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Short-Term Fiscal Spillovers in a Monetary Union

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SUMMARY

In this paper, a simple, two-country, static model is developed in order to analyze short-run fiscal spillovers in a monetary union, depending on (*i*) the way fiscal policy is implemented (expenditures versus net taxes), (*ii*) the strength of the supply-side channel of tax policies compared to the demand-side channel, and (*iii*) the extent of central bank accommodation. The analysis relies on two IS curves, two Phillips curves and an optimization behavior from the central bank. Fiscal policy consists in either a spending shock, which impacts on demand, or a tax shock, which impacts on both demand and prices. Fiscal shocks are assumed to be exogenously implemented in country 1, and their effect on output gaps and prices in both countries is analyzed.

It is shown that both a spending expansion and a tax cut produce positive spillovers on foreign output provided the central bank accommodates the shock, except if tax cuts have large supply-side effects. In this case, the foreign country does not benefit from a fall in the interest rate (because of interest-rate smoothing), whereas it suffers from loss in price-competitiveness.

If the central bank does not accommodate the shock, the spillovers of a fiscal expansion are generally negative: the common interest rate rises until aggregate demand is perfectly stabilized, which entails an output loss in the foreign country. However fiscal spillovers can be positive in the case of a tax cut because induced disinflation reduces or even reverses the reaction of the central bank.

Due to financial liberalization, it is possible that demand-side channels of fiscal policy have become less powerful compared to supply-side channels, because of higher ability of households to disconnect consumption from current disposable income. This has important implication for fiscal spillovers. For a spending expansion, the spillover effect is likely to become less positive. In turn, the rising importance of supply-side effects relative to demand-side effects is likely to turn positive spillovers into negative ones following a tax cut, at least if the central bank an interest-smoothing behavior.

ABSTRACT

In this paper, a simple, two-country, static model is developed in order to analyze short-run fiscal spillovers in a monetary union, depending on (*i*) the way fiscal policy is implemented (expenditures versus net taxes), (*ii*) the strength of the supply-side channel of tax policies

compared to the demand-side channel, and (*iii*) the extent of central bank accommodation. It is shown that both a spending expansion and a tax cut produce positive spillovers on foreign output provided the central bank accommodates the shock, except if tax cuts have large supply-side effects. If the central bank does not accommodate the shock, the spillovers of a fiscal expansion are generally negative. However fiscal spillovers can be positive in the case of a tax cut because induced disinflation reduces or even reverses the reaction of the central bank. Due to financial liberalization, it is possible that demand-side channels of fiscal policy have become less powerful compared to supply-side channels. To the extent that interest-rate variations are smooth, this could reduce the positive spillover of a spending expansion while turning the spillover of a tax cut into the negative territory.

JEL classification: E61, E62, F41.
Keywords: Fiscal policy, theoretical model, spillovers, monetary union, short run.

EXTERNALITÉS DE POLITIQUE BUDGÉTAIRE À COURT TERME EN UNION MONÉTAIRE

RÉSUMÉ

On développe ici un modèle simple statique à deux pays pour analyser les externalités à très court terme de la politique budgétaire en union monétaire, selon (*i*) le type de politique budgétaire (dépenses ou impôts nets), (*ii*) la force relative des effets d'offre de la politique fiscale et de ses effets de demande et (*iii*) le degré d'accommodation de la banque centrale. L'analyse repose sur deux courbes IS, deux courbes de Phillips et un comportement d'optimisation de la banque centrale. La politique budgétaire est supposée exogène. Il s'agit soit d'un choc de dépenses, qui affecte seulement la demande, soit d'un choc fiscal, qui affecte à la fois la demande et la formation des prix. Les chocs budgétaires ont lieu dans le pays 1 et on étudie leur impact sur l'écart de production et sur les prix dans les deux pays.

On montre qu'une hausse des dépenses publiques ou une baisse des impôts dans un pays produit une externalité positive sur le pays partenaire à condition que la politique monétaire soit accommodante, sauf si la politique fiscale a de puissants effets d'offre. Dans ce cas, le pays partenaire ne bénéficie pas d'une baisse du taux d'intérêt (puisque la banque centrale fait en sorte que le taux d'intérêt varie peu) tandis qu'il souffre d'une baisse de compétitivité-prix.

Si la banque centrale n'est pas accommodante, alors les externalités budgétaires sont généralement négatives : en cas d'expansion budgétaire, le taux d'intérêt de l'union augmente jusqu'à ce que la demande agrégée revienne à son niveau de référence, ce qui entraîne une baisse d'activité dans le pays partenaire. Cependant l'externalité peut être positive dans le cas d'une baisse d'impôt parce que la désinflation induite limite la hausse du taux d'intérêt, ou même conduit à une baisse du taux d'intérêt.

La libéralisation financière pourrait bien avoir affaibli les effets demande de la politique budgétaire, puisque les ménages peuvent plus facilement déconnecter leur consommation de leurs revenus disponibles courants. Ceci a d'importantes implications pour les externalités de politique budgétaire. L'externalité produite par une relance des dépenses publiques pourrait être positive qu'avant, tandis que l'importance relative croissante des effets d'offre pourrait avoir retourné les externalités de politique fiscale, une baisse d'impôts ayant un effet négatif sur la production des pays partenaires, en particulier si la banque centrale lisse les variations du taux d'intérêt.

