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An input-output approach in assessing the impact of extensive versus intensive farming systems on rural development: the case of Greece

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Abstract

This paper analyses the role of the extensive versus the intensive farming systems on rural development and specifically in a Greek rural area Trikala. The Generation of Regional Input Output Tables (GRIT) technique is applied for the estimation of the socio-economic impact of the farming systems through the estimation of an input-output (I/O) table. This is followed by an agriculture-centred multiplier analysis. The results suggest that intensive crops create stronger backward linkages from extensive ones. Almost all farming systems appear to have rather low Type 1 and Type 2 income and employment multipliers. Amongst them extensive crops seem to have the greatest due to high direct income and employment effects they create. Finally, the paper assesses the impact of the shift of land resources from intensive to extensive farming systems, due to the Mid-term Review of CAP, by exogenizing the output of the agricultural farming systems. The results of the above analysis indicate a reduction in the sectoral output of the region's economy.

Key words: intensive vs extensive farming systems; rural development; input-output analysis; CAP

JEL Classification: C67, O18, O13

1. Introduction

In the recent reform of CAP (2003/2004), the EU took a step towards maintaining and improving the multifunctional role of agriculture. This refers mainly to the introduction of "decoupling", "modulation" and "cross-compliance". In the same period, environmental protection and land management has become a key policy objective (Axis 2) of the EU rural development policy. These significant changes have introduced reallocation of land resources from intensive to extensive farming systems and have initiated restructuring in rural areas.

Under these circumstances, the analysis of the impact of extensive vs intensive farming systems on the development of rural areas should identify:

a. the farming systems which create the strongest backward linkages with the other sectors of the economy and contribute to the economic development of the area; and
b. how farm land reallocation from intensive to extensive crops, due to CAP reform, affects the total output of the regional economy.

In order to fulfill these objectives, this paper focuses on the application of the well-established input-output technique with particular attention to the role of different farming systems in rural development through final demand multiplier analysis. Often however, agricultural policies or other external factors induce exogenous changes in sectors' output which do not relate to final demand changes. In such cases, as the change in the mix of farming systems described here, it is essential to transfer the relevant exogenous changes on the sectors' output in order to measure the impact on the rest of the economy.

This analysis is carried out for the Greek study area of Trikala, a NUTS III-level area and "predominant rural" according to OECD classification (OECD, 1994). Trikala depends heavily on agriculture as agricultural employment accounts to 30% of total employment, while GDP in agriculture contributes to 15% of total GDP formation.

2. Methodological aspects of the input-output analysis

2.1 Input-output multiplier analysis

Input-output analysis is a quantitative technique for studying the interdependence of production sectors in an economy. An input-output table identifies the major sectors in an economy and the financial flows between them over a stated time period (usually a year). It indicates the sources of each sector's inputs, whether purchased from other firms in the economy, imported or earned by labour (household wages and salaries). It also provides a breakdown of each sector's output, which can be sales to other sectors and to final demand (household consumption, government consumption, capital formation and exports). The interdependence between the individual sectors of the given economy is normally described by a set of linear equations, representing fixed shares of input in the production of each output. Thus, by disaggregating the total economy into a number of interacting sectors, input-output analysis provides an effective tool for sectoral and impact analysis.

Within a macroeconomic framework, input-output modeling creates a basis for the evaluation of sectoral policies with respect to national or regional goals such as GDP, employment and the balance of trade. Also, it provides more general information compared to partial equilibrium models which concentrate on one sector and more disaggregated information compared to purely macroeconomic models.

An input-output model can be used for structural analysis, technical change analysis and forecasting. However, the most popular application of the I-O technique is impact analysis, where the model is used to estimate direct and indirect effects on related sectors and on the whole economy resulting from increased demand for the output of one or more sectors. These effects are measured as changes in output, income and employment, and are reflected in sectoral multipliers which express the ratio of total effect to the initial change in demand.

