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AUSTERITY AND ASYMMETRIES IN THE FISCAL POLICIES OF THE EUROZONE*

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Abstract

In this paper, we analyse the effects on the economies of the European Union and the rest of the world, of several austerity policies implemented by the Southern European countries, i.e., Portugal, Italy, Greece, and Spain. In particular, we simulate the reduction in one point in the government deficit-to-GDP ratio in each of these countries, through several alternative policies, both from the spending side and the revenue side. The empirical methodology is based on a computable general equilibrium model, which incorporates the backward sectoral linkages and inter-country flows generated by fiscal consolidations. Our results show that these austerity policies were generally more painful, in terms of a fall in the levels of activity and a worsening in income distribution for labour, in the scenarios of tax increases rather than in those based on spending cuts. The effects on the rest of the European Union and the rest of the world were however mostly negligible.

Keywords: Computable general equilibrium, Austerity policies, Global economy, European Union

JEL classification: C68, H62, H20, H50

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1. Introduction

One of the main features of the current international economic environment is the high degree of economic integration, as a result of the so-called globalisation process. In such a context, assessing the extent of the economic interrelationships across countries, and especially those related to fiscal policy, becomes especially relevant. On the other hand, the implementation of the so called "austerity policies" in the European Union (EU) following the global financial crisis of 2008, allows us to obtain some important lessons as regards the future. In particular, the analysis of the differential effects across countries of such policies should be used to provide additional evidence on their results, in order to not making the same mistakes once the expansionary fiscal policies implemented to face the COVID-19 pandemic came to an end.

There are several empirical studies that examine whether fiscal policy measures implemented in a particular country may affect other neighbouring countries. Most of these studies, which make use of the VAR methodology, analyse the case of the euro area; see, e.g., Beetsma et al. (2006), Hebous and Zimmermann (2013), Dabla-Norris et al. (2017), or Alloza et al. (2019), although some of them deal with the OECD countries instead, like Auerbach and Gorodnichenko (2013a) or Goujard (2017). In general, the results of these studies show that fiscal policy measures have economically and statistically significant effects on the output levels of other countries. This literature has been recently surveyed in Ilori et al. (2022).

On the other hand, in response to the huge government deficits that appeared in most advanced countries as an aftermath to the global financial crisis, a series of fiscal consolidation measures, known as austerity policies, were adopted, in particular in the EU. The aim of such policies was reducing the size of government deficits and the subsequent debt accumulation, and ultimately recovering the confidence of financial markets and avoiding the risk of a sovereign default. The justification of such policies was indeed reinforced by the great influence, both in the media and some academic circles, of the literature on the "non-Keynesian" effects of fiscal policy, starting from the pioneering work of Giavazzi and Pagano (1990). According to these authors, contractionary fiscal policies would result into an expansionary effect on activity levels, due to the greater confidence of private economic agents on the solvency of the government, which would lead them to expect lower taxes in the future. Also, a related aspect has to do with the composition of fiscal policy measures, so that, in the case of a fiscal consolidation, reductions in public expenditure would be more effective than tax increases in order to stabilise the level of debt and avoid a recession, the opposite occurring in the case of a fiscal expansion; see, e.g., Alesina and Ardagna (2010) and Alesina et al. (2015).

The implementation of these austerity policies was already the subject of a strong controversy from the start; see Blyth (2013) for an exhaustive discussion of their theoretical foundations and their failed results in practice. In fact, the generality of these "non-Keynesian" effects of fiscal policy has been put more recently into question from various standpoints, including the empirical literature that identifies changes in fiscal policy aimed to reduce the budget deficit from historical documents (Romer and Romer, 2010; Guajardo et al., 2014); and the standard result in Keynesian economics that fiscal

policy multipliers would be larger in recessions, in a scenario characterised by a binding zero lower bound on interest rates (Auerbach and Gorodnichenko, 2013b). Accordingly, contractionary fiscal policies implemented during the crisis would have resulted into a permanent decline in output levels, as well as being unable to reduce debt-to-GDP ratios (Fatás and Summers, 2018).

In a recent paper, Bajo-Rubio and Gómez-Plana (2022) simulated, using a Computable General Equilibrium (CGE) model, the effects of three alternative austerity policies, namely, a decrease in the level of aggregate government spending, an increase in taxes on consumption, and an increase in taxes on labour; and examined their effects on the main macroeconomic variables of the EU, as well as in six other regions of the world economy, namely, United States, Japan, China, Asia-Pacific, Latin America and Rest of the World. The objective of the three simulations was getting a one percentage point reduction in the EU's government deficit-to-GDP ratio. Unlike the predictions of the "non-Keynesian" effects of fiscal policy, contractionary effects on the activity levels of the EU were found in all cases, and these effects were accompanied with a worsening in the distribution of income for labour. The less unfavourable effects appeared in the case of a decrease in the level of aggregate government spending, followed by the cases of an increase in consumption taxes, and an increase in labour taxes. In turn, the effects on the other regions of the world economy were quantitatively very small.

In this paper, we will try to go more deeply into the results of our previous work, and using an updated database, through the quantification of the effects of some different austerity policies implemented by Southern European countries, namely, Portugal, Italy, Greece and Spain (i.e., the so called PIGS in the Anglo Saxon jargon), both on their economies and on the rest of the eurozone and the EU, as well as on the rest of the world. The interest of specifically analysing the Southern European countries lies on the fact that these were the countries which applied some more intense adjustment measures following the so-called sovereign debt crisis after 2010, as a consequence of the global financial crisis that started in 2008. An extension with respect to our previous paper is that, following Bajo-Rubio and Gómez-Plana (2015), we simulate a decrease, not in aggregate public spending, but separately in their three main components, namely, Health and social services, Education, and Other government services, which can provide some additional insights on the general equilibrium effects of spending-based austerity policies.

On the other hand, the interest of analysing this topic is not limited to past events. The COVID-19 pandemic has led again to strongly increase the magnitude of the government deficit and debt-to-GDP ratios across the world. Although the low levels of real interest rates make easier the financing of those deficits, recent inflation pressures introduce a high degree of uncertainty into the next future trends, so sooner or later some fiscal consolidation measures should be implemented. In addition, there are some other long-term facts that put pressure on public finances (see, e.g., Rawdanowicz et al., 2021 or Boone et al., 2022), such as the ageing of populations and the subsequent rising public expenditure in pensions, health and long-term care; the transition to a low-carbon economy, with additional expenditures on investment in clean energy infrastructure and

subsidies; the recent productivity slowdown; the rising of income and wealth inequalities; the after-effects of digitalization; and so on.

Accordingly, we will analyse in this paper the effects of several austerity policies implemented by Southern European countries in response to high government deficits, both on their economies and on the rest of the eurozone and the EU, as well as on the rest of the world. Two are the main differences as regards the papers mentioned in the first paragraph. On the one hand, the empirical methodology will be based on a CGE model, through an extension of the Global Trade Analysis Project (GTAP) model; see the next section for details. On the other hand, the model is designed on a multi-country basis for the whole world economy, so that we can analyse the effects of the proposed policy measure, not only on the economies under study, but also on a series of regions of the world economy.

The rest of the paper is organised as follows. A description of the model is provided in Section 2. The data and calibration process are discussed in Section 3. The results from the simulations are presented in Section 4. Section 5 concludes.

2. The model

The empirical methodology will be based on a CGE model; an extensive presentation of this methodology can be found, e.g., in Burfisher (2021). Some limitations of the CGE modelling have been discussed in the literature, and among them we can mention the deterministic nature of the calibration of the behavioural functions, the frequent lack of estimated elasticities for the simulations, the sometimes obscure source of the general equilibrium results, or the absence of a monetary side in the Walrasian framework; see Burfisher (2021) for a detailed review. However, the advantage of such methodology lies in allowing to obtain the consequences of a change in a particular variable on the whole economy under analysis, as well as the specific effects on the different productive sectors. Hence, the potential of CGE models lies in their ability to integrate both micro and macroeconomic elements (Devarajan and Robinson, 2005).

The system of equations of the model and the data reproduces a general equilibrium, which is presented as a mixed complementarity problem; see Mathiesen (1985) and Gómez-Plana (1999). The equilibrium of this system of equations is defined by a set of prices and quantities such that:

- Firms have zero profits.
- All markets for goods, services and factors are balanced, except for the labour market where unemployment is allowed; this implies that the equilibrium cannot be considered as a long-run equilibrium but a short and medium-run equilibrium.
- Income equals expenditure for all agents.
- Several macroeconomic closure rules are incorporated, such as the equality between savings and investment, and the possibility of a trade deficit or surplus at the level of each country is considered; once again, this implies that the equilibrium cannot be considered as a long-run equilibrium but a short and medium-run equilibrium.

The model has been developed in GAMS/MPSGE, where GAMS (General Algebraic Modeling System) is a software used for mathematical programming and optimisation,

and MPSGE (Mathematical Programming System for General Equilibrium) is a complementary software to GAMS for the specific resolution of CGE models based on the Arrow-Debreu general equilibrium framework. In Rutherford (1999) or Gómez-Plana (1999) the main features of MPSGE are explained in detail.

The model is an extension of the model developed by Lanz and Rutherford (2016), called GTAP9inGAMS. Our model extends it in the following aspects:

- The original model includes a representative agent for each region or country considered. In our model, this agent has been divided into two, i.e., a private representative agent and a public representative agent. This has involved the modelling of additional equations to the model, both on the demand side, as well as in the macroeconomic closure, and fiscal aspects. The flows of taxes and transfers between agents have been included.
- Both public spending and public saving are endogenized for some simulations. Note that the objective of some of the proposed simulations implies the modification of public spending and tax rates, which implies not limiting the model to exogenous public spending and saving as in the model of Lanz and Rutherford (2016).
- There is unemployment in national labour markets, which means abandoning the perfect competition framework of the original model. This extension seems plausible given the high levels of unemployment suffered by the countries in which the austerity policies will be simulated.
- The trade balance of each country or region is endogenous. This extension enables the transmission of the internal effects in the countries in which the austerity policies are applied to the rest of countries or regions. Therefore, the interactions among the countries in which the austerity policies are simulated are also included. Note, for example, that, in the case of Spain, trade exchanges in 2021 with Italy and Portugal meant that these countries were, respectively, her 3rd and 4th largest export markets (8.4% and 7.9% of total exports, respectively), and her 4th and 7th import markets (6.6% and 4% of total imports, respectively), according to data from the Spanish Secretariat of State for Trade (Secretaría de Estado de Comercio, 2022).

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.

2.1. Production

Each sector in each country or region has a nested production function. Specifically, each unit of output in a particular sector uses, in a first nesting level, intermediate inputs from all sectors of activity and a composite of value added. Additionally, some sectors (i.e., Agricultural products and Other industry) also use land as a factor of production. The Leontief structure used in this first nest means the elasticity of substitution across inputs is zero. In addition, there is a second nesting level for each intermediate input and for the composite of value added. Each intermediate input has a domestic and/or an imported origin, under a CES structure determined by sectoral Armington elasticities.

The aggregate of value added shows a positive elasticity of substitution between labour and capital, with a CES elasticity of substitution different for each sector.

The production functions exhibit constant returns to scale, except for the two sectors that use land, which is modelled as a specific factor.

The producers' optimisation problem consists of maximising profits subject to technological constraints (i.e., the production functions). The demand functions for each intermediate input and primary factor are derived from these optimisation problems. These demand functions are used in the equations that define the market equilibrium between supply and demand in the goods and factor markets.

2.2. Demand

Each country or region has a private representative agent and a public agent.

The private representative agent[1] has a welfare function defined over goods and services. This welfare or utility function has a single nesting level defined as a Cobb-Douglas function over all the goods and services. Their optimisation problem consists of maximising welfare, subject to the budget constraint, given by the income from the production factors they own, and the net balance of taxes and transfers with the public sector and other countries and regions.

Regarding the public agent, it behaves as a buyer of a Leontief composite of goods including different items of public spending such as health, social services, education, general expenses of the public administrations, defence, etc. This expenditure is financed through the revenue obtained from tax collection and the net balance of transfers of the agent with the other national and foreign agents. Taxes (modelled as ad valorem rates) include taxes on factors' income, indirect taxes on consumption, tariffs, and subsidies.

2.3. Foreign sector

All the countries and regions are open economies, with endogenous volumes of imports and exports. Furthermore, the model allows for the possibility of non-zero trade balances at the national level. Such an assumption means that the equilibrium in the model cannot be interpreted as a long-term equilibrium.

Goods and services present differentiation at the country level, which implies that consumers perceive the goods and services of the same sector as imperfect substitutes between them, following Armington's (1969) assumption, with a degree of substitution determined by Armington elasticities, different for each sector. Sectors that produce

[1] Notice that in some single-country analyses of fiscal reforms using CGE models a typology of households has been introduced, which allows to see their effects on income distribution. However, in a multi-country framework such as the one adopted in this paper, with a focus on the potential inter-country links of austerity policies, it is very problematic to have a homogeneous typology, and the associated data, for each country. Accordingly, we will analyse the effects on inequality by focusing on the different evolution of the incomes of labour versus capital; see Section 4 below.

more internationally homogeneous goods and services (e.g., primary products) tend to have higher substitution elasticities than those sectors producing more heterogeneous goods and services, such as many manufacturing industries. This assumption makes possible to model both inter-industry trade and intra-industry trade.

2.4. Factor markets

There are three primary factors in the model, i.e., labour, capital, and land. All the factors are owned by each national private representative agent, and factor endowments are fixed amounts. All factors are immobile at the international level but labour and capital are mobile across national sectors, and land is a specific factor for the sectors Agricultural products and Other industries.

Labour demand has been described in the subsection on Production. With respect to labour supply, we consider the possibility of endogenous unemployment. Hence, the level of employment becomes an endogenous variable, given the endowment or fixed supply of labour available in each country. In addition, we add as a restriction the wage curve, which relates the unemployment rate to the real wage (see Blanchflower and Oswald, 1994). This relationship makes possible to model different degrees of wage rigidity.

