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The Effects of Government Spending under Limited Capital Mobility

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Abstract

This paper studies the effects of government spending under limited international capital mobility, as featured by most developing countries. While external financing of government debt mitigates the crowding-out effect, it generates real appreciation, which contracts traded output and lowers the fiscal multiplier in the short run. The decline of the multiplier is larger when facing debt-elastic country risk premia. Also, government spending is more expansionary with more home bias in government purchases, more sectoral rigidities, and a less flexible exchange rate. Whether the twin-deficit hypothesis holds depends crucially on the extent to which government deficits are financed externally.

JEL Classification Numbers:E62; F41; F32

Keywords: fiscal policy; fiscal multipliers; small-open DSGE models; developing countries; imperfect capital mobility

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I. Introduction

The recent financial crisis and the subsequent global recession have rekindled the interest in fiscal policy effects in academic research and policy debates. Despite the wide adoption of countercyclical fiscal measures across the globe, a consensus on fiscal policy effects, both in theory and empirical evidence, has yet to be formed. As most efforts to study fiscal policy have been devoted to developed countries, this paper systematically analyzes country characteristics that are important for understanding government spending effects in developing countries.[1]

One of the main differences in the economic structure between developed and developing countries is capital account openness. With a less developed financial system and various capital control measures, international capital mobility in developing countries can be rather restricted in practice. Limited capital mobility has important implications for fiscal policy effects. When a government finances its spending with domestic borrowing, limited capital mobility implies that households cannot engage in international risk sharing as much as those in developed countries. Since government debt has to compete with private investment for domestic saving, rising interest rates would crowd out investment and consumption more than in an economy with perfect capital mobility.

Another difference is that developing countries tend to specialize in traded-good production that has small profit margins. This implies that traded good production is likely to be sensitive to movements in the real exchange rate. Consequently, government spending policy that induces changes in the real exchange rate—such as by shifting relative demand between traded and non-traded goods—can substantially affect traded output and thus the fiscal multiplier.

In this paper, we study government spending effects for developing economies, using a model that captures these economic features absent in developed-economy models. Given the imperfect capital mobility, financing decisions of government spending in terms of domestic vs. foreign borrowing become an important factor to consider. Empirically, external financing of government debt is important among developing countries. Panizza (2008) reports that external public debt averages 60 percent of total government debt for Latin American countries in 2005 (dropping from about 75 percent in 1994).[2]

Relative to domestic financing, external financing has two effects on the fiscal multiplier. On the one hand, it reduces crowding out of consumption and investment, increasing the expansionary effect of government spending. On the other hand, external financing induces a capital inflow, appreciating the real exchange rate, which in turn has a negative effect on traded output and offsets the expansionary effect. We find that for plausible calibrations, the

[1] Ilzetzki and Vegh (2008) and Ilzetzki et al. (2010) are among the few that study fiscal policy effects in developing countries. See Spilimbergo et al. (2009) for a survey of fiscal multipliers in the literature.

[2] Uribe and Yue (2006) provide empirical evidence that disturbances in external financial variables are important for driving business cycles in emerging economies.

real exchange rate channel dominates: More external financing results in a smaller fiscal multiplier for government spending. Moreover, because developing countries may face a debt-elastic country premium when borrowing in international financial markets, more debt services—invoking a larger scale of fiscal adjustments in the future—lower the fiscal multiplier in the longer run.

Our analysis of external financing also provides a theoretical explanation for the twin-deficit hypothesis in developing countries. When fiscal deficits are financed by external borrowing, reduced crowding-out and a more negative response of traded output drive up current account deficits, generating the co-movements between fiscal and current account deficits. In their study of ten developing countries, Easterly and Schmidt-Hebbel (1993) find strong evidence that fiscal deficits spill over into trade deficits, and the real exchange rate appreciates. This suggests the transmission mechanism through the real exchange rate channel identified here is a plausible one to explain government spending effects observed in developing countries with substantial external borrowing.

In addition to external borrowing, we also consider several other factors for analyzing government spending effects: the composition of government purchases in terms of traded and non-traded goods, sectoral rigidities of production factors, the fraction of hand-to-mouth households, the exchange rate regime, and capital account openness. Our model assumes that the law of one price holds for the traded goods to capture a lack of market power of traded good firms in developing countries. Facing an upward sloping labor supply curve, traded good firms only produce to the point of exhausting economic profit. When government spending concentrates more on traded goods, part of the increased demand for traded goods has to be met by foreign production. This introduces leakage in the expansionary effect of government spending, producing a smaller fiscal multiplier. More sectoral rigidities and a larger fraction of hand-to-mouth households, on the other hand, work to increase the fiscal multiplier. Less mobile labor and capital across sectors elevate factor prices, raising income and hence consumption. As for hand-to-mouth households, since they consume all of the disposable income, their consumption responds positively to a government spending increase; a larger fraction of them generates a higher fiscal multiplier.

As for the exchange rate regime, we find that the fiscal multiplier is larger under a fixed exchange rate. Conditioning on more home bias in government spending, a fixed exchange rate implies smaller appreciation in the real exchange rate, and thus a less negative effect on traded good production. Our finding is in line with the classical implication of the Mundell-Fleming models (Fleming (1962) and Mundell (1963)) that fiscal policy is more expansionary under fixed exchange rates, as well as the empirical evidence that countries with a fixed exchange rate have a larger multiplier (Ilzetzki et al. (2010)).

Lastly, whether capital account openness increases or decreases the fiscal multiplier depends on the extent that government spending is financed externally. When the government does not borrow much externally, households increase foreign borrowing to smooth consumption in response to a government spending increase. Thus, a more open capital account appreciates the real exchange rate more, suppressing the fiscal multiplier. If, instead, the government has already borrowed a lot externally, households respond by reducing foreign borrowing because the real appreciation lowers the benefits of foreign borrowing. As a result, a more open capital account drives up the multiplier.

The analytical framework used here is a two sector, New Keynesian model for a small-open economy. Relative to developed countries, macroeconomic frictions are pervasive in developing countries. Aside from common rigidities included for developed ones, the model features sectoral labor and capital rigidities and a disincentive parameter on production decisions to capture lower governance quality in developing countries. It also includes a lot of financial frictions, characterized by 1) a large share of hand-to-mouth households, who cannot participate in capital and asset markets, 2) a debt-elastic country risk premium, and 3) an adjustment cost on foreign liability (*a la* Schmitt-Grohe and Uribe (2003)) to control capital account openness. To study the influence of the exchange rate regime on government spending effects, the model includes a balance sheet of the central bank, allowing for interactions among fiscal, monetary, and reserve policy.

II. MODEL SETUP

The model is based on the one in Berg et al. (2010a). The economy has a non-traded and a traded good sector. The numeraire is domestic composite consumption, consisting of non-traded and traded goods. Since the financial infrastructure is less developed in developing economies, the model has a large share of hand-to-mouth households.[3]

A. Households

The model economy is populated by a continuum of households in the interval $[0, 1]$, of which a fraction f are savers and $1 - f$ are hand-to-mouth. Savers have access to asset and capital markets. The only asset that the hand-to-mouth can hold is money. A superscript a denotes a variable associated with savers and h with hand-to-mouth.

1. Savers

The household $j \in [0, f]$ chooses consumption $c_t^a(j)$, the real money balance $m_t^a(j)$, labor $l_t^a(j)$, investment $i_t^a(j)$, capital stock $k_t^a(j)$, nominal wage $W_t(j)$, domestic government debt $b_t^{ca}(j)$, and foreign debt $b_t^{*a}(j)$ to maximize the expected utility,

$$E_t \sum_{t=0}^{\infty} \beta^t \left[u^a \left(c_t^a(j), m_t^a(j) \right) - \frac{\kappa^a}{1+\psi} \left(l_t^a(j) \right)^{1+\psi} \right], \tag{1}$$

[3]Hand-to-mouth households (also known as spenders, rule-of-thumb consumers, and the liquidity-constrained) are also important for explaining fiscal policy effects in developed countries. See Mankiw (2000) and Gali et al. (2007).

where β is the discount factor, ψ is the inverse of the Frisch elasticity of labor supply, and κ^a is the disutility weight on labor.

Savers' budget constraint in units of domestic composite consumption is

$$c_t^a(j)+m_t^a(j)+i_t^a(j)+b_t^{ca}(j)-s_t b_t^{*a}(j)+\frac{\upsilon}{2}s_t\left[b_t^{*a}(j)-b^{*a}(j)\right]^2+\frac{\varsigma^w}{2}\left[\frac{W_t(j)}{W_{t-1}(j)}-\pi\right]^2\frac{W_t l_t^a}{P_t}$$
$$=(1-\tau_t)\left[\frac{W_t(j)}{P_t}l_t^a(j)+r_t^k k_{t-1}^a(j)\right]+\frac{m_{t-1}^a(j)}{\pi_t}+\frac{R_{t-1}b_{t-1}^{ca}(j)}{\pi_t}-s_t R^*\frac{b_{t-1}^{*a}}{\pi^*}+s_t rm^*(j)+z_t(j)$$
$$+\,\Omega_t^N(j)+\Omega_t^T(j). \quad (2)$$

An income tax rate τ_t is levied on labor and capital income. $rm^*(j)$ is foreign remittance in units of foreign goods (denoted by $*$), taken to be constant. $z_t(j)$ is government transfers, and $\Omega_t^N(j)$ and $\Omega_t^T(j)$ are dividends from non-traded (a superscript N) and traded (T) good firms. Other terms in (2) are to be explained later.

The utility function takes the form

$$u^a\left(c_t^a,m_t^a\right)=\frac{1}{1-\sigma}\left\{\left[\vartheta^a\left(c_t^a(j)\right)^{\frac{\eta-1}{\eta}}+\left(1-\vartheta^a\right)\left(m_t^a(j)\right)^{\frac{\eta-1}{\eta}}\right]^{\frac{\eta}{\eta-1}}\right\}^{1-\sigma}, \quad (3)$$

where σ is the inverse of the elasticity of intertemporal substitution for consumption, η is the elasticity of intratemporal substitution between consumption and the real money balance, and ϑ^a is the preference weight on consumption.

Our analysis focuses on a symmetric equilibrium, where a household j's choice equals the aggregate choice of its type. When there is no confusion, j is dropped from the description below. Both consumption c_t^a and investment i_t^a are CES baskets of non-traded and traded goods, as

$$c_t^a=\left[\varphi^{\frac{1}{\chi}}\left(c_t^{aN}\right)^{\frac{\chi-1}{\chi}}+(1-\varphi)^{\frac{1}{\chi}}\left(c_t^{aT}\right)^{\frac{\chi-1}{\chi}}\right]^{\frac{\chi}{\chi-1}} \quad (4)$$

and

$$i_t^a=\left[\varphi^{\frac{1}{\chi}}\left(i_t^{aN}\right)^{\frac{\chi-1}{\chi}}+(1-\varphi)^{\frac{1}{\chi}}\left(i_t^{aT}\right)^{\frac{\chi-1}{\chi}}\right]^{\frac{\chi}{\chi-1}}. \quad (5)$$

c_t^{aN} and i_t^{aN} (c_t^{aT} and i_t^{aT}) are consumption and investment made of non-traded (traded) goods. We assume that consumption and investment have the same intratemporal elasticity of substitution χ and the same degree of home bias φ. Non-traded goods are produced by a continuum of monopolistically competitive firms indexed by $i\in[0,1]$. Aggregating all non-traded consumption varieties yields

$$c_t^{aN}=\left[\int_0^1 c_t^{aN}(i)^{\frac{\theta-1}{\theta}}di\right]^{\frac{\theta}{\theta-1}}, \quad (6)$$

where θ is the elasticity of substitution between varieties produced by firm i.

The CES consumption basket implies that the CPI is

$$P_t = \left[\varphi\left(P_t^N\right)^{1-\chi} + (1-\varphi)(P_t^T)^{1-\chi}\right]^{\frac{1}{1-\chi}}, \tag{7}$$

where P_t^N and P_t^T are the nominal prices for non-traded and traded goods. $\pi_t \equiv \frac{P_t}{P_{t-1}}$ is the CPI inflation. The relative price of non-traded goods to the CPI is

$$p_t^N \equiv \frac{P_t^N}{P_t}. \tag{8}$$

We assume that the law of one price holds for traded goods, so $P_t^T = S_t P_t^*$, where S_t is the nominal exchange rate in units of domestic currency per dollar, and P_t^* is the foreign CPI. The relative price of traded goods to the CPI is

$$s_t \equiv \frac{S_t P_t^*}{P_t}. \tag{9}$$

s_t is also the CPI-based real exchange rate.

