Suppression of agricultural subsidies in the Extremadura region: an applied general equilibrium analysis

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ABSTRACT

In this paper an applied general equilibrium model for the Extremadura region is presented. Our aim is to show the importance of agricultural subsidies in this economy, that it is a distinctive characteristic of this region. To achieve this purpose, we analyse the effects of a supression of these subsidies, using different scenaries related to the labour market and tax compensation.

Model parameters are mainly obtained from a Social Accounting Matrix built for this economy. The results clearly show the negative effects on important microeconomic variables (prices, activity levels or household welfare) and macroeconomic variables (unemployment rate).

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1.- Introduction

One of the features that characterizes the economy of Extremadura (an objective 1 region of the European Union, situated in the southwest of Spain) is the important weight agricultural activities have in its production structure. Its participation in terms of value added or employment is greatly superior to that of the whole Spanish economy.

Additionally, it is worth emphasizing the enormous amount of subsidies on production received by Extremadurian agriculture. The relevance of these subsidies is very clear considering, for example, the percentages with regard to the value added of this sector or with respect to the regional GDP, as these percentages reach figures close to 18% and 2.5% respectively[1]. Apart from producing substantial injections of income into this sector, these subsidies play an important role in maintaining the population in rural areas and avoiding population movements towards urban zones[2].

Our objective in this work is to demonstrate and quantify the dependence that the Extremadura economy has on agricultural subsidies. A suppression of these subsidies is simulated, and the main economic effects are determined. On the other hand, given that these subsidies come from the European Union, an exercise of this nature is also interesting because of the reduction these aids may well experience as a consequence of the process of the expansion to a Europe of 25 member states.

Likewise, together with the suppression of agricultural subsidies, two additional exercises have been developed, which include respectively compensations with employers´ social contributions and income tax. Additionally, the three exercises have considered two different scenarios for the labour market, according to the sensitivity of real wages to the unemployment rate.

With respect to the methodology of the analysis employed, the simulations considered produce changes that affect all of the economic agents. In order to include all of these interrelations, it is better to use a general equilibrium approach, rather than partial equilibrium models[3]. Specifically, an applied general equilibrium model is used. The degree of detail that is included allows us to evaluate the effects on specific economic agents. In this way it surpasses the results obtained by macroeconomic models of a more aggregated nature.

With regard to the results obtained, they reveal in general the important negative impacts that the suppression of agricultural subsidies produces. For the first two simulations the results are

[1] Data referring to the year 1990. As it will be mentioned later, statistical limitations have determined that this was the reference year used for the analysis.

[2] These effects nonetheless remain excluded from the analysis developed later. See, for example, Kehoe and Noyola (1991), who presents an applied general equilibrium model that incorporates effects derived from population movements.

[3] "The partial equilibrium analysis is clearly insuitable when the "feed-back" effects of a particular policy change or a shock are considered to be relevant". Bandara (1991, page 4).

similar: in both cases a general increase in the different prices can be observed, as well as activity levels reflecting a reduction in consumption and an increase in investment. The third simulation has different results, especially in regard to the behaviour of prices. The three exercises are similar in that they show welfare losses in practically every household group.

Moving on to comment on the structure of work, the following section includes a description of the proposed model. In the third section, the Social Accounting Matrix which allows us to obtain the model parameters is shown very briefly. The analysis of the results from the three simulations carried out is included in section 4. Finally, in section 5 the main conclusions obtained are presented.

2.- The model

The applied general equilibrium model for the Extremadurian economy consists of a set of equations that reflect equilibrium conditions and the behaviour of the different agents. As such, we can consider in general terms producers, households, the public sector and the foreign sector.

With respect to the level of detail, the model developed for Extremadura (hereafter AGEM-EXT) incorporates 10 activity sectors, 9 commodities and 11 household groups (see Figure 1). The model also includes a detailed description of government taxes and transfers. Finally, three foreign sectors are distinguished, corresponding to the rest of Spain (RS), the European Community (EC) and the rest of the world (RW).

A) Production

In the model it is considered that each one of the ten production sectors produces a homogeneous good, using for this a nested production function. In the first nesting level, it can be observed that the total production for each sector (Q_j) is obtained as a Cobb-Douglas aggregate of the domestic output (Qd_j), and the three outputs corresponding to each of the foreign sectors (Qrs_j, Qec_j y Qrw_j)[4]. The second level reveals that domestic production for each sector is obtained as a Leontief production function between intermediate inputs and value added. Finally, the third nesting level shows that the value added of each sector is obtained by combining the primary factors capital and labour according to a Cobb-Douglas technology. The expressions used in these three levels are therefore the following:

[4] This means of representing the total output is commonly known as the Armington hypothesis (Armington, 1969). The underlying idea is that imported products are imperfect substitutes for domestically produced goods.

