Multiplier Decomposition within Regional SAMs: the case of Andalusia*

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ABSTRACT

In this work we present a methodology of multipliers decomposition (including an employment multiplier), for a regional economy as Andalusia using Social Accounting Matrices (SAM). These matrices are able to enlarge the information provided by the input-output analysis, because they complete the interindustrial flows of an economy with the behaviour of productive factors, consumers, public sector and foreign sector. This database allows us to capture conclusions about intersectoral dependences in a region in a double sense: firstly, from a partial perspective based on the results derived for every year, and secondly from an structural point of view along the decade of the nineties.

Keywords: ***social accounting matrix, regional accounting, structural analysis.***

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1. Introduction

Social accounting matrices (SAM) are databases comprising economic transactions and information about the economic agents such as the producers, the consumers, the government and the foreign sector; as well as the productive factors. They complete the information provided by the input-output analysis (IOA thereafter), with the regional or national accounting and the surveys of family constraints, among other databases.

The interest on SAMs is based on the fact that not only do they study the production relationships among the economic sectors, but also the transactions that take place among the different institutions of an economic system in terms of revenues or consumption. Besides their statistical content, the SAMs have became an useful instrument for evaluation of interventions from the political economy in national or regional economies.

If a SAM is available for more than one year, it is feasible to carry out a complete analysis of the productive structure and a perspective of the changes that have occurred. Several methodologies are able to outline such analysis in a particular economy and we develop one of them in this paper, the so called multiplier decomposition. In the next section, we apply the classical multiplier decomposition methodology to derive the *own, open and circular effects*. In section three we proceed to calculation of an employment multiplier in order to get some valuable information in terms of elasticity between economic activity and capacity of employment creation. In section four, we come up with an empirical application of this methodology on the SAMs for Andalusia in the years 1990 and 1995 which have been elaborated in previous works[1]. We will also use a first estimate for the SAM for Andalusia 1999[2]. This exercise will point out the multipliers decomposition for this regional economy, the type of interrelationships and the nature of linkages inside it. In section five we outline the main results and conclusions.

2. The classical multiplier decomposition applied to Social Accounting Matrices.

In this paper we work with multisectoral linear models, in which we assume the exogeneity of the prices. We consider as endogenous those accounts that are part of the

economic interrelations determined outside of the economic system (production factors, productive sectors and private sector); while the exogenous ones are tools for the political economy (as the public sector, foreign sector and capital)[3].

The multipliers decomposition methodology was initially proposed by Stone (1978) and Pyatt and Round (1979). Later on, Defourney and Thorbecke (1984) and again Pyatt and Round (1985) have been working on it. We also have Spanish references as those by Polo, Roland-Holst and Sancho (1991), among others. It is also interesting to highlight the works from the regional point of view developed by Cardenete and Sancho (2003) for Andalusia, de Miguel, Manresa and Ramajo (1998) for Extremadura or Llop and Manresa (2003) for Catalonia.

The formulation of these linear models of general equilibrium is the following:

Let y_n be:

$$y_n = \left(I - A_n\right)^{-1} \cdot x = Ma \cdot x \qquad (1)$$

where y_n is the column vector of total rents of the endogenous accounts, I is an identity matrix of order n x n, An is the average tendency matrix of expenditure between the different endogenous accounts and x is the vector that collects the flows of rent that the endogenous accounts receive from the exogenous ones.

A generic element of An as a_{ij} is interpreted as the expense carried out in i per each unit of expense of the sector j. Ma is the so called Accounting Multipliers Matrix and an element ma_{ij} indicates the effect that an exogenous unit of rent on an endogenous account j, generates on the rent of the endogenous account i. In other words, the interpretation would be how many monetary units of rent are generated in sector i because of the circular flow of rent when sector j receives a unitary shock. If we sum up these values of Ma by columns, we get the total effect of an exogenous shock received by one account on the rest of the economic activity. This way, the account with the greatest multiplier value points out one sector with an important influence on the rest of the economy when it is involved in an economic development policy.

The decomposition of multipliers can be carried out in two ways: additive or multiplicative. Both of them allow us to split the process of generation of rents in an economy. In this work we use the multiplicative procedure, which distinguishes among the own effects, open effects and lastly, circular effects.

So as to decompose in diverse submatrices, we begin by dividing *An*, in three components corresponding to added value, institutions and productive sectors:

$$A_n = \begin{pmatrix} 0 & 0 & A_{13} \\ A_{21} & A_{22} & 0 \\ 0 & A_{32} & A_{33} \end{pmatrix} \tag{2}$$

Starting from (2) we have a new matrix *An'* of the same dimension where we make zero in all the elements except those in the main diagonal:

$$A_n' = \begin{pmatrix} 0 & 0 & 0 \\ 0 & A_{22} & 0 \\ 0 & 0 & A_{33} \end{pmatrix} \tag{3}$$

From the initial expression, $y_n = A_n y_n + x$, we add and subtract this new matrix:

$$y_n = \left(A_n - A_n^{'}\right) y_n + A_n' y_n + x \tag{4}$$

$$y_n = \left(I - A_n'\right)^{-1} \left[\left(A_n - A_n'\right) y_n + x\right] \tag{5}$$

$$y_n = A^* y_n + \left(I - A_{n'}\right)^{-1} x \tag{6}$$

being $A^* = \left(I - A_n\right)^{-1} \left(A_n - A_n'\right)$.

Multiplying the result of (5) by A^* and repeating the previous step again:

$$y_n = \left(I - A^{*3}\right)^{-1} \left(I + A^* + A^{*2}\right) \left(I - A_n^{'}\right)^{-1} x \tag{7}$$

Finally we get:

$$y_n = Ma_3 Ma_2 Ma_1 x \tag{8}$$

We have decomposed the matrix of countable multipliers in other three matrices by means of a multiplicative expression following Pyatt and Round (1979). The first matrix, is called *matrix of circular effects* and reflects the effect that an exogenous injection of rent generates on the very account due to the circular flow of the rent. By further calculations, we reach the following diagonal expression, since it does not pick up any type of crossed effect:

$$Ma_3 = \begin{pmatrix} \left[I - A_{13}(I - A_{33})^{-1} A_{32}(I - A_{22})^{-1} A_{21}\right]^{-1} & 0 & 0 \\ 0 & \left[I - (I - A_{22})^{-1} A_{21} A_{13}(I - A_{33})^{-1} A_{32}\right]^{-1} & 0 \\ 0 & 0 & \left[I - (I - A_{33})^{-1} A_{32}(I - A_{22})^{-1} A_{21} A_{13}\right]^{-1} \end{pmatrix} \tag{9}$$

