

Economic impact of the European Funds in Extremadura during the period 2007-2013

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ABSTRACT: Although the evaluation of European Union regional policy is necessary to improve the effectiveness of the operational programmes, it is not usual to find studies comparing the efficiency of two programming periods for the case of a particular region. This could be explained by the fact that, at regional level, the study of the efficiency of the European funds during two different programming periods faces many different problems; for example, it entails the consideration of both adequate and homogeneous data, and similar methodology. The goal of this paper is twofold. The first goal is to estimate the economic impact of the European Union structural and cohesion funds received by Extremadura, a Spanish convergence objective NUTS II region, during the programming period 2007-2013. To this end, it is provided a multipliers analysis based on a Social Accounting Matrix (SAM) of Extremadura for the year 2000. Secondly, the paper will compare the returns obtained in terms of output and employment by the European funds received in Extremadura during the periods 2000-2006 and 2007-2013. Our results allow quantifying the effects of the EU regional policy, showing and comparing the efficiency for these two programming periods.

JEL Classification: C67; F35; H50; H54; R58.

Keywords: regional policy; European Funds; social accounting matrix; Extremadura.

Impacto económico de los Fondos Europeos en Extremadura en el período 2007-2013

RESUMEN: Aunque la evaluación de la política regional de la Unión Europea es necesaria para mejorar la eficiencia de los programas operativos, no es común encontrar estudios que comparen la eficacia de dos períodos de programación para el caso de una región. Esto puede deberse a que a nivel regional el estudio de la efica-

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cia de los fondos europeos se enfrenta a problemas de diversa índole; por ejemplo, se necesita disponer de datos adecuados y homogéneos y una metodología similar. El objetivo de este trabajo es doble. El primer objetivo es estimar, para el periodo de programación 2007-2013, el impacto económico de los fondos estructurales y de cohesión recibidos por Extremadura, una región NUTS II española del tipo «convergencia». Para este fin, se utiliza un análisis de multiplicadores basado en una matriz de contabilidad social (SAM) de Extremadura para el año 2000. En segundo lugar, el artículo compara los retornos obtenidos en términos de *output* y empleo debido a los fondos europeos recibidos en Extremadura durante los períodos de programación 2000-2006 y 2007-2013. Nuestros resultados permiten cuantificar los efectos de la política regional europea comparando la eficiencia para esos dos períodos de programación.

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Palabras clave: política regional; Fondos Europeos; matriz de contabilidad social; Extremadura.

1. Introduction

The general objective of the European regional policy is to promote economic and social progress and to help disadvantaged regions adjust to the challenges of the single market, eliminating disparities in living standards. In accordance with these objectives, the gaps among the development levels of the various Regions have to be narrowed. This implies that poorest European regions are the main priority of European Cohesion policy. These regions share some identical economic indicators; among others, higher unemployment rate, poor basic infrastructure and lack of services for businesses and individuals. It is therefore of most critical importance to evaluate the impact of Structural Funds in order to help the European Commission in the design of future policy. Nevertheless, the evaluation of the economic effects of European funds is a complex and difficult task. It is not easy to estimate the full socioeconomic costs and benefits resulting from European Funds since the information needed for a cost-benefit analysis does not exist. Hence, to measure the aggregate effects of European regional policies, the range of evaluation methods uses to apply top-down approaches like econometric models, input-output models and computable general equilibrium models.

In the context of the European NUTS II regions, territories with Gross Domestic Product per capita less than 75% of the EU average were defined as «Objective 1» regions in the 2000-2006 programming period, while in the 2007-2013 programming period, this type of regions were renamed as ‘«Convergence Objective» regions (European Commission, 2007). One of the great unresolved debates about European regional policy is the extent to which the regions that fall below the 75% of European Union Gross Domestic Product per capita is achieving higher levels of employment and economic growth. Policy makers need answer to these questions. The measure of these achievements would let us assess the effectiveness of the European funds. Nevertheless,

although the evaluation of European Union regional policy is necessary to improve the effectiveness of the operational programmes, it is not usual to find studies comparing the efficiency of two programming periods for the case of a particular region. This could be explained by the fact that, at regional level, the study of the efficiency of the European funds during two different programming periods face many different problems; for example, it entails the consideration of both adequate and homogeneous data, similar methodology, and the difficulty to isolate the effects of the programmes.

