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STRUCTURAL DEVELOPMENT POLICIES AND STRUCTURAL CHANGE IN RURAL/URBAN AREAS IN GREECE: AN INTERREGIONAL SAM ANALYSIS

D. Psaltopoulos[1], Eudokia Balamou[2]

Abstract. A three-area, interregional Social Accounting Matrix (SAM) model is used to assess the effects of structural policies implemented in the rural town of Archanes (Crete, Southern Greece) during the 1990s, in terms of changes in the structure of the local economy, the extent of economic impacts and their diffusion patterns to adjacent rural and urban localities. Structural changes within a time span of 10 years are estimated using a causative matrix approach, while structural decomposition analysis provides an indication of the attribution of local output growth to changes in the economic structure or final demand. Results reveal that final demand effects on gross production were more important than changes in technical coefficients. Structural policy injections was responsible for around 20.3% of gross production change in Archanes during this period. Also, structural policy specific impacts seem to be quite different, as CAP *support* measures are associated with comparatively high output and household income benefits for Heraklion and high output and employment benefits for N. Kazantzakis. In contrast, d*evelopment* measures are more successful in generating firm and household incomes in Heraklion and firm income and employment in N. Kazantzakis.

1. Introduction

Since the reform of the Structural Funds (1988), structural policies have been implemented in a more integrated framework in European regions. In the 1990s, CAP was gradually reformed and a new framework for rural development policy was established. Rural intervention in the EU moved outside the agricultural

[1] Demetrios Psaltopoulos, Associate Professor, Eudokia Balamou Research Fellow, Department of Economics, University of Patras, University Campus, Rio 26500 Patras, Greece, e-mail: dempsa@upatras.gr, e-mail: ebalamou@upatras.gr

domain, aiming to induce a more balanced social and economic development to rural areas. The average annual funds dedicated by the EU for this purpose have been raised significantly. The major share of these funds have been directed towards 'Objective 1' areas characterized by significant structural weaknesses, in an effort to stimulate economic growth and utilize comparative advantages, especially in view of the rising market-competition pressures.

It has been often argued that the potential effects of policy changes are not equally distributed amongst EU rural regions (European Commission, 1996). Most of the areas begin from distinctly different starting points in terms of their development, and there is significant diversity in terms of population change and densities, natural resource endowments, economic and social structures, and environmental conditions (Bryden, 1998). In addition, there has been an active debate over 'cohesion' and the role of 'balanced' and 'polycentric' development in the EU, focusing on regional and urban-rural interactions (Davoudi, 2002).

After the reform of Structural Funds several small rural towns have receipt structural development policy funds in the context of the EU Community Support Frameworks (CSF). To a large part, these funds have been aimed at encouraging both economic growth and increasing stability, particularly in terms of employment. In this context, they have promoted local investment in an effort to promote the diversification, of the usually agriculturally dependent, local economic base and generated local economic activity and affected the structure of the 'targeted' rural economies, through changes in intersectoral linkages.

Furthermore, there are indications of a likely diffusion of economic benefits to neighbouring urban/ rural localities. However, there is a question if these benefits flow rather towards the economy of adjacent urban centres than to neighbouring rural localities. If this is true, then the impacts of EU development policies do not seem to correspond to the core objective of promoting economic cohesion at the regional level, i.e. improving relative income levels in the poorer (usually rural) parts of the region.

The paper has two objectives. The first one is to analyze structural changes[2] in the structure of Archanes economy (before and after structural policy implementation). The second objective is to assess the effects of structural policies implemented in the rural town of Archanes (Crete, Greece) during the 1990s, in terms of the extent of economic impacts and their diffusion patterns to adjacent rural and urban localities, namely the less-developed agriculturally-dependent neighbouring rural area of N. Kazantzakis, and the adjacent urban area of Heraklion. For fulfilling these objectives, a hybrid, three-area interregional Social

[2] The term structural change is used in this paper to define changes in the relative contributions to economic activity provided by different sectors of the economy.

Accounting Matrix (SAM) model is constructed and used to analyze structural changes and the relevant diffusion patterns within and between these rural-urban localities. Structural changes within a 10 year time span in Archanes economy are estimated using a causative matrix approach, while structural decomposition analysis provides an indication of the attribution of local output growth to changes in technical coefficients (changes in the local economic structure) and changes in the composition of final demand. Furthermore, there is an estimate of the diffusion patterns of structural policy impacts in terms of generated output, household (distinguished by different income levels) and firm income, and employment in and between the three areas.

The paper is organized as follows. The next section presents the main socio-economic characteristics in the study area and assesses local development policy strategies and interventions. Section 3 presents the modelling framework, while Section 4 presents the results from multiplier, structural change and impact analysis. The paper ends with the relevant conclusions.

2. The Region under Study

2.1 Socio-Economic Characteristics of the Study Area

The study area consists of the rural municipalities of Archanes and N. Kazantzakis and urban centre of Heraklion (NUTS 5 areas), which are part of the Prefecture of Heraklion, located in north central Crete, Greece and are characterized as Objective 1 areas. Archanes is not particularly isolated from the rest of the Prefecture, since there is an adequate road network that connects it with adjacent localities. Moreover, it is very close (about 15-20 km) to the major administrative centre and entrance point of the island of Crete, the city of Heraklion. Its land area of 31.5 sq. km is classified as semi-mountainous, while 28.1 sq. km is agricultural land. The population of Archanes amounts to 4,548 people and has significantly increased since 1991 (Table 1), being amongst the top five areas of the Prefecture of Heraklion in terms of population expansion (Balamou, 2003).

The municipality of N. Kazantzakis is a less-developed agriculturally-dependent area, located southwest to Archanes (around 20-25km). In contrast to Archanes, N. Kazantzakis is relatively isolated from the main centre of economic activity in the wider area (i.e. the city of Heraklion), due to the inadequacies of both the road network and public transportation system. Its land area of 99.7 sq. km is semi mountainous, while 60.7 sq. km is agricultural land. The population of N. Kazantzakis amounts to 6,745 people and has significantly decreased since 1991 (-5.6%) mainly due to migration towards the urban centre of Heraklion.

