«ΣΠΟΥΔΑΙ», Τόμος 44, Τεύχος 3ο-4ο, Πανεπιστήμιο Πειραιώς / «SPOUDAI», Vol. 44, No 3-4, University of Piraeus

FACTORS INFLUENCING THE DECLINING CONTRIBUTION OF THE AGRICULTURAL SECTOR TO THE OVERALL GROWTH OF THE GREEK ECONOMY 1950 - 1990

By

George S. Sapounas
Agriculture Bank of Greece
Research and Planning Division

Abstract

The issue of (sectoral) contribution to growth is usually handled in the literature with some type of growth-accounting decomposition. The "state of the art" was established by Abramovitz (1956) and Denison (1967). Since then the literature has diversified considerably. The present paper uses this conventional growth accounting framework to explain the declining importance of the agricultural sector in the Greek economy. Agricultural sector contributions to overall growth are investigated using time series data for the period 1950-1990. The results reveal that capital accumulation, export contribution and import penetration along with the effects of "appropriationism" and "substitionism" are significant variables in explaining the declining importance of agricultural activity. In addition, the Common Agricultural Policy (CAP) and since 1986 the pressures for international liberalization of the agricultural product markets, have been leading to the further contraction of the agricultural activities. (JEL Ql 1, 013)

1. Introduction

Recent evaluations of the sectorial performance of the Greek economy[1] have focused their attention on the non-agricultural sectors as the key-leaders in the economy. These evaluations have significant short- and long-run implications for the agricultural population. Economic theory, as well as case studies, indicate that the agricultural sector is less flexible than other economic sectors in adjusting to changing economic conditions[2]. The shift of agricultural workers to urban areas has confirmed the hypothesis of "labour overflow". On the other hand, the Common Agricultural Policy (CAP), and since 1986 the pressures for international liberalization of the agricultural products markets (GATT in

Punta del Este and in Brussells), have been leading to the further contraction of the agricultural activities. As a result, additional economic, political and financial pressures are applied on the government so that goods can be supplied at affordable prices on the one hand, on the other, cheap credit and a reasonable income secured to agricultural workers in order to prevent from shifting to other activities. In addittion to these policies, industries with agricultural sector linkages have to establish their activities near rural areas thus providing complementary employment to agricultural part-timers.

Studies of the changing market shares of the sectors in the Greek economy[3] provide an interpretation for the historical shift from agricultural to non-agricultural sectors. With a view to "structural transformation model", government policies have been oriented towards the industrialization and expansion of the non-agricultural sectors and especially that of the services sector[4]. This explanation, however, provides only limited insight into the forces that have produced the diverse changes in market shares across sectors.

The purpose of this paper is to identify commonly accepted or yet unknown factors which may explain the declining contribution of the agricultural sector to the overall growth of the Greek economy.

The paper is organized as follows. Firstly, changes in agricultural contributions to the overall growth of the economy are decomposed into four parts and the observed differences by sector are being discussed. Contributions to growth are estimated for the agricultural and non-agricultural sectors for the historical period 1950-1990. Secondly, Ordinary Least Squares (OLS) are used to isolate sector characteristics that are statistically related to changes in gross domestic output in per capita terms. The results of both types of analysis provide evidence indicating that the differences in the economic performance of the agricultural and of its counterpart, non-agricultural sector, contribute to the determination of the declining importance of the first sector and to its reduced role in the future development of the Greek economy.

2. Agricultural and Other Sector Contributions. A Growth-accounting Decomposition

Agricultural contribution to the overall economy can be decomposed into four broad components: contribution to capital accumulation, to resources, to income distribution and to working population. Within each of these compo-

nents, agricultural contributions may further be disaggregated into contributions to the respective changes of aggregate variables of the economy such as

— capital accumulation (C1) that stems from private (C11) and public (C12) capital accumulation,
— gross domestic product (C21),
— total value of imports (C22) and exports (C23),
— import penetration (C24) and disposable goods of the domestic market (25),
— total active population (C3), and
— real national income (C4).

Let the share of a particular variable, that refers to agriculture (Xia), to the corresponding total value of the same variable in the economy (Xie) be denoted as wia. The annual rates of change of the variables Xia and Xie are denoted as ria and Ri, respectively. It can be shown[5] that the contribution (Cia) of a given economic as well as demographic variable of the agricultural sector (Xia) to the annual rates of change (Ri) of the corresponding variable in the economy (Xie) can be estimated on the basis of the following relation

$$Cia = 1/ [\ 1 + (rib/ria)\ (wib/wia) + (ric/ria)\ (wic/wia)\ ] \qquad (1)$$

where ria represents, as before, the annual rate of change of the variable Xi of the agricultural sector (Xia) and rib, ric of the corresponding variables of the industrial (Xib) and services (Xic) sectors. The variable wi represents the ratio Xi/Xie in each sector, whereas the constrait

$$Xia + Xib + Xic = Xie \qquad (2)$$

is imposed. The term on the left-hand side in (1) refers, in percentage terms, to the contribution of the variable Cia of the agricultural sector to the realisation of annual rates of change (Ri) of the corresponding variable (Xie) in the economy[6].

