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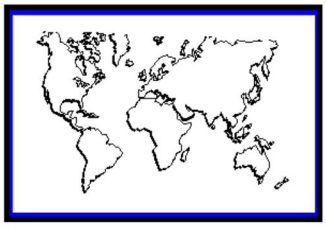

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Alternative strategies to reduce public deficits: Taxes vs. spending*

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Abstract

In this paper, we examine the effects of several alternative measures intended to reduce government deficits, distinguishing between those acting through either taxes or spending, for the case of Spain. The empirical methodology is based on a computable general equilibrium model. All the simulated policies lead to a decrease in the levels of output and employment, and to a higher unemployment rate. Spending cuts show greater contractionary effects than tax increases, and are associated with a worsening in the distribution of income for labour. These effects are stronger in the case of spending cuts in Public education.

Keywords: Computable general equilibrium, Government deficit, Taxes, Spending.

JEL classification: C68, H62, H20, H50.

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1. Introduction

Since the beginning of the current economic crisis, major fiscal imbalances are a matter of concern in many developed countries (Auerbach, 2011). This is particularly true for most European countries, especially those belonging to the euro area. Accordingly, fiscal consolidation strategies are being pursued in those countries in order to reduce such "excessive" government deficits, and so recovering the confidence of financial markets and avoiding the risk of sovereign default.

The effectiveness of fiscal policy on the levels of economic activity is a recurrent topic in the academic literature; a broad survey is provided in Hemming *et al.* (2002). However, the traditional "Keynesian" effects of fiscal policy (i.e., a fiscal expansion leading to an increase in output and a fiscal contraction leading to a decrease in output) have been challenged in recent years following the pioneering work of Giavazzi and Pagano (1990). According to the so called "non Keynesian" effects of fiscal policy, a contractionary fiscal policy can provoke an expansionary effect on output, due to the increased confidence of the private agents on government's solvency, which would lead to lower expected taxes in the next future.

However, the generality of these "non Keynesian" effects of fiscal policy has been put into question. On the one hand, successful expansionary fiscal contractions have been coupled with other simultaneous events (such as a decrease in interest rates, a depreciation of the exchange rate, episodes of wage moderation, or a decrease in taxes on labour), which should preclude explaining the favourable economic evolution exclusively in terms of the restrictive fiscal policy; see, e.g., Creel *et al.* (2005) or Perotti (2013). On the other hand, recent studies using a novel methodology (namely, identifying changes in fiscal policy motivated by the desire to reduce the budget deficit from historical documents) find that fiscal consolidations have a contractionary effect on economic activity, as expected from standard Keynesian models; see Romer and Romer (2010) and Guajardo *et al.* (2011). Even more, as shown by Auerbach and Gorodnichenko (2013), fiscal policy multipliers seem to be larger in recessions. This would follow in turn from several features that characterize depressed economies, such as the absence of supply constraints in the short run, and a binding zero lower bound on interest rates (DeLong and Summers, 2012).

Another issue that has received some attention in the literature relates to the composition of the fiscal adjustment measures. Following earlier work by Alesina and collaborators [e.g., Alesina and Perotti (1995, 1997) or Alesina and Ardagna (1998)], Alesina and Ardagna (2010) find that, in the case of a fiscal consolidation, spending cuts are more effective than tax increases in order to stabilize the debt and avoiding a recession; whereas, for the case of a fiscal stimulus, the opposite result would hold, i.e., tax cuts are more expansionary than spending increases. The less contractionary effect of spending cuts, compared to tax increases, in the case of fiscal consolidations, was also found in Guajardo *et al.* (2011). Following this line of research, Alesina *et al.* (2012) have recently found that, for 15 OECD countries, spending-based fiscal consolidations had been associated with minor and short-lived recessions; unlike tax-based consolidations, which led to deeper and longer recessions. According to the authors, the ultimate reason would lie in the confidence of

investors, which recovers much sooner following a spending-based adjustment than a tax-based one.

In this paper, we will examine the effects of several alternative measures intended to reduce public deficits, distinguishing between those acting through either taxes or spending, for the case of Spain. In Table 1 we present data on general government expenditure, revenue, surplus (i.e., net lending/borrowing of consolidated general government sector) and consolidated gross debt, as a percentage of GDP, for Spain and the euro area, from 1999 (i.e., the year in which the European monetary union started) to 2011. As can be seen, the Spanish government deficit was lower than the average of the euro area until 2007; an even a surplus was registered between 2005 and 2007. The start of the crisis meant a dramatic change, with government deficits reappearing in 2008, soaring in 2009 to 11% of GDP, and slowly decreasing after that date; as a result, the Spanish government deficit as a percentage of GDP in 2011 stands for more than twice the deficit of the euro area. On the other hand, even though government expenditure as a percentage of GDP has increased in Spain after the start of the crisis at a more similar pace than in the euro area (6 versus 3.4 percentage points between 2007 and 2011), the ratio of government revenue to GDP has experienced a large fall (5.4 percentage points between 2007 and 2011) that is strongly at odds with its stability for the euro area along the same period. Finally, these developments have led to a large increase in the ratio of government debt to GDP, which is however still lower than the average of the euro area.

[Table 1 here]

These figures suggest that the huge increase registered in the Spanish government deficit compared to the euro area, should be attributed more to the fall in revenues rather than to the rise in spending. In fact, as Reinhart and Rogoff (2009) have emphasized, the decrease in public revenues due to the subsequent recession is the main reason behind the higher government deficits associated with financial crises. In relation to this, a recent paper by Baldacci *et al.* (2012) stresses the need of relying on an increase in public revenues, and not only on spending cuts, in a process of fiscal consolidation when deficits are large, and even more if they follow a financial crisis.

In the rest of the paper, we will provide an empirical assessment of several alternative policy measures intended to reduce the Spanish government deficits, from both the expenditure and revenue sides. The empirical methodology will make use of a computable general equilibrium (CGE) model, which allows obtaining the consequences of changes in a particular variable on the whole economy under analysis, as well as the specific effects across the different productive sectors. Thus, the potential of CGE models lies in their ability to integrate micro and macro elements (Devarajan and Robinson, 2005).

The rest of the paper is organized as follows. A brief description of the model is provided in Section 2. The data and calibration process are discussed in Section 3. The results from the simulations, both at the macroeconomic and sectoral levels, are presented in Section 4. Section 5 concludes.

2. The model

The model in this paper follows earlier contributions on this methodology (Bajo-Rubio and Gómez-Plana, 2004, 2005; Faehn *et al.*, 2009; Gómez-Plana and Pascual-Arzoz, 2011), and represents a static CGE model describing an open economy, disaggregated in 18 productive sectors, one representative consumer, the public sector and a foreign sector representing the rest of the world. The main extensions with respect to standard CGE models (see, e.g., Shoven and Whalley, 1992, or Burfisher, 2011) refer to: (i) the modelling of capital as a factor of production, and the specificity assumption; (ii) the modelling of the public sector, whose main characteristic features change according to the simulations performed; and (iii) unlike the common assumption of full employment in the labour market, the model includes unemployment in a way derived from trade unions models, due to the high unemployment rate registered in the Spanish economy. In addition, the choice of the productive sectors represented in the model has been the result of a careful selection; see below.