For any one sector, a high level of intermediate inputs, ie., those purchased from local firms, suggests strong linkages within economy and creates significant indirect effects in the output of supplying sectors. These effects are quantified by Type 1 output, income and employment multipliers.

$$Type\ 1\ multiplier = \frac{Direct\ and\ indirect\ effects}{Direct\ effects}$$

Further economic activity, stimulated by increased household spending is termed the induce effect and is incorporated in the Type 2 multipliers:

$$Type\ 2\ multiplier\ =\ \frac{Direct,\ indirect\ and\ induced\ effects}{Direct\ effects}$$

Both these multipliers have value greater than 1.0, with their magnitude depending on the strength of the indirect and induced effects (Psaltopoulos, 1995).

The development of regional input-output models dates from the early 1950s. The various approaches to constructing a regional input-output table can be broadly categorized as ‘survey’, ‘non-survey’ and ‘hybrid’ (Richardson 1972). The ‘survey’ approach attempts to determine the regional input-output table by collecting primary data through various survey methods. The advantage of this approach is that it does not assume similarity between regional and national production functions. On the other hand, the vast amount of data required, makes the survey approach extremely expensive and time-consuming.

The ‘non-survey’ approach involves the representation of the regional economy through the modification of national technical coefficients. This stems from the fact that a regional economy is normally less diverse and more import-dependent than a national economy, because, besides receiving international imports, it also imports goods and services from other regions (Round, 1972). A number of methods have been developed, from the simple method of unadjusted national coefficients to more sophisticated techniques. However, none of these ‘non-survey’ methods provide satisfactory substitutes for the ‘survey’ approach as the constructed regional tables are not free from significant error (Richardson, 1972). In response to this problem, a ‘hybrid’ approach involves the application of ‘non-survey’ techniques to estimate an initial regional transactions matrix. Then, entries in this matrix relating to key or problem sectors are replaced by survey-based estimates. One of the most well-known hybrid techniques is GRIT (Generation of Regional Input-Output Tables).

2.2 The GRIT approach

The GRIT technique was developed and originally applied for the estimation of input-output tables for the regions of Queensland by Jensen *et al* (1979) and later used by Johns and Leat (1987), Psaltopoulos and Thomson (1993), Tzouvelekas and Mattas (1999) and Ciobanu *et al.* (2004). According to Jensen *et al*. (1979), GRIT system was developed '…to provide an operational method, free from significant error, for regional economic analysis'. A mechanical procedure (application of location quotients) is initially applied to adjust national tables. Then, the analyst can determine the extent to which he/she 'interferes' by the insertion of 'superior' data from survey or other sources. As a result, GRIT includes the advantages of both 'survey' and 'non-survey' techniques.

In summary, the GRIT method estimates the flows (million euro) of the regional Intermediate Demand and Primary Inputs quadrants by applying regional-to-national employment ratios and Cross-Industry Location Quotients to the corresponding flows of the national quadrants. The regional Final Demand quadrants are estimated by multiplying the national quadrant by the regional-to-national employment ratio for each sector. The Consumption column of the Final Demand quadrant is further adjusted through the use of location quotients. Regional Exports for each sector are calculated as a residual, ie., the difference between regional output and the sum of intermediate output, regional household consumption and other final demand.

At this point, the full form of the generated regional table may contain a number of sectors which are relatively insignificant within the regional economy. A suitable aggregation scheme to reduce the sectoral detail may be determined by the objectives of the study. However, the application of location quotients must take place before sectoral aggregation, because, as employment data become more aggregated, quotients tend to unity. As a result, regional imports will be underestimated and regional multipliers overestimated. After aggregation, superior data can be inserted, but should be fully compatible with the definition of the aggregate sectors.

2.3 Application of input-output analysis in the evaluation of agriculture's role in the economy

A number of studies, employing input-output analysis, appeared in the literature dealing with the estimation of agriculture's economic impacts on national or regional level. Agriculture plays an important role in the economy and especially in the economy of rural areas as it procures production inputs from, and produces inputs to, other sectors. Input-output models provide an appropriate framework for tracing these linkages in the economy. Henry and Schulder (1985) by measuring the backward and forward linkages of food and fiber sector in USA, stress the importance of agriculture. They state that the impact of agriculture in the whole economy is influenced not only by the magnitude of the linkages and the interdependence among the sectors of the economy, but also by the structure of the particular economy and the relative shares of the raw and processed food sectors. Tzouvelekas and Mattas (1999) examine the role of agro-food sector in the local economy of the Greek island Crete. Cummings *et al* (2000) investigate the role of farming sector in the local economy of Ontario region and evaluate the direct and indirect effects of agriculture to the rest sectors. The collective volume of Midmore and Harrison-Mayfield (1996), presents a number of studies examining the role of agriculture in an economy by utilizing I-O analysis. Sharma *et al* (1999) investigate the role of agriculture to the economy of Hawaii. Hamilton *et al.* (1991) and Baumol and Wolff (1994), both in their studies stress the significance of indirect effects of agriculture in the economy. However, very little analysis has actually taken place about the impact of disaggregated farming systems on the development of rural areas.

