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Economic Impact on Andalusian Economy of European Funds using a Dynamic General Equilibrium Model: 2014 - 2020

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Abstract

During the period 2014-2020 it will be the first time since Spain joined the European Economic Community that the southern region of Andalusia will not be considered as one of the Objective 1 priority areas of the European Regional Policy. This paper analyses the economic impact of the foreseeable withdrawal of an important amount of European Structural Funds in the region. Our point is to develop a Dynamic General Equilibrium model to assess, under different simulation scenarios, the effects of the removal of this funding on the main regional economic indicators, specially focusing on GDP growth and unemployment.

Keywords: Applied general equilibrium models, European Regional Policy, impact analysis.

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1. Introduction

This paper aims to perform an analysis for assessing the economic impact on the Andalusian economy of the foreseeable partial withdrawal of European funds in the next seven-year period (2014-2020), and, at the same time, drawing some practical recommendations from the economic policy point of view. With this purpose, this work suggests the construction of a dynamic computable general equilibrium (DCGE) model, which, once it is calibrated and the different simulation are defined, will allow interpreting the results of the impact. To begin with, a static applied general equilibrium model will be constructed to serve as a basis from which to tackle the later transformation into a dynamic computable general equilibrium.

This tool proposes a battery of different scenarios (optimistic, intermediate and pessimistic), in order to analyse two types of effects: the impact of the reduction of funds on the region's growth and the impact on the region's unemployment, two especially worrying issues during the current economic crisis.

The results show that, under a scenario in which the amount of funds received is similar to that provided in the current seven-year period, the region's GDP increases an annual average of 2.25 percent, whereas, when the amount received is only two thirds of the present funding, the GDP experiences a 1.49 percent increment. The validity of these data is clearly supported by the results of an index elaborated to measure the variation of the regional GDP according to the amount of funds received. Thus, in the first scenario the GDP growth rate increases 83.3 percent in relation to the growth rate expected if all the funds were withdrawn, while in the second scenario the GDP growth rate is only 24.17 percent higher than the one expected without funds.

The structure of this work is as follows. Section 2 includes some information about the European Regional Policy and the classification of the Andalusian economy as a priority region in what concerns fund reception. Section 3 describes the main characteristics of the applied general equilibrium model elaborated for this region, while section 4 presents the databases used in the analysis. Once the different simulation scenarios are detailed, section 5 reflects the results obtained. Finally, section 6 offers some conclusions that may be useful for the policy maker.

2. Background

Given the depth of the present economic crisis, the need to maintain the current regional cohesion policies and the subsidies to Andalusian agriculture has brought to the fore the debate on the effects of

the European funds on the region and the preoccupation about the impact of a possible partial withdrawal of those funds in the next years.

The European Structural Funds are the object of complex negotiations around the so-called “Financial Perspectives”, the budgetary framework that will govern the European Regional Policy during the 2014-2020 period. An indefatigable effort will be required during those negotiations to overcome the reluctance shown by Germany and the United Kingdom, two of the main “net contributors”, against any agreement involving an increase of the European budget items allocated to interregional solidarity. This way these countries aim to reaffirm their position in tune with the austerity policies prevalent at the national and supranational levels in present and, probably, future years.

In effect, the current effort to find a path towards an economic recovery that can guarantee economic growth and, consequently, the generation of employment, is translated into a series of coordinated structural adjustment, budget cuts and austerity policies, especially in the Eurozone countries. These policies could lead – as suggested by some documents consulted – to a reinforcement of the principle of concentration of the European support aimed at the development of social and territorial cohesion policies in the poorest European regions and countries.

In Spain, the virulence of the economic crisis has provoked a set of structural reforms that are very difficult to implement, and has disclosed an indisputable protagonist: unemployment. The so-called Okun’s Law, well-known by all macroeconomists, determines that a real GDP growth rate of around 2.5 percent is required in Spain and, consequently, in the region of Andalusia in order to revert the unfavourable situation in the labour market, to stop the employment destruction process and to reduce the unemployment rate. This requirement points to the imperative consolidation of the economic reactivation as the necessary condition to reduce unemployment and makes it difficult to accept a cut down of the European funding that could easily generate a contraction of the economic activity.

The situation is particularly complicated in Andalusia, where the last data collected by the Encuesta de Población Activa (EPA, Active Population Survey), published by the Instituto Nacional de Estadística (INE, National Statistics Institute) at the end of 2011, reflect a regional unemployment rate of 31.23 percent. This rate is among the highest at the regional level and well above the already worrying national unemployment rate, which reached 22.85 percent on the same date and ranks as the highest one in the European Union.

For more than twenty years, Andalusia has received European Regional Policy funding due to its being classified as a priority or Objective 1 region. The objective requirement for a region to enter this category was to have a GDP per capita below 75 percent of the European average. Andalusia’s

structural weaknesses, mainly associated to its problems of territorial articulation and its evident deficiencies in basic infrastructures, fully justified its inclusion in this category. This way, in the successive 1989-1993, 1994-1999, 2000-2006 programming periods and in the current 2007-2013 period, Andalusia has continuously been the recipient of privileged funding while other Spanish regions progressively stopped complying with the above-mentioned requisite.

