Cross-Border Spillovers from Fiscal Stimulus*

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The global recession of 2008–09 has revived interest in the international repercussions of domestic policy choices. This paper focuses on the case of fiscal stimulus, investigating cross-border spillovers from an increase in exhaustive government spending on the basis of a two-country business-cycle model. Our model allows spillovers to be affected by a range of features, including trade elasticities, the size and openness of economies, and financial imperfections. Beyond these well-known determinants, however, we highlight the central importance of policy frameworks, notably the medium-term debt consolidation regime. We consider the plausible case in which a temporary debt-financed increase in government spending gives rise to higher future taxes along with some reduction in spending over time. The anticipated spending reversal not only strengthens the domestic stimulus effect but also enhances positive cross-border spillovers through its impact on global long-term interest rates. Thus, our findings lend support to the notion that coordinated short-term stimulus policies are most effective when coupled with credible medium-term consolidation plans featuring at least some spending restraint.

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1. Introduction

The debate on the appropriate government response to the dramatic global recession of 2008–09 has revived classical controversies about fiscal policy. Arguments rage over the size of fiscal multipliers (e.g., Cogan et al. 2009, Romer and Bernstein 2009, or Uhlig 2009), as well as the magnitude of international spillovers from fiscal stimulus at the national level. According to the received wisdom, domestic fiscal stimulus benefits foreign output and employment via increased demand for imports as the home country's real exchange rate appreciates. A coordinated fiscal expansion, the traditional argument goes, can internalize this effect, balancing demand leakages and preventing unwelcome exchange rate fluctuations. However, there are also forces counteracting positive spillovers across countries. In particular, domestic fiscal stimulus (in large economies) may raise global interest rates and thus dampen foreign activity; this effect will be even more pronounced if fiscal expansions are debt-financed and public debt is already high.

Whatever their net effect, potential spillovers from fiscal expansions (as well as the ensuing "exit strategies") are high on the agenda of international policy discussions.[1] As a contribution to the ongoing debate on fiscal policy, this paper analyzes systematically the international spillover effects of short-term fiscal stimulus. Our modeling framework allows spillovers to be affected by a range of relevant factors, such as trade elasticities, openness, or financial imperfections, but our particular interest is on the regime of medium-run debt consolidation. Specifically, our analysis departs from the simplistic assumption that higher government outlays today will be fully offset by higher (future) taxation alone. Instead we allow for a realistic response to debt of both taxation and government spending, implying that at least some of the current fiscal stimulus is paid for through future expenditure cuts.[2]

[1]The IMF, for example, has repeatedly called on its members to coordinate their policies in response to the crisis, regarding not only the design of effective short-run measures but also the identification of fiscal consolidation strategies; see Spilimbergo et al. (2008).

[2]In previous work (Corsetti, Meier, and Müller 2009a), we have documented the empirical relevance of such a feedback channel for the United States and shown how it enhances the short-term expansionary effects of government spending on domestic activity. This paper extends our analysis to the question of cross-border spillovers from fiscal stimulus.

We carry out our analysis using a two-country business-cycle model, drawing on earlier work by Backus, Kehoe, and Kydland (1994) and Chari, Kehoe, and McGrattan (2002), among others. This stylized model allows us to provide a sharp characterization of our main results. An exogenous increase in government spending financed entirely by (current or future) taxes—the experiment typically analyzed in the literature—causes output to expand and private consumption to fall.[3] The home currency appreciates in real terms and induces expenditure switching toward foreign goods. Yet this positive effect on demand for foreign goods is counteracted by a contraction of global private absorption due to rising interest rates (unless the domestic economy is very small). Overall, the effect on foreign activity is quite contained or even negative, depending on the exact parameterization of the model.

The model predictions change profoundly under an alternative medium-term fiscal regime where not only taxes but also government outlays adjust systematically to consolidate public debt over time. In this case, the initial debt-financed increase in exhaustive government spending triggers a subsequent spending reversal, defined as a reduction of government spending below trend that partially offsets the detrimental effect of the initial fiscal expansion on public finances. Such dynamics can arise, even in the absence of credible commitment mechanisms, from de facto constraints on governments' capacity to raise taxes beyond voters' tolerance level.[4] Spending reversals, in turn, generate expectations of a fall in future real short-term interest rates, which immediately affect today's long-term real rates, both domestically and, to the extent that the home economy is large relative to the rest of the world, globally. Provided that domestic and foreign monetary policy exhibit a measured response to inflation and the output gap, long-term rates actually fall on impact, inducing a considerable increase in domestic and foreign output. Remarkably, the home real exchange rate depreciates in this

[3] As customary, we consider only the case of lump-sum taxation. Anticipation of higher distortionary taxes can lead to a wide range of responses, especially regarding individual components of aggregate demand.

[4] The Californian electorate's resistance to higher taxes, expressed in the famous Proposition 13, is but one particularly striking example of such constraints.

case—in sharp contrast to the prediction under a purely tax-based debt-consolidation strategy, but matching the time-series evidence.[5]

Our analysis thus highlights the importance of debt-consolidation regimes for the fiscal transmission mechanism, at both the national and the international level. At the core of the transmission mechanism lies the impact of spending reversals on global financial markets: the anticipated fall of spending below trend prevents, or at least contains, increases in global long-term real interest rates and thus allows the temporary fiscal expansion to stimulate private absorption worldwide. From the viewpoint of supporting global demand during the current global recession, our findings confirm the promise of combining short-term stimulus with clear and credible communication on (at least partial) expenditure-side consolidation over the medium term.

As an important corollary of our results, we find no more than a limited role for expenditure switching effects from exchange rate movements. This qualifies commonly cited concerns about unfair gains in competitiveness accruing to countries that do not implement a fiscal expansion. According to the conventional wisdom, an appreciation of the currency of the stimulus country would enable such "fiscal free-riders" to gain a larger share of foreign markets. In our analysis, by contrast, real appreciation is neither a necessary result of domestic fiscal stimulus nor even a primary determinant of spillovers on foreign economic activity. In fact, our analysis shows domestic stimulus to trigger a real *depreciation* under spending reversals; yet such a policy simultaneously induces sizable *positive* output spillovers abroad.

To the extent that government spending is actually used to stabilize public debt, our findings square well with results from empirical analyses of spillovers. Canzoneri, Cumby, and Diba (2003), for instance, identify fiscal shocks within a VAR framework and find a delayed but sizable increase in French, Italian, and British output in response to U.S. fiscal expansions. Beetsma, Giuliodori, and Klaasen (2006) combine a VAR model with an estimated trade

[5] A host of time-series analyses have documented real depreciation in response to fiscal expansion for the United States, the United Kingdom, and Canada; see Kim and Roubini (2008), Monacelli and Perotti (2006), and Ravn, Schmitt-Grohé, and Uribe (2007).

equation for European countries and find sizable output spillovers from shocks to German and French government spending. Cwik and Wieland (2009), in turn, use a multicountry model to explore the likely consequences of the fiscal packages legislated in Europe in late 2008/early 2009. They find that output spillovers from fiscal expansions in Germany to France and Italy are small or even negative. Although seemingly at odds with our own results, this theoretical prediction is actually consistent with our analysis, insofar as Cwik and Wieland consider a time path for fiscal policy that does not feature any spending reversals.[6]

The remainder of this paper is structured as follows. Section 2 outlines the model structure. Section 3 discusses the parameterization of the model and provides results from various simulations. Section 4 concludes.

2. Model Structure

In this section we outline a two-good, two-country business-cycle model, similar to Chari, Kehoe, and McGrattan (2002). We assume, however, that prices and wages are sticky and adjusted à la Calvo. We also allow for the possibility that a fraction of households is excluded from financial markets, as in Erceg, Guerrieri, and Gust (2006) and Bilbiie, Meier, and Müller (2008), among others—a way to capture financial frictions which may motivate the resort to fiscal policy as a stabilization tool. In addition to these "Keynesian" features, we assume that financial markets are incomplete at the international level, with trading restricted to non-contingent bonds. We posit an endogenous discount factor to ensure stationarity of equilibria. Lastly, we allow for differences in country size and for the possibility that the composition of final goods depends on their use for either private or public consumption.[7]

[6]These authors also point out the importance of the exchange rate regime for the strength of fiscal spillovers; see also Wieland (1996). We explore the interaction of exchange rate and debt-stabilization regimes in shaping the fiscal transmission mechanism in a companion paper; see Corsetti, Meier, and Müller (2009b).