RÉSUMÉ COURT

On développe ici un modèle simple statique à deux pays pour analyser les externalités à très court terme de la politique budgétaire en union monétaire, selon (*i*) le type de politique budgétaire (dépenses ou impôts nets), (*ii*) la force relative des effets d'offre de la politique fiscale et de ses effets de demande et (*iii*) le degré d'accomodation de la banque centrale. On montre qu'une hausse des dépenses publiques ou une baisse des impôts dans un pays produit une externalité positive sur le pays partenaire à condition que la politique monétaire soit accommodante, sauf si la politique fiscale a de forts effets d'offre. Si la banque centrale n'est pas accommodante, alors les externalités budgétaires sont généralement négatives : en cas d'expansion budgétaire, le taux d'intérêt de l'union augmente jusqu'à ce que la demande agrégée revienne à son niveau de référence, ce qui entraîne une baisse d'activité dans le pays partenaire. Cependant l'externalité peut être positive dans le cas d'une baisse d'impôt parce que la désinflation induite limite la hausse du taux d'intérêt, ou même conduit à une baisse du taux d'intérêt. Si la libéralisation financière a affaibli les effets demande de la politique budgétaire, alors les externalités budgétaires pourraient bien elles aussi avoir été affaiblies, voire renversées dans le cas des externalités fiscales.

Classification *JEL* : E61, E62, F41.
Mots Clefs : Politique budgétaire, externalités, court terme, union monétaire.

SHORT-TERM FISCAL SPILLOVERS IN A MONETARY UNION

Agnès BÉNASSY-QUÉRÉ [1]

1 Introduction

One popular view concerning macroeconomic policy in the European Monetary Union is that the ECB should deal with aggregate shocks whereas national governments should concentrate on idiosyncratic shocks. Still, this simple division of labor encounters several difficulties.

First, the ECB will react to aggregate shocks only to the extent that this does not contradict the objective of keeping inflation close to 2%. If there are only demand shocks, stabilizing output amounts to stabilizing the inflation rate. This is no longer true if there are supply shocks. For instance, a negative supply shock leads output to fall and inflation to increase. The ECB will likely react by raising rather than reducing its interest rate, which will negatively impact on both demand and supply through reduced capital accumulation.

Second, monetary policy is not a perfect substitute for fiscal policy. Indeed, monetary policy impacts on output and prices with long lags. Fiscal policy can act more quickly depending on the way it is implemented. Hence, in the case of an aggregate, negative demand shock, there is still some room for an aggregate fiscal response by Member States provided it is implemented quickly, for instance through automatic stabilizers.

Third, a fiscal impulse in one country may impact on output and prices in another country, due to higher imports (trade channel), lower price competitiveness (relative price channel) or to a rise in the common interest rate (interest-rate channel). The first two spillovers are positive whereas the third one is negative. Hence, the net spillover impact of a fiscal shock in one Member State is ambiguous. But whatever the sign, the very existence of a fiscal spillover asks for some form of coordination among member states. Such coordination is needed for symmetric shocks (because the Nash equilibrium does not deliver the best aggregate fiscal response in this case) but also for idiosyncratic shocks (because reacting to one specific shock in one country could itself trigger a shock in another country).

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Last, but not least, the effectiveness of fiscal policy is a much debated issue. The recent literature reviews provided by Hemming et al. (2002) and Briotti (2005) conclude that, at least in the very short run, fiscal policies have some Keynesian effects, i.e. a fiscal expansion leads to a rise in output, although multipliers are generally found to be small. More importantly, it is possible to draw a list of factors that may increase the impact of fiscal policy. For instance, in the case of a fiscal expansion, the positive impact on output is higher when there is excess capacity, monetary policy is accommodating, additional public expenditures are productive and not a direct substitute for private spending, removed taxes were distorsionary, government debt is low, prices are sticky.

These conditions may not apply the same way to cross-country Keynesian multipliers. For instance, a fiscal expansion in country 1 is likely to have more positive impact on the output of country 2 if the price level in country 1 reacts upward (which will raise the price competitiveness of country 2) provided the common central bank does not react too much to this price increase. Hence, price stickiness may rise the direct multiplier while reducing the cross-multiplier.

In addition, the spillover may depend on whether the fiscal policy is carried out through expenditures or taxes, for several reasons. First, the relative impact of expenditure shocks and tax shocks at home is debated. Due to the marginal propensity to save, the Keynesian multiplier is lower for net tax shocks than for spending (consumption and investment) shocks, and this is what macroeconometric models generally find. However tax and spending shocks may have different implications for households and investors' expectations, hence for private demand ; they may also have different supply effects. Indeed, a tax cut is likely to positively impact on aggregate supply, which raises permanent income and/or reduces the inflationary impact of the shock in the short run. Relying on a VAR methodology, Mountford and Uhlig (2005) find the tax multiplier to be higher than spending one. Second, as explained by Alho (2001), a tax shock in one country impacts on output in another country through both a demand channel and a supply channel. For instance, a tax cut will increase domestic prices through higher domestic demand, but reduce them through lower costs. The net effect on domestic prices, hence on foreign competitiveness, is ambiguous. Conversely an expenditure expansion raises foreign competitiveness without ambiguity.