This paper centers his focus on the analysis of the economic impact of the European Funds in Extremadura, an Autonomous Community in the southwest of Spain. The region of Extremadura was considered as one of the «Objective 1» priority areas for the European Regional Policy during the period 2000-2006, being a «Convergence Objective» region for the programming period 2007-2013. The goal of this paper is twofold. The first goal is to estimate the economic impact of the European Union structural and cohesion funds received by Extremadura, a Spanish convergence objective NUTS II region, during the programming period 2007-2013. Secondly, the paper will compare the returns obtained in terms of output and employment by the European funds received in Extremadura during two programming periods (2000-2006 and 2007-2013). It needs to be emphasized that it is not usual to find empirical contributions about this type of comparison in the literature (see for instance Cancelo *et al.*, 2009). Thus, it is necessary to design a methodological approach that will quantify the economic impacts of European Funds in Extremadura. Concretely, a multisectoral economic model based on a Social Accounting Matrix (SAM) is used to quantify the output and employment effects derived from the structural and cohesion funds that this region received due to its 'Convergence Region' situation. The multipliers analysis was based on a Social Accounting Matrix (SAM) of Extremadura for the year 2000. Our results allow quantifying the effects of the EU regional policy, showing and comparing the efficiency for these two programming periods. For the programming period 2000-2006, and as base of comparison, the results presented in Márquez *et al.* (2010) will be considered. The comparison will provide an interesting information since it will be shown empirical evidence about the efficiency of two programming periods for the case of Extremadura: the only region in Spain considered to be less developed (with a GDP per inhabitant below 75% of the EU27 average) for the next programming period 2014-2020.

The rest of the paper is organized as follows. Section 2 tries to place the Extremadurian region within the Spanish context, and the basic features of the economy of Extremadura are described. Additionally, it is shown a brief description of the EU regional policy for the program period 2007-2013. Section 3 presents the methodological issues and discusses the main results. Finally, Section 4 concludes.

2. Extremadura in the context of the European regional policy

To properly situate Extremadura in the European context, firstly, this section describes the basic features of this regional economy. Therefore, subsection 2.1

analyzes the evolution of the regional economy of Extremadura in the period 2000-2013. More specifically, the evolution of production, employment and GDP per head for both the Spanish economy and the regional economy of Extremadura are presented. Secondly, in subsection 2.2, the main features of the European funds received by Extremadura in the programming period 2007-2013 are briefly shown.

2.1. The economy of Extremadura in the period 2000-2013

Extremadura has an area of 41,634 km², which accounts for 8.3% of the Spanish area. Its population in recent years has been around 1,080,000 inhabitants; thus, the population density of Extremadura approaches 26 Inhabitants/Km² (less than a third of the Spanish population density). Since the population of Extremadura is distributed sparsely and irregularly along the territory, it is easy to corroborate that the demographic base of Extremadura has got a great weakness. In short, it is possible to infer that domestic demand is not going to be a stimulus when conducting an increase of regional productive activities in Extremadura. Even more, this diagnosis is related to a low birth rate, high aging population and, as it will become clear later, low levels of income.

Gross Domestic Product (GDP) in constant terms (euros of year 2000) for Extremadura reflects a cumulative growth for 2000-2006 of 20.77% (in average terms, Spain grew 22.19%). This increase has its translation in a lost of weight of the economy of Extremadura in terms of share on the Spanish economy, decreasing from 1.62% to 1.60%. In the same way, during the period 2007-2013 Extremadura showed a negative growth of -6.79% (Spain had a negative growth of -5.88%). This fact implies, again, that the economy of Extremadura lost relative importance with respect to the Spanish economy (from 1.60% to 1.59%). Consequently, in terms of GDP, it is not possible to find an advance in the Extremadura economy, since Extremadura lost relative weight within the national context. In addition, Table 1 displays the growth rates of GDP (in constant terms) for Extremadura and Spain in the two programming periods.

