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The Impact of European Structural Funds in the South of Spain

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Abstract *Over the last decades, the European Union has contributed to the development of poor regions of the Associate Members. This is the case of Andalusia, an Objective 1 region for the European regional policy in the south of Spain. In this paper we carry out an impact analysis of the European Regional Development Fund (ERDF), one of the most important Structural Funds, to the object of assessing its effect on aggregate and sectoral production, price indexes and consumers' welfare. To this extend we compute an Applied General Equilibrium Model (AGEM) and we present a counterfactual analysis with simulations for three representative years: 1990, 1995 and 1999. We conclude that regional funding has deeply contributed to Andalusian regional development and the effectiveness of the funds seems to be larger for the last years of the study.*

Introduction

The European Regional Policy is based on two concepts: solidarity and cohesion. These two concepts aim to narrow the gaps of income and wealth between the poorer regions and countries and those that register a better behaviour in terms of European Union (EU) key indicators. The EU regional policy means one-third of total EU budget between 2000 and 2006 (€213 billion). One of the main instruments of this policy are the "Structural Funds", where €195 billion are allocated. A 70% of this amount is concentrated on the so-called Objective 1 regions where gross domestic product (GDP) is less than 75% of the EU average. During this programming period the amounts transferred to the Objective 1 regions in Spain reached 0.8% of the Spanish GDP.[1]

Andalusia, a large region in the south of Spain, is one of those Objective 1 regions and it is also the Spanish region that has received the biggest amount of funding because of its economic situation, geographical extension and population. The causes of inequality in this economy can be explained by the important lack of infrastructures, necessary to develop the economic activity, and the need of a better qualification of human capital

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in all educational categories, issues that have been outlined in its regional planification documents.[2] Andalusia has been receiving important financial support since the EU approved the first Community Support Framework (CSF). In this document, the European Commission signed an agreement with national governments including the financial grants for 1989–1993, and the same happened in later years for 1994–1999 up to now, at the end of the CSF 2000–2006 and at the beginning of the CSF 2007–2013. The allocation rule of these amounts has considerably changed from the first CSF, because of the enlargement of 2004. The new members register an income lower than the European average, and even lower than the initially poor regions in the EU-15. This last enlargement has expanded the population of the EU by 20%, but the GDP has increased only by 5% following Eurostat data.[3] This fact means a complete change in the map of reception regions. The newcomers have received pre-adhesion grants before entry and will need additional help in future years. The financial perspectives for this pluriannual period 2007–2013 have been recently approved and follow this behaviour. They have been negotiated with similar global figures, slightly smaller to be exact, with the last enlargement countries as the main receptors and a small group of "old receptor" regions that concentrate the rest of the investment. In fact, when the negotiations of the new CSF were done, Andalusia was classified as an Objective 1 region for the CSF 2007–2013 together with other two Spanish regions as Galicia and Extremadura. Nevertheless, the "statistical effect" generated by the new EU-27 and the investments on this economy, locate Andalusia over the 75% average income reference nowadays.[4]

Hence, in the near future, Andalusia will need an adaptation period for the loss of European funding. But to what extend have these funds contributed to economic growth in the south of Spain? Which would have been the actual scenario if funds had never existed? In this work we assess the effects of the European spending on the main macroeconomic variables of Andalusian economy. To that extend, we carry out an Applied General Equilibrium Model (AGEM) for the region of Andalusia with the object of analysing the impact of the Structural Funds, and more specifically those coming from the European Regional Development Fund (ERDF), which has been 60% over the total amount received by this regional economy. In this exercise we do not include national or regional co-financing.

The AGEM works with three databases corresponding with the Andalusian Social Accounting Matrices (SAMs) available for 1990 (Cardenete, 1998), 1995 (Cardenete & Sancho, 2003) and an approach for 1999 (Cardenete & Sancho, 2004) by means of an updating technique called Cross Entropy Method (CEM)[5] applied on the SAM 1995. Each of them will be used to evaluate the incidence of the European expending that is approved after the negotiation between the European Commission and the national or regional government. The CSFs have been distributing the EU grants for the pluriannual periods 1989–1993, 1994–1999 and 2000–2006 so far. In our impact assessment, we will annualize the total amounts of each of the pluriannual CSF. Furthermore, we will make a clear distribution between the "priority axes" contained in the CSF and the different accounts that make up our SAM.

