Optimal Macroprudential and Monetary Policy in a Currency Union

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Macroeconomic Stabilization Tools

Closed Economy

- Monetary policy (before the crisis)
- Macroprudential policy (after the crisis)

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Monetary Union

- Monetary policy *cannot* stabilize asymmetric shocks
- Macroprudential policy *can* be used to stabilize economy

Today

Key elements of the model

1. Nominal rigidities
2. Financial sector
3. Monetary union

Main results

1. Optimal regional macroprudential policy
   - 2 AD and 2 pecuniary externalities
2. Optimal global (coordinated) macroprudential policy
   - Two international spillovers
   - Local PM overregulates due to pecuniary externality
   - Local PM overregulates if many countries in recession

Contribution to the Literature

Pecuniary externality in international models

- Jeanne-Korinek(2010), Bianchi(2011), Benigno et al.(2013)
- **This paper**: pecuniary externality in the financial sector

Macroprudential policy due to nominal rigidities and ZLB

- Farhi-Werning (2016), Korinek-Simsek (2016)
- **This paper**: macroprudential regulation of the financial sectors in a currency union

Financial regulation in monetary union

- Rubio (2014), Quint-Rabanal (2014)
- **This paper**: optimal policy

A Model with Nominal Rigidities

Households $\max_{\{c_t, n_t\}, D_1^c} \; u(c_0) - v(n_0) + \beta \Big[u(c_1) - v(n_1) \Big]$

$$s.t.: \; P_0 c_0 + \frac{D_1^c}{1+i_0} \leq W_0 n_0 + \Pi_0$$

$$P_1 c_1 \leq D_1^c + W_1 n_1 + \Pi_1$$

Firms produce $y_t = A_t n_t$

Solution

$$u'(y_1) = \frac{1}{A_1} v' \left(\frac{y_1}{A_1} \right) \quad \Rightarrow \quad y_1^* = y_1(A_1)$$

$$u'(y_0) = \beta \frac{1+i_0}{P_1/P_0} u'(y_1^*) \Rightarrow \quad y_0 = y_0 \left(\frac{1+i_0}{P_1/P_0}, y_1^* \right)$$

Welfare

$$u'(y_0) \neq \frac{1}{A_0} v' \left(\frac{y_0}{A_0} \right) \quad \Rightarrow \quad \tau_0 \equiv 1 - \frac{v'(y_0/A_0)/A_0}{u'(y_0)} \neq 0$$

A Model with Banks: Preferences

$$\mathcal{U} = u(c_0) - v(n_0) + \beta \Big[u(c_1 + \underline{c}_1) - v(n_1) \Big]$$

- $c_1 + \underline{c}_1$ – total consumption in period 1

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$$\mathcal{U} = u\left(c_0\right) - v\left(n_0\right) + \beta\left[u\left(c_1 + \underline{c}_1\right) - v\left(n_1\right)\right]$$
$$+\beta \;\; \nu u\left(\underline{c}_1\right)$$

- $c_1 + \underline{c}_1$ – total consumption in period 1
- $\underline{c}_1$ – must be bought with safe securities D_1^c: $P_1 \underline{c}_1 \leq D_1^c$

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- $\underline{c}_1$ – must be bought with safe securities D_1^c: $P_1 \underline{c}_1 \leq D_1^c$
- h_1 – consumption of durable goods
- $X_1 = \begin{cases} 1, & \text{with prob } \mu \\ \theta, & \text{with prob } 1-\mu \end{cases}$ – shock to preferences

A Model with Banks: Financial Sector

Durable goods production

$$h_1 = G(k_0)$$

A Model with Banks: Financial Sector

Durable goods production

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Banks

$$\max_{k_0, D_1^b, B(s_1)} \ \mathbb{E}\left\{Q(s_1)\left[\Gamma_1(s_1)G(k_0) - D_1^b - B(s_1)\right]\right\}$$

$$\text{s.t. } D_1^b \leq \min_{s_1}\{\Gamma_1(s_1)\}G(k_0)$$

$$P_0 k_0 \leq \frac{D_1^b}{1+i_0} + \mathbb{E}\left[B(s_1)Q(s_1)\right]$$

A Model with Banks: Financial Sector

Durable goods production

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$$\max_{k_0, D_1^b, B(s_1)} \mathbb{E}\left[Q(s_1)\Gamma_1(s_1)\right] G(k_0) - P_0 k_0 + \frac{\tau_A}{1+\tau_A} \cdot \frac{D_1^b}{1+i_0}$$