With respect to employment, in 2000 Extremadura had about 335,100 employments, and 386,400 in 2006 (an increase of 15.31% in the programming period 2000-2006). At national level, this increase was 22.5%. This way, the labor force of Extremadura lost relevance at national level (from 2.04% in 2000 to 1.92% in 2006). On the other hand, in the case of the programming period 2007-2013, Extremadura had about 395,000 employments in 2007 and 332,400 in 2013 (decreasing -15.85%). Nevertheless, employment in Spain decreased during this period about -16.71%. Thus, employment in Extremadura was 1.91% of the total Spanish employment in 2007, being about 1.93% in 2013. From Table 2, the growth of employment in Extremadura showed a best relative behavior during the programming period 2007-2013.

Table 1. Growth of GDP (Constant € of the year 2000) during the period 2000-2013

<i>Programming period 2000-2006</i>							
	2001	2002	2003	2004	2005	2006	
Extremadura	2.32%	3.34%	3.17%	3.07%	3.54%	3.74%	
Spain	3.67%	2.71%	3.09%	3.26%	3.58%	4.08%	
Net change	-1.35%	0.63%	0.08%	-0.19%	-0.04%	-0.34%	
<i>Programming period 2007-2013</i>							
	2007	2008	2009	2010	2011	2012	2013
Extremadura	3.86%	1.56%	-3.23%	-0.02%	-0.93%	-2.85%	-1.45%
Spain	3.48%	0.89%	-3.83%	-0.20%	0.05%	-1.64%	-1.22%
Net change	0.38%	0.67%	0.60%	0.18%	-0.98%	-1.21%	-0.23%

Note: Net change is difference between the growth of GDP in Extremadura and the growth of GDP in Spain.

Source: Own elaboration from National Statistics Institute of Spain (2014).

Table 2. Growth of employment during the period 2000-2013

<i>Programming period 2000-2006</i>							
	2001	2002	2003	2004	2005	2006	
Extremadura	1.37%	2.30%	2.62%	2.80%	3.44%	1.90%	
Spain	3.23%	2.46%	3.21%	3.62%	4.15%	3.98%	
Net change	-1.86%	-0.16%	-0.59%	-0.82%	-0.71%	-2.08%	
<i>Programming period 2007-2013</i>							
	2007	2008	2009	2010	2011	2012	2013
Extremadura	2.23%	0.48%	-5.62%	-1.12%	-2.48%	-4.93%	-3.20%
Spain	3.03%	-0.13%	-6.49%	-2.21%	-1.87%	-4.23%	-2.96%
Net change	-0.80%	0.61%	0.87%	1.09%	-0.61%	-0.70%	-0.24%

Note: Net change denotes the difference between the growth of employment in Extremadura and the growth of employment in Spain.

Source: Own elaboration from National Statistics Institute of Spain (2014).

Finally, Table 3 displays the GDP per capita for both programming periods. In the first programming period, Extremadura had a GDP per capita about the 61.46% of the Spanish average in 2000 (Spanish average =100%), increasing in 2006 (66.01%). In the second programming period, Extremadura increased from 66.76% in 2007 to 68.06% in 2013. As stated before, and for the 2007-2013 period, the European Commission approved a Regional Operational Programme for Extremadura that falls within the framework laid out for the «Convergence Objective» regions.

Tabla 3. GDP per capita during the period 2000-2013

<i>Programming period 2000-2006</i>							
	<i>2000</i>	<i>2001</i>	<i>2002</i>	<i>2003</i>	<i>2004</i>	<i>2005</i>	<i>2006</i>
Spain	21.05	21.50	21.70	21.91	22.37	22.70	23.30
Extremadura	12.94	13.19	13.64	14.06	14.47	14.86	15.38
Percentage	61.46%	61.36%	62.84%	64.16%	64.68%	65.49%	66.01%
<i>Programming period 2007-2013</i>							
Spain	23.85	23.57	22.38	22.20	22.13	21.74	21.53
Extremadura	15.92	16.06	15.47	15.40	15.23	14.81	14.65
Percentage	66.76%	68.14%	69.15%	69.38%	68.81%	68.15%	68.06%

Note: Percentage denotes the ratio between the GDP per capita in Extremadura and the GDP per capita in Spain.

Source: Own elaboration from National Statistics Institute of Spain (2014).