Figure 1 – Production sectors, Commodities and Households Groups included in the AGEM-EXT

PRODUCTION SECTORS:

j_1 - Agriculture
j_2 - Energy
j_3 – Chemistry and minerals
j_4 – Food, drinks and tobacco
j_5 – Other industries
j_6 - Construction
j_7 – Trade
j_8 – Transports and communications
j_9 – Other private services
j_{10} – Public services

COMMODITIES:

h_1 – Food and non-alcoholic drinks
h_2 – Alcoholic drinks and tobacco
h_3 – Clothing and footwear
h_4 – Housing, heating and lighting
h_5 – Furnishings and fittings
h_6 – Medical services
h_7 – Transports and communications
h_8 - Leisure, education and culture
h_9 – Other commodities

HOUSEHOLDS GROUPS:

f_1 – Less than 65 years, agricultural sector, low income
f_2 - Less than 65 years, agricultural sector, high income
f_3 - Less than 65 years, other sectors, 1st quintile
f_4 - Less than 65 years, other sectors, 2nd quintile
f_5 - Less than 65 years, other sectors, 3rd quintile
f_6 - Less than 65 years, other sectors, 4th quintile
f_7 - Less than 65 years, other sectors, 5th quintile
f_8 - 65 years o more, rural, low income
f_9 - 65 years o more, rural, high income
f_{10} - 65 years o more, urban, low income
f_{11} - 65 years o more, urban, high income

$$Q_j = \$_{Aj}\ Qd_j^{*dj}\ Qrs_j^{*rsj}\ Qec_j^{*ecj}\ Qrw_j^{*rwj} \quad (1)$$

$$Qd_j = min\ \{ X_{1j}/a_{1j}\ ,\ X_{2j}/a_{2j}\ ,\ \ldots\ ,\ X_{10j}/a_{10j}\ ,\ VA_j/v_j \} \quad (2)$$

$$VA_j = \$_j\ K_j^{\varepsilon_j}\ L_j^{1-\varepsilon_j} \qquad \forall j = 1,2,\ldots,10 \quad (3)$$

In these expressions $\$_{Aj}$ and $\$_j$ are scale parameters; $*d_j$, $*rs_j$, $*ec_j$ and $*rw_j$ are parameters which reflect the coefficients of domestic and imported outputs as a part of the total production, normalised to add up to one; ε_j and $(1-\varepsilon_j)$ are parameters which represent the participation of the primary factors, capital and labour, with regard to value added; and finally the parameters a_{zj} show the minimum amount of good z necessary in order to obtain a unit of good j.

B) Households

The utility function employed for the different household groups is once again a nested function, in this case with two nesting levels. In the first level the utility appears as a CES function between an aggregate consumption ($Cagreg_f$) and savings or future consumption (S_f). In the second, the aggregate consumption is a new CES function between the 9 different commodities. In this way, the expressions used for the household groups are the following:

$$U_f = [\$c_f \, Cagreg_f^{\,nf} + (1 - \$c_f) \, S_f^{\,nf}]^{1/nf} \quad (4)$$

$$Cagreg_f = [\,(_{1f} \, C_{1f}^{\,Df} + \,(_{2f} \, C_{2f}^{\,Df} + \ldots + \,(_{9f} \, C_{9f}^{\,Df}\,]^{1/Df} \qquad \text{œ} f = 1,2,\ldots,11 \quad (5)$$

In these equations $\$c_f$ and $(_{hf}$ represent the distribution parameters from the first and second CES respectively; n_f and D_f reflect the substitution parameters; and finally C_{hf} represents the consumption of commodity h by the household group f.

On the other hand, the budget constraint each household group faces can be expressed in the following manner:

$$\sum_{h=1}^{9} p_h (1 + te_h)(1 + vat_h) \, C_{hf} + p_i \, S_f \le YD_f \quad (6)$$

The sum incorporated on the left hand side reflects the expenditure in final consumption. For the AGEM-EXT, as consumption taxes have been incorporated the taxes on alcoholic drinks and tobacco, whose effective tax rate for commodity h is te_h; and value added tax, whose tax rate is vat_h . Savings are also included in the expression, which in the model is valued at the price of the saving/investment, p_i .

The right hand side of the previous inequality shows disposable income, YD_f . For the majority of the household groups this income basically comes from the sale of its factors capital (K_f) and labour (L_f) at the prices r and w respectively[5]. Additionally, households receive transfers from the public sector (TPS_f), including unemployment benefits, pension benefits and other net transfers[6]. Net income is also received from the foreign sector (TFS_f) in the form of wages and private international transfers, although their quantitative importance is minimal. Finally, employees' social contributions and income tax have to be subtracted, whose tax rates are cob_f and J_f respectively.

In this way, the equation that allows us to obtain the disposable income for the household group f is the following:

$$YD_f = (1 - J_f)[r \, K_f + w \, L_f (1-u) + TPS_f + TFS_f - cob_f \, w \, L_f (1-u)] \quad (7)$$

[5] As it will be commented in detail later, the model contemplates the possibility that the whole factor labour is not employed. In this sense, u is an endogenous variable of the model that reflects the unemployment rate.

