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What is the impact of tax and welfare reforms on fiscal stabilisers? A simple model and an application to EMU

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What is the Impact of Tax and Welfare Reforms on Fiscal Stabilisers? A Simple Model and an Application to EMU

Abstract

Reforms aiming at lowering the tax burden and cutting social benefits may boost efficiency and output, and improve market adjustment to shocks, but, by reducing the size of automatic stabilisers, may also imply less cyclical smoothing. This would be problematic in EMU given the loss of national monetary autonomy. This paper argues that the alleged trade-off between efficiency/flexibility and stabilisation depends on the typology of shocks affecting the economy. While higher taxes and benefits stabilise output in the event of demand shocks, if the initial tax burden is high, they may have destabilising effects in the event of supply shocks. As to inflation, very high taxes are destabilising thereby increasing the likelihood of a policy conflict with the central bank. Numerical simulations show that European countries – especially very open ones – may well have a tax burden above the threshold beyond which perverse output stabilisation effects in the event of supply shocks occur. Hence tax reforms may not only improve efficiency, but, if supply shocks prevail, also enhance cyclical stabilisation.

Keywords: Taxation, Tax Reforms, Automatic Stabilisers, Economic and Monetary Union, Shocks

JEL classification: E52, E61, F42

1. Introduction

Taxation inevitably impinges on most aspects of economic activity, and thus careful consideration must be given to its design — in addition to its level and hence the level of related expenditure. So long as taxation affects incentives it may alter economic behaviour of consumers, producers or workers in ways that reduce the amount or utilisation of physical, human and knowledge capital, and thus growth. Therefore, to the extent the tax system matters for economic efficiency, its costs are likely to rise with the level of taxation. The widespread perception that in many European countries the tax burden is too high and the tax system unduly distortive has led to calls for tax reforms. Empirical research suggests that a cut in the tax share in GDP by 1 percentage point raises output per working-age person in the long run by 0.6 to 0.7 per cent (OECD, 2000).

While policy makers' efforts to streamline the welfare state and enact tax reforms that aim to bringing down the tax burden may thus pay off in terms of better efficiency, this may come at a cost in terms of weaker fiscal automatic stabilisation. This trade off between stabilisation and efficiency would be particularly unpalatable in EMU countries, since they already have lost national monetary policy and the exchange rate as adjustment mechanisms to country-specific shocks. Indeed, EMU members would ideally aim for both stronger fiscal stabilisation and higher economic efficiency, and a trade-off between the two would be quite unwelcome.

Fortunately, this difficult trade-off may not always be relevant. In other papers (Buti et al., 2003a and b) we have shown that here may be a level of the tax burden beyond which reducing it may not only yield better efficiency, but, depending of the nature of economic shocks, also render fiscal automatic stabilisers more effective. If supply shocks tend to prevail, a reduction in the tax burden might carry a "double dividend" of efficiency gains and better fiscal stabilisation properties. This conclusion draws on evidence that lower taxation improves the terms of the short-run inflation-unemployment trade off (i.e. makes the Phillips curve flatter) by reducing the wedge between the marginal cost of labour and the marginal take-home pay. This is encouraging for countries with high tax burdens that are considering a reduction in the size of the public sector.

The present paper takes this analysis further, by introducing a distinction between the "optimal" tax burden at which, under supply shocks, the automatic stabilisers are most powerful and beyond which favourable stabilisation properties decline, and a "critical" tax burden beyond which stabilisation properties become perverse. Beyond the latter point, taxes and benefits have destabilising effects on output in the event of supply shocks and destabilising effects on inflation in the event of supply and demand shocks, thereby increasing the likelihood of a policy conflict with the central bank. Numerical simulations show that several euro area countries – especially the very open ones – may well have a tax burden above this critical level, while most countries will have a tax burden that exceeds the "optimal" level.

The paper is organised as follows. In section 2, a model of wage setting incorporating the effect of taxes is developed. The basic mechanisms are then incorporated in section 3 in simple macroeconomic model to analyse the stabilising effects of taxation. In section 4, the two concepts of "threshold" tax rates are derived. Section 5 provides some numerical simulations of such tax rates. The final section concludes.

2. A model of wage setting with wage resistance

The basic tenet of this paper is that automatic stabilisers operate not only on the demand side through their impact on disposable income, but also on the supply side through their impact on *ex ante* profitability. Distortionary taxes and benefits affect the level of equilibrium unemployment and potential output[1]. What is important in our analysis, however, is the impact of distorting taxes and benefits on the reaction of aggregate supply to unexpected inflation, that is the slope – not the position - of the aggregate supply curve.

We assume that workers pass through the cyclical variations in their tax burden at least partly onto employers. This implies that there is "real wage resistance" in an

1 See, e.g. Kneller, Bleaney and Gemmel (1999), Van den Noord and Heady (2001) and OECD (2002).

imperfect labour market[2]. This is illustrated in Figure 1, which depicts the downward sloping labour demand schedule and an upward sloping wage formation curve. It shows that the wage formation curve is steeper for higher tax and benefit rates. This is based on the following mechanism. As demand for labour increases, employers will bid up real wages. The higher the tax rate, the higher will be the increase in the tax bill for a given *ex ante* pay rise. Given that the labour market is tightening, workers may be able to recover some of that extra tax from their employer via a real wage increase on top of the initial "scarcity premium". Thus, the higher the tax rate, the more compensation workers will seek to obtain from their employer for a given *ex ante* increase in employment and real wages.[3] To the extent benefits can be considered as negative taxes (*i.e.* are means tested), this will prompt workers to seek extra compensation to top up the scarcity premium as well. The higher the (initial) benefit the larger this compensation will be and the steeper will be the wage formation function.

The first panel of Figure 1 depicts an increase in the demand for labour, represented by an outward shift of the labour demand schedule. With low taxes and benefits this is shown to raise employment from L^* to L_1 and the real producer wage from w^* to w_1. In order to obtain the same result in terms of after-tax wages if taxes and benefits are higher, however, the real employer wage needs to increase by more, from w^* to w_2, and employment would increase by less, from L^* to L_2. This implies that the deviation of employment from the initial equilibrium is smaller. In line with the results of Auerbach and Feenberg (2000), the tax and benefit system thus operates as an automatic stabiliser also on the labour market.

However, the opposite holds in the case of a shock to labour supply. This is illustrated in Figure 2, which shows that, following a negative supply shock – e.g., a wage push following a rise in unionisation - taxes and benefits drive employment further away

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[2] Evidence of "real wage resistance" in continental Europe is found by Daveri and Tabellini (2000), but not by Layard (1997) who finds that in the long-run tax neutrality holds. Notice, however, that what is crucial for our analysis is real wage resistance in the short run. Hence the results below are not incompatible with long run neutrality of taxes. In OECD (1990), a simple test based on time series regressions of 16 OECD countries shows that while total taxes have no long run effects on labour costs, they have a substantial short run. For an overview of the debate, see Carone and Salomäki (2001) and Daveri (2001).

[3] Note that this assumes that the government fails to provide such compensation via incomes policy. This assumption is consistent with the starting point of our analysis that governments rely on automatic

from the initial equilibrium. The higher the tax burden and the generosity of the benefit system (i.e. the higher the marginal effective tax rate), the stronger the destabilising effect.