The second matrix, is known as the *matrix of open or crossed effects*, and the elements of its main diagonal are identity submatrices. It shows the effects on the rest of accounts of a shock received by one particular account. Its expression is as follows:

$$Ma_2 = \begin{pmatrix} I & A_{13}(I - A_{33})^{-1} A_{32} & A_{13} \\ (I - A_{22})^{-1} A_{21} & I & (I - A_{22})^{-1} A_{21} A_{13} \\ (I - A_{33})^{-1} A_{32}(I - A_{22})^{-1} A_{21} & (I - A_{33})^{-1} A_{32} & I \end{pmatrix} \tag{10}$$

Finally, we have the *matrix of own or internal effects*, also known as matrix of transfers because the first element of the main diagonal is an identity submatrix (there are no transfers among the productive factors), the second shows the transactions among institutions and the later includes the interindustrial transactions, and is in fact the inverse of Leontief. The expression is as follows:

$$Ma_1 = \begin{pmatrix} I & 0 & 0 \\ 0 & (I - A_{22})^{-1} & 0 \\ 0 & 0 & (I - A_{33})^{-1} \end{pmatrix} \quad (11)$$

To interpret the multiplicative decomposition in terms of relative importance of each element on the total effect, we can express the equation (8) by means of an additive transformation:

$$Ma = I + (Ma_1 - I) + (Ma_2 - I)Ma_1 + (Ma_3 - I)Ma_2Ma_1 \quad (12)$$

3. The employment multipliers

In the previous expression, the identity matrix allows to discount the initial injection of rent of each of the effects, so that we work with a net multiplicative decomposition. It is possible to calculate one more multiplier to extract the accounts that generate more employment when receiving a unitary exogenous injection of rent. The *employment multipliers* are the result, in the first place, of a new diagonal matrix that we call *E*. This matrix includes the quotients between the volume of employment and the total resources for each productive sector. In the second place, we multiply this matrix with the part of *Ma* that incorporates the rows and columns corresponding to the productive sectors (in our case the order of this matrix is *10x13*). When increasing the rent of an endogenous account, we will obtain the effects of this change in the corresponding column of the partition of *Ma* and, by means of the diagonal matrix *E*, we convert this impact into number of jobs. This way the expression of the *employment multiplier*, *Me*, is the following:

$$Me = E * Ma \quad (13)$$

An element me_{ij}, is the increment experienced in the volume of employment of the sector *i* when the sector *j* receives a unitary exogenous injection[4]. If we analyse the sum of columns, we have the effect on the employment at a global level, which entails the reception of an exogenous monetary unit on a particular sector. As far as rows is concerned, they show the increment that the activity sector in question experiences in its

employment if the rest of sectors receive the exogenous monetary unit. As we are dealing with very small figures in absolute terms, we proceed to the normalization of the multipliers based on the average values by row and column and total average value. We get the new results by following these steps:

- We calculate the columns and row average values.
- We derive the total average value by means of the sum of all the values of *Me* divided by the number of elements of *Me*.
- We divide the average values by rows and columns by the total average value. If the result is greater than 1, the normalized figure indicates an employment multiplier over the average.

By this process we can carry out comparisons that can be easily interpreted. Accordingly, they can be used as a reference to contrast if a value is greater than what we consider an average reaction or not. Thereby, we get a classification of sectors that are able to transform its activity increments into new employment.

4. Empirical application to Andalusian economy

By applying the previous theoretical analysis on the SAM of Andalusia, we have obtained four types of multipliers: those that measure the own, open, circular effects, and finally, the employment multipliers. If we had carried out a decomposition of multipliers on the inverse of Leontief's theory instead of on the SAM, we would have found the limitation that the first one has no capacity to measure the feedback effects or interdependences generated by an exogenous shock on the final demand of a particular sector. That is to say, the multipliers obtained working with SAMs incorporate all the flows that take place between the institutions and the productive sectors (the induced effects if we carry out an additive multipliers decomposition or the circular effects if we follow the terminology of the multiplicative one). Therefore, we can affirm that the difference between the multipliers calculated according to the SAM and the input-output ones, is in fact the value of this third multiplier that captures the feed-back again from the institutions toward the

activity sectors, once the initial impulse has been transmitted from the productive sectors to the institutions.

To start with, we outline the structure of the SAM we are using. Such SAMs for Andalusia belong to the years 1990, 1995 and an approach to 1999 by means of an updating technique called *Cross Entropy Method (CEM)* on the SAM for 1995. In our endogenous accounts we find the two productive factors (capital and labour), the private sector represented by the consumers and finally ten activity sectors. Our exogenous accounts, following the most common approaches in the literature are three: public sector, savings and investment, and foreign sector. Our three databases have been added to 16 accounts as it is shown in the following table:

(Table 1)

With relation to the information on the following tables, we present the value of the multipliers firstly by rows and secondly by columns, although logically, the partial or total added value of the multipliers for every year is the same regardless of the presentation we choose.

The data in the following tables are derived from carrying out a transformation on the multiplicative decomposition. This transformation consists in expressing in an additive way for an easier interpretation and comparison. The data are presented in absolute and percentage terms, in order to quantify the relative importance of each of the mechanisms of transmission of the shocks experienced by the regional economy.

All the following tables are structured in the same way: we display the net total effects of the unitary shock in the first column. In the second, the own net effects are picked up. In the third column the open effects are shown so as to measure the impact on the whole economy of a rent injection received by one account. Finally, we have the circular effects to catch up the reaction of the exogenous accounts as a result of the circular flow of the rent.

The results of the multipliers decomposition for the Andalusian economy throughout the nineties, show that the effects that register a bigger weight in relation to the others, are the circular ones, followed by the open effects and last by the own effects. The role played by the circular effects reaffirms the importance of using SAMs instead of IO tables. There is a single exception to the leadership of the circular effects, namely, labour factor and consumers; in this case, the order of importance between circular and open effects is inverted. This circumstance is similar to the case of the capital factor, although slightly softer.

From a global perspective of the decade, the multipliers measured at added level reach the highest values in 1990, with a descending tendency up to 1999 (this one is next to 60% in some of the cases, see for example Table 2, where the variation rates have been calculated).

(Table 2)

We can observe how a widespread decrease has taken place since 1990. The highest value for 1995 is 17.70% of decrement of the circular net effects. This descent is even stressed in 1999, when there is an outstanding fall of the own net effects (it almost reaches 60%), followed by the circular ones with more than 25%. Finally, the open net effects are not so affected (13.03%). In general the data show a reduction in terms of total effects so that the variation rate is doubled from one period to the other.

If we analyse Table 3 with the aggregate multipliers for 1990, it shows the general behaviour where the circular effects have a high weight that surpasses 40% of the total net effects at the worst, and at best they represent more than 60% (“Extractives” (2) and “Trade and Repair” (9) respectively). The next ones are the open net effects that vary around 30% with the exceptions of the productive factors whose data are considerably bigger, and the “Extractives” (2) whose value is smaller than average. Finally, we have the own net effects with an the oscillation band of 5.14% for “Trade and Repair" (9) in the lower bound and again the “Extractives” (2) ones in the upper with 35.05%.