Table 1 Profile of the Study Area and the Prefecture of Heraklion, 1991-2001

	1991	2001	1991	2001
	Archanes		N. Kazantzakis	
Population	4,279	4,548	7,144	6,745
Density (persons/km^2)	135.84	144.38	71.65	67.06
% Population Change	8.74		-5.60	
Employment	1,657	1,960	2,429	2,707
% Primary	57	41	62	55
% Secondary	12	9	12	17
% Tertiary	31	50	26	28
	Heraklion		Prefecture of Heraklion	
Population	120,563	137,711	264,906	292,489
Density (persons/km^2)	1105.15	1260.21	100.30	110.74
% Population Change	14,22		10.41	
Employment	40,718	57,395	97,494	115,217
% Primary	6	5	31	26
% Secondary	21	18	18	17
% Tertiary	73	77	51	57

Source: National Statistical Service of Greece

Economic activity in both rural areas is dominated by agriculture, mainly vine and olive production. The secondary sector is based on traditional small and medium sized enterprises which process local farm output and provide inputs to farmers and the construction sector. In Archanes, since the early 1990s, there has been a gradual development of the tertiary sector, including retail and wholesale trade units, but also firms that serve a continuously expanding tourist demand (local restaurants, accommodation facilities, banks, etc.). Also, the implementation of structural policy, the rich architectural and historical tradition of Archanes, the significant improvements in local public infrastructure and its enhanced proximity to the urban centre of Heraklion, have all resulted into a significant increase of tourism flows in this area. Taking also account of the local dynamic agricultural sector (which has undergone significant restructuring), a dynamic local economy has been developed. The results of this process are indicated by the continuous increase of the local population, while employment has increased by 18% since 1991.

On the contrary, N. Kazantzakis presents difficulties in development. The majority of farming can be characterized as traditional, with small farm-size land and shortcomings in irrigation. The absence of an efficient manufacturing sector and the lack of promoting agricultural products are affecting the development process of the area. Furthermore, the manufacturing of the agricultural products is

characterized by weaknesses in planning, organization, standardization and constraints in the relevant infrastructure. Also, traditional activities, such as pottery, weaving, wood-carving etc. are having viability problems due to the absence of investments, high production costs and difficulties in market access. Moreover, tourism flows in the area are low due to the inadequacy of infrastructure, but also due to the low quality of local tourism services. All these issues have been negatively affecting the development prospects of the N. Kazantzakis economy.

The city of Heraklion is amongst the larger urban centres of Greece and represents one of the two poles of the urban network of Crete and one of the biggest and most significant ports of the country. Its economy consists of a large number of industries, especially a modern tertiary sector, while it concentrates the largest part of economic activity in the wider area. Economic performance in recent years has been very satisfactory, as indicated by the continuous increase of local employment (41%). Its population amounts to 137,711 and has significantly increased since 1991 (14.2%), due to inner migration mainly from the rural parts of the Prefecture.

2.2 Development – Policy Measures

During the First CSF (1989-93) period a broader range of programmes and projects was stimulated in Archanes, while total spending increased significantly. The main bulk of funding in this area was still directed towards farm support and on improving agricultural productivity. After 1993, attention was shifted towards the improvement of quality in agricultural production and the sustainable management of water resources. In the context of both CSFs, significant publicly funded infrastructural projects (local roads, water and sewage networks, waste management) were implemented in Archanes, in an effort to improve accessibility and quality of life. Also, investment funds were directed towards environmental improvement and architectural renovation projects. Community Initiatives (Leader) promoted private investment in the secondary and (especially) tertiary sectors, while funds from the national 'agricultural development' operational programs were directed towards the modernization of agricultural holdings (Development Agency of Heraklion, 2001).

Average annual spending on structural policy measures implemented in Archanes during the period 1988-98, amounted to 1428.2 ml Drs[3] (4.49 ml Euro) in 1988 prices (Table 2). The vast majority of this funding was directed towards farm income support (50.1% of total structural policy spending in Archanes) and on

[3] 1 Euro=340.75 Drs

improving public infrastructure (16%). Most of farm income support consisted of direct payments to vine growers and subsidies for olive oil. In terms of measures aiming at improving farm productivity (12.6%), most funds were spent on farm improvement plans and the installation of young farmers. Measures on environment and culture (13.7%) were mostly related to environmental improvement and architectural renovation projects. Finally, measures aiming at diversifying the local economy (7.6%) were directed towards agrotourism and the establishment of small firms.

Table 2 Development Policy Measures Implemented in Archanes, 1988-98
(1988 prices)

Structural Policy Measures	Annual Average Expenditure (ml. Drs)	% Share
Public Infrastructure	229.2	16
Environment and Culture	196.1	13.7
Farm Income Support	715.0	50.1
Increase of Farm Productivity	179.4	12.6
Diversification of Economic Activity	108.5	7.6
Total Spending	1428.2	100

Source: Development Agency of Heraklion

3. Modelling Framework

3.1 The Construction Process

Various types of interregional input-output models have been developed, all of them owing their conceptual structure to work by Leontief (1953) and Isard (1951). The structure of the interregional SAM in this study draws from these pioneering efforts and also by that of Round (1985) and Roberts (1998).

First, an interregional I/O Table was generated for the three areas using the hybrid GRIT technique (Jensen *et al*. 1979) and extended to an interregional framework by West *et al.* (1982) as GRIT III. This method was chosen since the cost of using a full survey-based method to generate the interregional tables was prohibitive, while regional I-O tables constructed via non-survey techniques suffer from insufficient accuracy (Richardson, 1972). The GRIT technique generates an initial regional transactions matrix via the mechanical adjustment of the national direct requirements matrix by using employment-based Simple Location Quotients (SLQs) and Cross-Industry Location Quotients (CILQs). Subsequently, the analyst can 'interfere' with the mechanically produced table through the insertion of 'superior' data from surveys or other sources, at various stages in the development

of the table. Thus, GRIT incorporates the advantages of both the 'survey' and 'non-survey' I/O regionalization approaches.

The benchmark year was determined by the availability of both national I/O tables and data from other secondary sources, as well as the purpose of the analysis (estimation of policy impacts; impacts of structural policy on changes in the structure of the local economy). Therefore, it was decided that the interregional I/O Tables to be constructed should correspond to years 1988 and 1998 (i.e. year before and after policy implication).

After regionalizing the available national I/O tables (mechanical GRIT procedure), information available from sectoral business surveys in Archanes and N. Kazantzakis was utilized. In the case of Heraklion, resources and the magnitude of the urban economy prohibited survey-work. Instead relevant data was collected from public administration, chambers of commerce and the local knowledge of policy-makers. The selection of target sectors for the business surveys was primarily based on the importance of particular sectors within the structure of the local economy, and as recipients of EU Structural Funds during the period under analysis. The sample was selected so as to be representative of the geographical distribution of businesses within the local economies. Businesses were selected through stratified random sampling from business directories supplied by local authorities. Although sampling was largely random, some major businesses were purposely chosen due to their major economic impact on the study areas (which mostly consisted of small enterprises). Surveys were conducted face-to-face with business owners, using a structured questionnaire. Around 25% of local firms completed questionnaires, while data on the three sectors of agriculture was provided by the local agricultural cooperatives.