Capital and land supplies are rigid and equal to the endowment of each factor in each economy. In these two factor markets, factor incomes adjust so that their markets clear in equilibrium.

2.5. Macroeconomic closure equations

The model incorporates the usual macroeconomic accounting identities. Total savings in each country include savings of the private representative agent, the public agent, and foreign savings. Total savings are equal to the total investment of the economy in equilibrium. In turn, total investment in the economy is made up of the gross capital formation of all sectors of activity, which are grouped around a Leontief-type aggregate. On the other hand, the level of foreign savings is linked to the endogenous trade balance, explained in the subsection on Foreign sector.

3. Data and calibration

As mentioned in the introduction, our empirical methodology is based on a CGE model, through an extension of the GTAP model. GTAP is a network of university researchers, research centres and private and public institutions, which use the GTAP database for multi-country quantitative analyses of the general equilibrium effects of shocks or public policies, among other aspects. It is a global database built from National Accounts, Input-Output Tables, and bilateral trade flows. GTAP is coordinated by a team based on the Department of Agricultural Economics at Purdue University, West Lafayette, Indiana, United States.

The model used in the empirical analysis has been calibrated using the GTAP 10 Data Base (Aguiar et al., 2019), taking the year 2014 as benchmark. The model has been built for 17 productive sectors (namely, Agricultural products, Chemical industry, Machinery and equipment, Electronic equipment, Motor vehicles, Other transport equipment,

Other industry, Construction, Trade and hostelry, Transport and communications, Financial intermediation, Other business services, Recreational services, Education, Health and social services, Other government services, and Other services), a private representative consumer and a public sector for each region, and three primary productive factors (namely, labour, capital, and land). We will present the results of the simulations for the four countries analysed, i.e., Greece, Italy, Portugal, and Spain, as well as for the rest of the eurozone, the rest of the EU and the rest of the world.

We present the definition of sectors in Table 1. The sectors are classified according to their labour intensity in the countries analysed. This classification becomes relevant for the explanation of the results given that most of the simulated shocks are directly or indirectly related to labour (e.g., increases in taxes on labour and cuts in public consumption of labour-intensive services sectors such as health, education, and public administration). We define sectoral factor intensities according to their capital-to-labour ratio, where both factors are measured using the Social Accounting Matrix data of compensation of employees and gross operating surplus (Aguiar et al., 2019), with their prices normalised. This practice was first introduced by Harberger (1964), and is now widely used in general equilibrium analysis; see Burfisher (2021, pp. 51-53) for an explanation. The table presents the sectors ordered by labour intensity from the highest to the lowest. We denote as "labour-intensive sectors" the eight out of seventeen sectors with the lowest capital-to-labour ratios, and as "capital-intensive sectors" the remaining nine sectors with the highest capital-to-labour ratios. Note that each country has different sectoral capital-to-labour ratios, which allows to generate different results from the same simulated fiscal policies. Nevertheless, Greece, Italy, Portugal, and Spain have five out of eight sectors that are labour intensive for all of them, i.e., Education, Health and social services, Motor vehicles, Other transport equipment, and Agricultural products. In turn, Other government services and Recreational services are labour intensive for Italy, Portugal, and Spain; Machinery and equipment is labour intensive for Greece, Italy, and Spain; Construction is labour intensive for Portugal; and Electronic equipment and Financial intermediation are labour intensive for Greece.

< Insert Table 1 here >

A relevant extension of our model is the modelling of the public sector. Hence, some additional information needs to be incorporated to the model, although many variables for the public sector are or can be derived from GTAP 10 (e.g., regional public savings have been estimated as the difference between tax revenue and public expenditure). The shares of public gross capital formation on total gross capital formation have been estimated with data from European Commission (2022a) and United Nations (2015), with the exchange rates taken from International Monetary Fund (2022) (at 30 December 2014).

As mentioned before, our simulations will consist of both increasing tax rates and decreasing government spending. Regarding tax rates, we will focus on consumption and labour taxes, which are the most significant in the EU in terms of public revenue, accounting in last years for around 27% and 54%, respectively, of the total EU-27 tax

revenue; see European Commission (2022b). The effective tax rates across the different sectors are shown in Table 2.

< Insert Table 2 here >

Another relevant point is the weight of the different public consumption categories on aggregate public consumption. As explained in detail in the next section, we separate the public expenditure into their three more relevant components of public consumption, namely, Health and social services, Education, and Other government services. According to GTAP 10 Data Base, the shares of the three components on total public consumption are very similar in the three countries. In particular, these shares are 34, 14 and 35% in Greece; 36, 15 and 37% in Italy; 36, 14 and 37% in Portugal; and 33, 14, and 34% in Spain, for Health and social services, Education, and Other government services, respectively.

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 Dawkins et al. (2001). The benchmark values for the elasticities appearing in the different equations of the model are those of the GTAP 10 Data Base. The elasticity of the real wage with respect to the unemployment rate has been fixed as −0.1, a standard value from the wage curve literature (e.g., Blanchflower and Oswald, 1995).

Finally, data for some regional variables, taken from other sources, were also needed; see Bajo-Rubio and Gómez-Plana (2022) for more details. In particular, regional unemployment rates have been estimated using the labour force and the total unemployment for each country or region, with the data coming from World Bank (2014).

4. Simulation results

We have simulated a reduction of one percentage point in the government deficit-to-GDP ratio in Greece, Italy, Portugal, and Spain. The simulations include five different fiscal policies to reach this objective where two of them involve changes in public revenue while keeping constant the level of public expenditure:

A) An increase in the effective tax rates on final consumption
B) An increase in the effective tax rates on labour (including social contributions)

and the other three involve changes in public expenditure while keeping constant all the effective tax rates:

C) A decrease in the level of public consumption in Health and social services
D) A decrease in the level of public consumption in Education
E) A decrease in the level of public consumption in Other government services, where Other government services include Public administration and defence; compulsory social security, and Activities of extra-territorial organizations and bodies (i.e., Divisions 84 and 99 of the International Standard Industrial Classification, Revision 4).

Each simulation is applied simultaneously in Greece, Italy, Portugal, and Spain; and their results are shown for each country taken individually, as well as for the rest of the eurozone (Rest of EZ), the rest of the EU (Rest of EU) and the rest of the world (ROW).

In Table 3 we show the results of the simulations on the main macroeconomic variables, including the levels of GDP (at factor cost) and employment, the unemployment rate, the ratio real wage rate/real capital rent, the compensation of employees, the gross operating surplus, the trade balance as a ratio to GDP, as well as the levels of public expenditure and public revenue. The figures represent the counterfactual changes in those variables measured in percentage with respect to the benchmark equilibrium; except for the unemployment rate and the trade balance to GDP ratio, where changes are expressed as percentage points (p.p.). The *numeraire* is the consumer price index of the ROW region. A particularly interesting feature of our results is the emphasis on the variables compensation of employees and gross operating surplus, which proxy the shares of labour and capital on total income, i.e., the functional distribution of income. The analysis of distributional issues has been usually neglected in empirical assessments of austerity policies; some exceptions in a single-country framework are Jensen and Rutherford (2002), Bajo-Rubio and Gómez-Plana (2015) or, more recently, Campoy-Muñoz et al. (2022).

< Insert Table 3 here >

We start with the discussion of the results of tax increases (parts A and B of Table 1). In both cases, a contractionary effect on GDP appears in the four involved countries, ranging between 0.48% for Greece and 0.27% for Italy in the case of rising consumption taxes, and between 1.14% for Greece and 0.65% for Spain, in the case of rising labour taxes. In a similar vein, employment would decrease, with the unemployment rate increasing up to one point in Greece, and around half a point in the other three countries in the case of rising consumption taxes; and one point and a half in Greece, around one point in Italy and Portugal, and 0.6 points in Spain, in the case of rising labour taxes. The greatest contractionary effects on the levels of activity appear in Greece, and following an increase in labour taxes.

On the other hand, the ratio real wage/real capital rent rises when increasing consumption taxes, but falls when increasing labour taxes. In addition, both the compensation of employees[2] and gross operating surplus would fall, although more strongly in the first case, which implies a worsening in income distribution for workers in relation to the capital owners. As before, this effect is stronger in Greece, and in the case of rising labour taxes. In turn, the effects on the trade balance are quite small; if any, we can just report a little worsening in Greece, especially in the second simulation. It can also be seen in the table that, in order to reduce in one point the government deficit-GDP ratio without changing the level of expenditure, a greater increase in public

[2] Notice that, in the case of rising consumption taxes, this happens despite the increase in the ratio real wage/real capital rent, as can be seen in the table. Higher consumption taxes actually lower the real wage net of taxes, which decreases labour supply, and the resulting excess demand leads to a rise in wages. However, the larger fall in employment more than offsets this increase in real wages.

revenue is required in general when rising consumption taxes. Finally, the previous effects might be transmitted on the rest of the world via trade flows, even though the changes in GDP and the other macroeconomic variables of the rest of world regions (i.e., Rest of EZ, Rest of EU and ROW) seem to be almost nil.

Turning to the results of the simulations of spending cuts (parts C, D and E of Table 1), GDP also falls in all cases: 0.3% in Greece and around 0.2% in the other countries, when cutting spending in Health and social services; 0.5% in Greece and Spain and somewhat less in the other countries when cutting spending in Education; and around 0.2% in all countries when cutting spending in Other government services. Similarly, employment falls, and the unemployment rate rises up to 0.6, 0.8 and 0.2 points for Greece in each scenario, and somewhat less for the other countries. As with tax increases, the most unfavourable results are those for Greece. In general, however, the effects are quantitatively lower in the case of spending cuts as compared to tax increases, except for cuts in Education, where the effects are comparable.

Now, the ratio real wage/real capital rent decreases unambiguously in all cases. Moreover, the compensation of employees falls and the gross operating surplus rises (except when cutting spending in Other government services), leading again to a worsening in income distribution for workers, especially in the case of cutting spending in Education, and, to a lower extent, in Health and social services, although not too different across countries. As before, the effects on the trade balance are quite small, again with the only exception of Greece, which experiences a slight negative effect in all cases. Now, the required reduction in the level of expenditure to decrease in one point the government deficit-GDP ratio without changing the tax rates, is similar in the three cases. Again, the changes in GDP and the other macroeconomic variables in the rest of world regions would be very small.

Next, we will discuss the results of the above simulations at the sectoral level. In Tables 4, 5 and 6 we present the effects of our five simulated policies on sectoral prices, output, and employment, according to the classification shown in Table 1.

< Insert Table 4 here >
< Insert Table 5 here >
< Insert Table 6 here >

Starting with the simulations based on tax increases, when raising consumption taxes the changes in sectoral prices of goods are relatively small, both in absolute and relative terms across sectors, as can be seen in part A of Table 4. Within this limited and small overall effect, changes in prices in labour-intensive sectors are more inflationary (or less deflationary) than those in capital-intensive sectors, due to the relative increase in real wages with respect to real capital rents, which tends to make labour-intensive goods more expensive in relation to the capital-intensive ones. On the other hand, as can be seen in Table 2, in all four countries the effective tax rates on labour are almost identical at sectoral level apart from Agricultural products, where the rates are significantly lower. So, when raising labour taxes labour-intensive sectors are, in general, those with the

highest price increases or smallest price decreases (see part B of Table 4), except for Agricultural products, with a lower tax burden on labour.

Turning to sectoral output (see parts A and B of Table 5), there are three main factors affecting the evolution of sectoral output, namely, the prices of goods, the consumption tax rates, and the sectoral capacity to attract capital, even though the most important is the first one. Thus, those sectors with the highest relative increases in prices are having a greater negative effect on the quantity produced due to the decrease in demand; this is the case, e.g., of Other government services, Health and social services, Education, and Recreational services. Such an effect, however, can be offset to some extent by the benchmark level of the effective tax rate on consumption for both domestically produced and imported goods (see Table 2), as well as the capacity to attract capital of some sectors such as Construction, Other transport equipment, Machinery and equipment, Electronic equipment, and Motor vehicles. Finally, the results for sectoral employment (see parts A and B of Table 6) are roughly similar to those for sectoral output.

Regarding the simulations based on spending cuts (see parts C, D and E of Tables 4, 5 and 6), the factors determining the changes at sectoral level are quite different from the simulations based on tax increases. Now the main factor is the fall in the demand for the main components of public consumption. Since the three sectors (i.e., Health and social services, Education, and Other government services) are labour-intensive, the lower activity in these sectors releases some amounts of labour that have a positive effect on the activity levels of labour-intensive sectors such as Construction, Other transport equipment, Machinery and equipment, and Motor vehicles. Also, since the main sources of intermediate inputs for these government sectors in which spending is reduced, suffer a decrease in their demand, the changes in prices, output and employment are smaller than in the rest of the sectors; this is the case of Trade and hostelry, Transport and communications, Other business services, and Other services.

To conclude, we have performed a sensitivity analysis of the above results. A selection of results is shown in Table 7, including all the scenarios and some macroeconomic variables such as GDP, employment, compensation of employees, gross operating surplus, and total public expenditure and revenue for Greece, i.e., the country the most unfavourably affected; as well as GDP for the remaining countries and regions. In particular, we have changed the values of the most relevant elasticities appearing in the model, which are alternatively halved and doubled. In addition, the final two lines in each part of Table 7 include a simple systematic sensitivity analysis where all the previous elasticities have been simultaneously halved and doubled. The full sensitivity analysis for all microeconomic and macroeconomic variables is available from the authors upon request.

< Insert Table 7 here >

All results are robust in sign for changes in GDP. For the remaining macroeconomic variables in the case of Greece, the results are robust in sign except for:

(i) The gross operating surplus in the scenario of a decrease in public consumption in Health and social services, where the counterfactual result of the main simulation is very close to zero (i.e.,−0.022%). However, when performing the sensitivity analysis, this also results in figures that are close to zero, and sometimes positive.

