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How much can European governments squeeze out of their taxpayers?

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Abstract

In this paper we use the concept of distributable surplus, introduced by Allais (1943) and Luenberger (1992), to evaluate the capacity of European countries to repay their debts. We first show that the surplus generated between 2005 and 2009 was not sufficient to cover the 2009 deficit for Greece, Ireland, Spain and the UK. In order to generate a surplus equal to the 2009 deficit, these countries would have had to reduce their initial well-being. Assuming that no reduction of well-being is acceptable by the community, we use Computable General Equilibrium (CGE) models to simulate different policies that can be implemented in order to generate sufficient surplus. We show that the results are very sensitive as to whether we consider deficits before and after the recent financial and economic crises. Then, assuming that governments are able to capture all the distributable surpluses, we compute the date at which they are able to repay their debts. We find that most EU countries, excepted Germany and to lesser extent France and the UK, cannot achieve debt sustainability. We finally discuss the usefulness of Eurobonds.

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1 Introduction

Over the years European governments have built huge public debts. With the recent economic crisis the deficits have reached unprecedented levels as it seemed necessary to support the economy with expansionary fiscal policies as, for instance, the financial support to the French automobile industry.

The question arises as to whether European governments will be able to repay their debt or whether they will have to resort to inflationary measures, or explicit default. Governments need the cooperation of taxpayers to be able to levy enough taxes to repay their debts. However, if taxes are too high, people could modify their behavior by reducing labor supply and by transferring capital offshore, implying that the State will not be able to levy enough taxes. So, it is not possible, as often advocated in the popular press, to simply take money from the relatively wealthy.

The idea of our paper is that only surpluses can be taxed away by governments. Surplus can be loosely defined as the difference between the maximum price a buyer is willing to pay and the minimum price a seller is willing to accept for any trade. In the absence of public intervention, the surplus is shared by the buyer and the seller according to their bargaining power. The government can potentially take the entire surplus generated by the transaction but not more as the buyer and/or the seller would get less than their reservation price and would then withdraw from trade. Because of its excessive greediness, the state would dry out the source of income on which it draws.

The surplus indicates the maximum amount that is taxable by the State. We will assume here that governments are able to tax all surpluses even if, in practice, the effective amount that can be extracted depends on the available fiscal tools as well as on the information available to the State. The specific concept of surplus that is used in our paper is that of the distributable surplus proposed by Allais (1943, 1981) or, equivalently, of the benefit function proposed by Luenberger (1992a, 1995). In particular, Allais and Luenberger define surplus as the maximum quantity of a reference good that can be taken away from a consumer with a given level of utility. Hence, the reservation price interpretation when the reference bundle is a unit of gold.

The aim of our paper is to evaluate, using the concept of distributable surplus, the amount of surplus that can be extracted from European economies in order to investigate whether their public spending/debts are sustainable. In particular, given that the distributable surplus represents the maximum taxable output that governments can extract from their respective taxpayers, we compute the maximum level of debt that governments can afford and determine the date at which governments are able to repay their debts. Our results show that most EU countries, except Germany and to a lesser extent France and the UK, cannot achieve debt sustainability.

It is important to note that the methodology used in our paper differs from that of previous studies. Public debt sustainability has been empirically tested by assuming that past behavior of fiscal policies remains constant. Hamilton and Flavin (1986) propose a framework for analyzing whether governments can run a Ponzi scheme and find evidence of the sustainability of the US public debt. A number of studies have tested the sustainability of public deficits by analyzing the stationarity and the cointegration properties of total public expenditures and revenues as ratios of GDP. Concerning European countries, Bravo and Silvestre (2002) assume that the cointegration of expenditures and revenues is a sufficient condition for sustainability and find that the fiscal policy is sustainable in Germany, the UK, Austria, France and the Netherlands, but not in Belgium, Denmark, Ireland, Portugal, Italy and Finland. Greiner *et al.* (2007) find that fiscal policies in some European countries are sustainable following the approach developed by Bohn (1995, 1998) implying that the intertemporal budget constraint of the government holds in the case in which the public debt to GDP ratio is a mean-reverting process.

The paper is organized as follows. In the following section we define distributable surplus with Allais' (1943) and Luenberger's (1992b) benefit function and Boiteux' (1951) distributable income function. In section 3, we investigate whether European countries have generated sufficient surplus during the period 2005-2009 that would have enabled to cover their public deficits. In section 4, we simulate different macroeconomic policies that governments could implement in order to create sufficient distributable surpluses. In section 5, we analyze the sustainability of the European public debts. We conclude in the last section.