The second main source of superior data was an extended survey of households in Archanes and N. Kazantzakis. Around 8% of local households provided information on the sources of their income and their consumption patterns, enabling also their disaggregation into different income-groups. In the case of Heraklion, household consumption patterns were mechanically generated. In order to develop the non-I/O components of the interregional SAMs, a wide range of regional and national data sources was used.

However, the constructed interregional SAMs had many discrepancies caused by inconsistencies between different data sources. Consequently the interregional tables were unbalanced and the SAM and National Income Accounts identities were not in valid. In order to exceed these problems the Cross-Entropy (Robinson *et al.* 2000) balancing technique was used in a GAMS code to balance the unbalanced interregional SAM.

The final interregional SAMs has symmetrical interindustry matrices, it consists 13 sectors in the Archanes matrix, 12 sectors in the N. Kazantzakis matrix, 9 sectors in the Heraklion matrix, 3 factors (labour, capital and land), 3 household groups spilt by income levels (poor, middle-income and rich) one firm account, one government account while the Rest of the World account is disaggregated to Rest Crete, Rest Greece and Rest of the World.

3.2 Economic Linkages

An interregional SAM model recognises two types of directs flows between its areas. The geographical movement of commodities, either for final consumption or for intermediate use in production, and the transfers of payments for factor services mainly in the form of employment income earned by households from areas 1 working in area 2. Also, the model areas trade and transfer flows to the exogenous accounts, including the rest of the world and government accounts. These flows are in fact, the leakages from the model. Moreover, the model can consistently estimate new equilibria for the structure of production, the distribution of factor incomes and the pattern of consumer demands in all areas, simultaneously (Roberts, 1998).

The aggregate interregional multiplier matrix, M, of the interregional SAM captures all the relationships in the system. It takes into account the effect of relationships within each area relating to income distribution and the structure of production and also the dependencies between the regions resulting from interregional flows. Consequently, the aggregate interregional multiplier matrix is decomposed into two different multiplier matrices, which explain the relative importance of the various types of linkages and interdependencies that exist between the areas. The following explanation is based on the methods suggested by Round (1985).

By endogenising production, factors and household accounts the basic equation of an interregional SAM model can be represented as:

$$y = Zy + x \tag{1}$$

where y = column vector of endogenous accounts incomes in the three areas

Z = transaction coefficient matrix including linkages within and between areas

x = column vector of exogenous expenditures.

The aggregate interregional multipliers from the system are estimated as:

$$y = (I - Z)^{-1} x = Mx \tag{2}$$

The interregional SAM model for a three – region system can be expressed in a partitioned form as follows:

$$\begin{bmatrix} y_1 \\ y_2 \\ y_3 \end{bmatrix} = \begin{bmatrix} Z_{11} & \tilde{z}_{12} & \tilde{z}_{13} \\ \tilde{z}_{21} & Z_{22} & \tilde{z}_{23} \\ \tilde{z}_{31} & \tilde{z}_{32} & Z_{33} \end{bmatrix} \begin{bmatrix} y_1 \\ y_2 \\ y_3 \end{bmatrix} + \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} \tag{3}$$

where subscripts 1, 2, 3 relate to regions 1, 2, and 3 of the system, respectively, and subscript ~ to the diagonal sub-matrices.

The multipliers from the modelling system, within and between regions are derived as:

$$\begin{bmatrix} y_1 \\ y_2 \\ y_3 \end{bmatrix} = \begin{bmatrix} Z_{11} & 0 & 0 \\ 0 & Z_{22} & 0 \\ 0 & 0 & Z_{33} \end{bmatrix} \begin{bmatrix} y_1 \\ y_2 \\ y_3 \end{bmatrix} + \begin{bmatrix} 0 & \tilde{z}_{12} & \tilde{z}_{13} \\ \tilde{z}_{21} & 0 & \tilde{z}_{23} \\ \tilde{z}_{31} & \tilde{z}_{32} & 0 \end{bmatrix} \begin{bmatrix} y_1 \\ y_2 \\ y_3 \end{bmatrix} + \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} \tag{4}$$

$$\begin{bmatrix} y_1 \\ y_2 \\ y_3 \end{bmatrix} = \begin{bmatrix} (I - Z_{11})^{-1} & 0 & 0 \\ 0 & (I - Z_{22})^{-1} & 0 \\ 0 & 0 & (I - Z_{33})^{-1} \end{bmatrix} \left\{ \begin{bmatrix} 0 & \tilde{z}_{12} & \tilde{z}_{13} \\ \tilde{z}_{21} & 0 & \tilde{z}_{23} \\ \tilde{z}_{31} & \tilde{z}_{32} & 0 \end{bmatrix} \begin{bmatrix} y_1 \\ y_2 \\ y_3 \end{bmatrix} + \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} \right\} \tag{5}$$

$$\begin{bmatrix} y_1 \\ y_2 \\ y_3 \end{bmatrix} = \begin{bmatrix} 0 & (I - Z_{11})^{-1}\tilde{z}_{12} & (I - Z_{11})^{-1}\tilde{z}_{13} \\ (I - Z_{22})^{-1}\tilde{z}_{21} & 0 & (I - Z_{22})^{-1}\tilde{z}_{23} \\ (I - Z_{33})^{-1}\tilde{z}_{31} & (I - Z_{33})^{-1}\tilde{z}_{32} & 0 \end{bmatrix} \begin{bmatrix} y_1 \\ y_2 \\ y_3 \end{bmatrix} \tag{6}$$

$$+ \begin{bmatrix} (I - Z_{11})^{-1} & 0 & 0 \\ 0 & (I - Z_{22})^{-1} & 0 \\ 0 & 0 & (I - Z_{33})^{-1} \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix}$$

By defining $D_{ij} = (I - Z_{ii})^{-1} z_{ij}$

$$\begin{bmatrix} y_1 \\ y_2 \\ y_3 \end{bmatrix} = \begin{bmatrix} I & -D_{12} & -D_{13} \\ -D_{21} & I & -D_{23} \\ -D_{31} & -D_{32} & I \end{bmatrix} \begin{bmatrix} (I - Z_{11})^{-1} & 0 & 0 \\ 0 & (I - Z_{22})^{-1} & 0 \\ 0 & 0 & (I - Z_{33})^{-1} \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} \tag{7}$$

$$\text{or } y = M_{rz} M_{r1} x \tag{8}$$

M_{rz} in equation (8) is the interregional multiplier matrix. It captures all of the (spatial) repercussions between the accounts of one region and those of the other

two, excluding all of the within-region effects. The interregional multiplier depends upon the linkages represented by z_{12}, z_{13}, z_{21}, z_{23}, z_{31} and z_{32} while the degree of departure of M_{rz} from the identity matrix depends on the strength of bilateral trade linkages and other endogenous interregional transfers. The interregional multiplier matrix, M_{rz}, can be further decomposed into interregional open and closed loop effects (Round, 1985). The interregional open loop multiplier matrix, M_{r2}, captures the effect that one region has upon the others, after accounting for all own-region effects, while the interregional closed loop multiplier matrix, M_{r3}, shows impacts which pass through the accounts in the other regions before returning to the region of origin (Roberts, 1998). In other words it shows the interregional feedback effects.