2.4 Theoretical aspects of exogenizing sectoral outputs

Input-output analysis implicitly assumes that all endogenous sectors can produce any level of output required to meet final demands. Given this assumption, changes in the elements of final demand can be introduced to the input-output model, and through the calculation of final demand input-output multipliers as presented above, total effects on each sector can be measured. Often however, policies or uncontrollable factors induce exogenous changes in total outputs of sectors and commodities. Since what is exogenously altered is the output of sectors or commodities not belonging to the exogenous final demand, the use of final demand multipliers induces bias and inflates the results (Papadas and Dahl, 1999).

Attempts to resolve the problem include the development of an iterative linear programming solution applied to the input-output model as one method of handling exogenous constraints on sectoral outputs, which are predetermined rather than simultaneously determined by final and intermediate demand (Petkovich and Ching, 1978). Final demand changes are then accommodated subject to these constraints. This scenario is a special case of the more general one in which the output of a given sector or commodity is restricted to some predetermined level. Such cases are output's reduction because of policy changes (Bromley *et al.*, 1968) or cases where production is increased because of irrigation and generally all those cases where the objective is to determine the impact, not of changes in final demand, but changes in total output. To accommodate this more general scenario, Johnson and Kulshreshtha (1982) propose a procedure within input-output framework which leads to a new set of multipliers which Papadas and Dahl (1999) call "supply-driven" for obvious reasons.

The usefuleness of these supply-driven multipliers according to Papadas and Dahl (1999) is not limited to impact analysis of specific exogenous changes in total outputs but they can also be used to assess the output effects of economic phenomena of wider economic processes by translating accurately these phenomena into output changes. In Henry *et al.* (1986) for example, changes in farm size and type distributions are translated into exogenous output changes, and such multipliers are used to evaluate the implications of structural changes in the farm sector for the non-farm economy.

The procedure of Johnson and Kulshreshtha (1982) to exogenise a given set of outputs is described here. The basic equation of input-output analysis is:

$$X = AX + F \qquad (1)$$

Using subscript 1 to denote the sectors whose outputs are to be exogenised and subscript 2 for the rest, with matrix partitioning (1) can become:

$$\begin{bmatrix} X_1 \\ X_2 \end{bmatrix} = \begin{bmatrix} M_{11} M_{12} \\ M_{21} M_{22} \end{bmatrix} \begin{bmatrix} X_1 \\ X_2 \end{bmatrix} + \begin{bmatrix} F_1 \\ F_2 \end{bmatrix} \quad (2)$$

which represents a system of two matrix equations. The unknowns now are X_2 and F_1 while X_1 and F_2 are exogenously determined. Solving the second equation yields:

$$X_2 = (I - M_{22})^{-1}(M_{21}X_1 + F_2) \quad (3)$$

Given the levels of X_1 and F_2 (or their change), the level of X_2 (or its change) can be estimated from (3). Inserting this value in the first equation of the system gives the new value of F_1 or its change:

$$F_1 = (I - M_{11})X_1 - M_{12}X_2 \quad (4)$$

If the interest is only in the impact of exogenous changes in outputs, on other outputs, one can assume the change in F_2 to be zero and the suggested multipliers matrix from (3) is

$$(I - M_{22})^{-1} M_{21} \quad (5)$$

If k sectors are exogenised, the matrix is of dimension (m-k, k) and the ijth element shows the change in sector i's output due to a unitary change in sector j's output.

