Sharing the Burden: Monetary and Fiscal Responses to a World Liquidity Trap

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Global Policy Responses to a Liquidity Trap

- Paper looks at optimal fiscal and monetary policy in global liquidity trap
- Large negative demand shock emanating from one country
- Pushes down world 'natural real interest rates'
- Standard tools of monetary policy cannot achieve first best
- How should monetary and fiscal policy be jointly used?
  - What should be global response?
  - How should the response be borne across individual countries?

Background

Motivation: Policy

- Great recession caused large fall in demand in US; heterogeneous affect on other countries
- Reduced policy interest rates globally
- Led to disparate responses of fiscal policy
- Return to positive interest rates at different rates

Motivation: Theory
(Krugman, 1999, Eggertson and Woodford, 2003, Jung et al. 2005)

- Literature focuses on zero bound constraint in one country
- Looks at monetary fiscal mix responses
- In situation of global LT with heterogenous affects
  - Monetary-fiscal mix becomes more complicated
  - Standard description of monetary policy may not be optimal

$$r_t = \max(0, \tilde{r}_t)$$

Main Results

Focus on shock differentially hitting one country

- When trade is fully open (no home bias)
  - Liquidity traps are global - all countries identically affected
  - Under discretion - only option is coordinated expansionary fiscal expansion
- With less than full trade openness countries differentially affected
  - Exchange rate plays a destabilizing role in liquidity trap
  - Optimal cooperative monetary policy may be for for monetary contraction in foreign country
  - Optimal fiscal responses depends critically upon monetary responses

Model Description

Standard Two Country New Keynesian Model:

- Complete Assets Markets
- Calvo Price Adjustment
- Private and Public Goods Production
- Time Preference Shocks

Model

Home Preferences

$$U_t = E_0 \sum_{t=0}^{\infty} (U(C_t, \xi_t) - V(N_t) + J(G_t))$$

ξ_t is a preference shock, and $U_{12} > 0$

Composite consumption defined as

$$C_t = \Phi C_{Ht}^{v/2} C_{Ft}^{1-v/2}, \quad v \geq 1$$

Simplifying assumptions for analytical solution

Standard Euler equations, labor supply, price setting

Natural Real Interest Rates

For any variable x_t, define the world average and world relative level, $x_t^W = \frac{x_t + x_t^*}{2}$ and $x_t^R = \frac{x_t - x_t^*}{2}$.

Wicksellian ('natural') real interest rates are a function of the demand shocks

Shock continues (ends) with probability μ, $(1-\mu)$

$$\widetilde{r}_t = \overline{r} + \left(\frac{\phi c_y}{\phi + \sigma} \varepsilon_t^W + \frac{\phi c_y (\upsilon - 1)}{\Delta} \varepsilon_t^R \right) (1-\mu)$$

$$\widetilde{r}_t^* = \overline{r} + \left(\frac{\phi c_y}{\phi + \sigma} \varepsilon_t^W - \frac{\phi c_y (\upsilon - 1)}{\Delta} \varepsilon_t^R \right) (1-\mu)$$

For $\upsilon = 1$, natural real interest rates are identical
Take shock from Home country $\varepsilon_t^* = 0$ and $\varepsilon_t^W = \varepsilon_t^R = \frac{\varepsilon_t}{2}$

World Averages and Relatives:

Averages:

$$\pi_t^W = k(\phi + s)\widehat{n}_t^W - ks \cdot \widehat{cg}_t^W + \beta E_t \pi_{t+1}^W$$

$$sE_t(\widehat{n}_{t+1}^W - \widehat{n}_t^W) - sE_t(\widehat{cg}_{t+1}^W - \widehat{cg}_t^W) = E_t\left(r_t^W - \widetilde{r}_t^W - \pi_{t+1}^W\right)$$