In the rest of this section we provide a short description of the model. The full set of equations, together with the complete list of the endogenous and exogenous variables and parameters of the model, are shown in the Appendix.

Equilibrium conditions

The equilibrium of the model is a set of prices and an allocation of goods and factors. It involves the simultaneous solution of three sets of equations:

- Zero-profit conditions.
- Market clearing in goods and factor (capital) markets.
- Constraints on disposable income (total revenue must equal total expenditure), labour market (that includes unemployment), public sector constraints, and macroeconomic closure of the model.

Firms and production

Production is based on a technology characterized by a nested structure of intermediate inputs, capital and labour. The firms' decision problem is to maximise profits subject to the technology constraints, obtaining the unit cost functions, which are further used in the zero-profit conditions. In turn, the demands for factors and intermediate inputs are obtained from Shephard's lemma on cost functions, and then used in the market-clearing equations.

Firms show constant returns to scale in their technologies and fix a competitive pricing rule, with free entry and exit of firms. Figure 1 shows the nested structure of firms' technology in sector *i*. This is a two-level technology. The first nest is a Leontief function over intermediate inputs and a composite of labour and capital, where a value added tax (vat_i^{II}) and other indirect taxes (oit_i^{II}) can be levied on intermediate inputs. The second nest is a CES function over labour and capital, where social contributions (soc_i) are levied on labour.

[Figure 1 here]

Representative household and consumption

There is a representative consumer household that behaves as a rational consumer. The level

of consumer's welfare is determined by the endowments of capital and labour jointly with exogenous net transfers paid by the public sector.

The fixed endowment of labour should be interpreted as a maximum supply of labour since leisure and unemployment are assumed to be endogenous. Hence, labour supply would be elastic up to the endowment constraint. The fixed endowment of capital is supplied to all sectors except to sectors 1, 2, 3, 8 and 10 (see Table 2 below), which only utilize public capital.

The household's decision problem consists of choosing an optimal consumption bundle, by maximizing a nested utility function subject to the budget constraint. As shown in Figure 2, preferences are represented by a nested utility function on (consumption of) goods, leisure and savings. Notice that, given our static approach, we consider a unit elasticity of substitution between savings and (consumption of) goods (Howe, 1975), so that savings can be interpreted as the purchase of bonds for future consumption. The representative consumer buys all the final consumption goods, but the good from sector 1. Goods can be subject to a value added tax (vat_i^{CF}) and other indirect taxes (oit_i^{CF}).

[Figure 2 here]

The budget constraint includes total factor rents jointly with exogenous net transfers paid by the public sector. Demand functions for goods, leisure and savings are derived from the first-order conditions, and are included in the goods and factor markets equations, as well as in the macroeconomic closure for savings.

Public sector

The role of the public sector in the model is twofold, i.e., it is an owner of resources (e.g., from its capital endowment and tax revenues), and a purchaser of certain goods. We deal with these two functions in turn.

As an owner of resources, public sector's wealth includes income from capital rents, tax revenues, and net transfers from the representative household. Capital rents of the public sector include, by definition (see Eurostat, 1996), the fixed capital consumption because the net operating surplus is zero for the public sector. The fixed capital consumption has been assigned to sectors 1, 2, 3, 8, 10, and 18, where all capital in the first five is owned by the public sector, whereas in the latter some capital is publicly owned and the rest is private, according to empirical data (see below). Taxes consist of social contributions paid by both employers and employees, value added tax, other net indirect taxes, and income taxes. The latter are exogenous, and the rest have been modelled using actual *ad valorem* rates calibrated from benchmark data, with an endogenous revenue level.

On the other hand, the public sector also enters the model as a purchaser of goods. Public sector expenditure includes both market (i.e., output that is disposed of in the market at economically significant prices) and non-market goods (i.e., output that is provided at prices that are not economically significant).

The representation of the public sector changes according to the scenario modelled (see section 4 for a full description of the scenarios). So, when simulating a cut in public expenditure in one sector, spending for that particular sector is represented as exogenous, while the remaining public expenditure is assumed endogenous. In turn, when simulating tax increases, tax rates are represented as endogenous.

Foreign sector

The model incorporates the small open economy assumption, meaning that the country faces a perfectly elastic export supply function. There is also a constant elasticity of transformation function between domestic and foreign sales. Regarding imports, we assume that goods are differentiated according to their origin (i.e., domestic or foreign), following Armington's assumption (Armington, 1969), which allows for the possibility of intra-industry trade despite the assumption of exogenous world prices.

The foreign sector is closed by assuming that the difference between receipts and payments from the rest of the world is exogenous. This constraint would avoid, e.g., a permanent increase in exports with no change in imports, an unlikely scenario since it would involve an unlimited capital inflow to the country. However, this requires a matching movement in trade flows.

Factor markets

Two factors enter into the model: capital and labour. Regarding capital, both the representative household and the public sector own fixed endowments. Capital rents adjust to clear the domestic capital market, under the assumptions of capital international immobility, and no mobility across domestic sectors. Capital is specific in two levels, i.e., each sector employs only specific capital, and capital is differentiated in relation to the owner (public or private).

The only owner of labour is the representative household. The demand for leisure is derived from the household's optimization problem. Hence, labour supply (i.e., the labour endowment less the demand for leisure) would be elastic up to the fixed amount of labour. Labour is assumed to be internationally immobile, but mobile across domestic sectors.

In addition, we assume that the labour owners (i.e., workers) have some market power so that their bargained real wage is related to the unemployment level (Kehoe *et al.*, 1995). Accordingly, the model includes the following constraint:

$$w = \left(\frac{1-u}{1-\overline{u0}}\right)^{\frac{1}{\beta}}$$

where w denotes the real wage, u is the unemployment rate, $\overline{u0}$ is the unemployment rate in the benchmark, and β is a nonnegative parameter that proxies the degree of flexibility of the real wage with respect to the unemployment rate. Hence, when β approaches infinity, the real wage approaches its benchmark value (which is 1 according to the calibration process explained below): this is the case of rigid real wages when wages do not change when unemployment does. If β approaches zero, the unemployment rate approaches the benchmark unemployment rate, with real wages being flexible. Other intermediate values for

β would mean different flexibility levels of real wages to the unemployment rate.

Macroeconomic closure

Total investment is split into sectoral gross capital formation using a fixed-coefficients Leontief structure (Dervis *et al.*, 1981). Notice that, in our static framework, total gross capital formation affects the economy as a component of final demand. The model embodies a macroeconomic closure equation stating that investment and savings (private, public, and foreign) are equal.

Finally, the model is solved as explained in Rutherford (1999), with the general equilibrium model defined as a mixed complementarity problem (see Mathiesen, 1985). The software used in the empirical application is GAMS/MPSGE.

3. Calibration and data

The model has been calibrated using Spanish data. The calibration method is based on a benchmark equilibrium corresponding to the National Accounts and a set of exogenous parameters. A detailed explanation of the calibration method can be found in Mansur and Whalley (1984) and Dawkins *et al.* (2001).

