Miguel, Francisco Javier De; Perez-Mayo, Jesus

Conference Paper

Measuring inequality in a region: a SAM approach

44th Congress of the European Regional Science Association: "Regions and Fiscal Federalism", 25th - 29th August 2004, Porto, Portugal

Provided in Cooperation with:
European Regional Science Association (ERSA)

Measuring inequality in a region: a SAM approach

Francisco Javier de Miguel – Universidad de Extremadura [*]

Jesús Pérez – Universidad de Extremadura

Abstract

In this paper, we apply SAM linear models to the economy in a Spanish region, Extremadura, from the usual household disaggregation of these matrices.

The analysis aims to some issues related to income distribution. To achieve these goals, some relative multipliers are computed and we propose different simulations based on final demand and income transfers.

Finally, we also compute the standard statistical measures of inequality and show how these measures change if different transfer policies are applied.

JEL CODES: C69, D31,D59, H59

[*] The first author acknowledges the institutional support of Fundación Centro de Estudios Andaluces (centrA) and Red Temática en Economía Computacional XT02-0037 (Generalitat de Catalunya). The other author is also grateful to the Junta de Extremadura for their financial support, research project 2PR02A102.

1. - Introduction

Social Accounting Matrices can be generally conceived as a disaggregated matricial representation of the circular flow of income, showing thus manner the generation and distribution processes of income.

The main application of these matrices is providing a database for the elaboration of economic models. In this sense, a first group of models built from a SAM are the linear SAM models. They allow determining the changes in the income levels caused by exogenous shocks. Besides, other models can be proposed to analyse the income changes in relative terms.

It is important to precise that this methodology adequately shows the effects caused by exogenous changes because it fully captures the interrelationships between the different agents. The degree of detailed incorporated by SAMs makes also possible to show the multipliers with a high disaggregation.

This paper is based on this framework of SAM modelization. Our objective is the application of these models on the economy of Extremadura to quantify and order the interdependence relationships, by focusing the analysis on some results related to households and the income distribution.

To achieve this objective, with a short analysis of the more common SAM multipliers, two additional exercised are presented. In fact, both are the main parts of the paper. First, we computed the effects caused in the relative incomes of the households by exogenous injections on the activities or households. Afterwards, different simulations have been done for showing how inequality changes when both exogenous modifications happen.

Among the obtained results, we should emphasize that inequality raise if demand increases in Extremadura and, on the other hand, the growth of transfers causes an inequality reduction.

The paper is organised as follows. Section 2 sets out the SAM multipliers methods by showing the procedure to calculate the multipliers with redistributive effects. Section 3 presents the SAM for Extremadura. Section 4 outlines the results of the developed applications that are joined in three groups. Finally, the main concluding remarks are presented.

2. - SAM linear models and redistribution matrix

The accounting matrices are some consistent databases that show all the flows of commodities, services and incomes in an economy. Thus, they are an enlargement of the well-known input-output tables because these matrices shows disaggregated information on expenditure and income structures of economic agents beyond the operations related to the productive field of the economy.

These matrices are in general presented as square tables where every economic agent or sector in the matrix has a row and a column, both identically labelled. While the values by row are incomes, the values by column are expenditures or payments. Besides, a SAM must satisfy an important restriction: the sum of every row must be equal to the sum of the corresponding column.

Before developing a linear multipliers model from a social accounting matrix, it is necessary to distribute the accounts in two groups: endogenous and exogenous accounts. The accounts not directly determined inside the economic system as well as those for some tools of economic policy are considered as exogenous. Thus, the accounts related to Public Administrations, capital, saving/investment and foreign sector are usually considered as exogenous. Therefore, the remained accounts (usually accounts for factors, institutional sectors less Public Administrations and activities) are considered as endogenous [1].

For getting the mathematical expressions of these models, the accounting identities provided in the SAM are transformed. Exactly, let A_n the average expenditure propensities, x the column vector with represents the amount of exogenous injections received by each endogenous account, I the identity matrix and y_n the total of each endogenous account. With these notations, the general expression of the model is:

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

The multiplier matrix Ma allows relating exogenous injections of income to the endogenous accounts incomes. To be precise, an element Ma_{ij} of this matrix expresses the income growth of account i as consequence of a unitary and exogenous injection received by the account j [2].

[1] However, there are some alternative assumptions. For instance, Polo, Roland-Holst and Sancho (1991) and Ferri and Uriel (2000) include the capital account in the endogenous part of the model. Read Reinert, Roland-Holst y Shiells (1993) to observe the multipliers values caused by the new assumptions of endogeneity.

[2] Read Pyatt and Round (1979) for a more detailed analysis of the expression of these models. They also present a decomposition procedure of multipliers, by showing some conditions of existence for the final matrices.

It is interesting to observe the existing similarity between the equation above (1) and the expression of the well-known input-output model of demand. Nevertheless, the SAM model we present here is a widest model and includes better the interdependences between the economic agents and sectors. However, the simplicity of the expression above contrasts with the underlying hypothesis of these SAM multipliers. Among them, first we should emphasize that an overflow in production and constant prices are assumed in the model. Second, production technology and resources endowments are given and so, it is a short-term analysis. Finally, average expenditure propensities are fixed and income elasticities are unitary[3].

