Economic effects of a biofuel's consumption tax exemption in the Spanish Personal Income Tax: a computable general equilibrium approach

José M. Cansino[1], M. A Cardenete[2] and Rocío Román[3].

Abstract

This paper simulates the effects on the economy of Spain that are produced by a new tax credit in the Income Tax, based on biofuels consumption. A computable general equilibrium model is employed as a modelling framework. Model parameters are obtained by calibration, using a social accounting matrix for Spain updated to the year 2000.

According to results, a) the greater the reduction of the effective rate, the growth of domestic prices is higher, b) the greater the reduction of the effective rate, the levels of activity (in absolute value) are higher, c) the greater the reduction of the effective rate, higher unemployment, further reducing real GDP growth and higher disposable income, and, d) the greater the reduction of the effective rate, is the worst collection of all taxes.

Keywords: Income tax, biofuels, computable general equilibrium models, social accounting matrices, fiscal policy.

JEL classification: C68, D58, R13.

---

[1] University of Seville. Corresponding author: jmcansino@us.es
[2] University of Pablo de Olavide.
[3] University of Seville.

Economic effects of a biofuel's consumption tax exemption in the Spanish Personal Income Tax: a computable general equilibrium approach

José M. Cansino, M. A. Cardenete and Rocío Román.

1.- Introduction.

Green book of the European Commission (1996) on the renewable energy sources, it fixed as objective to duplicate the contribution of those sources to the national gross energy consumption in fifteen years. This supposed to fix the contribution of the renewable energies by 12 percent in 2010. In 2008, the same institution has raised this objective up to 20 percent by the year 2020.

Part of EU's policy on renewable energies has focused on biofuels. The EU promotion iniciatives have been justified as a source of enviromentals benefits, fostering the security of energy supply, and leading to job creation in the agricultural sector[4].

For an industrialized economy like the US one, the transport sector has seen the fastest growth in carbon dioxide emissions in the 1990's. Because of roughly 97 per cent of all energy consumed by cars is still pretroleum based, in the absence of strong government

[4] However, the net employment effect on the country level remains unclair because of the crowding-out effect accounts for job losses in the rival mineral oil industry. Peters and Thielmann (2008) have pointed out this aspect of the biofuels public promotion. Referred to renewable energies, not only biofuels, Pfaffenberger (2006) discussed the employment effects of these sources of energy in industrialized countries. For the European context, see Dannenberg et al. (2007).

policies, the IEA projected that the worldwide use of oil in transport will nearly double in between 2000 and 2030, leading to a similar increase on greenhouse gas –GHG- emissions (IEA, 2004). Among biofuels' environmental benefits, the abatement of GHG- emissions is the most frecuently argument when we compare them with fossil fuels.

In fact, many observers consider biofuels to be the only feasible option for the substitution of fossil fuels in the transport sector[5], although other observers think that the best option consists in the use of hybrid gasoline-electric vehicles and finally in replacing gasoline with a zero-carbon fuel[6]. Nowadays, the most important biofuels are biodiesel and bioethanol – commonly we referred to them as first-generation biofuels[7].

The specific target for biofuels was fixed by 2003/30/CE Directive setting that fuels used in transport (gasoline and diesel) must represent the 5,75 per cent over the total fuel used in transport before 2010, 31st december. Although the real posibilities of this target has been critizied[8], in 2008 the new proposal for a Directive of the European Parliament and of the Council on the promotion of the use of energy from renewable resources rose this quota to 10 per cent in 2020.

---

[5] See Peters and Thielmann (2008).

[6] See Romm (2006).

[7] Others like biohydrogen and various hydrocarbons are a part of second-generation biofuels.

[8] Edwards et al. (2008).

In Spain, the 12/2007 Act allowed the Industry Department to design the promotions' instruments for biofuels. Finally, the Spanish Industry Department fixed the national quota of biofuels[9] over the total fuel used in transport in the 1,9 per cent for 2008[10], the 3,4 per cent for 2009 and the 5,83 per cent for 2010.

In order to raise these national quotas, the EU authorities have recommended the use of tax exemptions (EU, 2003/96/CE Directive). In fact, the instruments that are usually applied to promote biofuels are tax exemptions and mandatory blending quotas. Actually, all the EU-27 members have introduced total or partial exemption of biofuels in their national specific taxes on fuels. Spanish authorities did it in 2002.