In this last seven-year period, Objective 1 regions have changed their name to Convergence regions. The Spanish regions that currently belong to this category are Galicia, Castilla-La Mancha, Andalusia and Extremadura, the latter being the only one still complying with the below-75 percent requisite for the next programming period. In fact, the region of Andalusia already exceeded this threshold in the present period but it was finally considered among the Convergence regions because data from the beginning of the 2000s were used for its classification. This justifies the strong commitment of the region with various initiatives to improve competitiveness and the increase of its investment in R&D&I during the present period, in line with the requirements of the second objective of the European Structural Funds, namely Regional Competitiveness and Employment.

The rest of the original priority regions have also left the list, and have formed two different groups. On the one hand, the group of the so-called “phasing out” regions, the ones that abandoned the category gradually: despite their still having a GDP which is below 75 percent of the EU-15 income, they are not poor in relation to the EU-27 average. These regions were subject to the “statistical effect” associated to the recalculation of the average European GDP per capita after the accession to the EU of new countries with comparatively lower income levels in 2004 and 2007. These regions are undergoing a regime transition in what concerns the withdrawal of the structural aid. On the other hand, there are the “phasing in” regions, the ones subject to the “growth effect”. Having belonged to the priority intervention group, they have experienced a dynamic reaction that has allowed them to improve their income level independently from the set of countries (EU-15 or EU-27) considered in the calculation. These regions enjoy another transitory regime associated to the second objective of the European Structural Funds, Regional Competitiveness and Employment, a budget item with a significantly lower financial weight. The rest of Spanish regions benefit directly from this second objective. There is also a third and residual group called European Territorial Cooperation. In a parallel way, new regions belonging to countries in Central and Eastern Europe have enrolled the group of priority needs.

In previous works and through the application of static general equilibrium modelling methodologies to the region of Andalusia (see Lima, Cardenete & Usabiaga, 2010), satisfactory results were achieved regarding the impact of the structural funds received and managed in the region during the 2000-2006 period, which still corresponded to a pre-crisis economic framework. The models developed indicated

that these funds contributed to a relevant extent to the generation of regional GDP and to the reduction of unemployment during those years. In terms of efficiency, the investment on physical infrastructures (ERDF) contributed to the growth of the regional GDP to a greater extent than the funds aimed at stimulating employment and human capital formation (ESF) or at financing agricultural structures (the already extinct EAGGF-G). This positive behaviour, added to the already mentioned statistical effect, have resulted in the takeoff of Andalusia from the tail group and in its reaching a GDP per capita that represents 81.2 percent of the EU-27 average, according to the latest Eurostat data.

3. Applied General Equilibrium Model

Computable General Equilibrium (CGE) models analyse the effect of economic policy actions on a specific economy, in terms of satisfaction of the requirements of welfare and technological feasibility and considering the restrictions associated to the available resources. This way, these models are capable of capturing the chain of interrelations generated by certain exogenous shocks on the agents and markets and, in general, on the whole economy, fine-tuning their nature better than the results provided by partial models.

CGE models are built upon the general equilibrium theories developed by Walras (1874) and later improved by Arrow & Debreu (1954), Wald (1951) and McKenzie (1959). Given the important mathematical foundations of these theories, potent algorithms capable of obtaining equilibrium solutions were required. It was Scarf (1973) who made this computational development possible, opening the door for works like those by Shoven & Whalley (1972) and Whalley (1975, 1977) or Shoven (1976), among others, where the so-called CGE models were presented as a tool allowing the assessment of public policies and the implementation of comparative statics exercises.

General equilibrium models have been traditionally used to analyse the effects of changes in economic policies. Depending on the case study, the parameters of the model are required to reach price and output levels that solve the general equilibrium model and provide the initial equilibrium. Next, a new calculation is made based on a specific behaviour hypothesis and using any of the available algorithms. The impact of the exercise on the most significant economic variables (prices, output level, government revenues and the new distribution of income among consumers) is thus predicted.

The choice of the functional forms that will reflect the behaviour of the economic agents usually depends on the use given to the model elasticities. Most frequently, the functional form chosen is that which will better allow the incorporation of the key parameter values (for instance, price and income elasticities), while trying not to damage the treatment of the model. This is the main reason why

“convenient” functional forms as the Cobb-Douglas, Constant Elasticity of Substitution (CES), Linear Expenditure System (LES), Translog, Generalised Leontief or other flexible forms are most often used.

Another obstacle that needs to be overcome is the calculation of the parameter values that define the functional relations. Two are the main methods to obtain these values: determinist calibration processes and econometric estimation. The first method, which is also the most frequently used, is the one applied in this work. The assumption is that the economy studied, represented by an empirical database, is in equilibrium under the existing fiscal policy; this is called “benchmark equilibrium”. The model parameters are thus calculated so that they reproduce the empirical data as an equilibrium solution for the model. No statistical test can contrast the specification of the resulting model. Through this procedure, the interest in improving the economic model does not prioritise the model statistical characteristics.