[7]Corsetti and Müller (2006) provide evidence for the empirical relevance of such a distinction.

The world economy consists of two countries. The countries may differ in size but are otherwise symmetric, so that in steady state, per capita quantities are identical across countries and trade is balanced. In what follows we denote the population of country $i \in \{1, 2\}$ by N_i and measure the size of country 1 on the unit interval: $\varsigma = N_1/(N_1 + N_2)$. We also refer to country 1 as the domestic economy or as "Home" and to country 2 as "Foreign." The following subsections detail, in turn, the economic choices faced by agents in the two economies, the conduct of monetary and fiscal policies, and the relevant market-clearing conditions.

2.1 Final-Good Firms

Final goods—used for either private consumption, investment, or government consumption—are bundles of intermediate goods. The bundles are assembled by final-good firms, which operate under perfect competition and minimize the cost of combining intermediate goods. These goods, in turn, are produced by a continuum of monopolistically competitive firms in both countries. We use $j \in [0, 1]$ to index these firms (as well as their products and prices).

Let F_{it}, with $F \in \{C, X, G\}$, denote, respectively, the final goods used for household consumption, investment, and government consumption in country i at time t. Further, let $A_{it}(j)$ and $B_{it}(j)$ denote the amount of intermediate good j originally produced in country 1 and 2, respectively, that is subsequently used in country i to assemble some final good F. The specific final-good baskets are defined as follows:

$$F_{it} = \begin{cases} \left[\begin{array}{c} (\omega_{1F})^{\frac{1}{\sigma}} \left(\left[\int_0^1 A_{1t}(j)^{\frac{\epsilon-1}{\epsilon}} dj \right]^{\frac{\epsilon}{\epsilon-1}} \right)^{\frac{\sigma-1}{\sigma}} \\ + (1-\omega_{1F})^{\frac{1}{\sigma}} \left(\left[\int_0^1 B_{1t}(j)^{\frac{\epsilon-1}{\epsilon}} dj \right]^{\frac{\epsilon}{\epsilon-1}} \right)^{\frac{\sigma-1}{\sigma}} \end{array} \right]^{\frac{\sigma}{\sigma-1}}, & \text{for } i = 1 \\ \left[\begin{array}{c} (\omega_{2F})^{\frac{1}{\sigma}} \left(\left[\int_0^1 B_{2t}(j)^{\frac{\epsilon-1}{\epsilon}} dj \right]^{\frac{\epsilon}{\epsilon-1}} \right)^{\frac{\sigma-1}{\sigma}} \\ + (1-\omega_{2F})^{\frac{1}{\sigma}} \left(\left[\int_0^1 A_{2t}(j)^{\frac{\epsilon-1}{\epsilon}} dj \right]^{\frac{\epsilon}{\epsilon-1}} \right)^{\frac{\sigma-1}{\sigma}} \end{array} \right]^{\frac{\sigma}{\sigma-1}}, & \text{for } i = 2, \end{cases} \tag{1}$$

where σ measures the elasticity of substitution between foreign and domestic intermediate goods and ϵ measures the elasticity of substitution between intermediate goods produced within the same country. The parameter ω_{iF} measures the average weight of domestically produced intermediate goods in final good F_{it}.

Let $P^A_{it}(j)$ denote the price in country i of a generic intermediate good produced in country 1 and let $P^B_{it}(j)$ denote the price in country i of a generic good produced in country 2. Then, letting $\mathcal{E}_t$ denote the nominal exchange rate and assuming that the law of one price holds, we have

$$P^B_{1t}(j) = P^B_{2t}(j)/\mathcal{E}_t; \qquad P^A_{1t}(j) = P^A_{2t}(j)/\mathcal{E}_t. \tag{2}$$

The price indices for final-good baskets are given by

$$P^F_{it} = \begin{cases} \left[\omega_{1F}\left(P^A_{1t}\right)^{1-\sigma} + (1-\omega_{1F})\left(P^B_{1t}\right)^{1-\sigma}\right]^{\frac{1}{1-\sigma}}, & \text{for } i = 1 \\ \left[(1-\omega_{2F})\left(P^A_{2t}\right)^{1-\sigma} + \omega_{2F}\left(P^B_{2t}\right)^{1-\sigma}\right]^{\frac{1}{1-\sigma}}, & \text{for } i = 2, \end{cases} \tag{3}$$

where

$$P^A_{it} = \left(\int_0^1 P^A_{it}(j)^{1-\epsilon} dj\right)^{\frac{1}{1-\epsilon}} \text{ and } P^B_{it} = \left(\int_0^1 P^B_{it}(j)^{1-\epsilon} dj\right)^{\frac{1}{1-\epsilon}} \tag{4}$$

denote the producer price index (PPI) in Home and Foreign, respectively. As final-good firms minimize expenditures in assembling intermediate goods, aggregate domestic and foreign demand for domestically produced goods is given by

$$A_{it} = \begin{cases} \sum_{F\in\{C,X,G\}} \omega_{1F}\left(\frac{P^A_{1t}}{P^F_{1t}}\right)^{-\sigma} F_{1t}, & \text{for } i = 1 \\ \sum_{F\in\{C,X,G\}} (1-\omega_{2F})\left(\frac{P^A_{2t}}{P^F_{2t}}\right)^{-\sigma} F_{2t}, & \text{for } i = 2. \end{cases} \tag{5}$$

Analogously, aggregate domestic and foreign demand for intermediate goods produced abroad is given by

$$B_{it} = \begin{cases} \sum_{F\in\{C,X,G\}} (1-\omega_{1F})\left(\frac{P^B_{1t}}{P^F_{1t}}\right)^{-\sigma} F_{1t}, & \text{for } i = 1 \\ \sum_{F\in\{C,X,G\}} \omega_{2F}\left(\frac{P^B_{2t}}{P^F_{2t}}\right)^{-\sigma} F_{2t}, & \text{for } i = 2. \end{cases} \tag{6}$$

Note that A_{2t} and B_{1t} correspond to domestic exports and imports in terms of per capita values of country 2 and country 1, respectively. Global demand for a generic good j produced in country i, measured in per capita terms, is then given by

$$Y_{it}^{D}(j) = \begin{cases} \left(\frac{P_{1t}^{A}(j)}{P_{1t}^{A}}\right)^{-\epsilon}\left[A_{1t} + \frac{N_2}{N_1}A_{2t}\right], & \text{for } i = 1 \\ \left(\frac{P_{2t}^{B}(j)}{P_{2t}^{B}}\right)^{-\epsilon}\left[\frac{N_1}{N_2}B_{1t} + B_{2t}\right], & \text{for } i = 2. \end{cases} \tag{7}$$

2.2 Intermediate-Good Firms

In each country, there is a continuum of intermediate-good firms. A generic firm $j \in [0, 1]$ in country i engages in monopolistic competition, facing the demand function (7). The production function is assumed to be of the Cobb-Douglas type:

$$Y_{it}(j) = K_{it}(j)^{\theta}\tilde{H}_{it}(j)^{1-\theta}, \tag{8}$$

where $K_{it}(j)$ and $\tilde{H}_{it}(j)$ denote, respectively, the capital and labor services employed by firm j on a period-by-period basis. Both factors may be adjusted freely in each period. Letting W_{it} denote the price of labor services and R_{it} the rental rate of capital, cost minimization implies $\tilde{H}_{it}(j)/K_{it}(j) = (1-\theta)R_{it}/(\theta W_{it})$, such that marginal costs are independent of the level of production and identical across firms:

$$MC_{it} = \frac{W_{it}^{1-\theta}R_{it}^{\theta}}{\theta^{\theta}(1-\theta)^{1-\theta}}. \tag{9}$$

We assume that price setting is constrained exogenously by a discrete time version of the mechanism suggested by Calvo (1983). Each firm has the opportunity to change its price with a given probability $1-\xi_P$. When a firm has the opportunity, it sets the new price in order to maximize the expected discounted value of net profits. In setting the new price $P_{10}^{A}(j)$ and $P_{20}^{B}(j)$ in country 1 and 2, respectively, the generic intermediate-good firm j faces the following optimization problem:

$$\max \sum_{t=0}^{\infty} \xi_P^t E_0 \begin{cases} \rho_{1t}Y_{1t}^{D}(j)\left[P_{10}^{A}(j) - MC_{1t}\right]/P_{1t}^{C}, & \text{for } i = 1 \\ \rho_{it}Y_{2t}^{D}(j)\left[P_{20}^{B}(j) - MC_{2t}\right]/P_{2t}^{C}, & \text{for } i = 2 \end{cases} \tag{10}$$

subject to demand functions defined by (7), the production function (8), and the optimality condition on factor inputs (9). Profits are discounted with the factor ρ_{it}, which is determined by the consumption profile of the owners of the firms.