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With non-pecuniary safety preferences: $\mathbb{E}Q(s_1) \neq 1/(1+i_0)$

$$\tau_A \equiv \frac{1/\mathbb{E}Q(s_1) - (1+i_0)}{1+i_0}$$

A Model with Banks: Equilibrium

Equilibrium with flexible prices

$$u'(c_0) = v'(y_0/A_0)/A_0, \quad u'(y_1) = v'(y_1/A_1)/A_1$$

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$$\beta \frac{u'(y_1)}{u'(c_0)} \left[(\mu + (1-\mu)\theta) \frac{g'[G(k_0)]}{u'(y_1)} G'(k_0) \qquad\qquad \right] = 1$$

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$$\tau_A = \frac{\nu u'(d_1^b)}{u'(y_1)}, \; d_1^b = \frac{\theta g'[G(k_0)]}{u'(y_1)} G(k_0)$$

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First best

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First best

- $\tau_A = 0$
- Policy: issue lots of government safe bonds (Friedman rule for safe assets)

A Model with Banks: Second Best

Assumption: fiscal policy cannot achieve first best

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Available tools: regulator varies the amount of private safe debt
(Pigouvian taxes on safe debt issuance)

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Private allocation isn't 2nd best efficient: pecuniary externality

$$d_1^b = \frac{\theta g'[G(k_0)]}{u'\left(y_1^*\right)} G(k_0)$$

too much safe debt; durable price – too low; too many durables

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Optimal macroprudential tax mitigates pecuniary externality

$$\tau_0^b = \frac{\tau_A}{1+\tau_A} \epsilon_\Gamma$$

[ϵ_Γ - elasticity of durables demand]

Model of Monetary Union: Assumptions

- Continuum of countries $i \in [0,1]$
- Goods
  - $c^i_{NT,t}$: non-traded produced goods [sticky price in $t = 0$]
  - $c^i_{T,t}$: homogenous traded goods [endowment e^i_0, e^i_1]
  - h^i_1: non-traded durable goods
  - Cole-Obstfeld (log) utility

Preferences

- No labor mobility
- International markets
  - traded goods
  - safe debt
- Government
  - union-wide monetary authority
  - regional financial regulators who rebate locally
- Safe-assets-in-advance constraint (more general in the paper):

$$P_{T,1}\underline{c}^i_{T,1} \leq D^{c,i}_1$$

Optimal Regional Policy

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Objective: max $\mathcal{U}^i$

Constraints

- all regional equilibrium conditions
- international prices $(P_{T,0}, P_{T,1}, i_0)$ are exogenous

Macroprudential tool

- country-specific tax on safe debt issuance $\tau_0^{b,i}$

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- country-specific tax on safe debt issuance $\tau_0^{b,i}$

Proposition 1.

$$\tau_0^{b,i} = \frac{1}{1-\tau_0^i}\left(\frac{\tau_A^i \epsilon_\Gamma^i}{1+\tau_A^i} - \tau_0^i Z_2^i + Z_3^i d_1^{b,i} - \frac{a}{1-a}\tau_0^i Z_4^i\right)$$

$$Z_2^i, Z_3^i, Z_4^i > 0$$

Optimal Regional Policy

Intuition

$$\tau_0^{b,i} = \frac{1}{1-\tau_0^i}\left(\frac{\tau_A^i \epsilon_\Gamma^i}{1+\tau_A^i} - \tau_0^i Z_2^i + d_1^{b,i} Z_3^i - \frac{a}{1-a}\tau_0^i Z_4^i\right)$$

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2) $d_1^{b,i}\uparrow \;\Rightarrow\; k_0^i \uparrow \;\Rightarrow\; y_{NT,0}^i \uparrow$ (AD externality)