2 Distributable surplus

Consider an economy composed of two consumers $j = 1,2$ and two goods $i = 1,2$. Individuals have the following utility function $U_j(x_j) = U_j(x_j^1, x_j^2) = \prod_i (x_j^i)^{\alpha_j^i}$ with $\alpha_j^1 + \alpha_j^2 = 1$ and they are endowed with the bundle of goods $\omega_j = \{\omega_j^1, \omega_j^2\}$.

Let $g \in \Re_+^2$ be an arbitrary reference bundle of goods and u_j a reference utility level which represents the minimum utility level acceptable for the individual j. We can define the distributable surplus relative to the reference utility u_j and the bundle of good x_j as:

$$b_j(x_j, u_j) = \max_{\beta} \beta \quad s.t. \quad u_j(x_j - \beta g) \geq u_j \tag{1}$$

In words, the distributable surplus represents the maximum number of units of bundle g that the consumer j is ready to give up to obtain bundle x_j when his initial utility level is u_j. If g is a unit of gold, then $b_j(x_j, u_j)$ can be interpreted as the maximum price that the agent will agree to pay in order to acquire x_j given his utility level u_j. Hence, $b_j(x_j, u_j)$ can be interpreted as the reservation price of x_j for individual j when one of the goods is gold and is used as the *numéraire*.

In the case of the above Cobb-Douglas utility function, for $g = (1,0)$, the distributable function is given by:

$$b_j(x, u) = x_j^2 - \left(\frac{u_j}{(x_j^1)^{\alpha_j^1}} \right)^{\frac{1}{\alpha_j^2}}$$

Alternatively, it is possible to use Boiteux' surplus function to evaluate the total distributable surplus in the economy. Boiteux' (1951) and Courtault *et al.* (2008) present an analogue of the benefit function in the dual space of price-income pairs, ranked with the agent's indirect utility functions v_j. Agent j's Boiteux' surplus at utility level u_j, relative to the price-income pair $(\mathbf{p}, R_j)$, is defined by:

$$d(\mathbf{p}, R_j, u_j) = \min_{d} d \quad s.t. \quad v_j(\mathbf{p}, R_j + d) \geq u_j \tag{2}$$

The Boiteux' distributable income function $d(\mathbf{p}, R_j, u_j)$ measures the level of income that must be given to an individual to move from a reference utility level u_j to an environment $(\mathbf{p}, R_j)$. The Boiteux's distributable income function, defined in terms of income, is more intuitive than the benefit function which is defined in terms of an arbitrary bundle of goods. In the case of the Cobb-Douglas utility function, the distributable income function is given by:

$$d(\mathbf{p}, R_j, u_j) = R_j - u_j \cdot \prod_i \left(\frac{p^i}{\alpha_j^i} \right)^{\alpha_j^i} \tag{3}$$

It is often advocated that inflation represents an effective tool that can be used to reduce public debt. However, supposing for simplicity that all prices increase at the same rate and real GDP remains constant (which implies that the growth rate of the nominal GDP coincides with the inflation rate), equation 3 shows that inflation permits to increase distributable surplus only if the reference utility of the representative agent remains unchanged (or grows at a lower rate than prices).

In Appendix 1 we determine the distributable surplus in a 2x2 pure exchange economy. In particular, we compute the equilibrium of this economy and we deduce the total maximal distributable surplus using both the Allais' and Boiteux' measures that can be extracted from this economy. This distributable surplus is computed using as reference utility level for each consumer the initial utility given by initial endowments, as this represents the minimum utility level that an individual achieves if he chooses not to trade.

3 Have European economies generated sufficient surpluses?

In this section we use CGE models[1] for seven European countries (France, Germany, Greece, Ireland, Italy, Spain and the United Kingdom) in order to quantify the distributable surplus that European governments can extract from their taxpayers. The models are calibrated using the 2005 input-output tables provided by OECD and other macro data concerning national accounts. In order to take into account the effects of the recent crisis on the possibility of surplus extraction, the CGE models are also calibrated using the 2009 data from national accounts and assuming the same structure for input-output. It is important to note that in CGE models the observed situation represents the equilibrium of the economy. Hence, the initial equilibrium allocation in CGE models is already Pareto-optimal as the first welfare theorem always holds in the absence of externalities and market frictions. However, fiscal policies or other macroeconomic shocks can change the equilibrium of the economy. Thus, the model allows to compute the distributable surplus that is generated by a shock. This will permit us, in the next section, to quantify the surplus generated by different policies.