2.3 Households

2.3.1 Labor Services

We assume that there is a continuum of households and use $h \in [0,1]$ to index the variables associated with a generic household. Each household provides a differentiated labor good $H_{it}(h)$, with $W_{it}(h)$ denoting its price. Following Erceg, Henderson, and Levin (2000), we assume that a representative labor aggregator bundles individual labor goods into aggregate labor services subject to the following aggregation technology:

$$\tilde{H}_{it} = \left(\int_0^1 H_{it}(h)^{\frac{\epsilon-1}{\epsilon}} dh \right)^{\frac{\epsilon}{\epsilon-1}}. \tag{11}$$

Under these conditions, the unit cost of labor services is given by

$$W_{it} = \left(\int_0^1 W_{it}(h)^{1-\epsilon} dh \right)^{\frac{1}{1-\epsilon}}. \tag{12}$$

It can be interpreted as the aggregate wage index. Optimal bundling of differentiated labor goods implies the demand function

$$H_{it}(h) = \left(\frac{W_{it}(h)}{W_{it}} \right)^{-\epsilon} \tilde{H}_{it}. \tag{13}$$

There are two types of households in the model. The first type owns the domestic intermediate-good firms. It also trades contingent securities at the national level and non-contingent one-period bonds at the international level.[8] We refer to these households as

[8]As argued in previous work of ours—see Corsetti, Meier, and Müller (2009a)—the international transmission mechanism associated with spending reversals operates through international prices, rather than through relative wealth effects. Hence results are virtually unchanged if we assume that asset holders trade a complete set of Arrow-Debreu securities across countries.

"asset holders" and index the relevant variables with a subscript "A." Asset holders account for a fraction of $1 - \lambda$ of all households. The remaining households (a fraction λ of the total) do not participate at all in asset markets; i.e., they are "non-asset holders" and are indexed with a subscript "N."

2.3.2 Asset Holders

An asset-holding household h chooses consumption, $C_{A,it}$, and provides labor services, $H_{A,it}$. Its utility function is given by the following expression:

$$E_0 \sum_{t=0}^{\infty} \beta_{it} \left(\frac{C_{A,it}(h)^{1-\gamma} - 1}{1-\gamma} - \vartheta \frac{H_{A,it}(h)^{1+\mu}}{1+\mu} \right) \tag{14}$$

$$\beta_{i0} = 1, \;\; \beta_{it+1} = \left(1 + \psi C_{A,it}\right)^{-1} \beta_{it}, \;\; t > 0.$$

The discount factor is endogenous in order to ensure stationarity of equilibria; see Schmitt-Grohé and Uribe (2003).

Capital is internationally immobile; asset holders in each country own the domestic capital stock K_{it}. As in Baxter and Crucini (1993), we assume that it is costly to adjust the capital stock such that the law of motion for capital is given by

$$K_{it+1} = (1-\delta)K_{it} + \phi\left(\frac{X_{it}}{K_{it}}\right) K_{it}, \tag{15}$$

where δ measures the depreciation rate. Regarding investment adjustment costs, we assume that in steady state $X/K = \delta$ and $\phi'(X/K) = 1$, where variables without subscript refer to steady-state values. In the following, the parameter χ measures the elasticity of adjustment costs with respect to the investment-capital ratio, $\frac{-\phi''(X/K)X/K}{\phi'(X/K)}$.

The period budget constraint of a representative asset holder is given by

$$W_{it}H_{A,it} + (R_{it}K_{it} + \Upsilon_{it} - P^X_{it}X_{it})/(1-\lambda) - T_{A,it} - P^C_{it}C_{A,it}$$
$$= \begin{cases} \frac{\Theta_{11t+1}}{1+i_{1t}} + \frac{\Theta_{21t+1}}{(1+i_{2t})\mathcal{E}_t} - \Theta_{11t} - \Theta_{21t}/\mathcal{E}_t, & \text{for } i=1 \\ \frac{\Theta_{22t+1}}{1+i_{2t}} + \frac{\mathcal{E}_t\Theta_{12t+1}}{(1+i_{1t})} - \Theta_{22t} - \mathcal{E}_t\Theta_{12t}, & \text{for } i=2 \end{cases}. \tag{16}$$

Here Θ_{ijt} denotes bonds denominated in the currency of country i held by asset holders in country j. Υ_{it} denotes nominal profits earned by monopolistic firms and transferred to asset holders; and $T_{A,it}$ denotes lump-sum taxes levied on asset holders; i_{it} denotes the nominal interest rate denominated in the currency of country i. Ponzi schemes are ruled out by assumption.

Households are restricted in their ability to adjust wages analogously to how intermediate-good firms are restricted to adjust prices. Specifically, only a fraction $1 - \xi_W$ of asset holders may adjust wages in a given period. We assume, however, that asset-holding households completely insure among themselves the consumption risk resulting from their limited ability to adjust wages. Consequently, consumption levels of asset-holding households are identical (their initial wealth being identical by assumption). When allowed to adjust $W_t(h)$, household h maximizes (14) subject to the demand function for its labor services (13); for details, see Erceg, Henderson, and Levin (2000).

2.3.3 Non-Asset Holders

As in Erceg, Guerrieri, and Gust (2006), we assume that non-asset-holding households set their wage to be equal to the average wage of asset holders. Moreover, they spend disposable income on consumption in each period; i.e., for a representative non-asset-holding household, we have

$$P_{it}^{C} C_{N,it} = W_{it} H_{N,it} - T_{N,it}, \tag{17}$$

where $T_{N,it}$ denotes lump-sum taxes levied on asset holders. As non-asset holders' consumption equals disposable income in each period, they are also referred to as "hand-to-mouth consumers" (another frequently used label is "rule-of-thumb consumers"). Since non-asset-holding households charge the average wage and face the same demand function as asset-holding households, their work effort is equal to the average work effort of asset-holding households; i.e., $H_{N,it} = H_{A,it} = \int_0^{1-\lambda} H_{A,t}(h)dh$. Regarding aggregate consumption, we have

$$C_{it} = \lambda C_{N,it} + (1 - \lambda) C_{A,it}. \tag{18}$$

2.4 Monetary and Fiscal Policy

2.4.1 Fiscal Policy

Government spending is financed either through lump-sum taxes, T_{it}, or through issuance of nominal one-period debt, D_{it}, which is denominated in domestic currency.[9] The period budget constraint of the government reads as follows:

$$\frac{D_{it+1}}{1+i_{it}} = D_{it} + P_{it}^{G} G_{it} - T_{it}. \tag{19}$$

The time path of government spending and real taxes, $T_{R,it} = T_{it}/P_{it}^{C}$, is described by feedback rules, which we assume to take the following form:

$$G_{it} = (1-\psi_{gg})G_i + \psi_{gg} G_{it-1} + \psi_{gy}\big(Y_{it-1} - Y_{it-1}^{f}\big) + \psi_{gd}\frac{D_{it}}{P_{it-1}^{C}} + \varepsilon_t \tag{20}$$

$$T_{R,it} = G_i\left(\frac{P_{it}^{G} G_{it}}{P_{it}^{C} G_i}\right)^{\psi_{tg}} + \psi_{td}\frac{D_{it}}{P_{it-1}^{C}}, \tag{21}$$

where ε_t measures an exogenous i.i.d. shock to government spending. Y_{it-1} denotes a measure of aggregate output in period $t-1$ defined below and Y_{it-1}^{f} denotes the level of output that would prevail under flexible prices and wages. The ψ-parameters capture the responsiveness of spending and taxes to government spending, the output gap, and debt.[10] Note that for $\psi_{tg} = 1$, changes in government spending lead to a one-for-one increase in taxes, leaving government debt unchanged.