Figure 1 ***The impact of taxation on wage formation: labour demand shock***

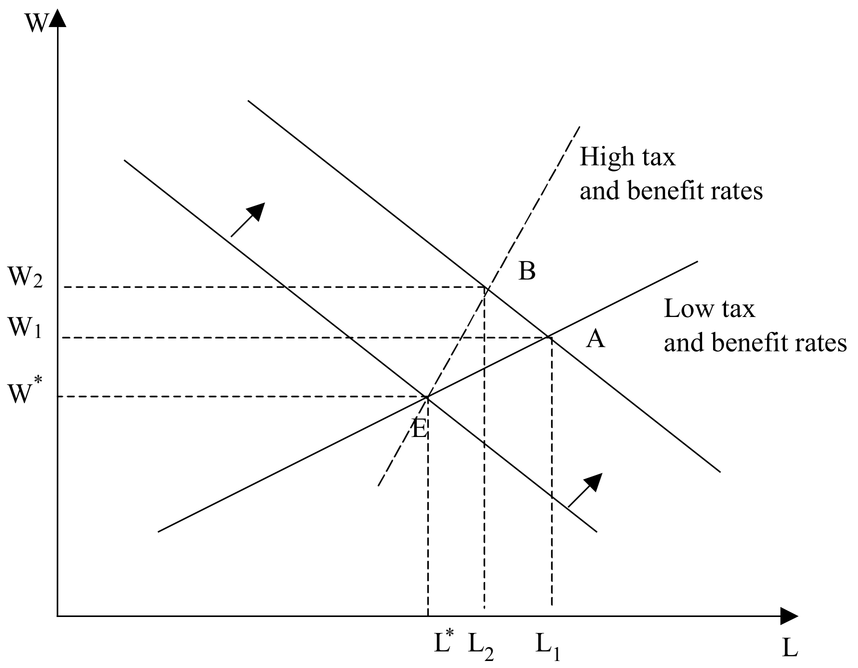
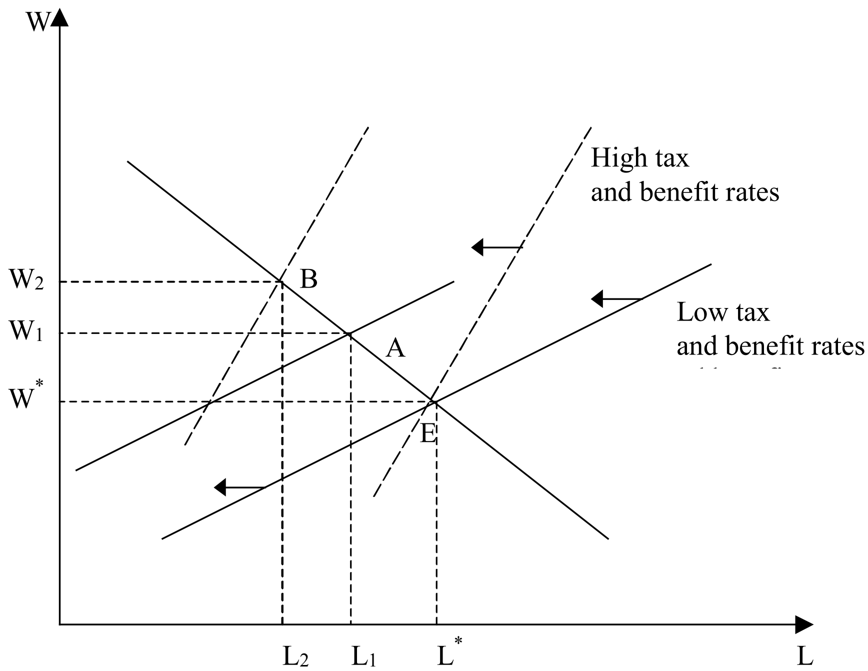


Figure 2 ***The impact of taxation on wage formation: labour supply***



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stabilisers, hence do not modify the tax and spending parameters in response to cyclical fluctuations in economic activity.

To convert these notions into a formal relationship we postulate the following wage formation function:

(1) $$w = f(L) + \gamma(T - G)$$

where w is the real producer wage, L is employment and T is the real revenue of distorting tax per worker and G is the real (means-tested) benefit per worker. We assume the first derivative of the function f with respect to L to be positive, in line with the graphical representation in Figure 1. γ is the coefficient of wage resistance: it varies between 0 (all tax increases or benefit losses are borne by labour) and 1 (tax increases or benefit losses are passed through entirely to employers). Rewriting in rates of change (denoted by a dot over a variable) yields:

(2) $$\dot{w}[1-\gamma(\frac{\Delta T}{\Delta w}-\frac{\Delta G}{\Delta w})] = [1-\gamma(\frac{T}{w}-\frac{G}{w})]\rho\dot{L}$$

in which $\rho = (df/dL)(L/f(L))$ is the elasticity of the real wage with respect to (cyclical variations in) employment.

Next, we define the average and marginal rates of the distortive tax and benefits as, respectively, $t=\frac{T}{w}$ and $t'=\frac{\Delta T}{\Delta w}$, $g=\frac{G}{w}$, $g'=\frac{\Delta G}{\Delta w}$. These are all positive, except for the marginal benefit rate g' which is negative due to means testing.

By replacing t and t' in (2) and defining the tax elasticity with respect to wage earnings ξ_t as the ratio between the marginal and average tax rate and ξ_g as the ratio between the marginal and average benefit rate, after some manipulations, we obtain:

(3) $$\dot{w} = \frac{(1-\gamma(t-g))}{[1-\gamma(\xi_t t-\xi_g g)]}\rho\dot{L}$$

Equation (3) can be easily transformed into an output supply function of the Lucas-Phillips type. In order to do so, we assume the nominal rate of change of the producer wage to be equal the expected rate of inflation (π^e) plus the rate of change of the real producer wage and that wages are fully passed into prices (i.e. $\pi = \dot{w} + \pi^e$). We assume the *ex ante* tax and benefit rates t and g to be the same (*i.e.* in equilibrium taxes are just sufficient to finance benefit expenditure, hence $t = g$). This is consistent also with the fiscal rule in EMU that the budget should be balanced over the cycle.[4] Finally, we assume that output supply is proportional to labour input. Under those assumptions the output supply function becomes:

(4) $$y = (1 - \gamma\xi t)\omega(\pi - \pi^e)$$

where ω and $\xi = \xi_t - \xi_g$ are constant, positive parameters.

Hence, if there is some degree of wage resistance (*i.e.* γ is positive), the reaction of output to an inflation surprise is smaller the larger the value of t. In other words, in countries with bigger governments and higher taxes, a value of inflation larger (smaller) than expected will lead to a smaller (larger) reaction of output, which corresponds to a steeper supply function in the output-inflation space. The intuition for this result is clear. Take the case of a positive inflation surprise: as employers demand more labour to increase production, they will have to pay higher wages to cover not only for the higher prices but also on account of the fact that the real production wage moves up; this tends to limit the rise in production.[5]

A progressive tax system (that is $\xi_t > 1$) accentuates this effect, although it is not a necessary condition for it to occur.[6] At first sight this contradicts the standard finding in union-wage models that progressive taxation moderates wage claims because it reduces the loss associated with a fall in wage income per worker without affecting the gain in wage income associated with increased employment. However, these models are based exclusively on the behaviour of unions, look only at taxation as opposed to the tax and benefit system and ignore the impact of taxation and benefits on search efforts, consumption-leisure trade-offs and efficiency wages. Taking these mechanisms into account may be shown to change the sign of the impact of a progressive tax and benefit system on wage claims from negative to positive (Naess-Schmidt, 2003).

[4] We assume furthermore that the tax and benefit system is neutral with respect to capital and labour, i.e. exactly the same average and marginal rates apply to capital income and, for that matter, total value added.

[5] For this to hold true it must be assumed that governments fail to provide an offsetting tax break to moderate wage demands, i.e. do not pursue an incomes policy. But this is consistent with the basic assumption of our analysis: governments solely and fully rely on automatic stabilisers, hence do not modify the tax and spending parameters in response to cyclical fluctuations in economic activity.

[6] A sufficient condition is that $\xi > 0$, hence $\xi_t > \xi_g$, *i.e.* the tax an benefit system as a whole is redistributive.

3. Taxation and stabilisation in a simple macroeconomic model

We now consider a version of the standard AD-AS model of a country belonging to a monetary union which is closed vis-à-vis the rest of the world.[7] The IS aggregate demand and Lucas-Phillips supply curves for the home country are written as:

(5) $$y^d = \phi_1 d - \phi_2 (i - \pi^e) - \phi_3 \pi - \phi_4 y + \varepsilon^d$$

(6) $$y^s = (1 - \gamma \xi t)\omega(\pi - \pi^e) + \varepsilon^s$$

where y is output, d is the budget deficit, π is inflation ("^{e}" reads 'expected'), i is the nominal interest rate and t is the tax rate. y, d and t are expressed in terms of potential (baseline) output. ε^d and ε^s represent, respectively, uncorrelated temporary demand and supply shocks of zero mean. All the variables are percentage points deviations with respect to the baseline. ϕ_1, ϕ_2, ϕ_3 are ϕ_4 are non-negative parameters.