2.2. The EU regional policy for Extremadura 2000-2013

This section is aimed at describing the basic features of the finished Regional Operational Programme for Extremadura for the 2007-2013 programming period, comparing it with the earlier cohesion policy program 2000-2006.

The Structural Funds and Cohesion Funds are the main budgetary items of the European Union to support economic and social cohesion in the member states. Regional and structural policies are the second largest item in the budget after the agricultural funds; they cover more than a third of the budget. They are set-up as multi-annual initiatives, and the period from 2000 to 2013 consists of two programming periods, the first running from 2000 to 2006 and the second from 2007 to 2013.

In Márquez *et al.* (2010) a synthesis of the general lines of the programming period 2000-2006 for Extremadura is presented. On the other hand, the Regional Operational Programme for Extremadura in the period 2007-2013 contemplates seven priorities (see European Commission, 2014). Priority 1 is «Development of the Knowledge Economy». Under this priority, the primary objectives are «*to contribute to increasing economic competitiveness, to increase the effectiveness of the regional system of science and technology, and to increase the level of information and communication technology as a fundamental axis of the knowledge economy.*» Priority 2 is «Entrepreneurial Development and Innovation», that is, «*to safeguard existing competitive enterprises and to create favourable conditions for their expansion as well as for business start-ups and relocations.*» Priority 3 is «Environment, Natural Surroundings, Water Resources and Risk Prevention», being the strategic objectives «*to protect and preserve biodiversity, improve water infrastructures and waste management, prevent risks and control pollution.*» Priority 4: «Transport and Energy», where the specific objectives are «*to improve transport infrastructure for better traffic flows through the road network and integrate Extremadura into the*

national communication network; to promote and improve the communication network with neighbouring territories; to promote accessibility within the region; to encourage energy efficiency and the use of renewable sources». Priority 5: «Local and Urban Sustainable Development», where the main objectives are «*to implement new integrated urban projects for cities in Extremadura and to preserve its historical, artistic, natural and cultural heritage.*» Priority 6: «Social Infrastructures»; where the programme seeks «*to guarantee access to education and health systems and to extend the welfare infrastructure and services to all members of society.*» Priority 7: «Technical Assistance», that is, technical assistance in implementing the Programme.

In this context, Table 4 shows a summary of the total funds received by Extremadura during the programming periods 2000-2006 and 2007-2013 in constant euros of 2000. From Table 4, the total amount of funds in the 2007-2013 period decreased 8.21% with respect to the 2000-2006 period (from 3,007,203 thousands of euros to 2,760,078 thousands of euros). Thus, the total funds were obtained from four funds: European Regional Development Fund (ERDF), Cohesion Fund (CF), European Social Fund (ESF), and European Agricultural Fund for Rural Development (EAFRD). The ERDF is the most important fund in both programming periods. It is important to highlight that the EAFRD increased its relevance with respect to the ESF during the programming period 2007-2013.

Table 4. Summary of European Funds received in 2000-2013 by Extremadura (total expenditure, including European and national co-financing; thousands of 2000 constant euros)

	<i>ERDF</i>	<i>CF</i>	<i>ESF</i>	<i>EAFRD</i>	<i>Total Funds</i>
Total 2000-2006	1,836,980	0	710,822	459,401	3,007,203
2007	449	0	66,686	0	67,135
2008	4,610	0	66,568	168,357	239,535
2009	232,041	0	67,560	166,947	466,548
2010	396,984	0	68,767	113,875	579,626
2011	278,884	0	70,403	138,627	487,914
2012	222,680	0	72,251	138,454	433,385
2013	183,743	27,190	138,167	136,835	485,935
Total 2007-2013	1,319,391	27,190	550,402	863,095	2,760,078

Note: ERDF = European Regional Development Fund; CF = Cohesion Fund; ESF = European Social Fund; EAFRD = European Agricultural Fund for Rural Development.

Source: Own elaboration using data from the Ministry of Economy and Finance of Spain and the Government of Extremadura.

3. Economic effects of the EU Funds received by Extremadura during the period 2007-2013: a SAM multiplier analysis

For the case of the Spanish regional economy of Extremadura, this section provides the estimation of the economic impact in terms of output and employment induced by the EU Funds received during the programming period 2007-2013.