3. The socio-economic profile of the study area Trikala

The prefecture of Trikala belongs to the region of Thessaly and is located in the central part of Greece. Its land area amounts to 3.384 km^2 (2,5% of land of Greece) of which 83% is mountainous and semi-mountainous and only 18% is level area. Its population, in 2001, amounted to 138.047 people, with very low density (40,8 persons/km^2), much lower compared to the national average (83,1 persons/km^2). The population in Trikala was declining following the general trend in

Greek rural areas. However during the 1990s, population remained stable, compared to the overall depopulation trend in mountainous areas of Greece.

The primary sector has traditionally been the main productive sector in the area. In 1971, almost two thirds (66%) of total employment were in agricultural activities. However, in the last few decades the continuing exodus from agriculture was followed by the expansion of services (50% of total employment in 2001), while the relevant share of the secondary sector has remained stable (around 20%) since 1981. Albeit, in relation to the national average (14,7%), the prefecture still remains dependent on agriculture, as a significant part of the labour force is still occupied in agricultural activities (30% in 2001).

During the period 2000-2006, GDP (current prices) in Trikala increased with an annual growth rate of 6,7% compared to 7,7% in Greece. In a similar manner, GDP per capita at the same period increased by an annual growth rate of 7%, compared to 7,4% at the national level. As a result, in 2006 GDP per capita in Trikala represented 60% of the national average (Giannakis, 2006). In terms of the sectoral shares of GDP, it is important to note the high contribution of services to the formation of GDP in Trikala (67% in 2001).

The number of farms in Trikala amounts to 15.619 (Agricultural Census 2000) with an average size quite low (3,9 ha vs 4,4 ha nationally). Agricultural utilized area is about 60.000 hectares, of which 70% is irrigated. Predominant cultivated crops are mainly arable crops, such as wheat, maize, cotton, barley, fodder crops etc. Livestock farming is mainly based on extensive sheep, goat and cattle grazing systems and consists a very important component of primary economic activity in the mountainous areas of Trikala, as it concentrates in the mountainous part of the prefecture.

The farming systems in Trikala region are quite diverse. Based on the FADN data, four farming systems seem to prevail: (a) extensive crop production of cereals, (b) extensive livestock farming and sheep grazing, (c) intensive farming of irrigated crops of cotton, maize, sugarbeets etc and (d) other agricultural system (residual) including land under tree cultivation and other minor crops.

4. Analysis and Results

4.1 The construction of the Trikala input-output table

The basis of the analysis is the 2000 Greek symmetric 'commodity-by-commodity' input-output table, updated to 2004 by the application of the RAS method (O' Connor and Henry, 1975). The year 2004 was chosen as the base year since it is the first year after the implementation of CAP reform (2003-2004). The initial scheme of 59 sectors of economic activity ended to 18 after the aggregation.

The next step was the construction of the regional input-output table for Trikala region using the GRIT technique described above. This method was chosen because the cost of using a full survey-based method to generate the regional tables was prohibitive and regional I-O tables constructed via non-survey techniques are not sufficiently accurate (Richardson, 1972). Furthermore, as noted by Johns and Leat (1987), GRIT is particularly suitable for smaller regions, as it allows the more accurate estimation of the (expectedly) smaller multipliers that characterize small regional economies.

According to Jensen *et al.* (1979), 'superior' data can be selected according to objectives and resources and can be confined to sectors of particular interest. Czamanski and Malizia (1969) suggest that superior data should be obtained for sectors in which the economy under study is specialized. In order to investigate in further detail the relationships between local economic sectors and the rest of the rural economy, primary data available from a survey of enterprises of the most important sectors of the study area was utilized. The selection of sampled sectors was based on the following two criteria: (a) significance of sectors in regional economy and (b) existence of strong intersectoral linkages with the products of the agricultural sector. Along those lines, the survey was carried out to the following sectors: agriculture, food manufacturing, trade and tourism. The final I/O table constructed consists of 21 sectors of economic activity: 17 non-agricultural and 4 agricultural as the agricultural sector is disaggregated into four farming systems: extensive arable crops, extensive livestock, intensive arable crops and other agricultural system.