[6] Unemployment benefits are determined in an endogenous way, based on changes in the unemployment rate. Pensions benefits and other net transfers are indexed on the consumption prices.

C) Government

The activity of the government consists on the one hand of producing public services (sector j_{10}). On the other hand, it demands public services (public consumption) and investment goods. In this sense it can be considered that this agent maximises a Leontief utility function, defined in the following way:

$$U^G = min\{C^G_{j10}, \beta^G \cdot C^G_i\} \tag{8}$$

In this equation β^G is an economic policy parameter reflecting the existence of a fixed proportion between public consumption and public investment. On the other hand, the budget constratint that government confronts can be expressed in the following way:

$$p_{j10}C^G_{j10} + p_i C^G_i \leq R^G + p_i w^G_i - \sum_{f=1}^{11} TPS_f = I^G \tag{9}$$

The left hand side of this expression reflects this agent's spending on consumption and investment. On the right hand side, government's income via taxes is expressed (R^G), from which transfers paid to the 11 household groups have to be subtracted. w^G_i represents the stock of debt that the government issues when it is in budgetary deficit. The rest of the sectors can buy this debt at the same price as the good savings/investment, p_i.

With respect to the tax revenues R^G, the model includes as indirect taxes the net taxes on production (taxes minus subsidies), employers' social contributions, import taxes, and the previously mentioned taxes on alcoholic drinks and tobacco and value added tax. As direct taxes, employees' social contributions and income tax are included. Finally, given that agricultural subsidies, the object of this analysis, consist of payments from the European Community foreign sector, in the model they are effectively considered as borne by this foreign sector, and not by government.

D) Foreign Sector

As has already been commented, in the model there are three different foreign sectors: the rest of Spain (RS), the European Community (EC) and the rest of the world (RW). The treatment given to this sector is simple: each one of these foreign sectors produces a different trade good, using as inputs the exportations of Extremadura on a fixed coefficients technology. As a consequence of this activity, and at the same time considering the transfers between foreign sectors and domestic agents, our economy can fall into deficit with regard to these foreign

sectors. The cited deficit must appears as savings for these foreign sector in order to achieve macroeconomic consistency between saving and investment.

E) Saving and investment

The model constructed for the Extremaduran economy is a static model, being especially valuable for analysing the changes in relative prices and in the allocation of resources. In this sense, the treatment given to investment and savings is once again relatively simplified: basically, the model must guarantee that in equilibrium the aggregated savings from all the economic agents (households, government and the foreign sectors) is the same as the total investment in the economy.

F) Labour Market

The model contemplates the possibility that rigidities exist in the labour market. Specifically, it considers that workers offer the labour factor at a real wage that depends on the unemployment rate, however it doesn't adjust sufficiently so that in equilibrium the labour market does not empty itself completely. This feed-back between real wage and unemployment rate is expressed in the following equation:

$$\left(\frac{w}{cpi}\right)=\left(\frac{1-u}{1-u_0}\right)^{\frac{1}{\beta_d}} \qquad (10)$$

(w/cpi) represents the real wage; *u* is the unemployment rate; u_0 is a parameter of the model that reflects the unemployment rate in the benchmark equilibrium; and β_d is a parameter that expresses the sensitivity of real wages to the unemployment rate.

This last parameter can have values between 0 and infinity. If $\beta_d = 0$, real wages will adjust sufficiently so that the unemployment rate remains constant (and the same as the rate of benchmark equilibrium). If $\beta_d = 4$, the situation is exactly the opposite, that is to say, real wages remain constant and unemployment rates are flexible. For intermediate values, the more this parameter increases the greater salary rigidity is, in other words, the sensitivity of real wages to the unemployment rate diminishes.

In the simulations we shall show later, calculations are carried out for two different values of this parameter. Specifically, the values $\sigma_d = 0$ and $\sigma_d = 1.5$ are used[7].

G) Equilibrium

The notion of equilibrium that is used in the model is that of Walrasian competitive equilibrium, extended to include not only producers and households, but also government and foreign sector. Specifically, economic equilibrium is determined by a price vector for all sectors, commodities and factors, a vector of activity levels, and a series of macro variables such that supply equals demand in all markets, with the sole exception previously mentioned, namely the labour market. Additionally, each of the economic agents included in the model verifies its budget constraint and its problem of optimisation.

On the other hand, it has been considered as the only closure rule that the model maintains fixed the public sector activity level; the objective sought is to show the adjustment of this sector and the whole of the economy, when, faced by the proposed fiscal simulations, this activity level is not modified. This is a especially interesting scenario for exercises that include tax compensations. For the foreign sector, commercial deficits remain fixed at the levels of benchmark equilibrium, which allows the activity levels in these foreign sectors to vary.

