Government Spending Effects in Small Open Economies with Limited Capital Mobility

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Motivation

How big are fiscal multipliers?

- degree of real and nominal rigidities, preferences, fraction of hand-to-mouth consumers, fiscal adjustment, monetary policy

The uncertainty regarding the size of fiscal multipliers in small open economy is even greater.

Ilzetzki, Mendoza and Vegh (2010)

- degree of openness, composition of government spending, exchange rate regime, debt level
**Motivation**

Is there a strong link between a national economy’s current account deficit and fiscal deficit (Twin Deficits)?

- Yes, very strong. (Kumhof and Laxton (2009), Abbas (2011))

- No, very small. (Erceg, Guerrieri and Gust (2005), Forni (2010))

- It depends. (Corsetti and Muller (2006))
Modeling Objectives

- Understand under what conditions small-open economies have larger fiscal multipliers.
- Investigate twin-deficit hypothesis for small-open economies.
Main Channels

In closed economy, unproductive government spending works through:

- intertemporal effect
- intratemporal effect

In open economy, what’s more?

- real interest rate channel — openness in capital market
- real exchange rate channel — openness in goods market
Main Results on Fiscal multipliers

Fiscal multipliers tend to be smaller if

- less home bias in government purchases
- less nominal rigidities in non-traded goods
- more flexible exchange rate regime
- more debt
Main Results on Twin-Deficit Hypothesis

Twin deficits tend to be larger if

- fiscal deficits is financed by external debt
- more open private capital account
Model Features

- **Standard Real Frictions**
  - habit formation, investment adjustment cost, hand to mouth consumers

- **Standard Nominal Frictions**
  - price rigidity, wage rigidity

- **Open Economy Features**
  - foreign borrowing of the government, capital account openness, exchange rate regime

- Interaction among fiscal, monetary and reserve policies
The savers $j \in [0, f]$ maximize the expected utility,

$$E_t \sum_{t=0}^{\infty} \beta^t \left[ u^a(c^a_t(j), m^a_t(j)) - \frac{\kappa^a}{1 + \psi^a} (l^a_t(j))^{1+\psi^a} \right]$$

(1)

The utility function takes the form

$$u^a(c^a_t, m^a_t) = \frac{1}{1 - \sigma} \left\{ \left[ \psi^a (c^a_t(j) - \gamma c^a_{t-1}(j)) \frac{n-1}{n} + (1 - \psi^a) (m^a_t(j)) \frac{n-1}{n} \right] \frac{n}{n-1} \right\}^{1-\sigma}$$

(2)
subject to the budget constraint

\[
\begin{align*}
&c_t^a(j) + m_t^a(j) + I_t^a(j) + b_t^a(j) + s_t b_t^a(j) + \\
&\frac{v}{2} s_t (b_t^a(j) - b_t^a(j))^2 + \frac{s_w}{2} \left( \frac{W_t(j)}{W_{t-1}(j)} - n\pi \right)^2 \frac{W_t l_t^a}{P_t} = \\
&(1 - \tau_t) \frac{W_t(j)}{P_t} l_t^a(j) + (1 - \tau_t) R_t^k k_{t-1}^a(j) + \frac{m_{t-1}^a(j)}{n\pi_t} + \frac{i_{t-1} b_{t-1}^a(j)}{n\pi_t} + \\
&s_t i_{t-1}^* \frac{b_{t-1}^a}{n\pi^*} + s_t r m^* + z_t
\end{align*}
\]
Households: Savers

Households supply differentiated labor inputs to a representative labor aggregator who groups the savers’ labor hours in the same proportions that firms would choose:

\[
l^a_t = \left[ \int_0^1 l^a_t(j) \frac{\tilde{\theta} - 1}{\tilde{\theta}} \, dj \right]^{\frac{\tilde{\theta}}{\tilde{\theta} - 1}}
\]  

(4)

The competitive labor aggregator’s demand function comes from solving its profit maximization problem subject to (4), to yield,

\[
l^a_t(j) = \left( \frac{W_t(j)}{W_t} \right)^{-\tilde{\theta}} l^a_t
\]  

(5)

Wage rigidity is introduced by quadratic adjustment cost of nominal wages

\[
\frac{\zeta w^2}{2} \left( \frac{W_t(j)}{W_{t-1}(j)} - n\pi \right)^2 \frac{W_t l^a_t}{P_t}.
\]
Households: Savers