On the other hand, the SAM multipliers analysis has been usually focused in determining absolute changes in incomes and the value of the Ma_{ij} has been considered as an indicator of the effect caused by different exogenous shocks. Nevertheless, it is also important to determine which modifications outline these shocks on the relative position of a given agent or economic sector. To capture these redistributive effects, a relative incomes vector z_n is defined:

$$\boldsymbol{z}_n = \frac{\boldsymbol{y}_n}{\left(\boldsymbol{e}' \boldsymbol{y}_n\right)} \tag{2},$$

where *e'* is a unitary row vector. From the expression (1), we differentiate the equation above:

$$\begin{aligned} \boldsymbol{dz}_n &= \left(\boldsymbol{e}' \boldsymbol{Ma}\, \boldsymbol{x}\right)^{-1} \left[\boldsymbol{I} - \left(\boldsymbol{e}' \boldsymbol{Ma}\, \boldsymbol{x}\right)^{-1} \left(\boldsymbol{Ma}\, \boldsymbol{x}\right) \boldsymbol{e}'\right] \boldsymbol{Ma}\, \boldsymbol{dx} \\ &= \frac{\mathbf{1}}{\boldsymbol{e}' \boldsymbol{y}_n} \left[\boldsymbol{I} - \frac{\boldsymbol{y}_n}{\boldsymbol{e}' \boldsymbol{y}_n} \boldsymbol{e}'\right] \boldsymbol{Ma}\, \boldsymbol{dx} = \boldsymbol{R}\, \boldsymbol{dx} \end{aligned} \tag{3}$$

R is called redistribution matrix and shows the final distribution of relative incomes caused by different exogenous shocks. An individual element of the matrix R_{ij} shows the direction and magnitude of the change in the relative income of the account *i* because of an exogenous injection received by the account *j*. On the other side, it can be showed that the sum of the columns in this matrix is zero for whatever distribution of endogenous and exogenous accounts was assumed. Therefore, this income

[3] Alternative multipliers have been proposed to correct some of these problems. For instance, while Lewis and Thorbecke (1992) propose mixed multipliers, Pyatt and Round (1979) present the fixed-prices multipliers.

redistribution procedure can be considered as a zero sum game[4].

For showing and explaining more clearly these redistributive effects, we express the element R_{ij} as:

$$\boldsymbol{R}_{ij} = \frac{\mathbf{1}}{\boldsymbol{e}'\boldsymbol{y}_n}\left[\boldsymbol{Ma}_{ij} - \frac{\boldsymbol{y}_{ni}}{\boldsymbol{e}'\boldsymbol{y}_n}\left(\boldsymbol{e}'\boldsymbol{Ma}_{\cdot j}\right)\right] \tag{4}$$

where y_{ni} is the n-th element of vector y_n and Ma_{ij} is the j-th column of matrix Ma. It can be observed that the sign of R_{ij} depends on the terms in brackets, that is, it depends on the relationship between $Ma_{ij}/(e'Ma_{\cdot j})$ and $y_{ni}/(e'y_n)$.

If the first term were higher than the second one, R_{ij} would be positive and implies that, when j receives an exogenous income unit, the proportion of additional income received by i $Ma_{ij}/(e'Ma_{\cdot j})$ is higher than its initial proportion $y_{ni}/(e'y_n)$. Therefore, the account i has suffered an improvement of its relative status. Otherwise, an inflow in account j would negatively affect the account i if the proportion $Ma_{ij}/(e'Ma_{\cdot j})$ is lesser than the initial proportion of nominal income and so, it will be determined a negative value for R_{ij}[5].

3. - Social Accounting Matrix for Extremadura

The base we used in the following applications is the only one Social Accounting Matrix available for Extremadura that contains data for 1990[6]. The figure 1 shows the included accounts in this matrix and the SAM (henceforth, SAMEXT90) is presented in an appendix at the end of the paper. However, the matrix presented here is the result of an aggregation of a wider matrix with a higher disaggregation for taxes and transfers and a differentiation between production and consumption commodities.

We use the usual statistical sources to build the matrix, namely, a table of inter-sector flows (a Regional Input-Output table), the Regional Accounts and a survey on expenditures and incomes of consumers groups (the Encuesta de Presupuestos Familiares or Expenditure Household Survey). Besides, some more specific sources

[4] These relative multipliers are described in more detail in Roland-Holst (1990), Polo, Roland-Holst and Sancho (1990) and Roland-Holst and Sancho (1992).

[5] An analysis of income redistribution by using a different methodology can be read in Cohen and Tuyl (1991). These authors present some measures of relative distribution. Ferri and Uriel (2000) also present two applications based in these measures.

[6] Statistical limitations prevent building an updated SAM. Anyway, a future improvement of this paper will be the calculation of multipliers from an updated SAM by non-survey methods.

have been used to complete some flows in the matrix.

Regarding to disaggregation, our matrix firstly shows two accounts for the production factors, labour and capital, which reflect the generated added value and its distribution between the groups of households.

