Economics Bulletin

Volume 31, Issue 3

Fiscal policy, economic activity and welfare: the case of Greece

Dimitris Papageorgiou
Athens University of Economics and Business

Abstract

This paper examines how changes in different fiscal (tax-spending) policy instruments affect economic activity and social welfare in the Greek economy. The setup is a neoclassical growth model augmented with a public sector. The government's spending instruments include public consumption, investment and lump-sum transfers; on the revenue side, labour, capital and consumption taxes are employed. The results suggest that changes in the tax rates on labour and capital income have quantitatively significant effects on key macroeconomic variables, as well as on social welfare. When financed by distorting taxes, increases in government consumption hurt both output and welfare. To the contrary, a rise in public investment, when financed by consumption or labour income taxes, can stimulate the economy and increase welfare in the long run.

I thank the editor for helpful comments. I also thank Tryphon Kollintzas, Apostolis Philippopoulos and Vanghelis Vassilatos for comments and suggestions. Any errors are my own. Department of Economics, Athens University of Economics and Business, 76 Patission Street, Athens 10434, Greece. E-mail address: dpapag@aueb.gr

Citation: Dimitris Papageorgiou, (2011) ''Fiscal policy, economic activity and welfare: the case of Greece'', *Economics Bulletin*, Vol. 31 No. 3 pp. 2629-2640.
Contact: Dimitris Papageorgiou - dpapag@aueb.gr.
Submitted: September 06, 2010. **Published:** September 13, 2011.

1. Introduction

This paper examines how changes in different fiscal (tax-spending) policy instruments affect economic activity and social welfare in the Greek economy. The setup is a neoclassical growth model augmented with an enriched public sector. In particular, the government's spending instruments include public consumption, investment and lump-sum transfers; on the revenue side, labour, capital and consumption taxes are employed. The approach of the paper can be summarized as follows. First, the model is calibrated on data for the Greek economy. Then, departing from the benchmark calibrated economy, we examine two types of balanced-neutral policy experiments: (i) changes in distorting tax rates or spending instruments that are met by adjustments in lump-sum transfers (ii) changes in spending instruments that are met by adjustments in distorting taxes**.** We focus on the steady-state, so that we compare the pre-reform long-run equilibrium to the post-reform long-run equilibrium.

With few exceptions, applied macroeconomic research based on micro-founded dynamic general equilibrium models is limited in Greece.[1] Hence, there are no many reliable quantitative answers to questions related to the macroeconomic effects of policy reforms. This is particularly important nowadays where the accumulation of chronic imbalances calls for drastic changes. The present paper tries to fill this gap.

Our main results are as follows. First, changes in the tax rates on labour and capital income have quantitatively significant effects on key macroeconomic variables, such as output and consumption, as well as on social welfare. For instance, a 5% decrease in the tax rate on labour income, when financed by lower lump-sum transfers, leads to an increase in long-run output and welfare by 1.2% and 0.78% respectively. Second, while a rise in public consumption, being financed by lower lump-sum transfers, stimulates output, it has adverse effects on social welfare. By contrast, a rise in public investment is good for both output and welfare. Third, increases in government consumption, being financed by higher distorting taxes, have negative effects on both output and welfare, and this is regardless of the tax rate used to satisfy the government budget constraint. In contrast, higher public investment spending, when financed by consumption or labour income taxes, can stimulate the economy and increase social welfare.

The rest of the paper is as follows. Section 2 presents the model, calibration and the long-run solution. Section 3 contains the results. Section 4 concludes.

2. The Model Economy

The model economy consists of a household, a firm and a government. The household owns physical capital, makes investment decisions and rents labour and capital services to the firm. It also receives profits in the form of dividends. The firm behaves competitively and produces output by choosing private capital and labour and by using public capital. Long-term growth is driven by labour augmenting technology that grows at an exogenous rate γ_z.[2] The government levies taxes on labour and capital income and on consumption. It then uses its tax revenues to finance three activities: public consumption that provides direct utility to the

[1] See Kollintzas and Vassilatos (2000), Angelopoulos *et al*. (2009) and Papageorgiou (2009) for the Greek economy. By contrast, there is a large and still growing literature on the effects of fiscal policy in other countries (see, among many others, Baxter and King (1993), Jonsson and Klein (1996), Mendoza and Tesar (1998), Ardagna (2001), Malley *et al*. (2009) and Forni *et al*. (2010)).

