Analysis of the Impact of the European Structural Funds in Andalusia between 2000 and 2006 using the 2005 Social Accounting Matrix

Cardenete, M. Alejandro[1]; Delgado, M. Carmen[2]

[1] European Commission (IPTS-JRC)
Edif. Expo, C/Inca, 3 - E-41092 Sevilla (Spain)
Tel.: (+34) 954-488293 Fax: (+34) 954-488434
E-mail: Manuel-Alejandro.CARDENETE@ec.europa.eu
Department of Economics, Quantitative Methods and Economic History
Pablo de Olavide University
Ctra. Utrera km.1, s/n - 41013 Sevilla (Spain)
Tel.: (+34) 954-349081 Fax: (+34) 954-349117
E-mail: macardenete@upo.es

[2] Department of Economics, Quantitative Methods and Economic History
Pablo de Olavide University
Ctra. Utrera km.1, s/n - 41013 Sevilla
Tel.: (+34) 954-348996 E-mail: mcdellop@upo.es

Abstract

After two decades during which the Autonomous Region of Andalusia has been receiving financing from the European Structural Funds with the objective of developing, through these investments, the economic sectors that can boost economic growth in the region, this paper[2] proposes an analysis that will reveal the economic impact of the European funds obtained by Andalusia during the period 2000-2006. With this purpose, the Social Accounting Matrix for Andalusia

[1] The first author wishes to thank the funding received from projects MICINN-ECO2009-11857, SGR2009-5781 and SEJ479, while the second author thanks the funding received from Project 092-2011 of the Centro de Estudios Andaluces (Centre for Andalusian Studies). The opinions, analyses and results of this work are the exclusive responsibility of the authors and do not represent the position of the European Commission.

[2] The authors would also like to thank Prof. Carmen Lima for the data on the distribution of the European Funds by sectors.

in year 2005 and a linear multipliers model are used. This model will help identify the sectors that benefit the most from the transfer of income provided by these funds, and to show how these exogenous injections bring about an impact on the endogenous accounts. The results underscore the significant contribution of the European funds to the growth of the region during the period analysed (2000-2006).

Keywords: Social Accounting Matrix, Linear Multipliers Model, European Regional Policy, Impact Analysis.

Classification JEL: C67

1. Introduction

Ever since the accession of Spain to the European Union (EU), Andalusia has been the recipient of European funds. Classified as an Objective 1 Region, it was included from the beginning among the beneficiaries of the actions of the European Regional Policy, due to its structural weaknesses caused by a lack of basic infrastructures.

According to the Dirección General de Fondos Comunitarios (Directorate General of Community Funds) of the Spanish Ministry of Economy, Objective 1 of the Structural Funds is the main priority of the EU cohesion policy. This is the reason why two thirds of the credits granted as Structural Funds (more than 135,000 million euros) are devoted to the recovery of the most disadvantaged regions, those called “Objective 1 Regions”, which have a gross domestic product (GDP) below 75 percent of the European average.

The convergence of the Andalusian economy to the conditions of other European regions in terms of GDP per capita during the beginning of the 1990s was not the one expected, due to the economic situation affecting the region. It was only after 1994 when the region experienced a positive reaction towards a real convergence to the Community standards in terms of GDP per capita.

With the aim of evaluating the impact that the EU structural policies may have on the regions where they are implemented, various macroeconomic works

have been developed using different methodologies. Among them, the most common models used to asses the impact of the European Regional Policy in Spain are:

- The HERMIN[3] model, which considers the effects of both the demand and the supply, especially those that reflect changes in productivity and competition.
- The QUEST II model, based on an anticipatory growth model.
- The MOISEES model, created by a group of economists of the Ministry of Economy and academics associated to the Secretariat of State of Taxes and Expenditure of the Ministry of Finance. This model mainly analyses the impact of the funds on the demand, although the effects of the supply related to the greater production capacity due to an increase of the capital stock are also taken into account.
- General equilibrium models[4], which explain the reality through hypotheses and allow calculating the impact of different economic policies and making predictions. Input-output models, Social Accounting Matrix (SAM) linear models and applied general equilibrium models are all included in this group.

This work presents an analysis that is framed within general equilibrium models, namely within SAM linear models. It implements a linear multipliers model that allows revealing the economic impact of the European funds received by the Autonomous Region of Andalusia between 2000 and 2006. This model is an extension of the Leontief Model, which applies the same methodology as the input-output models and is based on the accounting identities of the matrix that allow putting in relation the exogenous injections of income with the accounts that are considered endogenous. This way, it is possible to analyse the impact of the Community aid on all the sectors of the Andalusian economy. The Social Accounting Matrix for Andalusia in 2005 is used with this purpose.

[3] See, among other works applying this model, De la Fuente (2005) and Sosvilla (2007) for Spain, Sosvilla & Herce (2003) and Sosvilla & García (2006) for Madrid, Sosvilla (2003) for the Canary Islands, Sosvilla, Bajo & Díaz (2003) for Castilla La Mancha, Sosvilla & Murillo (2005) for Andalusia.

[4] See, among the works applying this model, Dones & Pérez (2002) for Spain, Morillas, Moniche & Marcos (1999 and 2004), Murillo (2005 and 2007), Lima & Cardenete (2005 and 2008), Lima, Cardenete & Usabiaga (2010) for Andalusia, Cámara (2008) and Cámara, Marcos & Monrobel (2008) for Madrid.

2. Structural Funds in Andalusia

The region of Andalusia, located to the south of Europe and Spain, has an area of 87,268 km^2 and a population of 8,424,102. It is the most populated of the Spanish autonomous regions and the second largest in area, two facts that explain its weight in relation to the whole of Spain.