This paper evaluates the effects of a Personal Income Tax (IRPF) reform in the Spanish economy. This reform is carried out by introducing a tax credit based on personal biofuel consumption in transport. The proposal of this reform is to promote the used of biofuels in a similar way as biofuels exemption works in the special tax.

As Spanish regional authorities can participate in the design of a part of the IRPF structure, this reform is also interesting from the fiscal federalism point of view.

The evaluation is implemented by using an applied Computable General Equilibrium Model –CGE-. Debt to the actual crisis context, the simulation is carried out by allowing an unbalanced budget scenario provoked by the reform.

In the last 25 years, the GGE's have been profusely used to analyse the government economic policies, both in developed and developing countries (Shoven and Whalley, 1992). In general terms, these models translate the theoretical Walrasian general

[9] See article 4 of O ITC/2877/2008, October 9 st.

[10] Only for 2009 and 2010 the quotas are mandatories ones.

equilibrium system into fully operative tools, including an endogenous output and price system, substitutability in production and demands, and the optimization behaviour of individual agents. A computable general equilibrium analysis allows to study the changes in the spheres of production and consumption, as well as in income distribution, in response to changes in a given economic policy, as these models explicitly include a representation of the framework of interdependencies among all markets in an economy.

It is important to note that this model framework has also been widely used to assess the economic effects of different environmental tax reforms. Among the large number of applications in the literature, those by Dessus and Bussolo (1998), Bye (2000), Xie and Saltzman (2000), Wender (2001), Conrad and Löschel (2005) and Van Heerden et al. (2006). Besides, Manresa and Sancho (2005), Andre et al. (2005) and De Miguel et al. (2008) can be mentioned as they are referred to the Spanish economy and the Spanish regions of Andalucía and Extremadura.

For this tax reform evaluation we use the Social Accounting Matrix (SAM) that has been built for the Spanish economy for 2000 (SAM00). In 2000, the fiscal framework came from the Personal Income Tax Act[11].

The paper is structured as follows. In Section 2, we present the main features of the CGE model that has been implemented. Section 3 shows the SAM built for the Spanish economy that was used to calibrate the model parameters. A detailed description of the tax reform is presented in section 4, together with the main results. Section 5 concludes.

2.- The Model.

[11] We refer to 40/1998 Act, December 9 st.

A static CGE model has been developed for the Spanish economy. This model allows us to determine the effects on resource allocation caused by the introduction of the tax reform. This model involves a set of equations that reflect equilibrium conditions and the behaviour of the different economic agents. For that reason, the producers, the households, the public sector and the foreign sector are considered in general terms. In this section, a detailed analysis of each sector or agent (subsections A to D below), including some observations in relation to the labour market (subsection E) and the notion of equilibrium used (subsection F)[12] is showed.

2.1.- Production

The model for the Spanish economy incorporates 16 productive sectors. It is assumed that each productive sector generates a homogeneous product, according to a nested production function. At the first nested level, following the Armington hypothesis, the total production of each sector (Q_j) is obtained as a Cobb-Douglas aggregate of domestic output (Qd_j) and imports (Qm_j),. At the second level, the domestic production for each sector is obtained with a fixed-coefficients technology between intermediate inputs (X_{ij}) and value added (VA_j). Finally, at the third nested level, the value added of each sector is obtained by combining the primary factors of capital (K_j) and labour (L_j), according to a Cobb-Douglas technology function. The expressions used at these three levels are given in (1), (2) and (3) respectively:

$$Q_j = \beta_{Aj}\, Qd_j^{\delta dj}\; Qm_j^{1-\delta dj} \qquad (1)$$

[12] The main equations of the model are shown in the paper. The full listing of equations is available upon request.

$$Qd_j = \min\left\{ X_{1j}/a_{1j}, X_{2j}/a_{2j}, \ldots, X_{16j}/a_{16j}, VA_j/v_j \right\} \quad (2)$$

$$VA_j = \beta_j K_j^{\alpha_j} L_j^{1-\alpha_j}, \quad j = 1,2,\ldots,16 \quad (3)$$

In these expressions, β_{Aj} and β_j are scale parameters; δd_j are parameters which reflect the share of domestic output of j in j's total production; parameters a_{zj} express the minimum amount of z needed to obtain a unit of j; v_j is the technical coefficient of value added; and, finally, α_j and $(1-\alpha_j)$ are parameters which represent the participation of the primary factors, capital and labour, with regard to value added[13].

Finally, it is assumed that firms obtain their demand functions for inputs and supplies of outputs by maximising profits under these technological constraints.