These effects are computed by using a multisectoral economic model that takes into account the interrelationships between the different agents in the economy. Besides, unlike aggregate macroeconomic models, the multisectoral models provide results with a high disaggregation detail. For this purpose, one of the most used tools in the literature is the input-output analysis. However, a slightly different methodology is employed, in our opinion, more complete and suitable. Specifically, the multiplier effects are obtained from a *social accounting matrix* (SAM) for Extremadura (see, for example, Lima and Cardenete, 2005).

The main difference between the input-output model and the SAM multipliers model is that the latter includes a wider closure model and interdependence effects ignored by the former. In particular, while the traditional input-output demand model only considers the interdependences related to the productive sphere, i.e. the interdependences between production sectors, the SAM multipliers model also includes the primary factors income, its distribution among the institutions (mainly the households) and other income redistribution transactions.

Therefore, the SAM multipliers model can be seen as a generalization of the input-output model, providing a more precise assessment of the effects produced by exogenous changes (as it is considered in this paper). However, the SAM multipliers model also has some limitations that must be considered for the results; mainly, the linear relationships among the economic agents, exogenous prices, and no supply constraints in the economy. Some of these limitations are resolved in the more complex computable general equilibrium models (for some recent applications, see, among others Monrobel *et al.*, 2013, and Cardenete *et al.*, 2014).

3.1. The SAM for Extremadura and the SAM multipliers model

In our application, the SAM of reference comes from the work of De Miguel *et al.* (2009), where a social accounting matrix for Extremadura for the year 2000 (SAMEXT2000) was constructed. Due to statistical limitations, in particular the lack of updated and surveyed input-output tables, this SAM came of updating a previous SAM for Extremadura for the year 1990 by using the cross-entropy method. The original SAMEXT2000 incorporated 37 accounts, including 6 different taxes and a wide sectoral disaggregation, and showing 16 production sectors as well as 9 commodities.

In this paper, the original SAMEXT2000 was aggregated to make easier the assignments of exogenous income injections, resulting a total of 11 accounts. So, the

production system was divided into 5 sectors that represent the productive activity of the Extremadurian economy: agriculture, manufacturing, construction, sales oriented services, and non-sales oriented services. Additionally, the social accounting matrix shows two primary factors (labor and capital) and a generic account containing the revenues and expenditures of the households. The aggregate capital account shows all the sources of investment and savings of all the economic agents. The government account includes their relationships with other agents, basically through taxes and transfers. Finally, it was considered an account for the foreign sector, in which relations with external agents (both from the rest of Spain and from the world) are collected. Table 5 shows the 11-accounts SAM that served as basis for the multipliers model described below.

Formally, the development of a SAM multiplier model requires distributing the accounts in the matrix between endogenous and exogenous accounts; that is, it is necessary to establish a closure model assumption. Traditionally, the accounts relative to the government, the capital (saving/investment) accounts, and the foreign sector accounts are considered exogenous. On the other hand, the remaining accounts (usually the primary factors, households and production sectors) are considered endogenous. In our case, given the importance of the public sector in the reception and generation of spending associated with the European Funds, the government account has been considered as endogenous. This way, the only exogenous accounts are those related to savings/investment accounts, and the external sector.¹

Regarding its mathematical formulation, the SAM multipliers model basically transforms the accounting constraints that have to be verified by the social accounting matrix, expressing them in a different way (to relate exogenous injections with endogenous incomes). Thus, the basic equation of the model can be expressed as follows (Pyatt and Round, 1979):

$$y = (I - A)^{-1} x = M \cdot x \quad (1)$$

where y denotes a n -column vector of endogenous incomes, A represents a $n \times n$ matrix of average propensities of spending, x is a n -column vector of exogenous investment injections, I is an identity matrix, and M is the multipliers $n \times n$ matrix obtained from the original SAM that is usually known as *accounting multipliers matrix* (see Table 6).

These multipliers can be decomposed into several values that reflect the role of the different types of interdependencies. Different methods for multipliers decomposition have been proposed in the literature. In our case, taking as point of departure the work of Cardenete and Sancho (2003), we propose a decomposition technique that allows differentiating between direct effects and non-direct effects. The resulting expression is as follows:

$$M = (I + A) + (M - I - A) = M_{DE} + M_{NDE} \quad (2)$$

¹ Alternative closure model assumptions can be found in the literature, depending on the topic considered. For example, Polo, Roland-Holst and Sancho (1991) and Ferri and Uriel (2000) also include the saving/investment account into the endogenous part of the model.