In practice, the data used for the calibration, which represent the benchmark equilibrium, are obtained from the National Accounts and other documents provided by governmental institutions. These data (the flows of goods, services and income for a specific or reference period) must be compiled and organised so they can be operative. One of the most consistent ways to do it is through the elaboration of a database called Social Accounting Matrix (SAM). A SAM includes data on the transactions between companies, the initial allocation of the different consumers and the amounts of consumption goods and services demanded by them, the decomposition of the value added by productive sectors, the taxes and transfers between government and private agents, the transactions of the economy with the foreign sector, etc. The compatibility of the information sources is achieved by implementing a hierarchy. Input-Output tables or the National Accounts are usually at the top of that hierarchy. In this case, the 2005 Social Accounting Matrix for Andalusia is used and updated for year 2013 by applying the cross entropy method, for which GDP, GVA and sector production data are required.

After explaining what an CGE model is, the next section will comment on some of the characteristics of the model applied in this work. It is a model that reflects the economic interactions that take place between consumers/families, producers/companies, the government and the foreign sector.

3.1 Static model

A static general equilibrium model, like the one proposed by Cardenete (2003), is taken as the basis for this work. In this case, the model used is formed by 25 productive sectors obtained from an aggregation of the Input-Output Tables for Andalusia in 2013, where the domestic production Xd_j of each sector uses as factors the production of the other sectors:

$$X_{dj} = \min (X_{1j}/a_{1j}, X_{2j}/a_{2j}, \dots, X_{25j}/a_{25j}, VA_j/v_j) \quad j= 1, 2, \dots, 25 \quad (1)$$

In this equation, X_{ij} represents the amounts of good i required for the domestic production of good j ; a_{ij} are the equivalents to technical coefficients in the framework of Input-Output analysis; VA_j stands for the value added of sector j , and v_j is the minimum amount of value added required to produce one unit of good j .

On the following nesting level, the regional value added of each sector j (VA_j) is the result of combining the primary factors (labour, L , and capital, K) by using a Leontief fixed coefficients technology:

$$VA_j = \min (K_j/k_j, L_j/l_j) \quad j= 1, 2, \dots, 25 \quad (2)$$

Total production Q_j is the result of combining domestic production X_{dj} with the equivalent imports X_{rowj} , which are considered imperfect substitutes of domestic production, following the already mentioned Leontief technology. In particular, the production of sector j is given by:

$$Q_j = \min (X_{dj}, X_{rowj}) \quad j=1, 2, \dots, 25 \quad (3)$$

The government is an agent that taxes the transactions between the other economic agents to obtain public revenue (R), has an influence on the consumers' disposable income (DPI), makes transfers to the private sector (TPS), and demands goods and services GD_j . The difference between revenues and payments represents the deficit or surplus of the administration.

In relation to investment and savings, savings are considered an exogenous component, thus allowing investment to be defined endogenously. In the equilibrium situation, it is necessary to guarantee the macroeconomic equality between savings at the aggregated level and the total investment of the economy:

$$\sum_{i=1}^n DI_i \text{ pinv} = DAHO \text{ pinv} + DP + DPRM \quad (4)$$

Finally, it is important to state that the two factors, labour and capital, are considered as used at full capacity. In addition, the levels of activity of both the government and the foreign sector are assumed to be fixed, allowing relative prices, the levels of activity of the productive sectors, and public and foreign deficits to function as endogenous variables.

Formally, the model reproduces a state of equilibrium of the Andalusian economy in which the supply and demand functions of all the goods are obtained as a solution for the utility and profit maximisation problems. The result is a vector of prices of goods and factors, of levels of activity and taxes so that they satisfy the above-described conditions.

The applied general equilibrium model here presented follows the traditional Walrasian equilibrium doctrine – Scarf & Shoven (1984), Ballard et al. (1985) and Shoven & Whalley (1992) –, now enlarged to include the public and the foreign sectors.

3.2 Dynamic model

In static models, the analysis is made through comparative statics exercises. However, in some empirical applications it may be interesting to generate a temporal path for the endogenous variables. With this objective, dynamic or multi-period models are developed.

These models incorporate dynamic growth aspects through changes in the capital stocks. The most frequent specification in the literature on dynamic general equilibrium takes as a starting point the Ramsey growth model (1928) with its infinite-lifetime consumer, later on improved by Cass (1965) and Koopmans (1965). However, overlapping generations models can also be found.

It was not until 1973 that the work of Scarf and Hansen contributed to the strengthening of the dynamic general equilibrium models. Nevertheless, it was Johansen who, in a very simple manner, developed the first model, which represented the dynamics of Norwegian economy. Another of the pioneers in using this dynamic analysis was Harberger, who examined the impact of a tax with a two-sector model.