Equation (5) assumes that fluctuations in aggregate demand depend on (changes in) the budget deficit, the real interest rate, competitiveness, absorption and a shock. Equation (6) is equivalent to equation (4) with an exogenous shock term added.

Aggregate demand and supply equations are complemented with the policy rules followed by the fiscal and monetary authorities. The central bank aims at stabilising inflation and output of the currency area as a whole. We posit a simple Taylor rule of the form:

(7) $$i = \lambda(\alpha\pi + \beta y)$$

where λ captures the weight of the domestic country in the currency area, and α and β are the preferences of the monetary authority over inflation and output, respectively. For a conservative central banker, we have $\alpha > \beta$. We assume that the monetary authority sets interest rates so as to maintain inflation on a fixed target in the "medium run", which, in this simple setting, means in absence of shocks. Since shocks – regardless of whether they are symmetric or country-specific – are serially uncorrelated with zero average, this implies $\pi^e = 0$.

[7] The more explicit microfoundations of the supply curve and the focus on a single country within a monetary union are the main changes compared to the model in Buti et al. (2003a).

For the fiscal authority, we assume that, in line with the Stability and Growth Pact, the government pursues a neutral discretionary policy, which implies that it sets a target for the structural budget balance and let automatic stabilisers play symmetrically over the cycle[8]. The deviation of the actual budget balance from the baseline (the latter being structural balance in absence of shocks) is approximated by:

(8) $$d = -(\xi_t - 1)ty + (\xi_g - 1)gy = -\xi ty$$

We capture the size of automatic stabilisers via the interaction of the elasticity ξ and the parameter t, with the latter in equilibrium assumed to be equal to the government expenditure ratio g.

Equating (1) and (2), after substitution of equations (7) and (8) in (5) and (6), the whole system can be solved for y and π:

(9) $$y = \frac{(1-\gamma\xi t)\omega\varepsilon^d + (\phi_2\lambda\alpha + \phi_3)\varepsilon^s}{(1-\gamma\xi t)(1+\phi_1\xi t + \phi_2\lambda\beta + \phi_4)\omega + \phi_2\lambda\alpha + \phi_3}$$

(10) $$\pi = \frac{\varepsilon^d - (1+\phi_1\xi t + \phi_2\lambda\beta + \phi_4)\varepsilon^s}{(1-\gamma\xi t)(1+\phi_1\xi t + \phi_2\lambda\beta + \phi_4)\omega + \phi_2\lambda\alpha + \phi_3}$$

We turn now to the analysis of shocks. We are interested in analysing the effects on the degree of stabilisation in the event of shocks for different tax burdens t (or the elasticity ξ: since the two terms enter in the expression as a product, the effect on the response to shocks is the same).

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8 This is the definition of a well behaved" fiscal authority, according to Alesina et al. (2001). For more sophisticated reaction functions of fiscal authorities in EMU, see, Buti, Roeger and in't Veld (2001) and Buti and Giudice (2002).

Figure 3 The effects of a positive demand shock under alternative tax rates

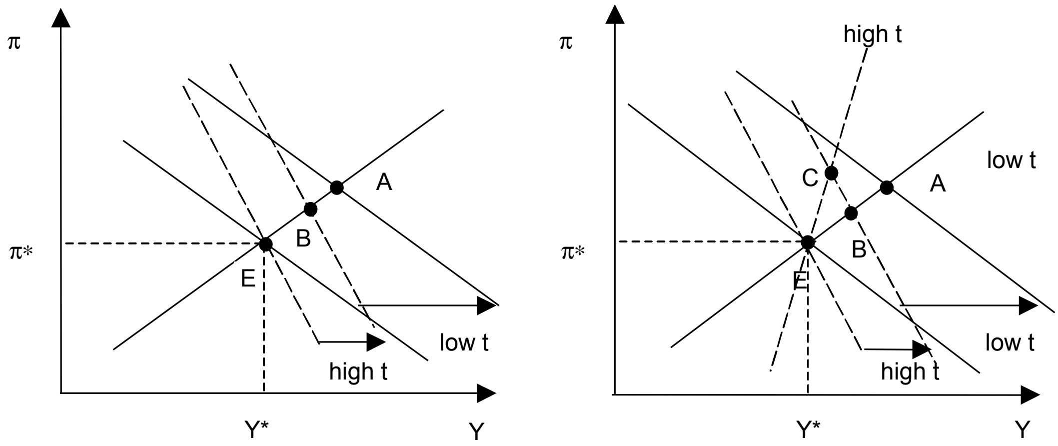
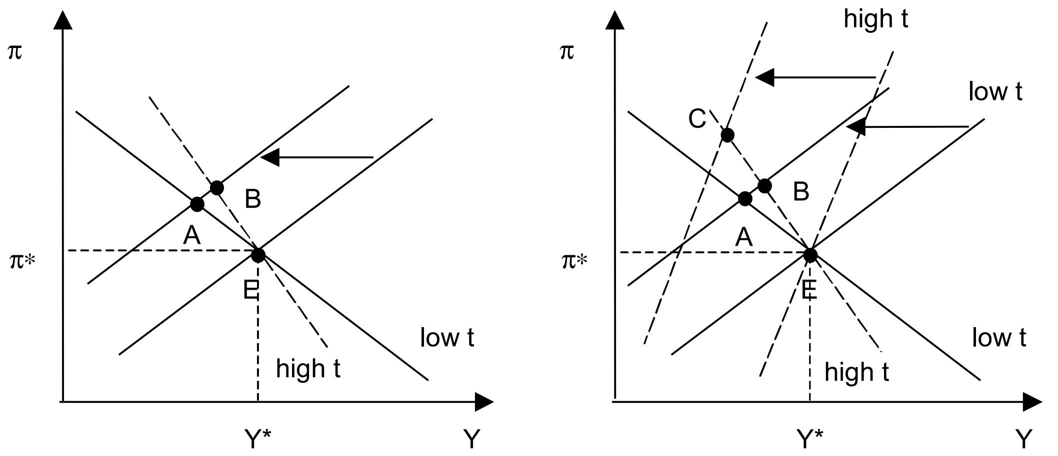


Figure 4 The effects of a negative supply shock under alternative tax rates



The standard model which neglects the effect of taxes and benefits on supply predicts that automatic stabilisers stabilise output and inflation in the event of demand shocks and stabilise output, but destabilise inflation under supply shocks (Blanchard, 2000, Brunila, Buti and in't Veld, 2002, and European Commission, 2001). In this standard model, automatic stabilisers operate only on the demand side. Higher stabilisers imply a lower effect of inflation on demand. In the output-inflation space, the aggregate demand schedule is steeper and displays smaller shifts in the event of shocks. The basic difference in our model is that, as stressed earlier, automatic stabilisers operate not only on the demand side, but also on the supply side: higher stabilisers - which means a higher level of taxes - make the supply schedule steeper.

The left panel of Figure 3 pictures the case of a positive demand shock under a "low" and "high" tax rate (or a low and high budget elasticity) according to the standard model. The slope of the demand curve is higher (in absolute terms) with a high tax rate than with a low one. The reason is that the higher the tax rate, the stronger will be the cushioning effect of automatic stabilisers on demand after an economy has been hit by rise in inflation. A rise in inflation will lead to a fall in demand on various accounts, most prominently a weakening in international competitiveness, a decline in real disposable income and a tightening of monetary policy. Note that the latter effect, in an EMU context, is strongest in the largest economies whose weight in the central bank's reaction function is biggest. Automatic stabilisers provide an offset, and hence reduce the impact of inflation on demand and make the demand curve steeper.

The initial equilibrium, E, corresponds to target levels of output (Y^*) and inflation (π^*).[9] A positive demand shock induces a shift of the demand curve to the right.[10] The new equilibrium points when only the steeper demand curve is considered (left panel) are now at A with a low tax rate and at B with a high one. The new equilibrium level of output is closer to the optimal level with a high tax rate than with a low one. A similar picture emerges for inflation. Hence, in this case an increase in the tax rate is both output and inflation stabilising.