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3) $d_1^{b,i}\uparrow \Rightarrow c_{T,0}^i\uparrow,\; c_{T,1}^i\downarrow \;\Rightarrow\; d_1^{b,i} \leq \theta^i \frac{g'[G(k_0^i)]}{(1-a)/c_{T,1}^i} G(k_0^i)$ - tighter

Plot (International pecuniary externality)

Optimal Regional Policy

Intuition

$$\tau_0^{b,i} = \frac{1}{1-\tau_0^i}\left(\frac{\tau_A^i \epsilon_\Gamma^i}{1+\tau_A^i} - \tau_0^i Z_2^i + d_1^{b,i} Z_3^i - \frac{a}{1-a}\tau_0^i Z_4^i\right)$$

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Plot (International pecuniary externality)

4) $d_1^{b,i} \uparrow \;\Rightarrow\; c_{T,0}^i \uparrow \;\Rightarrow\; \uparrow c_{NT,0}^i = \frac{a}{1-a}\frac{P_{T,0}}{P_{NT,0}^i} c_{T,0}^i \;\Rightarrow\; y_{NT,0}^i \uparrow$

(Monetary union AD externality)

Optimal Coordinated Policy

Objective: $\int \omega^i \mathcal{U}^i di$

Constraints: all local equilibrium conditions
and international market clearing

Tools: $\{\tau_0^{b,i}\}$ and i_0

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Proposition 2.

- *Monetary policy*: $\int \omega^i \tau_0^i di = 0$

Optimal Coordinated Policy

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Proposition 2.

- *Monetary policy*: $\int \omega^i \tau_0^i di = 0$
- *Macroprudential policy*

$$\tau_0^{b,i} = \frac{1}{1-\tau_0^i}\left(\frac{\tau_A^i \epsilon_\Gamma^i}{1+\tau_A^i} - \tau_0^i Z_2^i + Z_3^i d_1^{b,i} - \frac{a}{1-a}\tau_0^i Z_4^i + Z_5^i \widetilde{\psi}_0\right)$$

International Spillovers

Intuition

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1) $\boxed{\tau_0^{b,i} \uparrow} \Rightarrow d_1^{b,i} \downarrow \Rightarrow c_{T,1}^{i} \uparrow \Rightarrow \boxed{c_{T,1}^{j} \downarrow}$

International Spillovers

Intuition

1) $\boxed{\tau_0^{b,i} \uparrow} \;\Rightarrow\; d_1^{b,i} \downarrow \;\Rightarrow\; c_{T,1}^{i} \uparrow \;\Rightarrow\; \boxed{c_{T,1}^{j} \downarrow}$

- collateral constraint in country j gets tighter:

$$d_1^{b,j} \leq \theta^j \frac{g'[G(k_0^j)]}{(1-a)/c_{T,1}^j} G(k_0^j)$$

(International spillover)

International Spillovers

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(International spillover)

2) $\boxed{\tau_0^{b,i}\uparrow} \;\Rightarrow\; d_1^{b,i}\downarrow \;\Rightarrow\; r_0\downarrow \;\Rightarrow\; \boxed{y_{NT,0}^{j}\downarrow}$

$$\left[\downarrow P_{T,0} = \frac{1+r_0}{1+i_0}P_{T,1} \Rightarrow\downarrow c_{NT,0}^{j} \sim \frac{P_{T,0}}{P_{NT,0}}c_{T,0}^{j} = \frac{P_{T,1}}{(1+i_0)P_{NT,0}}\,\frac{c_{T,1}^{j}}{\beta\left(1+\tau_A^{j}\right)}\right]$$

(Monetary union spillover)

Conclusion

1. Optimal macroprudential and monetary policy in MU
2. Regional macroprudential policy
   - takes into account 2 AD and 2 pecuniary externalities
3. Spillovers
   - negative due to international pecuniary externality
   - negative (positive) on neighbours in recessions (booms) due to monetary union AD externality