The analysis of government spending shocks has typically been conducted under the assumption that $\psi_{gy} = \psi_{gd} = 0$, in which case

[9] We assume that government spending does not alter production possibilities, but may enhance private welfare. We assume, however, that preferences are additively separable in government spending (and, hence, do not explicitly consider it as an argument in (14) above).

[10] To the extent that ψ_{gy} differs from zero, government spending responds to the output gap; we assume that it responds to the lagged rather than contemporaneous output gap as a result of decision and/or implementation lags.

government spending follows an exogenous process.[11] Relaxing this restriction is central to our analysis, as we wish to trace the implications of the debt-stabilizing regime for the international transmission of fiscal shocks. While under $\psi_{gd} = 0$ government debt is redeemed only through tax increases, $\psi_{gd} < 0$ implies at least some reduction in debt through lower government spending for any given increase in taxes.

Note in this context that (20) need not be interpreted strictly as an institutional rule constraining the fiscal authorities. Instead, like a Taylor rule for monetary policy, it is chiefly meant to provide an empirically realistic description of fiscal policymaking, reflecting the complex set of incentives and constraints that govern the authorities' decisions on the level of government spending. One important constraint appears to be voters' resistance to ever-increasing taxes, which ultimately induces policymakers to pursue fiscal consolidation at least in part through expenditure reduction (relative to trend).

2.4.2 Monetary Policy

We assume flexible exchange rates and specify the conduct of monetary policy by an interest rate feedback rule:

$$i_{it} = i_i + \phi_\pi\left(\Pi_{it}^D - \Pi_i^D\right) + \phi_y \frac{Y_{it} - Y_{it}^f}{4Y_i}, \tag{22}$$

where Π_{it}^D measures domestic inflation (i.e., P_{1t}^A/P_{1t-1}^A) in country i. A Taylor-type rule such as (22) provides a familiar and simple way to account for the role of monetary policy in the transmission of fiscal policy.

2.5 Equilibrium

Equilibrium requires that firms and households choose prices and quantities optimally subject to their constraints, initial conditions, and policy rules. Moreover, by market clearing, the production of intermediate goods is such that $Y_{it}(j) = Y_{it}(j)^D$, where demand is

[11]If, in addition, $\lambda = 0$, the relative magnitude of ψ_{tg} and ψ_{td} is irrelevant for the equilibrium allocation (Ricardian equivalence), provided that ψ_{td} is set so as to ensure the stability of debt.

given by (7). Defining an index for output, $Y_{it} = (\int_0^1 Y_{it}^{\frac{\epsilon-1}{\epsilon}}(j)dj)^{\frac{\epsilon}{\epsilon-1}}$ as in Galí and Monacelli (2005), we obtain, in aggregate terms

$$Y_{1t} = A_{1t} + \frac{N_2}{N_1} A_{2t}, \tag{23}$$

$$Y_{2t} = \frac{N_1}{N_2} B_{1t} + B_{2t}. \tag{24}$$

Factor markets clear if

$$\tilde{H}_{it} = \int_0^1 \tilde{H}_{it}(j)dj \tag{25}$$

$$K_{it} = \int_0^1 K_{it}(j)dj. \tag{26}$$

We assume that only domestic bonds are traded internationally and impose the following market-clearing condition:

$$N_1(1-\lambda)\Theta_{11t} + N_2(1-\lambda)\Theta_{12t} = N_1 D_{1t}. \tag{27}$$

For future reference we define the trade balance and the real exchange rate as follows:

$$NX_t = \frac{N_2 P_{1t}^A A_{2t} - N_1 P_{1t}^B B_{1t}}{N_1 P_{1t}^A Y_{1t}}, \;\; RX_t = P_{1t}^C \mathcal{E}_t / P_{2t}^C, \tag{28}$$

such that an increase of RX_t corresponds to an appreciation of the real exchange rate.

3. Fiscal Spillovers with Spending Reversals

In this section we analyze the cross-border macroeconomic effects of fiscal stimulus. We consider fiscal expansions in one country and study their effects on the domestic economy, on foreign economic activity—i.e., on the level and composition of foreign aggregate demand—and on key asset prices, such as short- and long-term interest rates. Our analysis is focused on unexpected variations in exhaustive government spending, i.e., “shocks” to government final demand for goods and services. We identify spillovers by tracing the global repercussions of these shocks, abstracting from possible strategic policy interaction across borders. Our particular interest relates to the role of the domestic debt-consolidation regime for the international transmission of fiscal shocks: how are cross-border spillovers affected by a fiscal regime that exhibits spending reversals, i.e., debt consolidation that operates at least in part through the expenditure side?

For the model simulations, we rely on a linear approximation of the equilibrium conditions around a deterministic and symmetric steady state in per capita terms. For this steady state we assume that trade is balanced,[12] government debt is zero, inflation is zero, and the consumption and labor supply of asset holders and non-asset holders are identical. The latter results from appropriate lump-sum transfers in steady state. We assume, however, that outside steady-state lump-sum transfers change by equal amounts for both types of households. Alternative assumptions regarding the steady state are unlikely to have a first-order effect on the transmission of fiscal shocks. Before discussing the results, we briefly discuss our choice of parameter values for the model economy.

3.1 Parameterization

Table 1 summarizes our parameter choice and provides a brief rationale, by referencing relevant studies and/or by referring to specific calibration targets. In the upper panel we list the parameters which are kept constant throughout all model simulations. In the lower panel we list the parameters for which we consider alternative values for the purpose of sensitivity analysis. Most of the parameter values match those commonly employed in other studies and are closely related to key characteristics of the U.S. economy.

A period in the model corresponds to one quarter. The value of the discount factor in steady state is set to 0.99. We set μ so that the Frisch elasticity of labor supply is 0.5; see Domeij and Flodén (2006), and assume that households spend one-third of their time working. We set $\gamma = 1$ to ensure the existence of a balanced

[12]To the extent that countries differ in size, the foreign import share differs from the home import share in order to ensure that trade is balanced in steady state. Specifically, the foreign import share is N_1/N_2 times the home import share.

Table 1. Parameter Values Used in Model Simulations

Parameter		Value	Calibration Target/Source	Value
Discount Factor (Steady State)	β	0.99	Quarterly Interest Rate	0.01
Inverse Frisch Elasticity	μ	2.00	Domeij and Flodén (2006)	
Utility Weight of Work	ϑ	25.8	Hours Worked in Steady State	0.33
Risk Aversion	γ	1.00	Balanced Growth	
Depreciation Rate	δ	.025	Investment-Output Ratio	0.225
Capital Adjustment Costs	χ	0.25	Bernanke et al. (1999)	
Price Elasticity	ϵ	11.0	Markup	1.1
Capital Share	θ	0.3	Labor Share	0.7
Government Share Steady State	G_i/Y_i	0.2	Government Spending Share	0.2
Calvo Prices	θ_p	0.7	Price Durations Quarters	3.3
Calvo Wages	θ_w	0.7	Wage Durations Quarters	3.3
Government Spending Persistence	ψ_{gg}	0.9	VAR Studies	
Home Bias Government Spending	ω_G	0.94	Corsetti and Müller (2006)	
Debt Stabilization Taxes	ψ_{td}	0.02	Non-Explosiveness of Public Debt	
Parameter		**Baseline**	**Sensitivity**	
Debt Stabilization Spending	ψ_{gd}	−0.02	0	
Government Spending Output Gap	ψ_{gy}	0	$[-0.01, 0.04]$	
Tax Finance	ψ_{tg}	0	[0,1]	
Monetary Policy Inflation	ϕ_π	1.5	[1.1,2]	
Monetary Policy Output Gap	ϕ_y	0	[0,0.5]	
Trade Price Elasticity	σ	0.66	[0.66,3]	
Rule-of-Thumb Consumers	λ	0.33	[0,0.5]	
Home Bias Private Absorption	$\omega_X = \omega_C$	0.865	Importshare 5–40%	
Size of Domestic Economy	ς	0.37	[0.01,0.99]	