In contrast, M_{r1} is the intra-regional multiplier matrix. It shows the multiplier effects that result from linkages wholly within each separate region of the system. Also, the intra-regional multiplier matrix, M_{r1}, can be decomposed in order to show some of the separable effects and linkages within and between types of endogenous accounts within a region. Therefore, M_{r1} is decomposed into three multiplicatively multiplier matrices, $M3_{r1}$, $M2_{r1}$ and $M1_{r1}$, which reflect inter-account, cross-account and intra-account effects, respectively (Pyatt and Round, 1979).

The total multiplier relationship in the interregional system can be expressed as:

$$y = M_{r3} M_{r2} M_{r1} x \tag{9}$$

This clarifies the nature of the separate effects involved in the interregional system. The total interregional multiplier effect for 'own regions' is obtained as the product of multiplying M_{r3} and M_{r1}; while the equivalent multiplier effect of one region upon the others is the product of the appropriate interregional open loop (M_{r2}) and the total 'own region' effect for the former regions.

3.4 Measurement of Structural Changes

For fulfilling the objective of this paper, the causative matrix approach is used in order to investigate structural changes within a ten-year time span. The causative matrix approach to the analysis of temporal changes was presented by Jackson *et al*. (1990) in an extension to input – output analysis. In this context, one can utilize either the technical coefficients matrix, A, or the inverse matrix. Jackson *et al.* (1990) used the inverse matrix in order to compute the transition matrix (standardized Leontief inverse), K, by the formula:

$$\mathrm{K} = \mathrm{Z}\mathrm{M}^{-1} \tag{10}$$

where Z = Leontief inverse matrix

M = diagonal matrix whose elements M_{jj} equal the sum of the jth column of Z matrix.

The elements of each column of the Leontief inverse matrix are normalized by their perspective column sums, as the transition matrices must have column sums equal to 1. This process standardizes for changes in the magnitude of output multipliers and focuses the analysis upon the relative influences of each sector on each other. Using the two times period's t and t+1 the corresponding transition matrices are assumed to be linked by the formula:

$$\mathrm{K}_{t+1} = CK_t \tag{11}$$

where K_{t+1} and K_t are estimated according to equation (10) and C is the causative matrix, which is defined as:

$$C = K_{t+1}K_t^{-1} \tag{12}$$

Matrix C explains the change between the transition matrices K_t and K_{t+1} through the interpretation of the elements and rows of C. It is also called left causative matrix. Matrix C may contains negative terms, where a negative C_{ik} implies a reduction in sector i's contribution to sectors j's output multiplier due to the presence of sector k. All columns sums of C equal 1. Row sums less than 1 indicate smaller contributions to output multiplier, i.e. the corresponding recording of smaller impacts when final demands in other sectors change (and vice versa for row sums greater than 1). Negative deviations of the diagonal elements of sectors from 1 imply decreased relative internalization of their own final demand output impacts (and vise versa for positive deviations of the diagonal elements from 1). The causative matrix approach has the advantage of capturing both the direct changes in interactions and the relative changes due to the presence of other sectors.

Decomposition of Structural Changes. Differences in the structure of an economy between two different points in time can be shown on production and employment data. More specifically, the differences in output and employment levels and in the structure of the economy can be depicted with the help of the SAM model basic equation:

$$X=Zy \tag{13}$$

where X = total output

Z = Leontief inverse matrix

y = final demand

If the difference in gross output between two different years, t and t+1, are expressed by equation (13), then the structural changes can be identified as changes in technical coefficients and changes in final demand (Skolka, 1989). Thus:

$$\Delta X = (Z_{t+1} - Z_t)y_{t+1} + Z_t(y_{t+1} - y_t) \quad (14)$$

where ΔX is the difference in total outputs and Z_t and Z_{t+1}, and y_t and y_{t+1} are the inverse matrices and the final demands, respectively[4]. In the first term of the right hand side of equation (14), differences in the inverse matrices of input coefficients weighted with the t+1 level of final demand, result in the gross production change between t and t+1 that is attributed exclusively to changing technical coefficients given period t+1 final demand. In the second term, the difference of final demand weighted with the inverse input coefficients of the year t results in the gross production change between t and t+1, solely attributable to changes in final demand.

4. Results

4.1 Multiplier Analysis

Based on the constructed interregional SAM, results from the decomposition of interregional and intra-regional multiplier matrices are presented below. Results presented in this section are for year 1998 because they reflect better the structure of the interregional economy. Table 3 (last column) shows the aggregate interregional output multipliers from the interregional SAM model; these figures indicate the impacts on the industry accounts of a unitary change in final demand for sectoral output. For example, results suggest that an increase of 1 ml. Drs in demand for output from the food-processing sector in Archanes would result in an increase of Drs 1.711 ml. in total industrial activity in this area; however, at the same time, this shock will increase industrial activity in N. Kazantzakis by Drs 0.174 ml. and in Heraklion by Drs 0.345 ml.

In the case of Archanes, own-region output multipliers (M_{r3}*M_{r1}) range from 1.179 for the timber and furniture sector to 1.785 for other agriculture sector. Multiplier values for the area's key sectors (vine-growing, olive-growing, food processing) seem to be quite high because of high level of linkages between these sectors and the rest of the Archanes economy. These sectors seem to present the greater potential for stimulating local economic activity. Also, it seems that the diffusion of impacts is considerably stronger towards the urban area of Heraklion,

[4] For differences in employment, in equation (14) the inverse matrices and the final demands are replaced by SAM matrices and employment coefficients, respectively, for two different years.

than to the adjacent rural area of N. Kazantzakis. This is due to high level of interregional linkages between Archanes and Heraklion caused by the fact that communication from Archanes to Heraklion is rather satisfactory, while the same argument does not hold for N. Kazantzakis.