To build the Social Accounting Matrix (SAM), we depart from the last Input-Output symmetric table available for the Spanish economy, for the year 2005. In order to do so we further use the institutional sectors accounts from the Spanish National Statistics Institute (Instituto Nacional de Estadística, 2012). Public revenue data have been disaggregated into Value Added Tax (VAT), Other indirect taxes, and Social security contributions. The 18-sector disaggregation in the SAM, from the 72 sectors of the Input-Output table, includes (see Table 2):

- Group 1: sectors 1 to 3, directly representing the most part of public expenditure.
- Group 2: sectors 4 to 10, where final public expenditure is over 1600 million €.
- Group 3: sectors 11 to 16, whose outputs are intermediate inputs for the Group 1 sectors (so that each sector sells by more of 1000 million € to the Group 1 sectors).
- Group 4: sector 17, where public final expenditure represents a limited amount.
- Group 5: sector 18, with no public final expenditure at all.

[Table 2 here]

On the other hand, the choice of elasticities plays a key role in the model. The benchmark values for those elasticities are:

- Elasticities of substitution in the welfare function:
  - between consumption and savings: 1.
  - between final consumption and leisure: 1.
  - across final consumption goods: 1.
- Elasticities related to production:
  - between intermediate inputs and value added composite: 0.
  - between labour and capital: values fluctuate between 1.26 and 1.68.

- between domestic and foreign goods (Armington elasticities): values fluctuate between 0.70 and 2.90.
- between goods sold in the domestic market and abroad (elasticities of transformation): values fluctuate between 1.90 and 4.30.

The literature sources for the elasticities are Narayanan and Walmsley (2008) for the elasticity of substitution between labour and capital and Armington elasticities; de Melo and Tarr (1992) for the elasticities of transformation; and the elasticity of substitution between consumption and leisure is consistent with the survey by Ballard and Kang (2003). The rest of values are common in the literature.

4. Empirical results

The aim of the different fiscal policy reforms simulated in this paper is to get a reduction in the government deficit as a ratio to GDP, which stands as the reference variable for fiscal policymakers. This decrease in public deficit can be achieved through either a cut in public expenditures or an increase in tax revenues; and both strategies, in turn, can be accomplished by acting on alternative expenditure items or taxes.

Definition of scenarios

Simulations have been performed under five scenarios, where the first three involve a spending cut with no change in taxes, and the last two mean a tax increase with no change in spending. Specifically, these scenarios are:

(i) A spending cut in Public administration (i.e., sector 1 in Table 2).
(ii) A spending cut in Public education (i.e., sector 2 in Table 2).
(iii) A spending cut in Public health (i.e., sector 3 in Table 2).

Recall that these three sectors represent the most part of public expenditure (79% of total in the benchmark, namely, 38% Public administration, 18% Public education, and 23% Public health), and concentrate the highest share of the spending cuts implemented by the Spanish government; notice that the first scenario would proxy a cut in wages for the public sector workers. The remaining scenarios are:

(iv) A rise in tax collections via an increase in VAT rates.
(v) A rise in tax collections via an increase in the rates of Other indirect taxes.

For each scenario, we have simulated a decrease in the ratio government deficit/GDP of one percentage point. Alternatively, we have also simulated the case in which the ratio government deficit/GDP was reduced by three percentage points, instead of one, but the results were fairly analogous; the only difference was merely quantitative, with the figures in Table 3 (see below) resulting around three times greater (results available from the authors upon request). The government surplus (if positive) or deficit (if negative) is measured by the net lending/net borrowing of the general government, computed by subtracting public investment from the value of public savings given from equations (A20) and (A24) of the Appendix. The five scenarios have been implemented in the model as follows. For the first three scenarios, final public consumption in the sector concerned (i.e., sector 1, 2 or 3 in Table 2) was reduced in equations (A19) and (A24) of the Appendix, in order to get the desired target (i.e., a 1% decrease in the ratio of government deficit to GDP). In turn, for the last two

scenarios, the rates of VAT or Other indirect taxes, in each case, were increased in the equations of the Appendix where they appear (namely, equations (A1), (A16), (A23), (A24) and (A26); and (A1), (A16), (A22), (A24) and (A26), respectively), again to get the desired target.

Simulation results

The results from the above simulations on the main macroeconomic variables appear in Table 3 as percentage changes from benchmark, except for the unemployment rate, in which case changes are expressed as percentage points.

[Table 3 here]

As shown in Table 3, GDP falls in all scenarios. The figures are not too high, and the negative effects on GDP are larger for spending cuts than for tax increases; the decrease in GDP lies between 0.45% for spending cuts in Public education, and 0.26% for an increase in the rates of Other indirect taxes. Employment also falls, and the rate of unemployment rises, in all scenarios. Again, the worse results correspond to spending cuts, especially to the case of Public education; on the contrary, the decrease in employment and the increase in the rate of unemployment seem to be smaller for tax increases, especially when VAT rates are increased. On the other hand, real wages fall in all scenarios, and more strongly in the cases of tax increases.

The next line in Table 3 shows the change in GDP at factor cost, i.e., the sum of the payments to the productive factors (namely, compensation of employees for labour, and gross operating surplus for capital). As can be seen, the contractionary effect when GDP is measured at factor cost is slightly higher in the scenarios of spending cuts, and around five times higher in the scenarios of tax increases; in fact, the decrease in GDP is higher for the latter scenarios, unlike the case in which GDP is measured at market prices. Regarding distributive issues, the compensation of employees clearly falls in all scenarios following the decrease in both real wages and employment, especially for tax increases, and, to a lower extent, spending cuts in Public education. In turn, the gross operating surplus slightly increases in the scenarios of spending cuts, and falls much strongly in the scenarios of tax increases. As a result, income distribution clearly worsens for labour in the scenarios of spending cuts (especially in the case of spending cuts in Public education), and improves, but very slightly, in the scenarios of tax increases.

Finally, total government expenditure should fall by around 6% in order to reduce the ratio government deficit/GDP in one percentage point, which is accompanied by a small decrease in government revenue. On the other hand, total government revenue should rise by around almost 4% in order to reduce the ratio government deficit/GDP in one percentage point, coupled with an additional decrease in government expenditure.

Next, we present in Tables 4 and 5 the results across sectors for the two most relevant variables, namely, output and employment. In order to interpret these sectoral results one should take into account the constraints that the model imposes on productive factors, i.e., labour is modelled under an unemployment rule and leisure can take place, but capital is

assumed fully employed and specific at the sectoral level. Notice also that in a general equilibrium framework the results can be driven by several forces which, in some cases, move in opposite directions.