It is interesting to highlight out the homogeneous behaviour of the sectors corresponding to “Agriculture, Cattle & Forestry and Fishing" (1), "Construction" (5) and all the services in general (from accounts (5) to (10)) with the mentioned exceptions. Another example of similar behaviour is that of the productive factors and the private sector (from account (11) to (13)), while a third block corresponds to the industrial sectors (from (3) and (4)). Lastly, we want to highlight an outlier value included in “Extractives” (2).

(Table 3)

Table 4 presents the results of the multipliers decomposition are shown for 1990 by rows. The biggest values are registered by productive factors together with the private sector. It is also important the role played by the open effects for these three accounts, while the own effects grow in the rest, which is an aspect that is compensated by a reduction in the open effects.

(Table 4)

Next we show the results corresponding to 1995, firstly, by columns in Table 5 and secondly by rows in Table 6:

(Table 5)

For 1995, the circular net effects continue at the top although they register a small fall with respect to the previous year. In spite of this, in most of the accounts they explain more than 50% of the total effect, showing the important feedback of an exogenous shock. The open effects also consolidate positions to the detriment of the own net effects that present a stationary behaviour in the accounts (1), (3), and (4) and a reduction in the rest. In relation to these last effects, again we verify that for the productive factors and the private sector, their value is 0 as we had previously argued.

(Table 6)

As far as rows is concerned, the circular effects are smaller, with some cases of reduction of the multiplier like in "Construction" (5) where there is a fall of more than 50%. The open net effects are also smaller than in columns while the own net effects grow in most of the cases. We verify that these are zero in the same way as in the whole decade for the accounts (11), (12) and (13).

In the third year of analysis, the circular net effects are again the greatest ones as it happened in the other years. The open effects grow slightly with the exception of the accounts of the productive factors and consumers. Similar behaviours are reflected in the Tables 7 and 8.

(Table 7)

(Table 8)

So as to be able to compare the multipliers by means of a temporary analysis, we have elaborated a group of figures where the different effects are taken into account:

(Figure 1)

As we observe in Figure 1, the highest multipliers both in absolute terms and in disaggregated level for each effect, are those of 1990. This shows a bigger activity of the economy before a monetary injection comes from any of the exogenous accounts. In Figure 3 we carry out a comparative analysis of each block of effects through a bars diagram. In this graph we find a certain harmony in the accounts with bigger total effects all through the decade. Those accounts are the “Commercial services”(9), “Non Commercial services” (10) and “Capital"(12). Only for “Commerce"(6), the total effects of 1995 are able to go above those of 1990. Lastly, it is interesting to analyse the important fall in the total effects for some sectors in 1999, for example “Manufacturing industry"(4) or “Extractives” (2), which was a common behaviour in the rest of accounts with the exception of "Labour" (11).

(Figure 2)

The own net effects only take values for the accounts corresponding to the activity sectors, showing a descending tendency with the exception of the “Construction"(5). This account increases from 16.54% to 24.46%, and falls in the last year up to 11.25%.

(Figure 3)

The open net effects register a very homogeneous behaviour during the whole decade, growing steadily from 1990 to 1999. The productive factors and the private sector behave different from the rest, with higher values for the whole period. The circular effects remain stable between 40% and 60%, and the highest multipliers correspond to services and specially to “Commercial services" (6).

(Figure 4)

(Figure 5)

Working on different endogeneity criteria is an interesting exercise to deepen in the relative weight of the mentioned interdependences. Although this is not the object of the present work, we can conclude that whenever we include one more endogenous sector in the analysis, the immediate result is an increment in the value of the multipliers. This is because more variables are part of the feedback flow.

We present now the employment multipliers for the Andalusian economy. The column analysis let us see that the effect on employment of the reception of a monetary unit coming from an exogenous account. Therefore, by means of the revision of the data given by the sum of rows, we can test the increase experienced in the employment of each activity sector after a positive shock on the final demand of the economy.

The present employment multipliers have been normalized by columns and rows. They are very relevant because they can be compared in relation to the average of the sector and with regard to the total average of productive sectors. As we already explained in the previous section, it has been necessary to build a diagonal matrix for every year to obtain

the figure of employment in relation to the total output of the sector. If we apply the coefficients of the SAM, the ten rows of the productive sectors and the thirteen endogenous accounts for columns to the previous ratio, we get these new multipliers.

Table 9 shows the multipliers for 1990. We observe that the accounts with a bigger capacity to generate employment are ”Agriculture, Cattle & Forestry and Fishing"(1), "Construction" (5), “Commerce" (6), “Commercial services"(9) and “Non Commercial services"(10). As we can see, these sectors also registered high values in the previous multipliers decomposition, but there are also some new accounts like the primary sector or the construction. All these sectors react over the average in terms of employment creation when receiving an exogenous shock in their own final demand.

(Table 9)

The rows show us that the accounts (1), (6), (9) and (10) react generating new employment as a consequence of an increment of the final demand. We can use the terminology of “key sectors” for the employment creation in those sectors that show a bigger employment-activity elasticity from the demand or offer point of view. The "Construction" (5) is taken down of this block of sectors and “Manufacturing industry" (6) seems to be more receptive in moments of good economic activity, which will entail the creation of new employment.

Table 10, presents the employment multipliers corresponding to 1995. Reading the figures of the columns, we find again the accounts of the precedent year with the exception of “Construction"(5) which registers a soft slope that locates it below the average reaction. Revising the data by rows, we find the same accounts of 1990. The employment generation capacity of “Commercial services"(9) with 2.7 times the average reaction, is only surpassed by “Commerce"(6). If in 1990 the “Manufacturing industry”(4) registered values below our reference, during this year the situation becomes even worse.

(Table 10)

Finally, Table 11 comprises the employment multipliers for 1999. To begin with the columns, the sectors that, when receiving an increment in their final demand of a monetary

unit, are able to impulse the employment to the rest of activity sectors; are the same ones than in 1995. However, there is a new incorporation that can suppose an important change for Andalusian economic activity. For the first time in the decade of the nineties, the account of “Manufacturing industry”(4) experiences a change that makes it join the group of activity sectors that produce new figures of employment.

(Table 11)

As for rows, there are three accounts that are greater than the established standard and register multipliers greater than one: on the one hand “Commerce"(6) together with “Commercial services"(9) which is strengthened as a key sector in terms of employment, and on the other hand the “Manufacturing industry"(4) that doubles the average. This way, the sector (4) is a key account for the employment creation in 1999 and we also consider it as a key sector for regional economic planning.

We have calculated for all the previous data some variation rates from 1990 to 1995 and from 1990 to 1999, so that we establish a comparison of the situation from the beginning of the period until the end of the period. We found very heterogeneous behaviours, for example the important growth experienced by “Extractives"(2) which is followed by “Manufacturing industry" (4) although if we observe the data in detail, the take off of this multiplier remains stable from 1995 onwards. The rest of accounts register a moderate growth between 10% and 25%. Such is the case of (3), (6), (7) and (9). The most significant fall is a 47% of “Commercial services"(10).