[1]CGE models, introduced by Shoven and Whalley (1984) are widely used for fiscal analysis (see for example Bettendorf *et al.*, 2010), agricultural and environmental analysis (see for example Valenzuela *et al.*, 2007), and international trade analysis (see for example Francois *et al.*, 2005), in order to assess the economic consequences of a policy or a deterministic shock in a coherent framework that takes into account the interrelations between economic agents (firms, households, government, and the rest of the world). In Appendix 2 we present a description of the CGE models used in our analysis.

In order to compute the surplus, it is first necessary to choose a reference utility level which represents the minimum utility level that households will accept. Two choices are possible: to fix the reference utility either at the 2005 utility level or at 2009 utility level. In the first case, we are able to conclude whether there was enough surplus in the economy to cover the 2009 deficit, or whether it would have been necessary to cut spending. We are also able to compute the reduction of well-being necessary to generate sufficient surplus when the reduction in public spending is not politically feasible. In contrast, the second case, where the 2009 utility level is used as reference utility, implies that no reduction of well-being is acceptable by the community. Hence, we analyze in the next section whether the governments are able to generate surplus through the introduction of a policy reform aiming to increase real GDP.

Here, we assume that the reference utility level is fixed at the 2005 level, i.e. before the crisis. In particular, we examine whether the economies have generated sufficient surpluses during the period 2005-2009 to cover public deficits for the same period. Surpluses are sufficient when the quantity of surplus generated by each economy is greater than or equal to the actual deficit.

In table 1 we first present for each country the level of the surplus generated in 2009 with reference utility 2005 and the 2009 public deficit. Then we present the percentage change in consumption between 2005 and 2009 and the percentage change in consumption that would have been compatible with budgetary equilibrium, i.e. to generate sufficient surplus. Our analysis shows that the surplus generated between 2005 and 2009 was not sufficient to cover the 2009 deficit for Greece, Ireland, Spain and the UK. For instance, Greece and Ireland generated a surplus equal respectively to 7.6% and 8.9% of GDP while their deficits were 15.4% and 14.3% of GDP. In order to generate a surplus sufficient to cover the 2009 deficit, it would be necessary to reduce the initial well-being (measured by the disposable income devoted to consumption) by 11.8% in Greece, 13.3% in Ireland, 13.4% in Spain, and 9.2% in the UK. Indeed to sustain such level of the deficit, Greece and Ireland would have to accept a level of disposable income which is respectively 11.8% and 13.3% lower than the 2005 level and that corresponds to the 2002 level. This table clearly shows that some countries have increased their level of consumption between 2005 and 2009 (Greece +9.2%, Ireland +3.1%, Spain +2.4%, and the UK +1.1%) even though they should have reduced it drastically. France has increased its consumption over and above the feasible level, while Italy has slightly decreased consumption as necessary. In contrast, Germany has increased consumption well below what they could have done.

In the second part of table 1 we carry out the same analysis by considering the cumulative deficit for the 2005-2009 period. Germany is the only country that could have been able to repay while maintaining the 2003 well-being level. Most of the other countries should accept a strong reduction of their well-being at a level comparable to their early 1990 level. Our analysis shows that each government could have extracted more surplus each year instead of running deficits, but they did not. Consequently, they have to repay past deficits with current surpluses.

Table 1: Analysis of the Capacity of the EU Countries to Cover Public Deficits

	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
France	8.0%	7.5%	5.1%	1.2%	2005-2006	18.7%	-21.2%	1994
Germany	7.1%	3.0%	1.8%	8.2%	>2010	7.5%	-0.4%	2003
Greece	7.6%	15.4%	9.2%	-11.8%	2002	42.5%	-53.1%	<1980
Ireland	8.9%	14.3%	3.1%	-13.3%	2002	17.0%	-13.3%	2002
Italy	5.1%	5.4%	-0.3%	-0.3%	2005	17.3%	-22.8%	1998
Spain	4.0%	11.1%	2.4%	-13.4%	2001	10.4%	-12.4%	2001
UK	5.8%	11.4%	1.1%	-9.2%	2001	25.2%	-33.1%	1993

(1) Surplus 2009 (reference utility 2005)/GDP (2009);
(2) Deficit (2009) / GDP (2009);
(3) % actual variation of consumption wrt 2005;
(4) % variation of consumption with respect to 2005, compatible with budget equilibrium;
(5) Year at which budget equilibrium is achieved;
(6) Cumulative deficits 2005-2009 / GDP (2009);
(7) % variation of consumption with respect to 2005, 2005 compatible with budget equilibrium;
(8) Year at which budget equilibrium is achieved.