The law of motion for private capital is given by:

\[ nk^a_t(j) = (1 - \delta)k^a_{t-1}(j) + \left[ 1 - \frac{\kappa^k}{2} \left( \frac{I^a_t(j)}{I^a_{t-1}(j)} - 1 \right)^2 \right] \]  

(6)

Both capital and labor are imperfectly substitutable between sectors,

\[ k^a_t = \left[ (\delta^k)^{-\frac{1}{\epsilon^k}} \left( k^aN_t \right)^{\frac{1+\epsilon^k}{\epsilon^k}} + (1 - \delta^k)^{-1} \left( k^aT_t \right)^{\frac{1+\epsilon^k}{\epsilon^k}} \right]^{\frac{\epsilon^k}{1+\epsilon^k}} \]  

(7)

\[ l^a_t = \left[ (\delta^l)^{-\frac{1}{\epsilon^l}} \left( l^aN_t \right)^{\frac{1+\epsilon^l}{\epsilon^l}} + (1 - \delta^l)^{-1} \left( l^aT_t \right)^{\frac{1+\epsilon^l}{\epsilon^l}} \right]^{\frac{\epsilon^l}{1+\epsilon^l}} \]  

(8)
Households: Savers

Composite consumption is the numeraire

\[ c_t^a = \left[ \varphi \frac{1}{x} \left( c_t^{aN} \right)^{\frac{x-1}{x}} + (1 - \varphi) \frac{1}{x} \left( c_t^{aT} \right)^{\frac{x-1}{x}} \right]^{\frac{x}{x-1}} \]  \tag{9}

The price of 1 unit of composite consumption

\[ 1 = \left[ \varphi \left( p_t^N \right)^{1-x} + (1 - \varphi) \frac{1}{x} \left( s_t \right)^{1-x} \right]^{\frac{1}{1-x}} \]  \tag{10}

- \( p_t^N \): relative price of non-traded to composite consumption
- \( s_t \): relative price of traded; assume the law of one price holds \( (P_t^T = S_t P_t^*) \); \( s_t \) is also the real exchange rate
Hand-to-mouth households (fraction $1 - f$) have the same utility function with the budget constraint

$$c_t^h + m_t^h = (1 - \tau_t) \frac{W_t}{P_t} l_t^h + \frac{m_{t-1}^h}{n \pi_t} + s_t r m^* + z_t.$$  \hspace{1cm} (11)

Hand-to-mouth households set their wage to be the average wage of the savers.
Non-Traded Good Sector

Production

\[ y_t^N (i) = z^N \left( k_{t-1}^N (i) \right)^{1-\alpha^N} \left( l_t^N (i) \right)^{\alpha^N} \]  \quad (12)

Maximize profit

\[
E_t \sum_{t=0}^{\infty} \beta^t \lambda_t^a \times \left\{ \left( 1 - \iota \right) \left[ p_t^N (i) y_t^N (i) - \frac{s^p}{2} \left( \frac{\pi_t^N (i)}{\pi_{t-1}^N (i)} - 1 \right)^2 p_t^N y_t^N \right] - \omega_t^N l_t^N (i) - R_t^N k_{t-1}^N (i) + \nu p_t^N y_t^N \left[ 1 - \frac{s^p}{2} \left( \frac{\pi_t^N}{\pi_{t-1}^N} - 1 \right)^2 \right] \right\}
\]  \quad (13)

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Traded Good Sector

Production

\[ y_t^T (i) = z_t^T (k_{t-1}^T (i))^{1-\alpha^T} (l_t^T (i))^\alpha^T \]  

(14)

Learning-by-doing externalities

\[ \ln z_t^T = \rho_{zT} \ln z_{t-1}^T + d \ln y_{t-1}^T. \]  

(15)

Maximize profit

\[ E_t \sum_{t=0}^{\infty} \beta^t \lambda_t^a \left[ (1 - \nu) s_t y_t^T (i) - w_t^T l_t^T (i) - R_t^T k_{t-1}^T (i) + \nu s_t y_t^T \right] \]  

(16)
Government

Government budget constraint

\[ \tau_t w_t L_t + \tau_t R_t^k K_{t-1} + B_t^c + B_t^{cb} + B_t^F - \left( D_t^G - \frac{D_{t-1}^G}{n\pi_t} \right) + s_t A^* = \]

\[ p_t^g G_t + Z_t + \frac{i_{t-1} B_{t-1}^c}{n\pi_t} + \frac{B_{t-1}^{cb}}{n\pi_{t-1}} + s_{t-1} i_{t-1}^{\ast} \frac{B_{t-1}^F}{n\pi_{t-1}} \]