In relation to the evolution by rows, again we highlight the “Extractives"(2), followed by the “Manufacturing industry"(4) and the “Commercial services"(9). Similar reductions take place in the multipliers of the primary sector, the energy production, the construction or the non Commercial services.

5. Conclusions

In this work we have introduced a methodology of classic multipliers decomposition for

SAMs, by means of several multipliers, that separates the derived net effects of an initial shock in own, open and circular effects. The use of the SAM has allowed us to complete the information derived from Leontief technology, as regards quantifying the importance of the feedback effects generated by the own circular flow of rent. In relation to the multipliers decomposition, we have come across with a fall of the total effects of 25% in the whole decade (the own net effects and the circular effects ended up registering a reduction of 60%). We have also noticed that in spite of this falling evolution, the circular effects have the greater values. This fact proves the important feedback that is taking place in the Andalusian economy.

Furthermore, we have completed the analysis of multipliers with a fourth multiplier in terms of number of jobs generated by the mentioned exogenous impulse. Later we have carried out an empiric application for the Andalusian economy, obtaining the corresponding multipliers for three representative years of the decade of the nineties: 1990, 1995 and 1999. The results show those activity sectors with an important effect on the rest, and these results let us analyse the reaction of the private sector, the government or the savings and investments when facing a change in the final demand. We have also found interesting answers in relation to the elasticity of each of the productive sectors as for their capacity to generate employment. The key sectors for this forth multiplier are those that react generating employment above the average value when they receive an exogenous injection or when it is the rest of the economy the one that experiences the shock. Such accounts remain invariable during the decade and they are the primary sector and services in general. It is important to underline that in 1999 we detect a new dynamic account, the one of the "Manufacturing industry" (4) which for the first time contributes to new employment creation. Such a behaviour can entail a new stage for the secondary sector in Andalusia.

In this work we have also outlined those sectors of an economy which can be used to analyse problems of regional planning by means of lineal general equilibrium models using SAMs. The main goal has been to study the internal arrangements within the Andalusian activity sectors from an aggregate point of view, in order to determine their potentialities and weaknesses. This type of exercises can provide economic politicians with interesting information about how to develop regional economies taking into account the capacity of

key sectors to produce economic activity. We also argue for the idea of space association in order to obtain an integrated regional development and a greater effectiveness on the efforts of regional policy.

6. Notes

[1] See Cardenete, M.A. (1998), and Cardenete, M. A. and Moniche, L. (2001), respectively.

[2] This first version has been calculated by the application of an updating technique called CEM (*Cross Entropy Method*) on the SAM for Andalusia 1995, carried out by Cardenete, M.A. and Sancho, F. (2002). Using this methodology, we can introduce known information inside the cells of the estimated SAM (*prior information*), letting us to use it for structural analysis because there are changes in the technical coefficients (see Robinson et al. (2001))

[3] Revising the literature, there are alternative classifications, for example the ones proposed by Polo, C., Roland-Holst, D. and Sancho, F. (1991) that endogenizes the capital account, or that of Llop, M. and Manresa, A. (2003) with an external sector endogenezation.

[4] Additional information about the employment multiplier and a comparison with other type of multipliers, is provided in Arango (1979).

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8. Tables

Table 1. Social Accounting Matrices for Andalusia. Structure (1990-95-99)

Note: Endogenous sectors: from 1 to 13. Exogenous sectors: from 14 to 16.

1	Agri1culture, cattle & forestry and fishing
2	Extractives
3	Electricity and natural gas
4	Manufacturing industry
5	Construction
6	Commerce
7	Transport and Communications
8	Other Services
9	Commercial services
10	Non Commercial services
11	Labour
12	Capital
13	Consumers
14	Savings/Investment
15	Government
16	Foreign sector

Source: Own elaboration.

Table 2: Total, own, open and circular net effects; and variation rates.

	1990	1995	1999	1995/90 %	1999/90 %
Total Net Effects	50.07	44.51	37.29	-11.11%	-25.52%
Own Net Effects	5.70	5.22	2.30	-8.41%	-59.69%
Open Net Effects	17.57	17.23	15.28	-1.94%	-13.03%
Circular Net Effects	26.81	22.06	19.72	-17.70%	-26.45%

Source: Own elaboration from the SAM 1990, 1995 and 1999 for Andalusia.

Table 3: Multipliers decomposition in absolute and percentage terms for 1990. Columns analysis.

Andalusia 1990	Total Net Effects	Own Net Effects	Open Net Effects	Circular Net Effects	% Own Net Effects	% Open Net Effects	% Circular Net Effects
11Labour	4.504	0.000	2.191	2.313	0.00%	48.64%	51.36%
12 Capital	4.504	0.000	2.191	2.313	0.00%	48.64%	51.36%
13 Consummers	3.504	0.000	1.611	1.893	0.00%	45.97%	54.03%
1 Agriculture, cattle & forestry and fishing	4.240	0.511	1.355	2.374	12.05%	31.96%	55.99%
2 Extractives	1.593	0.558	0.376	0.659	35.05%	23.60%	41.35%
3 Electricity and natural gas	3.120	0.780	0.850	1.490	24.99%	27.25%	47.75%
4 Manufacturer industry	2.531	0.647	0.685	1.199	25.58%	27.04%	47.38%
5 Construction	4.211	0.696	1.277	2.237	16.54%	30.33%	53.13%
6 Commerce	3.631	0.443	1.158	2.029	12.20%	31.90%	55.89%
7 Transport and Comunications	3.916	0.513	1.237	2.166	13.11%	31.57%	55.32%
8 Other services	4.912	0.708	1.528	2.677	14.41%	31.10%	54.49%
9 Commercial services	5.089	0.262	1.754	3.073	5.14%	34.47%	60.39%
10 Non-commercial services	4.317	0.578	1.359	2.380	13.40%	31.47%	55.14%
TOTAL	***50.072***	***5.697***	***17.570***	***26.805***	***11.38%***	***35.09%***	***53.53%***

Source: Own elaboration starting from the SAM of Andalusia 1990.

Table 4: Multipliers decomposition in absolute and percentage terms for 1990. Rows analysis.

