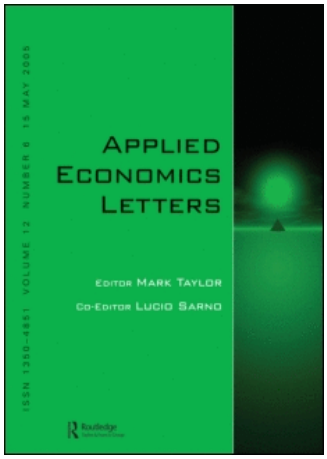

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The effects of European funds on a regional economy: an applied general equilibrium analysis

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The effects of European funds on a regional economy: an applied general equilibrium analysis

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In this work we conduct an impact analysis of European Structural Funds to assess their effect on output, prices and consumers' income on the European region of Andalusia, in the south of Spain. For this purpose we present an Applied General Equilibrium Model for Andalusia (AGEM_A) and proceed to compare the reception of regional funds scenario to a hypothetical situation where this financial support has been removed. The AGEM_A has been numerically implemented by supplementing the statistical information provided by the Social Accounting Matrices for Andalusia corresponding to 1990, 1995 and 1999, with data included in the three Community Support Frameworks approved by the European Commission.

I. Introduction

The general equilibrium theory of Walras (1874), paved the way for Arrow and Debreu (1954), Wald (1951) and McKenzie (1959) to show the existence of equilibrium and its properties. It was Scarf (1973) who did the complex computational work, followed by Shoven and Whalley (1972), Whalley (1975, 1977) and Shoven (1976), among others. This line of research led to what is known as an Applied General Equilibrium Model (AGEM), a set of modelling instruments and tools for the evaluation of public policies and other comparative static exercises.

The AGEMs are especially attractive for policy makers because they can be used to measure the effects of a specific decision on the productive sectors and also on the remaining agents in an economy. In this way, we can capture the effects of an exogenous shock on each of the agents, the markets and on the remainder of the economy.

When building an AGEM, the researcher initially gathers the necessary data in a particular economy, especially those provided by a Social Accounting Matrix (SAM). It is necessary to study a group of behavioural hypothesis reflected in different functional forms for consumers and producers. In this way, we can presuppose a fixed coefficients technology as the Leontief function, or a Cobb–Douglas function, or we can use more complex functions in order to apprehend reality more efficiently. We then carry out the calibration of the model and after that we reproduce the initial equilibrium by means of the corresponding computing algorithm. We then establish a new scenario and we calculate the new equilibrium vector. Afterwards, we can measure the effect of the shock on the most significant economic variables, such as prices, production levels, tax revenues or income distribution for the consumers.

In this work we build an Applied General Equilibrium Model for the region of Andalusia (AGEM_A) with the objective of assessing the impact on GDP and its components of European Regional Development Fund (ERDF).

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The AGEM_A works with three databases corresponding to the SAMs for 1990, 1995 and 1999.

The distribution of funds is negotiated for pluriannual execution periods called Community Support Frameworks (CSF) and each of the three Andalusian SAMs will be used to value one of the three CSFs approved so far. These frameworks correspond to the periods 1989–1993, 1994–1999 and 2000–2006. We work with a wide statistical base, in which we combine the regional accounting with the data from the regional economic programming on a European level. Hence, we will derive conclusions about the degree of dependence of this region with regard to community help.

This work is organized as follows. In Section II, we present our model, Section III discusses the main results and finally, in Section IV we summarize our conclusions.

II. The Model

To begin, we outline the structure of the SAM that we use. In our endogenous accounts we find the two productive factors [capital and labour, accounts (11) and (12), respectively], the private sector represented by the consumers (13) and finally ten activity sectors [accounts (1) to (10)]. Our exogenous accounts, following the most common approaches in relevant economic literature are three: the public sector (14), the savings and investment (15) and the foreign sector (16).

Suppose that markets work in perfect competition, where net profits after taxes are maximized for each of the ten productive sectors. The technology for production is represented by a nested production function, with constant returns to scale. In the first level, we have total production that is defined starting from a technology of fixed coefficients that combines two inputs: domestic production and production coming from the rest of the world.

The aggregation of production follows the specification of Armington (1969), based on the idea that imports are imperfect substitutes of domestic production. That is to say, the mere origin of the commodities brings about different types of production. For obtaining XD_j, we combine intermediate inputs and value added following Leontief's technology. In the following nested level, the regional value added for each sector j, is the result of combining the two production factors, capital and labour; again following a technology of fixed coefficients.

In our model there is a representative consumer, who receives a payment or wage, for his labour factor. In the same way, he receives a remuneration for the capital factor. In addition to the retribution of the production factors, the consumers' income consists of transfers from the public sector in terms of retirement pensions, social benefits or other noncontributory pensions. Finally, we have the group of transfers coming from the rest of the world that families add to their income. A Cobb–Douglas function shows how the representative consumer makes consumption decisions.

We work on a driven-saving model where saving is an exogenous component in our economy while investment is determined endogenously. At equilibrium, we should guarantee the macroeconomic equality among saving (coming from consumers, the public sector and the rest of the world) and the total investment of the economy.

The government demands commodities and services, carries out transfers to consumers and collects taxes. We assume that its activity level is constant and the public deficit is determined endogenously. Therefore, the equation of the public deficit works as a closing rule for the public sector:

$$\mathrm{PD} = \mathrm{DR} + \sum_{j=1}^{10} \mathrm{ITR_j} - \mathrm{PST}cpi - \sum_{j=1}^{10} \mathrm{GD}_j p_j$$
$$\forall j = 1, \ldots, 10$$

being the Public Deficit (PD), the result of subtracting government's transfers (PST) and demand (GD) from Direct Revenues (DR) and Indirect Total revenues (ITR).