Figure 1. Accounts included in SAMEXT90

Factors
1.- Labour
2.- Capital

Households
3.- Less than 65 years, agriculture, low income
4.- Less than 65 years, agriculture, high income
5.- Less than 65 years, other sectors, 1st quintile
6.- Less than 65 years, other sectors, 2nd quintile
7.- Less than 65 years, other sectors, 3rd quintile
8.- Less than 65 years, other sectors, 4th quintile
9.- Less than 65 years, other sectors, 5th quintile
10.- 65 years o more, rural, low income
11.- 65 years o more, rural, high income
12.- 65 years o more, urban, low income
13.- 65 years o more, urban, high income

Activities
14.- Agriculture
15.- Energy
16.- Metals
17.- Minerals
18.- Chemistry
19.- Machinery
20.- Automobiles
21.- Food
22.- Textile
23.- Paper
24.- Other industry
25.- Construction
26.- Commerce
27.- Transportation
28.- Finance
29.- Private services
30.- Public services

EXOGENOUS ACCOUNTS (linear SAM model)
31.- Capital account (saving/investment)
32.- Government
33.- Rest of Spain
34.- Rest of European Union
35.- Rest of the World

Eleven groups of households have been considered. The households have been disaggregated according to different criteria as age, activity, place of residence or income. Although household incomes mainly come from capital and labour, households also receive transfers from foreign sectors and government (unemployment and retirement payments). By using these incomes, households consume the commodities produced by activities, save and do some payments to government (direct taxes).

Regarding activities, the accounting structure they present in an input-output table remains almost identical in SAMEXT90. Exactly, their cost structures (columns) express payments to labour and capital factors, intermediate inputs, imports of products and payments to the government (production and import taxes). On the other side, their rows contains the uses, namely, intermediate outputs and final demand (private consumption, public consumption, gross FORMACION DE CAPITAL and exports).

Finally, SAMEXT90 also includes an aggregate account of capital where global balance between saving and investment appears, an account for government and the relations of the Economy of Extremadura and the environment are divided into three accounts: Rest of Spain, Rest of European Union and Rest of the World.

4. - Empirical results

We present three applications on SAMEXT90 in this paper. First, we calculate the accounting multipliers matrix that permits to determine as a first result the capacity that endogenous agents have to cause income increases. The other two applications are mainly focused on incomes of the groups of households and their relations to activities. In this sense, the second exercise incorporates two redistributive effect matrices both related to relative households incomes. Finally, changes in demand or transfers are simulated to show how income inequality is modified in either case.

A) Accounting multipliers matrix

As a first application of the linear SAM models on the Economy of Extremadura the accounting multipliers matrix *Ma(Ext)* has been calculated. If the accounts of factors, groups of households and activities are considered as endogenous, the resulting matrix is of order 30x30.

Although it is possible to differentiate some submatrices that provide relevant information, we only analysed the multipliers known as diffusion effects and equal to the column sums in matrix *Ma*. These multipliers show the global effects on incomes of the endogenous accounts of a unitary exogenous injection of income received by a given endogenous account. Thus, those agents or sectors with high diffusion effects generate meaningful drag effects, and so they can be considered the first ones for receiving exogenous inflows.

These diffusion effects are presented in table 1. The obtained results clearly show that the greater effects correspond to the services, standing out mainly credit and insurance institutions (account 28) and other private services (account 29) with an expansion of approximately 5 m.u. by exogenous received m.u.. They also originate some high expansion effects in the income of agriculture (account 14) and construction (account 25). On the other hand, the set of industrial sector accounts (accounts 18-24) presents some scarcely relevant multipliers.

With respect to the groups of households, it is interesting to observe that the low-income consumers present larger multipliers than their equivalent groups with high incomes, because, in relative terms, they present smaller savings and, therefore, push

more the economic activity by consumption. This result relies on the distribution between endogenous and exogenous accounts[7].

Table 1. Accounting multipliers matrix *Ma(Ext)*: diffusion effects

	Effect	Rank		Effect	Rank
1- Labour	4.442	11	**16- Metals**	1.466	28
2- Capital	4.392	14	**17- Minerals**	2.532	24
3- < 65-agric-low	4.486	9	**18- Chemistry**	1.322	29
4- < 65-agric-high	3.336	20	**19- Machinery**	2.110	26
5- < 65-nonagric-1st quint	4.497	8	**20- Automobiles**	1.048	30
6- < 65-nonagric-2nd quint	4.413	12	**21- Food**	3.291	21
7- < 65-nonagric-3rd quint	3.909	16	**22- Textile**	1.481	27
8- < 65-nonagric-4th quint	3.425	19	**23- Paper**	2.124	25
9- < 65-nonagric-5th quint	2.939	23	**24- Other industry**	2.988	22
10- ³ 65-rural-low	4.677	5	**25- Construction**	4.449	10
11- ³ 65-rural-high	3.707	17	**26- Commerce**	4.545	7
12- ³ 65-urban-low	4.393	13	**27- Transportation**	4.557	6
13- ³ 65-urban-high	3.491	18	**28- Finance**	5.017	1
14- Agriculture	4.802	3	**29- Private services**	4.857	2
15- Energy	4.088	15	**30- Public services**	4.788	4
AVERAGE EFFECT	**3.586**				

Source: Own elaboration.

B) Income redistribution matrices: activities-households and households-households

In this second section a more detailed analysis of various multipliers related to the groups of households is developed. Initially, we can define the activities-households multiplier as those that show the effects on the household incomes of exogenous injections on the activity branches. On the other side, households-households multipliers are those that reflect the effects on the household incomes when the households receive income transfers.