Notes: Upper panel: Values unchanged across simulations; see main text for discussion of target values. Lower panel: Parameter values for baseline simulation and range considered in sensitivity analysis.

growth path. The depreciation rate is set to $\delta = 0.025$, and the parameter value capturing capital adjustment costs is set to $\chi = 0.25$; see, e.g., Bernanke, Gertler, and Gilchrist (1999). The price elasticity of demand both for intermediate goods and for differentiated labor goods is set to $\epsilon = 11$, implying a steady-state markup of 10 percent. The capital share is set to $\theta = 0.3$. Regarding price and wage rigidities, we assume $\theta_p = \theta_w = 0.7$, which implies that prices and wages are adjusted, on average, every 3.3 quarters. Regarding fiscal policy, we set average government spending to 20 percent of GDP, approximately equal to the actual value for government consumption and investment (excluding transfers) in the United States. The parameter capturing the persistence of government spending ψ_{gg} is assumed to be equal to 0.9, which allows the model to match broadly the half-life of government spending after a shock identified by various VAR studies. We assume that government spending falls largely on domestically produced goods. Specifically, by setting $\omega_G = 0.94$ we posit that, on average, imports account for only 6 percent of government spending; see Corsetti and Müller (2006). Moreover, we assume throughout that taxes adjust to the level of public debt and set $\psi_{td} = 0.02$, which ensures debt stability in the absence of debt stabilization via spending cuts.[13]

As already discussed in the previous sections, a key innovation in our analysis relative to the existing literature concerns the way we model the medium-run fiscal framework. Instead of specifying government spending as a simple series of autocorrelated, exogenous shocks, we explicitly allow for endogenous spending dynamics reflecting a debt-stabilization motive. This notion is captured by a parameter choice of $\psi_{gd} = -0.02$, implying that government spending is cut by 0.02 percentage points of output for every additional percentage point of public debt (measured in terms of output). In this way government spending contributes to the consolidation of public finances. Such dynamics could arise from explicit fiscal frameworks or even numerical rules, but we actually have a

[13] Given a linear approximation of the equilibrium conditions around a deterministic steady state with zero inflation and debt, and assuming that government spending does not respond to the accumulation of public liabilities, debt stability requires that $(1 - \psi_{td})/\beta < 1$ under an "active" monetary policy rule; see Leeper (1991) for a general discussion.

broader motivation in mind. Notably, our setup attempts to capture in reduced form the reality of political (economy) constraints on governments' capacity to raise taxes. Canova and Pappa (2004), for instance, find a strong stabilizing response of government spending to the debt output/ratio across U.S. states, irrespective of whether state laws mandate explicit fiscal restrictions. Our assumption also finds support in empirical estimates of policy rules, which indicate a statistically significant adjustment of both spending and taxes in response to higher debt.[14]

To assess the importance of our modeling innovation for the fiscal transmission mechanism, we also carry out simulations assuming, alternatively, that $\psi_{gd} = 0$. Since in our baseline scenario government spending does not respond to the output gap $\psi_{gy} = 0$, setting $\psi_{gd} = 0$ implies that government spending follows an exogenous AR(1) process, as posited in most of the literature.[15] We explore the sensitivity of our results with respect to other fiscal parameters as well. Notably, we allow for cyclicality in government spending by varying the value of ψ_{gy}, and the extent of direct tax finance. In the baseline scenario we set $\psi_{tg} = 0$; this is motivated by the fact that VAR studies often document a strong immediate increase in public debt in response to spending shocks, e.g., Corsetti, Meier, and Müller (2009a). Yet we also consider the possibility of a significant reliance on simultaneous tax increases.

Regarding monetary policy, for the sake of simplicity, our baseline scenario assumes $\phi_\pi = 1.5$ and $\phi_y = 0$; that is, we posit the conventional Taylor-type inflation coefficient, but abstract from a separate output-gap response. However, section 3.3 below investigates the implications of specifying alternative Taylor rules.

For the trade price elasticity σ we assume a value of 2/3, in line with several studies; see Corsetti, Dedola, and Leduc (2008) for further discussion, but also consider higher values in our sensitivity

[14]Using annual observations, Galí and Perotti (2003), for instance, report estimates ranging from −0.04 to 0.03 for government spending, and from 0 to 0.05 for taxes, in a panel of OECD members. For the United States, Bohn (1998) reports estimates for the response of the *surplus* to debt in a range from 0.02 to 0.05.

[15]An alternative approach adopted recently by Cogan et al. (2009) and Cwik and Wieland (2009) is to assume a specific exogenous time path for government spending and study how it affects the economy.

analysis. Regarding the parameter λ—i.e., the extent of participation in financial markets—we posit $\lambda = 1/3$ for our baseline scenario; this is a relatively conservative number in light of the estimates reported by Campbell and Mankiw (1989), Galí, López-Salido, and Vallés (2007), and Bilbiie, Meier, and Müller (2008). We assume $\omega_X = \omega_C = 0.865$, which implies (for $\omega_G = 0.94$) an average import-to-GDP ratio of 12 percent. The size of the domestic economy is set to $\varsigma = 0.37$, which corresponds to the weight of the U.S. economy in the OECD.[16] As indicated by the right column in the lower panel of table 1, we subject results for the baseline scenario to extensive sensitivity analysis by varying parameters over a considerable interval.

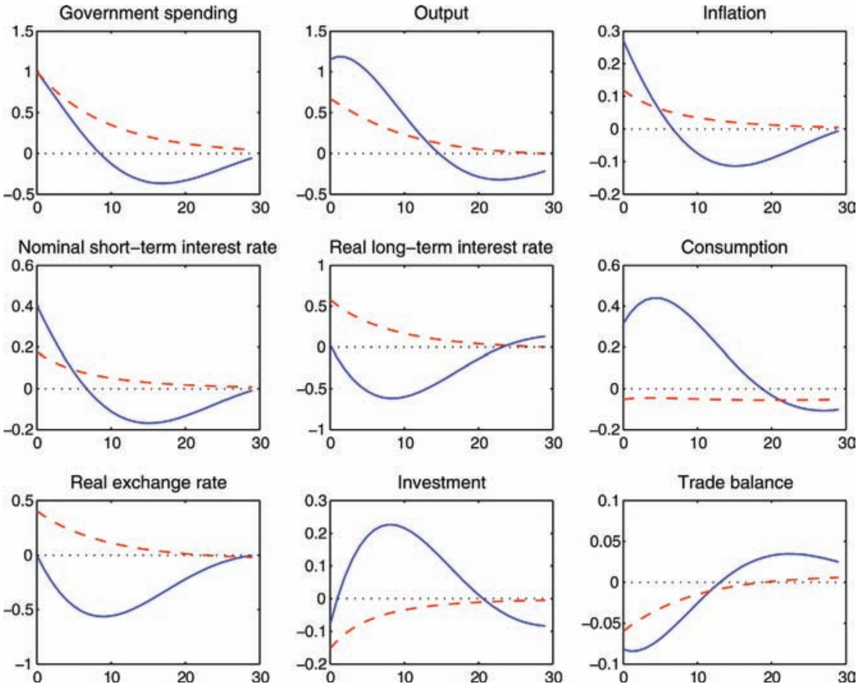
3.2 Tracing the Global Repercussions of Domestic Fiscal Expansions

We now turn to the domestic and cross-border effects of an exogenous increase in domestic government spending, explicitly accounting for the medium-term spending dynamics resulting from alternative regimes of public debt consolidation. Figure 1 shows the results in terms of impulse responses for a set of key macroeconomic and financial variables—government spending, output, inflation (measured in producer prices), the nominal short-term interest rate, the real long-term interest rate,[17] consumption, the real exchange rate, investment, and the trade balance. Quantity variables are measured in percent of steady-state output (in per capita terms); price variables are measured in percentage deviations from the steady-state level. Horizontal axes measure time in quarters. Figure 1 summarizes how key domestic variables adjust to the spending impulse, while figure 2 displays the responses of variables that capture cross-country spillovers. The solid line indicates the results for the baseline case (which assumes some consolidation of public debt via spending

[16] Calculations are based on OECD *Economic Outlook* data: GDP is measured in year 2000 USD (PPP).