This paper intends to analyze the sign of short-term fiscal spillovers in a monetary union depending on (*i*) the way fiscal policy is implemented (expenditures versus taxes), (*ii*) the strength of the supply-side channel of tax policies, and (*iii*) the extent of central bank accommodation. The recent evolution of prices in the Eurozone has been shown quite sensitive to tax policies in the large economies of the area, (see, for instance, de Bandt et al. 2004). Simultaneously, the ECB has proved relatively flexible concerning short-run movements of aggregate inflation, especially for one-off variations due to oil hikes or tax shocks. Hence, it is necessary to reconsider fiscal spillovers within such context where a tax increase in country 1 may impact positively on country 2 just because price competitiveness is improved in country 2 while the central bank reacts smoothly to higher inflation.

The paper is based on a simple, two-country model inspired from Alho (2001), Uhlig (2002) and Andersen (2002). The model is detailed in Section 2. As a first step, the central bank is assumed to fully stabilize demand shocks. The results for fiscal spillovers are detailed in Section 3. In Section 4, the central bank is no longer assumed to fully stabilize demand shocks. The impact of partial monetary accommodation on fiscal spillovers is derived. Section 5 concludes.

2 The model

The model used here is based on Alho (2001), Uhlig (2002) and Andersen (2002). Uhlig proposes a very simple model which is a static version of the Clarida-Gali-Gertler (1999) setting. There are three main differences here compared to Uhlig. First, only two identical countries are considered, whereas Uhlig studies a monetary union with n countries. Second, public expenditures are distinguished from net taxes.[2] Third, spillovers between the two countries are included in the model not only through the common monetary policy (as in Uhlig), but also through the real exchange rate (as in Alho). Indeed, relative price variations have been an important feature of the European monetary union since 1999 (see, for instance, Busetti et al. 2006).

The model describes the very short-term impact of fiscal policy. Hence the deviation of inflation from baseline is identified to the deviation of the price level from baseline. There are two equations for each country : an IS curve, and a Phillips curve. Indexing the countries by 1 and 2 respectively, the IS curves are given by :

$$y_1 = -\phi(r - p_1^e) + g_1 - \zeta t_1 + \alpha y_2 - \beta(p_1 - p_2) \quad (1)$$

$$y_2 = -\phi(r - p_2^e) + g_2 - \zeta t_2 + \alpha y_1 + \beta(p_1 - p_2) \quad (2)$$

with $\phi, \beta > 0$ and $0 < \alpha, \zeta < 1$. y_i denotes the logarithm of output in country i (i=1,2), p_i the logarithm of its price level, g_i a shock on public expenditures, t_i a shock on net taxes, p_i^e expected inflation (identical to the expected price level) and r is the nominal interest rate. All variables are expressed as deviations from steady state, either in relative terms (y_i, p_i, g_i, t_i) or in absolute terms (r). Hence, y_i can be interpreted as the output gap. Since both countries are in a monetary union, the nominal interest rate r is the same and therefore does not bear any country subscript. The real exchange rate of country 1 against country 2 is $p_1 - p_2$.

[2] public transfers are considered as negative taxes.

It is assumed here that fiscal shocks can be observed and that their price implications are perfectly understood by private agents. Hence price expectations are perfect. In our single-period model, this assumption writes : $p_i^e = p_i$.
The nominal rigidity comes from staggered labor contracts : in the short term, only a fraction n of wages adjust. The Phillips curve is derived from a simple WS-PS setting. The producer price level pp_i is assumed to be a constant mark-up on unit labor costs with constant labor productivity (only fiscal shocks will be considered in this model). Hence the producer price deviation from baseline is the following :

$$pp_i = w_i + t_i^w \tag{3}$$

where w_i denotes the gross wage level and t^w social contributions paid by employers. The wage level is assumed to depend on the (perfectly expected) consumer price index p_i (which includes VAT), on other net taxes paid by employees t^y (social contributions, personal income tax, minus social transfers received), and on the output gap y_i :

$$w_i = n(p_i + t_i^y + \gamma y_i) \tag{4}$$

with $0 < n < 1$ and $\gamma > 0$. Finally, the consumer price index is a weighted average of tax-included domestic prices and foreign prices, accounting for the residence principle of VAT :

$$p_1 = (1-\nu)(pp_1 + t_1^{vat}) + \nu(p_2 - t_2^{vat} + t_1^{vat}) \tag{5}$$

$$p_2 = (1-\nu)(pp_2 + t_2^{vat}) + \nu(p_1 - t_1^{vat} + t_2^{vat}) \tag{6}$$

with $0 < \nu < 1$, and t_i^{vat} denoting consumption taxes. Putting together these equation leads to the following Phillips curve :

$$p_1 = \lambda t_1 + \mu y_1 + \theta p_2 \tag{7}$$

$$p_2 = \lambda t_2 + \mu y_2 + \theta p_1 \tag{8}$$

with $t_i = (nt_i^y + t_i^w + t_i^{vat}) + \frac{\nu}{1-\nu}(t_i^{vat} - t_j^{vat})$, $\lambda = \frac{1-\nu}{1-n(1-\nu)} > 0$, $\mu = n\gamma\lambda > 0$ and $\theta = \frac{\nu}{1-\nu}\lambda > 0$.

t_i is an aggregate measure of tax policy. Note that all taxes would have the same impact on prices in the absence of nominal rigidities ($n = 1$). With wage rigidities, a transfer of taxes from employers' to employees' contributions ($t^w = -t^y < 0$) leads to a fall in inflation in the short run. Conversely, a transfer of taxes from employees' contributions or personal income taxes to VAT $t^y = -t^{vat} < 0$) has a positive impact on inflation in the short run. In the following, only aggregate net taxes will be considered.[3]

θ is an increasing function of ν (openness) and of n (wage indexation). If $\nu = 1$ or if $n = 1$, then $\theta = 1$ and the world price level is not determined. λ and μ are also increasing in n, but they are decreasing ν. This means that, in a more open country, domestic factors (t_i, y_i) have relatively less impact on domestic prices than imported inflation. In the following, it will be assumed that $0 < \theta < 1$, i.e. a 1% increase in imported prices has a less-than-1% impact on domestic prices.