Taking into consideration the possibility of the supply curve becoming steeper as well, automatic stabilisation may become, however, inflation destabilising. From the second panel in Figure 3, one can notice that this will still lead to a closer output to its optimal level but to a higher inflation. Hence, in this case an increase in the tax rate risks becoming inflation destabilising beyond a certain point if the slope of the supply curve is more sensitive to the tax burden than the slope of the demand curve.

We turn now to the analysis of a supply shock. As shown in the left panel of Figure 4, an adverse supply shock induces a shift of the supply curve to the left. The new equilibrium point is now at A with a low tax burden and at B with a high tax rate. One can easily notice that the new equilibrium level of output is further away from the

9 Notice that the initial equilibrium E is the same with low and high taxes only for reasons of expositional convenience because we want to focus on the slope of the curves trather than their position.

10. Note that the horizontal shift is smaller for higher tax rates as the impact of the demand shock is muted by the automatic stabilisers.

initial level with a low tax rate than with a high one. The reverse emerges for inflation. Hence, in this case an increase in the tax rate from a low value to a high one is output stabilising but inflation destabilising.

The increase of the tax rate may become, however, output destabilising if the supply curve also becomes steeper due to high taxation, as shown in the second panel of Figure 4. The new equilibrium point is now at C with a high tax burden. It is clear from the graph that the new equilibrium level of output is further away from the initial level with a high tax rate than with a low one. Inflation is always further away from its optimal level with a higher tax rate. Hence, in this case an increase in the tax rate from a low value to a high one is both output destabilising and inflation destabilising.

4. "Critical" levels of taxation

The previous analysis shows that the changes of taxation to become output-destabilising rise with the supply curve becoming steeper.[11] On the other hand, the output destabilising-effect diminishes as the demand curve become steeper. Since the slope of both curves depends on the tax rate, the threshold level for the tax rate beyond which further increase of taxation is destabilising for output in the event of a supply shock depends on the relative sensitivity of demand and supply to taxation. This, in turn, depends on the openness of the economy: the more open the economy, the lower will be the fiscal demand multiplier and therefore the steeper will be the supply curve relative to the demand curve for a given tax burden. Therefore, open economies are more likely to face adverse fiscal stabilisation properties in the face of a supply shock than relatively closed economies for a given level of taxation (and progressivity).[12]

It is also easy to show that always $\frac{\partial y}{\partial t} < 0$ for a positive demand shock ($\varepsilon^d > 0$) and $\frac{\partial \pi}{\partial t} > 0$ for an adverse supply shock ($\varepsilon^s < 0$). As was shown in the graphs in the previous section, this implies that a higher t (or ξ) unambiguously increases the

[11] In the extreme case where the supply curve becomes vertical the shock would not be smoothed at all and output would fall by the same extent of the supply shock.

stabilisation of output in the event of demand shocks and destabilises inflation in the event of a supply shock.

However, in the case of a response of output in the case of supply shocks or inflation in the case of demand shocks, the initial level of *t* matters. In line with the intuition, we show a higher *t* to entail stronger output stabilisation in the event of demand shocks while it is inflation-destabilising in the event of demand shocks. The crucial result concerns output-stabilisation in the event of a supply shock and inflation stabilisation in the case of a demand shock. In the traditional model in which taxes do not affect supply, higher taxes tend to stabilise both variables. In our model, instead, there exists a threshold level of taxation beyond which a further increase in taxes has perverse stabilisation effects.

We consider two concepts of the threshold tax level: the "optimal" *t*, call it *t**, which maximises output and inflation stabilisation in the event of supply and demand shocks, respectively; and the "critical" *t*, call it *t***, which corresponds to the level of taxation resulting in zero fiscal stabilisation (i.e. the same level of stabilisation arising when *t*=0).

*t** is obtained by taking the derivative of the coefficient of ε_d in π or the coefficient of ε_s in y to t and equating the result to zero:

$$(11)\ t^{*} = \frac{\phi_1 - (1 + \phi_2 \lambda \beta + \phi_4)\gamma}{2\phi_1 \gamma \xi}$$

Hence, for *t*>*t**, a rise in *t* reduces the degree of output stabilisation in the event of supply shocks and inflation stabilisation in the event of demand shocks.

*t*** is obtained by equating the coefficient of ε_d in π or the coefficient of ε_s in y to the same coefficient under *t*=0:

$$(12)\ t^{**} = \frac{\phi_1 - (1 + \phi_2 \lambda \beta + \phi_4)\gamma}{\phi_1 \gamma \xi}$$

So $t^{**} = 2t^{*}$.

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[12] However, it should be recognised that, due to stronger competition, wage resistance is likely to be smaller in more open economies. In our analysis, we do not consider this interaction.

Some intuitively appealing conclusions can be drawn from this result:

- *First*, it appears that there exists a trade-off between the redistributive thrust of the tax and benefit system (ξ) and the tax burden (t): the less redistributive taxes and benefits are, the higher will be the critical tax rate, and hence the wider is the range of tax rates whereby automatic stabilisers are effective.

- *Second*, the same applies to the degree of wage resistance (γ): the higher it is the lower will be the optimal (and critical) tax rate, because the more the level and redistributive thrust of taxation and spending matter for wage formation and hence the bigger will be its impact through the supply channel.

- *Third*, the threshold level of the tax rate above which automatic stabilisers become destabilising depends on the responsiveness of demand to the fiscal impulses stemming from the automatic stabilisers (ϕ_1). The weaker this responsiveness (e.g. because of Ricardian behaviour) the lower tax rate can be "afforded" without risking declining or perverse stabilisation properties.

- *Fourth*, the threshold varies inversely with the weight of output stabilisation in the central bank's reaction function (β). A dovish central bank will choke off the output effect of automatic stabilisers and thus weaken their effectiveness. Interestingly, this implies that the incentives to reform the tax and welfare system are lower under a hawkish central banker[13], although incentives to reform the tax system on efficiency grounds would obviously be decisive.

- *Fifth*, a greater openness of the economy (ϕ_4) reduces the threshold level of taxation. The reason is that the demand effects of automatic stabilisers leak out via foreign trade, implying that the negative supply effects predominate more quickly, i.e. even at a lower level of taxation. This is analytically similar to the third point above, but may be usefully highlighted separately. This is so because while trade leakage is related to the openness of the economy, policy transmission may be weak even in a closed economy. Open economies in the EMU are thus facing stronger incentives to reform their tax systems than the relatively closed ones.

[13] From a different perspective, this result is consistent with the view of those who see an expansionary monetary policy going hand in hand with structural reforms. See, e.g. Bean (1998) and Saint-Paul (2002).

4. How large are *t** and *t***? Some numerical simulations

The typical tax burden in EMU countries is in the range of 40 to 50 per cent of GDP. Is this exceeding the optimal level and would a reduction in the fiscal size thus work out favourably for stabilisation? Is it empirically possible or even likely that the tax burden exceeds the critical tax burden?

While a fully-fledged analysis is well beyond the scope of this paper we can nonetheless provide some tentative indication of the possible values of t^* and t^{**}. It goes without saying that our computations are purely illustrative and that one should refrain from drawing policy conclusions from the simple comparison of the estimated t^* and t^{**} with the actual tax burden in euro-area economies. Nevertheless, these estimates are helpful in exemplifying our reasoning.

In Table 1 we report the chosen baseline values of the coefficients. With regard to the demand equation we assumed that $\phi_1 = 1$ *and* $\phi_2 = \phi_3 = \phi_4 = ½$, which is broadly in line with the short-run elasticities reported in ready-reckoners of the OECD's INTERLINK model (Dalsgaard *et al.*, 2001). The budget elasticity – encompassing both spending and revenue - is set at $\xi = 1¼$ based on Van den Noord (2000). We assume a hawkish banker, i.e. $\alpha = 1½$ and $\beta = 0$, with the country's weight in the monetary policy reaction function set at $\lambda = ¼$. Concerning the supply equation we assumed that $\omega = 3$, which corresponds to the mid range of estimates of the price elasticity of aggregate supply reported in Clarida *et al.* (1998).[14] To gauge the degree of wage resistance we proceeded somewhat differently. Rather than making a prior assumption for γ we fixed the incidence of labour taxation on profits at one half, *i.e.* $\gamma.\xi = ½$. This implies that $\gamma = 0.4$. This is consistent with the evidence of Alesina and Perotti (1997) which estimate a coefficient of 0.4 for countries in continental Europe in the relation between labour taxes and unit labour costs in manufacturing in a sample of annual data from 14 OECD countries.