With regard to the economic sectors, the services sector is certainly strong in Andalusia. The accumulated experience and the sustained growth rates of this sector during the last three decades explain its consolidation and expansion. The primary sector is still very relevant, with the agrifood sector representing a basic component of the Andalusian economy, due to its weight and position within the economic structure and its critical importance in relation to exports. Finally, the weight of the industrial sector is relatively low when compared to its Spanish or EU counterparts, but the high participation of the construction sector in it brings the Andalusian secondary sector closer to that of other Spanish regions.

In the first two decades of EU aid, each multi-year planning period has been devoted to the financing of different measures. Thus, in the period 1989-1993 the investments were mostly on physical infrastructures for the promotion of the economic activity; in the period 1994-1999 the financing of infrastructures was mainly oriented to the promotion of human capital training.

The strong intervention co-financed by the European Regional Policy according to the 2000-2006 Andalusian Development Plan was justified by the need to address the structural weaknesses that characterised the Andalusian economy: the insufficient internal articulation that rendered difficult all intersectoral relations, the workers' low human capital, and the weakness of the foreign sector, which was hardly diversified and still little developed along high value added lines (the promotion of an agricultural sector based on modern and competitive exploitations outside Spain, the progressive industrial specialisation in agrifood and more technologically complex and export-oriented branches, and the diversification of the tourism sector, together with the consolidation of the commercial distribution sector). Thus, in the 2000-2006 Community Support

Framework (CSF), the financing of Objective 1 regions reflects the priorities established with the aim of consolidating the factors of sustainable development in each region. This financing was destined to: the conclusion of transport and energy networks (Priority 6), the conservation of the environment, nature and water resources (Priority 3), the improvement of competitiveness and the development of the productive network, supporting innovation and business modernisation (Priorities 1, 2 and 7), the promotion of human resources development (Priorities 4A, 4B, 4C, 4D, 4E) and, finally, social and territorial cohesion (Priority 5).

Consequently, Andalusia has received 11,708.9 million euros during the seven-year period between 2000 and 2006. Of this amount, the subsidised aid of the European Commission represented 7,840.4 million euros (67 percent), while the remaining 3,868.5 million euros (33 percent) were directly provided by the Spanish administration.

3. The Structural Funds received in Andalusia in 2000-2006

Despite the concentration of EU aid in the region, the data show that the convergence of Andalusia to the rates of other European regions seems slower than that of Spain as a whole. According to the European Commission, Andalusia's GDP per capita in 1986 represented 52.8 percent of the EU-15 average, while ten years later, in 1996, it had only reached 57.2 percent. Thus, on April 28, 2000, the Spanish government presented to the European Commission three single-fund operative programmes for Andalusia, one for each Structural Fund: the European Regional Development Fund (ERDF), the Guidance Section of the European Agricultural Guidance and Guarantee Fund (EAGGF-G) and the European Social Fund (ESF). After the negotiations with the Commission, a new version of the programme was presented on September 15, 2000, which integrated the three previous ones into a single document that was approved on December 29, 2000 with the name of Programa Operativo Integrado de Andalucía (POIA, Integrated Operative Programme of Andalusia). This programme included an exhaustive breakdown, with more than 70 different measures and their corresponding descriptions developing nine priority axes of

action with the following participation of Community funds: 6,152.7 million euros (78.5 percent) from the ERDF, 755.2 million euros (9.5 percent) from the EAGGF-G and 932.5 million euros (12 percent) from the ESF.

The table below shows the distribution of the total expenditure for the period under study as reflected in the programme.

Table 1. POIA Financial Plan 2000-2006, detailed by priority axes (euros)

Priority axes	Planned Expenses
1. Improvement of competitiveness and development of the productive network	1,225,022,084
2. Knowledge society (innovation, I+D, information society)	342,440,849
3. Environment, nature and water resources	2,996,057,318
4.1. Educational infrastructure and reinforcement of technical-professional education	757,645,950
4.2. Occupational insertion and reintegration of the unemployed	256,166,263
4.3. Reinforcement of stability and adaptability in employment	154,753,800
4.4. Integration of people with special difficulties into the labour market	98,133,260
4.5. Women's participation in the labour market	116,144,860
5. Local and urban development	525,696,238
6. Transport and energy networks	4,749,078,683
7. Agriculture and rural development	434,333,303
9. Technical assistance	53,428,187
TOTAL	11,708,900,795

Source: Own elaboration from the POIA 2000-2006.

The programme was a set of actions, the implementation of which corresponded to different bodies of the State General Administration and the Andalusian Regional Government. The breakdown by funding sources reveals that 49.8 percent of the funds, i.e. 3,910.8 million euros, were managed by the Autonomous Region, and the rest, 3,929.6 million euros representing 50.2 percent, were managed by the State General Administration.

In this section, the focus will be on the study of the Structural Funds received in Andalusia. The reasons for this focus are two-fold: the fact that Structural Funds

concentrate the largest part of the aid received and the fact that they are managed and implemented in the regional context. In the evaluation of the impact of the funds, national compulsory co-financing is considered in addition to Community subsidised aid.

In order to make this analysis, a variation of the work by Cámara & Marcos (2009) is developed in which two alternative scenarios are considered:

- The basic or reference scenario, which emerges from eliminating all the Structural Funds received in the period 2000-2006 from the database, so as to start from a situation without funds.[5]
- A second scenario in which all the Structural Funds received in the period 2000-2006 are injected into the Andalusian economy without funds in order to analyse each fund's contribution to it.