The model we present is a standard AGEM, and we use an *ex post* approach. We derive conclusions about the degree of dependence of the Andalusian region with regard to the community help. With this purpose, we address a counterfactual analysis where the real situation with the regional funds is compared with the hypothetical one where the funds are removed. We present three cross-sectional analysis and our conclusions will hold under the assumption that the behaviour of agents does not change in the short run.

As regards the organization of this paper, the second section presents some brief literature about developments on general equilibrium theory and more specific references about impact assessments of European funding under different methodologies. The third section deals with the formulation of the AGEM and the obtaining of our benchmark equilibrium. This equilibrium must replicate the initial data for each of the three SAMs. In the fourth section we go onto obtaining the new results when funds are dropped and in the fifth section, we outline the main conclusions.

Some Literature

The AGEMs have deeply contributed to economic modelling in the last decades. These models are also known as walrasian models and represent the empirical application of the general equilibrium theory. They extract implications that cannot be derived from the partial equilibrium methodologies such as SAMs linear models, because they allow for substitution between factors and they are able to capture the effects of a change in relative factor prices, consumer's demand or government' s behaviour on the whole economy.

The general equilibrium theory of Walras (1874), was followed by Arrow and Debreu (1954), Wald (1951) or McKenzie (1959); showing the equilibrium existence and its properties. Nowadays we can work with effective algorithms, being able to solve optimization problems after a complicate iteration process. It was Scarf (1973), who initially improved the complex computational work, laying the foundations for the research of Shoven and Whalley (1972), Whalley (1975, 1977), or Shoven (1976). One more recent contribution has been the one of Shoven and Whalley (1992). All these authors have outlined the importance of the AGEMs, as an instrumental for the evaluation of public policies and for other comparative static exercises.

Some more specific papers on European regional policy evaluation are the ones of Beugelsdijk and Eijffinger (2005), with a convergence study of the EU Member States for 1995–2001 and an efficiency analysis in the use of structural funds; and the macro-regional evaluation proposed by Bradley *et al.* (2003) with the HERMIN macro-economic model. This second framework has been used at the Spanish level in several papers such as that of Sosvilla *et al.* (2006) that presents an *ex post* analysis focused on a Spanish Objective 1 region such as Castilla-La Mancha with an adaptation of the HERMIN-Spain to this regional economy. Similar research based on a regionalization of the HERMIN-Spain model has been presented for other regions such as Canarias in Sosvilla (2003) or Comunidad de Madrid in Sosvilla and Herce (2003). For the region of Andalusia Sosvilla *et al.* (2004) apply a regionalization of the HERMIN model again to analyse the effects of the European grants for the period 1989–2006 and they detect an important contribution of these amounts in terms of real convergence. Furthermore, Sosvilla and Murillo (2005) work to capture the supply side effects of the CSF 1994–1999 using cointegration techniques and time series. In conclusion, all these estimations confirm the effectiveness of the European funding to help Andalusia to overcome its structural lag.

The idea of analysing the effectiveness of funds of Beugelsdijk and Eijffinger (2005) and the analysis of a possible trade off between aggregate growth and internal cohesion has also been discussed at the Spanish level in some works of De la Fuente (2002, 2003, 2005). This author deals with the contribution of Structural Funds to the growth of output and employment in the Objective 1 regions of Spain through a macro-economic

growth model. His results support the hypothesis that European grants have significantly contributed to Spanish regional convergence to the EU average income per capita.

As regards linear and non-linear applied general equilibrium methodologies, Sharify and Batey (2006) combine a SAM with a Linear Programming model for the impact analysis in the allocation of resources applied to the Golestan province of Iran. At the Spanish regional level, Cámara (2006) applies the multiplier theory to a SAM type model for the Comunidad de Madrid to assess the impact of European grants for 2000 to 2006. For the region of Andalusia, Morillas *et al.* (1999) try to catch up the externalities derived from the 1989–1993 funds through simulations with the input–output tables in Andalusia.