Relatives:

$$\pi_t^R = k(\phi + s_D)\widehat{n}_t^R - ks_D\widehat{cg}_t^R + \beta E_t \pi_{t+1}^R$$

$$s_D E_t(\widehat{n}_{t+1}^R - \widehat{n}_t^R) - s_D E_t(\widehat{cg}_{t+1}^R - \widehat{cg}_t^R) = E_t\left(r_t^R - \widetilde{r}_t^R - \pi_{t+1}^R\right)$$

$\widehat{cg}_t^i \equiv (1 - c_y)\widehat{g}_t^i$, $i = W, R$, $s_D < s$; relative vs world elasticity

Policy rates should target natural real interest rates

Write natural real interest rates as

$$\tilde{r}_t = \widetilde{r}(\varepsilon_t, v), \quad \tilde{r}^*_t = \widetilde{r}^*(\varepsilon_t, v)$$

- If $\tilde{r}_t > 0$, $\tilde{r}^*_t > 0$, then optimal policy is

$$r_t = \tilde{r}_t, \quad r^*_t = \tilde{r}^*_t, \quad g_t = g^*_t = 0$$

- Then no gain for cooperation in policy
- Fiscal policy should close all gaps

Zero lower bound on policy rates

Now define

$$\varepsilon_H(v) < 0, \text{ such that } \widetilde{r}(\varepsilon_H, v) = 0$$

Clearly

$$\varepsilon_H(v) \geq \varepsilon_F(v), \text{ with strict inequality when } v > 1$$