[17] The long-term real rate of interest is defined as the real yield on a bond of infinite duration. Formally, the deviation of this variable from its steady-state value corresponds to the infinite sum of deviations of future ex ante short-term real interest rates from steady state.

Figure 1. Effect of Government Spending Shocks: Responses of Key Domestic Variables

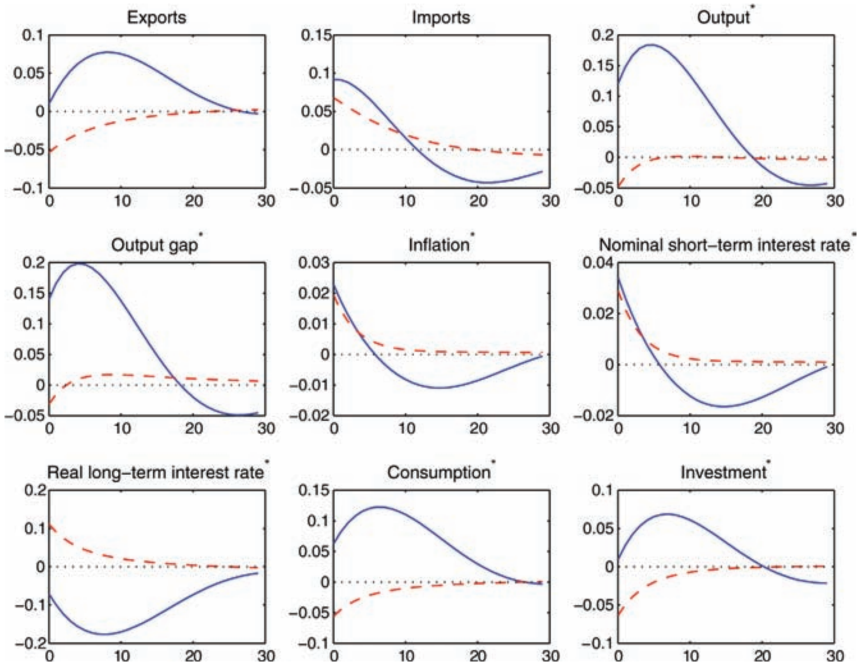


Notes: Baseline (solid line) vs. debt stabilization through taxes only ($\psi_{gd} = 0$, dashed line). Quantity variables are measured in percent of steady-state output. Price variables are measured in percentage deviations from the steady-state level. Horizontal axes measure time in quarters.

reversals); the dashed line shows the results for the case of exogenous government spending (where debt consolidation occurs through taxes only).

Focus first on our baseline specification, marked by the solid line. The first graph in the figure shows the dynamics of government spending after an initial exogenous rise of 1 percent of GDP. As a result of our baseline debt-consolidation regime, spending falls below trend about ten quarters after the initial innovation—hence the term "spending reversal." It is important to clarify that the present discounted value of the spending shock remains overall positive: agents do face a higher burden of taxation over their lifetime. Relative to

Figure 2. Effect of Government Spending Shocks: Responses of Variables That Capture Cross-Country Spillovers



Notes: Baseline (solid line) vs. debt stabilization through taxes only ($\psi_{gd} = 0$, dashed line); foreign economy variables are indicated with an asterisk (*). Quantity variables are measured in percent of steady-state output. Price variables are measured in percentage deviations from the steady-state level. Horizontal axes measure time in quarters.

the full tax-finance case, however, the burden is now reduced somewhat by trimming future spending. But, as will become clear below, the transmission of stimulus with spending reversals works mainly through the intertemporal price of consumption.

The fiscal transmission in the domestic economy is summarized in figure 1. The rise in government spending raises output and opens a positive output gap (not shown), causing higher inflation. The rise in inflation, in turn, leads to higher nominal and real short-term interest rates (not shown) on impact. Yet, the real long-term rate rises by much less; indeed, under our baseline specification it even falls. This reflects the fact that long-term rates capture the entire expected path of real short-term rates. As short-term real rates are expected to fall below steady-state levels after about eight quarters, slightly before the time in which spending falls below trend, long-term rates already fall upon impact. Note that this result crucially depends on the "hawkishness" of monetary policy. If the central bank were significantly more anti-inflationary than in our baseline parameterization—which features a standard Taylor-rule coefficient of 1.5—real long-term rates would not fall and might even rise by more than short-term real rates.[18]

The consumption multiplier in our baseline economy is positive: domestic consumption reaches a peak of almost half a percentage point of output in the first year, its response remaining positive throughout the first twenty quarters shown in the graph. The positive consumption response is driven by the response of long-term rates, which fall on impact and remain persistently below steady-state levels. The dynamics of long-term interest rates is mirrored by the real exchange rate, which weakens persistently—a result further discussed below.[19]

Overall, the fiscal expansion raises domestic output by more than the increase in public spending, by virtue of crowding-in not only consumption but also investment, which in our baseline scenario rises over time after a small contraction on impact. The rise in absorption

[18]Note that our results also depend on the degree of nominal rigidity. If prices or wages were sufficiently flexible, they would correctly signal the relative scarcity of home output in response to the additional demand created by the home government; both short- and long-run real rates would then necessarily rise; see Corsetti, Meier, and Müller (2009a) for a more detailed discussion.

[19]Note that long-term rates determine the consumption decisions (in terms of deviations from steady state) of asset-holding households. In the underlying scenario we assume that such asset holders account for two-thirds of all households. The remaining one-third of households do not hold assets. Their consumption is, accordingly, driven directly by disposable income, which rises unambiguously in case of a debt-financed government spending increase, given sticky prices. Although this enhances the "crowding-in" effect of government spending, consumption increases even if all households are asset holders, as long as real long-term interest rates fall under the influence of anticipated spending reversals; see figure 4. For a more detailed discussion, see also Corsetti, Meier, and Müller (2009a), where we derive results for a small open-economy model without capital. Here we show that the main conclusion of that analysis carries over to a two-country general equilibrium model with capital.

in turn gives rise to twin deficits: the short-run budget deficit is matched by an external trade deficit.

The importance of government spending reversals becomes apparent from a comparison with the case commonly considered in the literature. Specifically, the domestic transmission of fiscal policy is quite different if government spending is assumed to follow an exogenous AR(1) process. Results obtained under this assumption are indicated by the dashed line. Relative to the baseline scenario, three key differences stand out: First, the domestic output response is considerably weaker, reflecting a fall in private absorption. In fact, consumption declines despite the presence of a substantial share of hand-to-mouth consumers. Second, the real exchange rate appreciates. This reflects, third, a rise in long-term real interest rates.

Beyond these important implications for the domestic transmission of fiscal shocks, we show next that spending reversals crucially affect international transmission channels as well. This interaction between domestic fiscal frameworks and cross-border spillovers is indeed the central theme of this paper. The relevant responses are depicted in figure 2.

Consider again our baseline exercise depicted by the solid line. In the foreign economy, a stronger demand for exports (figure 2 displays the response of exports and imports of the domestic economy) increases output and opens a positive output gap, thus increasing marginal costs (not shown) and inflation on impact. While policy rates rise on impact, long-term rates immediately fall, foreshadowing the global repercussions of the future spending reversal. Consumption rises by about 0.1 percentage point of foreign GDP; output rises by about 0.15 percent above trend.