4.2 Output multipliers

Based on the constructed I/O table for Trikala, Table 1 indicates the Type 1 output multipliers which express the regional significance of the backward linkages of each sector. The multiplier for the farming system of intensive crops is amongst the highest (3rd in rank), while for the farming system extensive arable is relatively low, indicating weak linkages with other sectors. So, a unit increase in the final demand for the products of the intensive crops farming system (i.e., exports, consumption or investments) will increase the total (direct and indirect) output in the region of Trikala by 1,653 units. The highest backward linkages amongst the non-agricultural sectors are created by the products of the sector of trade (1,78) followed by the sector of metal products (1,66) and tourism (1,573).

The largest induced effects (Type 2 output multipliers) tend to be in the farming systems of other agr system (3,251 – 3rd in rank) and extensive livestock (2,679 – 4rth in rank). This is because wages and salaries represent a large proportion of their total inputs. Multiplier for the farming system of extensive arable is not amongst the highest, albeit not low. The highest induced effects amongst the non-agricultural sectors are created by the products of the sectors of public administration (3,561), education (3,538) and other services (2,643). The large proportion of inputs accounted for by wages and salaries in the sectors of agriculture and services contributes to a significant rise in regional incomes and household spending as output increases.

Table 1. Output multipliers for prefecture Trikala (2004)

Sectors of economic activity	**Type 1**	**Rank**	**Type 2**	**Rank**
Extensive arable	1,444	10	2,163	13
Extensive livestock	1,548	6	2,679	4
Intensive arable	1,653	3	2,566	7
Other agr system	1,634	4	3,251	3
Mining	1,157	20	1,646	20
Food manufacture	1,298	16	1,683	19
Textile	1,524	7	2,181	11
Wood and paper	1,457	9	2,181	12
Chemical and plastic products	1,484	8	1,913	18

Non metal products	1,430	12	2,252	10
Metal products	1,660	2	2,288	9
Machinery and equipment	1,197	19	1,550	21
Electricity, gas and water	1,204	18	1,941	16
Construction	1,433	11	2,113	14
Trade	1,780	1	2,540	8
Tourism	1,573	5	2,097	15
Transportation	1,396	13	2,587	6
Banking-Financing	1,360	14	1,932	17
Public administration	1,344	15	3,561	1
Education	1,062	21	3,538	2
Other services	1,257	17	2,643	5

4.3 Income coefficients and multipliers

Table 2 shows income coefficients and multipliers. Income coefficients indicate the total increase in incomes generated by a unit increase in the output of the products of a particular sector. Direct income coefficients (DICs) for other agr system and extensive livestock are amongst the highest, while capital-intensive sectors such as trade, chemical and plastic products and food manufacture have low coefficients. Type 1 income multipliers for the farming systems are rather low with the highest appearing to the farming system of extensive arable (1,599 – 5th in rank) and intensive arable (1,485 – 7th in rank). The sectors of trade (3,563) and tourism (1,918) have the largest income multipliers amongst the non-agricultural sectors. The Type 2 multipliers follow the same pattern as the Type 1 multipliers.

Table 2. Income coefficients & multipliers for prefecture Trikala (2004)

Sectors of economic activity	**Direct Income Coefficient**	**Direct & Indirect Income Coefficient**	**Type 1 Income Multiplier**	**Direct, Indirect & Induced Income Coefficient**	**Type 2 Income Multiplier**
Extensive arable	0,139	0,223	1,599	0,291	2,092
Extensive livestock	0,265	0,351	1,324	0,459	1,732
Intensive arable	0,191	0,283	1,485	0,370	1,943
Other agr system	0,400	0,501	1,254	0,656	1,640
Mining	0,131	0,152	1,161	0,198	1,518
Food manufacture	0,085	0,119	1,400	0,156	1,831
Textile	0,133	0,204	1,529	0,266	2,000

Wood and paper	0,159	0,224	1,412	0,293	1,847
Chemical and plastic products	0,074	0,133	1,788	0,174	2,339
Non metal products	0,191	0,255	1,335	0,333	1,746
Metal products	0,112	0,194	1,738	0,254	2,273
Machinery and equipment	0,086	0,110	1,270	0,143	1,662
Electricity, gas and water	0,199	0,228	1,147	0,299	1,501
Construction	0,151	0,211	1,396	0,276	1,826
Trade	0,066	0,235	3,563	0,308	4,661
Tourism	0,085	0,162	1,918	0,212	2,508
Transportation	0,303	0,369	1,219	0,483	1,594
Banking-Financing	0,124	0,177	1,425	0,232	1,864
Public administration	0,637	0,687	1,078	0,899	1,410
Education	0,757	0,767	1,014	1,004	1,326
Other services	0,384	0,430	1,118	0,562	1,462