The authors have also worked on this type of simulations before. In a previous paper, Lima and Cardenete (2005a), have developed an impact assessment of European Structural Funds using the SAM framework. Although the SAM linear model captures a wider range of effects than the ones provided by the input–output techniques, such as changes in income, consumption or final demand; they do not take into account the effects on sectoral and consumer prices, the tax revenues, or a wider flexibility in the technological assumptions. The possibility of capturing further impacts is the main reason to present the current paper following an Applied General Equilibrium methodology.

Undoubtedly, the AGEM, as most of the methodologies, can be improved in aspects such as the accuracy of the predictions. In fact, there is a trade-off between the search of sophisticated functional relations that replicate the behaviour of the different institutions, and the difficulties of solving really complex optimization problems. Nevertheless, these problems are also found in other methodologies such as econometrics, linear general equilibrium models—SAM models—or input–output analysis. Anyway, an AGEM provides us with a consistent solution, based on a group of relative prices and sectoral production levels that clear the markets, and make it possible to find a new equilibrium after simulation.

The AGEMs are useful to assess the effects of a specific decision of the policy-maker involving the productive sectors or the rest of the agents in an economy. Furthermore, it is possible to extract conclusions under *ex ante* alternative scenarios or to present counterfactual analysis. In an AGEM, we work with a wide database that includes the necessary information of a particular economy. This information is often provided by the SAMs that fullfill the information from the input–output tables with some other data coming from the national or regional accounting or the family budget statistics.

The Model

In this section we carry out a model describing the Andalusian economy: productive sectors, primary factors, families, public sector and foreign sector. In this paper, we are working with three SAMs with the following structure: the two productive factors (capital and labour—accounts (11) and (12), respectively—the private sector with a representative consumer (13) and finally 10 activity sectors [accounts (1) to (10)]. The exogenous accounts, following the most common approaches in the literature are: the public sector (14), the savings and investment (15), and the foreign sector (16). We work with the three SAMs for Andalusia for 1990, 1995 and 1999.

The Producers

Suppose that markets work in perfect competition, where net profits after taxes are maximized for all the productive sectors. We work with a nested production function, with constant returns to scale. In the first level, the total production X_j is defined by a technology of fixed coefficients that combines two inputs: the domestic production (XD_j), and the imports, M_j. The sub index j ranges from one to ten, according to the productive sectors:

$$X_j = \min(XD_j, M_j) \qquad \forall_j = 1 \ldots 10 \tag{1}$$

The aggregation of the production in X_j follows the specification of Armington (1969); meaning that the imports are imperfect substitutes of domestic production. For obtaining XD_j, we combine intermediate inputs and value added following Leontief's technology:

$$XD_j = \min\left(\frac{X_{1,j}}{a_{1,j}}, \frac{X_{2,j}}{a_{2,j}}, \ldots \frac{X_{10,j}}{a_{10,j}}, \frac{VA_j}{v_j}\right) \forall_j = 1 \ldots 10 \tag{2}$$

the $X_{i,j}$ being the corresponding quantities of good i necessary for the domestic production of good j, the so called intermediate inputs:

$$X_{i,j} = a_{i,j'} XD_j \qquad \forall_j = 1 \ldots 10 \tag{3}$$

The constant elements a_{ij} are equivalent to the technical coefficients in the input–output analysis. The VA_j value is the result of multiplying domestic production and coefficient v_j, which represents the value added needed to produce one unit of j:

$$VA_j = v_j XD_j \qquad \forall_j = 1 \ldots 10 \tag{4}$$

In the following nested level, the regional value added for each sector j, (VA_j), is the result of combining the two production factors, capital (K_j) and labour (L_j); following a technology of fixed coefficients again:

$$VA_j = \min\left(\frac{K_j}{k_j}, \frac{L_j}{l_j}\right) \qquad \forall_j = 1 \ldots 10 \tag{5}$$

The Consumers

The representative consumer receives a wage, w for his labour factor. In the same way, he receives a remuneration for the capital factor, r. Besides the retribution of the production factors, the consumers' income is completed with the transfers of the public sector in terms of retirement pensions, social benefits or other non-contributory pensions. We will call them *PST*. Lastly, *TROW* stands for the group of transfers from the rest of the world. If we take out from this gross income the corresponding direct tax, we obtain the net income:

$$YDISP = wL + rK + cpiPST + TROW - DT(wL + rK + cpiPST + TROW) \tag{6}$$

the direct tax being *DT* and *cpi* being a consumer price index, calculated as a weighted percentage of the consumption of each good, with regard to the total consumption, multiplied by the final prices of each good.