From Equations (7) and (8), it is possible to derive the real exchange rate (or relative price) between the two countries $p_1 - p_2$:

$$(1 + \theta)(p_1 - p_2) = \lambda(t_1 - t_2) + \mu(y_1 - y_2) \tag{9}$$

A tax cut has two competing effects on domestic prices : they fall through a direct, supply effect ; and they rise due to higher domestic demand (indirect, demand effect). The net effect of a tax cut on foreign country's competitiveness is positive if the demand effect dominates the supply effect. In a similar way, the output-gap differential $y_1 - y_2$ is given by :

$$(1 + \alpha)(y_1 - y_2) = -(2\beta - \phi)(p_1 - p_2) + (g_1 - g_2) - \zeta(t_1 - t_2) \tag{10}$$

The relative price between the two countries has an ambiguous impact on the output-gap differential. On the one hand, a rise in the relative price of country 1 leads to a loss of competitiveness in this country, hence in a drop on its relative output gap. On the other hand, if prices rise more in country 1, then the real interest rate is lower in this country (because the nominal interest rate is the same in the two countries). This leads to higher output gap in country 1. Both effects have been at play in the European monetary union, but the former is likely to dominate, which will be assumed in the following (i.e. we assume that $2\beta > \phi$).

The loss function of the central bank is standard :

[3]For simplification, the same aggregate measure of net taxes is included in the IS curve and in the Phillips curve. Hence we discard the fact that a rise in VAT does not affect price competitiveness. To account for this, $p_1 - p_2$ would need to be replaced by $(p_1 - p_2) - (t_1^{vat} - p_2^{vat})$ in the IS curve.

$$L = \frac{1}{2}\left(p^2 + \chi y^2\right) \tag{11}$$

where y and p denote average output gaps and price levels in the two countries and $\chi > 0$. Average output gaps and prices can be derived from Equations (1), (2), (7) and (8) :

$$(1-\alpha)y = -\phi(r-p) + g - \zeta t \tag{12}$$

$$(1-\theta)p = \lambda t + \mu y \tag{13}$$

where g and t denote average spending and tax deviations from baseline. Plugging Equation (13) into the loss function, and considering tax policies in the two countries as given, one gets the following first-order condition :

$$y = -\frac{\mu\lambda}{\mu^2 + \chi(1-\theta)^2} t \tag{14}$$

If $\lambda = 0$ (i.e. if $\nu = 1$, complete openness), taxes have no impact on prices and the optimal monetary policy is always to keep aggregate output at its baseline level $y = 0$, as in Uhlig (2002). However if $\lambda > 0$, a negative tax shock leads the central bank to only partly stabilize output because of the fall in the aggregate price index. This can be seen by recovering the average price level from Equations (13) and (14) :

$$p = \frac{\lambda\chi(1-\theta)}{\mu^2 + \chi(1-\theta)^2} t \tag{15}$$

Equation (15) shows that, if $\lambda > 0$, the average price will fall following a tax cut[4], and that the fall in prices will be larger the higher the relative weight of output stabilization χ in the loss function. Indeed, in the case of a large χ, the positive impact of the tax cut on aggregate output leads to an interest-rate increase despite the direct, supply effect of the tax cut. This reinforces the price reduction.
Finally, the interest rate can be recovered from Equation (12) :

$$\phi r = \phi p - (1-\alpha)y + g - \zeta t = g + \left(\frac{(1-\alpha)\mu + \phi\chi(1-\theta)^2}{\mu^2 + \chi(1-\theta)^2}\lambda - \zeta\right) t \tag{16}$$

[4]remember that $0 < \theta < 1$.

Equation (16) shows that the optimal monetary reaction to a positive shock on aggregate public expenditures g is an interest-rate increase, whereas this is not necessarily the case with a negative tax shock t. The interest rate rises following a tax cut if the demand effect dominates the supply effect, hence if :

$$\lambda \quad < \quad \zeta \frac{\mu^2 + \chi(1-\theta)^2}{(1-\alpha)\mu + \phi\chi(1-\theta)^2}$$

Since the right hand-side of this inequality is positive, this condition is met if $\lambda = 0$. In this case, the central bank reacts the same way to a negative tax shock as to a positive spending shock. The only difference is the direct tax multiplier ζ which is smaller than the direct spending multiplier (1 by assumption).