[2] Labour augmenting technology grows according to $Z_{t+1} = \gamma_z Z_t$, where $\gamma_z \geq 1$ and $Z_0 > 0$ is given. Without loss of generality, we work with de-trended variables.

household, public investment that augments public capital, and lump-sum transfers to the household.

2.1. Households

The infinitely-lived household has preferences over consumption and leisure that are represented by the intertemporal utility function:

$$\sum_{t=0}^{\infty}\beta^t u\left(c_t^p+\vartheta g_t^c,l_t\right) \tag{1}$$

where $\beta\in(0,1)$ is the discount factor, c_t^p is private consumption time at t, l_t is leisure time at t, and g_t^c is public consumption goods and services provided by the government.[3] Thus, public consumption influences private utility through the parameter $\vartheta\in[-1,1]$, which measures the degree of substitutability/complementarity between private and public consumption in the utility function.[4] The instantaneous utility function is of the form:

$$u\left(c_t^p+\vartheta g_t^c,l_t\right)=\frac{\left[\left(c_t^p+\vartheta g_t^c\right)^{\gamma}\left(l_t\right)^{1-\gamma}\right]^{1-\sigma}}{1-\sigma},\qquad \gamma\in(0,1),\quad \sigma\geq 0 \tag{2}$$

where γ and σ are preference parameters.

The household is endowed with one unit of time in each period and divides it between work effort, h_t, and leisure l_t; thus $l_t+h_t=1$ at each t. It saves in the form of investment, i_t, and receives labour income, w_th_t, and capital income, $r_tk_t^p$, where w_t is the wage rate and r_t is the return to private capital, k_t^p. Finally, the household receives dividends paid by the firm, π_t, and lump-sum government transfers, g_t^{tr}. The budget constraint in each period is:

$$\left(1+\tau_t^c\right)c_t^p+i_t=\left(1-\tau_t^l\right)w_th_t+\left(1-\tau_t^k\right)\left(r_t k_t^p+\pi_t\right)+\tau_t^k\delta^p k_t^p+g_t^{tr} \tag{3}$$

where $0\leq\tau_t^c<1$ is the tax rate on consumption, $0\leq\tau_t^l<1$ is the tax rate on labour income and $0\leq\tau_t^k<1$ is the tax rate on income from capital earnings and dividends. The term $\tau_t^k\delta^p k_t^p$ represents the depreciation allowance built in the Greek tax code, where $\delta^p\in(0,1)$ is the depreciation rate of private capital. The law of motion of private capital is:

$$\gamma_z k_{t+1}^p=\left(1-\delta^p\right)k_t^p+i_t \tag{4}$$

Taking prices and policy as given, the household chooses $\left\{c_t^p,l_t,h_t,i_t,k_{t+1}^p\right\}_{t=0}^{\infty}$ to maximize (1)-(2) subject to (3)-(4), $l_t+h_t=1$ and k_0^p given. The first-order conditions include:

[3] $\beta\equiv\beta^*\gamma_z^{\gamma(1-\sigma)}$, where β^* is the true discount factor.

[4] See also e.g. Christiano and Eichenbaum (1992).

$$\frac{\partial u_t(.)}{\partial l_t} = \frac{\partial u_t(.)}{\partial c_t^p}\frac{\left(1-\tau_t^l\right)}{\left(1+\tau_t^c\right)}w_t \tag{5}$$

$$\frac{\gamma_z}{\left(1+\tau_t^c\right)}\frac{\partial u_t(.)}{\partial c_t^p} = \beta\left[\frac{1}{\left(1+\tau_{t+1}^c\right)}\frac{\partial u_{t+1}(.)}{\partial c_{t+1}^p}\left(\left(1-\tau_{t+1}^k\right)\left(r_{t+1}-\delta^p\right)+1\right)\right] \tag{6}$$

where (5) is the intratemporal condition for the labour supply and (6) is the Euler equation for k_{t+1}^p. The optimality conditions are completed with the transversality condition, $\lim_{t\to\infty}\beta^t \frac{\partial u_t(.)}{\partial c_t^p}k_{t+1}^p = 0$.