A Cobb–Douglas function shows how the representative consumer takes consumption decisions. This function covers savings (*SD*) and the demand of consumption commodities (*C*), so we can attain the following optimization problem:

$$\max \quad U(C_j, SD) = \left(\prod_{j=1}^{10} C_j^{\alpha_j}\right) SD^{\beta} \qquad \forall_j = 1 \ldots 10 \tag{7}$$

subject to:

$$YDISP = (1 - DT)(wL + rK + cpiPST + TROW) \tag{8}$$

where α_j and β being the share coefficients of both factors *Cj* and *SD*.[6]

The Simulations

The aim of this paper is the evaluation of the European Regional Policy on an Objective 1 region such as Andalusia by means of an AGEM. For an initial approach to the importance of ERDFs on the Andalusian economy, Table 1 presents the spending in nominal terms of these annual financial transfers in relation to the regional GDP for 1990, 1995 and 1999. As we can see, these funds register a constant percentage for the first two CSFs represented by the years 1990 and 1995. For the present framework, an important growth has taken place.

With the AGEM we attempt to assess the contribution of these funds to the Andalusian economic activity, as being part of the circular flow of income. We want to catch up the corresponding multiplier effects and bring about the main sectoral interdependences derived from the EU grants. This way, we can answer the question of what has been the impact of the funds in the past—that is to say, a counterfactual analysis—and what can be expected for the future if we assume that the agents do not change their behaviour patterns.

Since our initial equilibrium is a situation in which the ERDF has been fully incorporated to the Andalusian economy, we must carry out three allocation rules (one for each

Table 1. Annual amount of funds received by Andalusia, regional GDP (both in millions pesetas) and percentage over the regional GDP

	1990	1995	1999
ERDF	55.294	81.499	145.779
Regional GDP	6.254.242	9.169.023	12.048.341
Percentage over GDP	0.88%	0.88%	1.21%

Source: Own elaboration based on the SAM 1990, 1995 and 1999, Spanish Ministry of Economy and Regional Government.

period of study) to determine the quantities that each of the 10 productive sectors in our SAM has received from the EU grants (see Lima & Cardenete, 2005a).

Together with this previous information, our AGEM will work with three different databases, the SAM for 1990, 1995 and 1999; since these matrices are representative of the situation in each of the three frameworks approved so far: 1989–1993, 1994–1999 and 2000–2006.

Once we have the AGEM for 1990, 1995 and 1999, we will get three initial equilibriums with funds, and afterwards we will outline a simulation on the drop of these funds. We base our simulation on an expenditure shock, that allows us to capture not only the Keynesian multipliers but also some neo-classical effects as changes in relative factor prices. To be more precise, we suppose that a negative shock consisting on the total amount of funds received is registered on the exogenous accounts (savings/investment, government and foreign sector) of our SAM when the EU grants are removed. We introduce the demand side reduction by a percentage fall in the final demand of the three AGEMs. Once we have the initial or benchmark equilibrium, we run the model again looking for a new equilibrium where all the variables in the model will adjust to the lower final demand level. This way, the structural funds produce a demand fall that is transmitted to the rest of the economy through intermediate variables that are included in the model to compute the final effects when we drop the funds. This new equilibrium covers all the conditions for the consumers as well as the technological feasibility for companies and the restrictions in terms of productive resources.

Comparing the initial equilibrium with the results of our simulation, we can draw attention to the variation experienced in the regional GDP, the remuneration of the production factors or the consumers' welfare.

The Table 2 shows that the GDP of Andalusia decreases by 0.18%, for the first year of study when funds are removed. For 1995, the impact of the funds is bigger, accumulating in our opinion, some effects generated during the first framework. In short, the fall registered in the GDP reaches almost 6%. For the third simulation we get a GDP fall of 7.75% in our AGEM 1999. All these results are presented in nominal terms.