Model with Banks and Nom. Regidities

Proposition

1. Optimal monetary and macroprudential policy

$$\tau_0 = 0$$
$$\tau_0^b = \frac{\tau_A}{1+\tau_A}\epsilon_\Gamma$$

Full Problem with RR | Full Problem | Equilibrium | Ramsey Problem

2. If monetary policy is suboptimal ($\tau_0 \neq 0$), then

$$\tau_0^b = \frac{1}{1-\tau_0}\left(\frac{\tau_A}{1+\tau_A}\epsilon_\Gamma - \tau_0 Z_2\right), Z_2 > 1$$

Farhi-Werning (2016), Korinek-Simsek (2016)

Household Problem

with Reserve Requirements

$$\mathbb{E}\Big\{u(c_0) - v(n_0) + \beta\Big[u(c_1 + \underline{c}_1) - v(n_1) + u(\underline{c}_1) + X_1 g(h_1)\Big]\Big\}$$

$s.t.:$

$$T_0 + P_0 c_0 + \frac{D_1^c}{1+i_0} + \frac{R_1^b}{1+i_0^r} + P_0 k_0 \leq \frac{D_1^b}{1+i_0} + W_0 n_0 + \Pi_0^j$$

$$P_1(c_1 + \underline{c}_1) + T_1 + \Gamma_1 h_1 + D_1^b \leq D_1^c + R_1^b + W_1 n_1 + \Gamma_1 G(k_0) + \Pi_1^j$$

$P_1 \underline{c}_1 \leq D_1^c$ [Safe-assets-in-advance constraint]

$D_1^b \leq \min\{\Gamma_1\} G(k_0) + R_1^b$ [Collateral constraint]

$z_0 D_1^b \leq R_1^b$ [Universal reserve requirement]

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Household Problem

with Pigouvian Taxes

$$\mathbb{E}\left\{u\left(c_0\right)-v\left(n_0\right)+\beta\left[u\left(c_1+\underline{c}_1\right)-v\left(n_1\right)+u\left(\underline{c}_1\right)+X_1 g\left(h_1\right)\right]\right\}$$

$s.t.:$

$$T_0+P_0 c_0+\frac{D_1^c}{1+i_0}+P_0 k_0 \leq \frac{\widetilde{D}_1^b}{1+i_0}\left(1-\tau_0^b\right)+W_0 n_0+\Pi_0^j$$

$$P_1\left(c_1+\underline{c}_1\right)+T_1+\Gamma_1 h_1+\widetilde{D}_1^b \leq D_1^c+W_1 n_1+\Gamma_1 G(k_0)+\Pi_1^j$$

$$P_1 \underline{c}_1 \leq D_1^c$$

$$\widetilde{D}_1^b \leq \min\{\Gamma_1\} G\left(k_0\right)$$

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Equilibrium

Euler equation

$$u'(c_0) = \beta \frac{1+i_0}{\Pi^*} u'(y_1^*)(1+\tau_A), \;\; \tau_A = \frac{\nu u'\left(d_1^b\right)}{u'(y_1^*)}$$

Investment in durable goods

$$\beta \frac{u'(y_1^*)}{u'(c_0)} G'(k_0) \left[(\mu + (1-\mu)\theta) \frac{g'\left[G(k_0)\right]}{u'(y_1^*)} + \zeta_0(\tau_0^b)\theta \frac{g'\left[G(k_0)\right]}{u'(y_1^*)} \right] = 1$$

Collateral constraint

$$d_1^b \leq \theta \frac{g'[G(k_0)]}{u'(y_1^*)} G(k_0)$$

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Ramsey Problem

$$\max_{c_0,k_0,\widetilde{d}_1^b} \quad u(c_0) - v\left(\frac{c_0 + k_0}{A_0}\right) + \beta\Big[u(y_1^*) - v(y_1^*/A_1)\Big]$$

$$+ \beta\Big[(\mu + (1-\mu)\theta)\, g\,(G(k_0)) + \nu u\left(d_1^b + d_1^g\right)\Big]$$