Table 1 presents empirical evidence on agricultural contributions to the overall development of the Greek economy. Agricultural contribution to the realised rates of change of the respective variables in the economy has varied greatly during the period reported in Table 1. Among the ten categories of contributions presented in Table 1, the contribution of agricultural exports to the realised rate of toral exports in the fifties and eighties (12.0% and -0.3%) has decreased markedly from 66.9% to 24.3%. Alternatively, the realised rates of change of the value of total exports in the fifties and eighties (12.0% and -0.31) are due to export expansion of the non-agricultural sectors by 33.1% and 75.7% respectively.

The first component of the agricultural contribution, i.e. the contribution to capital accumulation in the economy, serves also as a proxy variable for the production capacity of the sector in question. This capacity has been slowed down to a greater extent in the case of capital accumulation due to public investment in the agricultural sector. Nevertheless, in both cases (C11 and C12 in Table 1) there is a clear decreasing contribution of the capital accumulation in the agricultural sector to the realised rates of growth of capital accumulation in the economy. Thus, the rate of growth of the overall capacity, 23.4% in the fifties, can be explained by the respective contribution of agriculture by 12.1%. The realised rate of growth of the overall capacity by 0.3% in the eighties can be explained by the respective capital accumulation of the agricultural sector in the same decade by 9.3%. In the same way, the realised rate of growth of overall productive capacity that is due to private capital accumulation in the fifties (23.1%) is explained by 8.5% by the respective agricultural sector activities. In the eighties, the decrease in the realised rate of the productive capacity of the economy by -0.4% is due to the respective contribution of private capital accumulation in agriculture by 6.4% and in non-agricultural sectors by 93.6%. The contribution of capital accumulation, due to public investment in agriculture, to the respective accumulation in the economy in the period 1950-1970 was significant. However, there has been a notable decline in the agricultural capital accumulation, stemming from public investment, to the realised rates of the respective growth ofcapital accumulation in the economy.

The second component of agricultural contribution, i.e., contribution to the realised rates of growth of gross domestic product (C21), of imports and exports (C22, C23), of import penetration of the domestic market (C24) and of rates of growth of available goods (C25), expresses the outcome of the allocation of investment among sectors as well as the policies, that were followed since 1962, with a view to integrating the Greek economy into the E.E.C. The contribution of agricultural exports to the realised rates of total exports experienced dramatic decreases during the past two decades, since agricultural contribution to the expansion of the GDP and to the availability of goods in the domestic market has also decreased. The contribution of agricultural exports by 66.9% in the fifties has been reduced to 24.3% three decades later.

Imports of agricultural goods contributed at an insignificant and continously declining rate to the realised rates of imports in the economy. However, import penetration to the agricultural product domestic market has increased. Agricultural imports contributed by 20.2% to the increase of total imports by 7.9% in the fifties, whereas the respective contribution to an annual rate of increase of total imports by 5.7% was 13.5% in the eighties.

The contribution of the non-agricultural sectors to the total values of imports and exports show the willigness to transform the economy to current demands. The growth of non-agricultural output explains to a large extent the realised rates of growth of GDP. Policies for rapid industrialisation, import substitution in the case of industrial goods and their export expansion have been nore or less justified by the increasing contribution of the relevant variable of the industrial sector to total exports earnings and the decreasing contribution to total import payments. However, import penetration, mainly in the market of industrial goods, has to some extent decreased recently. The non-agricultural sector contributed by 75.3% to the realised rate of growth of total import penetration (equal to 1.3%) in the fifties, whereas it contributed by 64.3% to the rate of increase (equal to 5.0%) of total import penetration in the eighties.

The availability of goods in the domestic market (entry C25 in Table 1) in the se of agriculture corresponds to the expansion of its gross output and imports. Thus, available agricultural goods contributed by 47.0% in the fifties to a rate of increase of total available goods in the economy equal to 5.9% whereas in the eighties this contribution accounted to 22.8% for a rate of increase in total goods availability 2.7%.

The third component variable, i.e., contribution to labour supply refers, in an indirect way, to problems of migration and labour mobility during the decades reported in Table 1. The contribution of agriculture to labour supply markets, other than its own, has continuously increased due to certain policy goals regarding the transformation of the economy. Thus, it seems that in the period 1950-1980 agricultural labour supply contributed to the urban labour markets at an aggregate rate of 14.9%. It must be noted that in 60's and 80's, due to migration and retirements, the rate of change of the total active population amounted to -0.1%. The existence of disguised unemployment in the agricultural sector and the phenomenon of labour "overflow" in the non-agricultural sectors along with the required policies due to Greece's accesion to the E.E.C. will lead in the years to come to further reductions of the economically active population in the agricultural sector.

Finally, Table 1 shows the fourth component of agricultural contribution, i.e. the contribution to the realised rates of real national income. This contribution is proportionally related to the contribution of the agricultural sector to the realised rates of G.D.P., exports and imports and of capital accumulation that were described previously. However, the agricultural contribution here is larger, in all decades reported, than its contribution to the rates of G.D.P., because of

the existence of subsidies. On the contrary, the contribution of the non-agricultural sectors to the rates of change of real national income shows a close proportional relation with its respective contribution to the actual rates of growth of G.D.P. Thus, in the fifties the rate of growth of real national income by 8.8% was due to non-agricultural activities by 67.2%.

The results of agricultural contributions over the period 1950-1990 are in accordance with the respective results of contributions in each of the four decades reported. Factors influencing the declining importance of the agricultural sector can be identified in its minor contributions to the rate of change of G.D.P., as well as to the rate of change of capital accumulation and exportable goods. The four broad components of agricultural sector contribution to overall growth interact to determine the percentage change in per capita gross domestic product.