On the basis of these assumptions we find that $t^* = 0.4$ and $t^{**} = 0.8$, which suggests that for countries in the upper end of the range the tax burden would be sub-optimal, but well below the critical level (see Figure 5). This implies that a country with an initial tax burden of 50 per cent who would cut it by 10 percentage points realises a slight improvement in the output stabilisation properties after an adverse supply shock. The same holds true for the impact on prices after a positive demand shock.

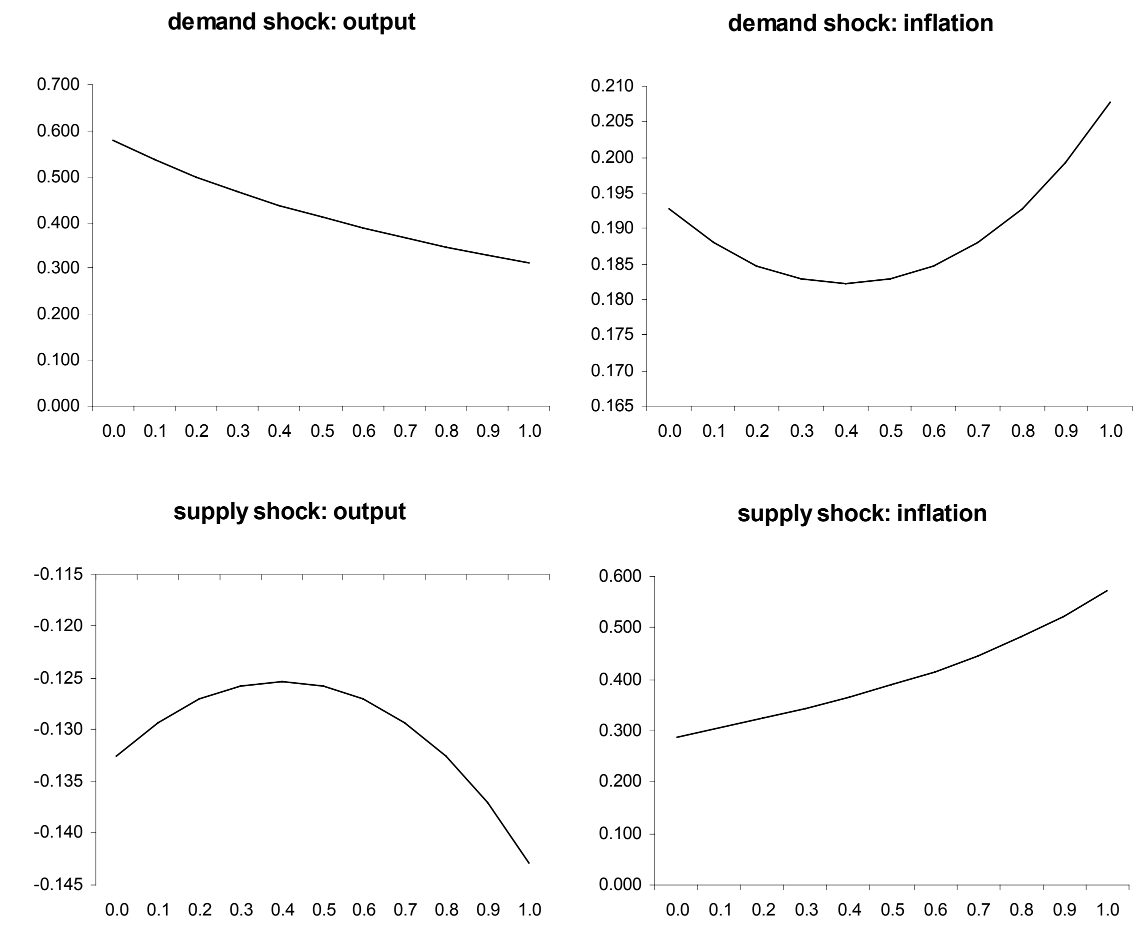
Table 1 Baseline parameters

$\phi_1 = 1$	$\xi = 1.25$
$\phi_2 = 0.5$	$\omega = 3$
$\phi_3 = 0.5$	$\lambda = 0.25$
$\phi_4 = 0.5$	$\alpha = 1.5$
$\gamma = 0.4$	$\beta = 0$

However, these results may be expected to be rather sensitive to the numerical assumptions and hence, if this proves true, the structural features of the economies in EMU. This is confirmed by sensitivity analysis. As shown in Table 2 and in the corresponding figures in the Annex, a reduction in the budget elasticity from 1¼ to 1 raises the value of t^* to 1/2 and t^{**} to 1. In other words, a tax burden equal to one half of GDP may still be optimal from a stabilisation point of view if the tax and benefit system is proportional. By contrast, a greater openness of the economy (ϕ_4=¾), a less effective fiscal policy (ϕ_1 = ¾) and greater wage resistance (γ = ½) all push t^* into a range of 0.2 to 0.3 and t^{**} into a range of 0.4 to 0.6. Under those conditions slashing the size of government would pay substantially in terms of the gains in fiscal stabilisation properties that would be realised.

[14] Note, however, that the value of ω , as well as those of ϕ_3 *and* α, has no impact the t^* and t^{**}. Even though they do affect the degree of fiscal stabilisation across levels of t, they are irrelevant for t^* which is obtained via the solution of the optimisation problem set out above.

Figure 5 Baseline simulation



Note: the horizontal axes indicate the tax burden (t) and the vertical axes the impact of a shock (normalised at unity) on the output gap or inflation.

From Table 2 can be inferred that a similar scope for reductions in the size of government results if the central banker turned dovish to an extent where it gives a positive weight to output and inflation in its policy reaction function (β is set equal to 1). This effect is even more pronounced for larger countries who have a bigger weight in the reaction function (for example λ = 1/2). Interestingly, this result runs somewhat counter to the general perception that a hawkish central banker would be more successful in raising incentives for structural reform than a dovish one.

Table 2 Sensitivity analysis

	*t**	*t***
Base line	0.4	0.8
$\xi = 1$	0.5	1
$\beta = 1$	0.35	0.7
$\phi_4 = 0.75$	0.3	0.6
$\phi_1 = 0.75$	0.2	0.4
$\gamma = 0.5$	0.2	0.4
$\beta = 1, \lambda = 0.5$	0.3	0.6

Our results are broadly in line with recent empirical investigations which have found evidence of a non linear relationship between the size of the government and macroeconomic stability.

Martinez-Mongay and Sekkat (2003) test whether the structure of the tax system affects the impact of tax changes on output volatility. In a sample of 25 OECD countries over the period 1960-1999, they find that the composition of tax and expenditure, in particular the tax mix, matters for output and price volatility: distorting taxes, namely taxes on labour and capital, tend to have negative effects on macroeconomic stability. Cuaresma, Reitschuler and Silgoner (2003) find that the smoothing effect of fiscal stabilisers may revert at high levels. In a panel of 14 EU countries over the period 1970-1999 the stabilising effect changes sign at a level of government expenditure of about 38% of GDP. According to their results, for a country displaying a public expenditure ratio around the median value of the distribution (40.6% of GDP), an increase in spending by 1% point of GDP will raise the standard deviation of output growth by 0.02 points. The destabilising effect is higher (0.04%) for a country with an expenditure ratio of 44.1%. However, this study is not entirely comparable to ours as it focuses solely on government spending and does not distinguish between automatic stabilisers and discretionary policy reactions.

6. Conclusions

Conventional AD-AS models imply that high and progressive tax systems are efficiency-decreasing but enhance output stabilisation in the event of shocks.