3.– Databases and calibration

The values for the parameters are carried out by the usual procedure of calibration, for which it is necessary to previously obtain a Social Accounting Matrix (SAM) for the Extremadura economy. These matrices can be conceived in general terms as an amplification of the traditional input-output tables, as they show, not only the operations related to the productive sphere, but they also incorporate information on the spending and income structure of the different economic agents.

Calibration basically consists of assuming that the SAM (i.e. the base period) represents a equilibrium of the economy. That is to say, it implies determining what values of the parameters verify this property. Furthermore, in the benchmark equilibrium measurement units are considered in such a way that all the prices and activity levels are unitary, so that percentage variations in them can be obtained immediately.

[7] This specification for the labour market, similar to that proposed by Oswald (1982), is the one employed to a large extent in the applied general equilibrium models constructed for the Spanish economy.

In our case it is possible to obtain by calibration practically all of the parameters in the model[8]. We have only to obtain external estimations for the elasticities of substitution in CES consumption functions, using for this information relative to the Spanish economy (López-Salido, 1993).

It is important to point out that the SAM for Extremadura used as basis to calibrate is referred to the year 1990, determining that this be taken as the year of reference for the analysis[9]. On the other hand, given that the matrix is constructed expressly to calibrate the applied general equilibrium model, there exists a perfect concordance between the SAM and the model. Together with the production sectors, commodities and household groups shown in figure 1, the Extremadurian matrix also includes the three external sectors mentioned, an aggregated capital account or savings/investment account, two primary factors (labour and capital) and the extensive breakdown of taxes and transfers depicted in the model.

4.- Simulations and results

Once the model is constructed and the benchmark equilibrium determined, various simulations have been carried out, centred on agricultural subsidies[10]. More specifically, three different exercises were carried out:

A) In the first instance a hypothetical scenario is used, consisting of a total suppression of these subsidies, without modifying any other tax or transfer. We have to point out that, although the recent amplification of the European Union could cause a reduction in such subsidies, and reform of the Common Agricultural Policy could create some uncertainty over the amounts involved, a total suppression of them does not appear probable. In any case, the motive for using this extreme scenario is to allow us to appreciate more clearly the dependence the Extremadura economy has on these subsidies, as well as to understand the negative effects that their absence would have on the main economic variables.

B) In the second exercise, a suppression of agricultural subsidies is once again used, but at the same time simulating a suppression of employers' social contributions in the agricultural sector. The objective pursued in this case is to analise if this suppression of employers' quotes enables it possible to counter the effects observed in the first simulation. The tax

[8] The tax rates incorporated are also obtained through calculation, using the data of tax revenues included in the SAM for Extremadura. They deal with effective rates and not nominal rates.

[9] This is the only Social Accounting Matrix that exists for the economy being analysed. Although it seems adequate to update this database, the statistical limitations are particularly serious at a regional level, and at the moment prevent the construction of a matrix for a more recent period.

[10] The set of equations that defines the model is highly non-linear. For the computation of the equilibriums, the GAMS software has been used (General Algebraic Modelling System).

compensation is applied to these contributions because they constitute a especially important tax burden in the whole of the Spanish economy.

C) Finally, the third exercise includes a clearly distinct simulation to the two previous ones, given that, in this case, agricultural subsidies are maintained. More precisely, this exercise supposes that government replaces the European Community foreign sector as the agent supporting agricultural subsidies. However, with the object of maintaining constant its tax revenues, it linearly increases tax rates on income. A simulation of these characteristics, including national agricultural subsidies and increases in income tax, would also appear to be a hypothetical scenario. In any case, the object pursued is to show that in a scenario of equivalent tax revenues the maintaining of these subsidies by government could have important consequences on multiple variables.

Before moving on to interpret the different results, it is important to point out that the model provides a large amount of information that has to be summarized. In this sense, the interpretation of results includes three major blocks of variables: prices, activity levels and household welfare.

A) Suppression of agricultural subsidies

With respect to this first simulation, table 1, which is shown below, presents the variations in the different prices considered[11]. Beginning with the production prices, the sectors that predominate are those that experience increases in prices, agriculture being particularly noteworthy, and given their connections with it, food industries as well. Increases experienced by chemicals and minerals and other industries are also relevant, given their dependency on the rest of Spain via imported products, and given the increase that in this case takes place in the price of this trade good. On the other hand, there exist diverse sectors (basically services) that present small reductions in prices, due to the modification that the elimination of subsidies produces in the factors prices. In this sense, in both of the scenarios considered, a reduction in the price of the factor capital takes place, and is more prominent the higher the salary rigidity[12].

Consumption prices also experience a general increase, once again commodities more closely linked to agriculture (food and drinks and alcoholic drinks and tobacco) stand out. The general

[11] For motives of exposition, the tables of results exclude the changes in the prices of the three trade goods. In the same manner, the tables that present the activity levels do not incorporate the changes that take place in the trade goods activity levels.

