Optimal Macroprudential and Monetary Policy in a Currency Union

Dmitriy Sergeyev
Bocconi University

BAFFI CAREFIN Centre, Bocconi University
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Macroeconomic Stabilization Tools

Closed Economy

- Monetary policy (before the crisis)
- Macroprudential policy (after the crisis)
Macroeconomic Stabilization Tools

Closed Economy

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

Monetary Union

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

Key elements of the model

1. A model with nominal rigidities
2. A model with banks (Stein, 2012)
3. A model of monetary union

Main results

▶ Optimal regional macroprudential policy
  1. 2 AD and 3 pecuniary externalities

▶ Optimal global (coordinated) macroprudential policy
  2. Three international spillovers
  3. Local PM overregulates if banks issues lots of safe debt
  4. Local PM underregulates if the union is in the ZLB
**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**
- **This paper**: optimal policy
Model with Nominal Rigidities
Model with Nominal Rigidities

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

subject to
\[
P_0 c_0 + \frac{D_1^c}{1 + i_0} \leq W_0 n_0 + \Pi_0
\]
\[
P_1 c_1 \leq D_1^c + W_1 n_1 + \Pi_1
\]

Firms produce \(y_t = A_t n_t\)
Model with Nominal Rigidities

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

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

\[ u'(y_1) = \frac{1}{A_1} v' \left( \frac{y_1}{A_1} \right) \Rightarrow y_1^* = y_1(A_1) \]
Model with Nominal Rigidities

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

\[ s.t. : \quad P_0 c_0 + \frac{D_1^c}{1 + i_0} \leq W_0 n_0 + \Pi_0 \]
\[ P_1 c_1 \leq D_1^c + W_1 n_1 + \Pi_1 \]

Firms produce \( y_t = A_t n_t \)

Solution

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

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

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

subject to
\[ P_0 c_0 + \frac{D_1^c}{1 + i_0} \leq W_0 n_0 + \Pi_0 \]
\[ P_1 c_1 \leq D_1^c + W_1 n_1 + \Pi_1 \]

Firms produce \( y_t = A_t n_t \)

Solution
\[ u'(y_1) = \frac{1}{A_1} v' \left( \frac{y_1}{A_1} \right) \Rightarrow y_1^* = y_1(A_1) \]
\[ u'(y_0) = \beta \frac{1 + i_0}{P_1/P_0} u'(y_1^*) \Rightarrow y_0 = y_0 \left( \frac{1 + i_0}{P_1/P_0}, y_1^* \right) \]

Welfare
\[ u'(y_0) \neq \frac{1}{A_0} v' \left( \frac{y_0}{A_0} \right) \]
Model with Nominal Rigidities

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

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

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

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

Welfare

\[ u'(y_0) \neq \frac{1}{A_0} v' \left( \frac{y_0}{A_0} \right) \Rightarrow \tau_0 \equiv 1 - \frac{v'(y_0/A_0)/A_0}{u'(y_0)} \neq 0 \]
Model with Banks: Preferences

\[ U = u(c_0) - v(n_0) + \beta [u(c_1 + c_1) - v(n_1)] \]

- \( c_1 + c_1 \) – total consumption in period 1


**Model with Banks: Preferences**

\[
U = u(c_0) - v(n_0) + \beta \left[ u(c_1 + c_1) - v(n_1) \right] \\
+ \beta \ nu(c_1)
\]

- \(c_1 + c_1\) – total consumption in period 1

- \(c_1\) – must be bought with safe securities \(D_1^c\): \(P_1 c_1 \leq D_1^c\)
Model with Banks: Preferences

\[ U = u(c_0) - v(n_0) + \beta \left[ u(c_1 + c_{\bar{1}}) - v(n_1) \right] \\
+ \beta \left[ \nu u(c_{\bar{1}}) + X_1 g(h_1) \right] \]

- \( c_1 + c_{\bar{1}} \) – total consumption in period 1

- \( c_{\bar{1}} \) – must be bought with safe securities \( D^c_1: P_1 c_{\bar{1}} \leq D^c_1 \)

- \( h_1 \) – consumption of durable goods
Model with Banks: Preferences

\[ U = u(c_0) - v(n_0) + \beta \left[ u(c_1 + c_1) - v(n_1) \right] 
+ \beta \left[ \nu u(c_1) + X_1 g(h_1) \right] \]

- \( c_1 + c_1 \) — total consumption in period 1
- \( c_1 \) — must be bought with safe securities \( D_1^c \): \( P_1 c_1 \leq D_1^c \)
- \( h_1 \) — consumption of durable goods
- \( X_1 = \begin{cases} 
1, \text{ with prob } \mu \\
\theta, \text{ with prob } 1 - \mu
\end{cases} \) — shock to preferences
Durable goods production

\[ h_1 = G(k_0) \]
Model with Banks: Financial Sector

Durable goods production

\[ h_1 = G(k_0) \]