In the model, savers are the sole owners of capital k_t^a, which has a real rate of return of r_t^k. Capital accumulates from investment i_t^a, according to

$$k_t^a = (1-\delta)k_{t-1}^a + \left[1 - \frac{\kappa^k}{2}\left(\frac{i_t^a}{i_{t-1}^a} - 1\right)^2\right] i_t^a, \tag{10}$$

where δ is the depreciation rate, $\frac{\kappa^k}{2}\left(\frac{i_t^a}{i_{t-1}^a} - 1\right)^2 i_t^a$ is investment adjustment costs, and $\kappa^k \geq 0$ controls the sluggishness of investment adjustment.

In addition to capital, savers allocate their disposable income on the real money balance m_t^a and domestic government bonds b_t^{ca}. A unit of government bonds pays $\frac{R_t b_t^{ca}}{\pi_{t+1}}$ units of domestic composite consumption at $t+1$, where R_t is the domestic nominal interest rate. Households can borrow from foreigners. Borrowing b_t^{*a} units abroad at t requires a payment of $\frac{R^* b_t^{*a}}{\pi^*}$ units of foreign goods at $t+1$, where R^* is the nominal foreign interest rate. The foreign borrowing rate faced by households and the foreign CPI inflation (π^*) are assumed to be constant. Following Schmitt-Grohe and Uribe (2003), changing foreign liability is subject to a portfolio adjustment cost, $\frac{v}{2} s_t \left(b_t^{*a} - b^{*a}\right)^2$, where b^{*a} denotes the steady-state foreign liability. The parameter v governs the openness of private capital account. A very large v indicates almost no access to international financial markets.

Nominal rigidities are modeled by quadratic adjustment cost functions, *a la* Rotemberg (1982). $\frac{\varsigma^w}{2}\left[\frac{W_t(j)}{W_{t-1}(j)} - \pi\right]^2 \frac{W_t l_t^a}{P_t}$ in (2) means that the nominal wage relative to the last period's is subject to a real cost when deviating from the steady-state CPI inflation π. Each household j supplies differentiated labor inputs to a perfectly competitive labor aggregator, who groups the households' labor inputs in the same proportions that firms choose. The aggregator maximizes profits $W_t l_t^a - \int_0^f W_t(j) l_t^a(j) dj$ using the assembling technology $l_t^a = \left[\int_0^f l_t^a(j)^{\frac{\tilde{\theta}-1}{\tilde{\theta}}} dj\right]^{\frac{\tilde{\theta}}{\tilde{\theta}-1}}$ in the Dixit-Stiglitz form (1977). The labor demand function for households j can be derived as

$$l_t^a(j) = \left(\frac{W_t(j)}{W_t}\right)^{-\tilde{\theta}} l_t^a, \tag{11}$$

where W_t is the economy-wide nominal wage. Labor inputs are demand-driven, and each household j works sufficient hours to meet the market demand given a chosen wage rate. The symmetric equilibrium implies $W_t(j) = W_t$, so $l_t^a(j) = l_t^a$.

To distinguish between traded and non-traded goods, the model has two production sectors. Following specific-factor models in the trade literature, we assume that labor and capital are specific to sectors to some degree, as sectoral rigidities are important for short- and medium-run analysis (Mussa (1974) and Mendoza and Uribe (2000)). The elasticities of substitution between sectors for capital and labor are ρ^k and ρ^l.[4] Following Bouakez et al. (2009), savers' labor supply is a CES combination of the hours supplied to each sector, as in

$$l_t^a = \left[(\delta^l)^{-\frac{1}{\rho^l}} \left(l_t^{aN}\right)^{\frac{1+\rho^l}{\rho^l}} + (1-\delta^l)^{-\frac{1}{\rho^l}} \left(l_t^{aT}\right)^{\frac{1+\rho^l}{\rho^l}}\right]^{\frac{\rho^l}{1+\rho^l}}, \tag{12}$$

where δ^l is the steady-state labor share in the non-traded sector, and l_t^{aN} (l_t^{aT}) is labor supplied to the non-traded (traded) good sector.

Capital is modeled analogously as labor. Total capital supplied by savers is an aggregate of capital supplied to each sector

$$k_t^a = \left[(\delta^k)^{-\frac{1}{\rho^k}} \left(k_t^{aN}\right)^{\frac{1+\rho^k}{\rho^k}} + (1-\delta^k)^{-\frac{1}{\rho^k}} \left(k_t^{aT}\right)^{\frac{1+\rho^k}{\rho^k}}\right]^{\frac{\rho^k}{1+\rho^k}}, \tag{13}$$

where δ^k is the steady-state capital share in the non-traded good sector, and k_t^{aN} (k_t^{aT}) is capital supplied to the non-traded (traded) good sector. From the minimization problems of factor costs, wage and the rental rate of capital can be derived as

$$w_t = \left[\delta^l \left(w_t^N\right)^{1+\rho^l} + (1-\delta^l)\left(w_t^T\right)^{1+\rho^l}\right]^{\frac{1}{1+\rho^l}}, \tag{14}$$

and

$$r_t^k = \left[\delta^k \left(r_t^N\right)^{1+\rho^k} + (1-\delta^k)\left(r_t^T\right)^{1+\rho^k}\right]^{\frac{1}{1+\rho^k}}.[5] \tag{15}$$

[4]Both Mussa (1974) and Mendoza and Uribe (2000) assume labor is perfectly mobile and capital can be quasi-fixed to sectors. Our specification allows varying substitutability for both factors.

[5]In addition to wage differentials, our model allows for capital return differentials between sectors. These differentials may be justified by differences in dependence on outside funding or heterogeneity in financial

Finally, to derive optimality conditions of each choice variable, savers solve the optimization problem (1), subject to the budget constraint (2), the law of motion for capital (10), and the labor demand function (11).

2. Hand-to-Mouth

Hand-to-mouth households have the same utility functional form as savers in (1) and (3), and they consume all their disposable income each period. Their budget constraint for household $j \in (1-f, 1]$ is

$$c_t^h(j) + m_t^h(j) = (1-\tau_t)\frac{W_t}{P_t}l_t^h(j) + \frac{m_{t-1}^h(j)}{\pi_t} + s_t r m^*(j) + z_t(j). \tag{16}$$

Following Erceg et al. (2005), we assume that hand-to-mouth households set their wage to be the average wage chosen by savers (W_t). Since each hand-to-mouth household faces the same labor demand function as savers (11), each household works the same hours as savers: $l_t^h(j) = l_t^h = l_t^a$.

B. Firms

The two production sectors have different market structures. Since non-traded goods can only be produced locally, non-traded good firms are assumed to be monopolistically competitive. This assumption also allows us to introduce price rigidities. Traded-good firms are perfectly competitive, reflecting a lack of pricing power in relevant world markets.

1. Non-traded Good Sector

The monopolistically competitive intermediate goods producer i produces according to the technology

$$y_t^N(i) = z^N \left(k_{t-1}^N(i)\right)^{1-\alpha^N} \left(l_t^N(i)\right)^{\alpha^N}. \tag{17}$$

Aggregating all non-traded goods $Y_t^N = \left[\int_0^1 y_t^N(i)^{\frac{\theta-1}{\theta}} di\right]^{\frac{\theta}{\theta-1}}$ and solving the profit maximization problem yield the demand function

$$y_t^N(i) = \left(\frac{p_t^N(i)}{p_t^N}\right)^{-\theta} Y_t^N. \tag{18}$$

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frictions across sectors (Rajan and Zingales (1998) and Antras and Caballero (2009)).

A non-traded intermediate goods producer chooses price, labor and capital to maximize its net present-value profit weighted by savers' (firm owners') utility,

$$E_t \sum_{t=0}^{\infty} \beta^t \lambda_t^a \times \underbrace{\left\{ (1-\iota) \left[p_t^N(i) y_t^N(i) - \frac{\varsigma^p}{2} \left(\frac{\pi_t^N(i)}{\pi_{t-1}^N(i)} - 1 \right)^2 p_t^N y_t^N \right] - w_t^N l_t^N(i) - r_t^N k_{t-1}^N(i) + \iota p_t^N Y_t^N \left[1 - \frac{\varsigma^p}{2} \left(\frac{\pi_t^N}{\pi_{t-1}^N} - 1 \right)^2 \right] \right\}}_{\Omega_t^N(j),\ \texttt{non-traded firms' dividends}}, \tag{19}$$

subject to the production function (17) and the demand function (18). λ_t^a is the savers' marginal utility of consumption, $\pi_t^N \equiv \frac{P_t^N}{P_{t-1}^N} = \frac{p_t^N}{p_{t-1}^N}\pi_t$ is non-traded good inflation. Like ς^w in (2), ς^p governs the degree of price rigidity. To capture additional costs in conducting business due to low governance quality commonly observed in developing countries, $\iota > 0$ acts like an implicit tax, discouraging firms from producing at a higher level.[6]

2. Traded Good Sector

A representative firm in the traded sector produces by the technology

$$y_t^T = z^T \left(k_{t-1}^T \right)^{1-\alpha^T} \left(l_t^T \right)^{\alpha^T}. \tag{20}$$

It chooses labor and capital to maximize weighted present-value profits subject to production function (20),

$$E_t \sum_{t=0}^{\infty} \beta^t \lambda_t^a \underbrace{\left[(1-\iota) s_t y_t^T - w_t^T l_t^T - r_t^T k_{t-1}^T + \iota s_t Y_t^T \right]}_{\Omega_t^T,\texttt{traded firms' dividends}}, \tag{21}$$

where Y_t^T is total traded output.

C. The Government

To finance expenditures, the government collects taxes and issues bonds. Government expenditures include government spending G_t, transfers to households Z_t, and debt services. The flow budget constraint in units of domestic composite consumption is

$$\tau_t \left(w_t L_t + r_t^k K_{t-1} \right) + B_t^c + B_t^{cb} + s_t B_t^{f*} = p_t^g G_t + Z_t + \frac{R_{t-1} B_{t-1}^c}{\pi_t} + \frac{B_{t-1}^{cb}}{\pi_t} + s_t \frac{R_{t-1}^* B_{t-1}^{f*}}{\pi^*}, \tag{22}$$

where B_t^c, B_t^{cb}, and B_t^{f*} are government debt held by domestic households (or c for consumers), the central bank, and foreigners. The government borrows at the rate R_t^* in the

[6]This implicit tax, however, does not appear in the government budget. Instead, it is rebated to the sector by a lump-sum fashion for simplicity.

international financial markets and may face a country risk premium. Borrowing B^{f*}_{t-1} units of foreign good requires a payment $s_t \frac{R^*_{t-1} B^{f*}_{t-1}}{\pi^*}$ in domestic composite consumption at t. In the spirit of Garcia-Cicco et al. (2010) and Buffie et al. (2011), we let the borrowing rate depend on the government debt-to-GDP ratio ($s^b_t = \frac{B_t}{Y_t}$). Let $r^*_t = R^*_t - 1$ be the net foreign rate. Then,

$$r^*_t = r^{rf} + p \left(\frac{s^b_t}{s^b} \right)^{\xi}, \quad \xi \geq 0, \tag{23}$$

where r^{rf} is the risk free rate, and p and s^b are the steady-state premium and the debt-to-GDP ratio. $\xi > 0$ indicates debt-elastic premia.

Government spending is a CES basket, consisting of traded and non-traded goods,

$$G_t = \left[\left(\varphi^G_t \right)^{\frac{1}{\chi}} \left(G^N_t \right)^{\frac{\chi - 1}{\chi}} + \left(1 - \varphi^G_t \right)^{\frac{1}{\chi}} \left(G^T_t \right)^{\frac{\chi - 1}{\chi}} \right]^{\frac{\chi}{\chi - 1}}, \tag{24}$$

where φ^G_t denotes the degree of home bias.[7] The relative price of government spending to the CPI is

$$p^G_t = \left[\varphi^G_t \left(p^N_t \right)^{(1-\chi)} + \left(1 - \varphi^G_t \right) (s_t)^{1-\chi} \right]^{\frac{1}{1-\chi}}. \tag{25}$$

We allow the degree of home bias to be time-varying. When the government increases spending to stimulate the economy, it is likely to raise the proportion of non-traded goods in G_t. Let $\bar{\varphi}^G$ be the steady-state home bias in government spending, and φ^G be the degree of home bias in additional spending. Then,

$$\varphi^G_t = \bar{\varphi}^G + \frac{p^g_t G_t - p^g G}{p^g G} (\varphi^G - \bar{\varphi}^G). \tag{26}$$

We assume that the government follow the fiscal rules, specified as

$$\log \frac{G_t}{G} = \rho_G \log \frac{G_{t-1}}{G} + \phi \log \frac{Y_t}{Y} + \varepsilon^G_t, \tag{27}$$

$$\log \frac{Z_t}{Z} = \rho_Z \log \frac{Z_{t-1}}{Z} + \gamma_Z \log \frac{s^b_{t-1}}{s^b}, \tag{28}$$

and

$$\log \frac{\tau_t}{\tau} = \rho_\tau \log \frac{\tau_{t-1}}{\tau} + \gamma_\tau \log \frac{s^b_{t-1}}{s^b}. \tag{29}$$

When the debt-to-output ratio rises above its steady-state level, the government can adjust transfers or the income tax rate to stabilize debt growth. In addition, government spending has known to be procyclical in many developing countries (e.g., see Gavin and Perotti (1997), Kaminski et al. (2004), and Alesina et al. (2008)). This procyclicality is modeled as

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[7] Our model does not distinguish between productive government spending (such as public investment) and unproductive one (such as government consumption). Following most macroeconomic literature, we assume that government spending does not yield utility or change the productivity of private production.

an automatic response embedded in the spending rule, captured by $\phi > 0$ in (27). ε_t^G is the government spending shock with a mean zero.