From the 1990s onwards dynamic CGE models became more frequently used and they allowed analysing different economic policy problems regarding issues such as foreign trade, price control, optimal taxation or even the climate change.

It is thus possible to mention the works by Hazilla and Kopp (1990) or McKibbin (1993), where the stationary state dynamic was imposed through the exogenous specification of the growth rate; Blitzer et al. (1994), who developed a dynamic general equilibrium model for Egypt in order to analyse the restriction of carbon dioxide emissions in the country; Bye (2000), who analysed an environmental tax reform and the possibilities of a double dividend with a dynamic Ramsey model for Norway; and Jensen (2000), who also used a Ramsey model to analyse the taxes on carbon dioxide in Denmark. Dissou et al. (2002) made an important advance by introducing monopolistic competition in a

Ramsey-type model for carbon dioxide emissions in Canada. Thanks to the progress made in computational tools, Kehoe (2002) created a dynamic model to analyse foreign trade policies.

There are different approaches to the dynamic applied general equilibrium model. In this work, a simple Ramsey model will be used. The model behaves differently depending on whether it is in the so-called stationary state or not. The stationary state is defined as a situation in which the different amounts (capital, product, investment, etc.) grow at a constant rate. This analysis starts from a situation in which, according to the information available, the economy is in a stationary state in the basis period.

In the dynamic version, the representative consumer maximises the current value of the utility of his/her lifetime as follows:

$$\text{Max} \sum_{t=0}^{\infty} (1/1+\rho)^t U(c_t) \quad (5)$$

where t represents the time periods, ρ is the intertemporal discount factor, U is the utility function and c_t denotes consumption during period t . The consumer is confronted with several restrictions. First of all, the total product of the economy is divided between consumption and investment, I_t . Second, the capital depreciates at rate δ . Third, investment cannot be negative. These restrictions may be expressed this way:

$$c_t \leq F(k_t, l_t) - I_t \quad (6)$$

$$K_{t+1} = K_t(1-\delta) + I_t \quad (7)$$

$$I_t \geq 0 \quad (8)$$

Where K stands for capital and F represents the production function. To solve the utility maximisation problem the following first-order conditions are obtained:

$$P_t = (1/1+\rho)^t \partial U(c_t) / \partial c_t \quad (9)$$

$$PK_t = (1-\delta) PK_{t+1} + 1 + P_t \partial F(K_t, L_t) / \partial K_t \quad (10)$$

$$P_t = PK_{t+1} \quad (11)$$

where P_t , PK_t , and PK_{t+1} are the values of the corresponding Lagrange multipliers. These may be interpreted, respectively, as the price of the product, the current price of capital and the future price of capital.

In order to quantify the value of the investment in the stationary state growth path, it is required to describe the evolution of capital and labour in time. Thus, assumptions regarding the growth rate, g , the capital depreciation rate, d , and the interest rate, r , are required. When the initial labour force is L_0 , employment in moment t is:

$$L_t = L_0 (1 + g) \quad (12)$$

Or, in an equivalent expression,

$$L_t = (1 + g) L_{t-1} \quad (13)$$

The evolution of capital is given by equation (26). If in the basis period an economy is in the stationary state growth path, all the amounts (capital, labour, production, consumption) will grow at the same constant rate (g). The capital growth equation can be thus represented as:

$$K_{t+1} = (1 + g) K_t \quad (14)$$

In addition, a constant interest rate (r) is considered so that all future prices (including those of labour and capital) will be, in their current value:

$$P_{t+1} = P_t / (1 + r) \quad (15)$$

Capital may be bought or rented. Therefore, the implementation of the dynamic involves two prices for capital: the purchase price, PK , and the rental price, RK .

$$VK_t = K_t RK_t \quad (16)$$

Now it is necessary to consider the first-order conditions for capital and investment. They may be rewritten as:

$$PK_t = (1 - \delta) PK_{t+1} + RK_t \quad (17)$$

and

$$PK_{t+1} = P_t \quad (18)$$

Equation (37) may be rearranged by using equation (34) for PK :

$$PK_t = (1+r)P_t \quad (19)$$

Substituting equation (38) for PK_t and equation (37) for PK_{t+1} in (36), the result will be:

$$(1+r)P_t = (1-\delta)P_t + RK_t \quad (20)$$

Consequently, the equation for the rental price of the capital is:

$$RK_t = (\delta-g)P_t \quad (21)$$

The following rule for investment in the stationary state is derived from equations (26) and (33):

$$I_t = (\delta+g)K_t \quad (22)$$

4. Database: Social Accounting Matrix and European Structural Funds

Social Accounting Matrices (SAMs) are meant to represent the whole set of transactions made in an economy during a specific period of time. It is an important database organised as a double-entry table that gathers the economic and social information concerning the transactions made between all the economic agents.

The use of Social Accounting Matrices was first introduced by Stone (1962) when he published a SAM for the United Kingdom. However, given their usefulness to show the intersectoral relations and income distribution of an economy, the first SAMs were elaborated with the purpose of starting poverty reduction programmes in developed countries.