Andalusia 1990	Total Net Effects	Own Net Effects	Open Net Effects	Circular Net Effects	% Own Net Effects	% Open Net Effects	% Circular Net Effects
11Labour	5.771	0.000	3.113	2.657	0.00%	53.95%	46.05%
12 Capital	6.391	0.000	3.096	3.295	0.00%	48.44%	51.56%
13 Consummers	14.162	0.000	7.789	6.373	0.00%	55.00%	45.00%
1 Agriculture, cattle & forestry and fishing	1.482	0.311	0.232	0.939	21.00%	15.63%	63.37%
2 Extractives	1.828	0.973	0.169	0.686	53.21%	9.26%	37.53%
3 Electricity and natural gas	1.076	0.450	0.124	0.502	41.83%	11.51%	46.66%
4 Manufacturer industry	7.599	1.664	1.174	4.761	21.90%	15.45%	62.65%
5 Construction	0.532	0.101	0.085	0.346	18.94%	16.04%	65.02%
6 Commerce	4.719	0.456	0.844	3.420	9.66%	17.88%	72.47%
7 Transport and Comunications	2.155	0.536	0.320	1.298	24.89%	14.86%	60.25%
8 Other services	2.930	1.023	0.377	1.530	34.90%	12.88%	52.22%
9 Commercial services	1.418	0.182	0.245	0.992	12.85%	17.24%	69.91%
10 Non-commercial services	0.010	0.002	0.002	0.007	18.17%	16.19%	65.64%
TOTAL	***3.852***	***0.438***	***1.352***	***2.062***	***19.80%***	***23.41%***	***56.79%***

Source: Own elaboration starting from the SAM of Andalusia 1990.

Table 5: Multipliers decomposition in absolute and percentage terms for 1995. Column analysis.

Andalusia 1995	Total Net Effects	Own Net Effects	Open Net Effects	Circular Net Effects	% Own Net Effects	% Open Net Effects	% Circular Net Effects
11Labour	2.910	0.000	1.442	1.468	0.00%	49.55%	50.45%
12 Capital	3.931	0.000	1.948	1.983	0.00%	49.55%	50.45%
13 Consummers	2.931	0.000	1.386	1.545	0.00%	47.29%	52.71%
1 Agriculture, cattle & forestry and fishing	3.444	0.437	1.256	1.751	12.68%	36.47%	50.86%
2 Extractives	0.709	0.151	0.236	0.322	21.31%	33.25%	45.44%
3 Electricity and natural gas	3.456	0.860	1.084	1.512	24.88%	31.38%	43.75%
4 Manufacturer industry	2.131	0.570	0.655	0.906	26.73%	30.76%	42.51%
5 Construction	4.027	0.985	1.296	1.746	24.46%	32.18%	43.37%
6 Commerce	4.360	0.542	1.597	2.221	12.44%	36.63%	50.93%
7 Transport and Comunications	3.518	0.490	1.274	1.754	13.94%	36.20%	49.87%
8 Other services	4.071	0.608	1.502	1.962	14.94%	36.88%	48.18%
9 Commercial services	4.707	0.180	1.868	2.659	3.82%	39.69%	56.49%
10 Non-commercial services	4.313	0.396	1.686	2.231	9.17%	39.09%	51.74%
TOTAL	***44.507***	***5.218***	***17.229***	***22.061***	***12.64%***	***38.38%***	***48.98%***

Source: Own elaboration starting from the SAM for Andalusia 1995.

Table 6: Multipliers decomposition in absolute and percentage terms for 1995. Rows analysis.

Andalusia 1995	Total Net Effects	Own Net Effects	Open Net Effects	Circular Net Effects	% Own Net Effects	% Open Net Effects	% Circular Net Effects
11Labour	5.583	0.000	3.287	2.296	0.00%	58.87%	41.13%
12 Capital	7.234	0.000	3.783	3.451	0.00%	52.29%	47.71%
13 Consummers	13.107	0.000	7.563	5.544	0.00%	57.70%	42.30%
1 Agriculture, cattle & forestry and fishing	0.964	0.339	0.121	0.504	35.13%	12.60%	52.27%
2 Extractives	0.585	0.346	0.047	0.193	59.08%	7.95%	32.97%
3 Electricity and natural gas	1.221	0.751	0.091	0.379	61.46%	7.49%	31.06%
4 Manufacturer industry	5.684	1.633	0.787	3.264	28.73%	13.85%	57.43%
5 Construction	0.477	0.300	0.034	0.142	62.96%	7.19%	29.84%
6 Commerce	4.291	0.330	0.769	3.192	7.69%	17.93%	74.38%
7 Transport and Comunications	1.440	0.521	0.179	0.741	36.17%	12.40%	51.43%
8 Other services	2.229	0.737	0.290	1.202	33.06%	13.00%	53.93%
9 Commercial services	1.645	0.246	0.272	1.127	14.95%	16.52%	68.53%
10 Non-commercial services	0.049	0.017	0.006	0.026	34.08%	12.80%	53.11%
TOTAL	***44.507***	***5.218***	***17.229***	***22.061***	***28.72%***	***22.35%***	***48.93%***

Source: Own elaboration starting from the SAM for Andalusia 1995.

Table 7: Multipliers decomposition in absolute and percentage terms for 1999. Columns analysis.

Andalusia 1999	Total Net Effects	Own Net Effects	Open Net Effects	Circular Net Effects	% Own Net Effects	% Open Net Effects	% Circular Net Effects
11Labour	3.686	0.000	1.741	1.945	0.00%	47.23%	52.77%
12 Capital	3.686	0.000	1.741	1.945	0.00%	47.23%	52.77%
13 Consummers	2.686	0.000	1.156	1.530	0.00%	43.04%	56.96%
1 Agriculture, cattle & forestry and fishing	2.589	0.202	1.019	1.369	7.80%	39.35%	52.86%
2 Extractives	0.573	0.115	0.195	0.263	20.12%	34.09%	45.79%
3 Electricity and natural gas	3.001	0.689	0.987	1.325	22.97%	32.87%	44.16%
4 Manufacturer industry	0.356	0.044	0.133	0.179	12.27%	37.44%	50.29%
5 Construction	3.186	0.358	1.207	1.621	11.25%	37.87%	50.88%
6 Commerce	3.791	0.172	1.544	2.074	4.54%	40.74%	54.72%
7 Transport and Comunications	2.640	0.239	1.025	1.376	9.06%	38.81%	52.13%
8 Other services	2.921	0.177	1.171	1.573	6.06%	40.09%	53.85%
9 Commercial services	4.282	0.075	1.795	2.412	1.75%	41.93%	56.32%
10 Non-commercial services	3.893	0.224	1.566	2.103	5.76%	40.22%	54.02%
TOTAL	***37.294***	***2.297***	***15.281***	***19.716***	***7.81%***	***40.07%***	***52.12%***