2.2. Firms

The firm produces an output, y_t, by choosing capital, k_t^p, and labor, h_t, and by making use of public capital, k_t^g. The production function is:

$$y_t = \left(k_t^p\right)^{a_1}\left(h_t\right)^{a_2}\left(k_t^g\right)^{a_3} \tag{7}$$

where $a_i \in (0,1)$, $i = 1,2,3$ is the output elasticity of private capital, of labour and public capital, respectively. We follow e.g. Lansing (1998) by assuming constant returns to all three inputs. Taking prices and policy as given, the firm chooses k_t^p and h_t to maximize profits:

$$\pi_t = y_t - r_t k_t^p - w_t h_t \tag{8}$$

The first-order conditions are:

$$r_t = a_1\frac{y_t}{k_t^p} \tag{9}$$

$$w_t = a_2\frac{y_t}{h_t} \tag{10}$$

which equate factor returns to marginal products. Then, profits are $\pi_t = \left(1-a_1-a_2\right)y_t > 0$.

2.3. Government

The government levies taxes on consumption spending and on labour and capital income to finance public consumption, g_t^c, public investment, g_t^i, and lump-sum transfers, g_t^{tr}. The within-period budget constraint is:

$$\tau_t^c c_t^p + \tau_t^l w_t h_t + \tau_t^k\left(r_t k_t^p + \pi_t\right) - \tau_t^k\delta^p k_t^p = g_t^c + g_t^{tr} + g_t^i \tag{11}$$

where only five of the six fiscal instruments, $\tau_t^l, \tau_t^k, \tau_t^c, g_t^c, g_t^{tr}, g_t^i$, can be exogenously set, with the sixth residually determined so that the budget is satisfied (see below).

The law of motion of public capital is:

$$\gamma_z k_{t+1}^g = \left(1-\delta^g\right) k_t^g + g_t^i, \qquad k_0^g > 0 \text{ given} \tag{12}$$

where $\delta^g \in (0,1)$ is the depreciation rate of public capital.

2.4. Decentralized competitive equilibrium

Given the paths of five of the six policy instruments, $\left\{\tau_t^l, \tau_t^k, \tau_t^c, g_t^c, g_t^{tr}, g_t^i\right\}_{t=0}^{\infty}$, and initial conditions for the state variables, k_0^p, k_0^g, a decentralized competitive equilibrium (DCE) is defined to be a sequence of allocations and prices $\left\{y_t, c_t^p, h_t, i_t, k_{t+1}^p, k_{t+1}^g; r_t, w_t\right\}_{t=0}^{\infty}$ and one policy instrument such that: (i) the household maximizes utility (ii) the firm maximizes profits (iii) all markets clear and (iv) the government budget constraint is satisfied. This equilibrium is determined by equations (4)-(7), (9)-(12) and the aggregate resource constraint, $y_t = c_t^p + i_t + g_t^c + g_t^i$.

2.4.1. Long-run equilibrium equations

In the long run (steady state), stationary variables remain constant. Thus, $x_{t+1} = x_t = x_{t-1} \equiv x$ for all t, where x is the long-run value of any variable x_t. The following equations summarize the long-run DCE:

$$h = \frac{a_2\left(\frac{\gamma}{1-\gamma}\right)\left(\frac{1-\tau^l}{1+\tau^c}\right)}{\frac{c^p + \vartheta g^c}{y} + a_2\left(\frac{\gamma}{1-\gamma}\right)\left(\frac{1-\tau^l}{1+\tau^c}\right)} \tag{13a}$$

$$\frac{k^p}{y} = \frac{\beta a_1\left(1-\tau^k\right)}{\gamma_z + \beta\left[\left(1-\tau^k\right)\delta^p - 1\right]} \tag{13b}$$

$$\frac{i}{y} = \left[\gamma_z - \left(1-\delta^p\right)\right]\frac{k^p}{y} \tag{13c}$$

$$\frac{c^p}{y} = 1 - \frac{i}{y} - \frac{g^c}{y} - \frac{g^i}{y} \tag{13d}$$

$$\frac{k^g}{y} = \frac{(g^i / y)}{\gamma_z - \left(1-\delta^g\right)} \tag{13e}$$

$$y = \left(k^p\right)^{a_1}\left(h\right)^{a_2}\left(k^g\right)^{a_3} \tag{13f}$$

$$\tau^c\frac{c^p}{y} + \tau^l a_2 + \tau^k\left(a_1 + a_3\right) - \tau^k\delta^p\frac{k^p}{y} = \frac{g^c}{y} + \frac{g^{tr}}{y} + \frac{g^i}{y} \tag{13g}$$

where $r = a_1\frac{y}{k^p}$ and $w = a_2\frac{y}{h}$. Equations (13a)-(13g) represent respectively the equilibrium condition in the labour market, the Euler equation for capital, the motion of private capital accumulation, the resource constraint, the motion of public capital accumulation, the production function and the government budget constraint, all written in the long run.