4 Simulation results of different macroeconomic policies on distributable surpluses

In this section we consider the case in which people do not accept any reduction of their well-being and we analyze the policies that governments could implement in order to generate sufficient surpluses. Indeed, we are entitled to consider that the reference utility level of agents is equal to the utility level that they achieved in the absence of the policies under consideration. In fact, given that the government is free to choose whether to introduce or not these policies, it can decide to capture all the surpluses that these policies can generate.

The analysis is carried out by using the CGE models presented in Appendix 2. The initial equilibrium used to calibrate our models gives us the reference utility level. Starting from this level, a macroeconomic shock or policy moves the economy out of the initial equilibrium and will allow us to compute the surplus generated by such a shock.

The effects are analyzed using five fiscal rules. In particular, in the first fiscal rule, the government deficit and the income tax rate are exogenous, while the total government expenditure is endogenously determined in order to satisfy the budget constraint. In the second fiscal rule, the government deficit is exogenous, the total government expenditure per worker is kept constant and the income tax rate is endogenously determined in order to satisfy the budget constraint. In the third fiscal rule, the ratio between the government deficit and GDP is fixed at the initial level, the income tax rate is exogenous and the total government expenditure is endogenously determined in order to satisfy the budget constraint. In the fourth fiscal rule, the ratio between the government deficit and GDP is fixed at the initial level, the total government expenditure is exogenous and the income tax rate is endogenously determined in order to satisfy the budget constraint. In the fifth fiscal rule, the total government expenditure and the income tax rate are exogenous, while the government deficit is endogenously determined in order to satisfy the budget constraint.

Here we quantify the surplus generated by a policy aiming to increase real GDP. Given that CGE models are supply-driven, the only way that permits to increase real GDP is by increasing the quantity of labor and/or capital available in the economy. In our simulations we consider a shock on both labor and capital supply. These shocks may be interpreted as government policies. An increase in the labor supply may be induced, for instance, by an immigration policy, an increase in the retirement age, or an increase in the legal number of work hours per week. An increase in capital supply may be induced, among others, by policies stimulating foreign investments or the repatriation of domestic capital invested abroad. Some of the fiscal rules considered in our simulations permits to consider the cost of these policies. For instance, an immigration policy requires an increase in expenditures (health, education, infrastructures) which is explicitly taken into account by the second fiscal rule in which the per capita public expenditure is kept constant.

The objective of our simulations is to compute, for each country and for the five fiscal rules, the percentage increase in both labor supply and capital supply that is necessary to generate a surplus sufficient to cover the 2009 public deficit. The results are reported in Table 2.

Table 2: Percentage Increase in both Factors Necessary to Cover the 2009 Deficits

	1st	***2nd***	***3rd***	***4th***	***5th***	***Average***
Germany	6.2	5.0	6.6	5.1	4.9	5.6
Italy	11.0	8.7	12.6	8.8	8.5	9.9
France	15.4	13.8	18.3	14.1	13.6	15.0
UK	23.5	19.5	31.3	19.8	19.2	22.7
Spain	23.2	20.9	30.9	22.0	20.3	23.5
Greece	21.3	24.6	27.6	24.7	24.7	24.6
Ireland	36.8	35.5	58.9	39.7	35.0	41.2

Table 2 shows that only Germany appears to have maintained its capacity to generate enough surplus to cover the deficit, whereas all the other countries have seen their situation drastically deteriorated. Indeed, a simple average across fiscal rules shows that for Germany an increase of 5.6% of both labor and capital is sufficient to generate a surplus equal to the deficit. For all the other countries, the percentage shock over both labor and capital is much higher, with a maximum average of 41.2% for Ireland. Countries may be ranked in ascending order according to their difficulty to get out of the public deficit dilemma: Germany with 5.6%, Italy with 9.9%, France with 15%, the UK with 22.7%, Spain with 23.5%, Greece with 24.6% and Ireland with 41.2%.

The media have particularly stressed the difficulty for Greece to repay its debt whereas its situation is not much worse than that of Spain and, surprisingly, the UK. The situation of Ireland seems catastrophic. This result is only partially explained by the value of the deficits which are different in each country. Even if the public deficit of Greece is more important than that of Ireland, the percentage increase in production factors to cover the deficit is smaller.