(ii) The same variable in the scenario of a decrease in public consumption in Education, for the same reasons.

(iii) The public revenue in the scenario of an increase in labour taxes, for the elasticity of substitution between labour and capital. Notice that it is usual to assume that, if there is a low substitution between capital and labour, if taxes on labour increase, this low substitution means that firms continue to hire a large share of workers, which results in a higher public revenue.

(iv) Finally, when all elasticities are changed simultaneously, this happens again for the gross operating surplus in the scenarios of decreases in spending in Health and social services and in Education, where the counterfactual values were very close to zero (−0.022 and 0.002%, respectively); and for the public revenue in four of the scenarios (the exception being the case of an increase in consumption taxes), even though with absolute values close to zero.

The elasticities of substitution related to trade with the rest of countries and regions are those more affecting the results. This influence should be expected since trade flows are the main transmission channel of the shocks from one country (Greece, in this case) to the rest of countries and regions.

5. Conclusions

We have analysed in this paper the effects of several austerity policies implemented by Southern European countries (i.e., Greece, Italy, Portugal, and Spain), in response to high government deficits, both on their economies and on the rest of the eurozone and the EU, as well as on the rest of the world. The empirical methodology was based on a CGE model, through an extension of the GTAP model, designed on a multi-country basis for the whole world economy. The last feature means that we can analyse the effects of each proposed policy measure, not only on the economies under study, but also on a series of regions of the world economy.

In particular, we have simulated a simultaneous reduction of one percentage point in the government deficit-to-GDP ratio in Greece, Italy, Portugal, and Spain. The simulations have included five different fiscal policy measures to reach this objective, namely, an increase in the effective tax rates on final consumption, an increase in the effective tax rates on labour (including social contributions), a decrease in the level of public consumption in the sector Health and social services, a decrease in the level of public consumption in the sector Education, and a decrease in the level of public consumption in the sector Other government services.

Note that a decrease in many categories of public consumption may be linked to a decrease in the wellbeing of the population. Since, in our simulations, all the shocks involved a decrease in GDP, we can mention here a recent paper by Patiño et al. (2022), who showed that a fall in economic activity had a clear negative effect on the subjective

wellbeing of the population. Obviously, the optimal cut in public consumption in welfare terms should be the reduction of non-essential and less efficient public spending, but in many cases the austerity policies have involved cuts in services that can be assumed as essential. This is turn has resulted in strong distributional problems that have jeopardised the social acceptability of these policies, and not only in the short run (Grüner, 2013). For all these reasons, knowing the general equilibrium linkages of such austerity policies should be very relevant; see International Monetary Fund (2012, p. 18) for a table summarising the different austerity policies implemented in a wide set of advanced and emerging economies in the first 2010s.

The main conclusions from our simulations are as follows:

- These austerity policies had non-negligible unfavourable effects in terms of GDP, employment, and unemployment rate, in all the countries analysed. The largest negative affects appeared in the case of an increase in labour taxes, followed by an increase in consumption taxes, a decrease in public spending in Education, a decrease in public spending in Health and social services, and a decrease in public spending in Other government services.
- Turning to particular countries, Greece experienced in general the most unfavourable effects in all cases. The results for the other three countries were roughly similar.
- Even though our results on changes in income distribution are not directly comparable with the literature on austerity and inequality[3], we obtained some relevant insights on the relative position of labour and capital. In particular, the ratio of the real wage to the real capital rate fell in all scenarios, except for the case of an increase in consumption taxes; and, even more importantly, the comparative evolution of the compensation of employees and gross operation surplus showed that the distribution of income worsened unambiguously for labour, in all four countries and for all scenarios, especially under the tax-based policies.
- The effects on the trade balance were quite small, and even negative in most cases, especially for Greece. Recall that one of the objectives of austerity policies in the "peripheral" Southern European countries members of the euro area was improving their trade balance by reaching a higher competitiveness, given their impossibility of devaluating within the euro (i.e., the strategy called "internal devaluation"). However, in Bajo-Rubio et al. (2016), it was shown that demand seemed to be more relevant than price competitiveness when explaining the evolution of the trade balance of the countries of Southern Europe.
- On the other hand, the spillover effects on the rest of the eurozone and the rest of the EU, as well on the rest of the world, seemed to be very low.
- Regarding the effects across sectors, they were driven by the changes in the prices of goods and the sectoral capacity to attract capital, in the two simulations involving an increase in taxes; and by the effects of backward linkages for the main categories of public expenditure, in the three simulations involving a

[3] This literature tends to analyse the problem at household and cohort level, instead of using a national representative consumer as in our model; see Heimberger (2020, pp. 54-61) for an overview of some recent research on the effects of austerity policies on inequality and income distribution.

decrease in public expenditure. Overall, some sectors such as Machinery and equipment, Other transport equipment, and Construction, experienced a rise in output in all the simulations. In turn, output fell in the three government sectors (i.e., Education, Health and social services, and Other government services) in the simulations involving tax increases; and only (and very strongly) in the concerned sector (i.e., either Education, Health and social services, or Other government services), unlike the other two, in the simulations involving spending cuts. In general, the results for sectoral employment were roughly similar to those for sectoral output. Again, the sectoral effects on the rest of regions of the world economy were mostly negligible, except for the case of tradable manufactures that experienced some quantitative effects in the rest of the eurozone and the EU.

- Finally, we performed a sensitivity analysis of the results, which proved to be essentially robust.

If we compare the results of this paper with those of Bajo-Rubio and Gómez-Plana (2022), we can see that:

- The disaggregation of the EU shows that the same austerity policies have asymmetrical effects at the national level. Specifically, Greece seems to be the country suffering the stronger effects, unlike Italy where the effects on variables such as GDP or employment seem to be milder. Nevertheless, the negative distributional effects on labour are normally stronger for Italy than for the rest of the countries.
- Another relevant extension refers to the differentiation among public spending categories when performing the simulations. In particular, both the contractionary macroeconomic effects and the redistribution pattern against labour, are stronger when cutting public spending in Education, being both effects milder when cutting public spending in Other government services; while the size of the effects of cuts in Health and social services is somewhat in the middle.
- Also, the changes in sectoral output and employment show a wider sectoral variance when spending cuts are separated into different categories as regards the case of a cut in aggregate public expenditure. In fact, the greater the labour intensity of the targeted category of spending, the larger the negative effect on output and employment.

Summarising, we have found that, contrary to the predictions of the “non-Keynesian” effects of fiscal policy, all these policy measures characterised as “austerity policies” would have led to contractionary effects on the levels of activity of the Southern European countries, which came in all cases accompanied by a change in income distribution that was detrimental to labour. Such effects, on the other hand, were the most unfavourable in the case of Greece, and relatively similar for the other three countries.

In addition, the spillover effects of these policies on the rest of the world were found to be quantitatively very small. This kind of result, on the other hand, was also found in Bajo-Rubio and Gómez-Plana (2022), who applied the same fiscal policy measures to the

whole EU, or in some recent studies on the impact of Brexit using the same methodology (e.g., Latorre et al., 2020). This result can be rationalised in terms of the existence of a home bias in international trade, i.e., when domestic consumers have a greater preference for domestic, rather than foreign, goods; an aspect emphasised by Obstfeld and Rogoff (2000).

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Appendix

This Appendix presents the full set of equations and the definition of all the variables and parameters which enter the model, listed in Tables A.1 and A.2 at the end of the Appendix. Endogenous variables are indicated by capital letters, exogenous variables by capital letters with a bar, and, finally, parameters by small Greek and Latin letters. There are 17 (*i,j* = 1,...,17) industries (and goods). The model represents the world economy made up of 7 regions and countries (*r,s* = 1,…,7). The model includes three productive factors, namely, labour, capital, and land. Land is treated as a specific factor. We present now in detail the full set of equations of the model.

Production

The supply side of the model is represented by firms applying competitive pricing rules, with technologies characterised by constant returns to scale. The production function of good *i* in country/region *r* is given by the nested composite:

$$Y_{ir} = min\left(II_r^i, VA_r^i\right)$$

where:

$$VA_r^i = \left(\sum_f \theta_{ir}^f \left(Q_{ir}^{pf}\right)^{1-\sigma_i^{VA}}\right)^{\frac{1}{1-\sigma_i^{VA}}}$$

$$II_r^i = min(II_{i1r}, \dots, II_{i17r})$$

$$II_{ijr} = \left(\theta_{ijr}^d \left(II_{ijr}^Y\right)^{1-\sigma_i^d} + \left(1-\theta_{ijr}^d\right)\left(II_{ijr}^m\right)^{1-\sigma_i^d}\right)^{\frac{1}{1-\sigma_i^d}}$$

The highest nest has a Leontief structure, so the zero-profit condition for sector *i* in country *r* is:

$$PROFIT_{ir}^Y = P_{ir}^Y\left(1-t_{ir}^O\right) - \theta_f P_{ir}^f - \sum_{j=1}^{17} \theta_j P_{jr}^i = 0$$

The second level nest is a CES function which corresponds to the unit cost of the aggregated value added produced by industry *i* in country *r*:

$$P_{ir}^f = \left(\sum_f \theta_{ir}^f \left(P_{ir}^{pf}\right)^{1-\sigma_i^{VA}}\right)^{\frac{1}{1-\sigma_i^{VA}}} \quad P_{ir}^{pf} = \begin{cases} P_r^F\left(1+t_{ir}^F\right) \\ P_r^S\left(1+t_{ir}^S\right) \end{cases}$$

where *F* denote the factors labour and capital, and *S* the specific factor, i.e., land.

The previous equation $PROFIT_{ir}^Y$ also includes another nest for the intermediate input price:

$$P_{jr}^i = \left(\theta_{ijr}^d \left(1+t_{ijr}^{fd}\right)^{1-\sigma_i^d} \left(P_{jr}^Y\right)^{1-\sigma_i^d} + \left(1-\theta_{ijr}^d\right)\left(1+t_{ijr}^{fm}\right)^{1-\sigma_i^d} \left(P_{jr}^m\right)^{1-\sigma_i^d}\right)^{\frac{1}{1-\sigma_i^d}}$$

At this nesting level, the intermediate input prices have national and imported components.

Shephard's lemma is applied to the above cost functions to get the demands for factors and intermediate inputs.

Equilibrium involves the clearing of both factor and goods markets, assuming unemployment in the labour market. The factor and goods demands estimated in the previous step are used to define the following market clearing conditions:

$$\sum_{i=1}^{17}\left(Y_{ir}\left(\frac{\partial PROFIT_{ir}^{Y}}{\partial P_r^{labour}}\right)\right) = \overline{EVOM_r^{labour}}(1-U_r)$$

$$\sum_{i=1,7}\left(Y_{ir}\left(\frac{\partial PROFIT_{ir}^{Y}}{\partial P_r^{S}}\right)\right) = \overline{EVOM_r^{S}}$$

$$Y_{ir}\left(\frac{\partial PROFIT_{ir}^{Y}}{\partial P_{jr}^{Y}}\right) = II_{ijr}^{Y}$$

$$Y_{ir}\left(\frac{\partial PROFIT_{ir}^{Y}}{\partial P_{jr}^{m}}\right) = II_{ijr}^{m}$$

where the four conditions above represent labour market clearing, equilibrium in the capital market, equilibrium for domestic intermediate inputs, and equilibrium for imported intermediate inputs, respectively.

Finally, the equilibrium conditions for good *i* and region *r*, are:

$$C_{ir}^{C} + G_{ir}^{G} + I_{ir}^{I} + \sum_{j=1}^{17} II_{ijr}^{Y} + \sum_{s=1}^{7} EXP_{irs} - IMP_{ir} = Y_{ir}$$

where:

$$C_{ir}^{C} = C_{ir}^{Cd} + C_{ir}^{Cm}$$
$$G_{ir}^{G} = G_{ir}^{Gd} + G_{ir}^{Gm}$$
$$I_{ir}^{I} = I_{ir}^{Id} + I_{ir}^{Im}$$
$$IMP_{ir} = C_{ir}^{Cm} + G_{ir}^{Gm} + I_{ir}^{Im} + \sum_{j=1}^{17} II_{ijr}^{m}$$

Consumption

Each region has a private representative consumer who maximises a nested welfare function defined over national and imported consumed goods subject to a budget constraint. This optimisation problem is defined as:

$$C_r^{priv} = \prod_{i=1}^{17}\left(C_{ir}^{C}\right)^{\theta_{ir}^{C}}$$

where:

$$C_{ir}^{C} = \left(\theta_{ir}^{C}\left(C_{ir}^{Cd}\right)^{1-\sigma_i^d} + \left(1-\theta_{ir}^{C}\right)\left(C_{ir}^{Cm}\right)^{1-\sigma_i^d}\right)^{\frac{1}{1-\sigma_i^d}}$$

subject to the budget constraint:

$$INCOME_r^{priv} = P_r^{labour}\left(\overline{EVOM_r^{labour}}\right)(1-U_r) + P_r^{capital}\left(\overline{EVOM_r^{capital}}\right) + P_r^{s}\left(\overline{EVOM_r^{S}}\right)$$

$$INCOME_r^{priv} = PRIVSAV_r + PC_r C_r^{priv}$$

where:

$$PRIVSAV_r = PI_r\overline{C_r^{privsav}}$$

$$PC_r C_r^{priv} = \sum_{i=1}^{17} P_{ir}^C \, C_{ir}^C$$

$$P_{ir}^C = \left(\theta_{ir}^C \left(1 + t_{ir}^{Cd}\right)^{1-\sigma_i^d} (P_{ir}^Y)^{1-\sigma_i^d} + \left(1 - \theta_{ir}^C\right)\left(1 + t_{ir}^{Cm}\right)^{1-\sigma_i^d} (P_{ir}^m)^{1-\sigma_i^d}\right)^{\frac{1}{1-\sigma_i^d}}$$