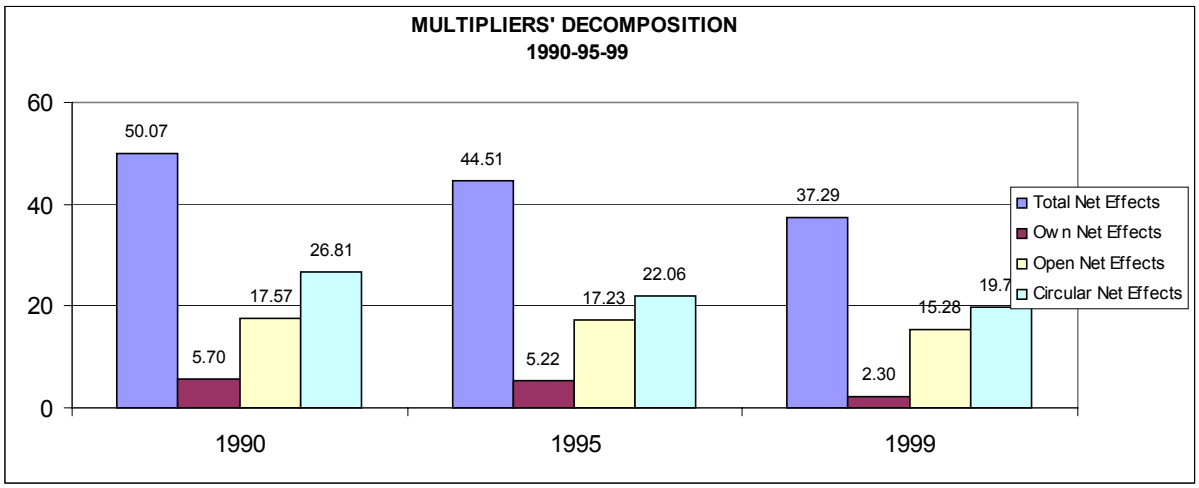
Source: Own elaboration starting from the SAM for Andalusia 1999.

Table 8: Multipliers decomposition in absolute and percentage terms for 1999. Rows analysis.

Andalusia 1999	Efectos Netos Totales	Efectos Netos Propios	Efectos Netos abiertos	Efectos Netos Circulares	% EN Propios	% EN Abiertos	% EN Circulares
11Labour	3.906	0.000	2.136	1.770	0.00%	54.69%	45.31%
12 Capital	7.321	0.000	3.600	3.721	0.00%	49.18%	50.82%
13 Consummers	13.227	0.000	7.321	5.906	0.00%	55.35%	44.65%
1 Agriculture, cattle & forestry and fishing	0.384	0.074	0.065	0.245	19.24%	17.03%	63.73%
2 Extractives	0.224	0.175	0.010	0.038	78.21%	4.59%	17.19%
3 Electricity and natural gas	0.992	0.547	0.094	0.352	55.10%	9.47%	35.43%
4 Manufacturer industry	1.774	0.508	0.267	0.999	28.66%	15.04%	56.30%
5 Construction	0.230	0.141	0.019	0.070	61.35%	8.15%	30.50%
6 Commerce	3.186	0.144	0.641	2.401	4.53%	20.13%	75.34%
7 Transport and Comunications	0.989	0.245	0.157	0.587	24.82%	15.85%	59.33%
8 Other services	2.738	0.328	0.508	1.901	11.99%	18.56%	69.45%
9 Commercial services	2.162	0.121	0.430	1.611	5.60%	19.90%	74.49%
10 Non-commercial services	0.162	0.013	0.031	0.117	7.93%	19.41%	72.65%
TOTAL	***37.294***	***2.297***	***15.281***	***19.716***	***22.88%***	***23.64%***	***53.48%***

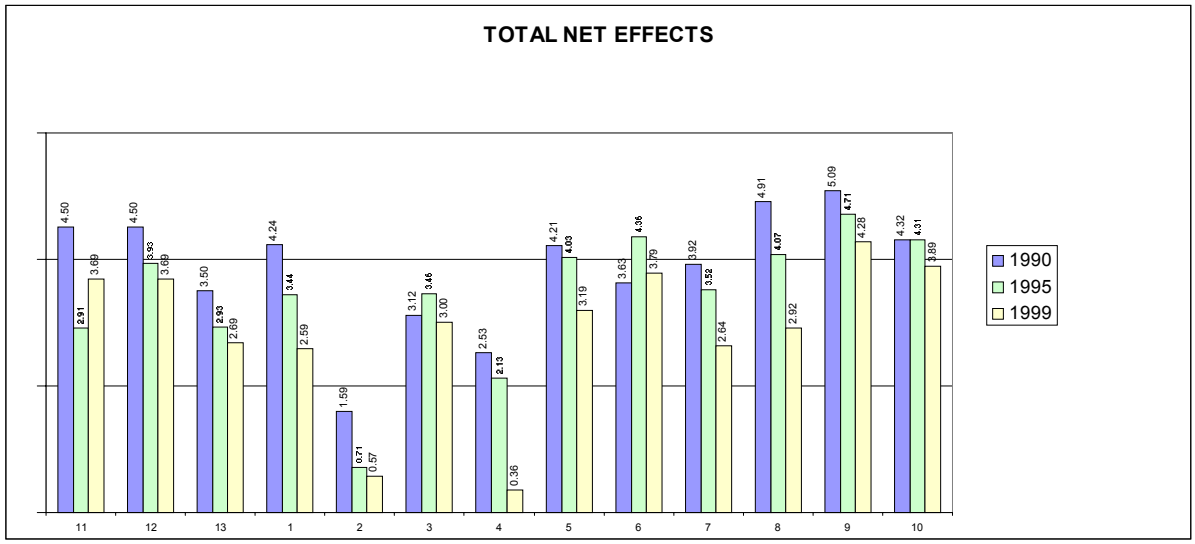
Source: Own elaboration starting from the SAM for Andalusia 1999.

Figure 1: Comparison of the total, own, open and circular net effects for Andalusia in the nineties.



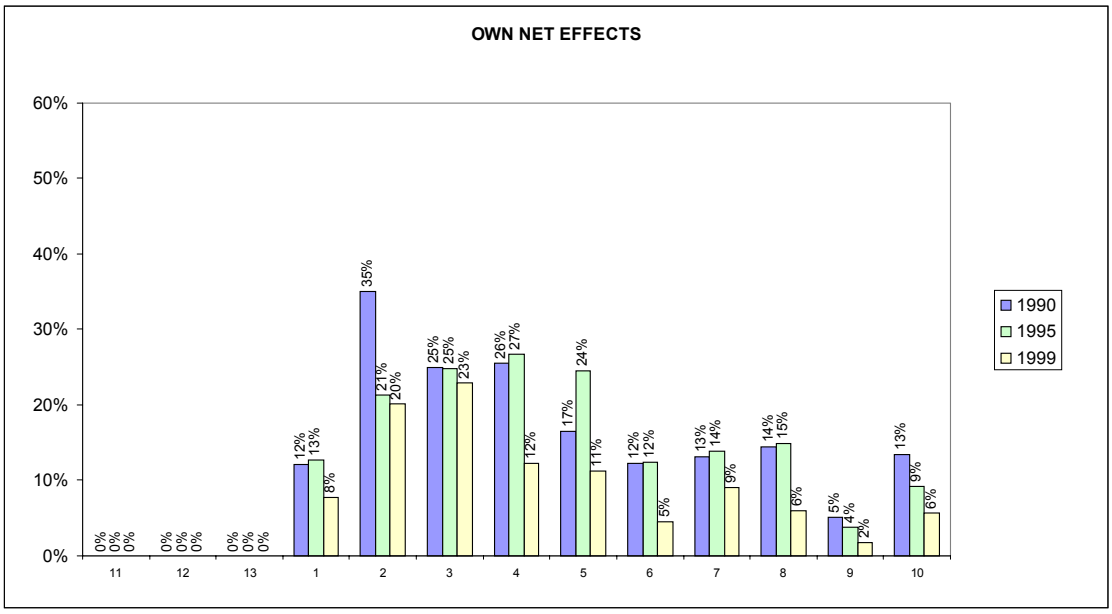
Source: Own elaboration starting from the SAM of Andalusia 1990-95-99.