Home has zero natural rate before foreign

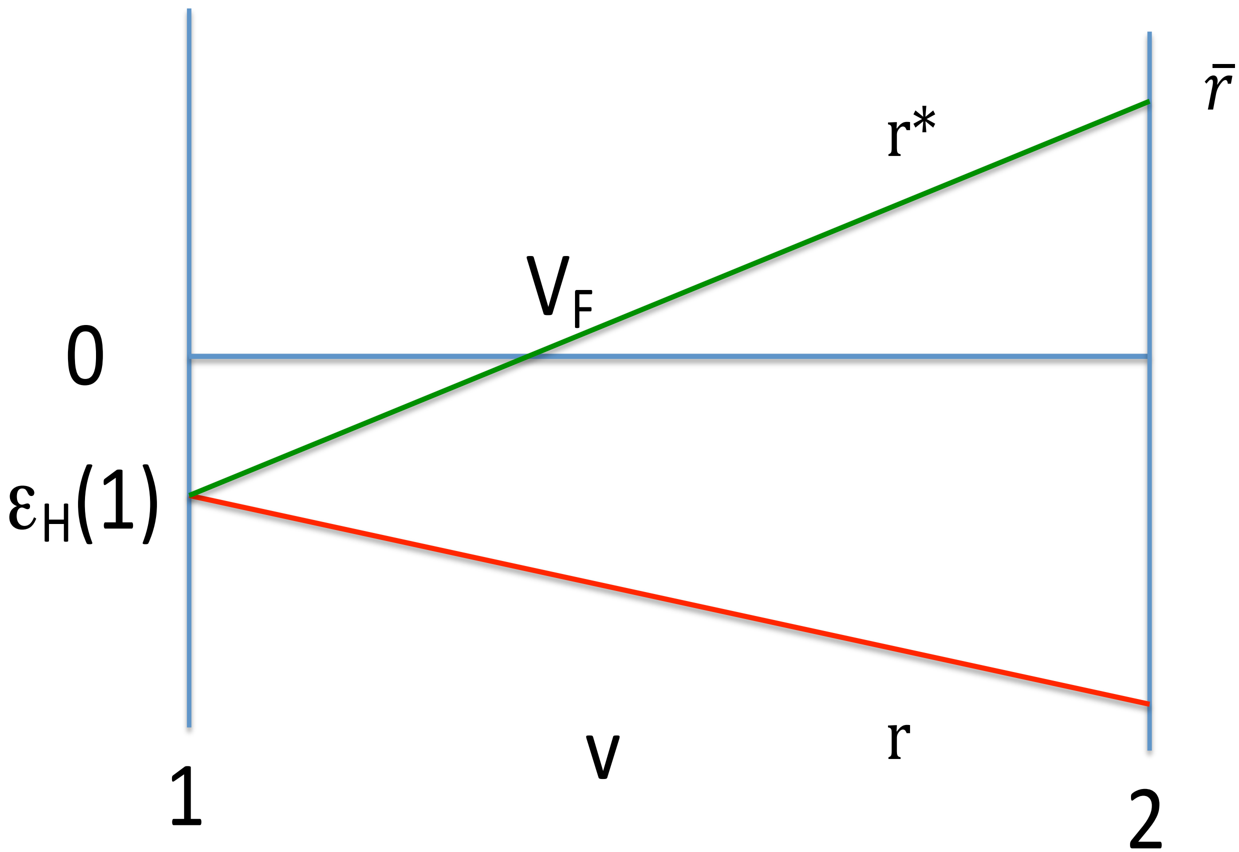
Assume now that

$$\varepsilon_t < \varepsilon_H(1)$$

Thus, $\tilde{r}(\varepsilon_t, v) < 0$ and cannot close all gaps

Threshold on foreign natural real interest rate

Define v_F s.t. $\tilde{r}^*(\varepsilon_t, v_F) = 0$



Stance of Monetary Policy

- What is the optimal monetary policy?
- Focus on monetary policy under discretion
- Conjecture that the optimal monetary rule is:

$$r_t = \max(0, \widetilde{r}_t), \qquad r_t^* = \max(0, \widetilde{r}_t^*)$$

- Natural extension of the optimal monetary rule in the closed economy
- Call this the 'conventional' monetary policy

Under this conjecture, look at effect of demand shocks

Case 1. For $v \leq v_F$, we have

$$\widehat{n}_t = (1 - \beta\mu)\left[\frac{\widetilde{r}_t^W}{\Delta_2} + \frac{\widetilde{r}_t^R}{\Delta_2^D}\right]$$

$$\widehat{n}_t^* = (1 - \beta\mu)\left[\frac{\widetilde{r}_t^W}{\Delta_2} - \frac{\widetilde{r}_t^R}{\Delta_2^D}\right]$$

In this case, the home output gap must fall, while the foreign output gap may rise or fall, depending on the size of v.

Effect of Demand Shocks

Case 2. For $v > v_F$, we have $\widetilde{r}_t^W = \widetilde{r}_t^R = \frac{\widetilde{r}_t}{2}$. Then we get:

$$\widehat{n}_t = (1 - \beta\mu)\widetilde{r}_t \left[\frac{1}{\Delta_2} + \frac{1}{\Delta_2^D} \right]$$

$$\widehat{n}_t^* = (1 - \beta\mu)\widetilde{r}_t \left[\frac{1}{\Delta_2} - \frac{1}{\Delta_2^D} \right]$$

Again, the home output gap must fall. But in this case, the foreign output gap will always *rise*, because, from the definitions above, we have $\Delta_2 > \Delta_2^D$.

Significant asymmetries in effects when $v > 1$

Due to pathological effect of real exchange rate

Demand shock causes real exchange rate *appreciation*

In a liquidity trap, exchange rate response is exacerbating, not mitigating

Intuition

- Deflation in the home country raises home real interest rate
- Must generate expected terms of trade depreciation
- Hence immediate appreciation

$$i_t - E_t\pi_{t+1} = i_t^* - E_t\pi_{t+1}^* + E_{t+1}(\tau_{t+1} - \tau_t)$$

But is the conventional monetary policy optimal?