2.5. Calibration and long-run solution

The model is calibrated to the Greek economy using annual data over 1970-2008.[5] Table I reports the calibrated parameters and the average values of the fiscal policy variables in the data. Some parameters are set on the basis of a priori information. As in most studies, the curvature parameter in the utility function, σ, is set equal to 2. The preference parameter, ϑ, which measures the degree of substitutability between private and public consumption in the utility function, is set equal to 0.1; see also Baier and Glomm (2001). Following the study of Kollintzas and Vassilatos (2000), the values of the two physical depreciation rates, δ^p and δ^g are set equal to 0.0279 and 0.0312, respectively. The gross growth rate of technological process, γ_z, is set equal to 1.02, which is the average annual growth rate of real per capita GDP in the US. The initial level of technological process Z_0 is normalized to one, since it is only a scale parameter.

Table I: Calibration

Parameter or Variable	Description	Value	Source
a_2	Labour elasticity in production	0.60	Set
a_3	Public capital elasticity in production	0.030	Set equal to g^i / y
a_1	Private capital elasticity in production	0.37	Calibrated as 1-a_2-a_3
γ_z	Growth rate of labour augmenting technology	1.02	Set
δ^p	Private capital depreciation rate	0.0279	Set
δ^g	Public capital depreciation rate	0.0312	Set
Z_0	Initial level of technological process	1	Set
σ	Curvature parameter in the utility function	2	Set
γ	Consumption weight in utility function	0.3766	Calibrated from (13a)
β	Time discount factor	0.9706	Calibrated from (13b) and (13c)
ϑ	Substitutability between private and public consumption in utility	0.1	Set
k^p / y	Private capital to output ratio	3.9332	Calibrated from (13b)
g^c / y	Government consumption to output ratio	0.1476	Data Average
g^i / y	Government investment to output ratio	0.030	Data Average
τ^l	Tax rate on labour income	0.2865	Data Average
τ^k	Tax rate on capital income	0.2316	Data Average
τ^c	Tax rate on consumption	0.1607	Data Average

[5] The data source is the OECD Economic Outlook No 87. Data on hours of work are from the Groningen Growth and Development Centre.

The average value of per capita hours of work in data is $h = 0.2354$.[6] The value of government consumption as share of GDP is set equal to 0.1476, which is the average value found in the data. The value of the labour share in output is taken from Papageorgiou (2009) and is equal to 0.60. Following Baxter and King (1993), the exponent of public capital in the production function, a_3, is set equal to the average public investment to output ratio in the data. The capital share is then residually calibrated as $a_1 = 1 - a_2 - a_3$. The tax rates on capital income, labour income and consumption are set equal to their average values over the period 1992-2008 from constructed effective tax rates.[7] Given the value of private investment to GDP, i/y, which is set equal to its average value derived from data, the time discount factor β and the ratio of private capital to GDP k^p/y are jointly calibrated from the Euler equation for private capital (13b) and the law of motion of private capital accumulation (13c). The preference parameter γ, which is the weight for consumption relative to leisure, is calibrated from the optimality condition for labour supply (13a). Table I summarizes results.

In turn, the long-run solution is reported in Table II. This unique solution is derived by substituting the parameters reported in Table I into (13a)-(13g) and solving for the endogenous variables. In this solution, government transfers as share of output are residually determined to satisfy the long-run government budget constraint. The results reported in Table II suggest that the model's long-run solution is in line with the data, and a reasonable starting point for the policy experiments described in the next section.