The third fiscal rule seems to be the worst rule to generate a surplus sufficient to cover the deficit. For all countries, except Greece, the best fiscal rule is the fifth, i.e. the case in which public deficits are endogenous. This result implies that a Maastricht rule type is not suitable during crisis and a more permissive budgetary policy seems more appropriate.

5 Sustainability of public debts

In this section we compute for each country, in the case where no policy reform is implemented, the year at which the total sum of the actual public debt and the present value of future public deficits is offset by the present value of future distributable surpluses. Public debt is defined as sustainable only in the case in which the date computed exists.

In our analysis we make the following assumptions: for each country, (i) the ratio of public deficit with respect to GDP decreases linearly over time towards zero between 2012 and 2020; (ii) real GDP and distributable surpluses grow at the constant rate of 1.5%, which implies that, given equation 3, the reference utility also grows at the constant rate of 1.5%.

In the computation of the present values, we consider four different interest rates. The first one is the ten-year government bond rate observed on November 9, 2011.[2] This interest rate is relevant when the entire public debt has to be renewed at that date. However, if the time to maturity of the debt is not immediate, this interest rate is not relevant. This is why, secondly, we consider the average ten-year government bond rate observed in 2011 and, thirdly, the current yield interest rate computed as the ratio between actual interests payments and the actual public debt. Finally, we consider the average ten-year government bond rate observed in the Euro zone weighted by the size of public debts. This rate is interesting because it could approximate the rate on Eurobonds in the case in which European governments decide to introduce this kind of instrument to finance the overall European debt.

Table 3 shows that, for any interest rate scenario, only France, Germany and the UK are able to repay their current public debt using future surpluses generated by their economies. If we consider the interest rate observed on November 9, 2011 (first scenario) Greece, Italy, Ireland and Spain are not able to repay their debts within a finite horizon. If we consider the average 2011 interest bond rate (second scenario) the public debt is not sustainable for Greece and Ireland, while for Italy and Spain the date computed is so far in the future that we can have doubts on the sustainability of their debts. If we consider the current yield and the Eurobond scenarios (third and fourth scenarios) the public debt is sustainable for all countries. However, the third scenario is not realistic as financial markets are not willing anymore to lend to most European countries on the basis of past interest rates at which the debt was contracted. It is interesting to note that in the Eurobond scenario the date computed is delayed, with respect to the second scenario, only for France and Germany and by only two years. However, even this scenario is not very realistic since for Greece, Ireland, Italy and Spain the date is so far in the future implying a strong uncertainty concerning the validity of our hypotheses over such a long period.

[2]This date is chosen in our analysis as it is one of the worst period in the history of the Euro zone in terms of high interest rates for most of highly indebted countries, such as Italy, Spain and Greece.

Table 3: Analysis of the Sustainability of Public Debts

		(1)	**(2)**	**(3)**	**(4)**
France	Interest rate	3.16%	3.32%	2.76%	4.66%
	Year	2026	2026	2025	2028
Germany	Interest rate	1.81%	2.74%	3.52%	4.66%
	Year	2021	2023	2023	2025
Greece	Interest rate	30.69%	16.66%	4.20%	4.66%
	Year	never	never	2049	2055
Italy	Interest rate	8.24%	9.87%	2.90%	4.66%
	Year	never	never	2043	2061
Ireland	Interest rate	6.76%	5.14%	3.60%	4.66%
	Year	never	2096	2049	2067
Spain	Interest rate	5.71%	5.40%	2.80%	4.66%
	Year	never	2136	2043	2064
UK	Interest rate	2.35%	3.13%	2.51%	
	Year	2034	2037	2035	

Source: Ecowin, November 2011.
(1) Beyond yield on November 9, 2011;
(2) Average bond yield in 2011;
(3) Interests/Public debt;
(4) Average bond yield in 2011 weighted by the size of public debts.

6 Conclusions

In this paper we use the concept of distributable surplus proposed by Allais (1943) and Luenberger (1992a) to investigate on (i) the capacity of European governments to generate sufficient surpluses to cover public deficits and (ii) the sustainability of public debts.