2.2.- Consumption

The model assumes only one consumer. The following Cobb-Douglas utility function (U), defined in terms of saving and consumption, is considered:

$$U = \sum_{h=1}^{9} \gamma_h \ln C_h + \gamma_s \ln S \quad (4)$$

In (4), the parameters γ_h and γ_s reflect the share of disposable income for commodities h and/or for private savings. S represents the saving and C_h expresses the private consumption of commodity h.[14]

---

[13] For the simulations considered in the paper, a sensitivity analysis for functional forms has been done. Specially, a Cobb-Douglas function between intermediate inputs and value added has been introduced instead of the Leontief function of equation (2). The results obtained in both cases are very similar –qualitative and quantitatively- and, therefore, those from the Cobb-Douglas specification have not been included in the paper.

[14] For the simulations considered in the paper, a sensitivity analysis for functional forms has been done. Specially, a Cobb-Douglas function between intermediate inputs and value

Inequality (5) shows the budget constraint for this representative household group[15]:

$$\sum_{h=1}^{9} p_h (1 + vat_h) C_h + p_i S = \sum_{h=1}^{9} p_h^F C_h + p_i S \leq YD \qquad (5)$$

The sum on the left hand side is the expenditure on final consumption. The parameter vat_h is the value added tax rate for the commodity h, and p_h^F is its final consumption price inclusive of taxes. Private saving is also included in the expression, being valued at the saving/investment price, p_i.

The right hand side of inequality (5) shows disposable income, *YD*. This income comes from the sale of its endowments of capital (*K*) and labour (*L*), at the prices *r* and *w* respectively. In addition, households receive transfers from the public sector, (*TPS*), indexed by the consumption price index (*cpi*), and receive transfers from the foreign sector (*TFS*), although their total quantitative importance is minimal. Finally, households have to pay employees' social contributions and income tax, whose rates are *ess* and τ, respectively.

Thus, the disposable income of the only household group[16] is given by (6):

$$YD = (1 - \tau)\left[rK + wL(1-u) + cpi\ TPS + TFS - ess\ wL(1-u)\right] \qquad (6)$$

---

added has been introduced instead of the Leontief function of equation (2). The results obtained in both cases are very similar –qualitative and quantitatively- and, therefore, those from the Cobb-Douglas specification have not been included in the paper.

[15] Due to the features of consumer's utility function – increasingly monotone- this weak inequality must be satisfied as an equality in the equilibrium. The same comments are valid for expression (8) –government budget constraint.

[16] As will be commented later, *u* is an endogenous variable that reflects the unemployment rate.

The representative consumer derives the consumption demand functions by maximising the utility function subject to the budget restriction shown in (5).

2.3.- Government

The activity of the government consists, on the one hand, of producing public services, by using the technology of "Non-sales oriented services" (j_{16}), while, on the other, of demanding public services (public consumption, $C^G{}_{j16}$) and investment goods ($C^G{}_i$). In this sense, this agent can be considered to maximise a Leontief utility function (U^G), defined by (7):

$$U^G = \min \left\{ C^G_{j16}, \gamma^G C^G_i \right\} \qquad (7),$$

where γ^G is an economic policy parameter reflecting the existence of a fixed proportion between public consumption and public investment.

The budget constraint that the government confronts can be expressed by inequality (8):

$$p_{j16} C^G_{j16} + p_i C^G_i \leq R^G + p_i w^G_i - cpi\ TPS \qquad (8)$$

The left hand side of this inequality reflects government spending on consumption and investment. On the right hand side, tax revenues are (R^G), from which transfers paid to households have to be subtracted. $w_i{}^G$ represents the stock of debt that the government issues when it is in budgetary deficit. The rest of the sectors could buy this debt at the same price as saving/investment, p_i.

With respect to the total tax revenues R^G, the model includes net taxes on production, employers' social contributions, import taxes and the previously mentioned value added tax as indirect taxes. As direct taxes, employees' social contributions and income tax are considered. The tax revenue components (a) to (f) are specified in (9) to (14) respectively:

a) Taxes on production (*Rt*):

$$Rt = \sum_{j=1}^{16} t_j \left[\sum_{z=1}^{16} p_z X_{zj} + w(1 + esc_j) L_j + rK_j \right] \quad (9)$$

That is, the domestic output of each sector is subject to a tax at a rate t_j. The production price for sector z is p_z. Finally, esc_j stands for the employers´ social contributions rate.