Based on both two groups of multipliers and using the previous expressions, we present two matrices of redistributive effects[8]. Nevertheless, instead of incorporating the redistribution matrix R a transformation of matrix R, that consists in pre-multiplying it by the term $(\boldsymbol{e}'\boldsymbol{y}_n)$, is done to get easier the interpretation of results. The elements of this new matrix reflect the redistributed income value as result of a unitary exogenous

[7] Even if the aggregate account of capital is considered as an endogenous account, this relation between diffusion effects for low and high incomes households. Despite of it, differences between these effects are clearly reduced.

[8] "Elements of the matrix R are in a one-to-one correspondence with those of the original Ma, and the normalization of incomes can be chosen for the subgroup of endogenous institutions under study". Roland-Holst (1990, pp. 129).

injection, assumed constant the initial income of endogenous accounts[9].

The pursued objective in any case is to determine in relative terms what groups of households are better off and what groups are in a worst situation if final demand or income transfers increase.

First, from the submatrix of *Ma(Ext)* that shows the activities-households multipliers the corresponding income redistribution matrix is calculated. This matrix is presented below in table 2. The row for total effects indicates the household income redistributed by each activity when its demand increases in one m.u.. For example, if demand of agricultural commodities grows, 0.091 m.u. of income are redistributed, corresponding 0.001 m.u. to the first group of households, 0.026 m.u. to the second, 0.004 m.u. to the sixth and 0.06 m.u. to the seventh, while the rest of households suffer a relative worsening. It can be observed that the activities with a higher redistribution of household income are in general rule the same that presented higher diffusion effects before, this is, services (accounts 26-30), followed by agriculture and construction. The rest of activities, especially the industrial ones, present some much lower redistributive effects.

It is more interesting, though, to observe the values in the final column ("average effect"). This column shows the redistributive effects from by a unitary increase in demand homogeneously distributed between the activities. In this case, it is firstly observed that the groups of households with high income are better off in relative terms. Particularly, around a 66% of the redistributed income values shown in this column corresponds to the account 9 (last quintile of not agrarian actives), a 13% to the account 8 (fourth quintile), a 5% to the account 7 (third quintile), and a 16% to the account 2 (high-income agrarian actives)[10]. Therefore, the results seem to show that the exogenous increases in demand tend to increase differences between low and high incomes.

On the other hand, the relative status of retired households (accounts 10 to 13)[11] worsens in almost all the simulations. This result is because a very important share of their income comes from government by retirement payments and the interdependence effect that shows the income distribution between household is lacking.

To conclude this subsection we aim the analysis toward households-households

[9] It can be demonstrated that the columns of this matrix of income redistribution also sum zero.

[10] Non-agrarian actives households in the two last quintiles are in better status whatever simulation is considered.

[11] More generally, it can be observed that the pattern of improvement/worsening of average effect are the same for every group (excepting few cases) irrespective of the activity that receives the exogenous injection.

multipliers and their consequent income redistribution matrix (see table 3). The objective is to determine the effects on relative household incomes of households caused by the transfers that households receive.

The results show homogeneous redistribution total effects on household income. Nevertheless, the obtained results are also analogous to the results obtained before for diffusion effects because high-income households again present a smaller capacity for generating significant effects than their equivalent groups of low incomes. It can be also observed also that there are not mutually useful linkages (couples of positive symmetrical elements) since the exogenous transfers of income only benefit to the households that receive it.

Finally, it is important to emphasize that the final column that shows the average redistributive effect provides results opposed to the obtained ones in previous table 2. Here low-income groups are that experience an improvement in their relative status and three of the groups of retired households standing out very much. On the opposite, high-income groups suffer a clear deterioration and it is possible to observe that the redistributive effects are mainly concentrated in the groups for the three last quintiles of not agrarian actives (accounts 7, 8 and 9).