[Table 4 here]

[Table 5 here]

According to the results in the tables, in the scenarios based on cuts in government spending both output and employment fall sharply in the concerned sector, the strongest effect being again in the case of spending cuts in Public education (26% in output and 28% in employment), followed by Public health (21% in output and 22% in employment), and Public administration (14% in output and 16% in employment). For the remaining sectors, the fall in output and employment is especially intense for sectors included in groups 1 and 2 (see Table 2), i.e., those sectors where final public expenditure plays a greater role; with some exceptions, such as Medical and precision instruments, where the reductions in output and employment are noticeable in the case of spending cuts in Public health. On the other hand, recall that in the scenarios based on tax increases the reductions in output and employment were smaller, especially when VAT rates were increased. Specifically, in the latter case output and employment rise in those sectors that provide intermediate inputs to other sectors, so VAT revenues are low (Medical and precision instruments, Other transport equipment, Wholesale trade, Other business activities); conversely, the sectors supporting a higher burden of VAT in absolute terms are those experiencing the highest reductions in output and employment (Post and telecommunications, Electricity, Chemicals). Finally, in the case of an increase in the rates of Other indirect taxes, the fall in aggregate demand leads to a generalized reduction of output and employment in almost all sectors.

Sensitivity analysis

To conclude, we present a sensitivity analysis of the above results.The new results are shown in Table 6, for four macroeconomic variables (namely, GDP, total public revenue and expenditure, and employment); the full sensitivity analysis for all variables is available from the authors upon request. We perform a change in the different elasticities appearing in the model, which are alternatively doubled and halved. All the results are robust in sign, except in one case, i.e., employment in the increase in VAT scenario for the elasticity of substitution between consumption and leisure. The change in employment takes here a very low value in the benchmark (–0.08%, close to zero), so it is not too surprising that when this elasticity is halved it reaches a small positive value (0.08%).

[Table 6 here]

In general, the changes in results for all variables tend to be very small when the values of the elasticities are modified. The case of the elasticity of substitution between labour and capital is that showing a higher variance in results, and the figures for public revenue and expenditure are very robust to changes in elasticities in all cases. Finally, the analysis regarding the flexibility of the real wage to the unemployment rate β, allows checking the robustness of

the effects on the labour market. Recall that a higher β involves a more rigid real wage and a higher adjustment in employment, whereas a lower β means a more elastic real wage and smaller changes in employment. This is the case for all scenarios; in particular, the changes in the effects on public revenue and expenditure are very small.

5. Concluding remarks

Since the beginning of the current crisis, most advanced economies are deeply concerned with the size of government deficits, which has led them to pursue severe fiscal consolidations in order to curb those deficits. However, such consolidation strategies have been associated with lower growth than expected, which makes even more difficult the reduction of deficits (Blanchard and Leigh, 2013). On the other hand, some authors have argued that spending cuts are more effective than tax increases to get a successful fiscal consolidation, and at the same time avoid a recession, the opposite result holding in the case of a fiscal stimulus; see, e.g., Alesina and Ardagna (2010).

In this paper, we have examined the effects of several alternative measures intended to reduce government deficits, distinguishing between those acting through either taxes or spending, for the case of Spain. The empirical methodology is based on a CGE model, which allows obtaining the consequences of changes in a particular variable on the whole economy under analysis, as well as the specific effects across the different productive sectors. In particular, we have simulated five scenarios, intended to reduce the ratio government deficit/GDP by one percentage point. These five scenarios consist of either (i) a spending cut with no change in taxes, in three sectors of the economy (namely, Public administration, education and health, where the first scenario proxies a cut in wages for the public sector workers), or (ii) a tax increase with no change in spending (namely, through an increase in the rates of VAT and Other indirect taxes).

We found that GDP and employment fell, and the unemployment rate rose, in all the simulated scenarios. When comparing the relative performance of spending cuts and tax increases, the negative effects on GDP and employment were stronger for spending cuts, especially in the case of spending cuts in Public education, and were accompanied with a worsening of income distribution for labour. In contrast, for tax increases the negative effects on GDP and employment were milder, especially for employment in the case of an increase in VAT rates, and were accompanied with a slight improvement of income distribution for labour.

As can be seen, all the simulated policies reduce the government deficit as a percentage of GDP, at the expense of a fall in the levels of activity and employment in the short run (i.e., the time period contemplated in our model). This result, as well as meaning an aggravation of the current recession, should yield afterwards a higher government deficit, since public spending should rise and tax collections fall through the operation of the automatic stabilizers. In addition, a lower GDP would raise the ratio government deficit/GDP, for a given level of the deficit.

On the other hand, if the consolidation strategy was based on spending cuts the contractionary effects would be greater, according to our results, especially in the case of

spending cuts in Public education. Even though the empirical methodologies are not directly comparable, notice that this result contrasts with that of Alesina and Ardagna (2010), unless GDP is measured at factor cost, where the opposite result holds (see Table 3). This might be related to the fact that a more accommodating monetary policy seems to follow spending-based adjustments, as pointed by Guajardo *et al.* (2011); such an effect is absent in our approach. Finally, from a longer term viewpoint, public expenditure items such as education or health care (as well as R&D or public investments) are deemed to be potentially growth-enhancing, so that consolidation strategies based on these items might harm future growth prospects (European Commission, 2012). Overall, our results show the challenges that the fiscal consolidation strategies currently pursued pose in a context of recession and very high unemployment rates.

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Table 1

Government expenditure, government revenue, government surplus and government debt in Spain and the euro area, 1999-2011 (% of GDP)

	Government expenditure		Government revenue		Government surplus		Government debt	
	Spain	euro area	Spain	euro area	Spain	euro area	Spain	euro area
1999	39.9	48.1	38.7	46.7	−1.2	−1.5	62.4	71.7
2000	39.2	46.2	38.2	46.2	−0.9	−0.1	59.4	69.2
2001	38.7	47.3	38.1	45.3	−0.5	−1.9	55.6	68.2
2002	38.9	47.6	38.7	44.9	−0.2	−2.6	52.6	68.1
2003	38.4	48.0	38.0	44.9	−0.3	−3.1	48.8	69.2
2004	38.9	47.5	38.8	44.6	−0.1	−2.9	46.3	69.7
2005	38.4	47.4	39.7	44.9	1.3	−2.5	43.2	70.3
2006	38.4	46.8	40.7	45.4	2.4	−1.4	39.7	68.7
2007	39.2	46.1	41.1	45.4	1.9	−0.7	36.3	66.5
2008	41.5	47.2	37.0	45.1	−4.5	−2.1	40.2	70.3
2009	46.3	51.2	35.1	44.9	−11.2	−6.4	53.9	80.1
2010	46.3	51.0	36.6	44.8	−9.7	−6.2	61.5	85.5
2011	45.2	49.5	35.7	45.4	−9.4	−4.2	69.3	87.5

Source: Eurostat.