A SAM gathers relevant economic and social information about all the economic agents manifested in their transactions during a specific period of time. These transactions describe production, distribution, and income use and accumulation operations, both within the economy itself and with the rest of the world. A SAM enlarges the information contained in Input-Output tables, because, in addition to including that information, it integrates all flows between the value added and the final demand. Therefore, a SAM reflects the circular flow of income in an economy.

In this work, the 2005 SAM for Andalusia has been updated to year 2013 by using matrix projections that allow making simulations with a larger time scope. An updating cross entropy methodology has been applied, for which GDP, GVA and sector production data have been required. See below the structure of the SAM accounts, which have been divided into 25 productive branches and 12 accounts corresponding to the institutional sectors.

Table 1. Structure of the SAM for Andalusia in 2013

1	Agriculture	20	Construction
2	Stockbreeding	21	Trade
3	Fishing	22	Transport and communication
4	Extractive industries	23	Other Services
5	Oil refining and nuclear waste treatment	24	Sale-oriented services
6	Production and distribution of electric energy	25	Non-sale oriented services
7	Production and distribution of gas, water steam and water	26	Labour
8	Water capture and treatment	27	Capital
9	Mining and iron and steel industry	28	Consumption
10	Construction materials	29	Gross capital formation
11	Chemical industries	30	Social Security contributions paid by employers
12	Metal manufactures	31	Indirect taxes
13	Machinery	32	Tariffs
14	Vehicles	33	VAT
15	Other transport elements	34	Direct taxes
16	Food	35	Social Security contributions paid by employees
17	Textiles and leather	36	Public sector
18	Wood manufactures	37	Foreign sector
19	Other manufactures		

Source: Own elaboration

The data concerning the European funds have been taken from the Integrated Operative Programme for Andalusia 2007-2013, developed by the Department of Economy and Taxation of the Andalusian Regional Government. See below a table with the funding allocated to Andalusia in the current seven-year period:

Table 2. European funding received by Andalusia in 2007-2013

YEAR	2007	2008	2009	2010	2011	2012	2013
AMOUNT OF THE FUNDS	2,264,117	2,937,825	2,936,401	2,960,603	2,838,203	2,864,207	2,889,191

Source: Own elaboration from the Integrated Operative Programme for Andalusia in 2007-2013

5. Simulations and alternative scenarios

Given that there is little information available on the amounts that are to be allocated to Andalusia during the next multi-year programming period, three initial scenarios are set out based on certain statements of the European Parliament. In particular, in its report of the beginning of June 2011, the Parliament firmly rejected freezing the European budget after 2013 and fixed a 5 percent reasonable margin for growth so that initiatives such as the 2020 strategy, the new tasks contemplated in the Treaty of Lisbon or the consolidation of regional convergence could be successful. In addition, by focusing on the cohesion policy, the European Parliament asked the European Commission to propose the establishment of an intermediate category for those regions having exceeded the threshold of the 75 percent of the European GDP per capita but still presenting values that are below 90 percent of the European average. The aim was to facilitate these regions, as literally specified by the report, “a clearer status and more security in their development”.

This is exactly the situation of Andalusia, which could thus benefit from belonging to this intermediate category in case the proposal was finally approved. Under these premises, the three scenarios designed for the simulation in this work can be described as follows:

- *Pessimistic scenario*: loss of the total amount of the present resources.
- *Optimistic scenario*: structural funding is maintained at the same amount as in the present period.
- *Intermediate scenario*: loss of a third part of the resources available in the present 2007-2013 period.

Although the third proposal is considered the most feasible one, the setting out of extreme scenarios may help establish the interval of possibilities and define the consequences of the decisions that are finally adopted based on this modelling.

6. Main results

This section presents the results obtained in the simulations. The simulations are made for a series of macroeconomic indicators in the above-described scenarios and assuming that the economy grows at an annual 1.2 percent rate, in accordance with the average forecasts of The Economist – Economist Intelligence Unit¹.

¹ **The Economist**. Economist Intelligence Unit. www.eiu.com.

Undoubtedly, the present situation of economic instability and the high volatility of the financial markets, the strict fiscal discipline rules and the grave uncertainties regarding the evolution of the real economy make it especially difficult to establish behaviour assumptions and to predict the future evolution of any economy, whether Andalusian, Spanish or European. Given that the model used in this work is fed with these forecasts on the evolution of the economy during the seven-year period under study, and that these forecasts are continuously revised, it is reasonable to think that the robustness of the results will increase if the economic situation becomes clearer in the next few years. Nevertheless, caution is a must in a period such as this one.