Banks

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

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

\[
P_0 k_0 \leq \frac{D_1^b}{1 + i_0} + \mathbb{E} [B(s_1) Q(s_1)]
\]
Model with Banks: Financial Sector

Durable goods production

\[ h_1 = G(k_0) \]

Banks

\[
\max_{k_0,D_1^b,B(s_1)} \mathbb{E}[Q(s_1)\Gamma_1(s_1)]G(k_0) - P_0k_0 + \frac{\tau_A}{1 + \tau_A} \cdot \frac{D_1^b}{1 + i_0} \\
\text{s.t. } D_1^b \leq \min_{s_1} \{\Gamma_1(s_1)\}G(k_0)
\]
Model with Banks: Financial Sector

Durable goods production

\[ h_1 = G(k_0) \]

Banks

\[
\max_{k_0, D^b_1, B(s_1)} \mathbb{E}[Q(s_1)\Gamma_1(s_1)] G(k_0) - P_0 k_0 + \frac{\tau_A}{1 + \tau_A} \cdot \frac{D^b_1}{1 + i_0}
\]

s.t. \( D^b_1 \leq \min_{s_1} \{\Gamma_1(s_1)\} G(k_0) \)

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

\[
\tau_A \equiv \frac{1/\mathbb{E}Q(s_1) - (1 + i_0)}{1 + i_0}
\]
Model with Banks: Equilibrium

Equilibrium with flexible prices

\[ u'(c_0) = v'(y_0/A_0)/A_0, \quad u'(y_1) = v'(y_1/A_1)/A_1 \]
Equilibrium with flexible prices

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

\[
\beta \frac{u'(y_1)}{u'(c_0)} \left[ (\mu + (1 - \mu)\theta) \frac{g'[G(k_0)]}{u'(y_1)} G'(k_0) \right] = 1
\]
Model with Banks: Equilibrium

Equilibrium with flexible prices

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

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

\[ \tau_A = \frac{\nu u'(d_1^b)}{u'(y_1)}, \quad d_1^b = \frac{\theta g'[G(k_0)]}{u'(y_1)} G(k_0) \]
Model with Banks: Equilibrium

Equilibrium with flexible prices

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

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

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

First best
Model with Banks: Equilibrium

Equilibrium with flexible prices

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

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

\[ \tau_A = \frac{\nu u'(d^b_1)}{u'(y_1)}, \quad d^b_1 = \frac{\theta g'[G(k_0)]}{u'(y_1)} G(k_0) \]

First best

- \( \tau_A = 0 \)
- Policy: issue lots of government safe bonds
  [“Friedman rule” for safe assets]
Model with Banks: Second Best

Assumption: fiscal policy cannot achieve first best

\[ d_b = \theta_g G(k_0) u'(y^*) G(k_0) \Rightarrow \text{too much safe debt} \Rightarrow \text{too low durable price} \Rightarrow \text{too many durables} \]

Optimal macroprudential tax mitigates pecuniary externality

\[ \tau_b = \tau_A + \tau_A \epsilon \Gamma \]

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Model with Banks: Second Best

Assumption: fiscal policy cannot achieve first best

Available tools: regulator varies the amount of private safe debt (Pigouvian taxes on safe debt issuance)
Model with Banks: Second Best

Assumption: fiscal policy cannot achieve first best

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

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

\[ d^b_1 = \frac{\theta g'[G(k_0)]}{u'(y^*_1)} G(k_0) \]

too much safe debt \(\iff\) too low durable price \(\iff\) too many durables
**Model with Banks: Second Best**

**Assumption:** fiscal policy cannot achieve first best

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

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

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

too much safe debt ⇔ too low durable price ⇔ too many durables

Optimal macroprudential tax mitigates pecuniary externality

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

\[\epsilon_\Gamma - \text{elasticity of durables demand}\]
Model of Monetary Union: Assumptions

- **Continuum** of countries $i \in [0, 1]$

- **Goods**
  - $c_{NT,t}^i$: non-traded produced goods [sticky price in $t = 0$]
  - $c_{T,t}^i$: homogenous traded goods [endowment $e_0^i, e_1^i$]
  - $h_1^i$: non-traded durable goods
  - Cole-Obstfeld (log) utility

- **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:**
  \[ P_{NT,1}^i c_{NT,1}^i + P_{T,1}^i c_{T,1}^i \leq D_{1,c,i} \]
**Optimal Regional Policy**

Objective: max $U_i$

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 $\tau_{b,i}^0$

Proposition 1.

$$\tau_{b,i}^0 = 1 - \tau_{i}^0 (\tau_{i}^A \epsilon_{i} \Gamma_{1} + \tau_{i}^A - \tau_{i}^0 Z_{i}^2 + Z_{i}^3 d_{b,i}^1 - Z_{i}^3 a_{1} - a \tau_{i}^0 Z_{i}^4) Z_{i}^2, Z_{i}^3, Z_{i}^4 > 0$$
Optimal Regional Policy

Objective: $\max U^i$

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 $\tau_{0,b,i}^i$
Optimal Regional Policy