Table 3 Aggregate Output Multipliers, 1998

ARCHANES	**Archanes**	**N. Kazantzakis**	**Heraklion**	**Aggregate**
Vine-growing	1.674	0.089	0.387	2.150
Olive-growing	1.687	0.095	0.375	2.157
Other Agriculture	1.785	0.085	0.407	2.277
Food Processing	1.711	0.174	0.345	2.230
Timber & Furniture	1.179	0.036	1.115	2.330
Metal Products	1.223	0.055	0.240	1.518
Construction	1.544	0.142	0.463	2.149
Trade	1.399	0.081	0.639	2.118
Hotels & Restaurants	1.442	0.090	0.375	1.907
Research & Develop.	1.247	0.045	0.544	1.836
Public Administration	1.643	0.122	0.606	2.371
Health & Social Care	1.533	0.102	0.579	2.214
Other Services	1.521	0.114	0.591	2.226
N. KAZANTZAKIS	**Archanes**	**N. Kazantzakis**	**Heraklion**	**Aggregate**
Vine-growing	0.024	1.421	0.254	1.699
Olive-growing	0.036	1.414	0.285	1.735
Other Agriculture	0.045	1.476	0.365	1.886
Food Processing	0.031	1.372	0.250	1.653
Timber & Furniture	0.027	1.265	0.419	2.711
Metal Products	0.019	1.195	0.564	1.778
Construction	0.056	1.476	0.351	1.883
Trade	0.043	1.300	0.769	2.112
Hotels & Restaurants	0.071	1.383	0.447	1.901
Public Administration	0.057	1.648	0.522	2.227
Health and Social Care	0.041	1.420	0.605	2.066
Other Services	0.050	1.309	0.444	1.803
HERAKLION	**Archanes**	**N. Kazantzakis**	**Heraklion**	**Aggregate**
Agriculture	0.012	0.013	1.764	1.789
Manufacturing	0.017	0.016	1.538	1.571
Construction	0.010	0.010	1.825	1.845
Trade	0.019	0.025	1.979	2.023
Hotels & Restaurants	0.009	0.012	1.680	1.701
Transport & Comm.	0.010	0.011	1.987	2.008
Research & Develop.	0.010	0.010	1.854	1.874
Public Admin. & Health	0.012	0.012	2.013	2.037
Other Services	0.016	0.017	1.928	2.117

Own-region output multipliers for the area of N. Kazantzakis are smaller compared to those of Archanes. Again, key sectors of the area (agriculture, food processing, and construction) seem to possess a satisfactory capacity for creating local output. The diffusion of economic activity from N. Kazantzakis towards Heraklion seems to be much larger than its equivalent towards Archanes with the sectors of trade and public administration seeming especially able to stimulate economic activity in both areas. Also, it is worth noticing that in general, urban (Heraklion) impacts originating from Archanes are larger than those that originate from N. Kazantzakis. Furthermore, economic activity in Archanes seems to generate a higher benefit to the N. Kazantzakis economy than vice versa. This is due the fact that firms of N. Kazantzakis buy a significant share of their inputs from Archanes.

In the case of the urban area, own-region multiplier values range from 1.538 for manufacturing to 2.103 for public administration and health. Moreover, the trade and the transport and communications sectors have the second and third rank importance for multiplier values. The diffusion of economic activity to both rural areas is marginal, with those towards N. Kazantzakis being a bit higher

The most important findings from Table 3 are that, in general, own-region output multipliers relating to the two rural areas are smaller than the equivalent urban areas multipliers. This can be explained by the fact that the urban area has a much-diversified economic structure and thus the ability to retain the benefits of increased exogenous demand, while the same argument does not hold for the two rural areas. Furthermore, this finding shows that the urban area of Heraklion still 'concentrates' economic activity in the wider area. Own-region output multipliers of the Archanes economy are larger than the equivalent of N. Kazantzakis, indicating that Archanes is a more diversified and developed economy compared to its neighbouring rural area. Also, in both rural areas, the agricultural sectors seem to create important economic benefits. Finally, both rural areas create economic benefits especially for the urban area of Heraklion and secondarily between them. The diffusion of economic activity from Archanes towards the urban centre of Heraklion seems to be much larger than that of N. Kazantzakis while Archanes generates a higher diffusion of economic benefits towards N. Kazantzakis than vice versa.

Table 4 presents aggregate household multipliers for the three areas, distinguished by income group; these figures indicate the impact on total household incomes in a region from a unitary change in the income of a rural/urban household group. For example, results suggest that an increase of 1 ml. Drs in the income of poor households in Archanes would result in an increase of Drs 1.324 ml. in total household income in this area; however, at the same time, this shock would increase household income in N. Kazantzakis by Drs 0.030 ml. and in Heraklion by

Drs 0.198 ml. The urban aggregate multiplier is higher than those of the two rural areas, while income multipliers in Archanes are higher than those in N. Kazantzakis. Also, it seems that the diffusion of rural areas' household income impacts (especially of N. Kazantzakis) is considerably stronger towards the urban area of Heraklion and rather weak between them. Moreover, middle-income households of Archanes and poor households of N. Kazantzakis seem to possess a higher income-generating potential than the rich income-group in both areas.

Table 4: Aggregate Household Multipliers

ARCHANES	**Archanes**	**N. Kazantzakis**	**Heraklion**	**Aggregate**
Poor Households	1.324	0.030	0.198	1.552
Middle Income Households	1.321	0.035	0.255	1.611
Rich Households	1.216	0.029	0.187	1.432
N. KAZANTZAKIS	**Archanes**	**N. Kazantzakis**	**Heraklion**	**Aggregate**
Poor Households	0.025	1.219	0.253	1.497
Middle Income Households	0.025	1.216	0.254	1.495
Rich Households	0.019	1.172	0.269	1.460
HERAKLION	**Archanes**	**N. Kazantzakis**	**Heraklion**	**Aggregate**
Households	0.009	0.007	1.773	1.789

4.2 Structural Changes Analysis

This section presents the results of the left causative matrix for each of the 13 sectors of the Archanes economy; both for 1998 compared with 1988 and for 1988 compared to 1998, based on the deviations of their dominant diagonal elements and sums of their perspective row elements from unity. The two computations are conducted in order to provide a more consistent check of sorts. That is, if the results are asymmetric in interpretation that would raises doubt upon the credibility of approach.