We abstract from modeling the borrowing decisions in terms of domestic and external debt. Our model is inadequate to capture many important considerations underlying decisions to borrow externally, e.g., the volatile supply of external funds and the risks of sovereign finance resulting from foreign-currency denominated liabilities.[8] Instead, government spending effects are examined under various shares of external financing to total government debt.

D. Reserve and Monetary Policy

Let B_t^{cb} denote government debt held by the central bank and FR_t^* denote foreign reserves. The central bank's balance sheet is

$$M_t - \frac{M_{t-1}}{\pi_t} = B_t^{cb} - \frac{B_{t-1}^{cb}}{\pi_t} + s_t(FR_t^* - \frac{FR_{t-1}^*}{\pi^*}). \tag{30}$$

The reserve policy follows the process

$$FR_t^* = (1 - \rho_{FR})FR^* + \rho_{FR}FR_{t-1}^* - \omega(\pi_t^S - 1), \tag{31}$$

where $\pi^S = \frac{S_t}{S_{t-1}}$. The exchange rate regime is signaled by ω: $\omega = 0$ indicates a flexible exchange regime, and a huge ω punishes substantially the deviation from the steady-state (or targeted) nominal exchange rate, amounting to a fixed exchange rate regime.

To conduct monetary policy, the central bank adjusts the money aggregate to target the CPI inflation by a simple rule

$$M_t = \frac{M_{t-1}}{\pi_t}\left[(1+\mu)\left(\frac{\pi_t}{\pi}\right)^{-\phi_\pi}\right], \tag{32}$$

where $1 + \mu$ is the steady-state growth rate of nominal money . Open market operations embedded in (30) and (32) imply a process for the holding of government debt by the central bank, as

$$B_t^{cb} - \frac{B_{t-1}^{cb}}{\pi_t} = \frac{M_{t-1}}{\pi_t}\left[(1+\mu)\left(\frac{\pi_t}{\pi}\right)^{-\phi_\pi} - 1\right] - s_t(FR_t^* - \frac{FR_{t-1}^*}{\pi^*}). \tag{33}$$

E. Aggregation and Some Identities

Denote the aggregate quantity of a variable x_t by its capital letter X_t. Then,

$$X_t = \int_0^1 x_t(j)dj = fx_t^a + (1-f)x_t^h, \quad x \in \left\{c, c^N, c^T, m, l\right\}. \tag{34}$$

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[8] See Panizza (2008) for a discussion on the trade-offs between domestic and external borrowing for developing countries.

Lump-sum transfers and remittance are assumed to be identical for each household,

$$X_t = \int_0^1 x_t(j)dj = x_t, \quad x \in \{z, rm^*\}. \tag{35}$$

Since only savers have access to the asset and capital markets, aggregate investment, capital, bonds, and dividends are

$$X_t = \int_0^1 x_t(j)dj = f x_t^a, \quad x \in \{i, k, b^c, b^*\}. \tag{36}$$

Total government borrowing is

$$B_t = B_t^c + B_t^{cb} + s_t B_t^{f*}. \tag{37}$$

The total demand for non-traded goods is

$$D_t^N = \varphi \left[C_t + I_t + \frac{\varsigma^w}{2} \left(\frac{W_t}{W_{t-1}} - \pi \right)^2 \frac{W_t l_t^a}{P_t} + \frac{\varsigma^p}{2} \left(\frac{\pi_t^N}{\pi_{t-1}^N} - 1 \right)^2 p_t^N Y_t^N \right] + \nu (p_t^G)^\chi G_t. \tag{38}$$

The market clearing condition for non-traded goods is

$$Y_t^N = (p_t^N)^{-\chi} D_t^N. \tag{39}$$

Current account deficits (CA_t^d) are

$$\begin{aligned} CA_t^d = {} & C_t + I_t + p_t^G G_t \\ & + \frac{v}{2} (B_t^* - B^*)^2 + \frac{\varsigma^w}{2} \left(\frac{W_t}{W_{t-1}} - \pi \right)^2 \frac{W_t l_t^a}{P_t} + \frac{\varsigma^p}{2} \left(\frac{\pi_t^N}{\pi_{t-1}^N} - 1 \right)^2 p_t^N Y_t^N \\ & - p_t^N Y_t^N - s_t Y_t^T + s_t \left(R_{t-1}^* - 1 \right) \frac{B_{t-1}^*}{\pi^*} + s_t \left(R_{t-1}^* - 1 \right) \frac{B_{t-1}^{f*}}{\pi^*} - s_t RM^*. \end{aligned} \tag{40}$$

The balance of payment condition is

$$CA_t^d = s_t \left[\left(B_t^* - \frac{B_{t-1}^*}{\pi^*} \right) + \left(B_t^{f*} - \frac{B_{t-1}^f}{\pi^*} \right) - \left(FR_t^* - \frac{FR_{t-1}^*}{\pi^*} \right) \right]. \tag{41}$$

Lastly, GDP in units of domestic composite consumption is

$$Y_t = p_t^N Y_t^N + s_t Y_t^T. \tag{42}$$

III. EQUILIBRIUM, SOLUTION, AND CALIBRATION

The model equilibrium is log-linearized and solved by Sims's (2001) algorithm. Appendix I describes the equilibrium conditions for the optimization problems. We calibrate the national account aspects of the model based on Mexican data from 1999 to 2008 (Country Tables of International Financial Statistics published by the International Monetary Fund). Table 1 summarizes the implied steady state.[9]

For public debt composition, the ratio of $\frac{sB^{f*}}{B}$ is set to 0.6, matching the average among Latin American and Caribbean countries in 2005 (Panizza (2008)). Also, more than half of the households are assumed to be hand-to-mouth $(1-f=0.6)$.[10]

For the procyclical response in government consumption, we set $\phi=0.5$ in the baseline calibration.[11] To calibrate fiscal adjustment coefficients, a small but sufficient magnitude is assumed to stabilize debt growth ($\gamma_Z=-0.005, \gamma_\tau=0.005$). This reflects that fiscal adjustments are often postponed during recessions and last for a sustained period. Fiscal adjustments are accomplished by both cutting transfers and raising the income tax rate, as often done in practice. All autocorrelation coefficients in fiscal rules (27)-(29) are set to be 0.9, as fiscal policy changes tend to be persistent in practice.

Following the convention to categorize services as non-traded goods, the average degree of home bias in consumption is roughly 50 percent (see Table 3 in Burstein et al. (2005)) or $\varphi=0.5$. Because a large proportion of government consumption goes to pay services of civil servants, the steady-state degree of home bias is set to be higher than that in households' consumption, with $\bar{\varphi}^G=0.7$. For additional government spending to counteract business cycles, we allow the content to bias more toward non-traded goods ($\varphi^G=0.8$) than regular spending. Given that developing or lower-income countries may have to rely more on imports for government purchases, a smaller value with $\varphi^G=0.4$ is also examined. For the elasticity of substitution between traded and non-traded goods, we set $\chi=0.44$ to indicate a small elasticity, following the estimate in Stockman and Tesar (1995). The elasticity of substitution between varieties of non-traded goods θ is set to be 12, taking the standard value in the New Keynesian literature. Without empirical support, we arbitrarily set the elasticity of substitution of differentiated labor to be the same: $\tilde{\theta}=12$. Also, without empirical support

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[9]Despite that part of the model structure is calibrated based on the Mexican data, the results of the paper should not be interpreted as an exercise to quantify the government spending multiplier in Mexico. To study government spending effects of a specific economy, one would model carefully the composition and functions of government spending and how policies—including monetary and reserve policy—are implemented. In addition, structure parameters should be calibrated or even estimated based on a richer dataset of the economy than that used here.

[10]Based on data in Klaehn et al. (2006), Skelton (2008) calculates that less than 25 percent of Mexicans have bank accounts. With informal mechanisms of saving, the share of people that cannot smooth consumption at all should be smaller than 0.75.

[11]Ilzetzki and Vegh (2008), using data of 27 developing countries, obtain estimates ranging from 0.39 to 0.61, depending on methodologies.

for developing countries on the elasticities of intertemporal substitution for consumption and labor, we set $\sigma = 2$ and $\psi = 2$ following the literature values for developed countries.

Our shortcut to model limited international capital mobility is through adjustment costs in households' foreign liability or asset holding. The literature often incorporates convex adjustment costs solely for the purpose of ensuring stationarity, and hence the parameter υ is tiny ($< 1e^{-4}$). We set $\upsilon = 0.01$ in the baseline to capture limited capital mobility. For country risk premia, Garcia-Cicco et al. (2010) estimate this elasticity for Mexico to be zero using a long sample from 1900 to 2005. Our baseline has $\xi = 0$, but we study a scenario with a positive elasticity of $\xi = 3$. Given that the annual risk free rate is calibrated to be 4 percent and the debt-to-annual GDP ratio to be 0.24, $\xi = 3$ implies that a 1-percentage-point increase in the debt-to-GDP ratio leads to a 12.5 percent increase in premia.[12]

To characterize imperfect mobility between sectors, we set $\rho^l = 0.9$. Horvath (2000) estimates this elasticity across 36 sectors using U.S. data and obtain a value roughly 1. Since labor markets in developing countries are likely to be more rigid, we set $\rho^l = 0.9$. Moreover, as capital tends to be much less mobile than labor, $\rho^k = 0.2$. Other friction parameters $\varsigma^p = 65$ and $\varsigma^w = 145$ imply that prices and wages are sticky for one year.

Finally, for a given investment-output ratio (0.21) and the depreciation rate ($\delta = 0.025$), the disincentive parameter in production (ι) is backed out from the firms' demand function for capital and labor. The baseline has $\iota = 0.007$.[13] Parameter values for the baseline calibration are summarized in Table 2.

IV. Government Spending Effects and External Financing

We analyze government spending effects for a 10-percent shock, roughly 1 percent of GDP. Figure 1 presents the results under the baseline calibration without external borrowing to finance the addition spending (solid lines). The y-axis is in percent deviations from the steady state, and the x-axis is in years after the shock. To see how external financing alters the effects of government spending, the dotted-dashed lines are the responses under partial external financing with 60-percent external debt (the steady-state level).

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[12]The literature has a wide range of estimates for the premium elasticity with respect to some debt measure. Akitoby and Stratmann (2008) estimate that a 1-percentage-point increase in debt to gross national income leads to about 1-percent increase in premia, while Garcia-Cicco et al. (2010) obtain a 1-percentage-point increase in external debt to GDP leads to an increase by over half a percentage point in premia using the Argentina data. In our calibration, Garcia-Cicco et al's estimate is equivalent to over 30 percent increase in premia.

[13]This disincentive parameter is very sensitive to the steady-state investment output ratio. When this ratio is 0.19 (v.s. 0.21 in our baseline), ι rises to 0.1.

A. Without External Financing

In a neoclassical or New Keynesian model for a closed economy, the dominant effect to higher government spending is the negative wealth effect that discourages consumption and induces labor supply. As the government increases its borrowing, domestic households demand a higher interest rate to hold government bonds. In equilibrium, a higher interest rate crowds out investment, and forward-looking households reduce consumption to increase saving via bond holding. Although the fiscal multiplier is positive, the leak through consumption and investment make it less than 1 (e.g., Leeper et al. (2010) and Cogan et al. (2010)).[14]

In our baseline without external financing, the dominant channel is still the real interest rate. Production in both sectors goes up initially as a result of more labor inputs. With more government demand, the non-traded prices and the CPI rise, triggering monetary tightening and raising the nominal and real interest rate. As in a closed economy, a higher real interest rate crowds out investment. Since the model features a large share of hand-to-mouth households, aggregate consumption increases initially because hand-to-mouth households consume more due to higher labor income. In the longer horizon, the crowding-out effect on investment lowers capital, together with fiscal adjustments, production declines in both sectors.