Table 2
Definition of sectors

Group	Sector	Input-Output Framework	Description	Acronym
1	1	67	Public administration	Public administration
1	2	68	Non-market education	Public education
1	3	69	Non-market health and social work	Public health
2	4	23	Manufacture of chemicals and chemical products	Chemicals
2	5	43	Retail trade; repair of personal and household goods	Retail trade
2	6	59	Research and development	Research and development
2	7	61	Market education	Private education
2	8	62	Market health and social work	Private health
2	9	70	Non-market sewage and refuse disposal, sanitation and similar activities	Sewage
2	10	72	Non-market recreational, cultural and sporting activities	Culture
3	11	9	Production and distribution of electricity	Electricity
3	12	35	Manufacture of medical, precision and optical instruments	Medical and precision instruments
3	13	37	Manufacture of other transport equipment	Other transport equipment
3	14	42	Wholesale trade and commission trade	Wholesale trade
3	15	52	Post and telecommunications	Post and telecommunications
3	16	60	Other business activities	Other business activities
4	17	21, 46, 47, 48, 49, 50, 51, 56, 65, 66	Paper; Transport; Travel agencies; Real estate; Market recreational, cultural and sporting activities; Other services	Other sectors with public final expenditure
5	18	Rest	Other activities	Sectors without public final expenditure

Source: Own elaboration, from the Spanish National Statistics Institute.

Table 3
Simulation results: Effects on macroeconomic variables
(% change from benchmark)

	∇ Public administration	∇ Public education	∇ Public health	Δ VAT	Δ Other indirect taxes
GDP	–0.42	–0.45	–0.33	–0.30	–0.26
Employment	–0.63	–0.84	–0.68	–0.08	–0.35
Unemployment rate (p.p.)	0.33	0.44	0.36	0.06	0.32
Real wage rate	–0.26	–0.34	–0.28	–1.40	–1.06
GDP at factor cost	–0.51	–0.57	–0.42	–1.51	–1.46
Compensation of employees	–0.95	–1.21	–0.93	–1.48	–1.40
Gross operating surplus	0.03	0.24	0.21	–1.56	–1.54
Public revenue	–0.38	–0.16	–0.09	3.77	3.88
Public expenditure	–6.26	–5.97	–5.89	–0.85	–0.88

Table 4
Simulation results: Effects on sectoral output
(% change from benchmark)

	∇ Public administration	∇ Public education	∇ Public health	Δ VAT	Δ Other indirect taxes
Public administration	–13.54	–0.72	–0.38	0.00	0.00
Public education	–0.73	–26.30	–0.37	–0.01	–0.02
Public health	–0.70	–0.66	–20.72	–0.06	–0.04
Chemicals	0.35	0.37	–0.59	–0.33	–0.38
Retail trade	0.00	–0.01	–0.23	–0.02	–0.31
Research and development	–0.21	0.24	0.13	–0.05	–0.18
Private education	–0.17	–0.15	–0.09	–0.23	–0.24
Private health	–0.75	–0.70	–0.38	–0.07	–0.01
Sewage	–0.20	–0.18	–0.63	–0.34	–0.23
Culture	–0.59	–0.57	–0.32	–0.04	–0.42
Electricity	–0.23	0.03	0.01	–0.44	–0.39
Medical and precision instruments	1.31	1.30	–2.20	0.71	0.73
Other transport equipment	0.09	1.58	1.65	1.03	1.42
Wholesale trade	0.22	0.37	0.11	0.13	–0.17
Post and telecommunications	–0.33	0.09	–0.03	–0.58	–0.28
Other business activities	0.16	0.58	0.28	0.17	–0.04
Other sectors with public final expenditure	0.15	0.22	0.18	–0.09	–0.55
Sectors without public final expenditure	0.73	0.76	0.74	–0.03	–0.11

Table 5
Simulation results: Effects on sectoral employment
(% change from benchmark)

	∇ Public administration	∇ Public education	∇ Public health	Δ VAT	Δ Other indirect taxes
Public administration	–15.75	–0.84	–0.45	0.00	0.00
Public education	–0.77	–27.59	–0.39	–0.01	–0.02
Public health	–0.73	–0.69	–21.56	–0.06	–0.04
Chemicals	0.62	0.65	–1.04	–0.58	–0.67
Retail trade	–0.01	–0.02	–0.38	–0.03	–0.50
Research and development	–0.22	0.25	0.13	–0.05	–0.19
Private education	–0.26	–0.23	–0.13	–0.34	–0.36
Private health	–1.00	–0.94	–0.51	–0.09	–0.01
Sewage	–0.32	–0.28	–0.99	–0.53	–0.36
Culture	–0.72	–0.70	–0.39	–0.04	–0.51
Electricity	–1.14	0.13	0.03	–2.18	–1.92
Medical and precision instruments	1.66	1.64	–2.76	0.89	0.92
Other transport equipment	0.12	2.09	2.18	1.36	1.88
Wholesale trade	0.49	0.81	0.24	0.28	–0.38
Post and telecommunications	–1.07	0.29	–0.10	–1.86	–0.89
Other business activities	0.25	0.91	0.44	0.26	–0.06
Other sectors with public final expenditure	0.56	0.79	0.66	–0.34	–1.97
Sectors without public final expenditure	1.29	1.34	1.31	–0.05	–0.20

Table 6
Sensitivity analysis: Effects on macroeconomic variables
(% change from benchmark)

	∇ Public administration				∇ Public education				∇ Public health			
	GDP	Public revenue	Public expenditure	Employment	GDP	Public revenue	Public expenditure	Employment	GDP	Public revenue	Public expenditure	Employment
Benchmark	–0.42	–0.38	–6.26	–0.63	–0.45	–0.16	–5.97	–0.84	–0.33	–0.09	–5.89	–0.68
$\tau_{sav} = 1$												
$\tau'_{sav}=2*\tau_{sav}$	–0.42	–0.38	–6.27	–0.65	–0.46	–0.16	–5.98	–0.85	–0.34	–0.09	–5.91	–0.69
$\tau'_{sav}=0.5*\tau_{sav}$	–0.41	–0.38	–6.25	–0.63	–0.45	–0.16	–5.96	–0.83	–0.33	–0.09	–5.89	–0.67
$\sigma^{CL} = 1$												
$\sigma'^{CL}=2*\sigma^{CL}$	–0.44	–0.38	–6.31	–0.69	–0.49	–0.17	–6.04	–0.91	–0.36	–0.09	–5.95	–0.74
$\sigma'^{CL}=0.5*\sigma^{CL}$	–0.40	–0.38	–6.23	–0.60	–0.43	–0.16	–5.93	–0.79	–0.31	–0.09	–5.86	–0.64
$\tau_i = 1$												
$\tau'_i=2*\tau_i$	–0.42	–0.38	–6.29	–0.64	–0.45	–0.16	–5.98	–0.83	–0.33	–0.09	–5.91	–0.68
$\tau'_i=0.5*\tau_i$	–0.41	–0.38	–6.24	–0.63	–0.46	–0.16	–5.96	–0.84	–0.33	–0.09	–5.88	–0.68
σ_i^{LK} = [1.26-1.68]												
$\sigma_i'^{LK}=2*\sigma_i^{LK}$	–0.25	–0.19	–5.72	–0.42	–0.28	–0.08	–5.46	–0.56	–0.19	–0.04	–5.49	–0.45
$\sigma_i'^{LK}=0.5*\sigma_i^{LK}$	–0.62	–0.73	–6.99	–0.86	–0.65	–0.33	–6.57	–1.12	–0.49	–0.20	–6.38	–0.91
σ_i^{A} = [0.70-2.90]												
$\sigma_i'^{A}=2*\sigma_i^{A}$	–0.42	–0.38	–6.26	–0.63	–0.46	–0.16	–5.97	–0.84	–0.33	–0.09	–5.89	–0.68
$\sigma_i'^{A}=0.5*\sigma_i^{A}$	–0.42	–0.38	–6.26	–0.63	–0.45	–0.16	–5.97	–0.84	–0.33	–0.09	–5.90	–0.68
ε_i = [1.90-4.30]												
$\varepsilon'_i=2*\varepsilon_i$	–0.42	–0.38	–6.26	–0.64	–0.46	–0.16	–5.97	–0.84	–0.33	–0.09	–5.90	–0.68
$\varepsilon'_i=0.5*\varepsilon_i$	–0.42	–0.38	–6.26	–0.63	–0.45	–0.16	–5.97	–0.84	–0.33	–0.09	–5.89	–0.68
$\beta = 1.5$												
$\beta'=2*\beta$	–0.51	–0.39	–6.42	–0.81	–0.58	–0.18	–6.19	–1.07	–0.43	–0.10	–6.08	–0.87
$\beta'=0.5*\beta$	–0.34	–0.35	–6.13	–0.48	–0.35	–0.14	–5.78	–0.64	–0.25	–0.08	–5.74	–0.52