4. Linear multipliers models

This section applies the methodology of the linear multipliers models to study the impact of the Structural Funds in Andalusia. This is a brief explanation of these models, as an extension of the Leontief Model: a square *n*x*n* matrix is considered, where each row and each column represent an economic account (productive sectors, consumers, government, capital, etc.) that satisfies the accounting equations of the economy (total income equals total expenditure). Each Y_{ij} component of the matrix represents the bilateral flow between account *i* and account *j*. Each row of the Social Accounting Matrix (SAM) reflects the total income that row *i* receives from column *j*; each column shows the total income of column *j* and how it is distributed among the different *i* rows. The average expenditure coefficients: $a_{ij} = Y_{ij} / Y_j$, $i, j=1\ldots n$, show the payments made to account *i* for every income unit of *j*. From this definition it is possible to obtain:

$$Y_i = \sum_{j=1}^{n} \left(Y_{ij} \Big/ Y_j\right) Y_j = \sum_{j=1}^{m} a_{ij} Y_j + \sum_{j=m+1}^{m+k} a_{ij} Y_j , \qquad n = m + k \qquad (1)$$

[5] In the case studied by Cámara & Marcos (2009), the funds received by the Autonomous Region of Madrid were subtracted from the Social Accounting Matrix for Madrid in 2000.

Indexes *m* and *k* represent the division of the SAM accounts into endogenous and exogenous accounts, which leads to the division of the *n*x*n* matrix into four submatrices: A_{mm}, A_{mk}, A_{km}, and A_{kk}. Y_m and Y_k respectively denote the total income of the endogenous and exogenous accounts. Therefore, it is possible to work out the value of Y_m from $Y_m = A_{mm}\ Y_m + A_{mk}\ Y_k$, and then, following the same procedure as with the Leontief equation, calculate the extended multipliers matrix from $Y_m = (I - A_{mm})^{-1}\ Z$, where Z is the vector of exogenous accounts[6] ($A_{mk}\ Y_k$) and $M = (I - A_{mm})^{-1}$ is the extended multipliers matrix in the SAM. These multipliers can be interpreted as the input requirements by unit increases of expenditure or income (depending on whether columns or rows are considered) in an account, as in the so-called inverse Leontief matrix, with the difference that this matrix reflects the relation between production, the factors' income, income distribution and final demand. It is important to point out that the selection of *m* (i.e., the decision regarding which accounts are endogenous) usually depends on the type of analysis undertaken, which determines which accounts (exogenous) are the ones explaining the variation of the income in other accounts (endogenous). If changes in the vector of exogenous accounts are denoted as *dZ*, changes in the income of the endogenous accounts will be expressed as:

$$dY_m = MdZ = Md(A_{mk}\,Y_k) = MA_{mk}\,dY_k \qquad (2)$$

The *ith* column in *M* indicates the total income generated in each of the endogenous accounts when a unit of income flows from the exogenous institutions towards endogenous account *i*.

In the simulation made in this section, the new vector is obtained by subtracting from vector *Z* all the injections of income from the Structural Funds received by the different branches of activity.

In the following table the accounts of the Social Accounting Matrix for Andalusia in 2005 (SAMAND05)[7] are divided into endogenous (26) and exogenous (10).

[6] Submatrix A_{mk} represents how the income flows from the exogenous accounts are distributed among the endogenous accounts.

[7] Cardenete, Fuentes & Polo (2010).

Table 2. Division of the SAMAND05 accounts into endogenous and exogenous

Endogenous Accounts	Branches of Activity
1	Agriculture
2	Stockbreeding
3	Fishing
4	Extraction of energy products
5	Other extractive industries
6	Oil refining and nuclear waste treatment
7	Production and distribution of electric energy
8	Production and distribution of gas, water steam and warm water
9	Water capture, treatment and distribution
10	Food
11	Textiles and leather
12	Wood manufactures
13	Chemical industry
14	Mining and iron and steel industry
15	Metal manufactures
16	Machinery
17	Vehicles
18	Construction materials
19	Transport
20	Other manufactures
21	Construction
22	Trade
23	Transport and Communications
24	Other services
25	Sale-oriented services
26	Non-sale oriented services
Exogenous Accounts	Branches of activity
27	Labour
28	Capital
29	Consumption
30	Gross capital formation
31	Social Security contributions paid by employers
32	Net indirect taxes
33	Social Security contributions paid by employees

34	Income tax
35	Public sector
36	Foreign sector (imports) (CIF)

Source: Own elaboration.

5. Reference scenario: the Andalusian economy without Structural Funds

In order to define a scenario without funds, it is required that all the amounts received by the economy between 2000 and 2006 are subtracted. This will be done by eliminating all the injections of income received during those years from the SAMAND05. With this purpose, it is also assumed that the economic structure of Andalusia did not vary significantly in the seven-year period under study.

Once the Structural Funds received in Andalusia are left out, they are disaggregated in order to study one by one their impact on the economy.

The amounts corresponding to each Structural Fund, as extracted from the economy, are the following:

Table 3. Distribution of the European Union and national financial contributions to the Andalusian economy in 2000-2006 (thousand euros)

Structural Funds	Resources
ERDF	6,152,700
EAGGF-G	755,214
ESF	932,500
NATIONAL CO-FINANCING	3,868,487

Source: Own elaboration from the POIA 2000-2006.

In order to establish a norm for the distribution of the resources derived from the Structural Funds among the different branches of activity that receive those investments, the work by Lima, Cardenete & Usabiaga (2010) has been used as reference. These authors defined a vector of sectoral funds, which

represented the total amount of funds received annually by a particular sector, by calculating a distribution matrix and a vector of funds.