After showing that European governments have not generated sufficient surplus with their economic policies implemented over the recent period (2005-2009), we investigate whether a policy aiming at increasing both labor and capital supply could be sufficient to cover actual deficits. Using CGE models for several European countries, we show that, except Germany, public deficits observed in 2009 could be covered only by very large increase in both labor and capital supply. In particular, the current public spending cannot be financed by taxing the distributable surplus as the level of the increase in labor and capital necessary to achieve the budget equilibrium is not realistic. Thus, European governments will have to reduce their public spending at least to the level observed before the crisis.

Concerning the sustainability of public debts in the Euro zone, which is necessary for the preservation of the Euro system, we find that the best solution is the introduction of Eurobonds. However, even this scenario is not very realistic since for Greece, Ireland, Italy and Spain the date at which the debt is completely repaid is so far in the future that it raises doubts on the effectiveness of this policy. In any case, the introduction of Eurobonds would imply the strict control of public expenditures of the different European countries by European institutions in order to maintain the debt under control.

Finally, it is important to note that these results are obtained by considering as the reference utility the utility level achieved by households before these policy reforms. Consequently, most European households will have to reduce their reference utility in order to unable the governments to extract more surpluses from their policies. This situation is analogous to the case of workers who have to accept a reduction in their wages in order to keep their jobs. Politicians have to convince citizens that their current well-being is no longer sustainable.

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Appendix 1

An illustration with a 2x2 pure exchange economy

Here, we present numerical simulations within a 2x2 pure exchange economy in which the economy is supposed to be composed by two consumers $j = 1, 2$ and two goods $i = 1, 2$. Consumers have the following utility function $U_j(x_j) = U_j(x_j^1, x_j^2) = \prod_i (x_j^i)^{\alpha_j^i}$ with $\alpha_j^1 + \alpha_j^2 = 1$ and they are endowed with the bundle of goods $\omega_j = \{\omega_j^1, \omega_j^2\}$. We also assume that there exists one unit of each type of good.

The following tables present, for a specific reference bundle, the effect of varying elasticities of the Cobb-Douglas utility function with respect to each good and the effect of varying the initial distribution of endowments, on the value of the distributable surplus expressed as the percentage of the total equilibrium value of income.

Firstly, we can see that the results are not affected by the choice of the reference bundle. Indeed, results are perfectly symmetrical when the reference bundle is $g = (0, 1)$ instead of $g = (1, 0)$. In addition, when we use income as *numéraire*, the results are qualitatively similar. It is possible to note that when the elasticity with respect to one good is exactly equal to the initial endowment in that good for any agent, then the distributable surplus, however measured, is nil as the initial distribution is already Pareto-optimal. Hence there is no incentives to trade (see for example Bewley, 2007, chapter 3). Moreover, the results show that the farther is the initial distribution from the Pareto-optimal allocation, the greater is the value of the distributable surplus that can be taxed by the government.

Table A.1: Distributable surplus (% of income) with reference bundle $g = (0, 1)$

		α_1^1				α_1^1				α_1^1		
α_2^1		**0.25**	**0.50**	**0.75**		**0.25**	**0.50**	**0.75**		**0.25**	**0.50**	**0.75**
	$\omega_2^1 = 0.25$, $\omega_1^2 = 0.75$				$\omega_2^1 = 0.25$, $\omega_2^1 = 0.50$				$\omega_2^1 = 0.25$, $\omega_2^1 = 0.25$			
0.25		9.93	2.97	0.00		2.61	0.00	2.74		0.00	2.39	8.50
0.50		23.99	12.50	2.91		11.48	3.33	0.00		2.46	0.00	2.45
0.75		30.58	20.04	8.64		17.99	9.57	2.37		6.89	2.22	0.00
	$\omega_2^1 = 0.50$, $\omega_1^2 = 0.75$				$\omega_2^1 = 0.50$, $\omega_2^1 = 0.50$				$\omega_2^1 = 0.50$, $\omega_2^1 = 0.25$			
0.25		2.48	0.00	2.66		0.00	3.29	11.09		2.48	11.24	21.26
0.50		11.24	3.33	0.00		3.29	0.00	3.21		0.00	3.33	10.99
0.75		21.26	10.99	2.50		11.09	3.21	0.00		2.66	0.00	2.50
	$\omega_2^1 = 0.75$, $\omega_1^2 = 0.75$				$\omega_2^1 = 0.75$, $\omega_2^1 = 0.50$				$\omega_2^1 = 0.75$, $\omega_2^1 = 0.25$			
0.25		0.00	2.46	6.89		2.61	11.48	17.99		9.93	23.99	30.58
0.50		2.39	0.00	2.22		0.00	3.33	9.57		2.97	12.50	20.04
0.75		8.50	2.45	0.00		2.74	0.00	2.37		0.00	2.91	8.64