Table 5. The Social Accounting Matrix for Extremadura (11x11 accounts; thousand euros)

	1. Labor	2. Capital	3. Households	4. Agriculture	5. Manufacturing	6. Construction	7. Sales Orient	8. Non-sales Orient Serv	9. Government	10. Saving/inv	11. Foreign sec	Total
1. Labor	0	0	0	152,242	513,451	758,846	1,633,713	1,963,176	0	0	0	5,021,428
2. Capital	0	0	0	1,044,882.0	464,264.0	324,881.8	2,517,697.1	177,899.1	0	0	0	4,529,624
3. Households	4,129,264	4,529,624	0	0	0	0	0	0	2,009,696	0	61,948	10,730,532
4. Agriculture	0	0	344,694.4	490,958.6	413,634.7	411.3	71,328.0	8,126.4	119,386.9	139,466.7	631,903.2	2,219,910.0
5. Manufacturing	0	0	871,015.7	88,246.3	242,384.9	250,930.7	184,053.9	85,691.8	0	110,845.2	439,205.6	2,272,374.2
6. Construction	0	0	175,326.4	8,046.7	9,262.4	0	39,765.1	26,856.7	0	1,796,485.7	0	2,055,743
7. Sales Orient	0	0	3,636,264.6	153,229.7	275,806.1	360,457.2	657,945.3	284,196.1	0	47,036.5	40,377.2	5,455,312.6
8. Non-sales Orient Serv	0	0	133,698.8	0	0	0	0	1,235,182,499	2,615,569	0	0	2,750,503
9. Government	892,164	0	1,469,936	0	3,390.3	46,355.7	41,777.8	0	0	2,291,028	0	4,744,651.9
10. Saving/inv	0	0	2,388,158	0	0	0	0	0	0	0	2,236,816	4,624,974
11. Foreign sec	0	0	1,711,438.1	282,304.7	350,180.8	313,860.3	309,032.4	203,321.7	0	240,111.9	0	3,410,250
Total	5,021,428	4,529,624	10,730,532	2,219,910.0	2,272,374.2	2,055,743	5,455,312,636	2,750,503	4,744,651,883	4,624,974	3,410,250	

Source: Own elaboration using data from De Miguel *et al.* (2009).

Table 6. The accounting multipliers matrix, *M*

	1. Labor	2. Capital	3. Households	4. Agriculture	5. Manufacturing	6. Construction	7. Market Service	8. Non Mark Serv	9. Government
1. Labor	1.63	0.56	0.56	0.61	0.79	0.97	0.91	1.33	0.99
2. Capital	0.62	1.60	0.60	1.17	0.92	0.80	1.12	0.70	0.67
3. Households	2.22	2.24	2.24	1.83	1.74	1.79	2.06	2.02	2.11
4. Agriculture	0.19	0.18	0.18	1.45	0.41	0.19	0.20	0.19	0.22
5. Manufacturing	0.27	0.26	0.26	0.28	1.34	0.36	0.29	0.28	0.27
6. Construction	0.05	0.05	0.05	0.04	0.04	1.04	0.05	0.05	0.05
7. Market Service	0.96	0.95	0.95	0.89	0.92	0.99	2.03	1.00	0.98
8. Non Mark Serv	0.36	0.26	0.26	0.22	0.24	0.27	0.28	1.31	0.84
9. Government	0.60	0.41	0.41	0.37	0.39	0.45	0.46	0.52	1.47

Source: Own elaboration using data from De Miguel *et al.* (2009).

M_{DE} can be called *direct effects matrix* because it captures the direct interdependencies among the different endogenous accounts, including the intermediate inputs. M_{NDE} incorporates the *non-direct effects*, i.e. it is a residual matrix because it includes the rest of interdependencies. Therefore, M_{NDE} captures the indirect effects among the production sectors; the induced effects arising from the feedback among the households and the production sectors through income and consumption; and the non-direct effects linked to the government through taxes, income transfers and public consumption.