This is in sharp contrast with the transmission mechanism under the assumption of no spending reversals (the dashed line). In this case, the foreign real long-term rate remains above its steady-state value throughout the sample period, as inflationary pressures induce monetary authorities to tighten their policy stance over the whole sample. The responses to a home fiscal expansion of both foreign consumption and output are therefore negative, although only moderately so.

Comparing the two scenarios shows that the domestic debt-consolidation regime plays a significant role for the size of spillovers from fiscal expansions. In our simulations, spending reversals raise fiscal spillovers on foreign output and consumption by about 0.2 percentage points of foreign output. Remarkably, this is so despite the fact that spending reversals cause the currency of the country implementing the fiscal expansion to weaken in real terms. Ceteris paribus, this would produce competitiveness losses abroad, but the effect of these losses on the level of activity is overridden by the general stimulative effect of lower long-term interest rates.[20] Thus, quantity spillovers on foreign economic activity are larger in a situation where the home currency depreciates in response to the fiscal shock.[21]

The main lesson from our analysis can be summarized as follows. The transmission of fiscal stimulus with spending reversals emphasizes the effects of spending dynamics on the intertemporal price of resources at the national and global level: unless monetary policy is strongly anti-inflationary, expectations of future spending cuts tilt interest rates in favor of higher current consumption and investment. This raises domestic aggregate demand above and beyond the additional government spending at home, with positive spillovers on foreign output as the domestic economy runs a trade deficit—even though the exchange rate depreciates. Most importantly, the level of foreign activity is raised by the endogenous dynamics of global real rates, which modern intertemporal analysis puts at the center of the global transmission mechanism.

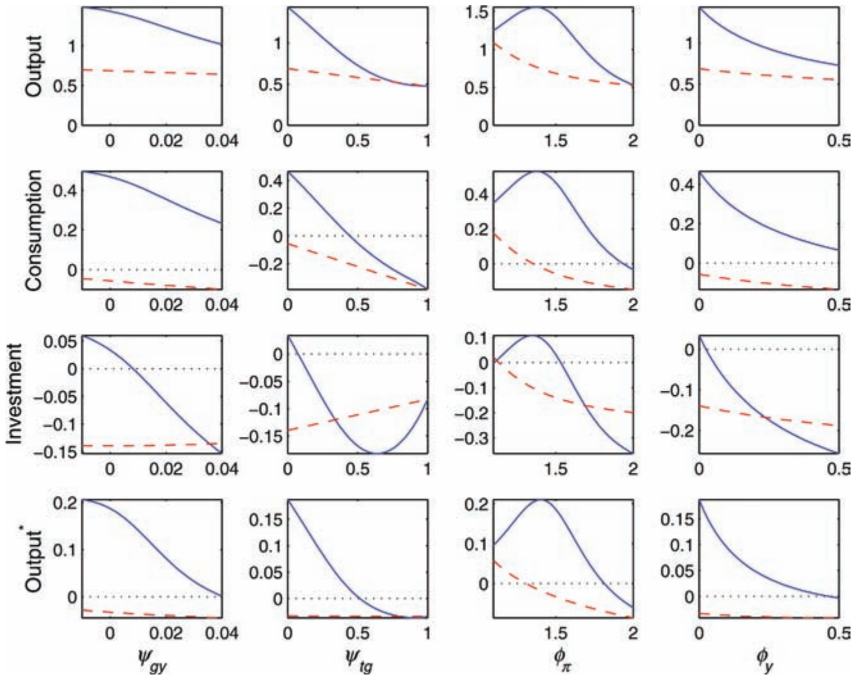
3.3 The Policy Framework and Further Structural Determinants of Spillovers

According to our baseline scenario, spillovers are moderate but not negligible. Foreign output and private absorption rise noticeably and for an extended period in response to the home fiscal shock. The quantitative importance of such spillovers may, however, be expected to vary with the policy framework as well as with structural features of the economy. In this section we will therefore conduct an

[20] Competitiveness gains for the home economy are apparent from the different dynamics of home exports under the two scenarios.

[21] The reason is straightforward: while the depreciation is determined by a negative differential between the home and foreign long interest rates, both rates fall in response to the shock, driving up aggregate world demand.

Figure 3. Government Spending Multipliers: Role of Parameters That Characterize Fiscal and Monetary Policy



Notes: Baseline (solid) vs. debt consolidation through taxes only (dashed). Multiplier is computed as cumulative change in variable of interest relative to cumulative change in government spending during first four quarters. Foreign economy variables are indicated with an asterisk (*). ψ-parameters and ϕ-parameters characterize fiscal and monetary rules, respectively.

extensive sensitivity analysis to understand how precisely the transmission mechanism depends on the parameters characterizing the policy framework, and the deeper economic structures.

A synthesis of our sensitivity exercises is provided in figures 3 and 4. It plots a measure of multipliers computed as the cumulative response of domestic output, consumption, and investment as well as foreign output, each scaled by the cumulative rise in domestic government spending during the first four quarters following the initial impulse. On the horizontal axis we consider a wide range of values for the parameters of interest. As before, solid lines refer to experiments conducted under the assumption of spending reversals, and dashed lines refer to experiments under the assumption of complete tax finance. Figure 3 explores the role of parameters that characterize fiscal and monetary policy.

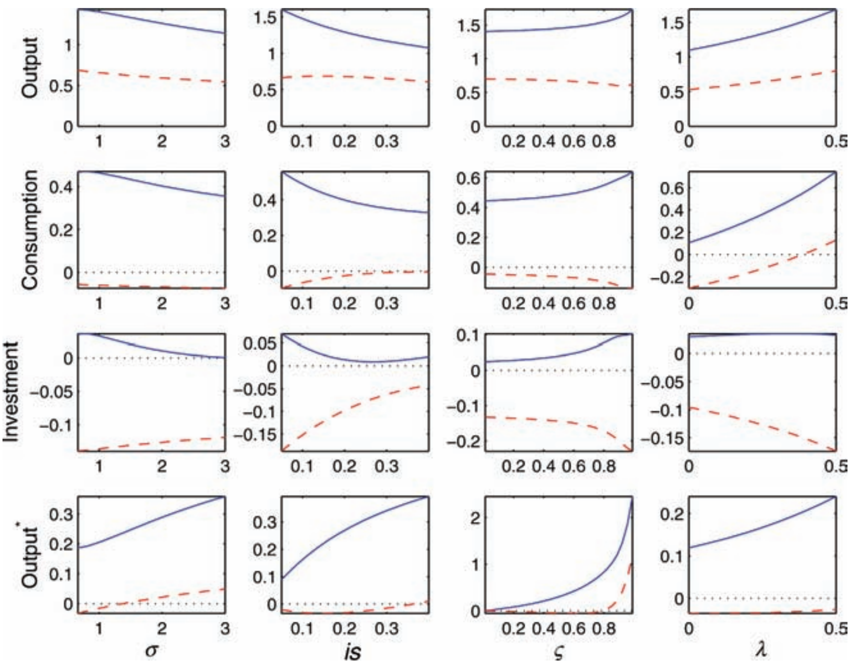
The first column shows multipliers for different values of ψ_{gy}, which captures the responsiveness of government spending to the lagged output gap. A negative (positive) value implies a countercyclical (procyclical) spending rule. We find that procyclicality in spending tends to reduce multipliers both at home and abroad. Intuitively, procyclicality triggers additional spending following the initial exogenous shock, increasing the output gap and thus the monetary policy rate. In a sense, procyclicality works in the opposite direction than spending reversals.[22]

The extent of contemporaneous tax finance, ψ_{tg}, is considered in the second column. Results are quite straightforward in this case. Multipliers are largest in the baseline scenario of complete contemporaneous debt finance. For the other extreme, fully front-loaded tax finance, multipliers are considerably smaller. Quite intuitively, the mechanism of spending reversals is less consequential, the lower is the public debt generated by the initial surge in government spending.