Table A.2: Distributable surplus (% of income) with reference bundle $g = (1, 0)$

α_2^1		α_1^1 0.25	0.50	0.75		α_1^1 0.25	0.50	0.75		α_1^1 0.25	0.50	0.75
	$\omega_2^1 = 0.25$ $\omega_1^2 = 0.75$				$\omega_2^1 = 0.25$ $\omega_2^1 = 0.50$				$\omega_2^1 = 0.25$ $\omega_2^1 = 0.25$			
0.25		8.64	2.91	0.00		2.50	0.00	2.66		0.00	2.22	6.89
0.50		20.04	12.50	2.97		10.99	3.33	0.00		2.45	0.00	2.46
0.75		30.58	23.99	9.93		21.26	11.24	2.48		8.50	2.39	0.00
	$\omega_2^1 = 0.50$ $\omega_1^2 = 0.75$				$\omega_2^1 = 0.50$ $\omega_2^1 = 0.50$				$\omega_2^1 = 0.50$ $\omega_2^1 = 0.25$			
0.25		2.37	0.00	2.74		0.00	3.21	11.09		2.37	9.57	17.99
0.50		9.57	3.33	0.00		3.21	0.00	3.29		0.00	3.33	11.48
0.75		17.99	11.48	2.61		11.09	3.29	0.00		2.74	0.00	2.61
	$\omega_2^1 = 0.75$ $\omega_1^2 = 0.75$				$\omega_2^1 = 0.75$ $\omega_2^1 = 0.50$				$\omega_2^1 = 0.75$ $\omega_2^1 = 0.25$			
0.25		0.00	2.45	8.50		2.50	10.99	21.26		8.64	20.04	30.58
0.50		2.22	0.00	2.39		0.00	3.33	11.24		2.91	12.50	23.99
0.75		6.89	2.46	0.00		2.66	0.00	2.48		0.00	2.97	9.93

Table A.3: Boiteux' distributable income surplus

α_2^1		α_1^1 0.25	0.50	0.75		α_1^1 0.25	0.50	0.75		α_1^1 0.25	0.50	0.75
	$\omega_2^1 = 0.25$ $\omega_1^2 = 0.75$				$\omega_2^1 = 0.25$ $\omega_2^1 = 0.50$				$\omega_2^1 = 0.25$ $\omega_2^1 = 0.25$			
0.25		26.27	13.40	3.00		2.62	0.00	2.78		0.00	2.41	8.91
0.50		12.21	3.41	0.00		12.21	3.41	0.00		2.53	0.00	2.53
0.75		42.26	26.27	10.11		24.47	11.65	2.50		8.91	2.41	0.00
	$\omega_2^1 = 0.50$ $\omega_1^2 = 0.75$				$\omega_2^1 = 0.50$ $\omega_2^1 = 0.50$				$\omega_2^1 = 0.50$ $\omega_2^1 = 0.25$			
0.25		11.65	3.41	0.00		0.00	3.33	12.26		2.50	11.65	24.47
0.50		3.33	0.00	3.33		3.33	0.00	3.33		0.00	3.41	12.21
0.75		24.47	12.21	2.62		12.26	3.33	0.00		2.78	0.00	2.62
	$\omega_2^1 = 0.75$ $\omega_1^2 = 0.75$				$\omega_2^1 = 0.75$ $\omega_2^1 = 0.50$				$\omega_2^1 = 0.75$ $\omega_2^1 = 0.25$			
0.25		2.41	0.00	2.41		2.62	12.21	24.47		10.11	26.27	42.26
0.50		0.00	3.41	11.65		0.00	3.41	11.65		3.00	13.40	26.27
0.75		8.91	2.53	0.00		2.78	0.00	2.50		0.00	3.00	10.11

Appendix 2

Description of the CGE models

In this paper, we use a CGE model for each of the seven countries considered. Each CGE model is multisectoral[3] and considers a representative household. The models are calibrated using the 2005 input-output tables provided by OECD and other macro data concerning national accounts. In order to take into account the effects of the recent crisis on the possibility of surplus extraction, the CGE models are also calibrated using the 2009 data from national accounts and assuming the same structure for input-output.