While the real interest rate rises for most periods, it has an unusual decline at the beginning. The price of traded goods falls initially because of nominal appreciation (resulted from traded output expansion). This induces a CPI decline and a brief monetary expansion. As the nominal rate falls, the real interest rate falls accordingly. This unusual result may diminish if some degree of price stickiness is assumed for traded goods.[15] If the price of the traded good is also sticky, the crowding out effect could be larger, reducing the expansionary effect of government spending.

Our model's prediction that a government spending increase generates real appreciation is a robust implication in traditional Keynesian (Mundell-Fleming) models, international real business cycle models (e.g., Backus et al. (1994)), and New Keynesian models (e.g., Erceg et al. (2005) and Forni and Pisani (2010)). Many empirical studies using data of developed countries, however, find the opposite (e.g., Kim and Roubini (2008) and Monacelli and Perotti (2010)).[16] In the analysis here, the demand pressure on non-traded goods induces households to substitute away from non-traded to traded goods; the real exchange rate must

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[14]The fiscal multiplier of government spending in a closed economy can be larger than 1 if wage is sufficiently sticky and there is a large share of hand-to-mouth households (Leeper et al. (2011)).

[15]For example, the price of traded goods may include distribution services, which are classified as non-traded goods and are sticky in the model (Backus et al. (1992)).

[16]Some opposite evidence also exists when using European data (e.g., Beetsma et al. (2008) and Forni and Pisani (2010)).

appreciate to clear the goods market. Later we show that the real exchange rate can depreciate when a smaller degree of home-bias is assumed in government spending.[17]

In summary, when the government finance the additional spending with domestic borrowing, the channel of the real exchange rate is operating but less important. Since the magnitude of real appreciation is small, its effects on traded output is also small. To see the relative importance of the two channels in fiscal multipliers, Table 3 reports the breakdown of fiscal multipliers in traded and non-traded goods, consumption, and investment. Following Mountford and Uhlig (2009), we compute cumulative, present-value multipliers at the end of the first and fifth year. The multiplier k quarters after an increase in government consumption is defined as

$$\frac{\sum_{i=1}^{k}\left(\prod_{j=1}^{i}\left(R_{t+j-1}\right)^{-1}\right)\triangle X_{t+i-1}}{\sum_{i=1}^{k}\left(\prod_{j=1}^{i}\left(R_{t+j-1}\right)^{-1}\right)\triangle G_{t+i-1}}, \quad X\in\left\{GDP, Y^{N}, Y^{T}, C, I,\right\}, \ k=4,20. \tag{43}$$

$\triangle X$ and $\triangle G$ are level changes relative to the steady-state values. Discount factors are constructed from the model-implied interest rate in a transition path.

Like the real interest rate channel, the real exchange rate channel also introduces leakage to the expansionary effect of government spending. At the end of the fifth year, the multiplier for traded production is -0.29, and the overall fiscal multiplier is 0.39 (row (1)). Meanwhile, the leak through crowding out is more substantial, investment multiplier is -0.16 (-0.50) at the end of the first (fifth) year.

Next, we explore how external financing of government debt amplifies the negative effect from the real exchange rate channel.

B. With External Financing

The dotted-dashed lines in Figure 1 assume that 60 percent of government debt is financed by external borrowing. Intuitively, external funds relieve competition from the government on domestic saving so the crowding-out effect should be mitigated. Financing government debt through external borrowing, however, introduces more real appreciation, reducing traded output and the fiscal multiplier. The two opposite effects from the real interest and exchange rate channel can be seen from the multipliers for consumption, investment, and traded goods (row (2)). At the end of the first (fifth) year, the cumulative multiplier of traded goods is -0.56 (-0.71). This leak is partially offset by smaller crowding-out. With external

[17] As pointed out by Monacelli and Perotti (2010), the key to generate real depreciation is to have positive consumption of forward-looking households in response to a spending increase, e.g., by countercyclical price mark-ups from “deep habits” (Ravn et al. (2011)). Alternatively, when government spending increases are financed by aid, it is possible to produce temporary real depreciation when sufficiently high demand pressure is generated (Berg et al. (2010b)).

financing, the real interest rate rises less, leading to a smaller investment decline, consistent with empirical finding (Aisen and Hauner (2008), using data of 60 countries). Moreover, aggregate consumption is more positive because of a smaller fall in savers' consumption. At the end of the fifth year the magnitude of crowding out—the sum of consumption and investment multipliers—drops from -0.59 under no external financing to -0.17 under some external financing. Relative to the steady state, current account deficits rise from 1.26 percent (without external financing) to 1.67 percent of GDP (with 60-percent external financing) on impact because access to external funds allows the economy to run large current account deficits.

Our multiplier calculation is cumulative and on a present-value basis. While the fiscal multiplier is larger without external financing at the end of the fifth year, Figure 1 shows that, GDP is more negative after three years. Because investment (and hence capital) falls less with external financing due to smaller crowding-out, and the difference in the real exchange rate between the two scenarios narrows eventually, GDP is less negative under external financing in the longer run.

1. Country Premium on External Debt

The baseline calibration assumes no debt-elastic country premium when borrowing externally. In reality, developing countries can face a rising premium in international financial markets when a government becomes more indebted.[18] Figure 2 contains the responses with a debt-elastic premium ($\xi = 3$, solid lines), relative to the case without (repeating the dotted-dashed lines in Figure 1). Since increasing government spending drives up the government debt to GDP ratio, a debt-elastic country premium lowers the fiscal multiplier in the longer run mainly because it requires a larger scale of fiscal adjustments to maintain budget sustainability.

A rising country premium increases the borrowing cost, which requires more debt services. Given a faster and larger accumulation of government debt, the fiscal adjustment magnitudes in the baseline ($\gamma_Z = -0.005$, $\gamma_\tau = 0.005$) can no longer sustain fiscal solvency;[19] transfers have to be cut more and the income tax rate raised higher ($\gamma_Z = -0.03$, $\gamma_\tau = 0.03$). Since these fiscal adjustments have negative effects on output—the former directly reducing consumption of hand-to-mouth households and the latter discouraging work efforts and investment, GDP is more negative in the longer horizon. Row (3) of Table 3 shows that at the end of the fifth year, the fiscal multiplier is 0.29 with a debt-elastic premium, vs. 0.32 without (row (2)). The differences become larger in the longer run: the cumulative multiplier with a debt-elastic premium dropped to 0.02 vs. 0.22 without such a premium at the end of the tenth year. Ilzetzki et al. (2010) find empirical evidence that fiscal multipliers in high-debt

[18]We only consider debt-elastic risk premia for public debt, not private debt. The foreign rate entering households' budget constraint (2) is fixed at its steady-state level R^*. This implies that when the private sector is a net creditor, the return does not change along with government indebtedness.

[19]Technically, the model cannot find a solution for a stationary equilibrium.

countries are almost zero. Our analysis offers an explanation for such a finding. Additional deficit-financed stimulus can raise concerns in financial markets regarding a country' fiscal sustainability. The negative effect from fiscal adjustments erode the expansionary effect of government spending, producing a small or even negative multiplier.

C. Twin Deficit Hypothesis

Our results that financing sources can matter for fiscal multipliers have implications on the twin-deficit hypothesis for developing countries. Under free capital mobility, many factors, such as trade price elasticity (Erceg et al. (2005)) and non-Ricardian saving behaviors (Kumhof and Laxton (2009)) are found to be important for the co-movements between the two deficits in developed economies. In an environment with limited capital mobility, the extent to which fiscal deficits are financed by external borrowing is crucial for the hypothesis to hold. Although we do not model exports and imports separately, implicitly higher domestic demand results in higher imports and the appreciated real exchange rate reduces exports, driving up current account deficits.

The left column of Figure 3 plots the increases in fiscal deficits and current account deficits (as a percentage of GDP) under $v = 0.01$. The top panel assumes no external borrowing, the middle assumes 40 percent, and the bottom assumes 80 percent external financing. Fiscal deficits are defined as government spending on consumption, transfers, and interest payments less tax receipts. When deficits are financed by domestic borrowing only (the top-left picture), the relationship between the two deficits is weak. At the end of the first year, a one-dollar increase in fiscal deficits leads to a 20-cent increase in current account deficits. Under 40 percent and 80 percent of external financing, the increases in current account deficits are 48 cents and 77 cents.

The role of external financing of government deficits diminishes, however, under an open capital account. The right column of Figure 3 assumes near perfect capital mobility with $v = 0.0001$. The fraction of external borrowing has little influence on the current account deficits, because the total external borrowing remains roughly constant regardless of the amount of external borrowing by the government. Across the three scenarios, a one-percentage-point rise in fiscal deficits causes a current account deterioration equal to about 0.5 percentage point of GDP. This magnitude is similar to the finding in Baxter (1995) and Kumhof and Laxton (2009). The moderate relationship between the two deficits here is driven by a large share of hand-to-mouth households (generating substantial non-Ricardian behavior) and sensitive responses of traded output to real exchange movements.

V. Other Country Characteristics

Aside from financing sources, our framework can explore how other country characteristics matter for fiscal multipliers. This section studies the influence of 1) the government purchase composition in terms of traded and non-traded goods, 2) sectoral rigidities of production factors, 3) the share of hand-to-mouth households, 4) the exchange rate regime, and 5) capital account openness on the size of fiscal multipliers. The exercises assume no external financing. The last part of this section looks at the interactions between external financing and each of these characteristics.

A. Composition of Government Purchases

Our baseline assumes that additional government spending has a high degree of home bias ($\varphi^G = 0.8$). For developing countries, it is also likely that domestic production cannot ramp up quickly to meet additional government demand and has to rely more on traded goods produced abroad. Figure 4 compares the baselines calibration (without external financing) with a smaller degree of home bias $\varphi^G = 0.4$ (solid lines).

When the government demands more traded goods, more labor inputs shift to the traded sector, but the ability of traded good firms to expand production is restricted because of no pricing power. As only part of increased government spending is supplied by domestic production, less home bias implies a smaller fiscal multiplier. Row (4) of Table 3 shows that the fiscal multiplier is 0.48 at the end of the first year. The multiplier for non-traded production is only 0.30 at the end of the first year, compared to 0.94 in the baseline (row (1)). Notice that consumption is much more negative with $\varphi^G = 0.4$. A smaller demand pressure in the non-traded sector, combining with more labor inputs, leads the aggregate wage rate to fall as shown in Figure 4. As labor income falls, hand-to-mouth's consumption falls, lowing aggregate consumption. Another distinctive difference is the depreciation of the real exchange rate. The demand for foreign goods brings forth nominal depreciation, hence real depreciation. Consistent with Penati (1987), government spending that falls more on traded goods generates real depreciation.

B. Sectoral Rigidities of Production Factors

Government spending stimulates economic activity mainly through the demand-side effect. Sectoral rigidities of production factors amplify demand pressure and thus enlarge fiscal multipliers. More sectoral rigidities drive up wage and the rental rate of capital more in the non-traded sector because less labor and capital can move to the non-traded sector in the short run. The higher factor prices translate to more income for households. Given that a large share of households are hand-to-mouth, more income directly increases consumption. Row (5) of Table 3 shows that the fiscal multiplier at the end of the first year is 0.91, compared to 0.71 under the baseline. The consumption multiplier is particularly large with more sectoral rigidities.

Our result that sectoral rigidities enhance the expansionary effects of government spending may be somewhat surprising. Berg et al. (2009) argue that when sectoral rigidities are high, a broad-based spending increase may be less expansionary because crowding-out by government spending may occur in those sectors less hit by negative shocks. In our framework, investment falls slightly more under a higher degree of sectoral rigidities. However, the positive wealth effect on consumption due to higher factor prices dominates.

One caveat is that our model does not capture the "gap to the potential" normally observed during recessions. The consumption increase due to rising factor prices would be subsided if the sector receiving government demand injection happens to be hit hard by negative shocks. Under that circumstance, factor prices would not rise much as what we have here for the non-traded sector, and the positive wealth effect on consumption would be reduced.

C. Fraction of Hand-to-Mouth Households

Hand-to-mouth households in the literature serve as a way to break Ricardian behaviors in response to fiscal policy changes. Since hand-to-mouth households consume all of their disposable income every period, more labor supply in response to a government spending increases raises income and consumption. While forward-looking agents would reduce consumption, the larger the fraction of hand-to-mouth households tend to increase the fiscal multiplier.

The fraction of hand-to-mouth households also signals the degree of financial development. A large fraction of hand-to-mouth households combined with limited capital mobility means that government bonds have to be absorbed by a smaller pool of savers. Hence, for a given amount of borrowing, a larger fraction of hand-to-mouth households lead to more crowding out in investment. Consistent with this story, row (6) of Table 3 shows that when $f = 0.2$, the GDP multiplier rises to 0.79 (from 0.71) at the end of the first year, and the consumption multiplier rises to 0.27 (from 0.07), but the investment multiplier falls to -0.23 (from -0.16) at the end of the first year.