4.4 Employment coefficients and multipliers

The employment coefficients and multipliers are shown in Table 3. The farming systems are labour-intensive and therefore they have high direct employment coefficients. An additional 1 million euro of output for the products of extensive livestock and intensive arable farming systems create 44 and 36 jobs, respectively. Type 1 employment multipliers indicate weak backward effects for the farming systems. Amongst them the highest Type 1 employment multiplier (1,581) belongs to the products of extensive arable crops, due to lower direct employment effects of this farming system compared to other farming systems. The linkages are significant for the products of trade (2,921) and chemical and plastic products (2,029). Direct, indirect and induced coefficients indicate the total effect of increased output on employment. The total number of jobs created in extensive livestock (68 – 1st in rank), other agr system (63 – 3rd in rank) and intensive arable (58 – 4th in rank) by increasing output in each is very high.

Table 3. Employment coefficients & multipliers for prefecture Trikala (2004)

Sectors of economic activity	**Direct Employment Coefficient**	**Direct & Indirect Employment Coefficient**	**Type 1 Employment Multiplier**	**Direct, Indirect & Induced Employment Coefficient**	**Type 2 Employment Coefficient**
Extensive arable	22	35	1.581	42	1.899
Extensive livestock	44	57	1.306	68	1.559
Intensive arable	36	49	1.368	58	1.619
Other agr system	34	47	1.361	63	1.821
Mining	4	5	1.459	10	2.776
Food manufacture	6	9	1.627	13	2.306
Textile	10	16	1.582	23	2.201
Wood and paper	15	22	1.450	29	1.921
Chemical and plastic products	3	7	2.029	11	3.238
Non metal products	9	14	1.530	22	2.406
Metal products	10	17	1.741	23	2.385
Machinery and equipment	6	8	1.361	11	1.954
Electricity, gas and water	6	8	1.363	15	2.604
Construction	18	24	1.287	30	1.648
Trade	13	38	2.921	45	3.497
Tourism	14	22	1.610	27	1.982
Transportation	20	26	1.283	38	1.855
Banking-Financing	10	15	1.451	20	1.997
Public administration	26	30	1.156	52	1.984
Education	38	39	1.022	63	1.662
Other services	27	30	1.135	44	1.646

4.5 Farming systems 'supply-driven' multipliers

To assess the impact of the farming systems on the local economy from the supply side, it is necessary to exogenize the output of the farming systems based on the methodology described above in paragraph 2.4. In Table 4, 'supply-driven' multipliers of each farming system for the rest sectors of economy are presented. Each element shows the output change of the i^{th} sector due to the exogenous change of the output of the corresponding farming system. The sum of the column's elements shows the total impact of the exogenous change of the output of the different farming systems by one unit on the local economy's output. In other words, if the output of intensive arable system increases by 1 million euro, the output of the other sectors of local economy will increase by 0,5381 million euro. Extensive arable farming system creates a lower impact on the local economy (0,4256) compared to the intensive one (0,5381). It is noted that the other agr system appears to have a rather high multiplier (0,5568).

Table 4. 'Supply-driven' multipliers of different farming systems to the local economy

Sectors of economic activity	**Extensive arable**	**Extensive livestock**	**Intensive arable**	**Other agr system**
Extensive arable	-	0,0541	0,0000	0,0108
Extensive livestock	0,1935	-	0,0002	0,0839
Intensive arable	0,0373	0,1601	-	0,0383
Other agr system	0,0087	0,0107	0,0003	-
Mining	0,0012	0,0019	0,0073	0,0039
Food manufacture	0,0002	0,0002	0,0045	0,0003
Textile	0,0001	0,0001	0,0023	0,0002
Wood and paper	0,0014	0,0017	0,0135	0,0029
Chemical and plastic products	0,0028	0,0032	0,0115	0,0063
Non metal products	0,0001	0,0001	0,0289	0,0002
Metal products	0,0003	0,0004	0,0262	0,0008
Machinery and equipment	0,0021	0,0025	0,0138	0,0047
Electricity, gas and water	0,0200	0,0364	0,0380	0,0770
Construction	0,0006	0,0007	0,0018	0,0019
Trade	0,1406	0,1728	0,3543	0,2755
Tourism	0,0002	0,0002	0,0005	0,0005
Transportation	0,0122	0,0069	0,0239	0,0238
Banking-Financing	0,0034	0,0020	0,0105	0,0236
Public administration	0,0000	0,0000	0,0000	0,0000
Education	0,0000	0,0000	0,0000	0,0000
Other services	0,0010	0,0010	0,0006	0,0020
Total	**0,4256**	**0,4550**	**0,5381**	**0,5568**