Table II: Data averages and long-run model solution

Variable	Description	Data averages	Long-run solution
c^p/y	Consumption to output ratio	0.7088	0.6340
i/y	Private investment to output ratio	0.1884	0.1884
h	Hours at work	0.2354	0.2556
k^p/y	Private capital to output ratio	na	3.9332
k^g/y	Public capital to output ratio	na	0.5859
g^{tr}/y	Government transfers to output ratio	0.1646	0.1634
TR/y	Tax Revenue to output ratio	0.2875	0.3410

Notes: na denotes not available.

3. Policy Experiments

This section examines the long-run effects of changes in fiscal policy instruments. We conduct two types of budget-neutral policy experiments. First, we study policy experiments in which exogenous changes in one of the distorting tax rates or spending categories ($\tau^l, \tau^k, \tau^c, g^c, g^i$) are met by changes in lump-sum transfers, g^{tr}, that adjust endogenously to satisfy the government budget constraint. In particular, we examine reductions in τ^l, τ^k, τ^c met by decreases in g^{tr}; and increases in g^c, g^i met by reductions in g^{tr}. This serves as a

[6] For the series of hours work to be compatible with the model economy, it is assumed that the time endowment is (365)*(15 hours per day) = 5475 hours per year.

[7] The effective tax rates were constructed using the methodology of Mendoza *et al*. (1994). An appendix that describes how these tax rates have been constructed is available upon request.

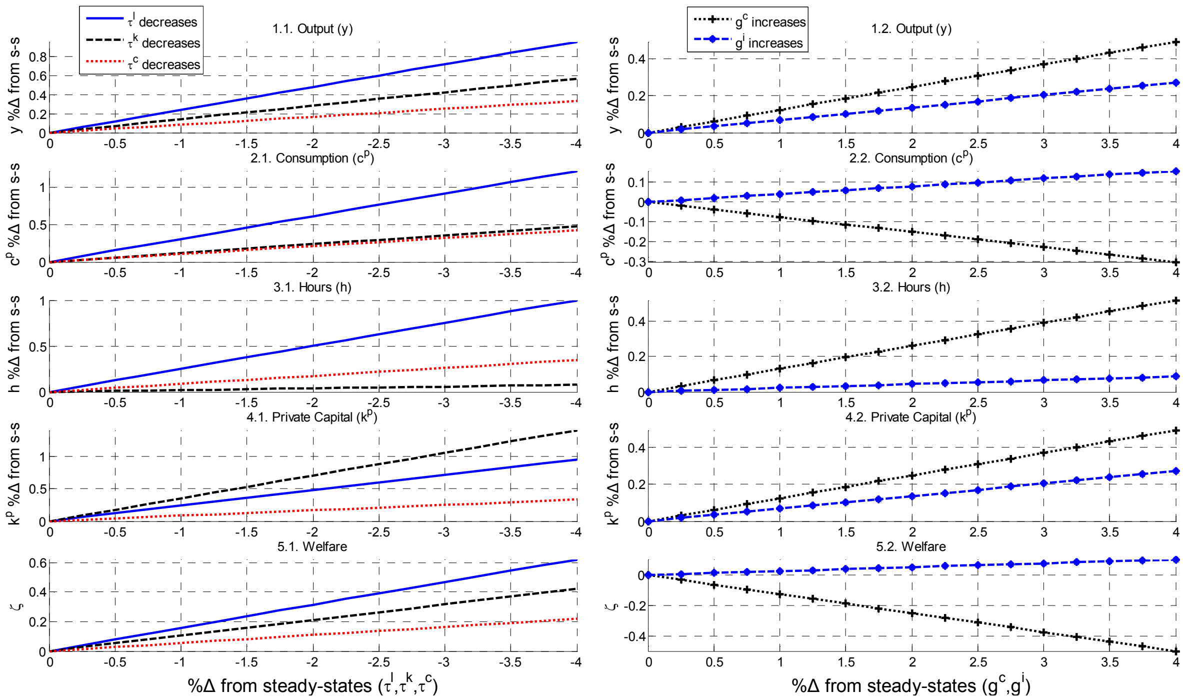
useful benchmark (see e.g. Baxter and King (1993)). Second, we analyze the effects of exogenous rises in one spending instrument (g^c, g^i) met by higher distorting tax rates (τ^l, τ^k, τ^c). In all experiments, we change one exogenous policy instrument at a time and allow one other policy instrument to adjust to close the budget, while all other instruments remain at their data average values.[8] We thus compare the initial steady state (see data) to the new steady state associated with the assumed policy reform.