[12] In all of the simulations the wage (w) has been taken as numeraire.

price index *cpi*, constructed over consumption prices, shows percentage increases that fluctuate between 1 and 2.5%.

Table 1. First simulation: suppression of agricultural subsidies.

Percentage variation in PRICES

Production		$\beta_d = 0$	$\beta_d = 1,5$
j_1	Agriculture	12.59	10.83
j_2	Energy	0.91	-0.8
j_3	Chemistry and minerals	4.77	3.18
j_4	Food, drinks and tobacco	6.16	4.57
j_5	Other industries	4.93	3.41
j_6	Construction	0.91	-0.22
j_7	Trade	0.73	-0.58
j_8	Transports and communications	0.64	-0.5
j_9	Other private services	-0.88	-2.39
j_{10}	Public services	0.43	0.06
Consumption (Commodities)			
h_1	Food and non-alcoholic drinks	5.59	4.05
h_2	Alcoholic drinks and tobacco	4.36	2.86
h_3	Clothing and footwear	2.6	1.2
h_4	Housing, heating and lighting	0.14	-1.32
h_5	Furnishings and fittings	1.96	0.72
h_6	Medical services	2.67	1.25
h_7	Transports and communications	1.9	0.49
h_8	Leisure, education and culture	1.28	-0.14
h_9	Other commodities	1.23	-0.22
cpi	General index	2.47	1.02
i	Investment	1.62	0.45
Primary factors			
r	Capital	-2.11	-4.14
w	Labour	Numeraire	Numeraire

Table 2 shows the percentage changes that take place in the different activity levels. For production sectors, a general reduction is observed, standing out agricultural sector and the food processing industry again[13]. This reduction is linked very closely to the decrease that takes place in consumption demand, especially with the first two commodities (see activity levels Y_h).

Returning to the sectors of production, the results show two clear exceptions to the previous behaviour: chemistry and minerals, and above all, construction, sectors whose production is largely directed to investment. To understand this result it is important to point out that, in the model, investment is determined by savings. In this exercise, the aggregated savings in the economy experiences an important increase, owing principally to the rise that takes place in the savings of the European Community foreign sector. This fact justifies the notable increase

[13] The activity level of public services remains constant, owing to the suppositions included in the model.

experienced by the investment activity level, which "*pulls*" the two previous productions sectors[14].

On the other hand, the general decrease observed in these sectoral activity levels also produces a reduction in the demands for factors, determining a more than 1 percentage point increase in the rate of unemployment with respect to initial equilibrium (from 18.81% to 20.04%)[15].

Table 2. First simulation: suppression of agricultural subsidies.

Percentage variation in ACTIVITY LEVELS

Production		$\beta_d = 0$	$\beta_d = 1,5$
j_1	Agriculture	-3.51	-4.13
j_2	Energy	-2.46	-3.08
j_3	Chemistry and minerals	2.73	1.08
j_4	Food, drinks and tobacco	-4.41	-4.63
j_5	Other industries	-0.38	-1.1
j_6	Construction	9.56	6.04
j_7	Trade	-2.54	-2.6
j_8	Transports and communications	-0.04	-0.84
j_9	Other private services	-0.72	-0.97
j_{10}	Public services	-	-
Commodities			
h_1	Food and non-alcoholic drinks	-6.3	-5.91
h_2	Alcoholic drinks and tobacco	-5.33	-4.96
h_3	Clothing and footwear	-3.74	-3.44
h_4	Housing, heating and lighting	-1.22	-0.83
h_5	Furnishings and fittings	-3.15	-3.05
h_6	Medical services	-3.86	-3.56
h_7	Transports and communications	-3.23	-2.95
h_8	Leisure, education and culture	-2.63	-2.33
h_9	Other commodities	-2.59	-2.27
i	Investment	10.67	6.77

We move on to analyse the changes produced in the welfare of the different household groups (see table 3). In order to obtain a monetary valuation of these changes, the equivalent variations are calculated (VE), obtained from the corresponding expenditure functions.

In practically every case, these equivalent variations are negative, in this way confirming that the suppression of agricultural subsidies produces a generalised loss of welfare[16]. The decrease in the factor incomes that the households receive determines that, with certain exception, their disposable income decreases. Furthermore, if consumption and savings/investment prices are also generally higher, the result is a general decrease in consumption and savings.

[14] Investment shows an important sensitivity with respect to the value of the parameter β_d, producing increases in Y_i that are clearly superior if there exists complete wage flexibility.

[15] Given the specification included in the model for the labour market, the changes in the unemployment rate only refer to the scenario that implies wage rigidity, because if there exists absolute wage flexibility, this rate remains constant.

[16] Only one single household experiences an improvement in its welfare, although this is somewhat modest. This refers to the household group f_3 when the parameter $\beta_d = 1.5$ is used. In this scenario this household sees a slight reduction in the income of the factors it receives, but unemployment benefits are clearly superior to those at initial equilibrium.