Figure 2: Temporary evolution of the total net effects for Andalusia along the nineties.



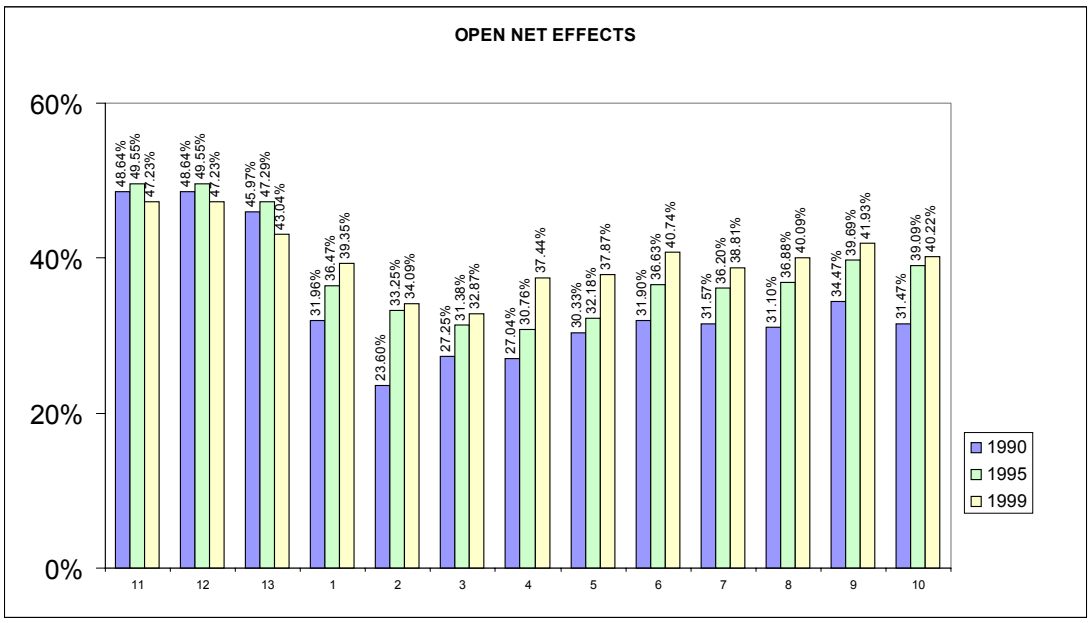
Source: Own elaboration starting from the SAM of Andalusia 1990-95-99.

Figure 3: Temporary evolution of the own net effects for Andalusia along the nineties.



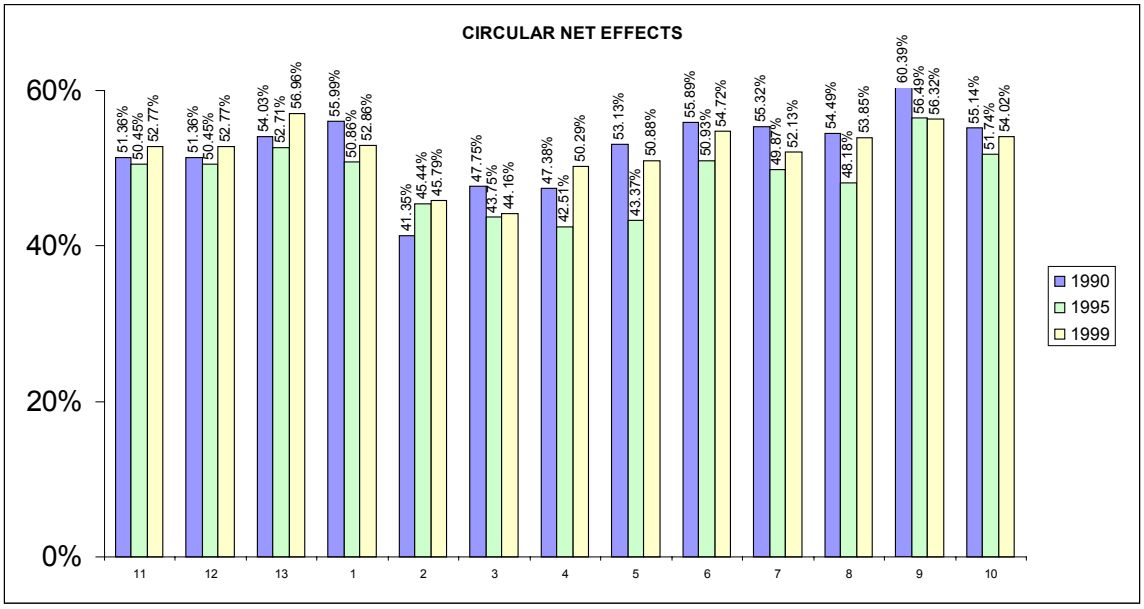
Source: Own elaboration starting from the SAM of Andalusia 1990-95-99.

Figure 4: Temporary evolution of the open net effects for Andalusia along the nineties.



Source: Own elaboration starting from the SAM of Andalusia 1990-95-99.

Figure 5: Temporary evolution of the circular net effects for Andalusia along the nineties.



Source: Own elaboration starting from the SAM of Andalusia 1990-95-99.

Table 9: Employment multipliers for Andalusia in 1990.