To provide a quantitative assessment of the welfare effects associated with policy reforms, we follow e.g. Lucas (1990) by computing the permanent percentage change in private consumption that makes the household indifferent between the pre-reform steady state utility and the post-reform steady state utility. This percentage change is defined as ζ. If $\zeta > 0$ (resp. $\zeta < 0$), there is a welfare gain (resp. loss) of moving from the initial steady state to a different one.

3.1. Results

Figure 1 shows the percentage change in the long-run levels of some key macroeconomic variables, relative to the percentage change in the fiscal instruments, $\tau^l, \tau^k, \tau^c, g^c, g^i$, when lump-sum transfers adjust to satisfy the government budget constraint. Data presented are percentage changes relative to the initial steady state. Figure 1 also shows the effects on long-run welfare, while a quantitative summary is in Table III.

Figure 1: Long-run effects of changes in $\tau^l, \tau^k, \tau^c, g^c, g^i$ when g^{tr} adjusts



[8] The computational steps are as follows. We assume that the economy is in the initial steady state implied by the benchmark fiscal policy structure. Then, we exogenously change one fiscal instrument and we allow one of the other policy instruments to residually adjust to satisfy the long-run decentralized competitive equilibrium.

Consider first the effects of changes in the tax rates. As we can see from subplot (1.1), a decrease in any of the tax rates that is met by a decrease in lump-sum transfers, leads to an increase in long-run output. The labour tax rate has the largest effect on output followed by the capital and consumption tax rates, respectively. This follows since the lower labour tax rate increases the after-tax return to labour leading to a rise in equilibrium labour supply and consumption.[9] At the same time, the increase in hours of work has a positive impact on the marginal product of capital that gives rise to an increase in investment and the capital stock (see subplots (2.1), (3.1), (4.1)). The capital tax rate has the largest impact on the capital stock due to the rise in the after-tax return to investment that fosters capital accumulation, while it has a limited effect on equilibrium labour supply. The channels through which the consumption tax rate affects the economy are the same as in the case of the labour tax rate since both tax rates affect the same decision margin (the consumption-leisure choice). However, there are no direct effects on the returns to productive factors and so the effects on hours of work, consumption, investment and output are milder than those of a labour tax rate.

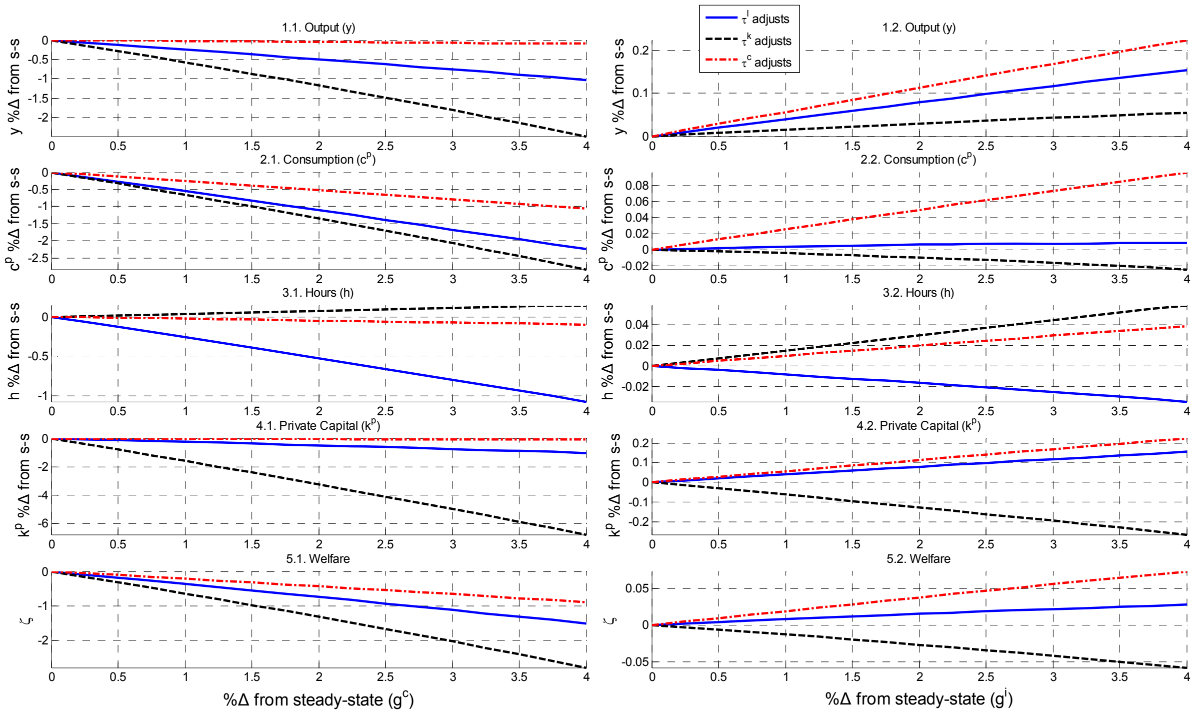
Concerning the effects on long-run welfare, subplot (5.1) illustrates that a reduction in any of the tax rates increases welfare. For instance, as can be seen from Table III, a 1% decrease in the tax rates leads to a welfare gain between 0.05% and 0.16%. Therefore, if the goal of fiscal policy is to stimulate the economy by changing the tax rates, and if a lump-sum instrument is available, the above results suggest that the government should reduce the tax rate on labour income. For example, as suggested by the elasticities in subplot (1.1) and Table III, a 5% decrease in the labour tax rate (i.e. a fall from 0.2865 to 0.2722), will increase long-run output and labour supply by 1.2% and 1.26% respectively. These findings are consistent with the results in e.g. Ardagna (2001).