3. Theoretical Aspects

The work of Kuznets and others has shown the importance of structural transformation as a key process for economic development (Kuznets, 1964; Chenery and Syrquin, 1975). In the later years agricultural economists lised that during have reatransformation a number of critical interactions occur between agriculture and the other sectors of the economy. The role of agriculture in the "structural transformation model" has been explored by Lewis. (Lewis, 1954; Ranis and Fei, 1961). The notion of a shortage phase in agriculture imposing severe constraints on the general development process appears in Lewis's structural model.

Dualism in growth has been generally applied to several economic variables of the agricultural sector other than the G.D.P. Eckaus (1955) identified dualism in production relationships between sectors. Boeke (1953) referred to dualism in consumption and savings patterns between agricultural workers and workers elsewhere in the economy. Baldwin (1966) identified differences between agriculture and other sectors in production and export possibilities.

Johnston and Mellor provided the clearest statement of the role of agriculture in the "structural transformation model". "The evolution of the agriculture", they argued, "was driven by (1) the possibility of a substantial expansion of agricultural production with a constant or declining farm labour force (2) an income elasticity for food that is less than 1 and declining" (Johnston and Mellor, 1961, p. 567), and (3) "failure to expand food supplies in pace with the

growth of demand can seriously impede economic growth" (p. 571) through "a substantial rise in food prices leading to political discontent and pressure on wage rates with consequent adverse effects on industrial profits (and) investment" (p. 573).

There are no generally accepted models explaining the growth process and therefore no standard analytical framework that is appropriate for studies such as this one. In fact, the best approach possible is to use a very simple explanatory function framework. However, the various versions of "the structural transformation model" of development imply a certain behaviour for the economic and demographic variables of the agricultural sector as well as specific relations with the other sectors of the economy. These implications are revealed by the findings of the present paper. In general the implications of the different versions of the -structural transformation model can be summarised by the following statements:

Firstly, one has to keep in mind that the versions of the "structural transformation model" imply undoubtely resourses taken away from agriculture and consequently greater effects of the non-agricultural output on the realised GDP rates. The resources refer to investment and export earnings as well as human capital. Ranis and Fei (pp. 544-45) considered investment in agriculture critical to the prevention of their shortage phase and uniquely defined balanced growth as involving an allocation of investment between industry and agriculture that maintained constant agricultural to industrial terms of trade. However, trade liberalization has minimized the phenomenon of the shortage phase of the agricultural sector.

Secondly, the different versions of the structural transformation model assume a transfer of labour resources from agriculture to the other sectors of the economy as development proceeds. Here, farmers are either being transferred to the other sectors of the economy or new entrants to the labour force are being absorbed by the industrial and service sectors more rapidly than before.

Thirdly, from the existing versions of balanced or non-balanced growth of the agricultural sector it appears that there are no direct means of evaluating whether agricultural sector growth has contributed to or has slowed down development.

Fourthly, the growth of agricultural productivity per worker, the declining share of agricultural labour to total labour force and the growth of per capita agricultural output have been accompanied by increasing labour skills and edu-

cation level in the agricultural sector. However, the "worker effect" on output is much more strong in the non-agricultural output.

Finally, the version of the structural transformation model through the channels of the non-proportional growth implies certain means of integration of the agricultural sector in the national economy. The phenomena of "substitutionism" and "appropriationism" are implied by the consideration of the non-balanced growth models suggested by Eckaus (1955), Boeke (1953), Baldwin (1966) and others. Due to the market forces as well as to recent developments in biotechnology, non-agricultural sectors absorb agricultural output at diminishing and even negative rates. In the case of clothing, for instance, biotechnology (reblon and other non-agricultural synthetics) seems to have abolished intermediate agricultural output.

4. Analysis

Theoretical discussions of the patterns of development[7] in order to obtain critical estimates of the behaviour of certain variables through single equations or simultaneous systems of equations, utilise macroeconomic statistical data. In the quantitative analysis of agricultural economics, growth of output and income have been always considered implicitly, in accordance with the potential of statistical information and the implications imposed by the several versions of the "structural transformation model". As noted in the previous section there are no generally accepted models explaining the growth process and therefore no standard analytical framework that is appropriate for studies such as this one. In fact the best possible approach is to use a very simple explanatory function framework[8].

To test the hypothetical relationships for empirical validity, a set of sixteen measures or variables were selected. The data was provided by the National Statistical Service of Greece (NSSG) standard publications as well as by other sources (Bank of Greece). These variables refer to the period 1950-1990 and are expressed in real values (1970=100) in percentage terms. They represent measures or proxies of factors that explain contributions of agricultural and non-agricultural economic activities to the general activity (per capita product). Variables used to explain capital accumulation in the primary and industrial sectors include: the ratio of public and private investment to gross product in each sector and real interest rates, as credit policies were not uniformly applied between sectors during the period of analysis. The distribution of resources between the sectors is captured by the following measures: the ratio of gross

product of each sector to GDP and the ratio of the terms of trade between agricultural and industrial goods. These variables are demand shifters. Finally, the effects of literacy of the labour force engaged in agricultural and other sectors have been included in the relative equations. The latter have been estimated by OLS. Experiments with the Box-Cox (1964, p. 212) technique of mathematical transformations of the variables suggested the interval 0.9-1.1 as the proper one within which transformations of variables should fall. However, without introducing any significant error, the linear transformation of the variables was adopted for the estimation of single equations presented in this paper. The Cochrane-Orcutt technique correcting for autocorrelation in the residuals of the estimated equations has been often used at the cost of missing some of the original observations. Finally, the presence of ratios of the independent variables secure more or less estimations free of multicollinearity.