Results for 1988 compared to 1998 show (Table 5) that row sums exceed unity for vine growing, timber and furniture, metal products, construction, research and development and other services. This means that compared to 1998, final demand in these sectors generates strengthened total output impacts in the local economy. Furthermore, sectors with diagonal elements exceeding unity imply increased relative internalization of their own final demand output impacts, meaning that they create (in 1988 compared to 1998) more output to themselves than to other sectors. In the Archanes economy, timber and furniture, metal products, trade, research and development and other services have diagonal

elements exceeding unity, with timber and furniture sector having the highest final demand own-impact.

Table 5 Sectoral Structural Changes Based on Left Causative Matrix Results

Sectors	1988 compared with 1998		1998 compared with 1988	
	Diagonal Elements	Row Sums	Diagonal Elements	Row Sums
Archanes				
Vine-growing	0.924	1.017	1.083	0.958
Olive-growing	0.930	0.949	1.076	1.048
Other Agriculture	0.865	0.895	1.156	1.117
Food Processing	0.813	0.775	1.231	1.263
Timber & Furniture	1.647	1.610	0.607	0.630
Metal Products	1.096	1.033	0.912	0.974
Construction	0.898	0.982	1.113	1.017
Trade	1.044	0.710	0.865	1.133
Hotels & Restaurants	0.941	0.951	1.063	1.049
Research & Development	1.115	1.122	0.897	0.891
Public Administration	0.975	0.981	1.026	1.019
Health and Social Care	0.969	0.967	1.032	1.031
Other Services	1.004	1.044	0.996	0.949

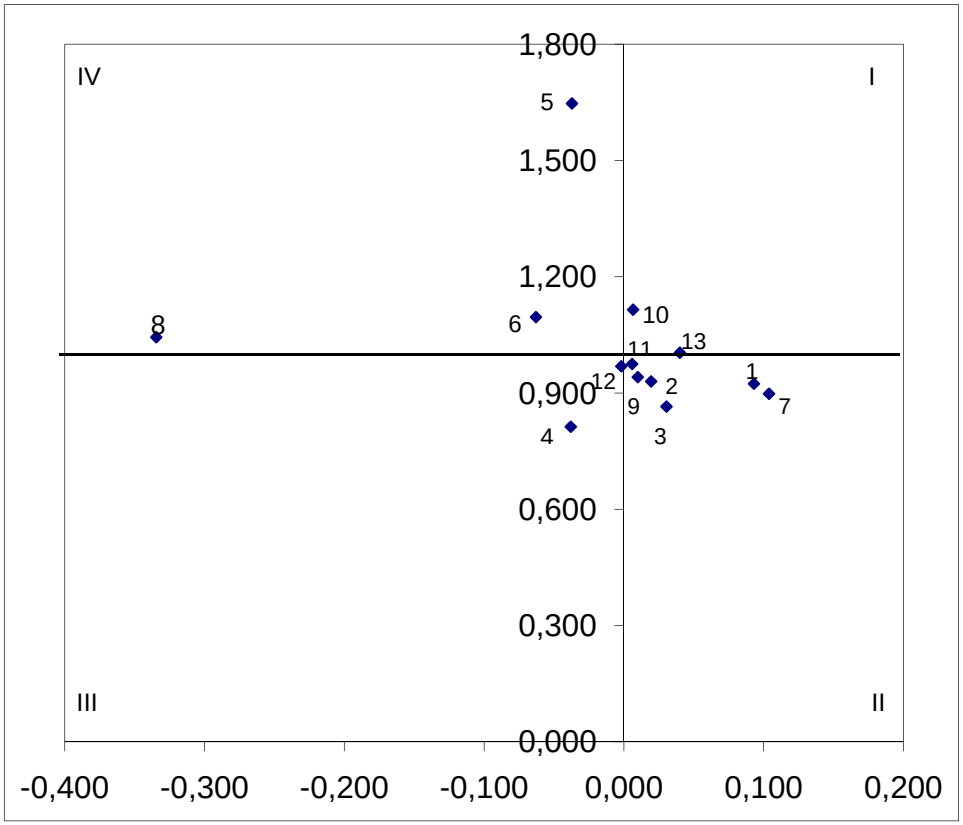
Results for 1998 compared with 1988 indicate that row sums exceed unity for a higher number of sectors, namely, olive growing, other agriculture, food processing, construction, trade, hotel and restaurants, public administration and health and social care sectors. Thus, compared to 1988, these sectors are more competitive in supplying the requirements of sectors in the local economy and therefore, they have a greater contribution to output multipliers than other sectors. Sectors, such as vine growing, timber and furniture, metal products, research, and other services, have row sums less than 1, indicating that they have become less important suppliers to sectors of the Archanes economy. Sectors with diagonal elements exceeding unity, in Archanes economy, are the three sectors of agriculture, food processing, construction, hotel and restaurants, public administration and health and social care. Compared to the impacts that they generate to other sectors in the local economy, it seems that they now generate more output for themselves.

Figure 1 presents the graphical typology of different type of structural changes for the 13 sectors of the Archanes economy, for 1988 compared with 1998 based on the results of the left causative matrix. According to Jackson *et al.* (1990) sectors are classified to four categories based on two criteria:

– The deviations of their respective diagonal elements from 1, with positive deviations indicating increased relative endogenization of their own final demand output impacts (horizontal axis), and

– The deviations from zero of the sums of their respective off – diagonal row elements, with positive deviations reflecting increased relative output impacts on the sector engendered by final demand in all other sectors (vertical axis).

Figure 1 A Graphical Typology of Sector – Specific Archanes Structural Changes, 1988 – 1998, based on the Left Causative Matrix Method



Notes: I = diagonal elements >1 and sum of off – diagonal row elements > 0

II = diagonal elements <1 and sum of off – diagonal row elements > 0

III = diagonal elements < 1 and sum of off – diagonal row elements < 0

IV = diagonal elements >1 and sum of off – diagonal row elements < 0

According to these criteria, for 1988 compared to 1988, the majority of regional sectors are classified as Type II. Own – sectors final demands are increasingly stimulating other sectors' output, while other sectors' final demands, on balance, are stimulating greater output impacts within these sectors. The opposite reaction is shown for Type IV sectors, for example trade. Type I sectors, namely research and development and other services, are characterized by greater endogenization of their own final demand impacts and increased output impacts engendered from other sectors. The last two sectors, food processing and health and social care are Type III sectors. More own – sector final demand output impacts are shared out to other sectors, and other sectors' final demands are stimulating less output in these two sectors.

