agriculture and the structural EEC's policy contributed to the increase of the farm size. An implication of the findings of this study is that the optimal farm size of Greek agriculture changed over a thirty year period in response to dynamic conditions. The net effect of all factors was probably small. But this increase in farm size occurred even in the absence of national structural policy. ●

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