$$s.t.: \quad d_1^b \leq \theta \frac{g'[G(k_0)]}{u'\,(y_1^*)} G(k_0)$$

◂ Back

Model of Monetary Union: Preferences

$$\mathcal{U} = u\left(c_0\right) - v\left(n_0\right) + \beta\Big[u\left(c_1 + \underline{c}_1\right) - v\left(n_1\right)\Big]$$
$$+\beta\Big[\nu u\left(\underline{c}_1\right) + X_1 g\left(h_1\right)\Big]$$

$$\Downarrow$$

$$\mathcal{U}^i = U\left(c^i_{NT,0}, c^i_{T,0}\right) - v\left(n^i_0\right) + \beta U\left(c^i_{NT,1} + \underline{c}^i_{NT,1}, c^i_{T,1} + \underline{c}^i_{T,1}\right)$$
$$+\,\beta\Big[\nu^i U\left(\underline{c}^i_{NT,1}, \underline{c}^i_{T,1}\right) + X^i_1 g\left(h^i_1\right) - v\left(n^i_1\right)\Big]$$

- i – country index
- T – traded goods index
- NT – non-traded goods index
- $P^i_{NT,1}\underline{c}^i_{NT,1} + P_{T,1}\underline{c}^i_{T,1} \leq D^{c,i}_1$

Assumption $\quad U\left(c_{NT}, c_T\right) = \log\left(c^a_{NT} c^{1-a}_T\right)$

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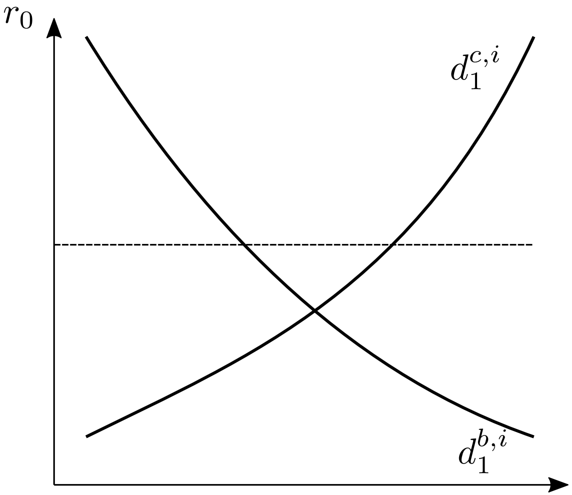
Small Open Economy



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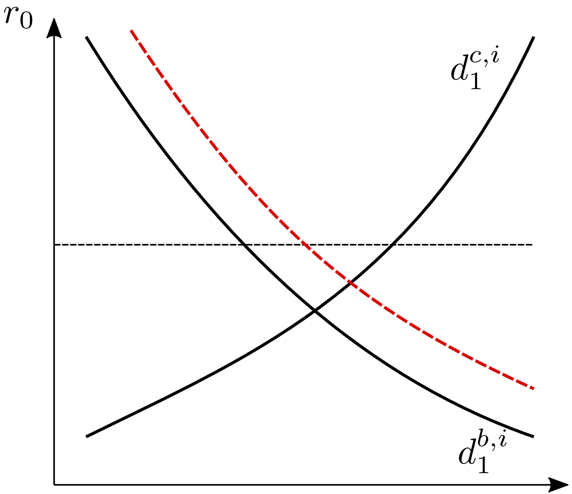
Small Open Economy



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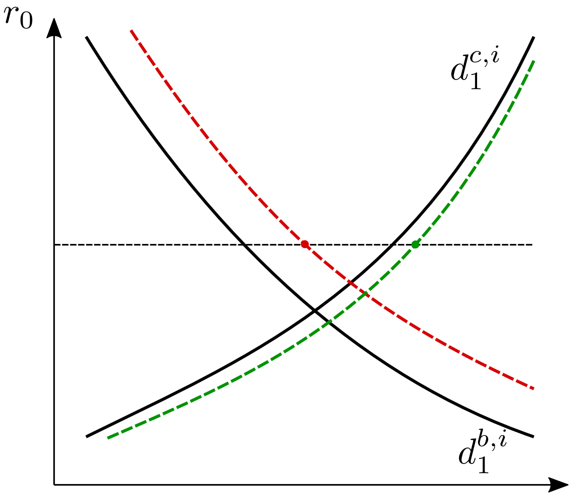

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