The equations estimated are the following

$$
\begin{aligned}
(gdp/p)_t / (gdp/p)_{t-1} = {} & \\
& a_0 + \alpha_1 (gdp1/gdp)_t \\
& + \alpha_2 (tas/tbs)_t + \alpha_3 (pepa/pepb)_t \\
& + \alpha_4 [\, (dpk1/gdp1) / (dpk2/\, gdp2) \,]_t \\
& + \alpha_5 (ipk1/gdp1)_t \\
& + \alpha_6 [\, (ipk1/gdp1) / (ipk2/gdp2) \,]_t \\
& + \alpha_7 (adlt1/adlt2)_t + (error)_t
\end{aligned}
\tag{3}
$$

and

$$
\begin{aligned}
(gdp/p)_t / (gdp/p)_{t-1} = {} & \\
& \beta_0 + \beta_1 (gdp2/gdp)_t \\
& + \beta_2 (tbs/tas)_t + \beta_3 (pepb/pepa)_t \\
& + \beta_4 [\, (dpk2/gdp2) / (dpk1/gdp1) \,]_t \\
& + \beta_5 (ipk2/gdp2)_t \\
& + \beta_6 [\, (ipk2/gdp2) / (ipk1/gdp1) \,]_t \\
& + \beta_7 (adlt2/adlt1)_t + (error)_t
\end{aligned}
\tag{4}
$$

where[9] gross agricultural (GDP1) and industrial sector (GDP2) output represent demand shifters of gross domestic product (GDP) that is expressed in per capita terms (P) in the left hand side of equations (3) and (4). Private and public investments in the agricultural (IPK1 and DPK1) and in the industrial (IPK2 and DPK2) sectors represent the capacity to increase output, whereas real interest rates reflect the different opportunities to borrow in the agricultural (PEPA) and industrial (PEPB) sectors. International market conditions are brought into

analysis by the presence of the terms of trade for the agricultural (TAS) and industrial (TBS) goods. The variables ADLT1 and ADLT2 denote demographic variables that capture the relative importance of literary in the sectors.

5. Summary of Findings

The results of regression analysis indicate that increase in nonfarm activity had a statistically significant relationship to the percentage change of per capita gross domestic product (table 2). Increases in aggregate economic activity draws resources and funds, through the transformation of the economy, away from agricultural sector. This conclusion is in accordance with the general theoretical aspects of the "structural transformation model". The larger the share of the industrial gross product to GDP the greater the effect on growth. The same holds true in the case of the terms of trade. Higher realised rates of growth of per capita domestic product are associated with better terms of trade of non-agricultural goods. The greater nonfarm prosperity contributes significantly to the increasing rates of change of GDP and so does private non-farm investment. However, aggregate economic activity has grown together with higher real interest rates in the case of the industrial sector. Public investment in the agricultural sector seems to determine higher rates of change of per capita GDP. In the case of the industrial sector, private investment seems to be an important determinant. Increases in the number of uneducated active population engaged in industry (adlt2) have a larger negative impact on the realised rates of growth of the per capita GDP than the corresponding variable (adltl) of the agricultural sector. The findings in table 2 indicate that farm prosperity has an insignificant impact on the per capita GDP. However, with the exception of the terms of trade of agricultural goods, all other variables that refer to the agricultural sector in table 2 may lead to the conclusion that agriculture still accounts for the increased rates of expansion of GDP. However, there do not seem to be any prospects.

The demographic variables that refer to the educated and the non-educated active population in the sectors play their own role in the expansion of GDP. Government officers and other Committees made substantial efforts to improve the educational level of the population. However, the "worker effect", i.e., the special characteristics that are attached to the economically active population (allocative and input selection experiences)[10] seem to be stronger in the case of industrial sector. As was noted previously, changes in the terms of trade in the case of agricultural goods are negatively related to changes in the overall growth of the economy. The opposite is true in the case of the terms of trade of indus-

trial goods. This outcome undoubtly reflects the changing conditions and prospects for each category of goods in the international markets, where the greek economy is gradually integrated[11]. The results in table 2 indicate that changes in the overall rates of growth of the greek economy in 1950-1990 were influenced by the economic variables of the non-agricultural sector.

In order to validate the earlier statistical results for later periods, the equations in (3) and (4) have been reestimated for two separate periods, 1950-1970 and 1970-1990. As it was expected, the results in table 2 reveal stronger non-agricultural economic growth in the past two decades (80, 90) than in the previous decades (60, 70). Possibly, the results can be attributed to the dramatic changes in the agricultural sector in 1960's (emigration, urbanisation) as well as in the 1980's (harmonisation to existing EEC policies and to changing international markets). Not surprisingly, the coefficients of each of the equations in these separate periods differ significantly[12].