Table 6 (continued)

	Δ VAT				Δ Other indirect taxes			
	GDP	Public revenue	Public expenditure	Employment	GDP	Public revenue	Public expenditure	Employment
Benchmark	–0.30	3.77	–0.85	–0.08	–0.26	3.88	–0.88	–0.35
$\tau_{sav} = 1$								
$\tau'_{sav}=2*\tau_{sav}$	–0.31	3.76	–0.85	–0.08	–0.31	3.86	–0.88	–0.41
$\tau'_{sav}=0.5*\tau_{sav}$	–0.30	3.77	–0.85	–0.07	–0.24	3.89	–0.88	–0.32
$\sigma^{CL} = 1$								
$\sigma^{'CL}=2*\sigma^{CL}$	–0.45	4.01	–0.81	–0.38	–0.37	4.08	–0.86	–0.59
$\sigma^{'CL}=0.5*\sigma^{CL}$	–0.23	3.64	–0.87	0.08	–0.20	3.78	–0.90	–0.22
$\tau_i = 1$								
$\tau'_i=2*\tau_i$	–0.35	3.86	–0.88	–0.12	–0.29	3.95	–0.89	–0.38
$\tau'_i=0.5*\tau_i$	–0.28	3.71	–0.83	–0.05	–0.25	3.84	–0.88	–0.33
σ_i^{LK} = [1.26-1.68]								
$\sigma_i^{'LK}=2*\sigma_i^{LK}$	–0.35	3.77	–0.88	–0.14	–0.40	3.89	–0.98	–0.57
$\sigma_i^{'LK}=0.5*\sigma_i^{LK}$	–0.27	3.76	–0.84	–0.03	–0.16	3.88	–0.82	–0.18
σ_i^{A} = [0.70-2.90]								
$\sigma_i^{'A}=2*\sigma_i^{A}$	–0.31	3.77	–0.85	–0.08	–0.26	3.88	–0.88	–0.34
$\sigma_i^{'A}=0.5*\sigma_i^{A}$	–0.30	3.77	–0.85	–0.08	–0.27	3.88	–0.88	–0.35
ε_i = [1.90-4.30]								
$\varepsilon'_i=2*\varepsilon_i$	–0.31	3.77	–0.85	–0.08	–0.26	3.88	–0.88	–0.34
$\varepsilon'_i=0.5*\varepsilon_i$	–0.30	3.77	–0.85	–0.08	–0.26	3.88	–0.88	–0.35
$\beta = 1.5$								
$\beta'=2*\beta$	–0.32	3.78	–0.85	–0.10	–0.35	3.95	–0.87	–0.51
$\beta'=0.5*\beta$	–0.29	3.76	–0.85	–0.05	–0.19	3.82	–0.90	–0.21

Note: τ_{sav} = elasticity of substitution between consumption and savings, σ^{CL} = elasticity of substitution between final consumption and leisure, τ_i = elasticity of substitution across final consumption goods, σ_i^{LK} = elasticity of substitution between labour and capital, σ_i^{A} = Armington elasticity of substitution, ε_i = elasticity of transformation, β = flexibility of the real wage to the unemployment rate.

Figure 1
Production function nests

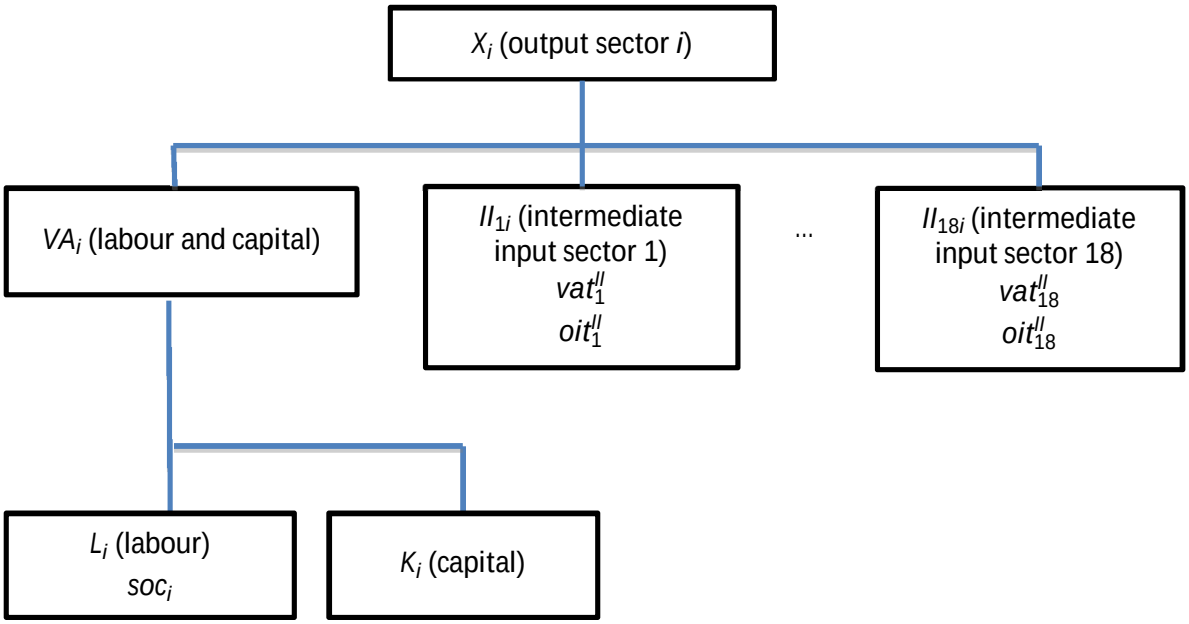
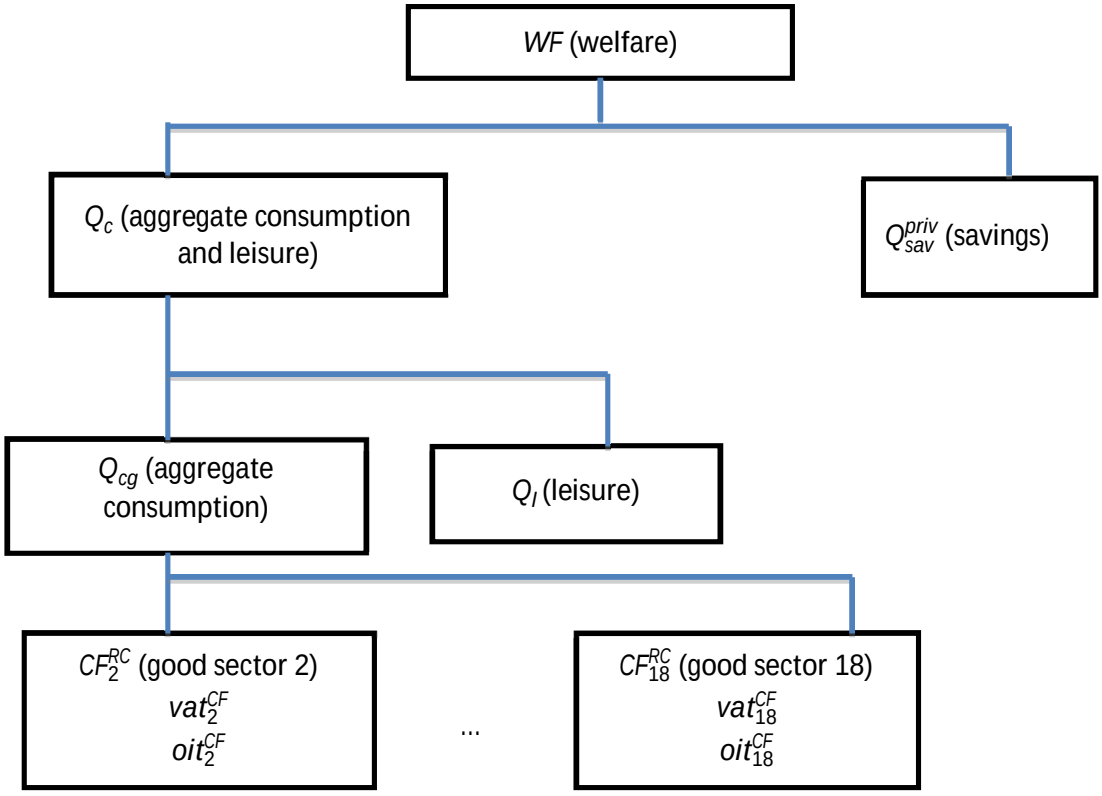