It can be observed that the higher equivalent variations (in absolute value) correspond to the groups f_7 , f_6 , f_5 and f_2 . In general, these refers to household groups with high incomes in which the participation of capital income is important, so they are more affected by the reduction in returns from this factor.

Table 3. First simulation: suppression of agricultural subsidies.

EQUIVALENT VARIATIONS (thousands of millions ptas)

	$\beta_d = 0$	$\beta_d = 1,5$
f_1 - Less than 65 years, agriculture, low income	-1.19	-0.9
f_2 - Less than 65 years, agriculture, high income	-2.58	-2.76
f_3 - Less than 65 years, other sectors, 1st quintile	-0.75	0.09
f_4 - Less than 65 years, other sectors, 2nd quintile	-1.6	-1.32
f_5 - Less than 65 years, other sectors, 3rd quintile	-3.12	-3.06
f_6 - Less than 65 years, other sectors, 4th quintile	-4.28	-4.29
f_7 - Less than 65 years, other sectors, 5th quintile	-9.29	-10.36
f_8 - 65 years or more, rural, low income	-0.22	-0.22
f_9 - 65 years or more, rural, high income	-1.88	-2.02
f_{10} - 65 years or more, urban, low income	-0.01	-0.02
f_{11} - 65 years or more, urban, high income	-0.71	-0.83

Before concluding the analysis of this first simulation, it is important to stress that the macroeconomic closure used in the model determines investment behaviour. Nevertheless, despite the increase that this experiences and the positive effects it generates, the results show very clearly the general deterioration the Extremaduran economy would suffer from the suppression of agricultural subsidies, with systematic reductions in sectorial activity levels and household welfare.

B) Suppression of agricultural subsidies and employers' social contributions in the agricultural sector

The suppression of employers' social contributions in this sector does not significantly change the results, as the effects observed in this second exercise are very similar to those of the first simulation. Nevertheless, the changes that take place in the variables are slightly less than the previous ones.

Beginning with the percentage variations in prices (see table 4), the results show once again an uneven behaviour with regard to production prices, and in general identify the same sectors with important price increases (basically agriculture and the food industry), or those with reductions (energy, construction and services). The increases observed are nevertheless somewhat less than those of the previous simulation, above all in the agricultural sector itself. This relation between the first and second simulation also holds true for consumption and investment prices.

Table 4. Second simulation: suppression of subsidies and contributions paid by employers in agricultural. Percentage variation in PRICES

Production		$\beta_d = 0$	$\beta_d = 1,5$
j_1	Agriculture	9.42	8.71
j_2	Energy	-0.52	-1.22
j_3	Chemistry and minerals	2.87	2.23
j_4	Food, drinks and tobacco	4.06	3.42
j_5	Other industries	3.06	2.45
j_6	Construction	-0.08	-0.54
j_7	Trade	-0.37	-0.9
j_8	Transports and communications	-0.32	-0.79
j_9	Other private services	-1.9	-2.52
j_{10}	Public services	0.09	-0.06
Consumption (Commodities)			
h_1	Food and non-alcoholic drinks	3.61	2.99
h_2	Alcoholic drinks and tobacco	2.59	1.98
h_3	Clothing and footwear	1.16	0.59
h_4	Housing, heating and lighting	-0.99	-1.58
h_5	Furnishings and fittings	0.73	0.23
h_6	Medical services	1.2	0.63
h_7	Transports and communications	0.55	-0.02
h_8	Leisure, education and culture	0.02	-0.56
h_9	Other commodities	-0.05	-0.64
cpi	General index	1.01	0.42
i	Investment	0.5	0.02
Primary factors			
r	Capital	-3.35	-4.18
w	Labour	Numeraire	Numeraire

Table 5 shows the percentage variations that, in this case, take place in the activity levels. The general results are similar to the previous ones: decreasing activity levels for the production sectors (apart from chemistry and minerals and construction, due to their relationship to investment), and also decreasing activity levels for commodities, although in all these cases the reductions are somewhat inferior to those obtained in the previous simulation. This fact, together with the lower cost of contracting the factor labour implied in the suppression of employers' quotas, produces a lower increase in the unemployment rate than that observed in the first simulation, going from an initial rate of 18.81% to a final value of 19.3%.

In relation to investment, important increases are again produced in its activity level, that fluctuate in function of the parameter β_d. In this sense, the increases in the aggregated savings of the economy that determine the change in Y_i are less than in the previous case, basically a consequence of a higher public deficit due to a lower tax revenue from employers' contributions.