The fiscal transmission mechanism is, furthermore, shaped by the interaction of monetary and fiscal policies, especially so under spending reversals, a point already stressed in Corsetti, Meier, and Müller (2009a). We assess the monetary side of this interaction systematically in columns 3 and 4, varying the interest rate rule coefficients ϕ_π and ϕ_y. If monetary policy is characterized by a very hawkish stance—i.e., if these coefficients take high values—multipliers are smaller. Intuitively, under a hawkish monetary policy rule, the equilibrium allocation is close to the flexible price allocation, reducing the scope for output adjustment in response to the shock. Short-term real rates respond strongly to fiscal policy, making long-term rates less sensitive to an anticipation of a future contraction in public demand. Interestingly, however, under spending reversals multipliers and spillovers are non-monotonic in the policymakers' aversion to inflation: they tend to fall also when policymakers are relatively dovish, i.e., for low values of ϕ_π. The reason is that monetary policy

[22]Note that we only consider a limited range of values of ψ_{gy}, because lower values would induce indeterminacy of the equilibrium.

Figure 4. Government Spending Multipliers: Role of Structural Model Features Likely to Impact International Dimension of Fiscal Transmission Mechanism



Notes: Baseline (solid) vs. debt consolidation through taxes only (dashed). Multiplier is computed as cumulative change in variable of interest relative to cumulative change in government spending during first four quarters. Foreign economy variables are indicated with an asterisk (*). σ measures the trade elasticity, *is* measures the import-to-GDP ratio in steady state (determined by ω_F), ς measures the size of the domestic economy on the unit interval, and λ measures the fraction of rule-of-thumb consumers.

hardly lowers interest rates when lower public spending (the reversal) puts downward pressure on inflation. Because of the interplay of lower short-term rates on impact and higher rates in the medium run, long-term real rates fall by less (and private absorption rises by less) than in the baseline scenario with $\phi_\pi = 1.5$.

The role of structural model features which are likely to impact the international dimension of the fiscal transmission mechanism are explored in figure 4. The figure shows how multipliers and spillovers vary with trade price elasticities, openness, size, and the share of non-asset-holding households. Consider first the effects of varying the trade price elasticity, indexed by the elasticity of substitution (σ), shown by the graphs in the left column. With spending reversals (the solid lines in the figure), cross-border output spillovers are stronger for a higher degree of substitutability between domestic and foreign goods. Intuitively, as the home government claims more domestic output, it is more tempting for households and firms to switch to foreign products. Correspondingly, domestic multipliers for output, consumption, and investment are lower.[23]

Similarly, when spending increases are entirely matched by (current or future) tax hikes (the dashed line), a higher trade elasticity also reduces domestic spending multipliers for output and consumption, while raising spending spillovers on foreign output. In this case, however, multipliers and spillovers are much lower, in some cases negative. Hence, the distance between the solid and the dashed lines—capturing the role of the debt-stabilizing regime—remains positive and roughly stable for different values of the trade elasticity.

Analogous considerations apply to the degree of openness of the economy measured by the import-to-GDP ratio in steady state (second column), which is governed by the home bias parameter ω_F. In our experiments we vary the import share between 5 and 40 percent by adjusting the home bias in private absorption accordingly. To account for the empirical regularity that home bias is stronger in government spending than in private demand (Corsetti and Müller 2006), we assume throughout that the import content in government spending is only half the import share of the entire economy. We find that the more open the domestic economy, the larger the foreign output multiplier; external "demand leakages" via higher imports simultaneously reduce the fiscal transmission on the level of domestic activity. Note that, relative to the standard experiment, the differential induced by spending reversals on the foreign output spillover is actually increasing in the degree of openness.

As a third experiment, we vary home-country size (ς) for a given degree of openness of the home economy (third column). Increasing

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[23]We found that the long-term rate actually falls by more for higher values of σ (not shown). Interestingly, however, a larger fall in long-term rates is not accompanied by a larger real depreciation as the financial transmission through foreign interest rates is also more pronounced.

the size of the domestic economy relative to the rest of the world raises domestic multipliers together with external spillovers in the presence of spending reversals, but reduces domestic multipliers if no spending reversals occur. Intuitively, the larger the weight of the domestic economy in the world economy, the stronger the effect of domestic shocks on interest rates in the rest of the world. Under our baseline regime this strengthens the positive effect on private absorption. By contrast, in the absence of spending reversals it strengthens the crowding-out effect on private foreign absorption.

We conclude by discussing the role of the fraction of non-asset-holding households in the fiscal transmission mechanism, shown in the fourth column of figure 4. In our baseline scenario, we posit that one-third of the population is excluded from financial markets—these are "rule-of-thumb" households who consume their entire labor income. As illustrated in figures 1 and 2, the presence of these consumers alone does not guarantee a positive consumption multiplier, underscoring the importance of spending reversals for this aspect of fiscal policy transmission.[24] Specifically, spending reversals critically affect the consumption-saving choices of asset holders, generating a positive consumption response which is then magnified by a large share of non-asset-holding households in the population, λ. This important result is shown by figure 4; with spending reversals, consumption and output multipliers, together with international spillovers, are consistently larger, the larger is λ. This is so because the transmission of reversals aligns the response of unconstrained and constrained households, with positive effects on wages and employment, and therefore on the consumption of the latter group.[25]

[24]Galí, López-Salido, and Vallés (2007) systematically explore the role of rule-of-thumb households in the fiscal transmission mechanism. In particular, they are interested in identifying conditions under which private consumption increases in response to government spending shocks. They find that even if 50 percent of households are characterized by rule-of-thumb behavior, consumption typically falls (for their preferred parameterization of the model), unless the labor market is assumed to be unionized.

[25]Note, however, that the transmission mechanism of fiscal stimulus with spending reversals does not rely on this Keynesian feature of the economy: multipliers and spillovers are positive even if λ is set to zero.

4. Conclusion

As economies become more and more integrated, policymakers are grappling with significant international spillovers, both from recessionary shocks and from macroeconomic policy decisions. This paper focuses on the case of fiscal stimulus policies, investigating cross-country spillovers on the basis of a two-country business-cycle model.

Our main contribution is to draw attention to the central importance of medium-term debt-consolidation patterns. Specifically, we focus on the plausible case of a debt-financed temporary increase in exhaustive government spending that gives rise not only to higher future taxes but also to some reduction in spending over time. Such spending reversals strengthen the domestic stimulus effect of fiscal expansion under conventional assumptions about monetary policy. Importantly, they also enhance positive spillover effects into the rest of the world through their impact on long-term real interest rates. Our findings thus lend support to the notion that coordinated short-term stimulus policies are most effective when coupled with credible medium-term consolidation plans featuring at least some spending restraint.

The importance of spending reversals is best appreciated in light of the classical trade-off at the core of fiscal stabilization. On the one hand, fiscal support for aggregate demand can be motivated by the presence of financial frictions constraining the choices of certain households and firms. On the other hand, higher budget deficits may induce unconstrained agents to reduce their consumption as interest rates rise—possibly undermining the desired overall stimulus effect. A debt-consolidation regime with spending reversals improves the terms of this trade-off by preventing, or at least containing, the negative consumption response of unconstrained agents and thus magnifying the desired effects from fiscal expansion.

The patterns of debt consolidation will of course vary across countries and time: using a single parameter value for the debt sensitivity of spending cannot possibly do justice to the specific policies pursued by different national fiscal authorities. We also caution against the idea that future spending contractions can be credibly announced under any circumstances. Yet, as our earlier empirical work on U.S. fiscal policy in Corsetti, Meier, and Müller (2009a) has documented, there is evidence for the practical relevance of spending reversals, perhaps arising from voters' intolerance for ever-higher taxes. Whatever the specific political mechanism to generate spending reversals, our theoretical analysis in this paper clearly underscores the importance of addressing short-run stimulus policies from a comprehensive perspective that accounts for longer-run implications as well.

As a final remark, we recognize that this paper does not explore the interesting special case of fiscal policy in economies where monetary policy is effectively constrained by the zero bound on nominal interest rates, as in Christiano, Eichenbaum, and Rebelo (2009). Yet our analysis has potentially useful implications for this case, too. In particular, by inducing expectations of future rate cuts, spending reversals can further strengthen the large fiscal multipliers predicted by these analyses, reducing the need for a sizable upfront fiscal expansion. A further exploration of this topic should provide an important direction for future work.

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