Progressive tax systems lead to a lower budget deficit (contraction of fiscal policy) in good times, while the deficit would increase in recessions (fiscal expansion). Moreover, large and progressive tax systems usually go hand in hand with more generous systems of social protection. Although social benefit programmes mainly have an equity role, as well as potential efficiency effects when they correct market failures, most of them also act as automatic stabilisers. Unemployment benefits make up the clearest example, but more generally the relative robustness of expenditure programmes to cyclical fluctuations serves to smooth economic activity, and this smoothing effect is likely to increase with the size of government. However, since distorting taxes and benefits have a pervasive impact on potential growth, a trade-off between stabilisation and efficiency seems to arise within the standard AD-AS framework. If there is a positive relationship between the size of automatic stabilisers and distortive taxation, any tax reform aiming at lowering distortions and enhancing efficiency will come at the expense of macroeconomic stability.

This issue is at the heart of macroeconomic policy design in EMU. If, as suggested by the standard model, there were a trade off between stability and flexibility, EMU members — having given up national monetary independence — would not dispose of enough policy instruments to deal with idiosyncratic shocks.

However, this paper suggests that, in the event of supply shocks, such a trade-off might not exist. Within our model, under the assumption of at least partial wage resistance, cutting tax rates reduces market distortions and enhances the output stabilisation in the event of supply shocks and inflation stabilisation in the event of demand shocks. So, if our conclusions are right, unless there is a clear predominance of demand over supply shocks, one should not worry about the possible adverse effects on stabilisation of the tax reforms that across the EU are lowering marginal and average tax rates across the whole income scale (European Commission 2000*a* and *b*, 2001).

It goes without saying that the analysis in this paper is only a first step into the analysis of the relations between efficiency and flexibility, on the one hand, and cyclical stabilisation, on the other hand. Obvious improvements concern the theoretical model (which is overly simple and static in nature) and the description of the behaviour of policy makers. Moreover, the numerical simulations are only indicative and should be supplemented by more thorough econometric investigation.

An issue that arises naturally is the apparent contradiction between our conclusion that adverse stabilisation effects may arise at lower levels of taxation in smaller economies and the finding that small, open economies tend to have larger governments (see the seminal contribution by Rodrick (1998), and, recently, Martinez-Mongay (2002)). Two explanations can be offered. First, whatever their initial level, higher taxes are output-stabilising in the event of demand shocks. Hence, if output stabilisation is the main goal of fiscal authorities and demand shocks (are expected to) prevail, larger governments would ensue. However, EMU may bring a change in the composition of shocks by increasing the relative frequency of supply compared to demand shocks.[15] If so, large automatic stabilisers may no longer be optimal. Second, to the extent the tax burden remains below the critical tax burden, a rise in it is stabilising, although increasingly less so. This, coupled with a higher exposure to shocks, may imply larger governments in small open economies. Econometric analyses based on past data may capture this effect. However, in recent years, the actual tax burden may have reached or even exceeded the critical one. Fresh empirical evidence tend to lend support to our results.

Our analysis indicates that tax reforms aiming at lowering marginal effective tax rates and the tax burden, under supply shocks, may enhance the stabilisation properties of automatic stabilisers, especially in small euro area economies. Hence they face a lesser dilemma between structural reform and stabilisation policy. This may contribute to explain their greater reform efforts and better performance compared with the big "laggards". However, if EMU

[15] Buti, Pench and Sestito (1999) argue that EMU's macroeconomic framework could lead to less policy-induced demand shocks while the increase in market competition brought about by the euro could entail more supply-related shocks.

brings about greater trade integration, the incentives to step up reform efforts would increase also in the large euro area countries.

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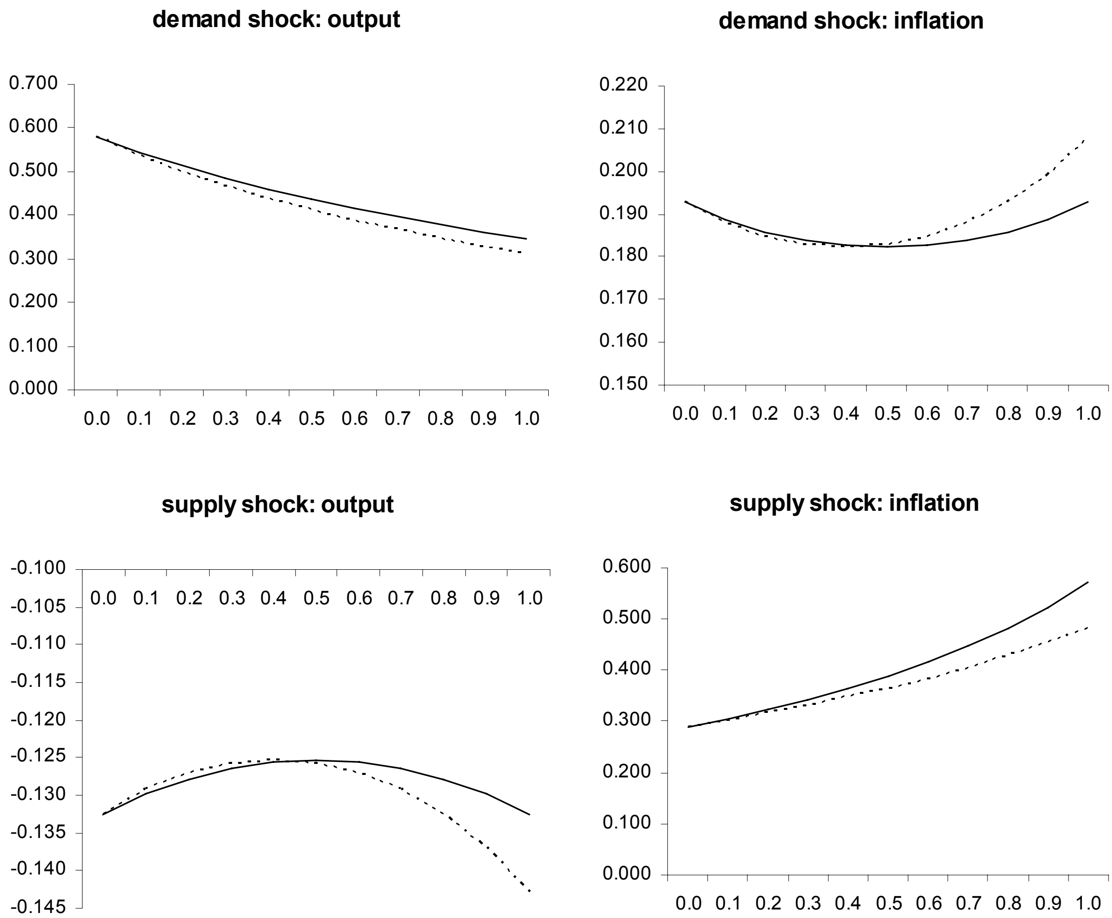
Annex: sensitivity analysis