Accounts	1	2	3	4	5	6	7	8	9	10	11	12	13	Sum of row	Average value	Total average	Normaliz. value
1	0.950	0.023	0.049	0.116	0.095	0.092	0.080	0.094	0.099	0.087	0.108	0.108	0.108	**2.008**	**0.154**	**0.091**	***1.699***
2	0.002	0.028	0.007	0.002	0.002	0.002	0.003	0.002	0.002	0.002	0.002	0.002	0.002	**0.058**	**0.004**		***0.049***
3	0.004	0.002	0.079	0.003	0.004	0.004	0.004	0.005	0.005	0.006	0.004	0.004	0.004	**0.129**	**0.010**		***0.109***
4	0.074	0.019	0.036	0.173	0.089	0.059	0.069	0.068	0.071	0.070	0.075	0.075	0.075	**0.951**	**0.073**		***0.805***
5	0.016	0.007	0.015	0.009	0.413	0.015	0.015	0.020	0.022	0.021	0.020	0.020	0.020	**0.611**	**0.047**		***0.517***
6	0.233	0.068	0.153	0.131	0.233	0.795	0.200	0.243	0.272	0.234	0.291	0.291	0.291	**3.437**	**0.264**		***2.907***
7	0.036	0.017	0.028	0.023	0.039	0.033	0.245	0.039	0.041	0.040	0.038	0.038	0.038	**0.657**	**0.051**		***0.555***
8	0.024	0.010	0.018	0.016	0.028	0.026	0.026	0.221	0.039	0.042	0.030	0.030	0.030	**0.539**	**0.041**		***0.456***
9	0.060	0.026	0.038	0.031	0.056	0.065	0.055	0.074	0.609	0.061	0.076	0.076	0.076	**1.303**	**0.100**		***1.102***
10	0.003	0.002	0.001	0.001	0.001	0.001	0.001	0.002	0.002	2.108	0.002	0.002	0.002	**2.128**	**0.164**		***1.800***
Sum of columns	**1.402**	**0.202**	**0.426**	**0.503**	**0.961**	**1.093**	**0.699**	**0.766**	**1.162**	**2.670**	**0.646**	**0.646**	**0.646**				
Average value	**0.140**	**0.020**	**0.043**	**0.050**	**0.096**	**0.109**	**0.070**	**0.077**	**0.116**	**0.267**	**0.065**	**0.065**	**0.065**				
Total average	**0.091**																
Normalized value	***1.542***	***0.222***	***0.468***	***0.553***	***1.057***	***1.202***	***0.769***	***0.842***	***1.278***	***2.936***	***0.710***	***0.710***	***0.710***				

Source: Own elaboration through SAM for Andalusia 1990.

Table 10: Employment multipliers for Andalusia in 1995.

Accounts	1	2	3	4	5	6	7	8	9	10	11	12	13	Sum of row	Average value	Total average	Normaliz. value
1	0.598	0.006	0.023	0.072	0.046	0.042	0.031	0.033	0.037	0.038	0.028	0.038	0.038	**1.033**	**0.079**	**0.072**	***1.101***
2	0.004	0.130	0.023	0.009	0.007	0.004	0.003	0.004	0.004	0.004	0.003	0.004	0.004	**0.200**	**0.015**		***0.213***
3	0.003	0.001	0.060	0.002	0.002	0.003	0.002	0.003	0.003	0.003	0.002	0.002	0.002	**0.086**	**0.007**		***0.092***
4	0.036	0.007	0.024	0.106	0.058	0.041	0.033	0.034	0.036	0.033	0.026	0.036	0.036	**0.506**	**0.039**		***0.539***
5	0.004	0.001	0.002	0.001	0.171	0.004	0.002	0.003	0.004	0.005	0.002	0.003	0.003	**0.206**	**0.016**		***0.219***
6	0.131	0.024	0.105	0.068	0.131	0.584	0.137	0.138	0.179	0.160	0.141	0.191	0.191	**2.179**	**0.168**		***2.323***
7	0.023	0.010	0.023	0.019	0.033	0.042	0.313	0.028	0.030	0.028	0.020	0.027	0.027	**0.624**	**0.048**		***0.665***
8	0.019	0.005	0.021	0.014	0.024	0.032	0.025	0.226	0.031	0.041	0.021	0.028	0.028	**0.514**	**0.040**		***0.548***
9	0.099	0.027	0.092	0.057	0.110	0.166	0.114	0.147	1.135	0.166	0.116	0.157	0.157	**2.543**	**0.196**		***2.711***
10	0.004	0.001	0.003	0.002	0.003	0.004	0.003	0.006	0.005	1.444	0.004	0.005	0.005	**1.489**	**0.115**		***1.587***
Sum of columns	**0.920**	**0.212**	**0.376**	**0.350**	**0.587**	**0.922**	**0.664**	**0.621**	**1.462**	**1.921**	**0.363**	**0.491**	**0.491**				
Average value	**0.092**	**0.021**	**0.038**	**0.035**	**0.059**	**0.092**	**0.066**	**0.062**	**0.146**	**0.192**	**0.036**	**0.049**	**0.049**				
Total average value	**0.072**																
Normalized value	***1.275***	***0.294***	***0.521***	***0.485***	***0.813***	***1.278***	***0.921***	***0.860***	***2.026***	***2.662***	***0.504***	***0.680***	***0.680***				

Source: Own elaboration through SAM for Andalusia 1995.

Table 11: Employment multipliers for Andalusia in 1999.

Accounts	1	2	3	4	5	6	7	8	9	10	11	12	13	Sum of row	Average value	Total average	Normaliz. value
1	1.157	0.004	0.020	0.013	0.026	0.035	0.021	0.024	0.037	0.039	0.040	0.040	0.040	**1.499**	**0.115**	**0.140**	***0.823***
2	0.003	0.628	0.082	0.003	0.007	0.004	0.003	0.003	0.004	0.004	0.004	0.004	0.004	**0.752**	**0.058**		***0.413***
3	0.002	0.001	0.081	0.000	0.002	0.003	0.002	0.002	0.003	0.003	0.003	0.003	0.003	**0.110**	**0.008**		***0.060***
4	0.209	0.057	0.155	1.352	0.341	0.209	0.186	0.146	0.195	0.191	0.200	0.200	0.200	**3.640**	**0.280**		***1.999***
5	0.004	0.001	0.003	0.000	0.313	0.003	0.002	0.002	0.004	0.006	0.003	0.003	0.003	**0.347**	**0.027**		***0.191***
6	0.232	0.047	0.213	0.029	0.264	1.449	0.241	0.244	0.371	0.341	0.406	0.406	0.406	**4.647**	**0.357**		***2.552***
7	0.024	0.014	0.029	0.004	0.033	0.042	0.481	0.026	0.037	0.035	0.038	0.038	0.038	**0.838**	**0.064**		***0.460***
8	0.048	0.011	0.054	0.007	0.061	0.079	0.055	0.403	0.087	0.096	0.091	0.091	0.091	**1.173**	**0.090**		***0.644***
9	0.153	0.040	0.157	0.021	0.188	0.254	0.166	0.191	1.501	0.272	0.298	0.298	0.298	**3.836**	**0.295**		***2.107***
10	0.011	0.002	0.011	0.001	0.013	0.016	0.011	0.013	0.019	1.205	0.021	0.021	0.021	**1.365**	**0.105**		***0.750***
Sum of columns	**1.844**	**0.805**	**0.803**	**1.430**	**1.248**	**2.096**	**1.169**	**1.054**	**2.257**	**2.193**	**1.102**	**1.102**	**1.102**				
Average value	**0.184**	**0.081**	**0.080**	**0.143**	**0.125**	**0.210**	**0.117**	**0.105**	**0.226**	**0.219**	**0.110**	**0.110**	**0.110**				
Total average value	**0.140**																
Normalized value	***1.317***	***0.575***	***0.573***	***1.021***	***0.891***	***1.496***	***0.834***	***0.753***	***1.612***	***1.566***	***0.787***	***0.787***	***0.787***				

Source: Own elaboration through SAM for Andalusia 1999.