D. The Exchange Rate Regime

Among the regularities documented in Ilzetzki et al. (2010) is that economies with a fixed exchange rate have much larger fiscal multipliers than those under a flexible exchange rate regime. Our framework delivers the same qualitative difference at least in the short run.[20] Compared to a flexible regime in the baseline, row (7) of Table 3 shows that the fiscal multiplier increases to 0.91 (from 0.71 under a flexible regime, row (1)) by the end of the first year.

A fixed regime keeps the nominal exchange rate and the price of traded goods fixed due to the law-of-one-price assumption. Relative to a flexible regime, where the price of traded goods falls, the smaller relative price difference between traded and non-traded goods with a fixed regime produces less real appreciation, hence a more positive response of traded output at the beginning. While traded output expands more, the fixed regime also generates more

[20] Ilzetzki et al. (2010) find that the long-run multiplier is 1.5 for countries with a fixed exchange rate and 0 with a flexible one. The 44 countries include both high-income and developing countries. They argue that with a flexible exchange rate, an increase in government spending is offset by reduction in net exports. Our analysis also shows that reduction in traded output offsets the government spending increase but the offset is less than one-for-one.

crowding out through the real interest rate channel. Our monetary policy specification—(30) and (32)—implies that reserve interventions are sterilized by open market operations. To prevent nominal appreciation, reserve increases automatically lead to reductions in the central bank's holding of government bonds to restrict monetary expansion. The increased holding of government debt by savers must drive up the nominal and the real interest rate, which crowds out more investment and consumption. If the central bank, instead, does not sterilize its reserve intervention, the fiscal multiplier can be even larger, as shown in row (8) of Table 3. At the end the first year, the fiscal multiplier further rises to 0.96.[21]

E. Capital Account Openness

Our analysis so far conditions on an arbitrary degree of capital account openness by setting $v = 0.01$. The range of this parameter can vary from a tiny number (like 0.000742 as in Schmitt-Grohe and Uribe (2003)—for the technical reason to ensure stationarity of net foreign assets) to a huge number (like $100,000$ as in Berg et al. (2010a)—for modeling a closed capital account). Figure 5 compares government spending effects under three v's. Solid lines assume $v = 0.0001$, implying very little restriction in capital mobility; dotted-dashed lines have $v = 0.01$ (as in the baseline); and the dashed lines have $v = 100$, implying an almost closed capital account. When $v = 0.0001$, foreign borrowing by the private sector follows closely to government debt. Savers simply increase their foreign borrowing to acquire domestic government debt.

Without external financing, a more open capital account leads to less crowding out but more contraction in traded output. Overall, government spending is less expansionary under a more open capital account with no external borrowing. In the longer run, since the investment decline is also smaller with a more open capital account, GDP bounces back more quickly. Rows (9) and (10) of Table 3 confirm this comparison. When $v = 0.0001$, the fiscal multiplier is smaller due to a much smaller multiplier for traded output. If the capital account is more closed ($v = 100$), although the investment multiplier falls from -0.16 in the baseline to -0.19 at the end of the first year, the multiplier for traded output is much less negative (-0.23 in the baseline vs. -0.01 with $v = 100$), producing a larger fiscal multiplier of 0.82 at the end of the first year, compared to 0.71 in the baseline.

F. Interactions with External Financing

The rest of this section studies the interactions of external financing with each of country characteristics analyzed above. Figure 6 summarizes the cumulative fiscal multiplier at the end of the first year. Each graph plots external financing shares against a wide range of a relevant parameter. The parameters not plotted are set to their baseline values.

[21]To simulate a scenario without sterilization, we replace (32) with $B_t^{cb} = \frac{B_{t-1}^{cb}}{\pi_t}\left[(1+\mu)\left(\frac{\pi_t}{\pi}\right)^{-\phi_\pi}\right]$ as in Berg et al. (2010a).

Several observations can be made. First, the fiscal multiplier is generally below 1. The preceding analysis finds that more home bias in government purchases, a high degree of sectoral rigidities, a large fraction of hand-to-mouth households, a fixed exchange rate, and a more closed capital account work to increase the fiscal multiplier. When combining these features *one at a time* with no external financing, the multiplier is still below 1. To obtain a larger multiplier, multiple characteristics have to be present. For example, when no external financing is combined with complete home bias in additional government spending ($\varphi^G = 1$) and the fixed exchange rate regime, the fiscal multiplier is 1.12 at the end of the first year.

Second, among the country characteristics considered here, the degree of home bias has the most influences in fiscal multipliers. Under no (full) external financing, when the degree of home bias gradually increases from 0 to 1, the fiscal multiplier at the end of the first year rises from 0.26 to 0.83 (0.01 to 0.62).

Third, except for capital account openness, the fiscal multiplier change monotonically with the degree of external financing and a characteristic analyzed. For capital account openness, Section E finds a more closed capital account leads to a larger multiplier *under no external financing*. The bottom left graph in Figure 6 shows that increasing capital account openness can actually raise the multiplier when the government finances most of its debt externally.

To explain this phenomenon, we resort to the optimality condition of foreign borrowing by savers:

$$s_t \lambda_t^a \left[1 - \upsilon \left(b_t^{*a} - b^{*a}\right)\right] = \beta E_t \left(\lambda_{t+1}^a s_{t+1} \frac{R^*}{\pi^*}\right), \tag{44}$$

where λ_t^a is the marginal utility of savers, which is inversely related to consumption. The left hand side is the marginal benefit of external borrowing at t, and the right hand side is the the discounted, expected marginal cost of $t+1$ at time t. The equation says that if consumption falls, the marginal benefit of borrowing one more unit of foreign debt (the left hand side) would rise, and savers want to increase foreign borrowing. Alternatively, if the current real exchange rate appreciates, the marginal benefit would fall, and savers want to decrease foreign borrowing. When the government only finances a small part of its additional spending by external borrowing, substantial crowding out occurs, reducing savers' consumption. Under this circumstance, a more open capital account (a small υ) means that savers would increase borrowing to smooth their consumption. As analyzed in Section E, borrowing by the private sector has the similar effect as external borrowing by the government: A more open capital account reduces the fiscal multiplier. In contrary, if the government already borrows a lot externally, the resulted real appreciation induces savers to cut foreign borrowing. Thus, a more open capital account reduces total external borrowing of the economy, producing less real appreciation and raising the fiscal multiplier.

VI. CONCLUSIONS

This paper studies the effects of government spending for developing countries. The framework accounts for limited international capital mobility, an important difference between developing and developed countries. It finds that the financing source affects the size of fiscal multipliers for government spending. On the one hand, access to international funds reduces crowding out in terms of consumption and investment, raising the multiplier. On the other hand, the inflow of external funds brings more real appreciation. Since traded output in developing countries can be very sensitive to the real exchange rate, real appreciation has a large negative effect on traded output. Overall, the negative effect from the real exchange rate channel dominates, leading to a smaller multiplier with external financing in the short run. When countries face a debt-elastic risk premium, fiscal multipliers under external financing are further reduced in the longer run because more debt services require a larger scale of fiscal adjustments to maintain budget sustainability.

Aside from financing sources, the analysis also studies how other factors affect fiscal multipliers. A higher concentration on traded goods means only part of the demand increases from more government spending is met by domestic production, leading to a smaller fiscal multiplier. More sectoral rigidities and more hand-to-mouth households amplify the demand pressure from government spending and thus increase the multiplier. A fixed exchange rate regime, on the other hand, reduces real appreciation and exerts a less negative effect on traded output. Finally, whether capital account openness reduces the multiplier depends on the amount of external borrowing by the government. When the government finances most of its spending through domestic borrowing, a more open capital account reduces the multiplier as the private sector increases its foreign borrowing to smooth consumption. The opposite occurs if the government already engages in a lot of external borrowing, because agents reduce foreign borrowing, making the real exchange rate appreciate less.

For the most scenarios we study, the fiscal multiplier is below one, suggesting that government spending in developing countries is not as expansionary as policy makers desire. One caveat to note is that our analysis assumes government spending is non-productive. It is foreseeable that the fiscal multiplier is more likely to rise above one when government spending is used, for example, to build productive public capital, which raises the productivity of the private sector.

Finally, our finding that externally financing leads to a smaller fiscal multiplier has implications on other types of foreign financed fiscal expansions. Since lower-income countries often rely on external funding to finance some of its government spending, such as aid, its expansionary effects can be quite small in general, as found in Berg et al. (2010a). When learning-by-doing is present, the negative effect from real appreciation can be amplified and prolonged, introducing more leak to the expansionary effects of government spending.

variables	values	notes
consumption/output	0.69	Mexico, average 1999-2008
investment/output	0.21	Mexico, average 1999-2008
government consumption/output	0.11	Mexico, average 1999-2008
trade balance/output	0.01	model implication
foreign reserve/annual output	0.08	Mexico, average 1999-2008
money/annual output	0.11	M1, Mexico, average 1999-2008
public debt/annual output	0.24	Mexico, gross debt, average 1999-2008
private foreign debt/annual output	0.09	model implication
external public debt/total government debt	0.6	average of Latin America in 2005
annualized inflation rate	8.33%	CPI, Mexico, average 1997-2008
tax revenues/output	0.15	cash receipts, Mexico, average 1999-2008
transfers/output	0.03	model implication
remittance/output	0.02	net foreign transfers to Mexico, average 1999-2008
annual nominal interest rate	10%	principal rate, Mexico, average 1997-2008

Table 1. **Steady State**

parameters	values	notes
σ	2	inverse of intertemporal elasticity of substitution for consumption
ψ	2	inverse of Frisch elasticity
φ	0.5	degree of consumption home bias
χ	0.44	elasticity of substitution between traded and non-traded
θ	12	elasticity of substitution among non-traded goods
$\tilde{\theta}$	12	elasticity of substitution among labor inputs
η	0.09	implying the interest elasticity of real money balance is -1.5
ϑ^a	0.9998	preference weight on consumption, savers, model implication
ϑ^h	0.9931	preference weight on consumption, hand to mouth, model implication
κ^a	0.4768	saver's disutility weight on labor, model implication
κ^h	0.2974	hand-to-mouth consumer's disutility weight on labor, model implication
δ^l	0.53	share of labor supplied to non-traded, model implication
δ^k	0.53	share of capital supplied to non-traded, model implication
ρ^l	0.9	elasticity of labor substitution between the two sectors
ρ^k	0.2	elasticity of capital substitution between two sectors
β	0.996	the discount factor, model implication
f	0.4	fraction of savers
α^T, α^N	0.7	labor income share
ι	0.007	production disincentive parameter, model implication
κ^N, κ^T	25	investment adjustment cost
δ	0.025	depreciation rate for capital
ς^p	65	implying the prices are sticky for almost one year
ς^w	143	implying the wages are sticky for almost one year
$\bar{\varphi}^G$	0.7	steady state home bias of government purchases
ϕ	0.5	parameter governs procyclical government spending
γ_z	-0.005	transfer adjustment parameter, stabilize debt growth
γ_τ	0.005	income tax rate adjustment parameter, stabilize debt growth
ρ_G	0.9	autocorrelation coefficient in government spending rule
ρ_z	0.9	autocorrelation coefficient in transfer rule
ρ_τ	0.9	autocorrelation coefficient in tax rule
v	0.01	implying limited international capital mobility
ω	0	flexible exchange rate regime
ϕ_π	1.25	consistent with an interest rule with inflation coefficient 1.5
ξ	0.0	country risk premium

Table 2. **Baseline Calibration**

	Calibration		GDP	Y^N	Y^T	C	I
(1)	baseline,	1yr	0.71	0.94	−0.23	0.07	−0.16
	no external financing	5yr	0.39	0.68	−0.29	−0.09	−0.50
(2)	baseline,	1yr	0.58	1.14	−0.56	0.18	−0.06
	with external financing	5yr	0.32	1.03	−0.71	0.00	−0.17
(3)	debt-elastic country premium	1yr	0.60	1.10	−0.50	0.16	−0.08
	($\xi = 3$)	5yr	0.29	0.80	−0.51	−0.15	−0.32
(4)	less home bias	1yr	0.48	0.30	0.18	−0.06	−0.16
	($\varphi^G = 0.4$)	5yr	0.28	0.05	0.24	−0.13	−0.50
(5)	more sectoral rigidities	1yr	0.91	1.13	−0.21	0.18	−0.17
	($\rho^l = 0.2, \rho^k = 0.1$)	5yr	0.45	0.82	−0.37	−0.06	−0.50
(6)	more hand-to-mouth households	1yr	0.79	1.01	−0.23	0.27	−0.23
	($f = 0.2$)	5yr	0.36	0.66	−0.30	0.04	−0.65
(7)	fixed exchange rate	1yr	0.91	0.69	0.22	−0.07	−0.27
	($\omega = 100,000$)	5yr	0.38	0.44	−0.07	−0.16	−0.72
(8)	fixed exchange rate	1yr	0.96	0.94	0.01	0.18	−0.15
	no sterilization	5yr	0.48	0.71	−0.23	−0.03	−0.48
(9)	more open capital account	1yr	0.63	0.06	−0.43	0.14	−0.10
	($\upsilon = 0.0001$)	5yr	0.36	0.86	−0.50	−0.04	−0.33
(10)	near closed capital account	1yr	0.82	0.83	−0.01	−0.00	−0.19
	($\upsilon = 100$)	5yr	0.40	0.65	−0.25	−0.11	−0.51
Except for row (2), all scenarios assume no external financing for additional government spending.							