In this work, the total amount of funds received in the period 2000-2006 has been disaggregated between the accounts of the SAMAND05, once the above-mentioned distribution norm is applied and the inflation is considered.

Table 4. Allocation of the European Structural Funds (ERDF, EAGGF-G and ESF) to the different branches of activity (thousand euros)

	Branches of activity	Structural Funds 2000-2006
1	Agriculture	490,008
2	Stockbreeding	620,664
3	Fishing	188,253
4	Extraction of energy products	6,370
5	Other extractive industries	7,361
6	Oil refining and nuclear waste treatment	129,089
7	Production and distribution of electric energy	49,315
8	Production and distribution of gas, water steam and warm water	40,030
9	Water capture, treatment and distribution	3,568
10	Food	317,517
11	Textiles and leather	96,552
12	Wood manufactures	41,286
13	Chemical industry	100,301
14	Mining and iron and steel industry	52,169
15	Metal manufactures	53,963
16	Machinery	1,300,038
17	Vehicles	100,952
18	Construction materials	41,008
19	Transport	52,962
20	Other manufactures	126,152
21	Construction	4,223,756
22	Trade	534,997
23	Transport and Communications	126,962
24	Other services	590,243
25	Sale-oriented services	913,777

26	Non-sale oriented services	1,501,603
	Total	11,708,901

Source: Own elaboration from Lima, Cardenete & Usabiaga (2010).

6. Estimation of the impact of the Structural Funds on the Andalusian economy in the period 2000-2006

In order to calculate the impact of the Structural Funds on the Andalusian economy during the seven-year period under study, the income derived from the exogenous accounts will be reduced by removing the revenues obtained through Community aid and national co-financing.

Once the distribution norm and the allocation of Structural Funds are determined, as specified in the previous section, the results obtained are presented below. The following table shows the variation of vectors *Z* and *Y* when the amounts received by the different branches of activity in the period 2000-2006, including those from the ERDF, EAGGF-G and ESF, are left out.

Table 5. Variation of the total output of the endogenous accounts once the Structural Funds of 2000-2006 are removed (thousand euros)

	Productive sectors	Z	ZwithoutFunds	Y	YwithoutFunds	Variation (%)
1	Agriculture	5,968,028	5,478,018	10,413,615	9,761,241	-6.26
2	Stockbreeding	745,445	124,781	2,474,139	1,774,903	-28.26
3	Fishing	1,023,590	835,336	1,396,690	1,193,556	-14.54
4	Extraction of energy product	15,869	9,498	6,360,745	6,091,183	-4.24
5	Other extractive industries	120,145	112,784	2,882,238	2,627,694	-8.83
6	Oil refining and nuclear waste treatment	9,482,952	9,353,862	17,355,828	16,760,310	-3.43
7	Production and distribution of electric energy	1,078,571	1,029,256	3,704,577	3,495,309	-5.65
8	Production and distribution of gas, water steam and warm water	100,455	60,424	1,171,876	1,069,713	-8.72
9	Water capture, treatment and distribution	375,875	372,307	1,100,115	1,047,496	-4.78
10	Food	20,195,426	19,877,909	30,117,198	29,344,041	-2.57
11	Textiles and leather	6,254,577	6,158,025	7,509,434	7,370,536	-1.85

12	Wood manufactures	959,264	917,978	4,329,165	4,078,151	-5.80
13	Chemical industry	6,450,023	6,349,722	12,132,050	11,704,273	-3.53
14	Mining and iron and steel industry	2,459,347	2,407,177	6,281,203	5,937,854	-5.47
15	Metal manufactures	1,416,045	1,362,082	4,815,122	4,402,160	-8.58
16	Machinery	6,724,015	5,423,977	14,234,609	12,241,923	-14.00
17	Vehicles	6,518,648	6,417,696	7,945,355	7,782,202	-2.05
18	Construction materials	930,063	889,054	7,140,461	6,340,645	-11.20
19	Transport	1,462,836	1,409,873	2,053,223	1,962,644	-4.41
20	Other manufactures	6,188,094	6,061,941	9,780,668	9,444,454	-3.44
21	Construction	29,972,586	25,748,830	48,054,390	41,689,969	-13.24
22	Trade	17,146,981	16,611,984	20,546,895	19,711,267	-4.07
23	Transport and Communications	6,280,369	6,153,407	16,739,870	15,951,165	-4.71
24	Other services	27,132,800	26,542,557	44,743,375	43,130,475	-3.60
25	Sale-oriented services	16,908,186	15,994,409	23,204,586	21,932,171	-5.48
26	Non-sale oriented services	12,646,853	11,145,250	13,046,073	11,503,793	-11.82
	Total	**188,557,043**	**176,848,142**	**319,533,500**	**298,349,135**	**-6.63**

Source: Own elaboration.

Table 5 shows vector *Z*, which contains the total injections of income that each of the endogenous accounts received from the whole set of exogenous accounts; vector *ZwithoutFunds*, in which the injections from the Structural Funds have been removed; vector *Y*, which reflects the total output of all the endogenous accounts in a scenario with funds, and vector *YwithoutFunds*, which represents the total output of the endogenous accounts prior to receiving the funds. Finally, the last column presents the percentage variation in that output once those funds are removed.

Thus, it is possible to observe how the branches of activity that are most affected by the removal of the funds are: Stockbreeding (2), with a negative variation of 28.26 percent; Fishing (3), with a 14.54 percent reduction of its output; Machinery (16), with a decrease of 14 percent and Construction (21), where the negative variation amounts to 13.24 percent. On the contrary, the branches of activity that are least affected by the removal of the funds are: Textiles and leather (11), with a reduction of 1.85 percent; Vehicles (17), with a negative variation of 2.05 percent; Food (10), where the negative variation reaches 2.57 percent, and Other manufactures (20), with a 3.44 percent reduction of the output.