Look at cooperative monetary policy under discretion
Choose $\widehat{n}_t^W, \widehat{n}_t^R, \pi_t^W, \pi_t^R, r_t, r_t^*$ to:

$$
\begin{aligned}
\max L_t \quad = \quad & -(\widehat{n}_t^R)^2 \frac{A}{2} - (\widehat{n}_t^W)^2 \frac{B}{2} - \frac{\theta}{4k}(\pi_t^W + \pi_t^R)^2 - \frac{\theta}{4k}(\pi_t^W - \pi_t^R)^2 \\
& + \lambda_{1t}\left[\pi_t^W - k(\phi + s)\widehat{n}_t^W - \beta E_t \pi_{t+1}^W\right] \\
& + \lambda_{2t}\left[\pi_t^R - k(\phi + s_D)\widehat{n}_t^R - \beta E_t \pi_{t+1}^R\right] \\
& + \psi_{1t}\left[sE_t(\widehat{n}_{t+1}^W - \widehat{n}_t^W) - E_t\left(\frac{r_t + r_t^*}{2} - \widetilde{r}_t^W - \pi_{t+1}^W\right)\right] \\
& + \psi_{2t}\left[s_D E_t(\widehat{n}_{t+1}^R - \widehat{n}_t^R) - E_t\left(\frac{r_t - r_t^*}{2} - \frac{\widetilde{r}_t^R}{2} - \pi_{t+1}^R\right)\right] \\
& + \gamma_{1t} r_t + \gamma_{2t} r_t^*
\end{aligned}
$$

First Order Conditions

$$\psi_{2t} + \psi_{1t} = \gamma_{1t}$$

$$\psi_{1t} - \psi_{2t} = \gamma_{2t}$$

Can be expressed as:

$$\Omega_D(\frac{r_t - r_t^*}{2} - \tilde{r}_t^R) = \psi_2$$

$$\Omega(\frac{r_t + r_t^*}{2} - \tilde{r}_t^W) = \psi_1$$

where $\Omega_D \geq \Omega$, with strict inequality when $v < 2$.

When do both constraints bind?

Proposition: $r_t = 0$ for all v. There exists $\bar{v} < v_F$, such that for $v \geq \bar{v}$, $r^* > 0$.

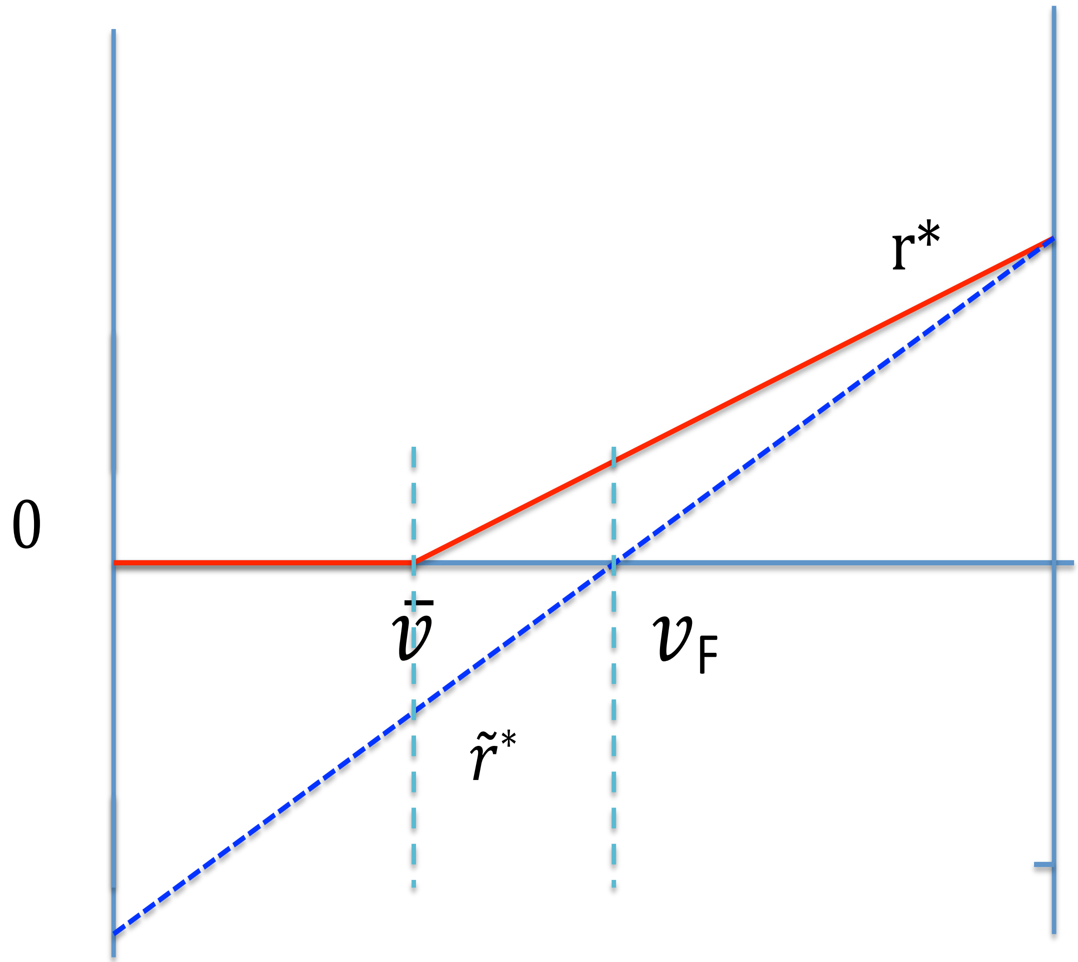
- Foreign interest rate is piecewise function of v
  - For $1 \leq \bar{v}$, $r^* = 0$
  - For $\bar{v} < v < 2$,