b) Employers' social contributions (*Resc*):

$$\mathrm{Re}sc = \sum_{j=1}^{16} esc_j \, w L_j \quad (10)$$

c) Import taxes (*Rtarif*):

$$Rtarif = \sum_{j=1}^{16} tarif_j \; p_m \, Qm_j \quad (11)$$

$tarif_j$ is the import tariff rate for sector j, while p_m is the weighted price index of imported products.

d) Value Added Tax (*Rvat*):

$$Rvat = \sum_{h=1}^{9} vat_h \; p_h \, C_h \quad (12)$$

e) Employees´ social contributions (*Ress*):

$$\mathrm{Re}ss = ess \;\; w L (1 - u) \quad (13)$$

f) Income tax ($R\tau$):

$$R\tau = \tau \left[rK + wL(1-u) + cpi \; TPS + TFS - ess \;\; wL(1-u) \right] \quad (14)$$

Equations (9) to (14) show the taxes included in the model benchmark. The tax reform considered modifies (14) changing the τ value.

Authorities aim to promote bioufuels by introducing a tax credit which compensate their higher cost and market prices so, in practise, the policy maker needs to know the spread between fossil fuels and biofuels prices, before quantify the tax credit.

However, there is not consensus about the spread. Joint to the observers who give information rather exactly of the spread[17], others point out that biofuels' cost of production differ country to country debt to climatic conditions and quality of land. Additionally, the production's cost of biofuels vary depending on soil quality[18] and the tecnology disposable. As the spread remains unclear, the tax credit's size is a political question.

Given the current regulation of the financial regional system in most of Spain, the level of application of the fiscal credit enables to the regional country governments to negotiate the way to share the cost of the reform[19].

The fiscal reform evaluated shocks the effective tax rate. This shock is quantified from the disposable data offered by the Spanish Fiscal Agency (AEAT) for 2000, refered to the adjusted gross income and to the tax liability.

---

[17] Demirbas (2007) calculated biodiesel has over double the price of petrodiesel. In Europe, Ryan et al. (2006) found that the production-cost differential between biodiesel and its fossil counterpart is 75 US-Cent / 1 l .

[18] Peters and Thiermann (2008) results are based on the use of jatropha oil in India and Tanzania.

[19] See article 38 of 21/2001 Act, December 27 st, related with the regional authorities competences on IRPF.

The tax credit is a *lump sum* one. To implement it and to avoid fiscal evasion, taxpayers have to retain and credited through invoices, annual spending on biodiesel and bioethanol[20]. The reform evaluated is based on a tax credit that was implemented before 2007, when certain taxpayers may deduct 35 percent of the value of the fuel consumed during the fiscal year[21]. In this case, taxpayers would be able to demonstrate biofuel in a cost equal to or greater than the value of the tax credit. The hypothesis of this paper states that all taxpayers meet this minimum level of consumption of biofuel.

In order to determine the sensitivity of the reform, we have been considered two other percentages, 30 and 40 per cent. The three percentages are applied to the average personal spending fuels. With data from the *Encuesta Continua de Presupuestos Familiares* in 2000, this expenditure was 265.06 euros[22].

---

[20] In Spain, most of the bioethanol is sold in the form of gasoline blended with ETBE. The tax reform proposal, articulated through a system of bills, just consider the spending Biodiesel that exceeds an amount of 5 percent (minimum amount for which the label explicitly mentioned their presence in the petrol diesel) and gasoline with bioethanol additional its presence in the ETBE. With data taken from energias-renovables.com in Spain, 487 gas stations that sell biodiesel and 9 serving biethanol.

[21] This tax credit was regulated in O EHA 493/2006, February 27 st and allowed certain taxpayers to reduce taxable at 35 per 100 in spending on diesel.

[22] This is the cost estimate provided by the most disaggregated survey. This cost exactly come from the 0722 code that corresponds to COICOP expenditure on fuel and lubricants. Although it would be desirable to refine disaggregating level codes 0722110L (fuel) and 0722125 (lubricants), this information is not available. On the behavior of the demand of fuel in Spain, see Álvarez et al. (2006: 13 and 14).

To contribute to the effectiveness of the tax credit based on their visibility to the taxpayer, the calculations have come up 80, 95 and 105 euros, according to the percentages used (30, 35 and 40, respectively). With data from the Memory of the AEAT[23] 2001, the effective rate[24] was 13.5 percent. The three stages of the reform proposal would cause reductions to decrease the effective rate 12.93; 12.82 and 12.75 percent respectively[25].

2.4.- Foreign sector

The model considers only one foreign sector, being the rest of Spain, the European Union and the rest of the world.