The following subsections describe the second scenario, in which the Structural Funds received in 2000-2006 are injected into the Andalusian economy without funds, with the aim of analysing the contribution made by each fund.

6.1. Estimation of the impact of the ERDF on the Andalusian economy in 2000-2006

The following table (Table 6) reflects the distribution of the resources derived from the ERDF among the different branches of activity during the period under study. This distribution has been implemented in the same way as the distribution of the overall resources described in the previous section.

Table 6. Allocation of the ERDF to the different branches of activity (thousand euros)

	Branches of activity	ERDF
1	Agriculture	91,219
2	Stockbreeding	69,432
3	Fishing	121,063
4	Extraction of energy product	1,703
5	Other extractive industries	1,968
6	Oil refining and nuclear waste treatment	87,413
7	Production and distribution of electric energy	33,394
8	Production and distribution of gas, water steam and warm water	27,107
9	Water capture, treatment and distribution	3,533
10	Food	134,213
11	Textiles and leather	66,896
12	Wood manufactures	27,348
13	Chemical industry	67,919
14	Mining and iron and steel industry	33,287
15	Metal manufactures	37,012
16	Machinery	1,280,995
17	Vehicles	68,360
18	Construction materials	27,164
19	Transport	35,864

20	Other manufactures	99,041
21	Construction	4,205,706
22	Trade	378,848
23	Transport and Communications	102,388
24	Other services	467,215
25	Sale-oriented services	270,534
26	Non-sale oriented services	1,232,791
	Total	8,972,410

Source: Own elaboration from Lima, Cardenete & Usabiaga (2010).

Table 6 shows the amounts that are added to vector *ZwithoutFunds* in order to obtain vector *ZwithoutFunds + ERDF*. By applying the multipliers model, vector *YwithoutFunds + ERDF* is also worked out.

The following table shows the increase of the endogenous accounts (*YwithoutFunds + ERDF – YwithoutFunds*), as well as the percentage increase of the output in each endogenous account due to the injection of ERDF.

Table 7. Increase of the total output of the endogenous accounts after the injection of ERDF during 2000-2006 (thousand euros)

	Branches of activity	ZwithoutFunds + ERDF	YwithoutFunds + ERDF	YwithoutFunds + ERDF – YwithoutFunds	Increase (%)
1	Agriculture	5,569,238	9,918,810	157,569	1.59
2	Stockbreeding	194,214	1,879,167	104,265	5.55
3	Fishing	956,399	1,324,228	130,672	9.87
4	Extraction of energy product	11,201	6,292,884	201,701	3.21
5	Other extractive industries	114,752	2,858,629	230,935	8.08
6	Oil refining and nuclear waste treatment	9,441,276	17,217,312	457,001	2.65
7	Production and distribution of electric energy	1,062,650	3,648,609	153,300	4.20
8	Production and distribution of gas, water steam and warm water	87,531	1,144,783	75,069	6.56
9	Water capture, treatment and distribution	375,840	1,081,603	34,106	3.15
10	Food	20,012,122	29,697,892	353,851	1.19
11	Textiles and leather	6,224,921	7,467,588	97,051	1.30
12	Wood manufactures	945,326	4,280,077	201,925	4.72
13	Chemical industry	6,417,641	12,015,485	311,212	2.59
14	Mining and iron and steel industry	2,440,465	6,231,521	293,667	4.71

15	Metal manufactures	1,399,094	4,764,492	362,332	7.60
16	Machinery	6,704,972	14,151,494	1,909,571	13.49
17	Vehicles	6,486,056	7,896,494	114,292	1.45
18	Construction materials	916,219	7,095,440	754,794	10.64
19	Transport	1,445,737	2,025,037	62,392	3.08
20	Other manufactures	6,160,982	9,713,835	269,381	2.77
21	Construction	29,954,535	47,898,161	6,208,192	12.96
22	Trade	16,990,832	20,292,199	580,932	2.86
23	Transport and Communications	6,255,794	16,582,713	631,548	3.81
24	Other services	27,009,772	44,361,085	1,230,610	2.77
25	Sale-oriented services	16,264,943	22,478,652	546,481	2.43
26	Non-sale oriented services	12,378,041	12,769,273	1,265,480	9.91
	Total	**185,820,552**	**315,087,465**	**16,738,329**	**5.12**

Source: Own elaboration.

Table 7 shows how the total output is increased by 16,738,329 thousand euros, an amount that represents approximately a 5 percent increment. The activity branches with a greater output increase are: Machinery (16), with a 1.49 percent variation; Construction (21), with an increase of 12.96 percent; Construction materials (18), where the percentage reaches 10.64; Non-sale-oriented services (26), with a 9.91 percent increment, and Fishing (3), with a 9.87 percent variation. On the contrary, the branches of activity that are least affected by the injection of ERDF are: Food (10), with a 1.19 percent increment; Textiles and leather (11), with a 1.30 percent variation; Vehicles (17), with a 1.45 percent increase; Agriculture (1), with 1.59 percent, and Sale-oriented services (25), with a 2.43 percent variation.

Some accounts increased their output in a greater degree than others that nevertheless receive more financing from the ERDF. This is, for example, the case of the Construction Materials sector (18), the output of which increases to a greater extent than that of the Non-sale oriented services (26), despite its receiving less funding from that source.