$$r_t^* = \widetilde{r}^*(\varepsilon_t, v) - \frac{(\Omega_D - \Omega)}{\Omega_D + \Omega}\widetilde{r}(\varepsilon_t, v) > 0$$

Foreign policy rate *above* the foreign natural real interest rate

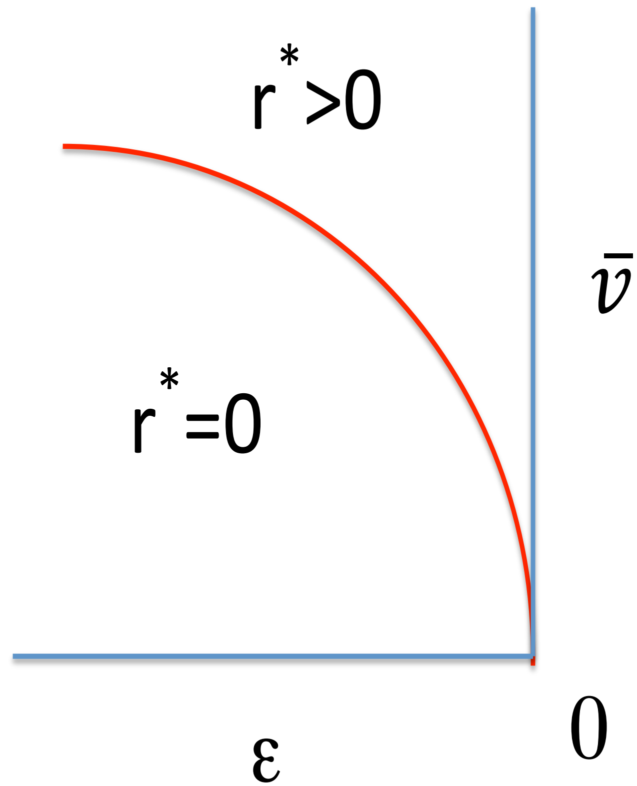
Key intuition: rising foreign interest rate reduces the appreciation of the home currency

Behavior of foreign interest rate



Size of $\bar{v}$ will also depend on size of shock

Trade off between ε and $\bar{v}$



Now incorporate both fiscal and monetary policy

- Outside a liquidity trap, fiscal gaps should be zero
- But may want to trade off non-zero fiscal gaps when interest rates are zero