2.5.- Labour market

Capital and labour demands are obtained from conditional factor demand functions, thus minimizing the cost of obtaining value added. For the capital factor, we assume perfectly inelastic supply and therefore this factor is always fully employed. However, the model allows possible rigidities in the labour market, so the unemployment rate may be positive. More precisely, we consider the relationship (17) between the real wage and the unemployment rate:

---

[23] The AEAT report of 2001 contains data from the liquidation of the personal income tax levied on personal income gained by taxpayers in 2000, reference year for the SAM that supports this paper.

[24] The average rate, as defined by the Report of the AEAT, is the ratio of the tax liability from the self-declared and personal income, the latter being the taxpayer's adjusted gross income plus the minimum exemption and family and the general reduction of wages.

[25] In 2000, the number of returns filed was 13433747 between joint and individual. The paper will have to become homogenized individual statements.

$$\left(\frac{w}{cpi}\right)=\left(\frac{1-u}{1-u_0}\right)^{1/\beta_d} \qquad (17)$$

This formulation of the labour market in CGE modelling is due to Kehoe *et al.* (1995), following the precepts established in Oswald (1982). The variable *(w/cpi)* represents the real wage; u is the unemployment rate; u_0 is a parameter that reflects the unemployment rate in the benchmark equilibrium; and β_d is a parameter that expresses the sensitivity of the real wage to the unemployment rate.

This last parameter can have values between zero and infinity. If $\beta_d = 0$, the real wage will adjust sufficiently so that the unemployment rate remains constant and equal to the benchmark equilibrium rate. If $\beta_d = \infty$, the situation is exactly the opposite, that is to say, the real wage remains constant and the unemployment rate varies. For intermediate values, higher values of this parameter represent greater salary rigidity. In other words, the sensitivity of the real wage to the unemployment rate diminishes.

In the simulations we shall show later, calculations are carried out for different values of this parameter. Specifically, the extreme values $\beta_d = 0$ and $\beta_d = \infty$ are used, as well as a value from the econometric literature ($\beta_d = 1.25$, see Andrés *et al.*, 1990).

2.6.- Equilibrium

The notion of equilibrium that is used in the model is that of the Walrasian competitive equilibrium, extended to include not only producers and households, but also the government and foreign sectors (see, for instance, Shoven and Whalley, 1992). Specifically, economic equilibrium is determined by a prices vector, an activity-levels vector, and a set of macro variables such that supply equals demand in all markets, with the sole exception being the labour market, as previously mentioned. Further, each one of the economic agents included in the model attains its corresponding optimal choices under the respective budget constraint, *i.e.*, the agents implement their optimal equilibrium solutions.

3.- Database and calibration.

The values of model parameters are obtained by the usual procedure known as calibration. First, it is necessary to obtain a Social Accounting Matrix (SAM) for the Spanish economy to calibrate the parameters. The latest SAM available is for 2000.

4.- Simulations and results

The values of the model parameters are obtained by the usual procedure known as calibration. However, first it is necessary to obtain a social accounting matrix (SAM) for the Spanish economy in order to calibrate the parameters. The last available SAM for this region is for the year 1990, so this was updated to 2000. For this, we applied the cross-entropy method (Robinson *et al*., 2001).

The resulting SAM includes 37 accounts. As this matrix has been built to calibrate our CGE model, there is a perfect concordance between the SAM and the model. Thus, the SAM-Spain-2000 incorporates the 16 productive sectors and the nine commodities. This matrix also contains two accounts for labour and capital factors, an account for households, an aggregate capital account or saving/investment account, an account for the government, six accounts for the taxes considered in the model and, finally, an account for the foreign sector.

The calibration process assumes that the SAM (the base period) represents an initial equilibrium of the economy. That is to say, it determines the parameter values that verify this property. Furthermore, in the benchmark equilibrium, measurement units are normalised so that all the price and activity levels are unitary. For the proposed model, all the parameters can be obtained by calibration, except the unemployment rate for the benchmark equilibrium[26].

Once the parameters and initial values of the variables are calculated, we can consider the simulations. The first objective of this paper is to quantify the effects of the introduction of the tax credit on Spanish economy.

4.1.- Introduction of the fiscal credit

The results analyzed in Tables 1 to 4 show the variations in prices, activity levels, macroeconomic indicators, household welfare measures and tax revenues.

[26] The tax rates introduced in the model are also obtained by calibration. Therefore, they are effective rates instead of nominal rates.