6.2. Estimation of the impact of the EAGGF-G on the Andalusian economy in 2000-2006

As in the previous case, Table 8 shows the distribution of the resources derived from the EAGGF-G among the different branches of activity in the period under study.

Table 8. Allocation of the EAGGF-G to the branches of activity (thousand euros)

	Branches of activity	EAGGF-G
1	Agriculture	361,427
2	Stockbreeding	517,559
3	Fishing	33,236
10	Food	145,017
22	Trade	107,842
24	Other services	49,921
	Total	1,215,003

Source: Own elaboration from Lima, Cardenete & Usabiaga (2010).

Table 8 shows the amounts that are added to vector *ZwithoutFunds* in order to obtain vector *ZwithoutFunds* + *EAGGF-G*. By applying the multipliers model, it is also possible to calculate vector *YwithoutFunds* + *EAGGF-G*.

The following table shows the increase in the endogenous accounts (*YwithoutFunds* + *EAGGF-G* – *YwithoutFunds*), as well as the percentage increase of every endogenous account due to the injection of EAGGF-G.

Table 9. Increase of the total output of the endogenous accounts after the injection of EAGGF-G during 2000-2006 (thousand euros)

	Branches of activity	ZwithoutFunds + EAGGF-G	YwithoutFunds + EAGGF-G	YwithoutFunds + EAGGF-G – YwithoutFunds	Increase (%)
1	Agriculture	5,839,446	10,202,881	441,640	4.33
2	Stockbreeding	642,340	2,328,598	553,696	23.78
3	Fishing	868,573	1,230,343	36,787	2.99
4	Extraction of energy product	9,498	6,111,854	20,670	0.34

5	Other extractive industries	112,784	2,631,919	4,225	0.16
6	Oil refining and nuclear waste treatment	9,353,863	16,811,099	50,789	0.30
7	Production and distribution of electric energy	1,029,256	3,515,293	19,984	0.57
8	Production and distribution of gas, water steam and warm water	60,424	1,075,208	5,494	0.51
9	Water capture, treatment and distribution	372,307	1,060,140	12,643	1.19
10	Food	20,022,926	29,681,901	337,859	1.14
11	Textiles and leather	6,158,025	7,375,377	4,840	0.07
12	Wood manufactures	917,978	4,094,740	16,588	0.41
13	Chemical industry	6,349,722	11,753,232	48,959	0.42
14	Mining and iron and steel industry	2,407,177	5,946,552	8,698	0.15
15	Metal manufactures	1,362,082	4,420,672	18,512	0.42
16	Machinery	5,423,977	12,268,624	26,701	0.22
17	Vehicles	6,417,696	7,790,988	8,786	0.11
18	Construction materials	889,055	6,352,343	11,698	0.18
19	Transport	1,409,874	1,965,744	3,099	0.16
20	Other manufactures	6,061,941	9,461,973	17,519	0.19
21	Construction	25,748,830	41,725,331	35,362	0.08
22	Trade	16,719,826	19,879,221	167,954	0.84
23	Transport and Communications	6,153,407	16,018,804	67,639	0.42
24	Other services	26,592,479	43,286,464	155,988	0.36
25	Sale-oriented services	15,994,409	21,965,249	33,078	0.15
26	Non-sale oriented services	11,145,250	11,504,633	840	0.01
	Total	**178,063,145**	**300,459,184**	**2,110,049**	**1.52**

Source: Own elaboration.

Table 9 shows how the total output increases by 2,110,049 thousand euros, with an average increase of approximately 1.5 percent. The branches of activity that experience a higher increase of their output are: Stockbreeding (2), with a 23.78 percent variation; Agriculture (1), with a 4.33 percent increase; Fishing (3), which reaches a 2.99 percent; Water capture, treatment and distribution (9), with a 1.19 percent increase, and Food (10), with a 1.14 percent variation. On the contrary, the branches of activity that are least affected by the injection of EAGGF-G are: Non-sale-oriented services (26), with a 0.01 variation; Textiles and leather (11), with a 0.07 percent increase; Construction (21), with a close 0.08 percent increase; Vehicles (17), with a 0.11 percent variation, and Sale-oriented services (25), with a 0.15 percent increment of the output.

It is also worth remarking that certain accounts that do not directly receive an injection of EAGGF-G, such as Water capture, treatment and distribution (9),

are nevertheless benefited from that injection to a greater extent than other accounts receiving direct funds from this source.

6.3. Estimation of the impact of ESF on the Andalusian economy in 2000-2006

Just as in the two previous cases, Table 10 reflects the distribution of the resources derived from the ESF among the different branches of activity in the period under study.

Table 10. Allocation of the ESF to the different branches of activity (thousand euros)

	Branches of activity	ESF
1	Agriculture	37,363
2	Stockbreeding	33,672
3	Fishing	33,954
4	Extraction of energy product	4,668
5	Other extractive industries	5,393
6	Oil refining and nuclear waste treatment	41,676
7	Production and distribution of electric energy	15,921
8	Production and distribution of gas, water steam and warm water	12,924
9	Water capture, treatment and distribution	35
10	Food	38,287
11	Textiles and leather	29,656
12	Wood manufactures	13,938
13	Chemical industry	32,382
14	Mining and iron and steel industry	18,882
15	Metal manufactures	16,951
16	Machinery	19,043
17	Vehicles	32,592
18	Construction materials	13,844
19	Transport	17,099
20	Other manufactures	27,112
21	Construction	18,051

22	Trade	48,307
23	Transport and Communications	24,575
24	Other services	73,107
25	Sale-oriented services	643,243
26	Non-sale oriented services	268,812
	Total	1,521,488

Source: Own elaboration from Lima, Cardenete & Usabiaga (2010).