4.6 Impact assessment of the land reallocation due to the CAP Reform (2003-2004)

The implementation of the Mid-term Reform of CAP has resulted in significant changes in the agricultural sector of the prefecture Trikala as well as at national level. The overwhelming bulk of production-linked and hence production-incentivising subsidies has been replaced by the Single Farm Payment (SFP) which does not require specific farm output or even specific farm input use. Specifically, in Trikala, upon the initiation of the CAP reform and between 2004-2007, 3.850 hectares were moved from intensive arable to extensive arable crops representing 12% of the intensive cropping land. This reallocation of land resulted in changes in the value of output of extensive arable by 7.104.471 euro which accounts for 2% of the total agricultural gross output. Replacing in equation (3) ΔX_1 = 7.104.471 euro, total output generated in the economy is about ΔX_2 = 3.023.663 euro. On the other hand, the output of the intensive arable farming system is decreased by 15.135.350 euro and as a result the total output of the local economy is reduced by 8.144.332 euro. In total, the net output of regional economy is reduced by 5.120.669 euro.

However, in this point it must be mentioned that agriculture beyond its primary function of producing food and fiber commodities, produces jointly a wide range of non-commodity outputs, some of which exhibit the characteristics of public goods or externalities (OECD, 2001). So, changes in land use and farming systems alter not only the levels of commodity outputs as calculated above but also the mix of non-commodities generated jointly during the production process.

It is widely acknowledged that low-input farming systems are more in 'harmony' with 'natural' ecological processes, contributing positively to the provision of such 'non-market' functions as biodiversity, landscape, water and air quality (Bignal, 1998; Phillips, 1998; Smeding and Joenje, 1999; Kolpin, 1997). In contrast, the intensification of agriculture has detrimental consequences for biodiversity (Donald *et al* 2001; McLaughlin 1995; Robinson & Sutherland 2002), water quality (Sutherland 2002) etc. putting at risk the resilience of ecosystems (Knickel, 1990). Furthermore, low-input agricultural activities provide important amenities in rural areas. As society places an increasing value on the preservation of the environment, the semi-natural habitats and the scenic features of cultivated landscapes, the aesthetic, ecological, cultural and historic aspects of such rural landscapes contribute positively to regional attractiveness for tourism sector as well as the quality of life of regional citizens. However, it is beyond the scope of this paper to estimate the gains for the local economy of the non-commodities produced by the extensive agricultural systems and which tend to compensate for the net output losses.

5. Conclusions

Input-output multiplier analysis shows that the farming system of intensive crops creates the strongest backward linkages with the other sectors of economy. Income and employment multipliers are rather low for almost all the farming systems with the system of extensive crops having the greatest one due to high direct income and employment effects they create. Amongst non-agricultural sectors, products of trade and tourism seem to create the greatest backward linkages with the rest economy. The Mid-term Reform of CAP (2003/2004) and the implementation of the Single Farm Payment regime have initiated changes in rural areas and have introduced reallocation of land resources from intensive to extensive farming systems. From the above analysis it seems that the net output generated from the land reallocation is negative for the rural economy. However, the process of land reallocation seems to be at initial stage and it is expected to go on. Considering also that, European policy initiatives aiming at strengthening the viability of rural areas have as central point the multifunctional role of agriculture and stress the importance of safeguarding the provision of agri-environmental goods, it is essential to take into consideration that this land reallocation enhance the generation of such positive externalities from agriculture and must be further investigated in future research.

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