Table 1. Introduction of a tax credit for income tax in the consumption of biofuels.

Percentage change in domestic prices

		Simulation 1	Simulation 2	Simulation 3
1	AGRICULTURA, GANADERÍA Y SILVICULTURA	0,0367	0,043	0,0489
2	PESCA	0,0246	0,029	0,0327
3	CARBON	0,0189	0,022	0,0251
4	PETRÓLEO Y GAS NATURAL	0,0231	0,027	0,0308
5	EXTRACTIVAS NO ENERGÉTICAS	0,0254	0,03	0,0338
6	REFINO	0,0264	0,031	0,0351
7	ENERGÍA ELÉCTRICA	0,033	0,039	0,044
8	GAS	0,0296	0,035	0,0395
9	AGUA	0,0229	0,027	0,0305
10	ALIMENTACIÓN, BEBIDAS Y TABACO	0,0266	0,031	0,0354
11	TEXTIL Y PIEL	0,0226	0,027	0,0301
12	ELABORADOS DE MADERA	0,0248	0,029	0,0331
13	INDUSTRIA QUÍMICA	0,0242	0,029	0,0322
14	MATERIALES DE CONSTRUCCIÓN	0,0239	0,028	0,0318
15	MINERÍA Y SIDERURGIA	0,0258	0,031	0,0344
16	ELABORADOS METÁLICOS	0,0219	0,026	0,0291
17	MAQUINARIA	0,022	0,026	0,0292
18	VEHÍCULOS	0,0229	0,027	0,0305
19	ELEMENTOS DE TRANSPORTE	0,0192	0,023	0,0256
20	OTRAS MANUFACTURAS	0,0224	0,026	0,0298
21	CONSTRUCCIÓN	0,0202	0,024	0,0269
22	COMERCIO DE VEHÍCULOS Y CARBURANTES	0,0209	0,025	0,028
23	RESTO COMERCIO	0,0242	0,029	0,0323
24	TRANSPORTE Y COMUNICACIONES	0,0274	0,032	0,0365
25	OTROS SERVICIOS	0,0206	0,024	0,0274
26	SERVICIOS	0,0221	0,026	0,0295

Source: Own elabotarion

Table 2. Introduction of a tax credit for income tax in the consumption of biofuels.

Percentages changes in activities levels

		Benchmark equilibrium	Simulation 1	Simulation 2	Simulation 3	%	%	%
1	AGRICULTURA, GANADERÍA Y SILVICULTURA	48468,31	48587,23	48609,126	48626,641	0,245	0,291	0,327
2	PESCA	4972,70	4992,164	4995,747	4998,614	0,391	0,463	0,521
3	CARBON	2507,40	2509,702	2510,126	2510,465	0,092	0,109	0,122
4	PETRÓLEO Y GAS NATURAL	15657,90	15684,551	15689,458	15693,383	0,170	0,202	0,227
5	EXTRACTIVAS NO ENERGÉTICAS	6795,80	6765,695	6760,151	6755,717	-0,443	-0,525	-0,590
6	REFINO	42449,90	42532,076	42547,207	42559,311	0,194	0,229	0,258
7	ENERGÍA ELÉCTRICA	21381,50	21409,843	21415,061	21419,235	0,133	0,157	0,176
8	GAS	4043,00	4049,021	4050,13	4051,016	0,149	0,176	0,198
9	AGUA	3433,10	3442,773	3444,554	3445,978	0,282	0,334	0,375
10	ALIMENTACIÓN, BEBIDAS Y TABACO	103444,82	103802,403	103868,243	103920,914	0,346	0,409	0,460
11	TEXTIL Y PIEL	48690,91	48845,425	48873,876	48896,637	0,317	0,376	0,423
12	ELABORADOS DE MADERA	28218,10	28205,262	28202,898	28201,007	-0,045	-0,054	-0,061
13	INDUSTRIA QUÍMICA	61504,20	61536,181	61542,069	61546,779	0,052	0,062	0,069
14	MATERIALES DE CONSTRUCCIÓN	26704,40	26539,856	26509,557	26485,318	-0,616	-0,730	-0,820
15	MINERÍA Y SIDERURGIA	31362,30	31278,2	31262,713	31250,324	-0,268	-0,318	-0,357
16	ELABORADOS METÁLICOS	33422,30	33280,438	33254,316	33233,418	-0,424	-0,503	-0,565
17	MAQUINARIA	100308,40	99884,168	99806,051	99743,557	-0,423	-0,501	-0,563
18	VEHÍCULOS	86952,91	86880,065	86866,651	86855,92	-0,084	-0,099	-0,112
19	ELEMENTOS DE TRANSPORTE	11846,90	11807,072	11799,738	11793,871	-0,336	-0,398	-0,448
20	OTRAS MANUFACTURAS	61557,50	61567,08	61568,844	61570,256	0,016	0,018	0,021
21	CONSTRUCCIÓN	134244,28	132921,962	132678,473	132483,681	-0,985	-1,166	-1,311
22	COMERCIO DE VEHÍCULOS Y CARBURANTES	23268,74	23324,869	23335,204	23343,472	0,241	0,286	0,321
23	RESTO COMERCIO	184232,36	184595,453	184662,307	184715,789	0,197	0,233	0,262
24	TRANSPORTE Y COMUNICACIONES	91686,96	91777,385	91794,033	91807,351	0,099	0,117	0,131
25	OTROS SERVICIOS	161331,00	161284,893	161276,402	161269,608	-0,029	-0,034	-0,038
26	SERVICIOS	233174,39	233477,025	233532,772	233577,374	0,130	0,154	0,173