From the previous figures we can conclude that, for the first CSF, the Andalusian economy does not react to this financing considerably. This fact can be explained because it was the beginning of the implementation phase and the spending was focused on investments in physical infrastructures whose works lasted for several economic exercises. Hence its incidence on the Andalusian economy can only be visible in a longer term than the CSF 1989–1993. The result for 1999 shows a considerable fall in the regional GDP, possibly larger because of the limitations of the database for this year.

Table 2. Andalusian GDP in 1990, 1995 and 1999 with ERDF fund and when ERDF is removed (in million pesetas)

	1990	1995	1999
GDP with ERDF	6.254.242	9.169.023	12.048.341
GDP with ERDF removed	6.242.815	8.627.162	11.114.484
Percentage change	−0.18%	−5.91%	−7.75%

Source: Own elaboration.

In the next paragraphs we assess the impact of the drop of the ERDF on the sectoral levels of production for each year. We begin with 1990 (Table 3).

As in the previous exercise, there are not important changes in the productive output for the first database in aggregate terms. However, we can point out some important falls in specific sectors, for example, "Electricity and natural gas (3)" where the output decreases by almost 7%, or "Agriculture, cattle & forestry (1)" with a 3.75% fall. With the opposite behaviour we find the "Extractives (2)" or "Commerce (6)" with 5.28% and 4.38% of growth, respectively.

The variation at aggregated level of the sectoral production for 1995 is not important again, and the most significant change is the fall in the production of energy of more than 5% (Table 4).

For 1999, there is a more significant fall of 1.30% for the total regional output. This change is explained by the sectors with a worse behaviour such as "Electricity and natural gas (3)" again, that confirms its special sensibility to the elimination of the funds along the whole decade. Other sectors seriously affected are "Agriculture, cattle & forestry (1)" with a 5.14% of reduction, and three more accounts such as: "Extractives (2)", "Manufacturing Industry (4)" and "Transport and Communications (7)", with some similar figures around 4%. "Other services (8)" and "Commercial services (9)"increase their weight in the regional value added. As we can see, there is a wide range of sectors seriously affected by the drop of the funds for the last period of study (Table 5).

With regard to the effects on prices of the funds, there are almost no variations during the first year of simulation in the consumer price index. However, for the following year there is a 6% decrease. In 1999, the prices slightly increase again, although they do not end up reaching the reference level before eliminating the community funds from the Andalusian economy. We can conclude that the impact on the general price index of the funds is approximately an average fall of 3.5% for the decade, what means a reduction of the inflation rate owing to the demand fall (Table 6).

The prices of the capital factor increase in the first year and later on they fall throughout the decade in the scenario without funds. However, the imported commodities start being inelastic to the effect of the funds, then they undergo a 4.2% fall and finally, they conclude the decade with an important growth of almost 13%. To finish with, the prices of the

Table 3. Sectoral production in 1990 when ERDF is removed (in million pesetas)

	With funds	Funds removed	Percentage change
1. Agriculture, cattle & forestry	1.038.670	999.736	−3.75%
2. Extractives	883.368	929.991	5.28%
3. Electricity & natural gas	386.396	360.214	−6.78%
4. Manufacturing industry	5.528.350	5.487.302	−0.74%
5. Construction	1.268.003	1.258.943	−0.71%
6. Commerce	2.214.215	2.311.183	4.38%
7. Transport & communications	978.470	995.578	1.75%
8. Other services	1.979.708	1.947.997	−1.60%
9. Commercial services	606.234	605.297	−0.15%
10. Non-commercial services	351.192	351.171	−0.01%
Regional output	15.234.606	15.247.412	0.08%

Source: Own elaboration on the bases of the AGEM_A 1990.