3.2. The results

Once exposed the SAM multipliers model, we can use the previous equations to calculate the effects that the EU Funds had in Extremadura during the programming period 2007-2013. In our analysis, we show the following results: first, increases in the domestic production, distinguishing between direct and no direct effects; and second, increases in the volume of employment. In all cases, we adopt the closure model assumption discussed above. Thus, the primary factors labor and capital, the representative group of households, the production sectors and the public sector were considered endogenous accounts.

From the previous equation of the SAM multipliers model, it is possible to express it in incremental terms as follows:

$$\Delta y = M \cdot \Delta x \quad (3)$$

Then, to obtain the economic impact on domestic output (vector Δy) associated with investments derived from the EU Funds, it is necessary to allocate these investments to the different exogenous accounts (vector Δx). The accounting multipliers matrix M acts as a «bridge» matrix to determine the corresponding effects on domestic production.

To compute the employment effects we consider the following equation:

$$\Delta e = E \cdot M \cdot \Delta x \quad (4)$$

where E represents a diagonal matrix whose generic term E_{ii} represents the quantity of employed in each sector for every euro of domestic output in this sector (employment coefficients).

In our application, the temporal distribution of flows that makes up the European Funds was considered, estimating the yearly effects of the investments under the programming period 2007-2013. Therefore, it was necessary to build seven 9-vectors of exogenous injections ($\Delta x(2007)$, $\Delta x(2008)$, ..., $\Delta x(2013)$), which has supposed to distribute for each year the investments among the nine endogenous accounts of our model. To do this, the specific objectives of each fund were considered, assigning all the investments projects listed in the programming period to specific production sectors or to the public sector.²

² See Delgado (2012) and Monrobel (2010) for the assignment rules.

Taking the accounting multipliers matrix for Extremadura M (Table 6) and the yearly exogenous sectoral spending $\Delta x(2007)$, $\Delta x(2008)$, ..., $\Delta x(2013)$, the effects on the domestic production and the employment were obtained for each of the seven years considered. These multipliers effects are shown in Table 7.

With respect to the output impact, the accumulated estimated effects (7,581 millions of constant euros) should be assessed in relative terms with respect to the entire amount of European Funds received by Extremadura during the period 2007-2013

Table 7. Impact of the European Funds received in the programming period 2007-2013 on the domestic production (constant € of the year 2000) and on the employment of Extremadura

		<i>TOTAL EFFECTS</i>	
		<i>Production</i>	<i>Employment</i>
2007	Direct	54,929,615	
	Non direct	116,871,199	
	Total	171,800,814	4,381
2008	Direct	283,617,186	
	Non direct	386,212,664	
	Total	669,829,850	16,402
2009	Direct	515,949,377	
	Non direct	772,261,987	
	Total	1,288,211,364	31,757
2010	Direct	615,432,951	
	Non direct	971,942,810	
	Total	1,587,375,761	39,293
2011	Direct	528,578,190	
	Non direct	812,670,639	
	Total	1,341,248,829	33,136
2012	Direct	472,178,144	
	Non direct	720,100,773	
	Total	1,192,278,917	29,442
2013	Direct	522,348,481	
	Non direct	808,315,485	
	Total	1,330,663,966	32,597
Total 2007-2013	Direct	2,993,033,944	
	Non direct	4,588,375,557	
	Total	7,581,409,501	

Source: Own elaboration.

(over 2,760 million of constant euros). Thus, this implies an output/investment ratio of 2.75, that is to say, an efficiency coefficient of output over the period 2007-2013 of 2.75 euros of domestic production for every euro of European Funds entering in the Extremadurian economy. The highest output effects values are for the years 2009 to 2013, those with the most relevant investments executed.

It is relevant to make a comparison with the European Funds received in the previous programming period 2000-2006. It implied a cumulative effect of approximately 6,600 million of euros constant of the year 2000, derived from a total investment of about 3,000 million of constant euros (Márquez *et al.*, 2010). Therefore, the output/investment ratio for the period 2007-2013 (2.75) has been higher than the previous one (2.18 million of euros per million invested for the period 2000-2006).