Extend welfare to allow for non-zero fiscal gaps:

$$
\begin{aligned}
V_t \quad = \quad & -(\widehat{n}_t^R)^2 \cdot \frac{A}{2} - (\widehat{n}_t^W)^2 \frac{B}{2} - (\widehat{cg}_t^R)^2 \cdot \frac{F}{2} - (\widehat{cg}_t^W)^2 \cdot \frac{H}{2} - J(\widehat{n}_t^R)(\widehat{cg}_t^R) \\
& -L(\widehat{n}_t^W)(\widehat{cg}_t^W) - \frac{\theta}{4k}(\pi_t^W + \pi_t^R)^2 - \frac{\theta}{4k}(\pi_t^W - \pi_t^R)^2
\end{aligned}
$$

Fiscal multipliers

- World multiplier

$$\widehat{n}_t^W = \frac{\Delta_3}{\Delta_2}\widehat{cg}_t^W$$

  - independent of home bias parameter
  - greater than unity when both r=r*=0

- Relative multiplier

$$\widehat{n}_t^R = \frac{\Delta_3}{\Delta_2 - (D-1)\mu k\phi}\widehat{cg}_t^R$$

  - decreasing in home bias
  - greater than the world multiplier

Home and Foreign Multipliers

$$\widehat{n}_t = \widehat{n}_t^R + \widehat{n}_t^W = \left[\frac{1}{2}\frac{\Delta_3}{\Delta_2} + \frac{1}{2}\frac{\Delta_3^D}{\Delta_2^D}\right]\widehat{cg}_t$$

- Home country multiplier
  - Greater than unity when both r=r*=0
  - Larger than closed economy multiplier (decreasing in home bias v)
  - Government spending causes depreciation: crowds in net exports

$$\widehat{n}_t^* = \widehat{n}_t^W - \widehat{n}_t^R = \frac{1}{2}\left[\frac{\Delta_3}{\Delta_2} - \frac{\Delta_3^D}{\Delta_2^D}\right]\widehat{cg}_t$$

- Foreign multiplier
  - Negative
  - Home depreciation reduces foreign output

Optimal Monetary and Fiscal Policy

- When $r_t = r_t^* = 0$ binds in both countries
- World fiscal gap is positive
  - Persistent fiscal expansion causes expected inflation, reduces world output gap
  - World fiscal gap is independent of degree of home bias
- When $v > 1$, relative fiscal gap is positive, so home fiscal gap is always positive

Numerical Analysis of optimal policy

- Look at jointly optimal policy
- Foreign interest rate is piecewise function of v as in theory
- Given $\varepsilon_t < \varepsilon_H(1)$, illustrate responses as function of v