Table 5 – Second simulation: suppression of subsidies and contributions paid by employers in agricultural. Percentage variation in ACTIVITY LEVELS

Production		$\beta_d = 0$	$\beta_d = 1,5$
j_1	Agriculture	-2.93	-3.19
j_2	Energy	-2.02	-2.27
j_3	Chemistry and minerals	2.03	1.34
j_4	Food, drinks and tobacco	-3.61	-3.7
j_5	Other industries	-0.34	-0.64
j_6	Construction	7.27	5.81
j_7	Trade	-2	-2.03
j_8	Transports and communications	-0.09	-0.42
j_9	Other private services	-0.49	-0.59
j_{1o}	Public services	-	-
Commodities			
h_1	Food and non-alcoholic drinks	-5.11	-4.95
h_2	Alcoholic drinks and tobacco	-4.26	-4.11
h_3	Clothing and footwear	-2.93	-2.81
h_4	Housing, heating and lighting	-0.71	-0.55
h_5	Furnishings and fittings	-2.54	-2.5
h_6	Medical services	-3.03	-2.91
h_7	Transports and communications	-2.48	-2.36
h_8	Leisure, education and culture	-1.93	-1.81
h_9	Other commodities	-1.87	-1.74
i	Investment	8.1	6.49

With respect to the variations in the welfare of the household groups shown in table 6, as the equivalent variations are always negative, they reflect in every case loses of utility with respect to the initial equilibrium. The higher equivalent variations once again correspond to the households f_7 , f_6 , f_5 and f_2 , although the suppression of employers' contributions makes feasible welfare losses smaller.

Table 6. Second simulation: suppression of subsidies and contributions paid by employers in agricultural. EQUIVALENT VARIATIONS (thousands of millions ptas)

	$\beta_d = 0$	$\beta_d = 1,5$
f_1 - Less than 65 years, agriculture, low income	-1.01	-0.89
f_2 - Less than 65 years, agriculture, high income	-2.39	-2.46
f_3 - Less than 65 years, other sectors, 1st quintile	-0.49	-0.14
f_4 - Less than 65 years, other sectors, 2nd quintile	-1.06	-0.94
f_5 - Less than 65 years, other sectors, 3rd quintile	-2.42	-2.2
f_6 - Less than 65 years, other sectors, 4th quintile	-3.37	-3.38
f_7 - Less than 65 years, other sectors, 5th quintile	-7.77	-8.21
f_8 - 65 years or more, rural, low income	-0.19	-0.19
f_9 - 65 years or more, rural, high income	-1.76	-1.81
f_{1o} - 65 years or more, urban, low income	-0.01	-0.01
f_{11} - 65 years or more, urban, high income	-0.69	-0.74

C) Agricultural subsidies and lineal increase in income tax.

This third simulation is of a different nature to the previous two exercises, determining that the results obtained do indeed show relevant differences compared to the previous ones. The

clearest example of this is in the behaviour of prices (see table 7), because in this case all of them fall (production, consumption and investment). Especially revealing is the different behaviour that, compared to the previous simulations, can be observed in the prices of production and consumption in the areas more closely linked to agriculture[17]. Furthermore, in each scenario of the labour market, the changes in production prices are similar for the different sectors, and the same can be said for commodities. The explanation of this result may be that the proposed change does not initially affect the production structures, but rather is essentially a change in demand.

Table 7. Third simulation: agricultural subsidies and lineal change in income tax.

Percentage variation in PRICES

Production		$\beta_d = 0$	$\beta_d = 1,5$
j_1	Agriculture	-0.84	-0.34
j_2	Energy	-0.91	-0.36
j_3	Chemistry and minerals	-0.82	-0.33
j_4	Food, drinks and tobacco	-0.8	-0.32
j_5	Other industries	-0.78	-0.31
j_6	Construction	-0.6	-0.24
j_7	Trade	-0.7	-0.28
j_8	Transports and communications	-0.61	-0.24
j_9	Other private services	-0.82	-0.33
j_{10}	Public services	-0.19	-0.08
Consumption (Commodities)			
h_1	Food and non-alcoholic drinks	-0.78	-0.31
h_2	Alcoholic drinks and tobacco	-0.77	-0.31
h_3	Clothing and footwear	-0.74	-0.29
h_4	Housing, heating and lighting	-0.79	-0.31
h_5	Furnishings and fittings	-0.65	-0.26
h_6	Medical services	-0.74	-0.3
h_7	Transports and communications	-0.74	-0.3
h_8	Leisure, education and culture	-0.76	-0.3
h_9	Other commodities	-0.77	-0.31
cpi	General index	-0.76	-0.3
i	Investment	-0.61	-0.24
Primary factors			
r	Capital	-1.12	-0.45
w	Labour	Numeraire	Numeraire

For its part, table 8 initially shows a reduction in the activity levels for the production sectors, although these decreases are generally far inferior to those of the previous two exercises. Once again, the chemistry and minerals and construction sectors constitute an exception to this result. With regard to commodities, there is likewise a drop in activity levels, a drop that is very similar for all the different goods.

[17] It seems appropriate here to remember that, in contrast to the previous exercises, in this simulation agricultural subsidies have not been withdrawn. In this case, we consider that government assumes responsibility for paying these subsidies, increasing income tax in order that the tax revenues do not vary with regard to the initial equilibrium.