Table 3. **Fiscal Multipliers for Government Spending.**

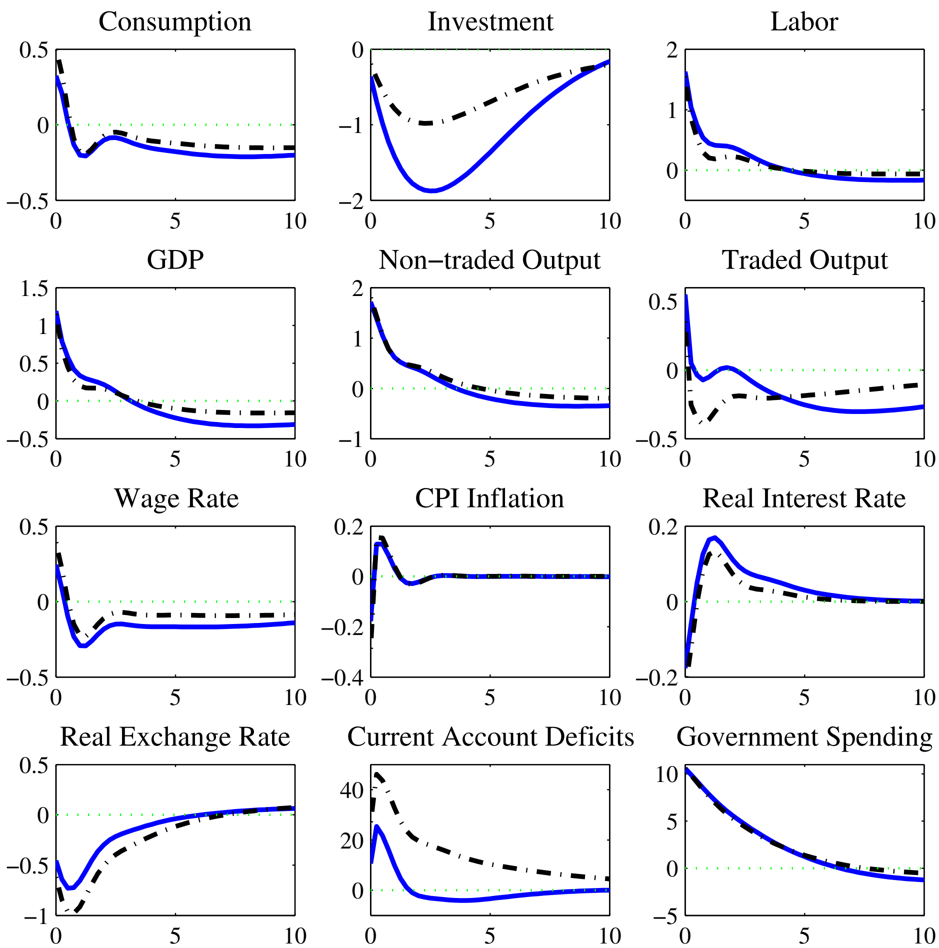

Figure 1. **Impulse responses to a 10-percent increase in government spending: baseline calibration.** Solid lines: no external financing; dotted-dashed lines: 60-percent external financing. Y-axis is in percent deviation from the steady state. X-axis is in years after the initial increase in government spending.

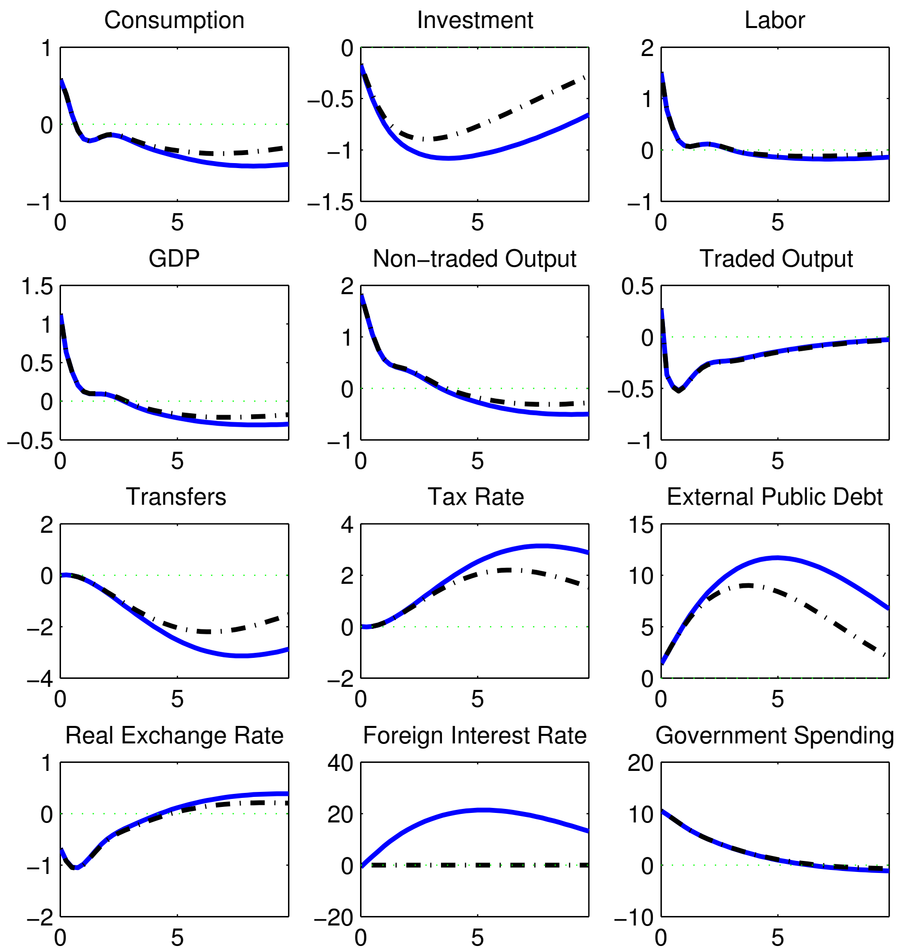

Figure 2. **Impulse responses to a 10-percent increase in government spending: country premium.** Solid lines: with a debt-elastic country premium ($\xi = 3$); dotted-dashed lines: constant premium ($\xi = 0$) as in the baseline. Y-axis is in percent deviation from the steady state. X-axis is in years after the initial increase in government spending.

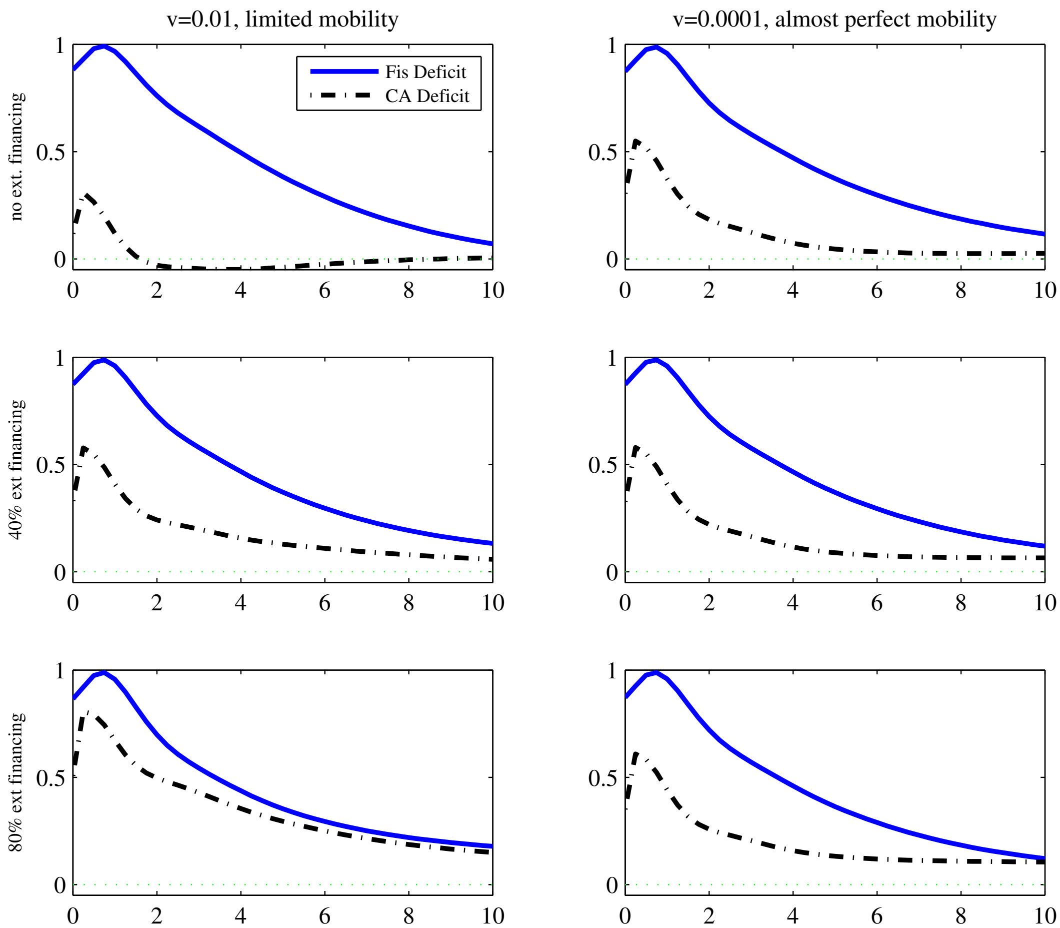

Figure 3. **Impulse responses to a 10-percent increase in government spending: twin deficits.** Fiscal deficits and current account deficits are in shares of GDP. X-axis is in years after the initial increase in government spending.

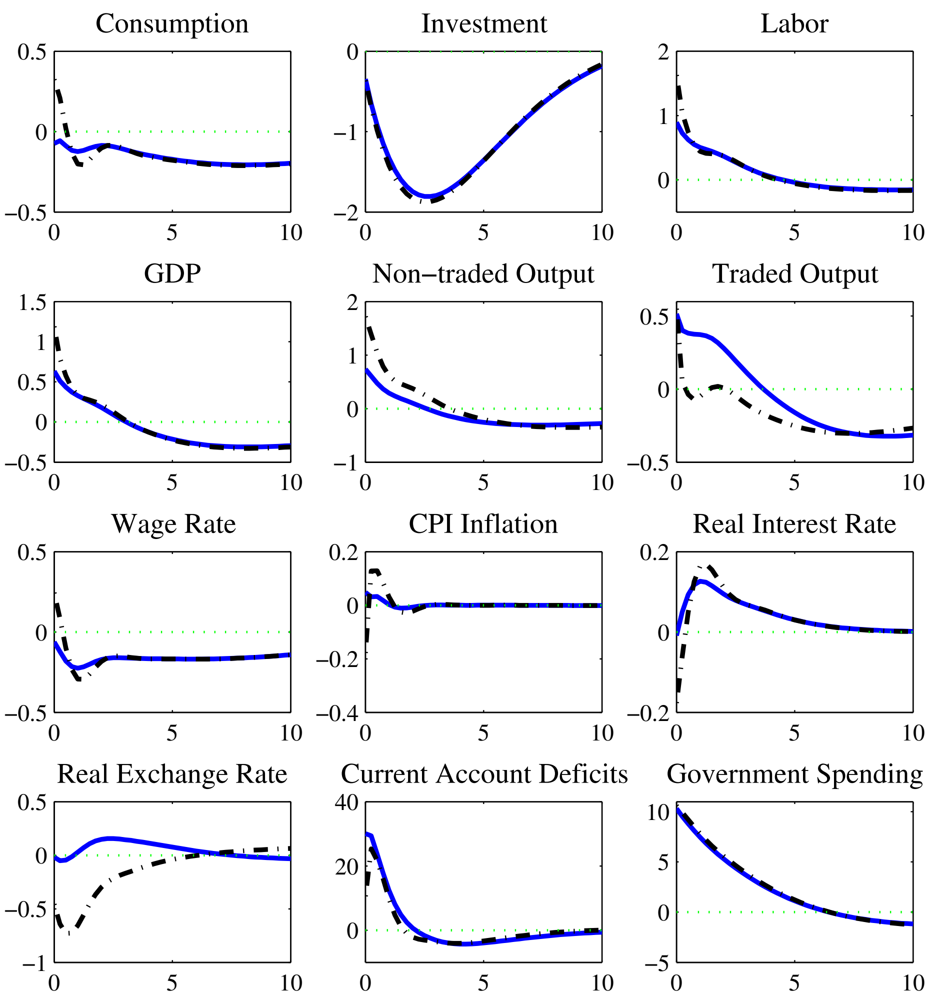

Figure 4. **Impulse responses to a 10-percent increase in government spending: home bias in government purchases.** Solid lines: less home bias ($\varphi^G = 0.4$); dotted-dashed lines: $\varphi^G = 0.8$ as in the baseline. Y-axis is in percent deviation from the steady state. X-axis is in years after the initial increase in government spending.

