On the International Dimension of Fiscal Policy

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Motivation

- How should fiscal policy be conducted in an open economy?
  - Is the prescription different than the case of closed economies?
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- What is the optimal level of tax smoothing?
  - Does the answer depend on the optimal level of exchange rate volatility?
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- From a positive perspective, transmission mechanism of fiscal shocks might depend on exchange rate fluctuations.
Motivation (2):
Complementing the literature

- Neoclassical literature on optimal fiscal policy has focused mainly on closed economy models
  - when taxes are distortionary, taxes should be smoothed over time and across states of nature
  - If possible, taxes would be essentially invariant (see Lucas and Stokey, 1983 and Chari, Christiano and Kehoe, 1991) or would follow a random walk (see Barro, 1979, Aiyagari et al. 2002).
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- Open economy models have concentrated in the analysis of monetary policy
  - Obstfeld and Rogoff (2002), Gali and Monacelli (2005) isomorphism result between optimal policy in open and closed economy
  - Corsetti&Pesenti (2001)/Benigno&Benigno (2003)/De Paoli (2008)-presence of terms of trade externality eliminates the result
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- Bridging the gap...
Approach

- Theoretical, normative analysis of fiscal policy
- Formalize a small open economy with endogenous fiscal policy
- Characterize a utility based loss function each specification
- Derive the optimal fiscal policy (also look at the planner’s problem)
- Analyse the implication for tax and exchange rate volatility
Anticipating the results

- Our analysis shows that in a small open economy optimal policy departs from tax smoothing.
- As emphasised in the optimal monetary policy literature policymakers in open economies are influenced by a “terms of trade externality”.

- E.g. In an open economy that is a monopolist producer of its own goods, a real exchange rate appreciation can lead to higher welfare by allowing domestic agents to consume more for lower levels of domestic production.
- Thus, policymakers have an incentive to use fiscal policy to exploit this externality.
- As a result, distortionary taxes vary over time and across states of nature.
- When we consider the joint fiscal and monetary policy problem, there is a trade-off between price stability and tax-smoothing that arises from the terms of trade externality. Quantitatively cost of inflation are high and optimal inflation volatility is low.
2-country DSGE model ⇒ small open economy

Home bias ⇒ deviations from PPP

Monopolistic competition and nominal rigidities a la Calvo ⇒ Role for monetary policy

Preferences ⇒ allow for trade imbalances

Fiscal authority issues nominal debt and set income taxes (extension includes the case of indexed linked debt)

Stochastic environment: domestic and foreign productivity shocks, markup and fiscal shocks
The model:

Preferences

Utility (country \( H \) – measure \( n \))

\[
U_t = E_t \sum_{s=t}^{\infty} \beta^{s-t} \left[ U(C_s) - V(y(h)_s, \varepsilon_Y,s) \right]
\]

\[
U_t = E_t \sum_{s=t}^{\infty} \beta^{s-t} \left[ \log C_s - \frac{1}{n} \int_0^n \varepsilon_{Y,s}^{-\eta} y(h)_s^{1+\eta} \right]
\]

Home bias (Sutherland 2001)

\[
C = \left[ v^{\frac{1}{\theta}} C_H^{\frac{-1}{\theta}} + (1-v)^{\frac{1}{\theta}} C_F^{\frac{-1}{\theta}} \right]^{\frac{\theta}{\theta-1}}
\]

\((1 - v) = (1 - n) \lambda\) and \(v^* = n \lambda\)

\[
C_H = \left[ \left( \frac{1}{n} \right)^{\frac{1}{\sigma}} \int_0^n c(z) z^{-\frac{1}{\sigma}} \, dz \right]^{\frac{\sigma}{\sigma-1}}
\]
The model: Relative prices and demand

Law of one price: \( p(z) = S \cdot p^*(z) \).