Table 3. Pessimistic Scenario. Evolution of the GDP expenditure and the regional output in 2014-2020. Thousand euros

Macroeconomic indicators	2013	2014	2015	2016	2017	2018	2019	2020
Consumption	115,339,500	116,723,500	118,124,200	119,541,700	120,976,200	122,427,900	123,897,100	125,383,800
Investment	43,412,500	43,933,450	44,460,650	44,994,180	45,534,110	46,080,520	46,633,490	47,193,090
Public expenditure	31,535,560	31,913,990	32,296,960	32,684,520	33,076,730	33,473,650	33,875,340	34,281,840
Net exports	-40,082,500	-40,563,500	-41,050,200	-41,542,800	-42,041,300	-42,545,800	-43,056,400	-43,573,100
GDP expenditure	150,205,060	152,007,440	153,831,610	155,677,600	157,545,740	159,436,270	161,349,530	163,285,630
Regional output	380,949,582	381,465,128	381,986,872	382,514,836	383,049,181	383,589,925	384,137,150	384,690,953

Source: Own elaboration

Table 3 shows the evolution of the GDP expenditure and its four components, together with the regional output for the 2014-2020 period, under a pessimistic scenario in which the total amount of funds allocated in the current seven-year period is withdrawn. It is thus possible to see how the GDP expenditure and the regional output increase year after year because of the growth rate applied to the economy.

Table 4. Optimistic scenario. Evolution of the GDP expenditure and the regional output in 2014-2020. Thousand euros

Macroeconomic indicators	2013	2014	2015	2016	2017	2018	2019	2020
Consumption	115,339,500	119,043,700	121,090,900	122,515,300	123,956,600	125,251,100	126,765,900	128,054,500
Investment	43,412,500	45,440,210	46,386,000	46,924,120	47,468,470	47,913,210	48,495,820	48,927,120
Public expenditure	31,535,560	32,033,180	32,450,370	32,838,240	33,230,760	33,619,270	34,023,330	34,419,290
Net exports	-40,082,500	-41,574,000	-42,342,200	-42,837,800	-43,339,300	-43,775,400	-44,305,800	-44,736,200
GDP expenditure	150,205,060	154,943,090	157,585,070	159,439,860	161,316,530	163,008,180	164,979,250	166,664,710
Regional output	380,949,582	382,031,780	382,698,165	383,219,585	383,747,342	384,244,678	384,794,544	385,297,046

Source: Own elaboration

Table 4 shows the evolution of the GDP expenditure and its four components, as well as the regional output during the 2014-2020 period, in a so-called optimistic scenario in which the assumption is that the amount of funds received in the present seven-year period will be maintained in the next programming period. As the previous table, this one shows that the GDP expenditure and the regional output increase every year at the growth rate applied to the economy. When comparing the two scenarios, it is possible to observe how, in the optimistic one, all macroeconomic variables increase to a greater extent due to the reception of the total amount of funds. Tables 6 and 7 below will show the variation rate between the different scenarios and Table 8 will present a regional GDP variation index defined according to the amount of funds received.

Table 5. Intermediate scenario. Evolution of the GDP expenditure and the regional output in 2014-2020. Thousand euros

Macroeconomic indicators	2013	2014	2015	2016	2017	2018	2019	2020
Consumption	115,339,500	118,276,400	120,082,500	121,515,000	122,953,300	124,314,000	125,776,800	127,168,800
Investment	43,412,500	44,942,680	45,732,870	46,276,210	46,818,640	47,306,020	47,854,880	48,353,090
Public expenditure	31,535,560	31,993,090	32,397,130	32,785,460	33,177,850	33,569,990	33,971,320	34,372,880
Net exports	-40,082,500	-41,239,900	-41,903,200	-42,402,400	-42,902,600	-43,367,400	-43,875,200	-44,350,700
GDP expenditure	150,205,060	153,972,270	156,309,300	158,174,270	160,047,190	161,822,610	163,727,800	165,544,070
Regional output	380,949,582	381,847,497	382,461,396	382,987,422	383,517,127	384,031,530	384,572,169	385,099,640

Source: Own elaboration

Table 5 reflects the evolution of the GDP expenditure, its four components and the regional output for the 2014-2020 period under the so-called intermediate scenario, in which a one-third reduction is

applied to the amount of funds allocated to Andalusia in the present seven-year period. Thus, it is possible to see how the GDP expenditure and the regional output increase year after year due to the growth rate applied to the economy and the reception of funds. The macroeconomic variables in this scenario decrease if compared to those in the optimistic scenario and, contrarily, they increase if compared to the pessimistic one.

See below the year-by-year comparisons of the pessimistic scenario with the optimistic and the intermediate ones, respectively.