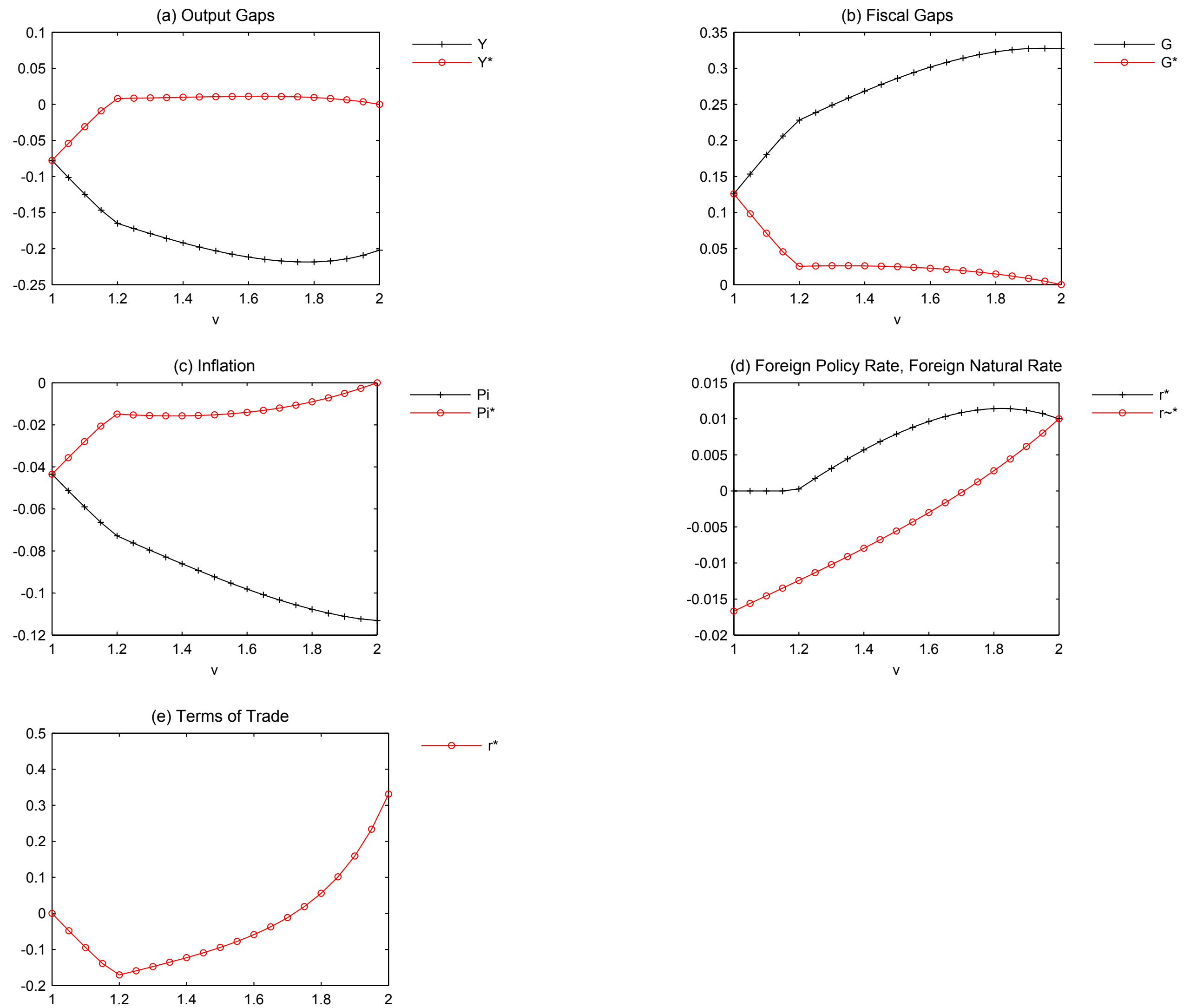
Calibration

Model calibration

PREFERENCES		
subjective discount factor	β	0.99, $(r = .01)$
risk-aversion	σ	2
home bias parameter	υ	free
labor supply elasticity	ϕ	1
Price stickiness parameter	κ	0.85
SHOCKS		
persistence of shocks	μ	0.8
Elasticity of substitution between varieties	θ	5

Optimal Fiscal and Monetary Policy

Figure 2: Optimal Policy



Optimal Fiscal and Monetary Policy

What would be result if foreign country used conventional monetary rule?