Another factor that is explored in this paper and that determines the declining importance of the agricultural sector in the greek economy refers to means of integration of the sector in the economy. As in other countries[13], "substitutionism" of agricultural activities by non-agricultural ones and "appropriationism" of agricultural outputs are phenomena of economic transformation. These phenomena also appear in the case of Greece and they can be determined when searching for intersectoral transactions. Due to data limitations, our investigation has been restricted to the period 1958-1977, since the available input-output tables refer to this period[14]. OLS applied on the equations[15] of the type reported in table 3 yield certain results of intersectoral transactions. The variables which are of interest to this paper are the following.

Y_{aj} = agricultural inputs used in the production (Q_j) of the j^{th} sector, j= 1, ..., 7, in current value terms,
K_j = total inputs of the j^{th} sector,
IK_j = private consumption of goods of the j^{th} sector,
TZ_j = final demand for goods of the j^{th} sector, the intersectoral demand excluded.

As it can be seen from table 3, due to market factors as well as to biotechnology implications, the non-agricultural sectors absorb agricultural output at diminishing and even negative rates. Exception to this rule are the cases of wood and leather, though in both cases the prospects do not look promising due to the demand inelasticities of the agricultural intermediate output.

Transportation and clothing present even poorer prospects from the point of view of agricultural output absorption. In the case of clothing, biotechnology (reblon and other non-agricultural synthetics) seems to have abolished intermediate agricultural output. The "processing" sector (i.e., food and other industries) also seems to move away from agricultural output, given the rates of absorption in table 3. The same holds true when agricultural output is considered as part of the total intermediate inputs of the sectors in table 3 (col. 3). Wood again is an exception. Wood and leather are also sectors with good market prospects (col. 4), when private consumption is considered. However, when intermediate demand is excluded and public consumption, capital stocks, exports and imports are considered in final demand (col. 5) these prospects dissapear.

According to table 3 (col. 6) an 1% increase in private consumption decreases the ratio of agricultural intermediate output to private consumption for goods of sectors such as wood, leather and transportation by 3.03%, 1.17% and 3.63%, respectively. In other words, agricultural output is not represented in value terms in the respective values of either private consumption (col. 6) or final demand (col. 7) for goods in the non-agricultural sectors. This phenomenon has been defined in the international literature[16] as "appropriationism" of agricultural output by the non-agricultural sectors. Due to biotechnology as well as to unequal terms of trade the diminishing usage of intermediate agricultural products in the production process of the non-agricultural sectors reported in table 3 (cols. 2, 3) reflects the effect of "substitutionism" of agricultural activities by non-agricultural ones. These phenomena in table 3 together with factors determining agricultural prospects in table 1 constitute the main reasons for the declining importance of the agricultural sector in the greek economy.

6. Concluding Remarks

Certain important policy implications concerning agricultural activities can be drawn from this paper. Firstly, non-farm economic activity can be perceived as both a blessing and a curse. Industrial growth increases the rate of expansion of gross domestic output per capita. Undoubtedly, industrial growth increases the corresponding rate of growth of the agricultural sector but on a non-proportional basis[17]. The industrial growth in output explains well the proposition that resources have to be directed into this sector for its required investment. These funds have to be allocated according to the contribution of each sector ouput to the realised rates of change of gross domestic product. However,

the identified decline of agriculture in no case means that policies encouraging the expansion of high elasticity agricultural goods should be abolished. The Common Agricultural Policy (CAP) has already taken into account the dynamics in the production and distribution of agricultural goods such as tropical fruits and fresh and frozen vegetables, among others whereas it has discouraged the production of "traditional" goods such as grapes and tobacco.

Secondly, it has been found that export structure and import penetration constitute important determining factors explaining the diminishing importance of the agricultural sector. It appears that agricultural exports adjusted rather poorly to the changing international economic environment. The low quality of the supplied agricultural goods and especially their low degree of standardisation, along with high transportation costs and constraints imposed by the Common Agricultural Policy constitute additional factors that explain the declining share of the greek processed agricultural products in the international markets and the deterioration in their terms of trade.

Finally, regression results for the period 1970-1990 more or less validated the above conclusions. Combined with results for the period 1950-1970, the findings imply that further expansion of non-agricultural activities should lead to higher and faster growth rates of the per capita gross domestic product. The deterioration in the terms of trade of agricultural goods in the international markets, the revealed increasing tendency in recent years for equalising real lending interest rates among sectors of the economy and, consequently, the observed shift of private investment from agriculture to non-agricultural sectors explain adequately the diminishing importance of agriculture in the greek economy. However, a permanent move of credit institutions policies away from agricultural lending will have significant regional and national implications. In view of the declining importance of agriculture and its poor prospectives care must be taken for the economically active population employed in this sector. The establishment of non-agricultural activities in rural areas should be seriously taken into account in addition to action taken recently by the EEC to improve the standard of living of the residents in these areas in order to persuade them to remain there.

Appendix

TABLE 1

Agricultural and Other Sector Contributions to the Rates of Change of Variables in the Economy. Greece 1950-190. Percentages.