The demands for national and imported goods are derived by solving analytically the welfare optimisation problem, so for each good *i* in region *r*:

$$C_r^{priv}\left(\frac{\partial PC_r C_r^{priv}}{\partial P_{ir}^Y}\right) = C_{ir}^{Cd}$$

$$C_r^{priv}\left(\frac{\partial PC_r C_r^{priv}}{\partial P_{ir}^m}\right) = C_{ir}^{Cm}$$

Public sector

One of the relevant characteristics of our model is that we present the public and private sector separately. Hence, public consumption does not correspond to the private representative consumer explained above, and is modelled by a Leontief composite:

$$G_r^{pub} = min(G_{1r}^G, \dots, G_{17r}^G)$$

where:

$$G_{ir}^G = \left(\theta_{ir}^{Gd}\left(G_{ir}^{Gd}\right)^{1-\sigma_i^d} + \left(1 - \theta_{ir}^{Gd}\right)\left(G_{ir}^{Gm}\right)^{1-\sigma_i^d}\right)^{\frac{1}{1-\sigma_i^d}}$$

subject to the budget constraints:

$$INCOME_r^{pub} - PG_r G_r^{pub} = PUBSAV_r$$

$$INCOME_r^{pub} = REV_r^O + REV_r^{fd} + REV_r^{fm} + REV_r^f + REV_r^{Cd} + REV_r^{Cm} + REV_r^{Gd} + REV_r^{Gm} + REV_r^{Id} + REV_r^{Im} + REV_r^{ms} - REV_r^{xs}$$

where the different taxes generate the following revenues:

$$REV_r^O = \sum_{i=1}^{17} t_{ir}^O \, P_{ir}^Y Y_{ir}$$

$$REV_r^{fd} = \sum_{i=1}^{17}\sum_{j=1}^{17} t_{ijr}^{fd} \, P_{ir}^Y II_{ijr}^Y$$

$$REV_r^{fm} = \sum_{i=1}^{17}\sum_{j=1}^{17} t_{ijr}^{fm} \, P_{ijr}^m II_{ijr}^m$$

$$REV_r^f = \sum_{i=1}^{17}\left(t_{ir}^S P_r^S\left(\overline{EVOM_r^S}\right) + t_{ir}^{capital} P_r^{capital}\left(\overline{EVOM_r^{capital}}\right) + t_{ir}^{labour} P_r^{labour}\left(\overline{EVOM_r^{labour}}\right)(1 - U_r)\right)$$

$$REV_r^{Cd} = \sum_{i=1}^{17} t_{ir}^{Cd} \, P_{ir}^Y C_{ir}^{Cd}$$

$$REV_r^{Cm} = \sum_{i=1}^{17} t_{ir}^{Cm} \, P_{ir}^m C_{ir}^{Cm}$$

$$REV_r^{Gd} = \sum_{i=1}^{17} t_{ir}^{Gd}\, P_{ir}^{Y} G_{ir}^{Gd}$$

$$REV_r^{Gm} = \sum_{i=1}^{17} t_{ir}^{Gm}\, P_{ir}^{m} G_{ir}^{Gm}$$

$$REV_r^{Id} = \sum_{i=1}^{17} t_{ir}^{Id}\, P_{ir}^{Y} I_{ir}^{Id}$$

$$REV_r^{Im} = \sum_{i=1}^{17} t_{ir}^{Im}\, P_{ir}^{m} I_{ir}^{Im}$$

$$REV_r^{ms} = \sum_{i=1}^{17} \sum_{\substack{s=1 \\ s \neq r}}^{7} t_{isr}^{ms} \left(P_{is}^{Y}(1 - t_{isr}^{xs}) EXP_{isr} + \sum_{j=1}^{15} P_{jisr}^{t} TRN_{jisr} \right)$$

$$REV_r^{xs} = \sum_{i=1}^{17} \sum_{\substack{s=1 \\ s \neq r}}^{7} t_{irs}^{xs} P_{ir}^{Y} EXP_{irs}$$

and:

$$PG_r G_r^{pub} = \sum_{i=1}^{17} P_{ir}^{G}\, G_{ir}^{G}$$

$$P_{ir}^{G} = \left(\theta_{ir}^{Gd} \left(1 + t_{ir}^{Gd}\right)^{1-\sigma_i^d} (P_{ir}^{Y})^{1-\sigma_i^d} + \left(1 - \theta_{ir}^{Gd}\right) \left(1 + t_{ir}^{Gm}\right)^{1-\sigma_i^d} (P_{ir}^{m})^{1-\sigma_i^d} \right)^{\frac{1}{1-\sigma_i^d}}$$

$$PUBSAV_r = PI_r C_r^{pubsav}$$

In the same way than for the private agent, we derive the public demands for national and imported goods, so for each good *i* in region *r*:

$$G_r^{pub} \left(\frac{\partial PG_r G_r^{pub}}{\partial P_{ir}^{Y}} \right) = G_{ir}^{Gd}$$

$$G_r^{pub} \left(\frac{\partial PG_r G_r^{pub}}{\partial P_{ir}^{m}} \right) = G_{ir}^{Gm}$$

Investment and savings

Investment is exogenous and it is introduced as a component of the final demand (i.e., it represents future consumption). It is modelled as an aggregate Leontief composite with national and imported components which are optimally estimated:

$$\overline{I_r} = min(I_{1r}^{I}, \ldots, I_{17r}^{I})$$

where:

$$I_{ir}^{I} = \left(\theta_{ir}^{Id} \left(I_{ir}^{Id}\right)^{1-\sigma_i^d} + \left(1 - \theta_{ir}^{Id}\right) (I_{ir}^{Im})^{1-\sigma_i^d} \right)^{\frac{1}{1-\sigma_i^d}}$$

subject to:

$$PRIVSAV_r + PUBSAV_r + PC_{num} VB_r = PI_r \overline{I_r}$$

$$PI_r \overline{I_r} = \sum_{i=1}^{17} PI_{ir}\, I_{ir}^{I}$$

$$PI_{ir}^{I} = \left(\theta_{ir}^{Id}\left(1+t_{ir}^{Id}\right)^{1-\sigma_i^d}(P_{ir}^{Y})^{1-\sigma_i^d} + \left(1-\theta_{ir}^{Id}\right)(1+t_{ir}^{Im})^{1-\sigma_i^d}(P_{ir}^{m})^{1-\sigma_i^d}\right)^{\frac{1}{1-\sigma_i^d}}$$

$$\sum_{r=1}^{7} PC_{num}VB_r = 0$$

Solving the previous optimisation problem gives the demands for the domestic and imported components of investment:

$$\overline{I_r}\left(\frac{\partial PI_r\overline{I_r}}{\partial P_{ir}^{Y}}\right) = I_{ir}^{Id}$$

$$\overline{I_r}\left(\frac{\partial PI_r\overline{I_r}}{\partial P_{ir}^{m}}\right) = I_{ir}^{Im}$$

Foreign sector

The model uses the Armington assumption which involves the differentiation of goods according to their origin (i.e., the country or region where they have been made). The firms in sector *i* and region *r* minimise the cost of the imported components:

$$IMP_{ir} = \left(\sum_{s}\theta_{isr}^{m}(EXPA_{isr})^{1-\sigma_i^m}\right)^{\frac{1}{1-\sigma_i^m}}$$

where:

$$EXPA_{isr} = min\left(EXP_{isr}, TRM_{jisr}\right) \qquad j = TRN$$

$$\sum_{i=1}^{17}\sum_{\substack{r=1\\ r\neq s}}^{7}\sum_{\substack{s=1\\ s\neq r}}^{7} TRM_{jisr} = \sum_{r=1}^{7}\theta_j^T Y_{jr}$$

In addition, we allow for trade deficit/surplus at the regional level:

$$\sum_{i=1}^{17}\sum_{\substack{s=1\\ s\neq r}}^{7} Pt_{isr}^{m}\, EXPA_{isr} + PC_{num}VB_{r} = \sum_{i=1}^{17} P_{ir}^{m}\, IMP_{ir}$$

$$r$$

where:

$$Pt_{isr}^{m} = \theta_{isr}^{m}P_{isr} + \sum_{j}\theta_j^T P_{jisr}^{t}$$

$$P_{isr} = P_{is}^{Y}(1-t_{isr}^{xs})(1+t_{isr}^{ms})$$

$$P_{jisr}^{t} = P_j^T(1+t_{isr}^{ms})$$

$$P_j^T = \prod_{r=1}^{7}\left(P_{jr}^{Y}\right)^{\theta_r^T}$$

$$P_{ir}^{m} = \left(\sum_{s}\theta_{isr}^{m}(P_{isr})^{1-\sigma_i^m}\right)^{\frac{1}{1-\sigma_i^m}}$$

Labour market constraint

All the markets clear except for the case of labour where unemployment is allowed at the regional level. The market clearing condition is:

$$\sum_{i=1}^{17}\left(Y_{ir}\left(\frac{\partial PROFIT_{ir}^{Y}}{\partial P_r^{labour}}\right)\right)=\overline{EVOM_r^{labour}}(1-U_r)$$

where the unemployment rate is linked to real wages according to the following constraint:

$$\frac{P_r^{labour}}{PC_r}=\left(\frac{U_r}{\overline{U_r}}\right)^{\beta}$$

where $\beta < 0$.

Simulations

In the main text, we perform five simulations in order to get a decrease of one percentage point in the government deficit-to-GDP ratio which is entered as a constraint in the model. These simulations involve some changes in the previous equations, which are as follows. Recall that, in each simulation, "country *r*" refers to Greece, Italy, Portugal, and Spain.

(1) Scenario of increase in consumption taxes in country *r*, holding public expenditure constant. The parameter $\overline{ADJUST_r}$ is 1 at the benchmark and takes a value above 1 in the simulation, so that the benchmark ad valorem consumption taxes rise. This increase leads to an increase in public savings $PUBSAV_r$ (note that public expenditure remains unchanged). In turn, public income $INCOME_r^{pub}$ is allowed to change endogenously:

$$P_{ir}^{C}=\Big(\theta_{ir}^{C}\big(1+\overline{ADJUST_r}t_{ir}^{Cd}\big)^{1-\sigma_i^d}(P_{ir}^{Y})^{1-\sigma_i^d}+\big(1-\theta_{ir}^{C}\big)\big(1+\overline{ADJUST_r}t_{ir}^{Cm}\big)^{1-\sigma_i^d}(P_{ir}^{m})^{1-\sigma_i^d}\Big)^{\frac{1}{1-\sigma_i^d}}$$

$$REV_r^{Cd}=\sum_{i=1}^{17}\overline{ADJUST_r}\;t_{ir}^{Cd}\;P_{ir}^{Y}C_{ir}^{Cd}$$

$$REV_r^{Cm}=\sum_{i=1}^{17}\overline{ADJUST_r}\;t_{ir}^{Cm}\;P_{ir}^{m}C_{ir}^{Cm}$$

$$INCOME_r^{pub}-\overline{PG_r}\,\overline{G_r^{pub*}}=PUBSAV_r$$

(2) Scenario of increase in labour taxes in country *r*, holding public expenditure constant. This simulation is analogous as that in the previous scenario, with the change now implemented on labour taxes:

$$P_{ir}^{f}=\left(\sum_{f}\theta_{ir}^{f}\big(P_{ir}^{pf}\big)^{1-\sigma_i^{VA}}\right)^{\frac{1}{1-\sigma_i^{VA}}}$$

$$P_{ir}^{pf}=\begin{cases}P_r^{labour}\big(1+\overline{ADJUST_r}t_{ir}^{labour}\big)\\ P_r^{capital}\big(1+t_{ir}^{capital}\big)\\ P_r^{S}\big(1+t_{ir}^{S}\big)\end{cases}$$

$$REV_r^f = \sum_{i=1}^{17} \left(t_{ir}^S P_r^S \left(\overline{EVOM_r^S}\right) + t_{ir}^{capital} P_r^{capital} \left(\overline{EVOM_r^{capital}}\right) + \overline{ADJUST_r} t_{ir}^{labour} P_r^{labour} \left(\overline{EVOM_r^{labour}}\right)(1 - U_r) \right)$$

$$INCOME_r^{pub} - \overline{PG_r}\,\overline{G_r^{pub*}} = PUBSAV_r$$

(3) Three scenarios (for each country *r*) of a reduction in the size of the real public expenditure in Education, Health and social services, and Other government services, respectively, holding all tax rates constant. Below we describe the case for sector 14 (Education) and the cases for the other two sectors are equivalent. The parameter $\overline{ADJUST_r}$ is 1 at the benchmark and takes a positive value but lower than 1 in the simulation, so that the benchmark real public expenditure for Education, $\overline{G_{14r}^{G*}}$, falls. The amount of the reduction in the level of public expenditure in Education is used to increase public savings $PUBSAV_r$. Tax rates do not change, even though the public income $INCOME_r^{pub}$ can change endogenously:

$$INCOME_r^{pub} - \sum_{\substack{i=1 \\ i \neq 14}}^{17} P_{ir}^G G_{ir}^G - P_{14r}^G \overline{ADJUST_r}\,\overline{G_{14r}^{G*}} = PUBSAV_r$$