Table 4. Sectoral production in 1995 when ERDF is removed (in million pesetas)

	With funds	Funds removed	Percentage change
1. Agriculture, cattle & forestry	1.420.759	1.411.707	−0.64%
2. Extractives	468.086	460.972	−1.52%
3. Electricity & natural gas	542.310	513.875	−5.24%
4. Manufacturing industry	7.760.811	7.717.704	−0.56%
5. Construction	2.025.719	2.007.680	−0.89%
6. Commerce	3.419.619	3.427.764	0.24%
7. Transport & communications	1.259.954	1.256.932	−0.24%
8. Other services	2.873.148	2.890.615	0.61%
9. Commercial services	1.196.951	1.214.425	1.46%
10. Non-commercial services	816.062	815.615	−0.05%
Regional output	21.783.419	21.717.291	−0.30%

Source: Own elaboration on the bases of the AGEM_A 1995.

investment commodities remain practically constant in 1990, they change this tendency in 1995 by falling almost 4% and finally they go up showing a growth in 1999 again. To sum up these results, the prices of the production factors, imported commodities and investment commodities; register small variations for 1990, while the biggest falls take place in the second year. This tendency changes in the third year, except for the interest rate. The retribution of the labour factor is our numeraire, and remains fixed for the whole decade in the initial value.

Before concluding with the main results, we present some data about the welfare of the consumers. In Table 7 we can see the evolution of the disposable income under both scenarios, together with the percentage fall for each year. The net income is smaller than the initial, except for the first year that registers a small increase.

The simulations that we have outlined by means of the three AGEMs for Andalusia show that the funds received have had a small effect on the regional GDP in the first years of reception. These quantities covered specific deficits that limited the regional growth. Some of these physical infrastructures projects that have deeply contributed to

Table 5. Sectoral production in 1999 when ERDF is removed (in million pesetas)

	With funds	Funds removed	Percentage change
1. Agriculture, cattle & forestry	1.300.079	1.233.301	−5.14%
2. Extractives	115.324	110.580	−4.11%
3. Electricity & natural gas	484.517	452.230	−6.66%
4. Manufacturing industry	4.999.769	4.777.393	−4.45%
5. Construction	2.865.800	2.831.661	−1.19%
6. Commerce	3.339.925	3.331.420	−0.25%
7. Transport & communications	1.300.845	1.245.934	−4.22%
8. Other services	4.051.016	4.111.358	1.49%
9. Commercial services	1.923.902	2.005.916	4.26%
10. Non-commercial services	1.455.938	1.452.607	−0.23%
Regional output	21.837.114	21.552.400	−1.30%

Source: Own elaboration on the bases of the AGEM_A 1999.

Table 6. Relative prices when ERDF is removed

	ERDF removed		
	1990	1995	1999
Consumers price index (cpi)	0.998	0.940	0.956
Labour (w)	1.000	1.000	1.000
Capital (r)	1.011	0.902	0.869
Price of imported commodities (prw)	0.997	0.958	1.129
Price of investment commodities (pinv)	1.009	0.962	1.029

Source: Own elaboration based on the AGEM_A 1990, 1995 and 1999.

regional articulation are the high-speed train Madrid–Seville, freeways and new roads, new accesses to Seville city, investments in the construction of see-ports in the province of Cádiz, reforms in the airports of Seville, Málaga and Almería, Technological Park of Málaga, International Centre of Tourist Services in Marbella, water and energy infrastructures for the towns in the Aljarafe area near the capital of Andalusia, the Sea Sciences College in Cádiz University, or the reclassification of industrial land in most of the capitals, etc.

However, this inelastic behaviour to the amounts received by our regional economy, changes for the second and third exercise, and comes to a regional economic expansion in the 1990s. At the beginning of the second CSF, which was basically focused on managerial activity and formation of human resources, the results of the financing are more outstanding, as we can see in the 5.91% yearly fall of the GDP for 1995. We consider that this fact is not exclusively the result of the funds received during the second framework, but also the multiplicative effects of the previous CSF after the first years of investment. We could argue as another possible explanation some economic cycle reasons because 1995 and 1999 are years of economic expansion in Andalusian and Spanish economies while 1990 stands the beginning of a crisis.

The results of the third CSF should be carefully taken into account since we have used an updating technique to get an initial version of the SAM 1999. This way, the 7.75% fall of the GDP given by the AGEM 1999, could be slightly bigger than the result we would obtain if we had "real data". But the SAM corresponding to year 2000 has not been carried out by the regional statistics office for the moment. In order to improve the results of this third simulation, the authors are working to carry out the SAM 2000 for a more accurate result for the last period.