Table 6. Pessimistic scenario vs. Optimistic scenario. Variation rate 2014-2020. Thousand euros

Year	Macroeconomic indicators	Consumption	Investment	Public expenditure	Net exports	GDP expenditure	Regional output
2014	WITHOUT FUNDS	116,723,500	43,933,450	31,913,990	-40,563,500	152,007,440	381,465,128
	WITH ALL THE FUNDS	119,043,700	45,440,210	32,033,180	-41,574,000	154,943,090	382,031,780
	VR (%)	1.988	3.430	0.373	2.491	1.931	0.149
2015	WITHOUT FUNDS	118,124,200	44,460,650	32,296,960	-41,050,200	153,831,610	381,986,872
	WITH ALL THE FUNDS	121,090,900	46,386,000	32,450,370	-42,342,200	157,585,070	382,698,165
	VR (%)	2.512	4.330	0.475	3.147	2.440	0.186
2016	WITHOUT FUNDS	119,541,700	44,994,180	32,684,520	-41,542,800	155,677,600	382,514,836
	WITH ALL THE FUNDS	122,515,300	46,924,120	32,838,240	-42,837,800	159,439,860	383,219,585
	VR (%)	2.488	4.289	0.470	3.117	2.417	0.184
2017	WITHOUT FUNDS	120,976,200	45,534,110	33,076,730	-42,041,300	157,545,740	383,049,181
	WITH ALL THE FUNDS	123,956,600	47,468,470	33,230,760	-43,339,300	161,316,530	383,747,342
	VR (%)	2.464	4.248	0.466	3.087	2.393	0.182
2018	WITHOUT FUNDS	122,427,900	46,080,520	33,473,650	-42,545,800	159,436,270	383,589,925
	WITH ALL THE FUNDS	125,251,100	47,913,210	33,619,270	-43,775,400	163,008,180	384,244,678
	VR (%)	2.306	3.977	0.435	2.890	2.240	0.171
2019	WITHOUT FUNDS	123,897,100	46,633,490	33,875,340	-43,056,400	161,349,530	384,137,150
	WITH ALL THE FUNDS	126,765,900	48,495,820	34,023,330	-44,305,800	164,979,250	384,794,544
	VR (%)	2.315	3.994	0.437	2.902	2.250	0.171
2020	WITHOUT FUNDS	125,383,800	47,193,090	34,281,840	-43,573,100	163,285,630	384,690,953
	WITH ALL THE FUNDS	128,054,500	48,927,120	34,419,290	-44,736,200	166,664,710	385,297,046
	VR (%)	2.130	3.674	0.401	2.669	2.069	0.158

Source: Own elaboration

Table 6 shows the variation rates obtained from comparing the so-called pessimistic scenario, in which no EU-funds are allocated to Andalusia, to the optimistic scenario, in which the amount of funds allocated is the same as the one provided in the present seven-year period (2007-2013). This analysis has been made for each of the components of the GDP expenditure and the regional output. Thus, it is

possible to observe that the average annual effect of the funds on the GDP is around 2.2 percent, while on the regional output the effect is smaller (0.17 percent).

Table 7. Pessimistic scenario vs. Intermediate scenario. Variation rate 2014-2020. Thousand euros

Year	Macroeconomic indicators	Consumption	Investment	Public expenditure	Net exports	GDP expenditure	Regional output
2014	WITHOUT FUNDS	116,723,500	43,933,450	31,913,990	-40,563,500	152,007,440	381,465,128
	1/3 REDUCTION	118,276,400	44,942,680	31,993,090	-41,239,900	153,972,270	381,847,497
	VR (%)	1.330	2.297	0.248	1.668	1.293	0.100
2015	WITHOUT FUNDS	118,124,200	44,460,650	32,296,960	-41,050,200	153,831,610	381,986,872
	1/3 REDUCTION	120,082,500	45,732,870	32,397,130	-41,903,200	156,309,300	382,461,396
	VR (%)	1.658	2.861	0.310	2.078	1.611	0.124
2016	WITHOUT FUNDS	119,541,700	44,994,180	32,684,520	-41,542,800	155,677,600	382,514,836
	1/3 REDUCTION	121,515,000	46,276,210	32,785,460	-42,402,400	158,174,270	382,987,422
	VR (%)	1.651	2.849	0.309	2.069	1.604	0.124
2017	WITHOUT FUNDS	120,976,200	45,534,110	33,076,730	-42,041,300	157,545,740	383,049,181
	1/3 REDUCTION	122,953,300	46,818,640	33,177,850	-42,902,600	160,047,190	383,517,127
	VR (%)	1.634	2.821	0.306	2.049	1.588	0.122
2018	WITHOUT FUNDS	122,427,900	46,080,520	33,473,650	-42,545,800	159,436,270	383,589,925
	1/3 REDUCTION	124,314,000	47,306,020	33,569,990	-43,367,400	161,822,610	384,031,530
	VR (%)	1.541	2.659	0.288	1.931	1.497	0.115
2019	WITHOUT FUNDS	123,897,100	46,633,490	33,875,340	-43,056,400	161,349,530	384,137,150
	1/3 REDUCTION	125,776,800	47,854,880	33,971,320	-43,875,200	163,727,800	384,572,169
	VR (%)	1.517	2.619	0.283	1.902	1.474	0.113
2020	WITHOUT FUNDS	125,383,800	47,193,090	34,281,840	-43,573,100	163,285,630	384,690,953
	1/3 REDUCTION	127,168,800	48,353,090	34,372,880	-44,350,700	165,544,070	385,099,640
	VR (%)	1.424	2.458	0.266	1.785	1.383	0.106

Source: Own elaboration

Table 7 allows observing the variation rates obtained from comparing the so-called pessimistic scenario, in which no EU-funds are received, to the intermediate scenario, in which only two thirds of the current fund allocation for 2007-2013 are provided. This analysis has been made for each of the GDP components and the regional output. The results show that the average annual effect of the funds on the GDP is around 1.49 percent, whereas on the regional output the effect represents only a 0.11 percent increase.