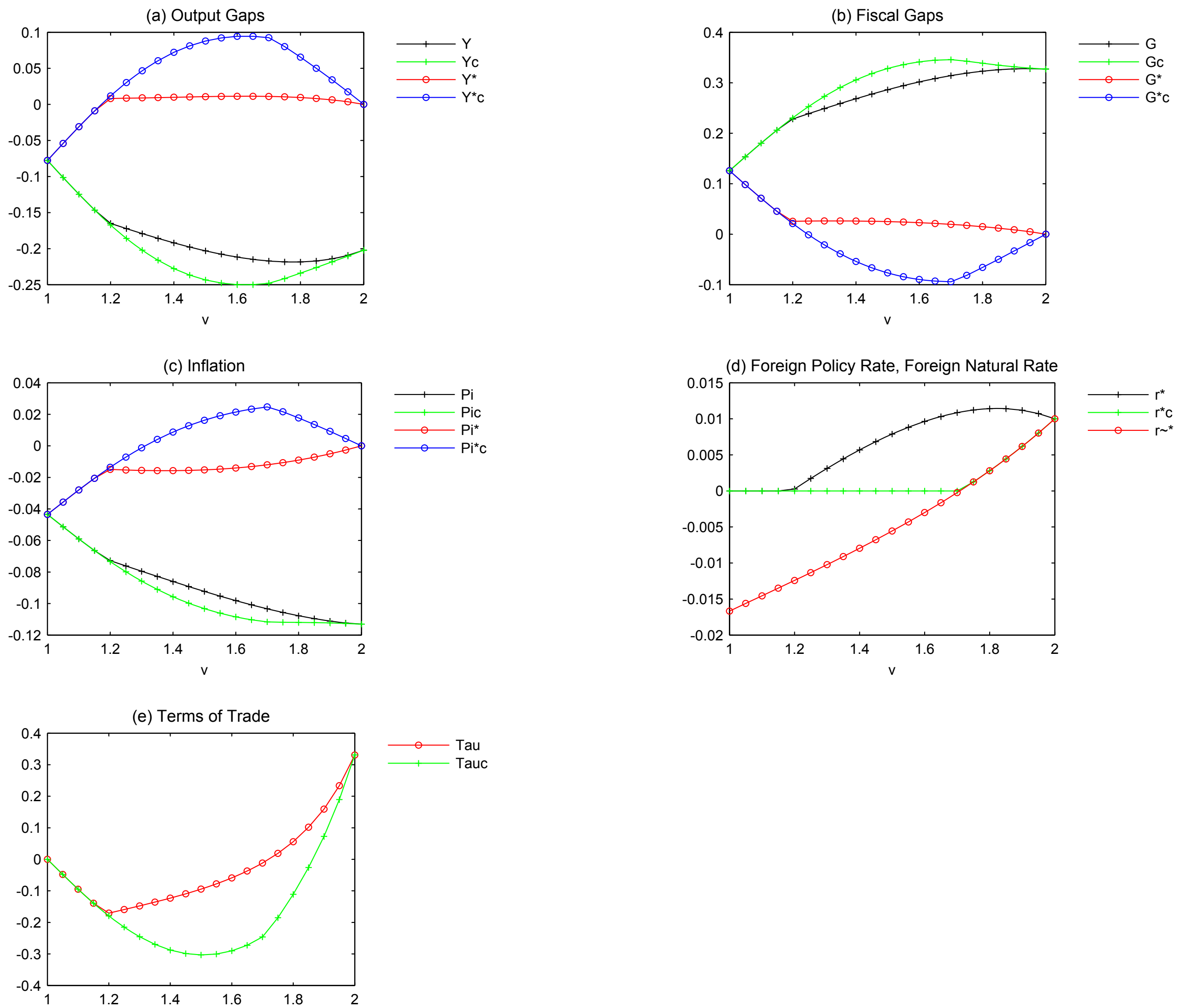
$$r_t = \max(0, \widetilde{r}_t), \qquad r_t^* = \max(0, \widetilde{r_t^*})$$

In this case, for $v > \bar{v}$, monetary policy is overly expansionary

Would result in optimal fiscal *contraction* for the foreign country.

Policy with Conventional Monetary Policy

Figure 3: Optimal and Constrained Policy



Qualifications

- Have looked only at cooperative policy choice
- Non-cooperative much harder to do in analytical framework
- Shock here is purely exogenous - not related to liquidity, credit constraints, deleveraging
- Fiscal policy has Ricardian equivalence - no tax distortions, crowding out, or default