Table 2. Income redistribution matrix: activities-households

	Acc 14	Acc 15	Acc 16	Acc 17	Acc 18	Acc 19	Acc 20	Acc 21	Acc 22	Acc 23	Acc 24	Acc 25	Acc 26	Acc 27	Acc 28	Acc 29	Acc 30	
	Agr	Energ	Metals	Miner	Chem	Mach	Automob	Food	Textile	Paper	Ot. Ind	Const	Com	Transp	Finance	PrivServ	Pub Serv	Av. Effect
3-<65-agric-low	0,001	0,002	0.000	0.000	0.000	-0.001	0.000	0.000	-0.001	-0.001	-0.001	-0.003	-0.001	-0.003	-0.002	0.003	-0.010	**-0.001**
4-<65-agric-high	0.026	0.027	0.003	0.007	0.001	0.003	0.000	0.011	0.000	0.002	0.008	0.009	0.017	0.009	0.018	0.036	-0.015	**0.010**
5-<65-noagric-1stq	-0.023	-0.020	-0.003	-0.009	-0.002	-0.006	0.000	-0.012	-0.002	-0.006	-0.011	-0.019	-0.022	-0.021	-0.027	-0.028	-0.021	**-0.014**
6-<65-noagric-2ndq	-0.017	-0.018	-0.002	-0.004	-0.001	-0.001	0.000	-0.007	0.001	0.000	-0.004	-0.002	-0.009	-0.002	-0.009	-0.024	0.020	**-0.005**
7-<65-noagric-3rdq	-0.001	-0.004	0.000	0.001	0.000	0.002	0.000	0.001	0.002	0.003	0.002	0.007	0.004	0.008	0.006	-0.004	0.024	**0.003**
8-<65-noagric-4thq	0.004	0.001	0.001	0.004	0.001	0.004	0.000	0.004	0.003	0.005	0.005	0.014	0.010	0.015	0.015	0.002	0.035	**0.007**
9-<65-noagric-5thq	0.060	0.050	0.007	0.024	0.005	0.017	0.001	0.032	0.008	0.019	0.030	0.057	0.061	0.061	0.075	0.069	0.077	**0.038**
10- ³65-rural-low	-0.026	-0.022	-0.003	-0.010	-0.002	-0.007	0.000	-0.014	-0.003	-0.008	-0.013	-0.024	-0.026	-0.025	-0.032	-0.030	-0.031	**-0.016**
11- ³65-rural-high	-0.021	-0.015	-0.003	-0.011	-0.002	-0.009	0.000	-0.013	-0.005	-0.010	-0.014	-0.030	-0.027	-0.032	-0.036	-0.021	-0.057	**-0.018**
12- ³65-urban-low	-0.003	-0.003	0.000	-0.001	0.000	-0.001	0.000	-0.002	0.000	-0.001	-0.002	-0.003	-0.003	-0.003	-0.004	-0.004	-0.004	**-0.002**
13- ³65-urban-high	0.000	0.002	0.000	-0.001	0.000	-0.002	0.000	-0.001	-0.001	-0.002	-0.002	-0.006	-0.004	-0.006	-0.006	0.002	-0.018	**-0.003**
TOTAL	**0.091**	**0.082**	**0.011**	**0.036**	**0.007**	**0.026**	**0.001**	**0.048**	**0.014**	**0.028**	**0.046**	**0.087**	**0.092**	**0.093**	**0.114**	**0.111**	**0.156**	

Source: Own elaboration.

Table 3. Income redistribution matrix: households-households

	Acc 3	Acc 4	Acc 5	Acc 6	Acc 7	Acc 8	Acc 9	Acc 10	Acc 11	Acc 12	Acc 13	
	<65-agric-low	<65-agric-high	<65-nonagric-1stq	<65-noagric-2ndq	<65-noagric-3rdq	<65-noagric-4thq	<65-noagric-5thq	³65-rural-low	³65-rural-high	³65-urban-low	³65-urban-high	Av. Effect
3-<65-agric-low	0.965	-0.035	-0.035	-0.035	-0.035	-0.035	-0.035	-0.035	-0.035	-0.035	-0.035	**0.056**
4-<65-agric-high	-0.060	0.935	-0.060	-0.060	-0.062	-0.064	-0.066	-0.058	-0.063	-0.059	-0.064	**0.029**
5-<65-noagric-1stq	-0.052	-0.047	0.948	-0.052	-0.049	-0.047	-0.045	-0.053	-0.049	-0.052	-0.048	**0.041**
6-<65-noagric-2ndq	-0.076	-0.073	-0.076	0.924	-0.075	-0.073	-0.072	-0.077	-0.074	-0.077	-0.074	**0.016**
7-<65-noagric-3rdq	-0.112	-0.112	-0.112	-0.112	0.888	-0.112	-0.112	-0.112	-0.112	-0.112	-0.112	**-0.021**
8-<65-noagric-4thq	-0.153	-0.155	-0.153	-0.153	-0.154	0.845	-0.155	-0.153	-0.154	-0.154	-0.154	**-0.063**
9-<65-noagric-5thq	-0.319	-0.333	-0.319	-0.320	-0.326	-0.332	0.662	-0.316	-0.328	-0.319	-0.331	**-0.235**
10- ³65-rural-low	-0.046	-0.040	-0.046	-0.046	-0.043	-0.040	-0.038	0.953	-0.042	-0.046	-0.041	**0.048**
11- ³65-rural-high	-0.106	-0.100	-0.106	-0.105	-0.103	-0.100	-0.098	-0.107	0.898	-0.105	-0.101	**-0.012**
12- ³65-urban-low	-0.006	-0.005	-0.006	-0.006	-0.006	-0.005	-0.005	-0.006	-0.005	0.994	-0.005	**0.085**
13- ³65-urban-high	-0.036	-0.035	-0.035	-0.035	-0.035	-0.035	-0.035	-0.035	-0.035	-0.035	0.965	**0.056**
TOTAL	**0.965**	**0.935**	**0.948**	**0.924**	**0.888**	**0.845**	**0.662**	**0.953**	**0.898**	**0.994**	**0.965**	

Source: Own elaboration.

C) Inequality measurement before changes in final demand and transfers

For finishing the applications on the economy of Extremadura two groups of simulations with a direct relationship with the income redistribution matrices shown before are outlined. In the first group, we attempt to determine in what extent income inequality are modified by increases in exogenous final demand. In addition, in the second the objective is to show how inequality changes by increases in income transfers from the public sector. In either case, the simulated growths are 10%, 20% and 30%.

Unlike the previous exercises, we use the Gini index now to measure income inequality. Given disaggregation of households in SAMEXT90, this index is globally calculated first way on 11 groups of households, and afterwards we differentiate between active (accounts 3-9 of the matrix) and retired (accounts 10-13) [12]. Besides, it is important to expose that changes in income distribution between groups of households, but the income distribution within the groups is not studied.