Contributions to the average rates of change of variables in the economy		Period				
		50-60	60-70	70-80	80-90	1950-1990
C1.	Contribution to	12.1	13.6	11.5	9.3	11.3
	rates of capital	(87.9)	(86.4)	(88.5)	(90.7)	(88.7)
	accumulation	(23.4)	(11.9)	(7.2)	(0.3)	(10.8)
C11.	Accumulation	8.5	9.9	7.7	6.4	7.3
	due to private	(91.5)	(90.1)	(92.3)	(93.6)	(93.7)
	investments	(23.1)	(11.2)	(6.7)	(-0.4)	(9.8)
C12.	Accumulation	17.6	18.4	15.7	11.5	15.4
	due to public	(82.4)	(81.6)	(84.3)	(89.5)	(84.6)
	investments	(21.5)	(13.1)	(7.9)	(4.0)	(11.7)
C21.	Contribution	27.1	21.4	15.1	12.1	18.6
	to G.D.P's	(72.9)	(78.6)	(84.9)	(87.9)	(81.4)
	rates	(5.8)	(6.8)	(5.3)	(1.3)	(4.8)
C22.	Contribution	20.2	14.5	10.0	13.5	19.8
	to rates of	(79.8)	(85.5)	(90.0)	(86.5)	(80.2)
	imports	(7.9)	(12.0)	(7.0)	(5.7)	(7.6)
C23.	Contribution	66.9	55.2	30.2	24.3	43.2
	to rates of	(33.1)	(44.8)	(69.8)	(75.7)	(56.8)
	exports	(12.0)	(9.9)	(12.4)	(-0.3)	(7.9)
C24.	Contribution	24.7	26.	28.1	35.7	28.9
	to rates of	(75.3)	(73.9)	(71.9)	(64.3)	(71.1)
	import penetration	(1.3)	(2.2)	(1.0)	(5.0)	(2.3)
C25.	Contribution	47.0	34.2	24.2	22.8	32.5
	to rates of	(53.0)	(65.8)	(75.8)	(77.2)	(68.5)
	available goods	(5.9)	(8.2)	(4.4)	(2.7)	(5.3)
C3.	Contribution	51.3	46.9	34.5	27.7	40.0
	to rates of labour	(48.7)	(53.1)	(65.5)	(72.3)	(60.0)
	supply	(2.4)	(-0.1)	(0.7)	(-0.1)	(0.3)
C4.	Contribution	32.8	23.0	18.1	17.9	22.1
	to rates of real	(67.2)	(77.0)	(81.9)	(83.1)	(77.9)
	national income	(8.8)	(8.1)	(5.1)	(-0.1)	(2.7)

Source: See statistical appendix.

Notes: The first parentheses in a row refer to the mean value of contributions of the non-agricultural sector whereas the second parentheses to the observed mean rate of change of the variable in the economy that corresponds to that row.

TABLE 2

Factors Influencing the Importance of Greek Agriculture in the Economy

Dependent variable $\frac{(GDP/P)_t - (GDP/P)_{t-1}}{(GDP/P)_{t-1}}$	Period					
	1950-1990		1950-1970		1970-1990	
	Agric.	Other	Agric.	Other	Agric.	Other
Constant	-12.5	-21.4	10.3	15.4	-25.1	-30.1
	(-1.97)	(-2.12)	(2.14)	(4.62)	(-2.16)	(-4.16)
Independent variables						
GDP1/GDP	0.81	----	1.15	----	0.70	----
	(3.16)		(5.16)		(3.14)	
GDP2/GDP	----	1.10	-----	1.23	----	0.95
		(2.16)		(3.19)		(2.99)
TAS/TBS	-10.1	----	-2.15	----	-13.9	----
	(-4.13)		(-4.19)		(-6.12)	
TBS/TAS	----	18.1	----	25.3	----	16.7
		(5.16)		(4.19)		(3.19)
PEPA/PEPB	2.01	----	3.43	----	1.10	----
	(1.45)		(2.19)		(7.14)	
		(2.17)		(3.46)		(10.4)
(DPK1/GDP1)/	7.01	----	10.4	----	4.15	----
(DPK2/GDP2)	(3.96)	(3.69)	(9.62)			
(DPK2/GDP2)/	----	-5.11	----	8.39	----	-6.15
(DPK1/GDP1)		(-4.16)		(2.16)		(-4.16)
(IPK1/GDP1)/	8.12	----	9.49	---	-1.36	----
(IPK2/GDP2)	(3.13)		(6.13)		(-7.19)	
(IPK2/GDP2)/	---	9.65	----	16.3	----	5.12
(IPK1/GDP1)		(4.10)		(9.12)		(6.16)
(ADLT1/ADLT2)	-7.10)	----	-2.46	----	-10.5	----
	(-2.16)		(-4.16)		(-1.96)	
(ADLT2/ADLT1)	----	-10.1	----	2.96	----	-15.4
		(-2.61)		(4.13)		(9.61)
Statistical parameters						
R^2	.8124	.8914	.9612	.9341	.7761	.7012
DW (C-O)	2.15	1.96	2.01	2.13	1.96	1.86
F	50.6	58.4	61.5	69.7	46.3	39.5

Notes:

1. The estimated coefficients of the variables (IPK/GDP) and (DPK/GDP) in the respective equations are insignificant.

2. t statistics in parentheses.

3. DW (C-O) denotes Durbin-Watson statistics corrected for autocorrelation in the residuals of the respective equations according to the Cochrane-Orcutt technique.