3 Tax and spending spillovers

In this model, there are four ways the output gap of country 2 is affected by fiscal policy shocks in country 1 : (*i*) the income channel (αy_1), (*ii*) the competitiveness channel ($\beta(p_1 - p_2)$, (*iii*) the imported inflation channel (ϕp_2) and (*iv*) the interest-rate channel ($-\phi r$). A positive shock on public expenditures in country 1 has a positive impact on the output gap of country 2 through the first three channels but a negative one through the fourth channel. A tax cut in country 1 also has a positive impact on the output gap in country 2 through the income channel, but the spillovers through the three other channels are ambiguous.
Since the two countries are identical, the model can be solved through considering variables in sums and differences :

Output gaps :

$$\left(\mu^2 + \chi(1-\theta)^2\right)(y_1 + y_2) \quad = \quad -\lambda\mu(t_1 + t_2) \tag{17}$$

$$(1 + \alpha + \Gamma\mu)(y_1 - y_2) \quad = \quad -(\Gamma\lambda + \zeta)(t_1 - t_2) + (g_1 - g_2) \tag{18}$$

with

$$\Gamma \quad = \quad \frac{2\beta - \phi}{1 + \theta}$$

Γ is positive if a domestic price increase has a negative impact on the domestic output gap because the negative impact through competitiveness decline (2β) dominates the positive impact of the fall in the real interest rate (ϕ), which is assumed here.

Prices :

$$\left(\mu^2 + \chi(1-\theta)^2\right)(p_1 + p_2) = \lambda\chi(1-\theta)^2(t_1 + t_2) \tag{19}$$

$$\Theta(p_1 - p_2) = (\lambda(1+\alpha) - \mu\zeta)(t_1 - t_2) + \mu(g_1 - g_2) \tag{20}$$

with

$$\Theta = (1+\theta)(1+\alpha+\Gamma\mu)$$

To the extent that $\Gamma > 0$, we also have $\Theta > 0$. Here fiscal shocks are assumed to come only from country 1, hence $g_2 = t_2 = 0$, $g = g_1/2$ and $t = t_1/2$. The output gaps and price levels of the two countries can be derived from Equations (17) to (20) :

$$y_1 = -\left(\frac{\lambda\mu}{\mu^2 + \chi(1-\theta)^2} + \frac{\Gamma\lambda + \zeta}{1+\alpha+\Gamma}\right)\frac{t_1}{2} + \frac{1}{1+\alpha+\Gamma}\frac{g_1}{2} \tag{21}$$

$$y_2 = -\left(\frac{\lambda\mu}{\mu^2 + \chi(1-\theta)^2} - \frac{\Gamma\lambda + \zeta}{1+\alpha+\Gamma}\right)\frac{t_1}{2} - \frac{1}{1+\alpha+\Gamma}\frac{g_1}{2} \tag{22}$$

$$p_1 = \left(\frac{\lambda\chi(1+\theta)^2}{\mu^2 + \chi(1-\theta)^2} + \frac{\lambda(1+\alpha) - \mu\zeta}{\Theta}\right)\frac{t_1}{2} + \frac{\mu}{\Theta}\frac{g_1}{2} \tag{23}$$

$$p_2 = \left(\frac{\lambda\chi(1+\theta)^2}{\mu^2 + \chi(1-\theta)^2} - \frac{\lambda(1+\alpha) - \mu\zeta}{\Theta}\right)\frac{t_1}{2} - \frac{\mu}{\Theta}\frac{g_1}{2} \tag{24}$$

The spillover effect of a positive spending shock is clearly negative. This is because the central bank completely stabilizes the average output gap : it raises the interest rate until the average output gap comes back to baseline. Both output gaps and prices rise in country 1 (where the shock takes place) but fall in country 2.

By contrast, the spillover effect of a tax shock is ambiguous. A tax cut in in country 1 has a positive impact on the output gap of country 2 if the disinflation effect of the tax cut is large enough for the central bank to react by an interest-rate reduction or smooth increase and if this disinflation in country 1 does not have too much a negative impact on country 2 through a loss in competitiveness loss :

$$\frac{\lambda\mu}{\mu^2+\chi(1-\theta)^2} > \frac{\Gamma\lambda+\zeta}{1+\alpha+\Gamma\mu}$$

Note that this condition never applies if $\lambda = 0$. In this case, the central bank raises its interest rate until aggregate output is fully stabilized. By contrast, a fiscal expansion always raises output in the country undertaking this policy (here country 1), whether it comes through an spending increase or a tax cut.

Turning to the impact of fiscal policies on prices, Equations (23) and (24) show that a positive spending shock in country 1 leads to a price increase in country 1 but a price decrease in country 2. A tax cut in country 1 has an ambiguous effect in both countries. Prices fall in country 1 if λ is sufficiently high compared to ζ :

$$\lambda\left(\frac{\chi(1-\theta^2)}{\mu^2+\chi(1-\theta)^2}+\frac{1+\alpha}{\Theta}\right) > \frac{\mu\zeta}{\Theta}$$

If $\lambda = 0$, this condition is never met and a tax cut raises domestic prices. In country 2, the price level falls if the following condition applies :

$$\lambda\left(\frac{\chi(1-\theta^2)}{\mu^2+\chi(1-\theta)^2}-\frac{1+\alpha}{\Theta}\right) > -\frac{\mu\zeta}{\Theta}$$

If $\lambda = 0$, this condition is always met and a tax cut in country 1 makes prices fall in country 2.