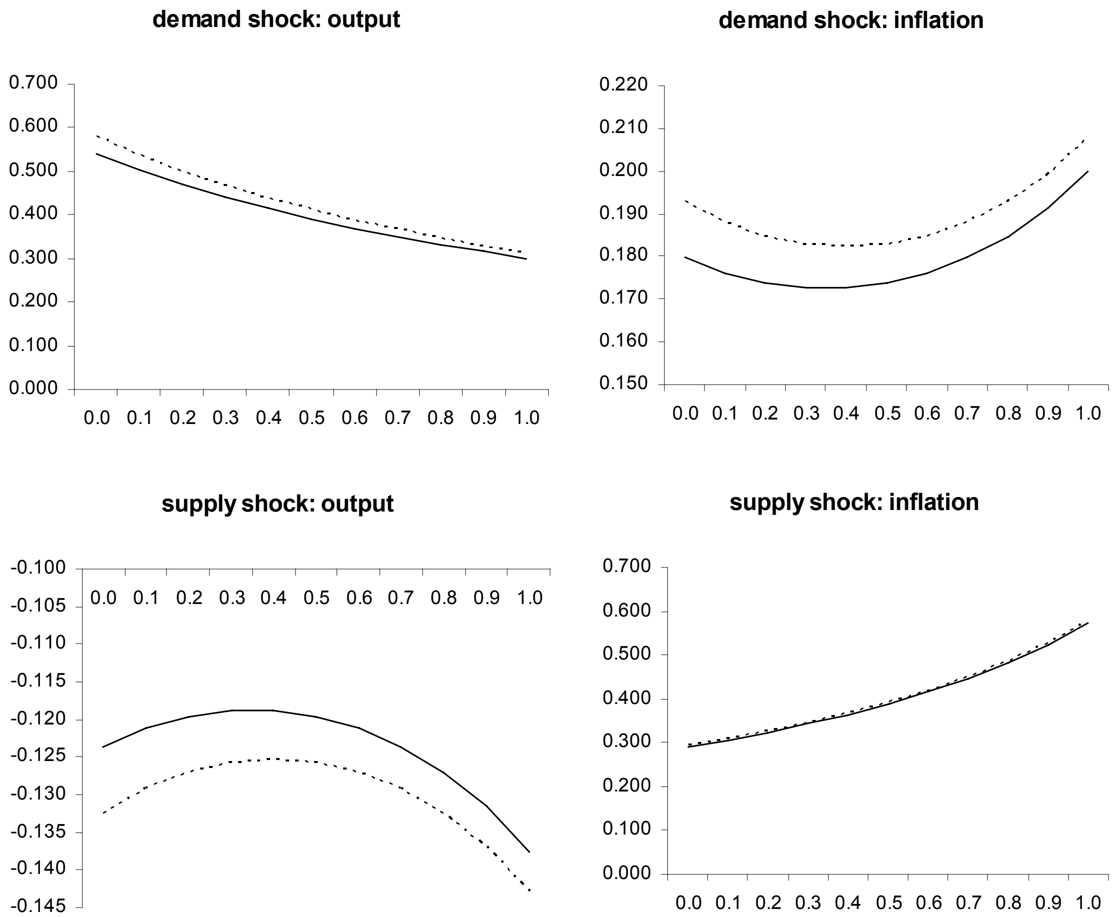
ξ = 1



Note: the horizontal axes indicate the tax burden (t) and the vertical axes the impact of a shock (normalised at unity) on the output gap or inflation. The dotted line is baseline.

Sensitivity analysis (continued)

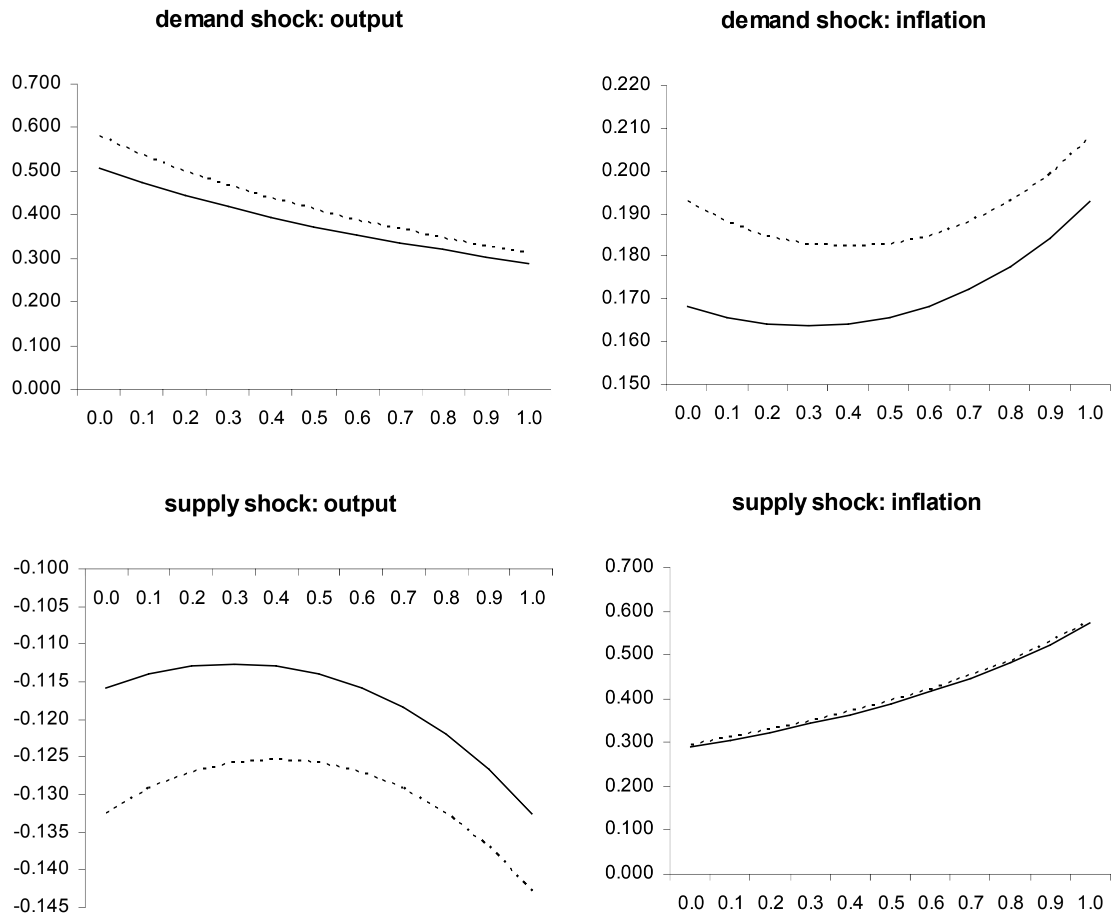
β = 1



Note: the horizontal axes indicate the tax burden (t) and the vertical axes the impact of a shock (normalised at unity) on the output gap or inflation. The dotted line is baseline.

Sensitivity analysis (continued)

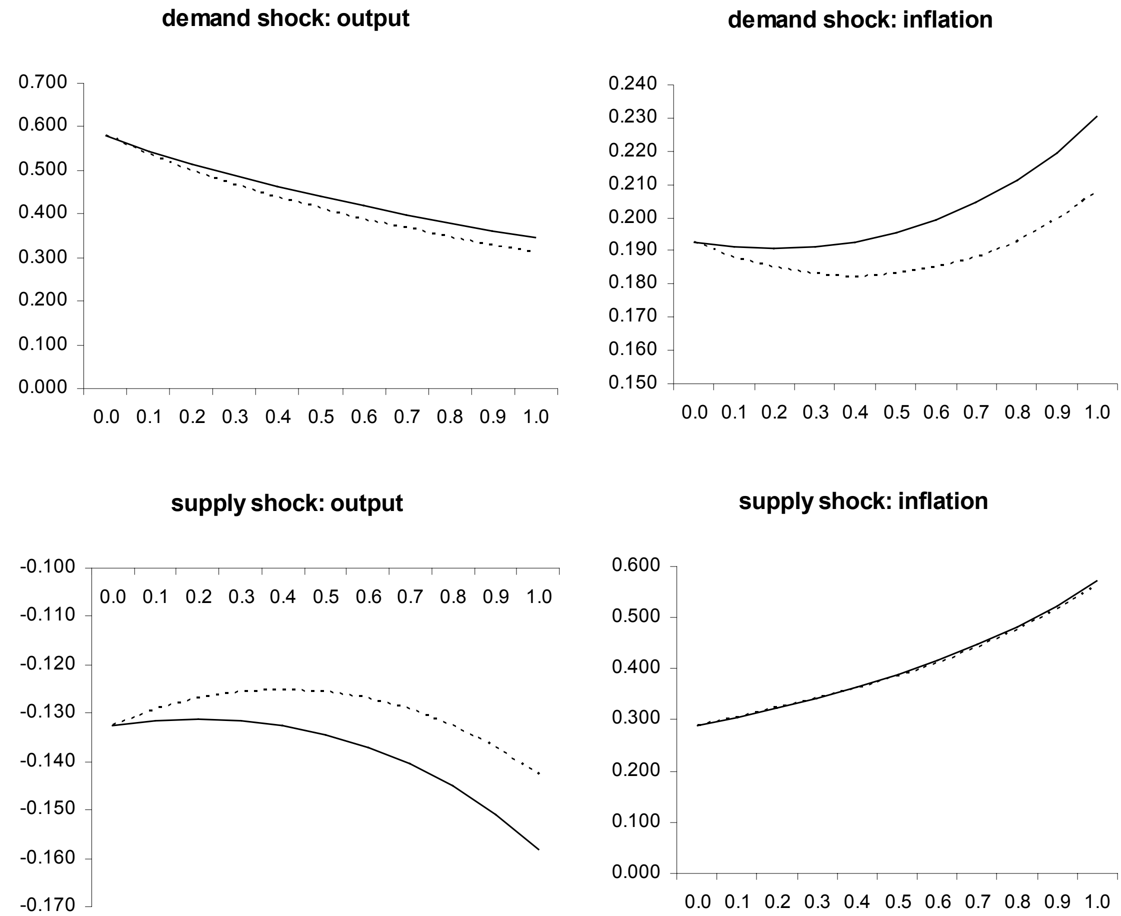
ϕ_4 = 0.75



Note: the horizontal axes indicate the tax burden (t) and the vertical axes the impact of a shock (normalised at unity) on the output gap or inflation. The dotted line is baseline.