Figure 2
Welfare function nests



Appendix: The model

As a general rule, the notation in the model is as follows: endogenous variables are denoted by capital letters, exogenous variables by capital letters with a bar, and parameters by small Latin and Greek letters. There are 18 (i, j = 1,..., 18) production sectors and each sector produces one good. All endogenous variables, and the exogenous variables and parameters, are listed in Tables A.1 and A.2 below. The model's equations are as follows.

Production

The nested technology presents constant returns to scale and a competitive pricing rule. Given that the top nest is a Leontief function, the zero-profit condition for sector i is:

$$PROFIT_i^X = PX_i\left(1-oit_i^{II}-vat_i^{II}\right)-c_{0i}PVA_i-\sum_{j=1}^{18}c_{ji}PO_j=0 \qquad (i = 1,..., 18) \qquad \text{(A1)}$$

where, according to the nested structure, the unit cost of the value added composite produced by sector i is a CES function:

$$PVA_i=\frac{1}{\alpha_i}\left(a_i^{\sigma_i^{LK}}\left(1+soc_i\right)^{1-\sigma_i^{LK}}W^{1-\sigma_i^{LK}}+\left(1-a_i\right)^{\sigma_i^{LK}}R_i^{1-\sigma_i^{LK}}\right) \qquad (i = 1,..., 18) \qquad \text{(A2)}$$

We assume that firms maximize profits, and choose the optimal mix of national and imported goods, and that of domestic sales and exports. This leads to the following zero-profit conditions:

$$PROFIT_i^A = PA_i-\left(e_i^{\sigma_i^A}PX_i^{1-\sigma_i^A}+(1-e_i)^{\sigma_i^A}(\overline{PFX}FC)^{1-\sigma_i^A}\right)^{\frac{1}{1-\sigma_i^A}}=0 \qquad (i = 1,..., 18) \qquad \text{(A3)}$$

$$PROFIT_i^{CET} = PA_i-\frac{1}{\varsigma_i}\left(d_i^{-\varepsilon_i}PO_i^{\varepsilon_i+1}+(1-d_i)^{-\varepsilon_i}(\overline{PFX}FC)^{\varepsilon_i+1}\right)^{\frac{1}{\varepsilon_i+1}}=0 \qquad (i = 1,..., 18) \qquad \text{(A4)}$$

These zero-profit conditions are used to get derived demand functions, by applying the Shephard's lemma on cost functions.

Next, we introduce the corresponding market clearing equations, with demands and supplies showing in the left-hand and the right-hand side, respectively:

$$X_i\left(-\frac{\partial PROFIT_i^X}{\partial PO_j}\right)=II_{ji} \qquad (i, j = 1,..., 18) \qquad \text{(A5)}$$

$$X_i\left(\frac{\partial PROFIT_i^X}{\partial R_i}\right)=\overline{K_i^{RC}}+\overline{K_i^{PUB}} \qquad (i = 1,..., 18) \qquad \text{(A6)}$$

$$\sum_{i=1}^{18}X_i\left(\frac{\partial PROFIT_i^X}{\partial W}\right)=(\bar{L}-Q_l)(1-U) \qquad \text{(A7)}$$

$$A_i\left(-\frac{\partial PROFIT_i^A}{\partial PX_i}\right)=X_i \qquad (i = 1,..., 18) \qquad \text{(A8)}$$

$$A_i\left(-\frac{\partial PROFIT_i^A}{\partial FC}\right)=IMP_i \qquad (i = 1,..., 18) \qquad \text{(A9)}$$

$$A_i\left(-\frac{\partial PROFIT_i^{CET}}{\partial PO_i}\right)=O_i \qquad (i = 1,..., 18) \qquad \text{(A10)}$$

$$A_i\left(-\frac{\partial PROFIT_i^{CET}}{\partial FC}\right)=EXP_i \qquad (i = 1,..., 18) \qquad \text{(A11)}$$

$$X_i + IMP_i = O_l + EXP_i \qquad (i = 1,..., 18) \qquad \text{(A12)}$$

$$I_i + \sum_{j=1}^{18} II_{ij} + CF_i = O_i \qquad (i = 1,..., 18) \qquad \text{(A13)}$$