The results are summarized in Table 1. For $\lambda = 0$, the impact of a fiscal expansion is the same whether such policy is implemented through an expenditure increase or a tax cut : output and prices rise in country 1 (where the shock takes place) and fall in country 2. For $\lambda > 0$, the results diverge between expenditure shocks (which have the same impact as for $\lambda = 0$) and for tax shocks (which now have an ambiguous impact except for the output gap of country 1). A fiscal expansion in country 1 is less painful for country 2 (in terms of the output gap) in the case of a tax cut if the disinflation impact of the tax cut has a small (negative) impact on country 2's competitiveness compared to the (positive) impact through the fall in the interest rate. Note that this will likely be the case following a cut in VAT, because in this case there is no impact on competitiveness. Conversely, a VAT increase in country 1 will raise the interest rate without improving the price competitiveness of country 2.

Table 1 – Impact of a fiscal expansion in country 1

	Spending shock ($g_1 > 0$)		Tax shock ($t_1 < 0$)	
	$\lambda = 0$	$\lambda > 0$	$\lambda = 0$	$\lambda > 0$
y_1	+	+	+	+
y_2	-	-	-	+/-
p_1	+	+	+	+/-
p_2	-	-	-	+/-

Within the European monetary union, the competitiveness effect is likely to dominate for countries which are highly integrated with the countries undertaking the tax cut, whereas the interest-rate channel is likely to dominate for other countries. For instance, a tax cut in Germany will be more painful than a spending expansion for France, Belgium, Austria and the Netherlands, because of German's increase in competitiveness. Conversely, further away countries like Spain or Ireland would perhaps suffer less from a tax cut than from an expenditure rise in Germany. Of course, the reverse applies in the case of a tax increase.
The problem with this view is that it is at odds with the empirical literature which generally finds either no fiscal spillovers or positive fiscal spillovers.[5] This possibility is ruled out in our framework for expenditure shocks because the central bank fully stabilizes demand shocks. To close the gap between the model and empirical results, it is necessary to relax the assumption of full stabilization of demand shocks by the central bank.

4 Interest rate smoothing

Empirical research on the behavior of central banks generally finds the interest rate to be less volatile than the optimal interest rate derived from an objective function like (11).[6] The rationale for such interest-rate smoothing is summarized by Clarida et al. (1999). One possibility is that the central bank is uncertain for instance about the parameters of the economy (Brainard, 1969). Another possibility is that it wants to influence the interest-rate term structure (Rotemberg and Woodford, 1997). A third reason is its fear of disrupting financial markets by erratic interest-rate variations (Goodfriend, 1991). A final explanation is disagreement among policy-makers.
One way to introduce interest-rate smoothing in the model is to include the square deviations of the interest rate from baseline in the loss function of the central bank :

$$L = \frac{1}{2}\left(p^2 + \chi y^2 + \rho r^2\right) \tag{25}$$

with $\rho \geq 0$. The first order condition now leads to :

[5] see, for instance, Bénassy-Quéré, Cimadomo and Mignon, 2006.
[6] See, for instance, Rotemberg and Woodford, 1997.

$$\Psi y = -\left(\frac{\mu\lambda}{(1-\theta)^2} + \frac{\rho}{\phi^2}\Omega\Lambda\right)t + \frac{\rho}{\phi^2}\Omega g \tag{26}$$

with

$$\Psi = \frac{\mu^2}{(1-\theta)^2} + \chi + \frac{\rho}{\phi^2}\Omega^2 > 0$$

$$\Omega = 1 - \alpha - \frac{\phi\mu}{1-\theta}$$

$$\Lambda = \zeta - \frac{\phi\lambda}{1-\theta}$$

Note that Ψ is a positive function of the smoothing parameter ρ. Ω can be either positive or negative. It is positive if a positive aggregate expansion ($g > 0$) has more impact on aggregate output directly ($1-\alpha$) than indirectly through price increase which reduces the real interest rate for a given nominal rate ($\frac{\phi\mu}{1-\theta}$). In the following, we assume $\Omega > 0$. Finally, the sign of Λ depends on the relative strength of supply-side and demand-side effects of fiscal policy. It is positive if demand-side effects are prominent.

If $\rho = 0$, then Equation (26) is equivalent to Equation (14) : the central bank completely stabilizes a shock on public expenditure but incompletely a shock on net taxes. If $\rho > 0$, then $\partial y/\partial g > 0$: now the central bank only partially stabilizes expenditure shocks. The interest rate goes as follows :

$$\phi r = \left[-\Lambda\left(1 - \frac{\rho\Omega^2}{\Psi\phi^2}\right) + \frac{\Omega\mu\lambda}{\Psi(1-\theta)^2}\right]t + \left(1 - \frac{\rho\Omega^2}{\psi\phi^2}\right)g \tag{27}$$

If $\rho = 0$, then Equation (27) is equivalent to Equation (16). However if $\rho > 0$, then the interest-rate increase after a positive shock on public expenditures is reduced. The impact of interest-rate smoothing on $\partial r/\partial t$ depends on Λ. If $\Lambda > 0$ (demand-side effects prominent), then more interest-rate smoothing (a higher ρ) means that the interest rate rises less or falls more following a tax cut. Conversely, if $\Lambda < 0$, then a higher ρ means that the interest rate will rise more or fall less following a tax cut.