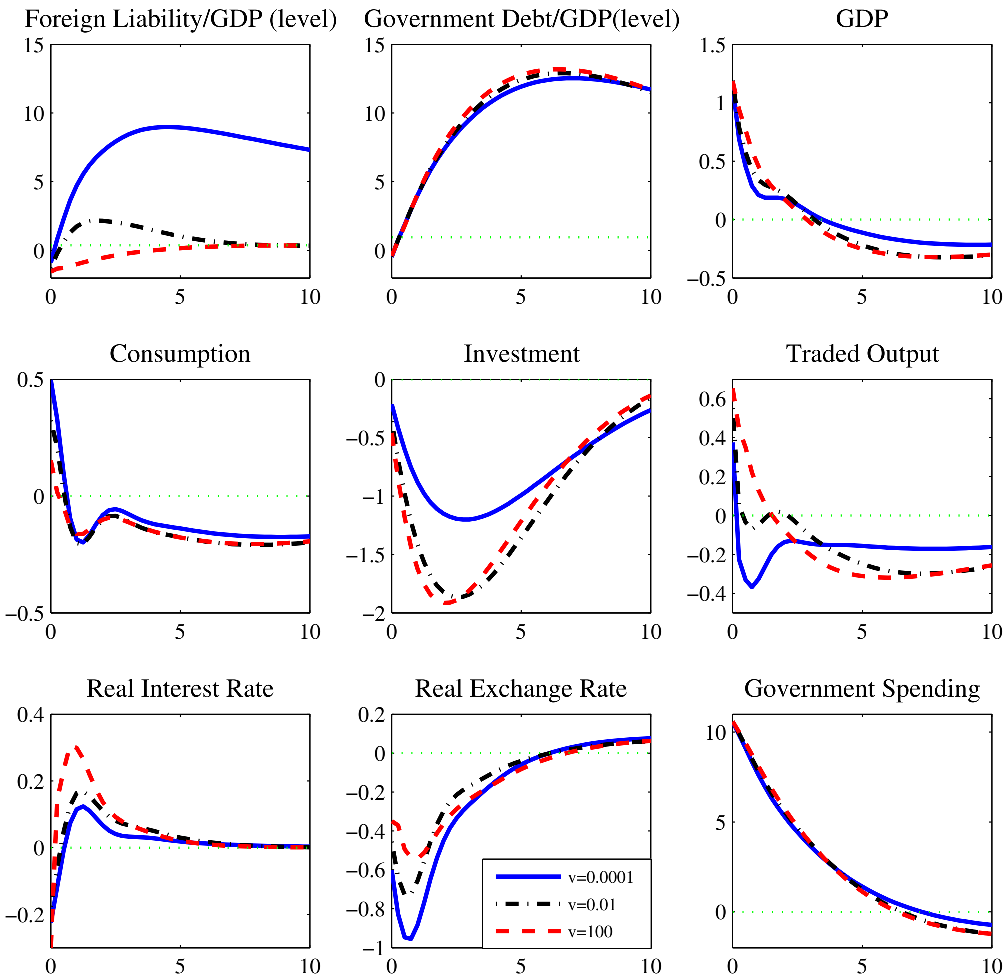

Figure 5. **Impulse responses to a 10-percent increase in government spending: capital account openness.** Solid lines: almost perfect capital mobility ($\upsilon = 0.0001$); dotted-dashed lines: limited capital mobility ($\upsilon = 0.01$ as in the baseline); dashed lines: almost closed capital account ($\upsilon = 100$). Y-axis is in percent deviation from the steady state unless stated otherwise. X-axis is in years after the initial increase in government spending.

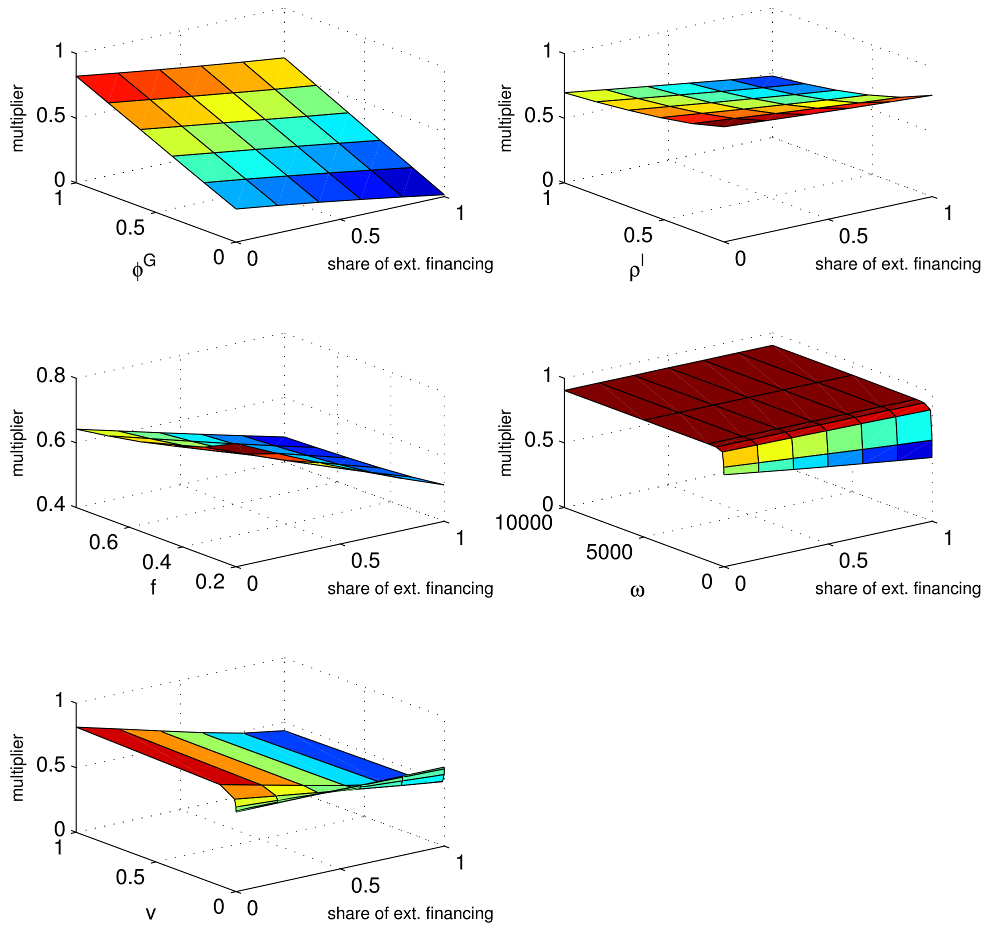

Figure 6. **Interactions with External Financing.** Cumulative fiscal multipliers at the of the first year: ϕ^G—home bias in government spending; ρ^l—sectoral labor mobility (smaller ρ^l $\rightarrow$ more rigidities); f—share of hand-to-mouth households; ω—exchange rate regime (larger $\omega \rightarrow$ less flexible regime); v—capital account openness (larger $v \rightarrow$ more closed capital account).

Appendix I. Optimality Conditions

This appendix contains the optimality conditions. Let λ_t^a and λ_t^h be the Lagrangian multipliers for the maximization problems of savers and non-savers, q_t is Tobin's Q.
Saver's FOC for $c_t^a(j)$

$$\lambda_t^a = \left[\vartheta^a \left(c_t^a\right)^{\frac{\eta-1}{\eta}} + \left(1-\vartheta^a\right)\left(m_t^a\right)^{\frac{\eta-1}{\eta}}\right]^{\frac{1-\eta\sigma}{\eta-1}} \vartheta^a \left(c_t^a\right)^{-\frac{1}{\eta}} \tag{I.1}$$

Saver's FOC for $b_t^{ca}(j)$

$$\lambda_t^a = \beta E_t \left(\lambda_{t+1}^a \frac{R_t}{\pi_{t+1}}\right) \tag{I.2}$$

Saver's FOC for $b_t^{*a}(j)$

$$s_t \lambda_t^a \left[1 - \upsilon\left(b_t^{*a} - b^{*a}\right)\right] = \beta E_t \left(\lambda_{t+1}^a s_{t+1} \frac{R^*}{\pi^*}\right) \tag{I.3}$$

Saver's FOC for $m_t^a(j)$

$$\left[\vartheta^a \left(c_t^a\right)^{\frac{\eta-1}{\eta}} + \left(1-\vartheta^a\right)\left(m_t^a\right)^{\frac{\eta-1}{\eta}}\right]^{\frac{1-\eta\sigma}{\eta-1}} \left(1-\vartheta^a\right)\left(m_t^a\right)^{-\frac{1}{\eta}} = \lambda_t^a \left(\frac{R_t - 1}{R_t}\right) \tag{I.4}$$

Saver's FOC for $l_t^a(j)$ and $W_t(j)$

$$-\lambda_t^a \varsigma^w (\pi_t^w - \pi)\pi_t^w l_t^a + \lambda_t^a (1-\tau_t)(1-\tilde{\theta}) l_t^a + \kappa^a \tilde{\theta} \frac{(l_t^a)^{1+\psi}}{w_t} + \varsigma^w \beta E_t \lambda_{t+1}^a (\pi_{t+1}^w - \pi) \frac{(\pi_{t+1}^w)^2 l_{t+1}^a}{\pi_{t+1}} = 0 \tag{I.5}$$

Saver's FOC for $k_t^a(j)$

$$q_t = \beta E_t \frac{\lambda_{t+1}^a}{\lambda_t^a} \left[(1-\tau_{t+1}) r_{t+1}^k + (1-\delta) q_{t+1}\right] \tag{I.6}$$

Saver's FOC for $i_t^a(j)$

$$-1 + q_t \left[1 - \frac{\kappa^k}{2}\left(\frac{i_t^a}{i_{t-1}^a} - 1\right)^2 - \kappa^k \frac{i_t^a}{i_{t-1}^a}\left(\frac{i_t^a}{i_{t-1}^a} - 1\right)\right] + \beta \kappa^k E_t q_{t+1} \frac{\lambda_{t+1}^a}{\lambda_t^a}\left(\frac{i_{t+1}^a}{i_t^a}\right)^2 \left(\frac{i_{t+1}^a}{i_t^a} - 1\right) = 0 \tag{I.7}$$

Hand-to-mouth consumer's FOC for $c_t^h(j)$

$$\lambda_t^h = \left[\vartheta^h \left(c_t^h\right)^{\frac{\eta-1}{\eta}} + \left(1-\vartheta^h\right)\left(m_t^h\right)^{\frac{\eta-1}{\eta}}\right]^{\frac{1-\eta\sigma}{\eta-1}} \vartheta^h \left(c_t^h\right)^{-\frac{1}{\eta}} \tag{I.8}$$

Hand-to-mouth consumer's FOC for $m_t^h(j)$

$$\lambda_t^h = \left[\vartheta^h \left(c_t^h\right)^{\frac{\eta-1}{\eta}} + \left(1-\vartheta^h\right)\left(m_t^h\right)^{\frac{\eta-1}{\eta}}\right]^{\frac{1-\eta\sigma}{\eta-1}} \left(1-\vartheta^h\right)\left(m_t^h\right)^{-\frac{1}{\eta}} \tag{I.9}$$

Hand-to-mouth consumer's FOC for $l_t^h(j)$

$$\kappa^h \left(l_t^h\right)^{\psi} = \lambda_t^h \left(1-\tau_t\right) w_t \tag{I.10}$$