We will assume that the commercial deficit is endogenous, whereas import levels, exports and transfers from the rest of the world are exogenous.

We apply the concept of Walrasian competitive equilibrium, enlarged to the public and foreign sector; and we suppose that productive factors are fully utilized and that markets are clear. Our equilibrium definition describes a situation in which producers maximize net profits, consumers maximize their utility levels and public sector activity levels condition the public deficit value; therefore, there is a similar behaviour for the foreign sector.

At the benchmark equilibrium, our starting point is a unitary level of prices, so that we can compare, when carrying out later simulations, the aforementioned benchmark situation with the new equilibrium after the shock introduced in the model. The calibration is a deterministic procedure that can be complemented with an econometric analysis of robustness contrasting the validity of the assigned values.

Table 1. GDP 1990 with funds and when funds are removed (*in millions of pesetas*)

	1990		
GDP	With funds	Funds removed	Δ%
Consumption	5.062.644	5.081.869	0.38%
Investment	1.536.739	1.535.717	−0.07%
Government expenditure	907.088	941.106	3.75%
Foreign sector	−1.252.229	−1.315.877	5.08%
GDP-expenditure	6.254.242	6.242.815	−0.18%
Labour income	2.586.918	2.586.918	0.00%
Capital income	2.510.259	2.537.530	1.09%
Indirect taxes	1.157.065	1.118.368	−3.34%
GDP-income	6.254.242	6.242.815	−0.18%

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

Table 2. GDP 1995 with funds and when funds are removed (*in millions of pesetas*)

	1995		
GDP	With funds	Funds removed	Δ%
Consumption	6.276.539	5.908.557	−5.86%
Investment	2.554.606	2.438.212	−4.56%
Government expenditure	2.001.000	1.858.501	−7.12%
Foreign sector	−1.663.122	−1.578.108	5.11%
GDP-expenditure	9.169.023	8.627.162	−5.91%
Labour income	3.190.651	3.190.651	0.00%
Capital income	4.684.521	4.223.704	−9.84%
Indirect taxes	1.293.851	1.212.806	−6.26%
GDP-income	9.169.023	8.627.162	−5.91%

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

Table 3. GDP 1999 with funds and when funds are removed (*in millions of pesetas*)

	1999		
GDP	With funds	Funds removed	Δ%
Consumption	7.938.698	7.385.986	−6.96%
Investment	4.094.765	4.166.997	1.76%
Government expenditure	2.731.770	2.516.923	−7.86%
Foreign sector	−2.716.893	−2.955.423	8.78%
GDP-expenditure	12.048.341	11.114.484	−7.75%
Labour income	4.043.008	4.043.008	0.00%
Capital income	5.965.350	5.182.962	−13.12%
Indirect taxes	2.039.982	1.888.514	−7.42%
GDP-income	12.048.341	11.114.484	−7.75%

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

III. Results

Among the possible simulations that we have been working with, we present an example from the demand point of view. Initially we build some corrective indexes on each of the variables that make up the final demand in the AGEM_A. These indexes comprise the demand fall caused by the funds after carrying out a decomposition of multipliers on a linear model with SAMs. This way, we establish the new scenario without funds and we look for a new equilibrium. We can draw attention to the variation experienced in all the components of the regional GDP. Below we analyse the main results.

As we can see in Table 1, the GDP of Andalusia decreases by only 0.18%, after studying the elimination of funds on the final demand of this regional economy. This can be because these investments were spent 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.

Table 2 shows the results for 1995. The impact of the funds is bigger than in 1990, in our opinion accumulating the effects generated during the first framework. In short, the fall registered in the GDP is close to 6%, as a result of an almost complete reduction of all its components.

From Table 3, the fall of the GDP is 7.75% according to our AGEM_A 1999. This result shows us a staggering effect of the funds so that, the impact will intensify over the long-term and consequently, there will be a considerable fall in GDP.

The simulations show that the funds received by this economy have a small effect on the regional GDP in the first years of reception. However, this situation changes as time goes by and contributes to the 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 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 due to funds received during the second framework, but due also in part to a progressive accommodation to this financing. The results of the third CSF of 7.75% fall of GDP given by the AGEM_A for 1999, could be bigger because of our statistical limitations.

Sosvilla *et al*. (2003), have assessed the European regional policy for the region of Castilla–la Mancha in Spain, which is also an Objective 1 for the European Commission. They used an adaptation of the HERMIN-Spain econometric model and worked with the financing of infrastructures. The results, although obtained by a different methodology, are very close to the ones attained in this work.

IV. Concluding Remarks

In this work we have built three AGEM to assess the incidence of the European Structural Funds in the region of Andalusia in the south of Spain. We have worked with the SAMs for 1990, 1995 and 1999. Also, we have included the additional information provided by the three CSFs that have been approved in the European Union for regional development corresponding to 1989–1993, 1994–1999 and 2000–2006.

The Andalusian economy progressively rebounds on account of receiving these funds. We highlight this gradual component, as in the first framework, our economy does not seem to react when it receives this financing. However, in subsequent periods this financing multiplies the interdependence effects captured by our AGEM_A. The decade concludes with an obvious accommodation effect to receiving the funds that makes us reconsider the evaluation of this receipt of funds in terms of efficiency in administration, as in future years we expect an important reduction of expenditure as a consequence of the entry of new countries to the European Union.

These exercises enable us to carry out *ex-ante* and *ex-post* simulations with the objective of assessing the repercussion of choosing certain investment projects instead of others. Applied General Equilibrium Models advance information on the results that can be expected after an intervention and they point out the prospective reaction of the most important regional economic linkages.

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