Finally, the average price level is given by :

$$(1-\theta)p = \frac{\mu\rho\Omega}{\Psi\phi^2}g + \left(\lambda - \frac{\mu^2\lambda}{(1-\theta)^2\Psi} - \frac{\mu\rho\Omega\Lambda}{\Psi\phi^2}\right)t \tag{28}$$

The aggregate price level rises in the case of an aggregate positive expenditure shock. Its reaction to a tax cut is ambiguous. If $\Lambda > 0$ (demand-side effects prominent), then a higher ρ means that the aggregate price level will increase more or fall less than in the absence of interest smoothing. If $\Lambda < 0$, the price level increases less or falls more following a tax cut. We now turn to the impact of a fiscal policy taking place in country 1 on output gaps and prices in both countries. Like in Section 3, this is done by writing the variables in sums and differences.

output gaps

$$\Psi(y_1+y_2) = -\left(\frac{\mu\lambda}{(1-\theta)^2} + \frac{\rho}{\phi^2}\Omega\Lambda\right)(t_1+t_2) + \frac{\rho}{\phi^2}\Omega(g_1+g_2) \tag{29}$$

$$(1-\alpha+\Gamma\mu)(y_1-y_2) = -(\Gamma\lambda+\zeta)(t_1-t_2) + (g_1-g_2) \tag{30}$$

Output gaps in the two countries can now be derived, assuming $g_2 = t_2 = 0$:

$$\begin{aligned} y_1 = & \left(-\frac{1}{\Psi}\left[\frac{\mu\lambda}{(1-\theta)^2} + \frac{\rho\Omega}{\phi^2}\Lambda\right] - \frac{\Gamma\lambda+\zeta}{1+\alpha+\Gamma\mu}\right)\frac{t_1}{2} \\ & + \left(\frac{\rho\Omega}{\phi^2} + \frac{1}{1+\alpha+\Gamma\mu}\right)\frac{g_1}{2} \end{aligned} \tag{31}$$

$$\begin{aligned} y_2 = & \left(-\frac{1}{\Psi}\left[\frac{\mu\lambda}{(1-\theta)^2} + \frac{\rho\Omega}{\phi^2}\Lambda\right] + \frac{\Gamma\lambda+\zeta}{1+\alpha+\Gamma\mu}\right)\frac{t_1}{2} \\ & + \left(\frac{\rho\Omega}{\phi^2} - \frac{1}{1+\alpha+\Gamma\mu}\right)\frac{g_1}{2} \end{aligned} \tag{32}$$

The domestic impact of a positive spending shock in country 1 stays positive, but the spillover on country 2 is now ambiguous. It is negative as in Section 3 if :

$$\rho < \frac{\phi^2}{\Omega(1+\alpha+\Gamma\mu)}$$

If $\rho = 0$, this condition is always met, which is consistent with previous results. If $\rho > 0$ (interest-smoothing case), a positive expenditure shock in country 1 can have a positive impact on the output gap of country 2. When ρ becomes very large (full monetary accommodation), the spillover effect is positive since the interest rate does not move following the shock and the competitiveness of country 2 necessarily rises.
If $\Lambda > 0$, i.e. if demand-side effects dominate supply-side effects, then a tax cut in country 1 has a positive impact on the output gap of country 1 and an ambiguous impact on the output gap of country 2. In this context, a higher ρ (interest smoothing parameter) leads to higher expansionary impact of the tax cut in country 1 and either more expansion or less recession in country 2, because the central bank refrains from raising the interest rate.
Now, if $\Lambda < 0$, a tax cut has an ambiguous impact on the output gap in both countries. A higher ρ now means that a tax cut in country 1 will be less expansionary for country 1 and lead to either less expansion or more recession in country 2. This is because now the central bank refrains to *lower* the interest rate.
When ρ becomes very large (full accommodation by the central bank), both countries output gaps react in the same way to fiscal shocks in country 1 : a rise in spending increases the output gap in both countries by the same amount, and a tax cut in country 1 has a positive or negative impact on the output gap of both countries of the same amount, depending on the sign of Λ : a tax cut raises the output gap in both countries if $\Lambda > 0$ whereas it reduces it in both countries if $\Lambda < 0$. In the latter case, the tax cut is disinflationary but the central bank does not reduce the interest rate accordingly. Hence the real interest rate rises which dominates the direct, demand effect of the tax cut. We now turn to the impact of the shocks on price levels.

Prices :

The sum and difference variables are given by the following relationships :

$$(1-\theta)(p_1+p_2) = \left(\lambda - \frac{\mu^2\lambda}{(1-\theta)\Psi} - \frac{\mu\rho\Omega\Lambda}{\Psi\phi^2}\right)(t_1+t_2) + \frac{\mu\rho\Omega}{\Psi\phi^2}(g_1+g_2) \quad (33)$$

$$\Theta(1-\theta)(p_1-p_2) = (\lambda(1+\alpha)-\mu\zeta)(t_1-t_2) + \mu(g_1-g_2) \quad (34)$$