Each sector produces one good using labor, capital and intermediate goods according to a two-stage CES production function. In the first stage, the production level depends on primary factors and total intermediate good and, in the second stage, the total intermediate good depends on the intermediate goods produced by the other sectors. The production is sold in the domestic market or exported, where exports depend on the relative foreign/domestic price. The production that is sold in the domestic market and the quantity imported are assumed to be imperfect substitutes according to the Armington assumption and constitute a composite good that is sold to the firms as intermediate good, to the representative household, to the government, or used as an investment good.

We consider one representative household who earns labor and capital incomes, transfers from the government and interests on the public debt, and pays direct taxes. We assume that an exogenous fraction of the disposable income is saved and the complementary fraction is consumed. The representative household maximizes his utility given a budget constraint by choosing the optimal quantity of goods demanded for each sector. We assume that the representative households has CES preferences

Concerning the budget constraint of the government, the difference between the total expenditure (for goods demanded, transfers to households and interests on the public debt) and the total revenue (direct and indirect taxation) determines the government deficit. We discuss the fiscal rule in the next section.

The equilibrium of the balance of payments is guaranteed by capital inflows or outflows that are endogenously determined while the exchange rate is exogenously fixed. In contrast, for the United Kingdom, capital inflows are fixed while the exchange rate is endogenously determined in order to equilibrate the balance of payments.

We use the neoclassical macro closure implying that investments are determined by aggregate savings, i.e. private and public savings and international capital flows.

We assume that all markets clear. For each sector, the domestic price adjusts in order to equalize the quantity produced and demanded (domestic and foreign). The real wage adjusts in order to equalize the total labor demanded by the sectors and the (exogenous) labor supplied by the representative household. Similarly, the real rate of capital remuneration adjusts in order to equalize the total capital demanded by the sectors and the (exogenous) capital supplied by the representative household.

The seven CGE models are solved separately by considering the producer price index as the *numeraire*.

[3] In our models we consider 16 sectors, reported in Table A.4.

Table A.4: List of the sectors in the CGE models

1	Agriculture
2	Food products
3	Textile
4	Oil and extraction industry
5	Mineral products
6	Metallurgy
7	Electric industry
8	Mechanic industry
9	Energy
10	Construction
11	Transports
12	Communications
13	Financial services
14	Non-financial services and R&D
15	Public administration
16	Other services

Fiscal rules

The government budget constraint can be written as:

$$D = G + \Gamma + r \cdot B - \left(\sum_i \tau_{VA_i} \cdot VA_i + \sum_i \tau_{prod_i} \cdot Y_i + \tau_Y \cdot Y \right)$$

where D represents public deficit, G total government expenditure for goods and services, Γ transfers to families, $r \cdot B$ interests paid on the public debt, τ_{VA_i} VAT rate differentiated by sector i, τ_{prod_i} tax rate on product i, and τ_Y income tax rate. The government can set any of the following variables (except one): the deficit, the total expenditure, the transfers to households, the income tax rate, the VAT rates and the tax rates on products. We do not consider as instruments transfers, VAT rates and tax rates on products and we consider the following five fiscal rules.

In the first fiscal rule, the government deficit and the income tax rate are exogenous and fixed at the initial level ($D = D_0$ and $\tau_Y = \tau_{Y_0}$), while the total government expenditure (G) is endogenously determined in order to satisfy the budget constraint.

In the second fiscal rule, the government deficit is exogenous and fixed at the initial level ($D = D_0$), the total government expenditure per worker is kept constant ($\frac{G}{L} = \alpha$) and the income tax rate (τ_Y) is endogenously determined in order to satisfy the budget constraint.

In the third fiscal rule, the ratio between the government deficit and GDP is fixed at the initial level ($\frac{D}{GDP} = \beta$), the income tax rate is exogenous ($\tau_Y = \tau_{Y_0}$) and the total government expenditure (G) is endogenously determined in order to satisfy the budget constraint.

In the fourth fiscal rule, the ratio between the government deficit and GDP is fixed at the initial level ($\frac{D}{GDP} = \beta$), the total government expenditure is exogenous ($G = G_0$) and the income tax rate (τ_Y) is endogenously determined in order to satisfy the budget constraint.

In the fifth fiscal rule, the total government expenditure and the income tax rate are exogenous ($G = G_0$ and $\tau_Y = \tau_{Y_0}$) and the government deficit (D) is endogenously determined in order to satisfy the budget constraint.

Reference bundle

In our analysis we consider two reference bundles. In the first case, we consider the equilibrium consumption bundle of the representative household. In the second case, we rather use the disposable income as the reference unit.