Turning to the effects of changes in the spending instruments, subplot (1.2) illustrates that increases in public consumption and investment, being financed by decreases in lump-sum transfers, have positive effects on long-run output. The rise in government consumption implies a drain in social resources that produces a negative wealth effect leading to lower private consumption and leisure. Accordingly, the increase in hours of work has a positive impact on the marginal product of private capital and thus on private investment (see subplots (2.2), (3.2), (4.2)). Similarly, a rise in public investment implies a drain in social resources, as in the case of a rise in public consumption, but now there are also supply-side effects, as a higher stock of public infrastructure leads to higher marginal products of private inputs, both capital and labour. As a result, private consumption increases. Regarding the effects on welfare, while an increase in government investment produces a welfare gain, an increase in government consumption leads to a welfare loss, which results from the increase in labour supply and the decrease in private consumption. This result is consistent with the findings of Ardagna (2001) and Forni *et al*. (2010), who argue that cuts in public consumption have a positive effect on social welfare.

Let us now consider the effects of increases in one spending instrument at a time, g^c, g^i, financed by higher distortionary tax rates τ^l, τ^k, τ^c. Figure 2 shows the percentage change in the long-run levels of some key macroeconomic variables, relative to the percentage change in the fiscal instruments, g^c, g^i, and Table III summarizes the quantitative results.

[9] There is also a wealth effect from the increase in after-tax income that induces the household to decrease labour supply and increase consumption. However, for all three tax rates the substitution effect on labour supply dominates the wealth effect and labour supply increases.

Figure 2: Long-run effects of increases in g^c, g^i when τ^l, τ^k, τ^c adjust



As can be seen from subplot (1.1), an increase in government consumption leads to a decrease in long-run output and welfare, regardless of the tax rate used to balance the government budget. When the rise in public consumption is financed by higher tax rates on labour or consumption, the decrease in the after-tax return to labour outweighs the negative wealth effect caused by the rise in public consumption. Thus, there is a fall in equilibrium labour supply and the economy's private capital stock. The largest decrease in output is observed when the capital tax rate is used to finance the increase in public consumption, which results from the large drop of private capital. These findings are consistent with the results e.g. in Baxter and King (1983) and Forni *et al.* (2010). A different picture emerges when we increase public investment. As subplot (1.2) illustrates, an increase in public investment has a positive effect on long-run output, regardless of the tax rate used to satisfy the budget constraint. Nevertheless, quantitatively, the best policy is to finance the increase in public investment by higher consumption taxes; this leads to the highest possible increase in output and welfare.