Hand-to-mouth consumers budget constraint

$$c_t^h(j) + m_t^h(j) = \left(1-\tau_t\right)\frac{W_t}{P_t} l_t^h(j) + \frac{m_{t-1}^h(j)}{\pi_t} + s_t r m^* + z_t \tag{I.11}$$

Labor supply between sectors are

$$l_t^N = \delta^l \left(\frac{w_t^N}{w_t}\right)^{\rho^l} l_t; \quad l_t^T = \left(1-\delta^l\right)\left(\frac{w_t^T}{w_t}\right)^{\rho^l} l_t \tag{I.12}$$

Capital supply between sectors are

$$k_t^N = \delta^k \left(\frac{r_t^N}{r_t^k}\right)^{\rho^k} k_t; \quad k_t^T = \left(1-\delta^k\right)\left(\frac{r_t^T}{r_t^k}\right)^{\rho^k} k_t \tag{I.13}$$

Nominal prices change follow

$$\pi_t^w = \frac{w_t}{w_{t-1}}\pi_t; \quad \pi_t^N = \frac{p_t^N}{p_{t-1}^N}\pi_t; \quad \pi_t^T = \frac{s_t}{s_{t-1}}\pi_t \tag{I.14}$$

Firms in non-traded sector's FOC for $P_t^N(i)$

$$\Pi_t^N = \beta E_t\left[\frac{\lambda_{t+1}^a}{\lambda_t^a}\Pi_{t+1}^N \frac{y_{t+1}^N}{y_t^N}\frac{p_{t+1}^N}{p_t^N}\right] + \frac{\theta}{\alpha^N \varsigma^p \left(1-\iota\right)}\frac{w_t^N l_t^N}{p_t^N y_t^N} + \frac{1-\theta}{\varsigma^p} \tag{I.15}$$

where $\Pi_t^N \equiv \frac{\pi_t^N}{\pi_{t-1}^N}\left(\frac{\pi_t^N}{\pi_{t-1}^N} - 1\right)$.
Firms in non-traded sector's FOC for $l_t^N(i)$ and $k_{t-1}^N(i)$

$$(1-\alpha^N)w_t^N l_t^N = \alpha^N r_t^N k_{t-1}^N \tag{I.16}$$

Firms in traded sector's FOC for l_t^T

$$w_t^T l_t^T = (1-\iota)s_t \alpha^T y_t^T \tag{I.17}$$

Firms in traded sector's FOC for k_{t-1}^T

$$r_t^T k_{t-1}^T = (1-\iota)s_t(1-\alpha^T)y_t^T \tag{I.18}$$

REFERENCES

Aisen, Ari, and David Hauner, 2008, "Budget Deficits and Interest Rates: a Fresh Perspective." IMF Working Paper WP/08/42.

Akitoby, B., and T. Stratmann, 2008, "Fiscal Policy and Financial Markets," *The Economic Journal*, Vol. 118, No. 533, pp. 1971-1985.

Alesina, Alberto, Guido Tabellini, and Filipe Campante, 2008, "Why is Fiscal Policy Procyclical?," *Journal of European Economic Association*, Vol. 6, No. 5, pp. 1006-1036.

Antras, Pol, and Ricardo J. Caballero, 2009, "Trade and Capital Flows: a Financial Fricitions Perspective," *Journal of Political Economy*, Vol. 117, No. 4, pp. 701-744.

Backus, David K., Patrick J. Kehoe, and Finn E. Kydland, 1994, "Dynamic of the Trade Balance and the Terms of Trade: the J-Curve?," *American Economic Review*, Vol. 84, No. 1, pp. 84-103.

Backus, David, Patrick J. Kehoe, and Finn Kydland, 1992, "International Real Business Cycles," *Journal of Political Economy*, Vol. 100, No. 4, pp. 745-775.

Baxter, Marianne, "International Trade and Business Cycles," 1995, in Gene Grossman, and Kenneth Rogoff, eds., *Handbook of International Economics*, Vol. 3 (Amsterdam: Elsevier Science B.V.), pp. 1801–1864.

Beetsma, Roel, Massimo Giuliodori, and Franc Klaassen, 2008, "The Effects of Public Spending Shocks on Trade Balances and Budget Deficits in the European Union," *Jounral of the European Economic Association*, Vol. 6, No. 2-3, pp. 414-423.

Berg, Andrew, Jan Gottschalk, Rafael Portillo, and Luis-Felipe Zanna, 2010, "The Macroeconomics of Medium-Term Aid Scaling-Up Scenarios." IMF Working Paper WP/10/160.

______, Norbert Funke, Alejandro Hajdenberg, Victor Lledo, Rolando Ossowski, Martin Schindler, Antonio Spilimbergo, Shamsuddin Tareq, and Irene Yackovlev, 2009, *Fiscal Policy in Sbu-Saharan Afrian in Response to the Impact of the Global Crisis* IMF Staff Position Note (Washington, D.C.: International Monetary Fund).

______, Tokhir Mirzoev, Rafael Portillo, and Luis-Felipe Zanna, 2010, "The Short-Run Macroeconomics of Aid Inflows." International Monetary Fund Working Paper WP/10/65.

Bouakez, Hafedh, Emanuela Cardia, and Francisco Ruge-Murcia, 2009, "The Transmission of Monetary Policy in a Multi-Sector Economy," *International Economic Review*, Vol. 50, No. 4, pp. 1243-1266.

Buffie, Edward F., Andrew Berg, Catherine Pattillo, Rafael Portillo, and Luis-Felipe Zanna, 2011, "Public Investment, Growth, and Debt Sustainability: Putting Together the Pieces." Manuscript, the International Monetary Fund.

Burstein, Ariel, Martin Eichenbaum, and Sergio Rebelo, 2005, "Large Devaluations and the Real Exchange Rate," *Journal of Political Economy*, Vol. 113, No. 4, pp. 742-784.

Cogan, John F., Tobias Cwik, John B. Taylor, and Volker Wieland, 2010, "New Keynesian versus Old Keynesian Government Spending Multipliers," *Journal of Economic Dynamics and Control*, Vol. 34, No. 3, pp. 281-295.

Dixit, Avinash K., and Joseph E. Stiglitz, 1977, "Monopolistic Competition and Optimum Product Diversity," *American Economic Review*, Vol. 67, No. 3, pp. 297-308.

Easterly, Williams, and Klaus Schmidt-Hebbel, 1993, "Fiscal Deficits and Macaroeconomic Performance in Developing Countries," *The World Bank Research Observer*, Vol. 8, No. 2, pp. 211-237.

Erceg, Christopher J., Luca Guerrieri, and Christopher J. Gust, 2005, "Expansionary Fiscal Shocks and the Trade Deficit," *International Finance*, Vol. 8, No. 3, pp. 363-397.

Fleming, J. Marcus, 1962, "Domestic Financial Policies under Fixed and under Floating Exchange Rates," *International Monetary Fund Staff Papers*, Vol. 9, No. 3, pp. 369-380.

Forni, Lorenzo, and Massimiliano Pisani, 2010, "Fiscal Policy in Open Economy: Estimates for the Europ Area." Manuscript, Bank of Italy.

Gali, Jordi, J. David Lopez-Salido, and Javier Valles, 2007, "Understanding the Effects of Government Spending on Consumption," *Journal of the European Economic Association*, Vol. 5, No. 1, pp. 227-270.

Garcia-Cicco, Javier, Roberto Pancrazi, and Martin Uribe, 2010, "Real Business Cycles in Emerging Countries?," *American Economic Review*, Vol. 100, No. 5, pp. 2510-2531.

Gavin, Michael, and Roberto Perotti, "Fiscal Policy in Latin America," 1997, in Ben Bernanke, and Julio Rotemberg, eds., *NBER Macroeconomics Annual 1997*, (Cambridge, MA: MIT Press).

Horvath, Michael, 2000, "Sectoral Schoks and Aggregate Fluctuations," *Journal of Monetary Economics*, Vol. 45, No. 1, pp. 69-106.

Ilzetzki, Ethan, and Carlos A. Vegh, 2008, "Procyclical Fiscal Policy in Developing Countries: Truth or Fiction?"

______, Enrique G. Mendoza, and Carlos A. Vegh, 2010, "How big (small?) are fiscal multipliers?" NBER Working Paper No. 16479.

Kaminski, Graciela, Carmen Reinhart, and Carlos Vegh, "When it Rains it Pours: Procyclical Capital Flows and Macroeconomic Policies," 2004, in Mark Gertler, and Kenneth Rogoff, eds., *NBER Macroeconomic Annual 2004*, (Cambridge, MA: MIT Press).

Kim, Soyoung, and Nouriel Roubini, 2008, "Twin Deficit or Twin Divergence? Fiscal Policy, Current Account, and Real Exchange Rate in the U.S.," *Journal of International Economics*, Vol. 74, No. 2, pp. 362-383.

Klaehn, Janette, Brigit Helms, and Rani Deshpande, 2006, *Mexico: Country-Level Savings Assessment*, Vol. Third Edition (Washington, D.C.: The World Bank).

Kumhof, Michael, and Douglas Laxton, 2009, "Fiscal Deficits and Current Account Deficits." IMF Working Paper WP/09/237.

Leeper, Eric M, Michael Plante, and Nora Traum, 2010, "Dynamics of Fiscal Financing in the United States," *Journal of Econometrics*, Vol. 156, No. 2, pp. 304-321.

Leeper, Eric M., Nora Traum, and Todd B. Walker, 2011, "Clearing up the Fiscal Multiplier Morass." NBER Working Paper No. 17444.

Mankiw, N. Gregory, 2000, "The Savers-Spenders Theory of Fiscal Policy," *American Economic Review Papers and Proceedings*, No. May, pp. 120-125.

Mendoza, Enrique G., and Martin Uribe, 2000, "Devaluation risk and the business-cycle implications of exchange-rate management," *Carnegie-Rochester Conference Series on Public Policy*, Vol. 53, No. 1, pp. 239-296.

Monacelli, Tommaso, and Roberto Perotti, 2010, "Fiscal Policy, the Real Exchange Rate and Traded Goods," *The Economic Journal*, Vol. 120, No. 544, pp. 437-461.

Mountford, Andrew, and Harald Uhlig, 2009, "What Are the Effects of Fiscal Policy Shocks?," *Journal of Applied Econometrics*, Vol. 24, No. 6, pp. 960-992.

Mundell, Robert A., 1963, "Capital Mobility and Stabilization Policy under Fixed and Flexible Exchange Rates," *The Canadian Journal of Economics and Political Science*, Vol. 29, No. 4, pp. 475-485.

Mussa, Michael, 1974, "Tariffs and the Distribution of Income: The Importance of Factor Specificity, Substitutability, and Intensity in the Short and Long Run," *Journal of Political Economy*, Vol. 82, No. 6, pp. 1191-1203.

Panizza, Ugo, 2008, "Domestic And External Public Debt In Developing Countries." United Nations Conference on Trade and Development, UNCTAD Discussion Papers, No. 188.

Penati, Alessandro, 1987, "Government Spending and the Real Exchange Rate," *Journal of International Economics*, Vol. 22, pp. 237-256.

Rajan, Raghuram G., and Luigi Zingales, 1998, "Financial Dependence and Growth," *American Economic Review*, Vol. 88, No. 3, pp. 559-586.

Ravn, Morten, Stephanie Schmitt-Grohe, and Martin Uribe, 2011, "Explaining the Effects of Government Spending Shocks on Consumptin and the Real Exchange Rate." NBER Working Paper No. 13328.

Rotemberg, Julio J., 1982, "Sticky Prices in the United States," *Journal of Political Economy*, Vol. 90, No. December, pp. 1187-1211.

Schmitt-Grohe, Stephanie, and Martin Uribe, 2003, "Closing Small Open Economy Models," *Journal of International Economics*, Vol. 61, No. 1, pp. 163-185.

Sims, Christopher A., 2001, "Solving Linear Rational Expectations Models," *Journal of Computational Economics*, Vol. 20, No. 1-2, pp. 1-20.

Skelton, Edward C., 2008, "Reaching Mexico's Unbanked," *Economic LetterInsights from the Federal Reserve Bank of Dallas*, Vol. 3, No. 7.

Spilimbergo, Antonio, Steven A. Symansky, and Martin Schindler, 2009, "Fiscal Multipliers." IMF Staff Position Note, SPN/09/22.

Stockman, Alan C., and Linda L. Tesar, 1995, "Tastes and Technology in a Two-Country Model of the Business Cycle: Explaining International Comovements," *American Economic Review*, Vol. 85, No. 1, pp. 168-185.

Uribe, Martin, and Vivian Yue, 2006, "Country Spreads and Emerging Countries: Who Drives Whom?," *Journal of International Economics*, Vol. 69, No. 1, pp. 6-36.