The analysis of structural changes with the use of left causative matrix revealed that during the period 1988 – 1998 the structure of Archanes economy has changed significantly. In 1988 the majority of Archanes economy was classified as Type II sectors, where their own final demand impacts generated less output in the other sectors of the economy. In 1998 the majority of Archanes economy is classified as Type IV sectors. This means that the local economy has the potential to stimulate more output to the other sectors of the economy, having now greater multiplier effects. Moreover, it is obvious that the sectors of the Archanes economy have increased their interdependencies and linkages in the local economy due to structural changes. All these show that there is an expansion of economic activity and, as a result, an economic development in Archanes economy.

Decomposition of Structural Changes. Differences between 1988 and 1998 can be distinguished into two general categories of structural changes and identified as changes in technical coefficients and changes in final demand. The SAM of 1988 was valued at 1998 prices using GDP deflator. This was done in order structural decomposition analysis to be free from problems caused by inflation (e.g. greater differences in production between 1988-1998). Table 6 shows the sources of output changes in the Archanes economy between 1988 and 1998. The first column presents the total percentage changes in sectoral gross output. The second column presents the percentage change in sectoral gross output, solely attributed to changes in technical coefficients. In more than half of the regional production sectors, changing coefficients result in increases in their output requirements. The largest positive impact of changing technical relationships on gross output requirements is observed in health and social care, research and development and other agriculture sectors. Only two sectors, metal products and hotels and restaurants, present a reduction in output requirements.

Table 6 Decomposition of Forces Determining Output Change Between 1988-1998
% Change in Gross Output

Sectors	Total	Due to Technical Coefficients	Due to Final Demand	Due to Structural Policies	Due to the Rest Final Demand
Archanes	**83.8**	**12.1**	**71.7**	**20.3**	**51.4**
Vine-growing	66.4	23.9	42.5	7.4	35.1
Olive-growing	63.3	29.6	33.7	7.0	26.7
Other Agriculture	140.8	52.4	88.4	9.9	78.5
Food Processing	20.2	3.3	16.9	9.5	7.3
Timber & Furniture	98.5	5.5	93.0	14.3	78.7
Metal Products	3.7	-4.4	8.1	25.5	-17.4
Construction	80.3	33.8	46.5	368.4	-321.9
Trade	8.3	1.0	7.2	13.4	-6.2
Hotels & Restaurants	424.7	-6.5	431.2	9.7	421.6
Research & Development	29540.7	194.6	29347.5	0.8	29346.6
Public Administration	140.6	25.5	115.0	9.1	105.9
Health and Social Care	394.5	316.9	77.6	2.9	74.7
Other Services	160.6	44.8	115.8	6.9	108.9

The third column shows the percentage change in gross production that is exclusively due to changes in final demand. It is noteworthy that changes in final demand seem to have increased sectoral gross output in all regional sectors. The largest percentage increase occurs in research and development, hotels and restaurants and other services. Comparing the percentage changes due to final demand with those attributed to changes in technical coefficients it is observed that in all sectors, with the exception of health and social care, the impact of final demand on gross production was much higher. In other words, during the 1988-1998 study period, final demand changes increased sectoral gross output significantly more than technical coefficients change.

Column 4 indicates the contribution of structural policy action on final demand change between 1988 and 1998. Estimations show that in total, structural policy injections was responsible for around 20,3% of gross output change in Archanes during this period. The contribution of structural-policy-specific final demand change seems to be substantial in construction, timber and furniture, metal products and trade. Even though structural policy seems to minimally affect final demand in hotels and restaurants, it should be noted that this finding cannot account for the fact that the significant change of other types of final demand (i.e. tourist demand) for this sector is in fact indirectly attributed to structural policy

action (as renovations, establishment of agrotourism units, improvements in transport, etc. are in fact "responsible" for the increase in local tourism).

4.3 Impact Analysis

Given the estimated interregional linkages, an indication of the estimation of the economic impacts of Structural Policy implemented in Archanes and their diffusion in the three study areas is provided in this section. The Structural Policy measures were grouped into five categories, namely, public infrastructure, environment and culture, farm income support, increase of agricultural productivity and economic diversification. Policy expenditures for period 1988-98 were first identified on a project-basis or/and CAP regime basis (in the case of Guarantee subsidies), classified in terms of directed demand for sectoral output, and then treated as injections of expenditure (in base-year prices) into the Archanes economy (1988), from both public (EU and national government) and private sources. Subsequently, following the traditional Leontief procedure, growth-generating impacts were estimated, in terms of average annual effects.

Results (Table 7) indicate that for the Archanes economy, the impacts of farm income support measures are by far the highest, especially in the case of firm and household income effects. On the other hand, public infrastructure measures seem to be able to generate satisfactory output and employment impacts in Archanes. In the case of income distribution, results show that farm income support measures mostly benefit the rich Archanes households. This pattern of income distribution is different in the case of public infrastructure, environment and culture and diversification of economic activity measures where changes are in favour of middle-income households. Also, results for N. Kazantzakis are in the same direction, but compared to Archanes, generated income seems to accrue even more in favour of rich households, and 'against' poor ones.

The diffusion of economic impacts away from Archanes economy is rather lower than that expected for a small open local economy. The proportions of economic impacts that remain in Archanes are especially high in the case of the output (76.4% of total impacts stay in Archanes) and employment effects generated by public infrastructure, environment and culture (65% and 69.2%, respectively) and economic diversification measures (76.4% and 75.9%, respectively) and also in terms of the firm (85.8%) and household income (63%) effects generated by farm income support. As possibly expected, related economic benefits leak primarily to the urban area and marginally to the less – developed agriculturally dependent neighbouring rural area. Farm income support and increasing farm productivity measures leak significant output and household income benefits to Heraklion, while the other three measures generate significant firm and household

income effects to this area. Farm income support measures generate the highest diffusion for N. Kazantzakis, in the case of generated output (11.6%) and employment (15%), while environment and culture and public infrastructure measures generate the highest firm income and employment benefits to N. Kazantzakis.