Source: Own elabotarion

Table 3. Introduction of a tax credit for income tax in the consumption of biofuels. Macroeconomic indicators and household welfare
Measures

	Benchmark equilibrium	New equilibrium			Variation		
		Simulation 1	Simulation 2	Simulation 3	%	%	%
Unemployment rate (%)	13,9	13,9164	13,919	13,9218	0,1180	0,1367	0,1568
Real GDP (millions euros)	630263,047	630248,632	630245,995	630243,887	-0,0023	-0,0027	-0,0030
Real disposable income (millions of euros	533123,028	535814,281	536309,964	536706,539	0,5048	0,5978	0,6722
Equivalent variation (millions of euros)	---	2588,13	3064,716	3445,988	---	---	---

Source: Own elabotarion

Table 4. Tax revenues

	Benchmark equilibrium	New equilibrium			Variation		
		Simulation 1	Simulation 2	Simulation 3	%	%	%
Taxes on production (Rt)	23146,021	23118,934	23113,945	23109,953	-0,117	-0,139	-0,156
Employers social contributions (Resc)	64967,001	64946,24	64942,417	64939,358	-0,032	-0,038	-0,043
Import taxes (Rtarif)	1073	1071,759	1071,531	1071,348	-0,116	-0,137	-0,154
Value added tax (VAT)	38379,996	38419,285	38426,521	38432,311	0,102	0,121	0,136
Employees social contributions (Ress)	16179,001	16175,921	16175,35	16174,9	0,000	0,000	-0,025
Income tax (Rt)	64002,003	61434,967	60962,168	60583,902	-4,011	-4,750	-5,341
Total tax revenues	207747,002	205167,106	204691,935	204311,772	-1,242	-1,471	-1,654

Source: Own elabotarion

5.- Conclusions.

According to results cointained in table 1-4, we conclude:

1 .- The greater the reduction of the effective rate, the growth of domestic prices is higher. In relative terms, the sectors with slower growth of domestic prices are coal, elements of transport, construction, trade in vehicles and fuels and other services.

2 .- The greater the reduction of the effective rate, the levels of activity (in absolute value) are higher. This is significant, the activity is higher when the values are positive activity and is worse when the values are negative.

3 .- The greater the reduction of the effective rate, higher unemployment, further reducing real GDP growth and higher disposable income.

4 .- The greater the reduction of the effective rate, is the worst collection of all taxes.

References.

Andre FJ, Cardenete MA and Velazquez E (2005). Performing an environmental tax reform in a regional economy. *Annals of Regional Science* 39:375–392

Boletín Estadístico de Hidrocarburos (2008). Annual report. 2007. Ministerio de Industria, Turismo y Comercio. www.mityc.es

Bye, B. (2000). Environmental tax reform and producer foresight: an intertemporal computable general equilibrium analysis. *Journal of Policy Model* 22(6):719–752

Cansino, J.M., Cardenete, M. A. y Roman, R. (2007). Regional evaluation of a tax on retailer sales of some fuels through social accounting matrix. *Applied Economics Letters.* 14, 877-880.

Conrad, K, Löschel, A. (2005). Recycling of eco-taxes, labor market effects and the true cost of labor. A CGE analysis. *Journal of Applied Economy* 8(2):259–278

Dannenberg, A. Mennel, T. Moslener, U. (2007). What does Europe pay for clean energy? *Review of Macroeconomics Simulation Studies*. ZEW Discusión Paper no. 07-019.