Table 10 shows the amounts added to vector *ZwithoutFunds* in order to obtain vector *ZwithoutFunds* + *ESF.* Vector *YwithoutFunds* + *ESF* is calculated by applying the multipliers model.

The table below shows the increase of the endogenous accounts (*YwithoutFunds* + *ESF* – *YwithoutFunds*), as well as the percentage increase of the output of each endogenous account due to the injection of ESF.

Table 11. Increase of the total output of the endogenous accounts after the injection of ESF during 2000-2006 (thousand euros)

	Branches of activity	ZwithoutFunds + ESF	YwithoutFunds + ESF	YwithoutFunds + ESF – YwithoutFunds	Increase (%)
1	Agriculture	5,515,383	9,814,407	53,166	0.54
2	Stockbreeding	158,454	1,816,177	41,275	2.27
3	Fishing	869,291	1,229,231	35,674	2.90
4	Extraction of energy product	14,166	6,138,374	47,191	0.77
5	Other extractive industries	118,177	2,647,078	19,384	0.73
6	Oil refining and nuclear waste treatment	9,395,539	16,848,038	87,728	0.52
7	Production and distribution of electric energy	1,045,177	3,531,293	35,984	1.02
8	Production and distribution of gas, water steam and warm water	73,348	1,091,312	21,599	1.98
9	Water capture, treatment and distribution	372,342	1,053,366	5,869	0.56
10	Food	19,916,196	29,425,488	81,446	0.28
11	Textiles and leather	6,187,681	7,407,543	37,006	0.50
12	Wood manufactures	931,916	4,110,651	32,499	0.79
13	Chemical industry	6,382,104	11,771,879	67,606	0.57
14	Mining and iron and steel industry	2,426,060	5,978,837	40,983	0.69
15	Metal manufactures	1,379,033	4,434,278	32,118	0.72
16	Machinery	5,443,020	12,298,337	56,414	0.46

17	Vehicles	6,450,288	7,822,276	40,074	0.51
18	Construction materials	902,899	6,373,969	33,324	0.52
19	Transport	1,426,972	1,987,733	25,088	1.26
20	Other manufactures	6,089,053	9,493,769	49,315	0.52
21	Construction	25,766,880	41,810,837	120,868	0.29
22	Trade	16,660,291	19,798,009	86,742	0.44
23	Transport and Communications	6,177,981	16,040,685	89,519	0.56
24	Other services	26,615,664	43,356,778	226,302	0.52
25	Sale-oriented services	16,637,652	22,625,027	692,856	3.06
26	Non-sale oriented services	11,414,062	11,779,753	275,960	2.34
	Total	**178,369,630**	**300,685,126**	**2,335,990**	**0.97**

Source: Own elaboration.

Table 11 reflects how the total output is increased by 2,335,990 thousand euros, an increment of approximately 1 percent. The branches of activity in which the output increases the most are: Sale-oriented services (25), with a 3.06 percent increase; Fishing (3), with a 2.90 percent variation; Non-sale-oriented services (26), where the increase reaches 2.34; Stockbreeding (2), with a 2.27 percent increment, and Production and distribution of gas, water steam and warm water (8), with a 1.98 percent increase. On the contrary, the branches of activity that are least affected by the injection of ESF are: Food (10), with a 0.28 percent variation; Construction (21), with a 0.29 percent increase; Trade (22) with a 0.44 percent increase; Machinery (16) with 0.46 percent, and Textiles and leather (11), with a 0.5 percent increase of the output. The increment in the output of Stockbreeding (2) is very similar to that of the Sale-oriented services (25), but the ESF destined to the latter are comparatively larger than the ones received by the former.

7. Conclusions

This work aims at identifying the Andalusian productive sectors that are most benefited by the reception of European Structural Funds. With this purpose, the Social Accounting Matrix for Andalusia in 2005 has been used and a linear multipliers model has been applied. The results obtained allow classifying the sectors of the Andalusian economy according to their capacity to absorb the

exogenous injections of income derived from these funds and to experience structural changes that may boost the growth of the regional economy.

These results reveal the region's need to receive those funds. They demonstrate that the output variations in every sector, once the injections of income associated to the funds are introduced, are quite significant.

In the case of the reference scenario, where a total elimination of the Structural Funds is simulated, it is possible to observe that the effect on the output is an average reduction of 6.63 percent, with Stockbreeding (2), Fishing (3), Machinery (16) and Construction (21) as the branches of activity that are most affected by the removal of those funds.

On the contrary, the data obtained for the second scenario – that in which the injections of income from each fund to the different sectors of the Andalusian economy are considered – show that the average increase in the output of the different endogenous accounts is also very significant. In the case of the injection of ERDF, the output increase reaches 16,738,329 thousand euros (a 5.12 percent increment), with the following branches of activity showing a greater absorption capacity: Machinery (16) and Construction (21). In the case of the EAGGF-G, the output increased by 2,110,049 thousand euros (1.52 percent), with the primary sector – Stockbreeding (2), Agriculture (1) and Fishing (3) – showing a greater absorption capacity. Finally, the injection of ESF is reflected in an increment of the output that reaches 2,335,990 thousand euros, with an average percentage increase of 0.97 percent. In this case, Sale-oriented services (25) and Fishing (3) are the two branches with a greater absorption capacity.

It is therefore possible to conclude that the European Structural Funds clearly help promoting the development of Andalusia through the investments made in this region by the European Regional Policy, which, as it was underlined above, not only affect those sectors that are the direct recipients of the funds, but also influence all the other economic sectors.