Table 8. Regional GDP variation index according to the amount of funds received, 2014-2020 (%)

GDP GROWTH RATE 2014-2020	
Without funds	1.2 %
With all the funds	2.2 %
1/3 reduction of the funds	1.49 %
GDP VARIATION INDEX (Pessimistic scenario vs. Optimistic scenario) 83.3 %	GDP VARIATION INDEX (Pessimistic scenario vs. Intermediate scenario) 24.17 %

Source: Own elaboration

Table 8 reflects the GDP variation index obtained from comparing the pessimistic scenario with the optimistic and the intermediate ones, respectively. This index allows to present a clearer picture of the effects of the European Structural Funds on the Andalusian economy. It demonstrates that, if the amount of funds is maintained in the next programming period, the GDP growth rate will increase 83.3 percent with respect to the growth rate expected if no funds are received. In case only two thirds of the current funds are allocated, the GDP growth rate will experience a 24.17 percent increase in relation to the growth rate expected if no funds are received.

6. Conclusions

We can conclude this analysis by underlining that the results obtained through the application of a dynamic CGE modelling methodology on the Andalusian economy in the 2014-2020 period reveal the relevant contribution of the European Structural Funds to all the main macroeconomic indicators, and their potential repercussion on the regional development during the seven years that are the object of this study.

The results presented show how the GDP in Andalusia grows with the reception of European funds to a greater or lesser extent depending on the scenario analysed. Thus, if a conservative scenario is considered (in which, as mentioned before, the total amount of funds received is the same as the one allocated in the current seven-year period) the GDP grows an annual average of 2.25 percent, whereas if a moderate scenario (in which two thirds of the current amount are received) is contemplated, the GDP grows but to a lesser extent (1.49 percent). These data are clearly supported by the values of the regional GDP variation index defined according to the amount of funds received. In the optimistic

scenario the GDP growth rate increases 83.3 percent in relation to the expected growth rate without those funds, while under the intermediate scenario the GDP growth rate only increased 24.17 percent.

All these results prove the remarkable impulse experienced by the Andalusian economy due to the reception of European funds. Therefore, it is possible to conclude that such reception has a positive and relevant impact on the economic growth of the Andalusian region.

The reason to focus on the issue of structural fund reception in Andalusia under the next EU framework still to be approved is the consideration that this region is about to enter a new phase. New and different guidelines determine the objectives to be achieved under the new category of Regional Competitiveness and Employment. On the one side, the “learning effect” derived from the management of funds in previous periods encourages optimism in relation to the change of scenario and should be considered an asset to be made the most of in future years. But, on the other side, the probable “adaptation or dependence effect” should be taken as an alert because those funds have contributed to a remarkable generation of growth in previous years and their foreseeable cut down, as proved by the forecasts made in this work, is going to have a clear impact on the region’s economy.

According to the above-specified arguments, this work agrees with other reports and studies on the radical need for a change in the Andalusian productive model, for which it is essential to support those sectors that should lead the process. For this process can only succeed if and only if the patterns of productivity and competitiveness are improved. An efficient use of the European structural funds could clearly contribute to this aim. The complicated but necessary resizing of the productive sectors (the excessive outsourcing of the economy or the strong presence of the construction sector have left the relative development of the industry and the resulting loss of value added in the background), the uncertain capacity of the new labour legal framework to confront the new challenges, and the relevant role that the Andalusian entrepreneurs have to play, given the austerity policies applied by the public sector, certainly stand in the way.

This work acknowledges that it is time for other regions with greater economic divergences to come to the fore. However, according to the philosophy that underlies the European Regional Policy, interregional solidarity is applied to achieve a further objective of stability that allows consolidating the process of economic integration and reinforcing a more competitive market. This work considers that Andalusia needs to advance in a non-dramatic way towards a new situation, something that could be achieved through the establishment of a period of transition in tune with the already mentioned precedents and with the opinion of the European Parliament. In this hypothetical scenario some budget items would be maintained under the objective of Convergence and linked to others focused on the

improvement of Regional Competitiveness and Employment, thus making transition more easily tackled.

The changes that the region of Andalusia must confront in the present moment are many and not easy to digest due to their strong structural character. Therefore, this work deems necessary to maintain a financial distribution of the funds provided by the European Regional Policy that, although demanding in relation to the expected results, allows consolidating the recovery of the regional economy while avoiding the economic turbulences that could endanger the important progress made during the region's long process of convergence. Consequently, this work stands on the assumption that the third suggested scenario could represent an adequate combination between budget austerity and a firm commitment with the consolidation and enlargement of the objectives already achieved in Andalusia in terms of convergence.

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