Table A1. Endogenous variables

Symbol	Definition
C_{ir}^{C}	Final private consumption of good *i* in country *r*
C_{ir}^{Cd}	Final private consumption of good *i* in country *r*, origin domestic production
C_{ir}^{Cm}	Final private consumption of good *i* in country *r*, origin imports
C_{r}^{priv}	Aggregate final private consumption in country *r*
C_{r}^{pubsav}	Aggregate public savings in country *r*
EXP_{irs}	Exports of good *i* from country *r* to country *s*
$EXPA_{irs}$	Exports of good *i* from country *r* to country *s*, including transportation margins
G_{ir}^{G}	Final public consumption of good *i* in country *r*
G_{ir}^{Gd}	Final public consumption of good *i* in country *r*, origin domestic production
G_{ir}^{Gm}	Final public consumption of good *i* in country *r*, origin imports
G_{r}^{pub}	Aggregate final public consumption in country *r*
I_{ir}^{I}	Investment (gross capital formation) in goods produced by sector *i* in country *r*
I_{ir}^{Id}	Investment (gross capital formation) in goods produced by sector *i* in country *r*, origin domestic production
I_{ir}^{Im}	Investment (gross capital formation) in goods produced by sector *i* in country *r*, origin imports
II_{ijr}	Intermediate inputs from sector *j* used by good *i* in country *r*
II_{r}^{i}	Aggregate intermediate inputs used by good *i* in country *r*
II_{ijr}^{Y}	Intermediate inputs from sector *j* used by good *i* in country *r*, origin domestic production
II_{ijr}^{m}	Intermediate inputs from sector *j* used by good *i* in country *r*, origin imports
IMP_{ir}	Imports of good i in country *r*
$INCOME_{r}^{priv}$	Private income in country *r*
$INCOME_{r}^{pub}$	Public income in country *r*
P_{isr}	Price (unit cost) of good *i* exported from country *s* to country *r*, excluding transportation margins
P_{ir}^{C}	Price (unit cost) for private consumption of good *i* in country *r*
$P_{r}^{capital}$	Price (unit cost) for capital in country *r*
P_{jr}^{i}	Price (unit cost) for aggregate intermediate input *j* used by good *i* in country *r*
P_{ir}^{f}	Price (unit cost) for aggregate factors used in good *i* produced at country *r*
P_{r}^{F}	Price (unit cost) for factor *F* (= labour, capital) in country *r*
P_{ir}^{G}	Price (unit cost) for public consumption of good *i* in country *r*
P_{ir}^{I}	Price (unit cost) for investment in sector *i* in country *r*
P_{r}^{labour}	Price (unit cost) for labour in country *r*
P_{ir}^{m}	Price (unit cost) for good *i* imported and used in country *r*
P_{ir}^{pf}	Price (unit cost) for factor *pf* (= labour, capital, specific) used in good *i* in country *r*
P_{r}^{S}	Price (unit cost) for specific factor *S* in country *r*
P_{j}^{T}	World price (unit cost) for transportation margins (*j*=*TRN*)
P_{jisr}^{t}	Price (unit cost) for international transportation (*j*=*TRN*) margins in good *i* traded from country *s* to country *r*, including tariffs
P_{ir}^{Y}	Price (unit cost) for good Y_{ir}
PC_{num}	Price (unit cost) for aggregate final private consumption in numeraire country
PC_{r}	Price (unit cost) for aggregate final private consumption in country *r*
PG_{r}	Price (unit cost) for aggregate final public consumption in country *r*
PI_{r}	Price (unit cost) for aggregate savings in country *r*
Pt_{isr}^{m}	Price (unit cost) of exports from country *s* to country *r*, including transportation margins
$PRIVSAV_{r}$	Private savings in country *r*
$PROFIT_{ir}^{Y}$	Unit profits for Y_{ir}
$PUBSAV_{r}$	Public savings in country *r*
Q_{ir}^{pf}	Quantity demanded of factor for good *i* in country *r*
REV_{r}^{Cd}	Revenue in country *r* from taxes on final private consumption of domestic goods
REV_{r}^{Cm}	Revenue in country *r* from taxes on final private consumption of imports

REV_{ir}^{f}	Revenue in country *r* from factor taxes
REV_{r}^{fd}	Revenue in country *r* from taxes on domestic intermediate inputs
REV_{r}^{fm}	Revenue in country *r* from taxes on imported intermediate inputs
REV_{r}^{Gd}	Revenue in country *r* from taxes on final public consumption of domestic goods
REV_{r}^{Gm}	Revenue in country *r* from taxes on final public consumption of imported goods
REV_{r}^{Id}	Revenue in country *r* from taxes on investment of domestic goods
REV_{r}^{Im}	Revenue in country *r* from taxes on investment of imported goods
REV_{r}^{ms}	Revenue in country *r* from tariffs
REV_{r}^{O}	Revenue in country *r* from output tax
REV_{r}^{xs}	Export subsidies in country *r*
TRM_{jisr}	Transportation (*j*=*TRN*) margin for good *i* exported from country *s* to country *r*
U_r	Unemployment rate in country *r*
VA_{r}^{i}	Aggregate value added used by good *i* in country *r*
VB_r	Foreign savings in country *r*
Y_{ir}	Quantity of good *i* produced in country *r*

Table A2. Exogenous variables and parameters

Symbol	Definition
$\overline{ADJUST_r}$	Parameter for adjustments in simulations, for country *r* (benchmark=1)
$\overline{C_r^{privsav}}$	Aggregate private savings in country *r*
$\overline{EVOM_r^{capital}}$	Capital endowment in country *r*
$\overline{EVOM_r^{labour}}$	Labour endowment in country *r*
$\overline{EVOM_r^{S}}$	Specific factor *S* endowment in country *r*
$\overline{G_r^{pub*}}$	Benchmark aggregate public expenditure in country *r*
$\overline{G_{14r}^{G*}}$	Benchmark public expenditure in sector 14 in country *r*
$\overline{I_r}$	Aggregate gross capital formation in country *r*
$\overline{U_r}$	Benchmark unemployment rate
$t_{ir}^{capital}$	Taxes on capital for good *i* in country *r*
t_{ir}^{Cd}	Taxes on private consumption for good *i* in country *r*, origin domestic production
t_{ir}^{Cm}	Taxes on private consumption for good *i* in country *r*, origin imports
t_{ir}^{F}	Taxes on factor *F* (=labour, capital) for good *i* in country *r*
t_{ijr}^{fd}	Taxes on domestic intermediate input *j* for good *i* in country *r*
t_{ijr}^{fm}	Taxes on imported intermediate input *j* for good *i* in country *r*
t_{ir}^{Gd}	Taxes on public consumption for good *i* in country *r*, origin domestic production
t_{ir}^{Gm}	Taxes on public consumption for good *i* in country *r*, origin imports
t_{ir}^{Id}	Taxes on investment for good *i* in country *r*, origin domestic production
t_{ir}^{Im}	Taxes on investment for good *i* in country *r*, origin imports
t_{ir}^{labour}	Taxes on labour for good *i* in country *r*
t_{isr}^{ms}	Tariff for good *i* exported from country *s* to country *r*
t_{ir}^{O}	Output taxes for good *i* in country *r*
t_{ir}^{S}	Taxes on specific factor *S* for good *i* in country *r*
t_{isr}^{xs}	Export subsidy for good *i* exported from country *s* to country *r*
B	Parameter of flexibility of the real wage to the unemployment rate
Θ	Share parameters
σ_i^d	Armington elasticity of substitution domestic-imported components in good *i*
σ_i^m	Armington elasticity of substitution among imported components in good *i*
σ_i^{VA}	Elasticity of substitution among factors in good *i*

Table 1. Sectoral factor intensities

	Greece	Italy	Portugal	Spain
More labour intensive	Other transport equipment	Education	Education	Education
	Education	Health and social services	Health and social services	Health and social services
	Motor vehicles	Agricultural products	Other transport equipment	Other transport equipment
	Health and social services	Other government services	Other government services	Motor vehicles
	Electronic equipment	Machinery and equipment	Agricultural products	Other government services
	Agricultural products	Other transport equipment	Construction	Agricultural products
	Machinery and equipment	Motor vehicles	Motor vehicles	Machinery and equipment
	Financial intermediation	Recreational services	Recreational services	Recreational services
	Other government services	Other industry	Machinery and equipment	Chemical industry
	Recreational services	Electronic equipment	Other industry	Electronic equipment
	Chemical industry	Chemical industry	Electronic equipment	Other industry
	Other industry	Financial intermediation	Trade and hostelry	Trade and hostelry
	Trade and hostelry	Construction	Chemical industry	Construction
	Construction	Trade and hostelry	Transport and communications	Financial intermediation
	Other services	Transport and communications	Financial intermediation	Transport and communications
	Transport and communications	Other business services	Other business services	Other business services
More capital intensive	Other business services	Other services	Other services	Other services

Source: Calculated with data from Aguiar et al. (2019).

Table 2. Effective tax rates (in %)

	Consumption taxes (domestic goods)				Consumption taxes (imports)				Labour taxes			
	Greece	Italy	Portugal	Spain	Greece	Italy	Portugal	Spain	Greece	Italy	Portugal	Spain
1. Agricultural products	2.08	14.39	9.10	4.20	2.11	16.48	10.77	4.94	31.65	22.89	26.77	19.18
2. Chemical industry	9.25	24.02	23.38	14.97	9.46	24.44	23.39	15.60	67.07	58.06	44.40	40.50
3. Machinery and equipment	6.53	18.73	41.80	27.01	6.58	20.15	41.72	24.12	67.07	58.06	44.40	40.50
4. Electronic equipment	6.68	20.20	43.55	28.58	8.33	19.24	40.64	23.09	67.07	58.06	44.40	40.50
5. Motor vehicles	38.04	10.87	38.47	7.65	38.19	10.87	39.12	15.94	67.07	58.06	44.40	40.50
6. Other transport equipment	2.64	30.60	0.00	5.40	3.21	31.31	35.58	6.19	67.07	58.06	44.40	40.50
7. Other industry	34.66	42.52	44.44	38.51	40.90	43.10	39.81	29.62	67.07	58.06	44.40	40.50
8. Construction	11.64	8.23	3.77	6.96	11.63	0.00	5.71	0.00	67.07	58.06	44.40	40.50
9. Trade and hostelry	5.08	2.73	3.16	3.56	2.31	0.00	2.09	0.00	67.07	58.06	44.40	40.50
10. Transport and communications	3.45	−5.37	3.88	5.75	3.14	7.39	6.98	3.83	67.07	58.06	44.40	40.50
11. Financial intermediation	5.76	14.03	8.36	7.56	11.42	3.38	8.76	2.77	67.07	58.06	44.40	40.50
12. Other business services	3.39	11.54	4.86	11.69	9.98	15.94	13.54	8.25	67.07	58.06	44.40	40.50
13. Recreational services	9.38	21.21	20.48	6.56	10.62	16.35	17.29	6.71	67.07	58.06	44.40	40.50
14. Education	1.81	7.22	1.82	2.36	0.31	5.13	0.38	0.00	67.07	58.06	44.40	40.50
15. Health and social services	0.47	5.81	0.48	1.01	0.73	5.57	0.80	0.00	67.07	58.06	44.40	40.50
16. Other government services	−1.00	4.26	−0.99	−0.46	−7.82	−3.40	−7.76	0.00	67.07	58.06	44.40	40.50
17. Other services	33.77	4.84	51.13	4.13	54.14	73.72	79.19	57.18	67.07	58.06	44.40	40.50

Source: Calculated with data from Aguiar et al. (2019).

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

A) Increase in final consumption taxes

	Greece	Italy	Portugal	Spain	Rest of EZ	Rest of EU	ROW
GDP	−0.484	−0.274	−0.329	−0.382	0.003	0.004	0.000
Employment	−1.255	−0.708	−0.729	−0.709	0.002	0.003	0.000
Unemployment rate (p.p.)	0.923	0.619	0.628	0.535	−0.002	−0.002	0.000
Real wage rate/real capital rent	0.367	0.112	0.234	0.198	0.003	0.001	0.000
Compensation of employees	−1.101	−0.665	−0.639	−0.650	0.007	0.007	0.001
Gross operating surplus	−0.210	−0.068	−0.143	−0.139	0.002	0.004	0.000
Trade balance/GDP (p.p.)	−0.090	0.001	−0.017	−0.006	−0.002	−0.001	−0.000
Public expenditure	0.000	0.000	0.000	0.000	0.002	0.003	0.000
Public revenue	0.696	0.563	0.846	0.269	0.004	0.007	0.001

B) Increase in labour taxes

	Greece	Italy	Portugal	Spain	Rest of EZ	Rest of EU	ROW
GDP	−1.136	−0.749	−0.858	−0.648	0.005	0.006	0.001
Employment	−2.047	−1.055	−1.111	−0.845	0.003	0.004	0.000
Unemployment rate (p.p.)	1.505	0.921	0.957	0.638	−0.003	−0.003	0.000
Real wage rate/real capital rent	−0.188	−0.556	−0.447	−0.101	0.003	0.000	0.000
Compensation of employees	−2.687	−1.807	−1.823	−1.145	0.009	0.010	0.001
Gross operating surplus	−0.467	−0.205	−0.274	−0.202	0.002	0.006	0.000
Trade balance/GDP (p.p.)	−0.213	0.003	−0.044	−0.011	−0.004	−0.002	−0.001
Public expenditure	0.001	0.001	0.001	0.001	0.003	0.004	0.000
Public revenue	−0.163	0.085	0.350	0.062	0.005	0.009	0.001

C) Decrease in public consumption in Health and social services

	Greece	Italy	Portugal	Spain	Rest of EZ	Rest of EU	ROW
GDP	−0.342	−0.166	−0.224	−0.261	−0.009	−0.005	0.001
Employment	−0.812	−0.401	−0.402	−0.471	0.001	0.000	0.001
Unemployment rate (p.p.)	0.597	0.350	0.346	0.356	−0.001	0.000	−0.001
Real wage rate/real capital rent	−0.277	−0.415	−0.369	−0.262	0.003	0.000	0.000
Compensation of employees	−1.108	−0.707	−0.709	−0.647	−0.007	−0.006	0.001
Gross operating surplus	−0.022	0.109	0.061	0.085	−0.011	−0.006	0.001
Trade balance/GDP (p.p.)	−0.226	0.012	−0.043	−0.010	0.025	0.026	−0.004
Public expenditure	−4.189	−4.655	−4.630	−4.407	−0.017	−0.015	0.002
Public revenue	−0.247	−0.250	−0.078	−0.178	−0.014	−0.014	0.001

Table 3 (continued)