Consumption

The final demand functions are derived from the maximization of the representative consumer's nested welfare function:

$$WF = (Q_c)^{1-\tau_{sav}}\left(Q_{sav}^{priv}\right)^{\tau_{sav}} \qquad \text{(A14)}$$

subject to the budget constraints:

$$Y_{RC} = W\left(\bar{L} - Q_l\right)(1-U) + \sum_{i=4,...,7,9,11,...,18} R_i\overline{K_i^{RC}} + \overline{NTPS} \qquad \text{(A15)}$$

$$Y_{RC} = P_{sav}Q_{sav}^{priv} + \sum_{i=2}^{18} PO_i\left(1 + oit_i^{CF} + vat_i^{CF}\right)CF_i^{RC} \qquad \text{(A16)}$$

and the nests in the welfare function are defined by:

$$Q_c = \left(b^{\sigma^{CL}}Q_{cg}^{1-\sigma^{CL}} + (1-b)^{\sigma^{CL}}Q_l^{1-\sigma^{CL}}\right)^{\frac{1}{1-\sigma^{CL}}} \qquad \text{(A17)}$$

$$Q_{cg} = \prod_{i=2}^{18}\left(CF_i^{RC}\right)^{\tau_i} \qquad \text{(A18)}$$

Consumption goods are purchased by the representative consumer and the public sector:

$$CF_i = CF_i^{RC} + CF_i^{PUB} \qquad (i = 1,..., 18) \qquad \text{(A19)}$$

The solution to the maximization problem yields the demand functions for savings, leisure, and final demand.

Public sector

The income of the public sector is given by:

$$Y_{PUB} = \sum_{i=1,2,3,8,10,18} R_i\overline{K_i^{PUB}} + \sum_{i=1}^{18}\left(SOC_i + OIT_i + VAT_i\right) - \overline{NTPS} \qquad \text{(A20)}$$

where revenues come from several taxes:

$$SOC_i = Wsoc_i X_i\left(-\frac{\partial PROFIT_i^X}{\partial W}\right) \qquad (i = 1,..., 18) \qquad \text{(A21)}$$

$$OIT_i = PX_i oit_i^{II} X_i \left(-\frac{\partial PROFIT_i^X}{\partial PX_i} \right) + PO_i I_i oit_i^{GKF} + PO_i CF_i \; oit_i^{CF} \qquad (i = 1,..., 18) \qquad \text{(A22)}$$

$$VAT_i = PX_i vat_i^{II} X_i \left(-\frac{\partial PROFIT_i^X}{\partial PX_i} \right) + PO_i I_i vat_i^{GKF} + PO_i CF_i \; vat_i^{CF} \quad (i = 1,..., 18) \qquad \text{(A23)}$$

The macro closure rule is:

$$Y_{PUB} - \sum_{i = 1,..., 10, 12, 13, 14, 16, 17} PO_i \left(1 + oit_i^{CF} + vat_i^{CF}\right) CF_i^{PUB} = P_{sav} Q_{sav}^{pub} \qquad \text{(A24)}$$

Foreign sector, investment and savings

The macro closure of the model involves some other constraints related to investment and savings in this open economy:

$$\sum_{i=1}^{18} \overline{PFX} EXP_i + \overline{FORSAV} = \sum_{i=1}^{18} \overline{PFX} IMP_i \qquad \text{(A25)}$$

$$P_{sav} Q_{sav}^{priv} + P_{sav} Q_{sav}^{pub} + \overline{FORSAV} = \sum_{i=1}^{18} PO_i \left(1 + oit_i^{GKF} + vat_i^{GKF}\right) I_i \qquad \text{(A26)}$$

Factor markets

The equilibrium in the capital market is given in (A6), and the equilibrium in the labour market in (A7), with some restrictions related to the unemployment assumptions:

$$\frac{W}{CPI} = \left(\frac{1 - U}{1 - \overline{U0}} \right)^{\frac{1}{\beta}} \qquad \text{(A27)}$$

$$CPI = \frac{\sum_{i=1}^{18} \theta_i PO_i}{\sum_{i=1}^{18} \theta_i \overline{PO_i}} \qquad \text{(A28)}$$

Table A1
Endogenous variables

Symbol	Definition
A_i	Armington aggregate (total amount of goods supplied) of sector *i*
CF_i	Final domestic consumption of goods produced by sector *i*
CF_i^{PUB}	Final public consumption of goods produced by sector *i*
CF_i^{RC}	Final private consumption of goods produced by sector *i*
CPI	Consumer price index
EXP_i	Exports of sector *i*
FC	Factor of conversion of foreign currency into domestic currency
I_i	Investment (gross capital formation) in goods produced by sector *i*
II_{ij}	Intermediate inputs from sector *j* used by sector *i*
IMP_i	Imports from sector *i*
O_i	Production of sector *i* sold in the domestic market
OIT_i	Other indirect taxes revenue in sector *i*
P_{sav}	Savings shadow price
PA_i	Unit cost of the Armington aggregate of sector *i*
PO_i	Unit cost of the production of sector *i* sold in the domestic market
$PROFIT_i^A$	Unit profits for A_i (according to origin)
$PROFIT_i^{CET}$	Unit profits for A_i (according to destination)
$PROFIT_i^X$	Unit profits for X_i
PVA_i	Unit cost of the primary factors used in sector *i*
PX_i	Price of the goods produced by sector *i*
Q_c	Demand for aggregate consumption
Q_{cg}	Demand for aggregate consumption of goods
Q_l	Demand for leisure
Q_{sav}^{priv}, Q_{sav}^{pub}	Private and public demand for savings
R_i	Capital rental rate in sector *i*
SOC_i	Revenue from social contributions paid by employers and employees of sector *i*
U	Unemployment rate
VAT_i	Value added tax revenue in sector *i*
W	Wage rate
WF	Welfare
X_i	Production of sector *i*
Y_{PUB}	Disposable income of the public sector
Y_{RC}	Disposable income of the representative consumer

Table A2

Exogenous variables and parameters

Symbol	Definition
$\overline{FORSAV}$	Foreign savings
$\overline{K_i^{PUB}}$	Capital endowment of the public sector to produce good *i*
$\overline{K_i^{RC}}$	Capital endowment of the representative consumer to produce good *i*
$\overline{L}$	Labour endowment
$\overline{NTPS}$	Net transfers from the representative consumer to the public sector
$\overline{PFX}$	World prices
$\overline{U0}$	Unemployment rate in the benchmark
a_i, b,c_{0i},c_{ji},d_i,e_i	Share parameters
vat_i^{II},vat_i^{GKF},vat_i^{CF}	Value added tax rates, *ad valorem*, in sector *i*, levied on intermediate inputs, investment and final consumption, respectively
oit_i^{II},oit_i^{GKF},oit_i^{CF}	Other indirect taxes rates, *ad valorem*, in sector *i*, levied on intermediate inputs, investment and final consumption, respectively
soc_i	Social contributions rates, *ad valorem*, in sector *i*
α_i,ζ_i	Scale parameters
β	Flexibility of the real wage to the unemployment rate
ε_i	Elasticity of transformation in sector *i*
θ_i	Share parameter
σ_i^A	Armington elasticity of substitution in sector *i*
σ^{CL}	Elasticity of substitution between final consumption and leisure
σ_i^{LK}	Elasticity of substitution between labour and capital in sector *i*
τ_i	Elasticity of substitution across final consumption goods
τ_{sav}	Elasticity of substitution between consumption and savings