Table 7. Effect of the ERDF removal on the welfare of the consumers (in million pesetas)

	Net income		
	Ex ante	*Ex post*	Percentage change
1990	5.704.778	5.726.441	0.38%
1995	9.090.931	8.557.946	–5.86%
1999	11.188.548	10.409.573	–6.96%

Source: Own elaboration based on the AGEM_A 1990, 1995 and 1999.

There are a lot of questions that are raised with these topics, but there is no doubt that one of the most important ones is the linkage between aggregate growth and internal cohesion. This would mean to change the point of view of the analysis and try to answer questions such as which would have been the aggregate growth if the money would have been distributed under an efficiency criteria and from an opportunity cost point of view.

Conclusions

In this work we have designed three AGEMs to assess the impact of the ERDF in the region of Andalusia in the south of Spain. We have dealt with the SAM for 1990, 1995 and 1999 and we have also worked with the information provided by the three CSFs approved in the EU for regional development. By means of an allocation rule for every period, we have turned the funds classified by intervention axes in the CSF into quantities to be included in the different accounts of our corresponding SAM. The years 1990, 1995 and 1999 have been representative of what was happening during any of the years of the pluriannual periods of intervention 1989–1993, 1994–1999 and 2000–2006.

We have carried out our AGEM by fixing the functional relationships that rule consumers, producers, investment, public sector and foreign sector. Later we have solved the optimization problem and have arranged the first simulations. We highlight a gradual pattern of dependence from the second CSF to the actual one. We have outlined a GDP fall close to 6% for each of the years between 1994 and 1999. This figure can reflect an increasing accommodation to this spending. We can also detect some kind of "learning effect" after several years of execution of the European regional policy. This "learning effect" can be explained by the increasing fall of the GDP as time goes by. It seems as if the policy-makers and the receivers of the funds were doing their best with this financial help from one year to another, as a result of a larger experience on managing the funds. In fact, the total amount of ERDF sent from the European Commission did not reach a 1% of the Andalusian GDP, but generated a GDP fall six times larger than the initial amount for the second CSF and the behaviour is similar for the third period.

Our AGEM clearly stands a growing dependence of the region to this spending, and the decade concludes with an evident accommodation effect to the funds that makes us reconsider the Andalusian growth model since for the next years we expect an important reduction of expenditure as a consequence of the last enlargement of the EU.

The previous literature studied in the second section on the evaluation of the European regional policy from a quantitative point of view agree on the influence of European funds on economic growth and employment. In our opinion, the exercise presented and others based on this methodology, are very interesting because they enable us to carry out *ex ante* and *ex post* simulations with the object of assessing the effects of a specific regional policy (in our case a huge investment in infrastructures) on sectoral production, GDP, prices or welfare.

In fact we can carry out not only counterfactual analysis like the one presented in this paper but an *ex ante* simulation to anticipate the possible effects on a regional economy of the CSF. Decisions of this type can condition regional growth in the long term, generating strangulations in the productive activity if an adapted development strategy is not designed. AGEMs advance information on the possible results and sectoral changes that can be expected after the programmed interventions.

We are aware that the assumptions taken in the model can influence some of the results or conclusions we have outlined. Trying to improve this fact, we are working on the model to avoid the more restrictive assumptions. In the same way, the lack of data for the third period of study has been solved by a Cross Entropy Method technique in this paper, but we are working at the moment on a new SAM in order to improve the quality of the results.

For future research, we need to compare the behaviour of different Objective 1 regions in Spain (for example the cases of Extremadura or Galicia) and some others in similar situations in Europe. This wider perspective could provide more accurate conclusions, especially if we deal with a multiregional model. Another interesting field for us to study is to measure the efficiency in the expenses, as an incentive to be taken into account when allocating the regional funds.

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Notes

1. Commission Decission (1999).
2. Consejería de Economía y Hacienda (2001).
3. Total Average Population and Regional Gross Domestic Product, Eurostat.
4. Regional Gross Domestic Product (PPS per inhabitant in percentage of the EU-27 average), Eurostat.
5. For details about this methodology see, Robinson *et al.* (2001).
6. Further technical details about the model such as the behaviour of the government, the saving/investment or the foreign sector; as well as the specific calculation of the parameters in the calibration process, see Lima and Cardenete (2005b).

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