Table 8. Third simulation: agricultural subsidies and lineal change in income tax.

Percentage variation in ACTIVITY LEVELS

Production		$\beta_d = 0$	$\beta_d = 1,5$
j_1	Agriculture	-0.61	-0.4
j_2	Energy	-0.59	-0.38
j_3	Chemistry and minerals	1.84	2.24
j_4	Food, drinks and tobacco	-1.25	-1.12
j_5	Other industries	-0.15	0.07
j_6	Construction	6.16	6.9
j_7	Trade	-1.6	-1.51
j_8	Transports and communications	0.08	0.32
j_9	Other private services	-1.16	-1.03
j_{10}	Public services	-	-
Commodities			
h_1	Food and non-alcoholic drinks	-2.25	-2.25
h_2	Alcoholic drinks and tobacco	-2.23	-2.23
h_3	Clothing and footwear	-2.4	-2.37
h_4	Housing, heating and lighting	-2.42	-2.42
h_5	Furnishings and fittings	-2.71	-2.61
h_6	Medical services	-2.29	-2.26
h_7	Transports and communications	-2.38	-2.34
h_8	Leisure, education and culture	-2.57	-2.54
h_9	Other commodities	-2.55	-2.51
i	Investment	6.98	7.79

The effects on household welfare are presented in table 9, and once more losses of welfare can be observed in every case. The calculation of the equivalent variations shows that the household group which deteriorates most clearly is f_7, that is to say, the non-agricultural asset group with the highest incomes, that supports the highest income tax rate. This result is similar to that obtained in previous exercises, although in this simulation it has increased significantly.

Table 8. Third simulation: agricultural subsidies and lineal change in income tax.

EQUIVALENT VARIATIONS (thousands of millions ptas)

	$\beta_d = 0$	$\beta_d = 1,5$
f_1 - Less than 65 years, agriculture, low income	-0.46	-0.53
f_2 - Less than 65 years, agriculture, high income	-1.52	-1.38
f_3 - Less than 65 years, other sectors, 1st quintile	-0.36	-0.6
f_4 - Less than 65 years, other sectors, 2nd quintile	-0.52	-0.58
f_5 - Less than 65 years, other sectors, 3rd quintile	-1.69	-1.62
f_6 - Less than 65 years, other sectors, 4th quintile	-2.63	-2.49
f_7 - Less than 65 years, other sectors, 5th quintile	-12.37	-11.44
f_8 - 65 years or more, rural, low income	-0.49	-0.46
f_9 - 65 years or more, rural, high income	-2.13	-1.98
f_{10} - 65 years or more, urban, low income	-0.17	-0.16
f_{11} - 65 years or more, urban, high income	-1.61	-1.49

To conclude the analysis, it is interesting to make a comparison between this third simulation and the initial exercise. The results obtained show that if people are willing to accept higher income taxes rates, the maintenance of agricultural subsidies causes smaller distortions than

the suppression of them. As has already been commented earlier, the reductions in the activity levels that occur in this third simulation are generally clearly inferior to those obtained in the first exercise. In fact, in comparison with the increase that the unemployment rate experiences in the first simulation, in this last exercise the rate *u* is reduced by 0.4 percentage points. In relation to the welfare of the different household groups, the behaviour is not so clear, although dominate the groups that in this third case experience losses of welfare inferior to the initial ones.

5. - CONCLUSIONS

The enormous importance that agricultural subsidies have for the Extremadura economy have led us, in this work, to propose different simulations related to suppression of subsidies. With the exercises carried out we have sought to demonstrate up to what point this region dependences on the cited agricultural subsidies.

On the other hand, given the proposed modifications, it would appear adequate to use a modelling framework that incorporates the interdependences between different economic agents. To be specific, an applied general equilibrium model is used that, although relatively simple and of a static nature, capture with sufficient clarity the relevance of the effects produced. It is important to highlight the usefulness of this framework of analysis for carrying out simulations of economic policy, as it allows us to grasp the microeconomic and macroeconomic effects produced.

Without any doubt, it is the first exercise carried out that shows most clearly this relation of dependence. By proposing an extreme scenario consisting in a total suppression of the agricultural subsidies, the negative effects express themselves in the first instance in an important reduction in the levels of welfare for practically every household group, especially for the groups whose income depends very much on the factor capital. At the same time, excepting investment and the sectors linked to it, it´s observed a generalized reduction in the activity levels. The results also show an increase in most of the prices considered. The largest changes takes place in the commodities and sectors most closely linked to agriculture.

The second exercise proposes, for its part, a fiscal compensation with employers' contributions in the agricultural sector itself, resulting in changes in the different variables similar to those of the first simulation, although less intense. Finally, the third exercise produces results which are clearly different to the previous ones, for example in relation to the behaviour of prices, as well as reinforcing welfare losses for the households with high rates of income tax.

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