De Miguel-Velez, F.J., Cardenete M.A.,and Perez-Mayo, J. (2008). Effects of the tax on retail sales of some fuels on a regional economy: a computable general equilibrium approach *Annals of Regional Science* DOI 10.1007/s00168-008-0228-9

Demirbas, A. (2007). Importance of biodiesel as transportation fuel. *Energy Policy* 35 4661–4670.

Dessus, S, Bussolo, M. (1998). Is there a trade-off between trade liberalization and pollution abatement? *Journal of Policy Model* 20(1):11–31

Edwards, R. et al. (2008). Bioufuels in the European context: Facts and uncertainties. European Comisión. Joint Research Center JRC44464.

EIA, 2005. Annual Energy Outlook 2005. US Department of Energy, Washington, DC DOE/EIA-0383 (2005).

Encuesta Continua de Presupuestos Familiares. Base 1997. (www.ine.es)

European Comission. Libro verde de la Comisión, de 20 de noviembre de 1996, sobre las fuentes de energía renovables. COM (96) 576 final.

European Comission. Libro Blanco para una estrategia y un plan de acción comunitarios sobre fuentes de energía renovables. Noviembre de 1997. Doc 210 de 6-7-1998, p.215.

European Comission. (2001). *Energía para el futuro: Fuentes de Energías Renovables. Libro Blanco para una Estrategia y un Plan de Acción Comunitarios*

European Comission. (2006), Comunicación de la Comisión. *Estrategia de la UE para los biocarburantes*, COM (2006: 34).

European Comission. (2001). *Energía para el futuro: Fuentes de Energías Renovables. Libro Blanco para una Estrategia y un Plan de Acción Comunitarios*

European Comission. (2006), Comunicación de la Comisión. *Estrategia de la UE para los biocarburantes*, COM (2006: 34).

European Comission. (2008), COM(2008)0019 – C6-0046/2008 – 2008/0016(COD)

European Comission. Directiva 2003/30/CE del Parlamento Europeo y del Consejo, de 8 de mayo de 2003, relativa al fomento del uso de biocarburantes u otros combustibles renovables en el transporte.

European Comission. Directiva 2003/96/CE del Consejo, de 27 de octubre de 2003, por la que se reestructura el marco comunitario de imposición de los productos energéticos y de la electricidad.

European Comisión (2008). Proposal for a Directive of the European Parliament ando f the Council on the promotion of the use of energy from renewable resources. COM (2008).

Manresa, A and Sancho, F (2005). Implementing a Double Dividend: Recycling Ecotaxes Towards Lower Labour Taxes,*Energy Policy*, 33, 1577-1585.

Pfaffenberger, W. (2006). Wertschöppfung und Beschäftingung durch grüne Energieproduktion? *Energiewirtschaftliche Tagessfragen* 56, 22-26.

Peters, J. and Thielmann, S. (2008). Promoting biofuels: Implications for developing countries. *Energy Policy* 36 1538–1544.

Rico, J. (2006). Biocarburantes en el transporte, Madrid. Instituto para la Diversificación y Ahorro de la Energía.

Romm, J. (2006). The car and fuel of the future. *Energy Policy* 34 2609–2614.

Ryan, L. Convery, F., and Ferreira, S. (2006). Simulating the use of biofuels in the European Union: implications for climatic change policiy. *Energy Policy* 34, 3184-3194.

Shoven, J. and Whalley, J (1992). Applying general equilibrium. Cambridge University Press, New York.

Sierra, V. (2005). Cambio climático, efecto invernadero, Protocolo de Kioto y algunas reflexiones. *Cuadernos de Información Económica*, nº 185.

Van Heerden, JH, Gerlagh R, Blignaut JN, Horridge M, Hess S, Mabugu R, MabuguM (2006). Searching for triple dividends in South Africa: fighting CO2 pollution and poverty while promoting growth. *Energy J* 27(2):113–142.

Villadrich, M. (2004). Las principales aportaciones a la teoría de la regulación medioambiental. Los últimos cuarenta años. *Economía Agraria y Recursos Naturales*, Vol. 4 (8).

Wender R (2001). An applied general equilibrium model of environmental tax reforms and pension policy. *Journal of Policy Model* 23:25–50.

Xie J, Saltzman S (2000). Environmental policy analysis: an environmental computable general equilibrium approach for developing countries. *Journal of Policy Model* 22(4):453–489