Home bias ⇒ PPP does not hold: \( Q_t \equiv S_t P_t^*/P_t \)

SOE demand

\[
y_t(h) = \left( \frac{p_t(h)}{P_{H,t}} \right)^{-\sigma} \left( \frac{P_{H,t}}{P_t} \right)^{-\theta} \left( (1 - \lambda) C_t + \lambda \left( \frac{1}{Q_t} \right) C_t^* \right)
\]

RoW demand

\[
y_t(f) = \left( \frac{p_t^*(f)}{P_t^*} \right)^{-\sigma} C_t^*
\]
The model:

Asset markets

Complete markets

\[
\frac{U_C(C^*_{t+1})}{U_C(C^*_t)} = \frac{U_C(C_{t+1})}{U_C(C_t)} \frac{Q_{t+1}}{Q_t}
\]
The model: Fiscal Policy

Government issues one period nominal risk free bonds expressed in local currency units, collects taxes and faces exogenous expenditure streams. Government debt $D^n_t$, expressed in nominal terms, follows the law of motion:

$$D^n_t = D^n_{t-1}(1 + i_{t-1}) - P_{H,t} s_t$$

where $s_t$ is the real primary budget surplus:

$$s_t \equiv \tau_t Y_t - G_t - Tr_t$$

The case real bonds:

$$D^r_t = D^r_{t-1}(1 + i^r_{t-1}) + \frac{P_{H,t}}{P_t} s_t$$

(1)
Firms’ behavior (flexible prices)
Set prices as a markup over marginal costs

\[ p_{H,t} = \frac{\sigma m u_t}{(1 - \tau_t)(\sigma - 1)} \frac{V_y(Y_t, \varepsilon_Y,t)}{U_c(C_T)} \]
Social planner vs. competitive allocation

Understanding the policy incentive:

- Planner problem (maximizes agents’ utility subject to resource constraint and complete markets assumption):

  \[ p_{H,t} U_c(C_t) = Q(RS_t) V_y(Y_t, \varepsilon_Y, t) \]

  Competitive equilibrium:

  \[ p_{H,t} U_c(C_t) = \frac{\sigma m_u t}{(1 - \tau_t)(\sigma - 1)} V_y(Y_t, \varepsilon_Y, t) \]

- Efficiency condition

  \[ \frac{\sigma m_u t}{(1 - \tau_t)(\sigma - 1)} Q(RS_t) = 1 \]

  \[ \Rightarrow \] Movements in the tax rate, in the real exchange rate, and markup shocks generate inefficiencies (i.e. competitive equilibrium departs from planner’s problem)
Social planner vs. competitive allocation (2)

- Efficiency condition

\[
\frac{\sigma \mu_t}{(1 - \tau_t)(\sigma - 1)} Q(RS_t) = 1
\]

- Closed economy

\[
\frac{\sigma \mu_t}{(1 - \tau_t)(\sigma - 1)} = 1
\]

Tax smoothing is optimal when there are no markup shocks

- Steady state tax subsidy eliminates steady-state distortion

\[
\bar{\tau} = -\frac{1}{\sigma - 1}
\]

(assuming \( \mu = 1 \))

- Open economy tax smoothing no longer optimal

- Steady state optimal tax depends on degree of openness and substitutability between goods

\[
\bar{Q}(\lambda, \rho, \theta)
\]
Understanding the ToT externality

- $\theta \rho > 1$: real exchange rate appreciation (or ToT improvement) increases welfare/reduces loss
- Substitute goods: appreciation decreases $C_H$ but increases $C_F$ - reduction in $U(C)$ smaller than in $V(Y)$
- Complement goods: appreciation cannot divert consumption towards foreign goods (decrease in $C_H$ accompanied by decrease in $C_F$)
- $\theta \rho < 1$: depreciation improve welfare $\Rightarrow$ leads to higher $C_H$ that increases marginal utility of $C_F$: $U(C) \uparrow > V(Y) \uparrow$
- Externality only eliminated only when the economy is closed ($\lambda = 0$) or when $\theta \rho = 1$ - in this case marginal utility of $C_H$ independent of $C_F$, and vice-versa
Linear Quadratic Approach:

Motivation

- Efficiency condition can pin down the optimal level of taxes in the case of nominal bonds
  ⇒ Set taxes to eliminate difference between social planner and competitive equilibrium
  ⇒ Government solvency condition satisfied given inflation can replicate state contingent debt
- But in the case of real bonds this is not the case
- Have to solve system of non-linear equations
- Linear quadratic loss function can also help policy implementation
Linear Quadratic Approach:

Loss function

- Agent’s Utility ⇒ Welfare metric
- Method of Benigno & Woodford (2003), Sutherland (2002)

\[
\min U_c \mathcal{C}E_{t_0} \sum \beta^t \left[ \frac{1}{2} \Phi_\tau (\hat{\tau}_t - \hat{\tau}_t^T)^2 + \frac{1}{2} \Phi_{RS} \hat{r}_s^2_t \right] + t.i.p + O(||\xi||^3),
\]

- Closed economy

\[
\min U_c \mathcal{C}E_{t_0} \sum \beta^t \left[ \frac{1}{2} \Phi_\tau (\hat{\tau}_t - \hat{\tau}_t^T)^2 \right] + t.i.p + O(||\xi||^3),
\]

- Open economy: \( \Phi_{RS} \hat{r}_s^2_t \) arises given the terms of trade externality
- Corsetti and Pesenti (2001): improvements in ToT ⇒ allow larger consumption for a given level of labour effort (or domestic production)
Optimal Policy:
The case of nominal debt

- Optimal targeting rule

\[ \Phi_{RS} \hat{\rho}_t + \frac{(1 + l)}{\rho(1 - \lambda)} \Phi_{\tau}(\hat{\tau}_t - \hat{\tau}_T') = 0. \]

- Closed economy:

\[ \hat{\tau}_t - \hat{\tau}_T' = 0. \]

Taxes are constant when \( \hat{\tau}_T' = 0 \) \( \Rightarrow \) when there are no markup shocks and the steady state is efficient.
Optimal Policy:
Closed economy with nominal debt

[Graph showing the relationship between steady state markup and Sdv tax rate relative to output with and without markup shocks.]
Optimal Policy:
Open economy with nominal debt

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Optimal Policy:
Open economy with nominal debt (efficient steady state and no markup shocks)
Optimal Policy:
Open economy with real debt (efficient steady state and no markup shocks)
Optimal Policy: Sticky prices targeting rules

Firms set prices following partial adjustment rule a la Calvo
Loss function now depends also on domestic producer inflation
General forms of targeting rules

\[
\left[ \frac{(1 + l) \Phi_y}{(1 - \lambda) \rho} \right] \Delta \hat{y}_t + \Phi_{RS} \Delta \hat{s}_t + \left[ \frac{k \Phi_\pi}{(1 - \bar{\tau}) + b d_{ss} k} \right] (\gamma \hat{\pi}^H_t + d_{ss} (a + 1) \hat{\pi}^H_{t-1}) = 0
\]

\[
E_t \hat{\pi}^H_{t+1} = 0,
\]
Optimal Policy: Sticky prices targeting rules

Figure: Figure 5

Standard Deviation of the Tax Rate

\( \sigma(t) \)

\( x \times 10^{-3} \)

\( \alpha \)

\( 0.1 \) to \( 0.9 \)

Figure: Figure 5
Concluding remarks

- Simple framework for fiscal policy in open economy
- Normative analysis: Fiscal policy problem in an open economy ≠ closed economy
  - Optimal tax variability in an open economy ≠ closed economy
  - Optimal steady state tax in an open economy ≠ closed economy
- Reason: incentive to use taxes to affect the terms of trade
- Fiscal policy efficiency depends on the type of debt.