Total government purchases \( G_t \) is a CES basket that includes traded and non-traded goods,

\[ G_t = \left[ \nu_t^\chi \left( G_t^N \right)^{\frac{x-1}{x}} + (1 - \nu_t)^\chi \left( G_t^T \right)^{\frac{x-1}{x}} \right]^{\frac{x}{x-1}}, \]

\( \nu_t \) can be time-varying when home bias in government spending shocks \( \nu_g \) deviate from the steady state home bias \( \nu \).

\[ \nu_t = \nu + \frac{p_t^g G_t - p_{t-1}^g G_t}{p_t^g G_t} (\nu_g - \nu) \]
Fiscal Policy

Fiscal Rules:

\[ \hat{G}_t = \rho_G \hat{G}_{t-1} + \varepsilon_t^G \]  
\[ \hat{Z}_t = \rho_z \hat{Z}_{t-1} - \gamma_z \hat{s}_t^b \]  
\[ \hat{\tau}_t = \rho_{\tau} \hat{\tau}_{t-1} - \gamma_{\tau} \hat{s}_t^b \]

- \( \hat{s}_t^b \): debt/GDP ratio

Government debt includes both internal debt and external debt

\[ \phi \hat{b}_t = \frac{B^f}{B} \hat{b}_t^f \]
The central bank’s balance sheet is

\[ m_t - \frac{m_{t-1}}{n\pi_t} + D_t^G - \frac{D_{t-1}^G}{n\pi_t} = B_t^{cb} - \frac{B_{t-1}^{cb}}{n\pi_t} + s_t \left( R_t^* - \frac{R_{t-1}^*}{n\pi_t^*} \right) \]  \( (24) \)

The reserve policy follows the process

\[ R_t^* = (1 - \rho_R) R_t^* + \rho_R R_{t-1}^* - \omega^S(\pi_t^S - \pi^S) \]  \( (25) \)

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

\[ m_t = \frac{m_{t-1}}{n\pi_t} \left[ (1 + \mu) \left( \frac{\pi_t}{\pi} \right)^{-\phi_\pi} - 1 \right], \]  \( (26) \)
Aggregation and Identities

Let $X_t$ denote the aggregate quantity of a variable. Then,

$$X_t = f x_t^a + (1 - f) x_t^h, \quad x \in \{c, c^N, c^T, k, m, l, rm^*, b^*, b^c\}$$  

(27)

Current account deficits ($CA_t^d$) of the model economy are

$$CA_t^d = \left[C_t + I_t + p_t^G G_t + \frac{s^w}{2} \left( \frac{W_t(j)}{W_{t-1}(j)} - n\pi \right)^2 \frac{W_t l_t^a}{P_t} + \frac{\zeta}{2} \left( \frac{\pi_t^N}{\pi_{t-1}^N} - 1 \right)^2 p_t^N y_t^N \right]$$

$$- p_t^N y_t^N - s_t y_t^T - s_t(i_t^* - 1) \frac{B_{t-1}^* - B_{t-1}^F}{n\pi^*} - s_t rm^*$$

(28)

The balance of payment condition is

$$s_t \left( A^* - \frac{v}{2} (B_t^* - B^*)^2 \right) = CA_t^d + s_t \left[ (B_t^* - \frac{B_{t-1}^*}{n\pi^*}) - (B_t^F - \frac{B_{t-1}^F}{n\pi^*}) + (R_t^* - \frac{R_{t-1}^*}{n\pi^*}) \right]$$

(29)
## Baseline Calibration

<table>
<thead>
<tr>
<th>parameters</th>
<th>values</th>
<th>notes</th>
</tr>
</thead>
</table>
| $\gamma$  | 0.5    | habit persistence for C  
| $f$        | 0.5    | fraction of savers  
| $\varrho^l$ | 1      | elasticity of substitution b/w the two types of labor  
| $\varrho^k$ | 0.2    | elasticity of substitution b/w the two types of labor  
| $\varsigma^p$ | 65    | implying the prices are sticky for almost one year  
| $\varsigma^w$ | 145   | implying the wages are sticky for almost one year  
| $\iota$    | 0.015  | investment distortion parameter  
| $\varphi$  | 0.51   | degree of home bias in C: $\frac{C^N}{C}$  
| $\chi$     | 0.63   | elasticity of substitution b/w traded and non-traded  
| $\nu$      | 0.7    | steady state home bias of government purchases  
| $\nu$      | 10     | implying relatively closed capital account for the private sector  
| $s^B$      | 0.2    | steady-state debt-to-GDP ratio  
| $s^B_f$    | 0.08   | steady-state external-debt-to-GDP ratio  
| $\omega$   | 0      | flexible nominal exchange rate regime  
| $\phi$     | 0      | proportion of external debt  
| $\phi_\pi$ | 2.5    | parameter to adjust interest rate to target CPI  