D) Decrease in public consumption in Education

	Greece	Italy	Portugal	Spain	Rest of EZ	Rest of EU	ROW
GDP	−0.451	−0.297	−0.423	−0.484	−0.004	−0.006	0.002
Employment	−1.145	−0.605	−0.705	−0.770	0.002	0.001	0.001
Unemployment rate (p.p.)	0.841	0.528	0.607	0.582	−0.001	−0.001	−0.001
Real wage rate/real capital rent	−0.410	−0.601	−0.627	−0.392	−0.002	−0.002	0.000
Compensation of employees	−1.543	−1.097	−1.258	−1.099	−0.004	−0.008	0.002
Gross operating surplus	0.007	0.107	0.070	0.061	−0.004	−0.006	0.001
Trade balance/GDP (p.p.)	−0.105	0.005	−0.021	−0.005	0.011	0.012	−0.002
Public expenditure	−4.383	−4.842	−4.897	−4.705	−0.010	−0.018	0.003
Public revenue	−0.406	−0.412	−0.322	−0.465	−0.010	−0.017	0.002

E) Decrease in public consumption in Other government services

	Greece	Italy	Portugal	Spain	Rest of EZ	Rest of EU	ROW
GDP	−0.249	−0.197	−0.244	−0.242	−0.008	−0.008	0.002
Employment	−0.276	−0.190	−0.181	−0.241	0.001	0.000	0.001
Unemployment rate (p.p.)	0.203	0.166	0.156	0.182	−0.001	0.000	−0.001
Real wage rate/real capital rent	−0.007	−0.148	−0.081	−0.074	0.000	−0.001	0.000
Compensation of employees	−0.462	−0.426	−0.419	−0.414	−0.009	−0.011	0.002
Gross operating surplus	−0.180	−0.088	−0.158	−0.100	−0.009	−0.010	0.001
Trade balance/GDP (p.p.)	−0.376	0.022	−0.077	−0.017	0.048	0.050	−0.007
Public expenditure	−3.682	−4.432	−4.432	−4.243	−0.018	−0.025	0.003
Public revenue	0.143	−0.103	0.060	−0.041	−0.016	−0.023	0.002

Table 4. Simulation results: effects on sectoral prices (% change from benchmark)

A) Increase in final consumption taxes

	Greece	Italy	Portugal	Spain	Rest of EZ	Rest of EU	ROW
1. Agricultural products	−0.037	−0.051	0.025	−0.010	−0.004	−0.008	−0.002
2. Chemical industry	−0.034	−0.011	−0.027	−0.016	0.001	0.002	0.000
3. Machinery and equipment	−0.020	−0.009	−0.021	−0.012	0.002	0.002	0.000
4. Electronic equipment	−0.003	−0.011	−0.024	−0.015	0.001	0.002	0.000
5. Motor vehicles	−0.001	−0.011	−0.015	−0.008	0.001	0.002	0.000
6. Other transport equipment	0.021	−0.010	−0.009	−0.004	0.001	0.002	0.000
7. Other industry	−0.027	−0.012	−0.022	−0.018	0.001	0.001	0.000
8. Construction	−0.060	−0.016	−0.021	−0.024	0.002	0.003	0.000
9. Trade and hostelry	−0.060	−0.021	−0.036	−0.027	0.002	0.003	0.000
10. Transport and communications	−0.063	−0.022	−0.045	−0.032	0.002	0.003	0.000
11. Financial intermediation	−0.033	−0.015	−0.058	−0.032	0.002	0.004	0.000
12. Other business services	−0.137	−0.027	−0.062	−0.043	0.002	0.003	0.000
13. Recreational services	−0.030	−0.011	−0.025	−0.017	0.002	0.003	0.000
14. Education	0.040	0.013	0.026	0.021	0.003	0.004	0.000
15. Health and social services	0.024	0.008	0.014	0.013	0.003	0.004	0.000
16. Other government services	−0.027	−0.006	−0.013	−0.007	0.003	0.004	0.000
17. Other services	−0.055	−0.050	−0.055	−0.089	0.002	0.003	0.000

B) Increase in labour taxes

	Greece	Italy	Portugal	Spain	Rest of EZ	Rest of EU	ROW
1. Agricultural products	−0.140	−0.139	−0.017	−0.043	−0.005	−0.008	−0.002
2. Chemical industry	−0.077	−0.032	−0.053	−0.025	0.001	0.002	0.000
3. Machinery and equipment	−0.046	−0.027	−0.040	−0.018	0.002	0.002	0.000
4. Electronic equipment	−0.006	−0.033	−0.047	−0.022	0.001	0.002	0.000
5. Motor vehicles	−0.003	−0.033	−0.029	−0.013	0.000	0.001	0.000
6. Other transport equipment	0.046	−0.032	−0.019	−0.006	0.001	0.002	0.000
7. Other industry	−0.062	−0.036	−0.046	−0.028	0.000	0.001	0.000
8. Construction	−0.133	−0.050	−0.040	−0.035	0.002	0.003	0.000
9. Trade and hostelry	−0.134	−0.063	−0.070	−0.039	0.002	0.004	0.000
10. Transport and communications	−0.141	−0.067	−0.086	−0.046	0.002	0.003	0.000
11. Financial intermediation	−0.074	−0.048	−0.112	−0.047	0.002	0.005	0.000
12. Other business services	−0.305	−0.082	−0.120	−0.062	0.003	0.004	0.000
13. Recreational services	−0.068	−0.035	−0.049	−0.024	0.003	0.004	0.000
14. Education	0.088	0.036	0.049	0.031	0.004	0.005	0.000
15. Health and social services	0.054	0.022	0.027	0.020	0.003	0.004	0.000
16. Other government services	−0.060	−0.019	−0.025	−0.009	0.003	0.005	0.000
17. Other services	−0.122	−0.152	−0.105	−0.130	0.002	0.004	0.000

Table 4 (continued)

C) Decrease in public consumption in Health and social services

	Greece	Italy	Portugal	Spain	Rest of EZ	Rest of EU	ROW
1. Agricultural products	−0.063	−0.034	0.037	−0.006	−0.002	0.001	0.000
2. Chemical industry	−0.089	−0.048	−0.059	−0.042	−0.009	−0.007	0.000
3. Machinery and equipment	−0.103	−0.072	−0.073	−0.053	−0.009	−0.007	0.000
4. Electronic equipment	−0.116	−0.055	−0.058	−0.043	−0.008	−0.006	0.000
5. Motor vehicles	−0.116	−0.062	−0.064	−0.040	−0.010	−0.009	−0.001
6. Other transport equipment	−0.153	−0.075	−0.099	−0.056	−0.008	−0.007	−0.001
7. Other industry	−0.068	−0.049	−0.059	−0.034	−0.008	−0.006	0.000
8. Construction	−0.093	−0.059	−0.090	−0.051	−0.009	−0.007	0.000
9. Trade and hostelry	−0.100	−0.049	−0.082	−0.052	−0.009	−0.007	0.000
10. Transport and communications	−0.049	−0.036	−0.061	−0.039	−0.009	−0.007	0.000
11. Financial intermediation	−0.140	−0.076	−0.063	−0.048	−0.008	−0.006	0.000
12. Other business services	−0.064	−0.029	−0.051	−0.033	−0.009	−0.007	0.000
13. Recreational services	−0.144	−0.090	−0.105	−0.069	−0.009	−0.007	0.000
14. Education	−0.198	−0.184	−0.195	−0.122	−0.008	−0.006	0.001
15. Health and social services	−0.178	−0.155	−0.161	−0.104	−0.009	−0.007	0.000
16. Other government services	−0.145	−0.112	−0.131	−0.082	−0.009	−0.006	0.000
17. Other services	−0.079	0.055	−0.044	0.028	−0.010	−0.007	0.000

D) Decrease in public consumption in Education

	Greece	Italy	Portugal	Spain	Rest of EZ	Rest of EU	ROW
1. Agricultural products	−0.079	−0.069	0.033	−0.025	−0.002	0.000	0.000
2. Chemical industry	−0.108	−0.099	−0.124	−0.103	−0.008	−0.010	−0.001
3. Machinery and equipment	−0.128	−0.140	−0.147	−0.124	−0.008	−0.010	−0.001
4. Electronic equipment	−0.148	−0.112	−0.120	−0.103	−0.007	−0.008	−0.001
5. Motor vehicles	−0.148	−0.123	−0.127	−0.089	−0.011	−0.012	−0.001
6. Other transport equipment	−0.197	−0.147	−0.192	−0.121	−0.008	−0.010	−0.001
7. Other industry	−0.084	−0.102	−0.123	−0.088	−0.008	−0.009	−0.001
8. Construction	−0.109	−0.127	−0.180	−0.131	−0.007	−0.009	0.000
9. Trade and hostelry	−0.117	−0.114	−0.168	−0.135	−0.006	−0.008	0.001
10. Transport and communications	−0.054	−0.093	−0.133	−0.112	−0.007	−0.009	0.000
11. Financial intermediation	−0.172	−0.156	−0.139	−0.132	−0.006	−0.008	0.001
12. Other business services	−0.058	−0.086	−0.119	−0.109	−0.006	−0.008	0.001
13. Recreational services	−0.177	−0.177	−0.209	−0.163	−0.006	−0.008	0.000
14. Education	−0.257	−0.313	−0.363	−0.245	−0.006	−0.008	0.001
15. Health and social services	−0.229	−0.268	−0.302	−0.212	−0.007	−0.009	0.000
16. Other government services	−0.178	−0.209	−0.253	−0.184	−0.006	−0.008	0.001
17. Other services	−0.092	0.034	−0.103	−0.017	−0.005	−0.008	0.001

Table 4 (continued)

E) Decrease in public consumption in Other government services

	Greece	Italy	Portugal	Spain	Rest of EZ	Rest of EU	ROW
1. Agricultural products	−0.016	−0.024	0.072	0.005	0.000	0.004	0.002
2. Chemical industry	−0.116	−0.093	−0.121	−0.091	−0.011	−0.012	−0.001
3. Machinery and equipment	−0.120	−0.116	−0.127	−0.100	−0.011	−0.012	−0.001
4. Electronic equipment	−0.120	−0.102	−0.114	−0.089	−0.010	−0.010	−0.001
5. Motor vehicles	−0.119	−0.109	−0.106	−0.073	−0.013	−0.014	−0.001
6. Other transport equipment	−0.139	−0.124	−0.140	−0.091	−0.011	−0.012	−0.001
7. Other industry	−0.085	−0.094	−0.111	−0.079	−0.010	−0.010	0.000
8. Construction	−0.138	−0.125	−0.148	−0.117	−0.011	−0.011	0.000
9. Trade and hostelry	−0.145	−0.126	−0.162	−0.123	−0.010	−0.011	0.000
10. Transport and communications	−0.097	−0.116	−0.151	−0.111	−0.010	−0.011	0.000
11. Financial intermediation	−0.166	−0.144	−0.174	−0.126	−0.010	−0.010	0.001
12. Other business services	−0.167	−0.122	−0.167	−0.121	−0.010	−0.011	0.000
13. Recreational services	−0.169	−0.148	−0.174	−0.132	−0.010	−0.011	0.000
14. Education	−0.171	−0.185	−0.202	−0.152	−0.010	−0.011	0.001
15. Health and social services	−0.162	−0.165	−0.179	−0.136	−0.010	−0.011	0.000
16. Other government services	−0.166	−0.157	−0.185	−0.137	−0.010	−0.011	0.000
17. Other services	−0.121	−0.096	−0.145	−0.104	−0.010	−0.010	0.000

Table 5. Simulation results: effects on sectoral output (% change from benchmark)

A) Increase in final consumption taxes

	Greece	Italy	Portugal	Spain	Rest of EZ	Rest of EU	ROW
1. Agricultural products	−0,117	−0,141	0,106	−0,013	−0,019	−0,012	−0,002
2. Chemical industry	−0,761	−0,079	−0,111	−0,107	−0,110	−0,084	−0,014
3. Machinery and equipment	2,079	1,360	1,420	1,222	0,123	0,105	0,019
4. Electronic equipment	0,529	1,222	0,921	0,925	0,106	0,088	0,022
5. Motor vehicles	0,070	0,372	0,264	0,456	0,025	0,025	0,004
6. Other transport equipment	3,407	0,997	1,990	2,252	0,068	0,116	0,040
7. Other industry	−0,041	0,124	0,069	0,049	−0,011	−0,015	−0,002
8. Construction	7,639	4,524	4,717	3,558	0,006	0,004	0,001
9. Trade and hostelry	0,046	0,029	−0,189	−0,257	0,003	0,002	0,001
10. Transport and communications	−0,045	0,333	0,063	−0,032	−0,004	−0,005	−0,002
11. Financial intermediation	−0,364	−0,228	−0,200	−0,261	−0,002	−0,003	0,000
12. Other business services	0,278	0,290	0,102	0,208	0,000	0,000	0,001
13. Recreational services	−0,738	−1,044	−0,846	−1,070	−0,002	−0,005	−0,001
14. Education	−2,914	−2,731	−2,282	−2,641	−0,001	0,002	0,000
15. Health and social services	−3,577	−3,596	−3,092	−3,640	0,001	0,004	0,000
16. Other government services	−4,304	−3,874	−3,579	−4,056	0,002	0,004	0,000
17. Other services	−1,317	−0,534	−0,855	−0,529	−0,006	−0,011	−0,001