Sensitivity analysis (continued)

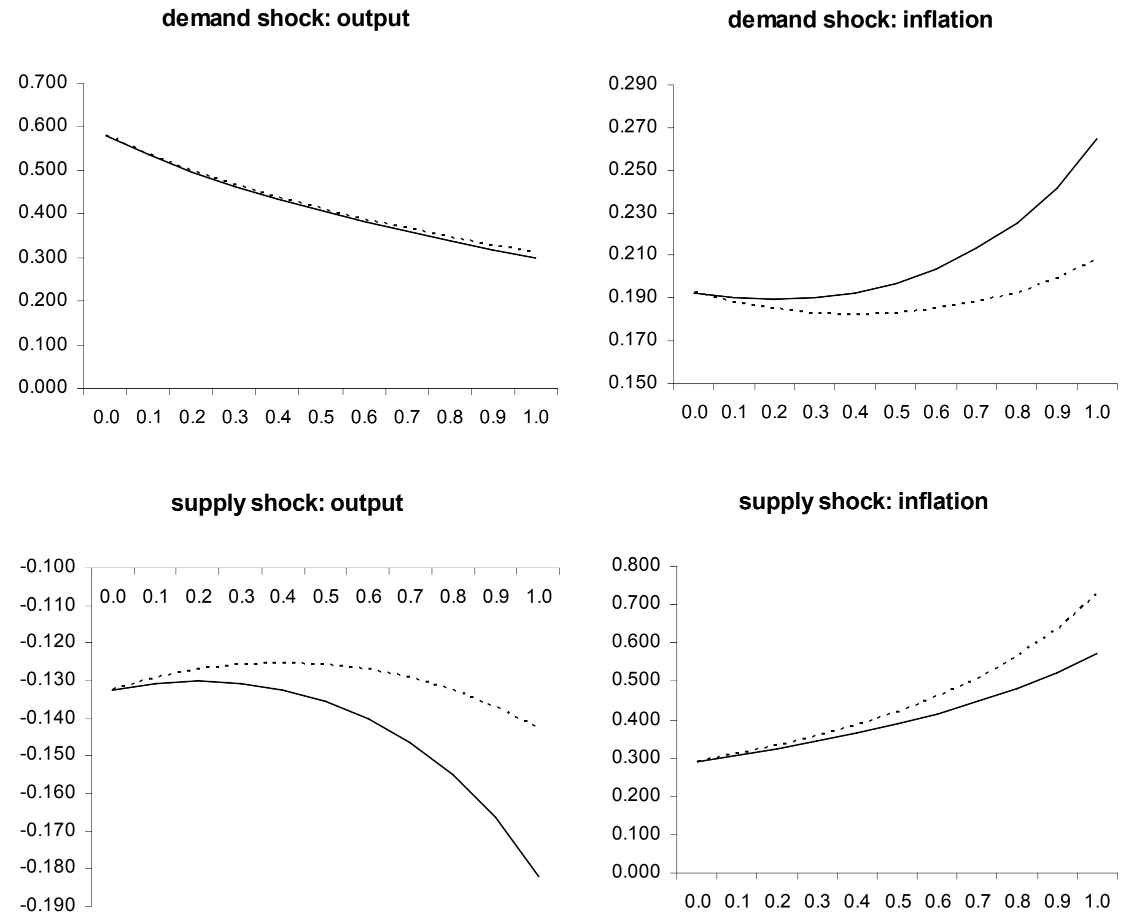
ϕ_1 = 0.75



Note: the horizontal axes indicate the tax burden (t) and the vertical axes the impact of a shock (normalised at unity) on the output gap or inflation. The dotted line is baseline.

Sensitivity analysis (continued)

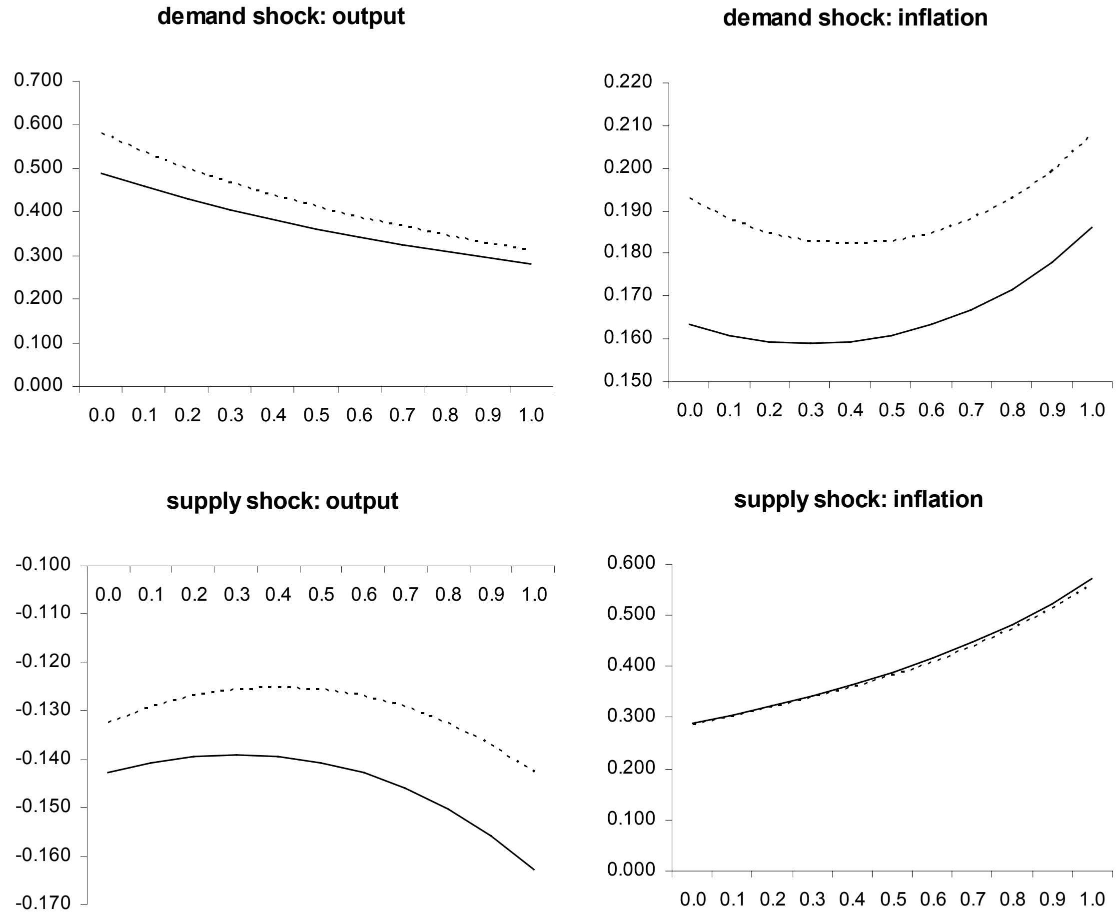
γ = 0.5



Note: the horizontal axes indicate the tax burden (t) and the vertical axes the impact of a shock (normalised at unity) on the output gap or inflation. The dotted line is baseline.

Sensitivity analysis (continued)

β = 1, λ = 0.5



Note: the horizontal axes indicate the tax burden (t) and the vertical axes the impact of a shock (normalised at unity) on the output gap or inflation. The dotted line is baseline.