The obtained results are presented below in tables 4 and 5. Beginning by changes in demand, the results clearly show that inequality increases when demand is stimulated demand without doing no other adjustment in the Economy of Extremadura, in global terms as well as for each differentiated group. The observed increases in Gini indices do not seem to be excessively relevant. Even though, the higher is the proposed percentage growth, the more intense is the increase. Moreover, the percentage variations suffered by the indices with respect to the initial situation permit to assert that inequality increase is slightly greater between groups of retired households.

The figures of table 5 show contrary results because all the outlined increases in transfers determine inequality reductions [13]. It is also interesting to indicate that although the exogenous injections considered in this exercise are very quantitatively lower than the ones of the former exercise, since households directly received them, they determine clearly larger changes in Gini indices than changes in table 4. Finally, inequality of retired households is the most modified with much larger reductions than the ones of actives households.

[12] This index could be also calculated on a classification of households that directly differentiate between high and low incomes, that is, on actives in agriculture households (groups 1 and 2), actives in other sectors (groups 3-7), in the rural retired (groups 8 and 9) and on the urban retired (groups 10 and 11). Nevertheless, the obtained results are in general very similar to the ones we presented here.

[13] In fact, incorporation of transfers determines an important reduction of inequality in SAMEXT90. For instance, the global Gini index for primary incomes is 0.4621, markedly higher than the index for final incomes, 0.5392.

Table 4. Increases in demand and Gini indices

	Initial Indices	Final indices after percentage increases in demand			Percentage change in indices		
		10%	20%	30%	10%	20%	30%
Global	0.5392	0.5431	0.5468	0.5503	0.731	1.417	2.052
Active	0.5002	0.5030	0.5057	0.5083	0.551	1.101	1.614
Retired	0.5646	0.5691	0.5733	0.5773	0.792	1.544	2.256

Source: Own elaboration.

Table 5. Increases in transfers e Gini indices

	Initial Indices	Final indices after percentage increases in transfers			Percentage change in indices		
		10%	20%	30%	10%	20%	30%
Global	0.5392	0.5309	0.5231	0.5157	-1.532	-2.983	-4.355
Active	0.5002	0.4944	0.4890	0.4838	-1.153	-2.247	-3.288
Retired	0.5646	0.5433	0.5239	0.5062	-3.776	-7.205	-10.338

Source: Own elaboration.

5. - Concluding remarks

From a social accounting matrix built for the region of Extremadura, we present a set of applications based on SAM multipliers methodology. Precisely, two exercises clearly guided toward an analysis of income distribution (the basic objective of the paper) are incorporated to the typical calculation of accounting multipliers.

While in the latter redistributive effects between activities and households and groups of households are showed, in the former simple simulations are outlined to determine how changes in demand or transfers affects inequality.

The obtained results show first that low-income consumers present a greater capacity than their equivalent groups of high income to generate income increases after exogenous injections. However, the greater diffusion effects correspond in general to services. Likewise, the accounts with greater diffusion effects also present greater total effects in the income redistribution matrices activities-households and households-households.

Besides, these matrices permit to determine the groups of households that suffer a relative improvement or worsening after changes in demand or transfers. The results of

both exercises are contrary. In the first case, high-income households experience a relative improvement at the expense of low income ones and so, initial differences increases. And in the second exercise, the groups that improve in relative terms are clearly low-income households.

The finally outlined simulations fall again upon the effects on income distribution after changes in demand or transfers. The calculation of Gini indices shows analogous results: inequality increases after the simulated increases in demand, and reduces after increases in transfers. Furthermore, in both cases the greater changes appear in the groups of retired households.

To conclude the paper we outline two final remarks. First, we want to attract the attention of the regional and national statistic institutions on the need of having adequate statistical sources, since they are the numerical support for developing any slightly updated economic analysis. Second, we wish to emphasize the potentialities of the developed analysis because the methodology of SAM multipliers has permitted to obtain important results related to distribution and redistribution processes of income, difficult to intuitively anticipate and quantify before.

REFERENCES:

Bottiroli, M . and Targetti, R. (1988). The distribution of personal income at the sectoral level in Italy: a SAM model. Journal of Policy Modeling, volumen 10. nº 3, pp. 453-468.

Cohen, S. and Tuyl, J. (1991). Growth and equity effects of changing demographic structures in the Netherlands. Simulations within a social accountin matrix. Economic Modelling, January, pp. 3-15.

De Miguel, F.J; Manresa, A. and Ramajo, J. (1998). Matriz de contabilidad social y multiplicadores contables: una aplicación para Extremadura. Estadística Española, volumen 40. nº 143, pp. 195-232.

Ferri, J. and Uriel, E. (2000). Multiplicadores contables y análisis estructural en la matriz de contabilidad social. Una aplicación al caso español. Investigaciones Económicas, volumen XXIV (2), pp. 419-453.

Isla, F. (1999). Multiplicadores y distribución de la renta en un modelo SAM de Andalucía. Estudios de Economía Aplicada, nº 12, pp. 91-116.

Isla, F.; Moniche, L. and Trujillo, F. (2002). Crecimiento económico y política de transferencias a partir de una matriz de contabilidad social de Andalucía. Estudios de Economía Aplicada, volumen 20, nº II, pp. 423-449.