Regarding the multipliers decomposition, the effects related to the non-direct interdependences are clearly higher than the direct effects for all years considered. In global terms (period 2007-2013), they are more than 50% greater than the direct effects (4,588 millions of euros against 2,993 millions).

As for the effects on employment in each of the years considered (last column of Table 7), it can be seen again that the greatest impact occurs during the period 2009-2013. During these years, they were created (or maintained) a number of employments near or higher than 30,000 employments, with a peak impact about 39,000 employments in year 2010. If we assess the estimates obtained in terms of the volume of investments received each year, the results suggest an efficiency coefficient of employment of 67, that is, for every million of constant euros invested they were generated or maintained around 67 employments in the region during the period 2007-2013.

During the previous period 2000-2006, the greatest impact occurred in the period 2003-2006, where they were generated (or maintained) near or above 24,000 employments, with a peak impact of 32,000 jobs in 2006 (Márquez *et al.*, 2010). Overall, the employment/investment ratio was 49 on average; this implied the generation or maintenance of approximately 49 employments for every million of euros invested.

In summary, and in terms of the benefits obtained from the generation or maintenance of production and employment, the estimates indicate the existence of a greater efficiency coefficients in the programming period 2007-2013 than during the previous programming period 2000-2006.

4. Conclusions

the main purpose of this paper was to compare the returns obtained in terms of output and employment by the European funds received in the Spanish region of Extremadura during the programming periods 2000-2006 and 2007-2013. Extremadura was defined as «Objective 1» regions in the 2000-2006 programming period, while in the 2007-2013 programming period, this region was a «Convergence Objective» region. The main contribution of this paper is that our analysis allows quantifying the

effects of the EU regional policy on a regional economy, showing and comparing the efficiency for two different programming periods.

As a first step, the paper has analyzed the impact of the European Funds in the period 2007-2013 on the Convergence Region of Extremadura by means a multipliers analysis based on a Social Accounting Matrix (SAM) of Extremadura for the year 2000. It is important to emphasize the reduction (-8.21%) of the total amount of European Funds in the period 2007-2013 with respect to the 2000-2006 period. Besides, although in both programming periods the ERDF is the most important fund, the EAFRD increased its relevance with respect to the ESF during the programming period 2007-2013.

From the estimations of the impacts of the European investments on the regional economy of Extremadura in 2007-2013, some results can be highlighted. In cumulative terms, the regional production of Extremadura increased above 7,580 millions of constant euros of the year 2000. This amount should be assessed in terms of the total investment, around 2,760 millions of euros constants of the year 2000. This implies an investment/total effect ratio of 2.75. The highest effects appeared in the period 2009-2013, since the main part of both the ERDF and the EAFRD were executed during this period.

Regarding employment effects caused by the European funds on the regional economy of Extremadura in 2007-2013, the greatest impact is, once again, on the period 2009-2013, where they were generated (or maintained) a number of employments of around 30,000. The most important effect was in 2010, with an impact in terms of employments over 39,000. By sectors, the employment effects were generated mainly in the market services sector, followed by non-market services and agriculture.

Considering the amount of investment received each year in Extremadura, the results of the programming period on the Extremadurian employment indicate that, for every million euros (in constant euros of the year 2000) invested in the period 2007-2013, they were generated or maintained on average around 67 employments in the region of Extremadura.

Finally, the main empirical contribution of this paper was to compare the returns obtained in terms of output and employment by the European funds received in the Spanish region of Extremadura during the programming periods 2000-2006 and 2007-2013. In this sense, it is important to remark that, in comparison with the economic impact of European funds received in the previous programming period (2000-2006), our estimations indicate higher efficiency coefficients for the 2007-2013 period. This efficiency is shown in both, in terms of the benefits obtained in generation of new production (an output/investment ratio of 2.18 in 2000-2006 vs 2.75 in 2007-2013), and in terms of maintenance or creation of new employments (employment/investment ratio of 49 for the period 2000-2006 vs 67 in 2007-2013).

To conclude, two final comments. First, it is necessary to highlight the importance of the economic impact of the European Funds in Extremadura in terms of economic growth and employment in the two programming periods. Second, it needs

to be emphasized that the evaluation of the impacts of the two programming periods on the economy of Extremadura shows a more efficient period during the period 2007-2013.

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