TABLE 3

Intersectoral Transactions. Substitutionism and Appropriationism. Elasticity values, 1958-1977

Sectors	FUNCTIONS					
	(Yij/Qi) = F(Qi)	(Yij/Ki) = F(Ki)	(IKi/Qi) = F(Qi)	(TZi/Qi) = F(Qi)	(Yij/IKi) = F(IKi)	(Yij/TZj) = F(TZj)
(1)	(2)	(3)	(4)	(5)	(6)	(7)
i = 1 Food	-.139 (-.012)	-.249 (-.095)	-.555 (-.104)	-.159 (-.061)	i.s.r.	i.s.r.
i= 2 Drinks	i.s.r.	i.s.r.	-.801 (-.016)	.008 (.002)	i.s.r.	i.s.r.
i = 3 Tobacco	---	---	-.934 (-.156)	i.s.r.	i.s.r.	.162 (.062)
i = 4 Clothing	-1.52 (-.192)	-1.30 (-.613)	-.742 (-.061)	-.840 (-.089)	i.s.r.	i.s.r.
i = 5 Wood	.807 (.047)	.505 (.143)	1.21 (.069)	i.s.r.	-3.03 (.152)	i.s.r.
i = 6 Leather	.915 (.081)	i.s.r.	.621 (.152)	-.901 (.104)	-1.17 (-.115)	i.s.r.
i = 7 Transportation	-3.21 (-1.00)	-1.96 (-.965)	-.523 (-.104)	.090 (.003)	-3.63 (-1.00)	-2.82 (-.965)

Notes:

1. Standard errors in parentheses. Values obtained using the Mosak (1939) formula of estimation.
2. i.s.r. denotes insignificant statistical results.

Statistical Appendix

Capital accumulation: The relative figures have been created e estimation of the following model of investment behaviour that is assumed to apply to each of the investigated sectors.

$K^*_t = \alpha Y_t$

$K_t - K_{t-1} = (1-\lambda)(K^*_t - K_{t-1}), \quad 0 \leqslant \lambda \leqslant 1$

$D_t = \delta K_{t-1}$

$K_t = K_{t-1} + I_t - D_t$

with the following definitions: K^*_t = desired level of capital accumulation, Y_t = income, K_t = existing capital stock in the tth period, λ = coefficient that expresses the degree of adaptability of the realised

capital stock (K_t) to the desired stock (K^*_t), D_t= value of capital depressiation realised at a rate δ, and I_t = current investment.

The estimated coefficients α, λ and δ are used in the estimation of the total value of capital accumulation stemming from private investment in the agricultural and other sectors on the basis of the following definitions

$K_{t-1} = [\alpha (1-\lambda) / (1-\lambda-\delta)] Y_t - [1 / (1-\lambda-\delta)]$ and
$K_t = K_{t-1} + I_t - D_t$

For the case of capital accumulation due to public investment it is assumed that D_t (or δ) = 0 in the above equations.

Imports and exports: Constant values of imports and exports of agricultural goods are approximated by the respective sum of constant values of imports and exports of 0,1,4 categories of goods of the Standard International Trade Classification (SITC) recorded in the publications of the National Statistical Service of Greece (NSSG). The respective values of imports and exports for industrial goods refer to the corresponding figures of the sum of values of 5, 6, 7 and 8 categories of goods in the same publications.

Import penetration: It is defined by the ratio EISA (EXA+GDP1), where EISA and EXA refer to values of imports and exports of agricultural goods in contant terms and GDP1 refers to the gross agricultural output. A similar ratio applies to the case of industrial goods.

Available goods: Defined by the sum GDP1+EISA-EXA in the case of agricultural goods, and by a similar sum of the corresponding variables in the case of industrial goods.

Economic active population (P): Interpolated values have been used for the years in between 1951, 1961, 1971 and 1981, where census data exist. For the years beyond 1982 extrapolated figures of the variables in question have been used. These extrapolated figures have been corrected properly given the statistical information recorded in the annual surveys of economic active population.

Real income in each sector: Only agricultural income can be used in a direct way in the calculations. The other components of national income, i.e., wages and salaries and profits have been alloted to the industrial and services sectors according to the percentage distribution of these components derived from input-output data of the corresponding variables in these sectors.

GDP: Gross domestic product of the national economy at factor cost and constant prices 1970. GDP1 for the agricultural sector and GDP2 for the industrial sector.

IPK: Private gorss fixed capital formation for the economy at factor cost and constant prices 1970. IPK1 for the agricultural sector and IPK2 for the industrial sector.

DPK: Public gross fixed capital formation for the economy at factor cost and constant prices 1970. DPK1 for the agricultural sector and DPK2 for the industrial sector.

PEPA: Nominal weighted average interest rates for the agricultural sector divided by the deflator of accumulated private capital stock in agriculture.

PEPB: Nominal weighted average interest rates for the industrial sector divided by the deflator of accumulated private capital stock in this sector.

TAS: Terms of trade for agricultural goods defined by the respective ratio P_{xa}/P_{ma} at constant prices 1970 with P_{xa} referring to the price index of the exportable goods and P_{ma} to the price index of the importable goods.

TBS: Terms of trade for the case of industrial goods defined similarly by the ratio P_{xb}/P_{mb} of price indices of exportable and importable goods.

ADLT1: The ratio of uneducated active population in the agricultural sector to total active population in the same sector.

ADLT2: The ratio of uneducated active population in the secondary sector to total active population in the same sector.

Footnotes

1. See among others, Baltas and Sakellis (1984), Koutsoumaris (1977), Sakellis (1977), Livas (1983), Kintis (1985) and Sapounas (1991).

2. Most of the studies listed above implicitly or explicitly refer to the dominance of the non-agricultural sector in the economy whereas the agricultural sector is treated as the residual of the analysis.