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*Government Spending Effects in Small Open Economies with Limited Capital Mobility*
Baseline Simulation

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Baseline Model Features

- home bias of government spending is 0.7
- relatively closed private capital account
- flexible exchange rate
- fiscal deficit financed by internal debt
- debt stabilized by transfer
More home-bias in government spending:

- Increases the demand on non-traded goods, raises overall CPI inflation and real interest rate.

- Increases wages in non-traded sector, drives up income and consumption of hand-to-mouth consumers.

- Decreases the relative price of tradable to non-tradable, appreciates domestic currency.
The Composition of Government Spending

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Nominal Rigidities

Less nominal rigidity in non-traded sector:

- higher price of non-tradable produces a greater crowding out effect

- labor demand in non-traded sector does not increase as much, decreases hours worked

- a lower relative price of tradable to non-tradable further appreciates real exchange rate
Nominal Rigidities

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Exchange Rage Regime

- Fiscal expansion raise interest rate, creates pressure to appreciate the domestic currency

- Reserve is accumulated to prevent this appreciation, improve current account balance

- More overall inflation together with higher interest rate lower consumption and investment, increases labor supply through wealth effect
Public Capital Account Openness

If the capital account is relatively open, a less enduring increase in interest rates results,

- Soften the crowding out effect on investment and consumption.
- Strengthen the impact on the currency and trade balance.

Higher current account deficit results smaller fiscal multiplier.
Public Capital Account Openness

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Government Spending Effects in Small Open Economies with Limited Capital Mobility
Private Capital Account Openness

Similar to open public capital account

- Soften the crowding out effect on investment and consumption.
- Strengthen the impact on the currency and trade balance.

The multiplier effect is compromised by current account deficits.
Private Capital Account Openness

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Multiplier and Twin Deficits

Present-value, cumulative output multiplier

\[
\sum_{h=0}^{k} \left( \prod_{j=0}^{h} i_{t+j}^{-1} \right) \Delta Y_{t+h} \\
\sum_{h=0}^{k} \left( \prod_{j=0}^{h} i_{t+j}^{-1} \right) \Delta G_C^{t+h}
\]

Twin deficits (in levels)

\[
\frac{CAD}{FD}
\]
## Model Comparison

<table>
<thead>
<tr>
<th>Model</th>
<th>1 year</th>
<th>2 years</th>
<th>5 years</th>
<th>20 years</th>
<th>twin deficits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>0.81</td>
<td>0.67</td>
<td>0.46</td>
<td>0.24</td>
<td>–</td>
</tr>
<tr>
<td>More Home Bias in G</td>
<td>0.91</td>
<td>0.74</td>
<td>0.51</td>
<td>0.28</td>
<td>–</td>
</tr>
<tr>
<td>Less Nominal Rigidity</td>
<td>0.75</td>
<td>0.64</td>
<td>0.43</td>
<td>0.20</td>
<td>–</td>
</tr>
<tr>
<td>Fixed Exchange Rate</td>
<td>0.87</td>
<td>0.75</td>
<td>0.51</td>
<td>0.22</td>
<td>–</td>
</tr>
<tr>
<td>External Debt (50%)</td>
<td>0.55</td>
<td>0.43</td>
<td>0.35</td>
<td>0.29</td>
<td>0.50</td>
</tr>
<tr>
<td>Open Private Capital Account</td>
<td>0.74</td>
<td>0.64</td>
<td>0.44</td>
<td>0.22</td>
<td>0.16</td>
</tr>
</tbody>
</table>

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Government Spending Effects in Small Open Economies with Limited Capital Mobility
Conclusion

- This model is able to match the empirical evidence of fiscal multipliers in small open economy.

- This model is able to justify twin deficits hypothesis under certain conditions.

- This model is able to investigate the relationship between fiscal multiplier and twin deficits.