Assuming $g_2 = t_2 = 0$, we get :

$$\begin{aligned} p_1 = & \left(\frac{\lambda}{1-\theta} - \frac{\lambda\mu^2}{(1-\theta)^2\Psi} - \frac{\mu\rho\Omega\Lambda}{(1-\theta)\Psi\phi^2} + \frac{\lambda(1+\alpha)-\mu\zeta}{\Theta}\right)\frac{t_1}{2} \\ & + \left(\frac{\mu\rho\Omega}{(1-\theta)\phi^2\Psi} + \frac{\mu}{\Theta}\right)\frac{g_1}{2} \end{aligned} \quad (35)$$

$$
\begin{aligned}
p_2 \;=\; & \left(\frac{\lambda}{1-\theta} - \frac{\lambda\mu^2}{(1-\theta)^2\Psi} - \frac{\mu\rho\Omega\Lambda}{(1-\theta)\Psi\phi^2} - \frac{\lambda(1+\alpha)-\mu\zeta}{\Theta} \right) \frac{t_1}{2} \\
& + \left(\frac{\mu\rho\Omega}{(1-\theta)\phi^2\Psi} - \frac{\mu}{\Theta} \right) \frac{g_1}{2}
\end{aligned} \tag{36}
$$

A positive spending shock in country 1 has a positive impact on prices in country 1. The impact on prices in country 2 is also negative as in Section 3 if the reaction of the central bank is strong enough, more precisely if :

$$\rho < \frac{(1-\theta)\phi^2\Psi}{\mu\Omega\Theta}$$

A tax cut in country 1 can either raise or reduce prices in country 1 as well as in country 2. For a very large value of ρ (muted monetary policy), the impact is the same in both countries and of the sign of Λ. If $\Lambda > 0$, then demand-side effects are prominent and prices rise in both countries ; if $\Lambda < 0$, then supply-side effects are prominent and prices fall in both countries.

The results are summarized in Table 2. From this table, it is possible to conclude that tax spillovers are positive when the central bank accommodates the shock, except if fiscal expansion is carried out through a tax cut which has large supply-side effects. If the central bank does not accommodate, fiscal spillovers are less likely to be negative if fiscal policies are carried out through net taxes than if it comes through public spending shocks. Knowing whether demand-side or supply-side effects dominate is especially relevant in the case of tax shocks and if the central bank accommodates fiscal shocks. In this case, the signs of both direct and cross-country multipliers are reversed depending on which effect dominates.

In practice, the central bank is likely to behave in-between full accommodation and full stabilization, hence with a finite $\rho > 0$. In this case, Table 2 shows that fiscal spillovers are ambiguous, but they are likely to be less negative (or more positive) if (*i*) fiscal policy is carried out through net taxes rather than public spending, and (*ii*) demand-side effects are prominent. Conversely, fiscal adjustment in one countriy is likely to be more costly (or less favorable) to partner countries if such adjustment is carried out through a tax increase and if demand-side effects are prominent.

It is often argued that due to financial liberalization, households inter-temporal optimization is now possible and fiscal multipliers are lower than in the past. If this is the case, demand-side effects of fiscal policies are reduced whereas supply-side effects are unchanged. In our model, this means that Λ has been declining. To the extent that the ECB does not fully stabilize demand shocks, this means lower (positive) spillovers of positive spending shocks to other members of the monetary union, and perhaps the rise of negative spillovers of tax

cuts. Conversely, fiscal adjustment becomes less costly to EMU partners if it is carried out through spending cuts, and a tax increase can now have a positive impact on their output in the short run (to the extent that the central bank does not raise the interest rate too much).

Table 2 – Impact of a fiscal expansion in country 1, interest-rate smoothing

	Spending shock ($g_1 > 0$)						Tax shock ($t_1 < 0$)					
	$\Lambda > 0$			$\Lambda < 0$			$\Lambda > 0$			$\Lambda < 0$		
ρ	0	>0	∞	0	>0	∞	0	>0	∞	0	>0	∞
y_1	+	++	+++	+	+	+	+	++	+++	++	+	-
y_2	-	+/-	+++	-	+/-	+	+/-	++/-	+++	+/-	+/- -	-
p_1	+	+	+	+	+	+	+/-	++/-	+	+/-	+/- -	-
p_2	-	+/-	+	-	+/-	+	+/-	++/-	+	+/-	+/- -	-

Note : the magnitudes should not be compared across the shocks but across parameter values.

5 Conclusion

In this paper, a simple, two-country, static model is developed in order to analyze short-run fiscal spillovers in a monetary union, depending on (*i*) the way fiscal policy is implemented (expenditures versus net taxes), (*ii*) the strength of the supply-side channel of tax policies compared to the demand-side channel, and (*iii*) the extent of central bank accommodation.

It is shown that both a spending expansion and a tax cut produce positive spillovers on foreign output provided the central bank accommodates the shock, except if tax cuts have large supply-side effects. In this case, the foreign country does not benefit from a fall in the interest rate (because of interest-rate smoothing), whereas it suffers from loss in price competitiveness.

If the central bank does not accommodate the shock, the spillovers of a fiscal expansion are generally negative : the common interest rate rises until aggregate demand is perfectly stabilized, which entails an output loss in the foreign country. However fiscal spillovers can be positive in the case of a tax cut because induced disinflation reduces or even reverses the reaction of the central bank.

Due to financial liberalization, it is possible that demand-side channels of fiscal policy have become less powerful compared to supply-side channels, because of higher ability of households to disconnect consumption from current disposable

income. This has important implication for fiscal spillovers. For a spending expansion, the spillover effect is likely to become less positive. In turn, the rising importance of supply-side effects relative to demand-side effects is likely to turn positive spillovers into negative ones following a tax cut, at least if the central bank smooths the interest rate.

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