B) Increase in labour taxes

	Greece	Italy	Portugal	Spain	Rest of EZ	Rest of EU	ROW
1. Agricultural products	0,029	0,136	0,281	0,110	−0,021	−0,014	−0,002
2. Chemical industry	−0,952	0,035	−0,024	−0,084	−0,126	−0,101	−0,018
3. Machinery and equipment	2,443	1,580	1,635	1,305	0,128	0,107	0,018
4. Electronic equipment	0,607	1,490	1,162	1,066	0,120	0,098	0,024
5. Motor vehicles	0,616	0,490	0,419	0,485	0,033	0,031	0,003
6. Other transport equipment	3,709	1,257	2,143	2,332	0,072	0,128	0,043
7. Other industry	0,291	0,445	0,361	0,240	−0,002	−0,008	−0,001
8. Construction	8,740	4,897	5,062	3,655	0,006	0,004	0,001
9. Trade and hostelry	−0,066	−0,174	−0,453	−0,385	0,003	0,002	0,000
10. Transport and communications	−0,074	0,106	−0,061	−0,074	−0,005	−0,006	−0,002
11. Financial intermediation	−0,555	−0,240	−0,313	−0,306	−0,003	−0,004	−0,001
12. Other business services	0,223	0,268	−0,021	0,201	−0,002	−0,003	0,000
13. Recreational services	−0,882	−0,908	−0,870	−1,200	−0,003	−0,006	−0,001
14. Education	−4,269	−3,461	−3,005	−2,921	0,001	0,003	0,001
15. Health and social services	−5,205	−4,576	−4,034	−4,011	0,003	0,005	0,001
16. Other government services	−6,186	−4,918	−4,595	−4,437	0,003	0,005	0,001
17. Other services	−1,295	−0,711	−0,694	−0,645	−0,006	−0,011	0,000

Table 5 (continued)

C) Decrease in public consumption in Health and social services

	Greece	Italy	Portugal	Spain	Rest of EZ	Rest of EU	ROW
1. Agricultural products	0,224	0,259	0,402	0,194	0,019	0,008	0,000
2. Chemical industry	−0,091	−0,013	−0,364	−0,369	−0,143	−0,103	−0,031
3. Machinery and equipment	2,134	1,554	1,634	1,341	0,107	0,075	0,003
4. Electronic equipment	1,481	1,486	1,242	1,228	0,145	0,122	0,015
5. Motor vehicles	0,970	0,588	0,608	0,560	0,057	0,047	0,002
6. Other transport equipment	3,644	1,367	2,420	2,206	0,080	0,114	0,021
7. Other industry	0,508	0,607	0,564	0,383	0,022	0,015	−0,002
8. Construction	5,850	3,985	4,408	3,219	−0,051	−0,053	0,010
9. Trade and hostelry	0,057	0,214	−0,018	−0,041	0,001	0,000	0,001
10. Transport and communications	0,135	0,472	0,371	0,396	−0,002	−0,001	0,001
11. Financial intermediation	0,210	0,269	0,199	0,086	0,006	0,003	0,000
12. Other business services	0,299	0,411	0,252	0,392	0,001	0,000	0,002
13. Recreational services	−0,047	−0,017	0,058	0,111	−0,001	−0,003	0,000
14. Education	2,068	1,654	2,204	1,384	−0,010	−0,008	−0,002
15. Health and social services	−10,880	−11,404	−12,211	−12,315	−0,011	−0,005	0,001
16. Other government services	1,855	0,382	1,818	1,167	−0,005	−0,013	−0,001
17. Other services	−0,358	−0,270	−0,138	−0,312	−0,001	−0,001	0,000

D) Decrease in public consumption in Education

	Greece	Italy	Portugal	Spain	Rest of EZ	Rest of EU	ROW
1. Agricultural products	0,292	0,437	0,678	0,398	0,015	0,009	0,000
2. Chemical industry	0,499	0,787	1,106	0,880	0,048	0,033	−0,008
3. Machinery and equipment	2,378	1,945	2,087	1,754	0,064	0,046	−0,008
4. Electronic equipment	1,573	1,742	1,624	1,486	0,121	0,116	0,010
5. Motor vehicles	1,069	0,894	0,947	0,771	0,036	0,026	−0,002
6. Other transport equipment	4,017	1,819	3,060	2,481	0,050	0,104	0,012
7. Other industry	0,577	0,858	0,934	0,676	0,011	0,012	−0,005
8. Construction	6,033	3,914	4,364	3,175	−0,076	−0,077	0,014
9. Trade and hostelry	0,377	0,340	0,207	0,097	0,001	0,000	0,002
10. Transport and communications	0,105	0,492	0,400	0,493	−0,006	−0,002	0,001
11. Financial intermediation	0,479	0,518	0,376	0,265	0,005	0,004	0,001
12. Other business services	0,402	0,650	0,435	0,629	−0,005	−0,003	0,002
13. Recreational services	−0,004	0,109	0,211	0,393	−0,009	−0,007	0,000
14. Education	−26,700	−27,972	−30,978	−29,915	−0,011	−0,009	−0,002
15. Health and social services	3,256	3,270	4,283	3,285	0,004	−0,001	0,002
16. Other government services	2,643	1,888	3,668	2,980	−0,021	−0,020	−0,002
17. Other services	−0,654	−0,355	−0,192	−0,465	0,000	0,001	0,001

Table 5 (continued)

E) Decrease in public consumption in Other government services

	Greece	Italy	Portugal	Spain	Rest of EZ	Rest of EU	ROW
1. Agricultural products	0,290	0,353	0,633	0,355	0,030	0,017	0,001
2. Chemical industry	0,399	0,660	0,884	0,677	0,019	0,013	−0,014
3. Machinery and equipment	2,133	1,756	1,917	1,513	0,081	0,059	−0,004
4. Electronic equipment	1,337	1,656	1,566	1,344	0,134	0,124	0,010
5. Motor vehicles	1,084	0,819	0,856	0,712	0,052	0,041	0,000
6. Other transport equipment	3,748	1,618	2,608	2,322	0,063	0,117	0,014
7. Other industry	0,706	0,859	0,926	0,670	0,021	0,020	−0,004
8. Construction	6,251	3,872	4,303	3,157	−0,091	−0,092	0,015
9. Trade and hostelry	0,559	0,409	0,300	0,242	0,001	0,000	0,002
10. Transport and communications	0,265	0,467	0,418	0,440	−0,007	−0,004	0,000
11. Financial intermediation	−0,231	−0,052	0,124	−0,064	0,002	0,002	−0,001
12. Other business services	0,578	0,540	0,425	0,554	−0,008	−0,007	0,000
13. Recreational services	0,175	0,137	0,285	0,226	−0,006	−0,004	0,001
14. Education	1,169	0,849	1,189	0,841	−0,008	−0,007	−0,002
15. Health and social services	1,258	0,433	0,946	0,650	−0,003	−0,006	0,002
16. Other government services	−11,467	−11,839	−12,661	−12,835	−0,018	−0,020	−0,001
17. Other services	−0,265	−0,194	−0,130	−0,193	0,001	0,002	0,001

Table 6. Simulation results: effects on sectoral employment (% change from benchmark)

A) Increase in final consumption taxes

	Greece	Italy	Portugal	Spain	Rest of EZ	Rest of EU	ROW
1. Agricultural products	−0.164	−0.170	0.100	−0.027	−0.022	−0.017	−0.003
2. Chemical industry	−0.980	−0.145	−0.275	−0.200	−0.112	−0.085	−0.014
3. Machinery and equipment	1.881	1.305	1.280	1.145	0.121	0.105	0.019
4. Electronic equipment	0.392	1.156	0.759	0.830	0.104	0.088	0.022
5. Motor vehicles	−0.047	0.313	0.129	0.387	0.023	0.025	0.003
6. Other transport equipment	3.318	0.942	1.901	2.206	0.067	0.116	0.039
7. Other industry	−0.205	0.079	−0.040	−0.021	−0.012	−0.016	−0.003
8. Construction	7.311	4.435	4.565	3.437	0.004	0.004	0.001
9. Trade and hostelry	−0.319	−0.082	−0.402	−0.397	0.001	0.001	0.000
10. Transport and communications	−0.497	0.225	−0.160	−0.179	−0.006	−0.005	−0.002
11. Financial intermediation	−0.571	−0.299	−0.393	−0.378	−0.004	−0.003	0.000
12. Other business services	−0.117	0.193	−0.105	0.071	−0.002	−0.001	0.001
13. Recreational services	−0.956	−1.106	−0.981	−1.157	−0.004	−0.005	−0.001
14. Education	−3.026	−2.755	−2.336	−2.672	−0.002	0.001	0.000
15. Health and social services	−3.695	−3.622	−3.150	−3.672	0.001	0.003	0.000
16. Other government services	−4.511	−3.923	−3.689	−4.122	0.000	0.004	0.000
17. Other services	−1.622	−0.664	−1.065	−0.749	−0.009	−0.012	−0.001
TOTAL	−1.255	−0.708	−0.729	−0.709	0.002	0.003	0.000

B) Increase in labour taxes

	Greece	Italy	Portugal	Spain	Rest of EZ	Rest of EU	ROW
1. Agricultural products	0.003	0.163	0.310	0.119	−0.024	−0.019	−0.003
2. Chemical industry	−1.437	−0.163	−0.336	−0.220	−0.128	−0.101	−0.018
3. Machinery and equipment	2.001	1.416	1.368	1.193	0.127	0.107	0.018
4. Electronic equipment	0.303	1.293	0.852	0.928	0.118	0.098	0.024
5. Motor vehicles	0.357	0.314	0.160	0.384	0.031	0.031	0.003
6. Other transport equipment	3.511	1.092	1.972	2.264	0.071	0.128	0.042
7. Other industry	−0.070	0.313	0.153	0.138	−0.003	−0.009	−0.001
8. Construction	8.003	4.630	4.770	3.477	0.004	0.004	0.001
9. Trade and hostelry	−0.875	−0.504	−0.859	−0.590	0.001	0.002	0.000
10. Transport and communications	−1.076	−0.215	−0.487	−0.288	−0.007	−0.006	−0.003
11. Financial intermediation	−1.014	−0.453	−0.681	−0.475	−0.005	−0.004	−0.001
12. Other business services	−0.652	−0.023	−0.416	0.001	−0.003	−0.003	0.000
13. Recreational services	−1.365	−1.094	−1.127	−1.328	−0.005	−0.006	−0.001
14. Education	−4.514	−3.534	−3.109	−2.965	0.000	0.003	0.001
15. Health and social services	−5.462	−4.653	−4.144	−4.058	0.002	0.005	0.000
16. Other government services	−6.637	−5.065	−4.803	−4.534	0.002	0.005	0.001
17. Other services	−1.971	−1.099	−1.098	−0.965	−0.009	−0.011	−0.001
TOTAL	−2.047	−1.055	−1.111	−0.845	0.003	0.004	0.000

Table 6 (continued)

C) Decrease in public consumption in Health and social services

	Greece	Italy	Portugal	Spain	Rest of EZ	Rest of EU	ROW
1. Agricultural products	0.283	0.326	0.504	0.240	0.022	0.011	0.000
2. Chemical industry	0.076	0.234	−0.106	−0.246	−0.145	−0.103	−0.032
3. Machinery and equipment	2.285	1.759	1.855	1.444	0.106	0.075	0.003
4. Electronic equipment	1.585	1.733	1.499	1.354	0.143	0.122	0.015
5. Motor vehicles	1.058	0.809	0.822	0.651	0.056	0.047	0.002
6. Other transport equipment	3.711	1.573	2.561	2.268	0.078	0.114	0.021
7. Other industry	0.641	0.784	0.741	0.480	0.022	0.015	−0.002
8. Construction	6.095	4.316	4.648	3.379	−0.053	−0.053	0.010
9. Trade and hostelry	0.334	0.629	0.321	0.145	−0.001	0.000	0.001
10. Transport and communications	0.479	0.875	0.726	0.591	−0.004	−0.001	0.000
11. Financial intermediation	0.368	0.536	0.506	0.241	0.004	0.003	0.000
12. Other business services	0.599	0.774	0.580	0.574	−0.001	0.000	0.002
13. Recreational services	0.120	0.219	0.273	0.228	−0.003	−0.003	0.000
14. Education	2.157	1.750	2.294	1.426	−0.010	−0.008	−0.002
15. Health and social services	−10.798	−11.315	−12.128	−12.276	−0.011	−0.005	0.001
16. Other government services	2.023	0.575	2.001	1.259	−0.006	−0.013	−0.001
17. Other services	−0.124	0.217	0.199	−0.021	−0.004	−0.001	0.000
TOTAL	−0.812	−0.401	−0.402	−0.471	0.001	0.000	0.001

D) Decrease in public consumption in Education

	Greece	Italy	Portugal	Spain	Rest of EZ	Rest of EU	ROW
1. Agricultural products	0.372	0.544	0.850	0.483	0.017	0.013	0.000
2. Chemical industry	0.749	1.147	1.552	1.068	0.050	0.035	−0.008
3. Machinery and equipment	2.602	2.243	2.465	1.908	0.064	0.047	−0.008
4. Electronic equipment	1.728	2.099	2.063	1.675	0.122	0.117	0.010
5. Motor vehicles	1.201	1.215	1.314	0.909	0.037	0.027	−0.002
6. Other transport equipment	4.118	2.118	3.302	2.573	0.051	0.105	0.012
7. Other industry	0.771	1.115	1.237	0.823	0.011	0.014	−0.005
8. Construction	6.397	4.393	4.772	3.416	−0.075	−0.076	0.014
9. Trade and hostelry	0.789	0.942	0.784	0.377	0.002	0.002	0.002
10. Transport and communications	0.615	1.077	1.003	0.787	−0.005	0.000	0.001
11. Financial intermediation	0.714	0.907	0.898	0.498	0.006	0.005	0.001
12. Other business services	0.848	1.178	0.994	0.903	−0.003	−0.001	0.002
13. Recreational services	0.243	0.450	0.578	0.570	−0.008	−0.006	0.000
14. Education	−26.605	−27.874	−30.874	−29.871	−0.010	−0.008	−0.002
15. Health and social services	3.397	3.420	4.451	3.353	0.005	−0.001	0.002
16. Other government services	2.892	2.173	3.986	3.121	−0.020	−0.019	−0.002
17. Other services	−0.309	0.352	0.380	−0.028	0.002	0.003	0.001
TOTAL	−1.145	−0.605	−0.705	−0.770	0.002	0.001	0.001

Table 6 (continued)