8. References

Cámara, A. & Marcos, M.A. (2009): "Análisis del impacto de los Fondos Europeos 2000-2006 en la Comunidad de Madrid a partir de la matriz de contabilidad social del año 2000", *Investigaciones Regionales*, 13, 71-92.

Cámara, A., Marcos, M. A. & Monrobel, J. R. (2008): "Análisis del impacto de la política regional comunitaria 2007-2013 en la Comunidad de Madrid". Baeza: XXXIV Reunión de Estudios Regionales.

Cardenete, M.A., Fuentes, P. & Polo, C. (2010):" Una estimación de la Matriz de Contabilidad Social de Andalucía de 2005 a precios de adquisición" mimeo.

Comisión Europea (1986): *Sexto informe periódico sobre la situación socioeconómica y desarrollo de las regiones de la Unión Europea*, Bruselas.

Consejería de Economía y Hacienda (2001): *Plan de desarrollo regional, marco comunitario de apoyo y programa operativo integrado de Andalucía 2000-2006*, Sevilla.

Cuadrado-Roura, J.R. & Marcos M.A. (2005): "Disparidades regionales en la Unión Europea. Una aproximación a la cuantificación de la cohesión económica y social", *Investigaciones Regionales*, 6, 3-90.

Curbelo, J.R. (1988):"Crecimiento y equidad en una economía regional estancada: El caso de Andalucía (Un análisis en el marco de las matrices de contabilidad social)", *Investigaciones Económicas*, 12:3, 501-518.

De la Fuente, A. (2002): "Fondos estructurales, inversión en infraestructuras y crecimiento regional", Fundación Caixa Galacia, *Documento de Economía n°18.*

De la Fuente, A. (2003): “El impacto de los Fondos Estructurales: convergencia real y cohesión interna”, *Documento de Trabajo*, Dirección General de Presupuestos, Ministerio de Hacienda.

De la Fuente, A. (2005): “El impacto de la reducción de las ayudas estructurales europeas: una primera aproximación”, *Documento de Trabajo D-2005-04*, Dirección General de Presupuestos, Ministerio de Economía y Hacienda.

Dones, M. & Pérez, J. (2002): "Evaluación de los efectos macroeconómicos de los Fondos Estructurales y los Fondos de Cohesión (1995-1999) mediante Tablas Input-Output regionales integradas", *Cuadernos del Fondo de Investigación Richard Stone*, 2, Instituto L.R. Klein-Centro Stone.

González-Páramo, J. M. & Martínez, D. (2002): “Public Investment and Convergence in the Spanish Regions”, *Documento de Trabajo EEE 112*, Estudios sobre la Economía Española, FEDEA.

Lima, M. C. & Cardenete, M. A. (2005): “Análisis de impacto de los Fondos FEDER recibidos por una economía regional: un enfoque a través de matrices de contabilidad social”, *Presupuesto y Gasto Público*, 40:3, 113-131.

Lima, M. C. & Cardenete, M. A. (2008): “The Impact of the European Structural Funds in the south of Spain: A CGE Approach”, *European Planning Studies*, 16:10, 1445-1457.

Lima, M. C., Cardenete, M. A. & Usabiaga, C. (2010): “Andalucía y el MAC 2000-2006: Una evaluación de los Fondos Estructurales recibidos”, *Papeles de Economía Espa*ñola, 123, 102-118.

Morillas, A., Moniche, L. & Marcos, J. (1999): “Evaluación de los efectos de los Fondos Estructurales en la economía andaluza”, *Estudios Regionales*, 54, 225-249.

Morillas, A., Moniche, L. & Marcos, J. (2004): “Efectos ultra frontera y convergencia regional: una reflexión a partir del MAC 94-99 en Andalucía”, http://campusvirtual.uma.es/morillas/Fondos.pdf.

Murillo, E. & Sosvilla, S. (2003): “Efectos a largo plazo sobre la economía andaluza de las ayudas procedentes de los Fondos Estructurales: el Marco de Apoyo Comunitario 1994-1999”, *Documento de Trabajo 2003-07*, FEDEA.

Sosvilla, S. (2003): “Canarias y los Fondos Estructurales europeos”, *Documento de Trabajo 2003-28*, FEDEA.

Sosvilla, S. (2007): "La economía española y la política de cohesión europea", *ICE*, *Revista de Economía*, 837, 211-230.

Sosvilla, S., Avilés, A., Murillo, E., Ordóñez, J.M. & Herce, J. A. (2004): *Andalucía y la política regional europea*, Colección Pablo de Olavide, Consejería de Economía y Hacienda, Junta de Andalucía, Sevilla.

Sosvilla, S., Bajo, O. & Díaz, C. (2003): “Efectividad de la política regional comunitaria: el caso de Castilla-La Mancha”, *Papeles de Economía Espa*ñola *2003-25*, 107, 243-255.

Sosvilla, S. & Herce, J. A. (2003): “Efectos de las ayudas europeas sobre la economía madrileña, 1990-2006: Un análisis basado en el modelo Hermin”. *Documento de Trabajo 2003-29*, FEDEA.

Sosvilla, S. & Herce, J. A. (2004): “La política de cohesión europea y la economía española: evaluación y prospectiva”, *Documento de Trabajo nº 142/2004*, Real Instituto Elcano de Estudios Internacionales y Estratégicos.

Sosvilla, S. & García, E. (2006): “Efectos de las ayudas europeas sobre la economía madrileña, 2007-2013: Un análisis basado en el modelo Hermin”. *Documento de Trabajo* 2006-07, FEDEA.