3. Most of references mentioned in note 1.

4. See Bacon and Karayiannis-Bacon (1980).

5. See Ghatak and Ingersent (1984, pp. 27-28).

6. Similar relationships can be defined in the case of the industrial and services sectors. However, at this stage of analysis the non-agricultural sectors are treated as the residual in estimations such as in (1). (100-Cia).

7. See Chenery and Syrquin (1975), Chenery (1960), Kelley (1969), Milanovic (1987), Shionoya (1968) among others.

8. Most of the empirical studies refer to these problems. See Landau (1986) for instance.

9. For analytical definitions of the variables included in the equations (3) and (4), see the statistical appendix.

10. For the effects of education on production, see Welch (1970).

11. Already, since 1962, Greece has been closely related to the EEC, being its tenth member since 1981.

12. Results of the analysis of covariance are based on the Hald (1962) test and are available on request.

13. See Goodman, et at, (1987).

14. See Skounzos and Mathaios (1980).

15. The complete results of the estimations are available.

16. As in note 13.

17. There is a vast literature on the non-proportional growth of the agricultural sector. See among others Arrow (1988).

References

Abramovitz, A. (1956), "Resources and output trends in the U.S. since 1870", - American Economic Review.

Arrow, K. J. (1988), "The balance between industry and agriculture in economic development", in Proceedings of the VIIIth World Comgress of the International Economic Association, Vol:l, Basic Issues. Macmillan.

Bacon, R. and
Karayiannis-Bacon, H. (1980), "The growth of the non-market sector in a newlly industrialised country: the case of Greece", - Greek Economic Review.

Baldwin, R. E. (1966), Economic development and export growth: a study of Northern Rhodesia, 1920-1960. University of California Press, Berkeley and Los Angeles, U.S.A.

Baltas, N. C. and *Sakellis, M. G.* (1984), "Greek agriculture in the National economic context", Paper presented in the IVth Conference of European Congress of Agricultural Economists, Kiehl-Germany.

Boeke, J. H. (1953), Economics and economic policy of dual societies. Institute of Pasific Relations. New York, U.S.A.

Box, G. E. P. and
Cox, G. D. P(1964), "An analysis of transformations", - Journal of the Royal Statistical Society.

Chenery, H. B. (1960), "Patterns of Industrial growth. American Economic Review.

Chenery, H. B. and
Syrquin, M. (1975), Patterns of Development. Oxford University Press.

Denison, E. (1967), "Why growth rates differ: Post-War experience in nine western countries. American Economic Review.

Eckaus, R. S. (1955), "The factor proportions problem in under-development areas", American Economic Review.

Ghatak, S. and
Ingersent, K. (1984), Agriculture and economic development. Harvester Press.

Goodman, D., Sorj, B. and *Wilkinson, J.* (1987), From farming to biotechnology: a theory of agro-industrial development. Blackwell Inc.

Hald, A. (1962), Statistical theory. John Willey and Sons.

Hayanni, Y and *Ruttan, V.* (1985), Agricultural development. An international perspective. 2 ed. John Hopkings University Press.

Johnston, B. F. and *Mellor, J. W.* (1961), "The role of agriculture in economic development", - American Economic Review.

Kelley, A. C. (1969), "Demand patterns, demographic change and economic growth", - Quarterly Journal of Economics.

Kintis, A. A. (1985), "Patterns and sources of growth in Greek manufacturing", - Greek Economic Review.

Koutsoumaris, G. (1977), Economic growth and economic policy. Sbilias (In Greek).

Kuznets, S. (1964), "Economic growth and the contribution of agriculture", in C. K. Eicher and L. W. Witt (eds.) Agriculture in economic development. McGraw Hill, New York, U.S.A.

Landau, D (1986), "Government and economic growth in the less developed countries: an empirical study for 1960-1980",- Economic Development and Cultural Change.

Lewis, W. A. (1954), "Development with unlimited supplies of labour", - Manchester School of Economics and Social Studies.

Livas, P. (1983), Sectorial analysis of employment in the Greek economy. Center of Planning and Economic Research, Athens (In Greek).

Mattas, K. and *Pagoulatos, A.* (1990), "Determining differencial sectorial impacts of investment", - European Review of agricultural Economics.

Milanovic, B. (1987), "Patterns of regional growth in Yugoslavia, 1952-83", - Journal of Development Economics.

Mosak, J. L. (1939), 'The least squares standard error of the coefficient of the elasticity of demand", - The Journal of the American Statistical Association.

Ranis, G. and *Fei, J. C. H.* (1961), "A theory of economic development", - American Economic Review.

Sakellis, M. (1977), "Greek agriculture in the National economic context", Conference of the 15th General Assemply of CICA. Athens (October, 24-30).

Sapounas, G. S. (1991), Greek agriculture. Analysis and prospects. Agricultural Bank of Greece (In Greek).

Shionoya, Y. (1968), "Patterns of industrial development", In L. Klein and K. Ohkawa (Eds.) Economic growth: The Japanese experience since the Meiji Era. Irwin, Homewood.

Skountzos, Th. and *Mathaios, G. S.* (1980), Input-output tables of the Greek economy, 1958-1977. Center of Planning and Economic Research, Athens (In Greek).

Welch, F. (1970), "Education in production", - Journal of Political Economy.