E) Decrease in public consumption in Other government services

	Greece	Italy	Portugal	Spain	Rest of EZ	Rest of EU	ROW
1. Agricultural products	0.339	0.416	0.743	0.414	0.035	0.023	0.001
2. Chemical industry	0.403	0.748	0.941	0.712	0.019	0.014	−0.014
3. Machinery and equipment	2.137	1.829	1.966	1.542	0.081	0.059	−0.004
4. Electronic equipment	1.340	1.744	1.623	1.379	0.135	0.125	0.010
5. Motor vehicles	1.086	0.898	0.903	0.738	0.052	0.042	0.000
6. Other transport equipment	3.750	1.691	2.639	2.340	0.063	0.117	0.014
7. Other industry	0.720	0.928	0.969	0.702	0.022	0.021	−0.004
8. Construction	6.257	3.990	4.355	3.202	−0.091	−0.091	0.015
9. Trade and hostelry	0.566	0.556	0.374	0.295	0.001	0.001	0.002
10. Transport and communications	0.274	0.610	0.495	0.495	−0.007	−0.003	0.000
11. Financial intermediation	−0.227	0.042	0.191	−0.020	0.002	0.003	−0.001
12. Other business services	0.585	0.669	0.497	0.606	−0.008	−0.006	0.000
13. Recreational services	0.179	0.221	0.332	0.259	−0.006	−0.004	0.001
14. Education	1.171	0.883	1.208	0.853	−0.008	−0.007	−0.002
15. Health and social services	1.261	0.469	0.967	0.662	−0.003	−0.006	0.002
16. Other government services	−11.463	−11.779	−12.627	−12.812	−0.017	−0.020	−0.001
17. Other services	−0.259	−0.021	−0.057	−0.111	0.001	0.004	0.001
TOTAL	−0.276	−0.190	−0.181	−0.241	0.001	0.000	0.001

Table 7. Sensitivity analysis: Effect on macroeconomic variables (% change from benchmark)

A. Increase in final consumption taxes

	Greece						Italy	Portugal	Spain	Rest of EZ	Rest of EU	ROW
	GDP	Employment	Compensation of employees	Gross operating surplus	Public expenditure	Public revenue	GDP					
Simulation	−0.484	−1.255	−1.101	−0.210	0.000	0.696	−0.274	−0.329	−0.382	0.003	0.004	0.000
σ_i^{VA}=[0.2-1.7]												
$\sigma_i'^{VA}$=0.5*σ_i^{VA}	−0.462	−1.097	−0.905	−0.263	0.001	0.815	−0.266	−0.310	−0.357	0.004	0.004	0.000
$\sigma_i'^{VA}$=2*σ_i^{VA}	−0.510	−1.435	−1.326	−0.150	0.000	0.560	−0.282	−0.350	−0.409	0.003	0.004	0.000
σ_i^{d}=[1.9-4.4]												
$\sigma_i'^{d}$=0.5*σ_i^{d}	−0.501	−1.279	−1.113	−0.227	0.000	0.732	−0.282	−0.332	−0.382	0.004	0.004	0.000
$\sigma_i'^{d}$=2*σ_i^{d}	−0.457	−1.216	−1.083	−0.182	0.000	0.638	−0.260	−0.324	−0.383	0.003	0.003	0.000
σ_i^{m}=[3.8-8.8]												
$\sigma_i'^{m}$=0.5*σ_i^{m}	−0.517	−1.301	−1.121	−0.247	0.000	0.759	−0.288	−0.357	−0.409	0.005	0.006	0.000
$\sigma_i'^{m}$=2*σ_i^{m}	−0.443	−1.199	−1.077	−0.164	0.000	0.620	−0.257	−0.297	−0.350	0.002	0.000	0.000
β=−0.1												
β'=0.5*β	−0.552	−1.405	−1.217	−0.258	0.001	0.419	−0.342	−0.398	−0.421	0.004	0.005	0.000
β'=2*β	−0.385	−1.633	−0.931	−0.140	0.000	1.105	−0.189	−0.242	−0.321	0.003	0.003	0.000
All elasticities												
Halved	−0.589	−1.245	−0.934	−0.425	0.001	0.802	−0.368	−0.418	−0.429	0.008	0.010	0.001
Doubled	−0.354	−1.053	−1.003	−0.068	0.000	0.967	−0.179	−0.235	−0.328	0.001	0.002	0.000

Table 7 (continued)

B. Increase in labour taxes

	Greece						Italy	Portugal	Spain	Rest of EZ	Rest of EU	ROW
	GDP	Employment	Compensation of employees	Gross operating surplus	Public expenditure	Public revenue	GDP					
Simulation	−1.136	−2.047	−2.687	−0.467	0.001	−0.163	−0.749	−0.858	−0.648	0.005	0.006	0.001
σ_i^{VA}=[0.2-1.7]												
$\sigma_i^{'VA}$=0.5*σ_i^{VA}	−1.115	−1.730	−2.318	−0.605	0.001	0.078	0.709	−0.800	−0.620	0.005	0.007	0.001
$\sigma_i^{'VA}$=2*σ_i^{VA}	−1.162	−2.393	−3.090	−0.323	0.001	−0.421	0.799	−0.925	−0.681	0.004	0.005	0.000
σ_i^{d}=[1.9-4.4]												
$\sigma_i^{'d}$=0.5*σ_i^{d}	−1.182	−2.102	−2.764	−0.498	0.001	−0.167	−0.780	−0.884	−0.669	0.005	0.006	0.001
$\sigma_i^{'d}$=2*σ_i^{d}	−1.061	−1.956	−2.563	−0.416	0.001	−0.156	−0.702	−0.813	−0.615	0.004	0.005	0.001
σ_i^{m}=[3.8-8.8]												
$\sigma_i^{'m}$=0.5*σ_i^{m}	−1.330	−2.279	−3.007	−0.601	0.001	−0.186	−0.865	−1.007	−0.733	0.006	0.009	0.001
$\sigma_i^{'m}$=2*σ_i^{m}	−0.934	−1.806	−2.354	−0.326	0.001	−0.138	−0.638	−0.711	−0.560	0.003	0.004	0.000
β=−0.1												
β'=0.5*β	−1.091	−2.119	−2.501	−0.482	0.001	−0.334	−0.685	−0.787	−0.616	0.005	0.007	0.001
β'=2*β	−1.218	−1.917	−3.026	−0.439	0.001	−0.148	−0.850	−0.971	−0.705	0.004	0.005	0.000
All elasticities												
Halved	−1.435	−2.059	−2.532	−0.959	0.002	0.011	−0.845	−0.971	−0.735	0.010	0.013	0.001
Doubled	−1.032	−1.893	−2.940	−0.209	0.000	−0.001	−0.759	−0.876	−0.636	0.002	0.002	0.000

Table 7 (continued)

C. Decrease in public consumption in Health and social services

	Greece						Italy	Portugal	Spain	Rest of EZ	Rest of EU	ROW
	GDP	Employment	Compensation of employees	Gross operating surplus	Public expenditure	Public revenue	GDP					
Simulation	−0.342	−0.812	−1.108	−0.022	−4.189	−0.247	−0.166	−0.224	−0.261	−0.009	0.005	0.001
σ_i^{VA}=[0.2-1.7]												
$\sigma_i^{'VA}$=0.5*σ_i^{VA}	−0.362	−0.928	−1.248	0.004	−4.311	−0.325	−0.183	−0.253	−0.293	−0.009	0.005	0.001
$\sigma_i^{'VA}$=2*σ_i^{VA}	−0.317	−0.666	−0.932	−0.058	−4.036	−0.148	−0.150	−0.196	−0.224	−0.009	0.006	0.001
σ_i^{d}=[1.9-4.4]												
$\sigma_i^{'d}$=0.5*σ_i^{d}	−0.357	−0.817	−1.123	−0.037	−4.204	−0.259	−0.166	−0.224	−0.261	−0.009	0.005	0.001
$\sigma_i^{'d}$=2*σ_i^{d}	−0.319	−0.803	−1.085	0.035	−4.167	−0.247	−0.166	−0.224	−0.261	−0.009	0.005	0.001
σ_i^{m}=[3.8-8.8]												
$\sigma_i^{'m}$=0.5*σ_i^{m}	−0.342	−0.812	−1.108	−0.022	−4.189	−0.247	−0.166	−0.224	−0.261	−0.009	0.005	0.001
$\sigma_i^{'m}$=2*σ_i^{m}	−0.342	−0.812	−1.108	−0.022	−4.189	−0.247	−0.166	−0.224	−0.261	−0.009	0.005	0.001
β=−0.1												
β'=0.5*β	−0.342	−0.812	−1.108	−0.022	−4.189	−0.247	−0.166	−0.224	−0.261	−0.009	0.005	0.001
β'=2*β	−0.342	−0.812	−1.108	−0.022	−4.189	−0.247	−0.166	−0.224	−0.261	−0.009	0.005	0.001
All elasticities												
Halved	−0.550	−1.133	−1.422	−0.186	−4.657	−0.471	−0.339	−0.420	−0.404	−0.017	−0.008	0.002
Doubled	−1.165	−0.398	−0.661	0.039	−3.670	0.030	−0.060	−0.093	−0.121	−0.005	−0.003	0.001

Table 7 (continued)

D. Decrease in public consumption in Education

	Greece						Italy	Portugal	Spain	Rest of EZ	Rest of EU	ROW
	GDP	Employment	Compensation of employees	Gross operating surplus	Public expenditure	Public revenue	GDP					
Simulation	−0.154	−0.387	−0.525	0.002	−1.471	−0.126	−0.091	−0.122	−0.144	−0.002	−0.002	0.001
σ_i^{VA}=[0.2-1.7]												
$\sigma_i^{'VA}$=0.5*σ_i^{VA}	−0.164	−0.444	−0.594	0.015	−1.528	−0.165	−0.098	−0.137	−0.159	−0.002	−0.002	0.000
$\sigma_i^{'VA}$=2*σ_i^{VA}	−0.141	−0.315	−0.437	−0.017	−1.399	−0.076	−0.084	−0.108	−0.127	−0.002	−0.003	0.001
σ_i^{d}=[1.9-4.4]												
$\sigma_i^{'d}$=0.5*σ_i^{d}	−0.160	−0.389	−0.530	−0.004	−1.476	−0.131	−0.097	−0.128	−0.150	−0.002	−0.002	0.001
$\sigma_i^{'d}$=2*σ_i^{d}	−0.145	−0.384	−0.515	0.010	−1.462	−0.118	−0.082	−0.114	−0.135	−0.002	−0.002	0.000
σ_i^{m}=[3.8-8.8]												
$\sigma_i^{'m}$=0.5*σ_i^{m}	−0.189	−0.398	−0.558	−0.035	−1.515	−0.159	−0.128	−0.169	−0.177	−0.003	−0.003	0.001
$\sigma_i^{'m}$=2*σ_i^{m}	−0.129	−0.377	−0.498	0.026	−1.438	−0.102	−0.066	−0.093	−0.121	−0.001	−0.001	0.000
β=-0.1												
β'=0.5*β	−0.188	−0.489	−0.586	−0.020	−1.548	−0.162	−0.121	−0.155	−0.175	−0.002	−0.002	0.001
β'=2*β	−0.115	−0.273	−0.456	0.026	−1.384	−0.065	−0.065	−0.094	−0.112	−0.002	−0.002	0.000
All elasticities												
Halved	−0.242	−0.534	−0.663	−0.065	−1.633	−0.225	−0.181	−0.224	−0.227	−0.003	−0.003	0.001
Doubled	−0.075	−0.192	−0.317	0.025	−1.267	0.004	−0.035	−0.052	−0.068	−0.001	−0.002	0.000

Table 7 (continued)

E. Decrease in public consumption in Other government services

	Greece						Italy	Portugal	Spain	Rest of EZ	Rest of EU	ROW
	GDP	Employment	Compensation of employees	Gross operating surplus	Public expenditure	Public revenue	GDP					
Simulation	−0.303	−0.337	−0.563	−0.218	−4.496	0.174	−0.227	−0.295	−0.275	−0.011	−0.011	0.002
σ_i^{VA}=[0.2-1.7]												
$\sigma_i'^{VA}$=0.5*σ_i^{VA}	−0.305	−0.349	−0.579	−0.227	−4.504	0.164	−0.239	−0.310	−0.290	−0.012	−0.011	0.002
$\sigma_i'^{VA}$=2*σ_i^{VA}	−0.300	−0.321	−0.542	−0.213	−4.479	0.186	−0.216	−0.282	−0.259	−0.011	−0.011	0.002
σ_i^{d}=[1.9-4.4]												
$\sigma_i'^{d}$=0.5*σ_i^{d}	−0.325	−0.342	−0.562	−0.242	−4.499	0.155	−0.249	−0.317	−0.295	−0.012	−0.011	0.002
$\sigma_i'^{d}$=2*σ_i^{d}	−0.268	−0.330	−0.534	−0.181	−4.490	0.205	−0.194	−0.260	−0.245	−0.010	−0.010	0.002
σ_i^{m}=[3.8-8.8]												
$\sigma_i'^{m}$=0.5*σ_i^{m}	−0.439	−0.362	−0.674	−0.367	−4.570	0.040	−0.350	−0.471	−0.386	−0.017	−0.016	0.003
$\sigma_i'^{m}$=2*σ_i^{m}	−0.207	−0.318	−0.482	−0.111	−4.439	0.272	−0.144	−0.184	−0.198	−0.007	−0.007	0.001
β=-0.1												
β'=0.5*β	−0.330	−0.421	−0.610	−0.236	−4.528	0.144	−0.261	−0.329	−0.312	−0.011	−0.011	0.002
β'=2*β	−0.271	−0.241	−0.508	−0.197	−4.458	0.209	−0.197	−0.266	−0.237	−0.011	−0.011	0.002
All elasticities												
Halved	−0.514	−0.403	−0.708	−0.473	-4.523	−0.014	−0.459	−0.580	−0.480	−0.020	−0.018	0.004
Doubled	−0.153	−0.176	−0.344	0.088	-4.309	0.355	−0.099	−0.135	−0.132	−0.006	−0.006	0.001