Lewis, K. and Thorbecke, E. (1992). District-level economic linkages in Kenya: evidence based on a small regional social accounting matrix. World Development, volumen 20 (6), pp. 881-897.

Llop, M. and Manresa, A. (2003). Income distribution in a regional economy: a SAM model. Documento de trabajo E2003/03. centrA.

Polo, C.; Roland-Holst, D. and Sancho, F. (1990). Distribución de la renta en un modelo SAM de la economía española. Estadística Española, volumen 32, nº 125. pp. 537-567.

Polo, C.; Roland-Holst, D. and Sancho, F. (1991). Descomposición de multiplicadores en un modelo multisectorial: una aplicación al caso español. Investigaciones Económicas, volumen XV, nº 1, pp. 53-69.

Pyatt, G. and Round, J. (1979). Accounting and fixed price multipliers in a social accounting matrix framework. The Economic Journal, volumen 89, pp. 850-873.

Reinert, K; Roland-Holst, D, and Shiells, C. (1993). Social accounts and the structure of the North American economy. Economic Systems Research, volumen 5, nº 3, pp. 295-326.

Roland-Holst, D. (1990). Interindustry analysis with social accounting methods. Economic Systems Research, volumen 2, nº 2, pps. 125-145.

Roland-Holst, D. and Sancho, F. (1992). Relative income determination in the United States: a social accounting perspective. Review of Income and Wealth, series 38, nº 3, pp. 311-327.

ANNEX. Social Accounting Matrix of Extremadura 1990 (SAM – Extremadura – 1990). Thousand ptas.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	0	0	0	0	0	0	0	0	0	0	0	0	0	24963041	7628500	190232	3128697	415846
2	0	0	0	0	0	0	0	0	0	0	0	0	0	98461023	78708421	525362	5731431	542573
3	6403869	20617525	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	11531141	58412185	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	7164833	6679596	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	36142644	16213627	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	49386782	48524435	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	68960273	71908035	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	143939018	199997885	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	281158	3105301	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	6746873	41971165	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	496767	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	2691552	20789038	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	1444645	1573137	1508610	2375505	3445325	3777524	5386872	1423593	2963616	134935	684772	45488136	0	0	30835	374798
15	0	0	1833047	2730195	1724499	3787862	4398790	5179787	10090277	1569249	3423307	243821	1341517	8050811	7215676	71303	1539550	404147
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	58990	353895	265428	0
17	0	0	48700	50004	54474	91442	126466	146429	278450	57165	106692	9083	47414	0	11362711	62133	4514104	97294
18	0	0	572344	1138537	556036	1124125	1758097	2074910	3991723	337746	962290	34722	388452	9250486	212363	28792	152529	540153
19	0	0	667197	1211830	645381	1366425	1915108	2368450	5358044	344433	1324826	33599	473819	7265751	6791384	34261	348223	41145
20	0	0	1380532	3194480	904431	3146657	3198927	3738856	7772058	389312	1820579	35172	567774	0	6244	0	4496	0
21	0	0	6120523	6658221	6248003	10038153	14487158	16365956	22779741	5750229	12503461	529438	2756418	11965216	0	0	0	1097
22	0	0	2528856	4299736	2862184	4531404	7894336	9355729	16660895	1828383	4429163	188586	2232426	147800	7136	2155	9383	4206
23	0	0	214436	386974	241621	451474	725376	915424	2080925	113416	448421	13084	166244	53407	192536	456	99438	22913
24	0	0	498509	802690	553110	945330	1618808	1880327	3819084	363145	943424	45550	470584	2036290	63421	361	146675	59695
25	0	0	795184	792887	901289	1508329	1995275	2361104	4316082	971589	1754396	156759	740635	1053382	356427	1937	40132	5428
26	0	0	9641209	14317613	9978877	17931950	26308871	30858132	55683869	7606513	18230897	871568	6743523	9281815	3581676	143114	1499505	157809
27	0	0	893245	2059727	570310	2093714	2027196	2388156	5253168	215638	1195391	21419	363756	5192814	1918313	37991	648460	179325
28	0	0	286609	564854	314303	603973	1034237	1241228	2679155	144988	517972	17990	227510	4537576	12640289	41667	843214	50781
29	0	0	5137851	7165384	5692531	10163205	14861753	17916266	36379622	4645161	10711456	690323	4421310	1911877	2369150	12059	204211	17951
30	0	0	363030	527466	362542	641291	1119973	1204364	2645870	281335	725996	33343	387729	0	0	0	0	0
31	0	0	0	21333580	0	0	14098022	39637193	119154372	0	17743641	0	5678363	0	0	0	0	0
32	0	0	3019075	6478013	3306288	7042475	12683767	18261042	60344951	1823670	8915532	585031	6512163	0	6876181	0	1108915	1513488
33	0	0	0	0	0	0	0	0	0	0	0	0	0	22156393	38314500	9618840	27062177	27494951
34	0	0	0	0	0	0	0	0	0	0	0	0	0	1038970	66933	312440	979776	1776681
35	0	0	0	0	0	0	0	0	0	0	0	0	0	2421190	1255820	7689	10994	0
Total	**333248143**	**488715559**	**35444992**	**75285328**	**36424489**	**67843314**	**113697485**	**159670877**	**364675158**	**27865565**	**88721060**	**3644423**	**34204409**	**255275978**	**179626671**	**11444687**	**48368173**	**33700281**