Table III: Steady – State comparisons (% changes)

Policy Experiments	y	c^p	h	i	k^p	*Endogenous Fiscal Instrument*	*Long–Run Welfare* (ζ)
1% decrease in τ^l and g^{tr} is endogenous	0.241	0.309	0.253	0.241	0.241	-0.508	0.157
1% decrease in τ^k and g^{tr} is endogenous	0.143	0.119	0.019	0.355	0.355	-0.161	0.106
1% decrease in τ^c and g^{tr} is endogenous	0.083	0.107	0.087	0.083	0.083	-0.435	0.054
1% increase in g^c and g^{tr} is endogenous	0.123	-0.075	0.129	0.123	0.123	-0.769	-0.124
1% increase in g^i and g^{tr} is endogenous	0.068	0.040	0.022	0.068	0.068	-0.059	0.027
1% increase in g^c and τ^l is endogenous	-0.247	-0.550	-0.260	-0.247	-0.247	1.532	-0.368
1% increase in g^c and τ^k is endogenous	-0.573	-0.661	0.037	-1.601	-1.601	4.856	-0.646
1% increase in g^c and τ^c is endogenous	-0.024	-0.264	-0.025	-0.024	-0.024	1.774	-0.221
1% increase in g^i and τ^l is endogenous	0.040	0.004	-0.008	0.040	0.040	0.117	0.008
1% increase in g^i and τ^k is endogenous	0.016	-0.004	0.015	-0.063	-0.063	0.368	-0.012
1% increase in g^i and τ^c is endogenous	0.057	0.025	0.010	0.057	0.057	0.136	0.019

Notes: All effects reported are percentage changes relative to the initial steady state

4. Conclusions

We employed a neoclassical growth model augmented with an enriched public sector to examine the quantitative macroeconomic implications of fiscal reforms in Greece. Our results show that output and welfare gains can be obtained by changing the tax-spending policy mix in a revenue neutral way. In particular, focusing on the case in which lump-sum policy instruments are not available, and departing from the average values of the Greek economy, government consumption should be reduced to allow a decrease in distorting taxation. On the other hand, an increase in public investment could lead to an increase in both output and welfare, especially when financed by higher consumption taxes. In this paper, we studied a closed economy. It would be interesting to extend our analysis to the case of a semi small open economy facing risk premia because of possible insolvency problems. We leave this for future research.

References

Angelopoulos, K., Philippopoulos, A and V. Vassilatos (2009) "The social cost of rent seeking in Europe" *European Journal of Political Economy* **25**, 280-299.

Ardagna, S. (2001) "Fiscal policy composition, public debt and economic activity" *Public Choice* **109**, 301-325.

Baier, S and G. Glomm (2001) "Long-run growth and welfare effects of public policies with distortionary taxation" *Journal of Economic Dynamics and Control* **25**, 2007-2042.

Baxter, M and R. King (1993) "Fiscal policy in general equilibrium" *American Economic Review* **83**, 315-334.

Christiano, L.J and M. Eichenbaum (1992) "Current real business cycle theories and aggregate labor market fluctuations" *American Economic Review* **82**, 430-450.

Forni, L., Gerali, A and M. Pisani (2010) "The macroeconomics of fiscal consolidations in euro area countries" *Journal of Economic Dynamics and Control* **34**, 1791-1812.

Jonsson, G and P. Klein (1996) "Stochastic fiscal policy and the Swedish business cycle" *Journal of Monetary Economics* **38**, 245-268.

Kollintzas, T and V. Vassilatos (2000) "A small open economy model with transaction costs in foreign capital" *European Economic Review* **44**, 1515-1541.

Lansing, K. (1998) "Optimal fiscal policy in a business cycle model with public capital" *The Canadian Journal of Economics* **31**, 337-364.

Lucas, R. (1990) "Supply side economics: an analytical review" *Oxford Economic Papers* **42**, 293-316.

Malley, J., Philippopoulos, A and U. Woitek (2009) "To react or not? Technology shocks, fiscal policy and welfare in the EU-3" *European Economic Review* **53**, 689-714.

Mendoza, E., Razin, A and L. Tesar (1994) "Effective tax rates in macroeconomics: cross-country estimates of tax rates on factor incomes and consumption" *Journal of Monetary Economics* **34**, 297-323.

Mendoza, E and L. Tesar (1998) "The international ramifications of tax reforms: supply-side economics in a global economy" *The American Economic Review* **88**, 226-245.

Papageorgiou, D. (2009) "Macroeconomic implications of alternative tax regimes: the case of Greece" *Bank of Greece*, working paper number 97.