Table 7 Impact Analysis of Structural and Agricultural Policies Implementation in Archanes, 1988-98

(ml Drs. 1988 prices)

	Annual Average Expenditure	Archanes		N.Kazantzakis		Heraklion	
		ml.Drs	%	ml.Drs	%	ml.Drs	%
		Output Effects					
Public Infrastructure	229.2	331.8	5.9	22.1	0.3	80.2	0.04
Environment and Culture	196.1	269.8	4.8	24.3	0.3	121.2	0.06
Farm Income Support	715.0	285.5	5.1	69.1	0.8	240.2	0.1
Aids to Increase Farm Productivity	179.4	88.6	1.6	17.9	0.2	64.6	0.03
Aids to Economic Diversification	108.5	157.1	2.8	10.5	0.1	38.0	0.01
		Firm Income Effects					
Public Infrastructure	229.2	94.0	4.5	7.3	0.2	29.8	0.04
Environment and Culture	196.1	127.4	6.1	9.8	0.3	46.9	0.08
Farm Income Support	715.0	801.5	38.2	27.9	0.9	105.1	0.2
Aids to Increase Farm Productivity	179.4	189.1	9.0	7.2	0.2	27.7	0.04
Aids to Economic Diversification	108.5	44.5	2.1	3.5	0.1	14.1	0.02

Structural Policy Expenditure	Archanes		N. Kazantzakis		Heraklion	
	ml.Drs	%	ml.Drs	%	ml.Drs	%
	Total Household Income Effects					
Public Infrastructure	100.0	2.4	7.1	0.1	43.6	0.03
Environment and Culture	104.7	2.5	8.4	0.2	65.5	0.04
Farm Income Support	331.8	7.9	40.7	0.8	154.4	0.1
Aids to Increase Farm Productivity	89.5	2.1	7.0	0.1	40.9	0.03
Aids to Economic Diversification	47.3	1.1	3.3	0.06	20.6	0.01

Structural Policy Expenditure	Archanes		N. Kazantzakis		Heraklion	
	No. jobs	%	No. jobs	%	No. jobs	%
	Employment Effects					
Public Infrastructure	126	7.6	12	0.5	27	0.07
Environment and Culture	138	8.3	16	0.7	42	0.1
Farm Income Support	163	9.8	43	1.8	82	0.2
Aids to Increase Farm Productivity	52	3.1	11	0.5	22	0.05
Aids to Economic Diversification	60	3.6	6	0.2	13	0.03

Structural Policy Expenditure	Archanes		N. Kazantzakis	
	ml. Drs	%	ml. Drs	%
	Poor Household Income Effects			
Public Infrastructure	9.2	1.1	0.5	0.1
Environment and Culture	10.0	1.2	0.6	0.1
Farm Income Support	53.6	6.7	1.4	0.3
Aids to Increase Farm Productivity	13.4	1.7	0.4	0.07
Aids to Economic Diversification	4.3	0.5	0.2	0.04
	Middle Household Income Effects			
Public Infrastructure	46.3	2.3	3.2	0.1
Environment and Culture	45.9	2.2	3.5	0.1
Farm Income Support	21.5	1.0	11.4	0.4
Aids to Increase Farm Productivity	11.7	0.6	3.0	0.1
Aids to Economic Diversification	21.9	1.1	1.5	0.06
	Rich Household Income Effects			
Public Infrastructure	44.5	3.4	3.4	0.2
Environment and Culture	48.8	3.7	4.3	0.3
Farm Income Support	256.7	19.4	27.9	1.6
Aids to Increase Farm Productivity	64.4	4.9	3.6	0.2
Aids to Economic Diversification	21.1	1.6	1.6	0.1

5. Conclusions

This paper has attempted to analyze structural changes in the structure of Archanes economy (before and after structural policy implementation) and, furthermore, to assess the effects of structural policies implemented in the rural town of Archanes during the 1990s, in terms of the extent of economic impacts and their diffusion patterns to adjacent rural-urban localities, namely the less-developed agriculturally-dependent neighbouring rural area of N. Kazantzakis, and the adjacent urban area of Heraklion. For fulfilling these objectives, a hybrid, three-

area interregional Social Accounting Matrix (SAM) model was constructed and used to analyze structural changes and structural policy diffusion patterns within and between these rural-urban localities. Structural changes in Archanes economy were estimated using a causative matrix approach, while structural decomposition analysis provided an indication of the attribution of local output growth to changes in technical coefficients and changes in the composition of final demand. Furthermore, we estimate the diffusion patterns of structural policy impacts in terms of generated output, household (distinguished by different income levels) and firm income, and employment in and between the three areas.

The results of this analysis suggest a number of important findings. First, own-region output multipliers relating to the two rural areas are smaller than the equivalent urban areas multipliers, showing that the urban area of Heraklion still 'concentrates' economic activity in the wider area. Moreover, own-region output multipliers of Archanes economy are larger than those of N. Kazantzakis indicating that Archanes is a more diversified and developed economy compared to its neighbouring rural area. Also, both rural areas create economic benefits especially for the urban area of Heraklion and secondarily between them. Output multipliers revealed that the diffusion of economic activity from Archanes towards the urban centre of Heraklion seems to be much larger than that of N. Kazantzakis. Moreover, Archanes generates a higher diffusion of economic benefits towards N. Kazantzakis than vice versa, while the urban centre of Heraklion has very marginal linkages with both rural areas with those towards N. Kazantzakis being a bit higher.

Second, the analysis of structural changes with the use of left causative matrix revealed that during the period 1988—1998 the structure of Archanes economy has changed significantly. Now the majority of Archanes sectors have the potential to stimulate more output to the other sectors of the economy, having now greater multiplier effects. Also, they have increased their interdependencies and linkages in the local economy due to structural changes. All these show that there is an expansion of economic activity and as a result an economic development in Archanes economy.

Third, structural decomposition analysis showed that the effects of final demand on gross production were more important than those occurred due to changes in the regional technical coefficients. This means that an increase in final demand for sectoral output in Archanes generates a significant stimulation of local economic activity. Successively, structural-policy-specific final demand (especially in the case of important local sectors) seems to be directly "responsible" for increased local economic activity during 1988-98. Estimations show structural policy injections was responsible for around 20.3% of gross output change in Archanes during this period. The contribution of structural-policy-specific final

demand change seems to be substantial in construction, timber and furniture, metal products and trade.

Finally, impact analysis results suggest that farm income support measures have generated significant impacts for the Archanes economy, especially in terms of firm and household incomes, while public infrastructure measures generated impacts in terms of output and employment. Also, farm income support and increase of farm productivity measures mostly generate income for rich households, in both rural areas, while the other three measures generate higher income for middle-income households. Moreover, economic benefits leak primarily to the 'affluent' urban area of Heraklion and only marginally to the less-developed agriculturally dependent neighbouring area of N. Kazantzakis. Policy measure-specific impacts seem to be quite different, as CAP *support* measures (farm income support and increase productivity measures) implemented in Archanes are associated with comparatively high output and household income benefits for Heraklion and high output and employment benefits for N. Kazantzakis. *Development* measures (public infrastructure, environment and culture, diversification of economic activity) seem to be more successful in generating firm and household incomes in Heraklion and firm income and employment in N. Kazantzakis.

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