ANNEX. Social Accounting Matrix of Extremadura 1990 (SAM – Extremadura – 1990). Thousand ptas. (continuing)

	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	Total
1	5500118	151765	11360403	3065145	983980	3229557	49830195	54733793	14289758	20442832	18101219	115233062	0	0	0	0	0	**333248143**
2	4604619	42658	18888416	598742	681316	4370213	39523521	88620310	10012925	29225800	104415434	3762795	0	0	0	0	0	**488715559**
3	0	0	0	0	0	0	0	0	0	0	0	0	0	8173622	82930	128475	38571	**35444992**
4	0	0	0	0	0	0	0	0	0	0	0	0	0	5088457	149329	80153	24063	**75285328**
5	0	0	0	0	0	0	0	0	0	0	0	0	0	22039063	92785	344719	103493	**36424489**
6	0	0	0	0	0	0	0	0	0	0	0	0	0	14691296	468049	252033	75665	**67843314**
7	0	0	0	0	0	0	0	0	0	0	0	0	0	14808748	639562	259925	78033	**113697485**
8	0	0	0	0	0	0	0	0	0	0	0	0	0	17502009	893040	313425	94095	**159670877**
9	0	0	0	0	0	0	0	0	0	0	0	0	0	18395408	1864019	368271	110557	**364675158**
10	0	0	0	0	0	0	0	0	0	0	0	0	0	23994210	3641	370131	111124	**27865565**
11	0	0	0	0	0	0	0	0	0	0	0	0	0	39130450	87372	603894	181306	**88721060**
12	0	0	0	0	0	0	0	0	0	0	0	0	0	3085815	0	47562	14279	**3644423**
13	0	0	0	0	0	0	0	0	0	0	0	0	0	10479320	34856	161236	48407	**34204409**
14	8477	34	55484703	387805	0	3286060	30644	4657221	0	0	28516	375553	6461377	17974530	89881783	4922658	1164314	**255275978**
15	493786	9897	2371458	259833	76576	528473	4230933	8186175	5489150	460240	974709	3699681	0	0	99241922	0	0	**179626671**
16	5204352	80633	4295	1369	5940	159790	4297985	0	18425	0	0	10838	97971	51760	0	833016	0	**11444687**
17	352987	0	978052	0	1937	42905	26684979	338676	0	0	18103	79616	619237	0	1662990	345733	190397	**48368173**
18	298303	14315	1197211	210807	122972	627730	2484369	634231	19108	22622	1585766	2017686	0	0	563119	724768	53969	**33700281**
19	5248749	37127	1378418	128553	4349	497153	15180002	415945	535047	267629	310584	6269548	13775548	0	7500234	1063279	149581	**82951622**
20	0	55314	0	0	0	0	0	2554026	1046813	0	13670	2199653	675385	0	12048	39672	347	**32756446**
21	0	0	11424083	22683	0	0	0	25739581	0	0	108625	1232312	2775496	0	66992612	6594753	743006	**231836765**
22	50217	833	110742	2569249	4006	76487	69116	168466	60235	15374	58006	574044	186536	0	181584	258704	9453	**61375430**
23	76027	7667	1214815	34261	1037631	63574	425313	642854	146935	494871	417856	1167368	12501	0	0	16836	9349	**11894003**
24	161074	3685	882304	108323	21180	4162726	3966863	1276004	1026601	62003	486826	1177120	3101124	0	6520810	2977273	314605	**40495524**
25	396310	839	200957	20478	2746	62624	0	1583582	387105	1189648	489316	1868875	181225953	0	0	0	0	**205179268**
26	2175932	39422	7086031	488986	250523	1215482	12313026	9661552	3642261	822524	1828716	4818705	1205424	0	5504126	1143335	441831	**265474817**
27	909671	11550	3372899	218357	159884	612575	9502928	5040058	1359299	1910907	1245859	4573908	410901	0	2945885	81941	13724	**57428969**
28	1417744	15326	3452251	362198	164642	882131	9433032	11417256	7915294	783021	1148335	519849	43652	0	0	0	0	**63301077**
29	359529	10082	1223725	84622	109281	224536	5502408	5416558	919077	1996897	2764993	7775081	2726062	0	0	0	0	**151412961**
30	0	0	0	0	0	0	0	0	0	0	0	1815	6771481	160785601	0	0	0	**175851836**
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	106429971	0	7620858	**331696000**
32	4433315	6559204	10020750	7220226	1101278	2549677	21703954	23613960	3626215	3483789	7587745	18494327	83665318	54719810	0	23669940	0	**410920099**
33	47659904	25180995	96784763	42118402	4008514	16499721	0	20663446	6934721	2122920	5132420	0	0	0	0	0	0	**391752667**
34	3013266	473760	2971348	3425895	2438313	1162316	0	0	0	0	0	0	27942034	0	0	0	0	**45601732**
35	587242	61340	1429141	49496	718935	241794	0	111123	0	0	4696263	0	0	0	0	0	0	**11591027**
Total	**82951622**	**32756446**	**231836765**	**61375430**	**11894003**	**4049 5524**	**205179268**	**265474817**	**57428969**	**63301077**	**151412961**	**175851836**	**331696000**	**410920099**	**391752667**	**45601732**	**11591027**	

Source: Own elaboration.