Objective: \( \max \ U^i \)

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 \(\tau_{0,b,i}^i\)

Proposition 1.

\[
\tau_{0,b,i}^i = \frac{1}{1 - \tau_0^i} \left( \frac{\tau_A^i \epsilon^i}{1 + \tau_A^i} - \tau_0 Z_2^i + Z_3 a d_1^b,i - Z_3 a d_1^c,i - \frac{a}{1 - a} \tau_0 Z_4^i \right)
\]

\(Z_2^i, Z_3^i, Z_4^i > 0\)
Optimal Regional Policy

Intuition

\[ \tau_{0}^{b,i} = \frac{1}{1 - \tau_{0}^{i}} \left( \frac{\tau_{A}^{i} \epsilon_{i}^{i}}{1 + \tau_{A}^{i}} - \tau_{0}^{i} Z_{2}^{i} + d_{1}^{b,i} Z_{3}^{i} - a d_{1}^{c,i} Z_{3}^{i} - \frac{a}{1 - a} \tau_{0}^{i} Z_{4}^{i} \right) \]
Optimal Regional Policy

Intuition

\[ \tau_{0,b,i} = \frac{1}{1 - \tau^i_0} \left( \frac{\tau^i_A e^i_{\Gamma}}{1 + \tau^i_A} - \tau^i_0 Z^i_2 + d_{1,b,i}^i Z^i_3 - a d_{1,c,i}^i Z^i_3 - \frac{a}{1 - a} \tau^i_0 Z^i_4 \right) \]

2) \( d_{1}^{b,i} \uparrow \Rightarrow k^i_0 \uparrow \Rightarrow y^{i}_{NT,0} \uparrow \) (AD externality)
Optimal Regional Policy

Intuition

\[
\tau_{0}^{b,i} = \frac{1}{1 - \tau_{0}^{i}} \left( \frac{\tau_{A}^{i} \epsilon_{i}^{i}}{1 + \tau_{A}^{i}} - \tau_{0}^{i} Z_{2}^{i} + d_{1}^{b,i} Z_{3}^{i} - a d_{1}^{c,i} Z_{3}^{i} - \frac{a}{1 - a} \tau_{0}^{i} Z_{4}^{i} \right) 
\]

2) \( d_{1}^{b,i} \uparrow \Rightarrow k_{0}^{i} \uparrow \Rightarrow y_{NT,0}^{i} \uparrow \) (AD externality)

3-4) \( d_{1}^{b,i} \uparrow \Rightarrow c_{T,1}^{i} \downarrow \Rightarrow P_{NT,1}^{i} / P_{T,1}^{i} \equiv p_{1}^{i} \downarrow \)
**Optimal Regional Policy**

**Intuition**

\[
\tau_0^{b,i} = \frac{1}{1 - \tau_0^i} \left( \frac{\tau_A^i \epsilon_i^i}{1 + \tau_A^i} - \tau_0^i Z_2^i + d_1^{b,i} Z_3^i - a d_1^{c,i} Z_3^i - \frac{a}{1 - a} \tau_0^i Z_4^i \right)
\]

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

3-4) \(d_1^{b,i} \uparrow \Rightarrow c_{T,1}^i \downarrow \Rightarrow P_{NT,1}^i / P_{T,1}^i \equiv p_1^i \downarrow \)

- collateral constraint gets tighter: \(d_1^{b,i} \leq \theta_i \frac{g'[G(k_0^i)]}{a/y_{NT,1}^i} G(k_0^i) p_1^i \) (negative pecuniary externality)
Optimal Regional Policy

Intuition

\[ \tau_{0,i} = 1 \frac{1}{1 - \tau_0^i} \left( \tau_A^i \epsilon_G^i - \tau_0^i Z_2^i + d_1^b,i Z_3^i - a d_1^c,i Z_3^i - a \frac{a}{1 - a} \tau_0^i Z_4^i \right) \]

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

3-4) \( d_1^b,i \uparrow \Rightarrow c_{T,1}^i \downarrow \Rightarrow P_{NT,1}^i / P_{T,1}^i = p_1^i \downarrow \)

- collateral constraint gets tighter: \( d_1^b,i \leq \theta^i g'[G(k_0^i)] \frac{a}{y_{NT,1}^i} G(k_0^i) p_1^i \) (negative pecuniary externality)

- SAIA constraint gets looser: \( c_{T,1}^i + c_{NT,1}^i p_1^i \leq d_1^c,i \) (positive pecuniary externality)
Optimal Regional Policy

**Intuition**

\[
\tau_{0,b,i} = \frac{1}{1 - \tau_0^i} \left( \frac{\tau_A^i \epsilon_i}{1 + \tau_A^i} - \tau_0^i Z_2^i + d_{1,b,i}^i Z_3^i - a d_{1,c,i}^i Z_3^i - \frac{a}{1 - a} \tau_0^i Z_4^i \right)
\]

2) \( d_{1,b,i}^i \uparrow \Rightarrow k_0^i \uparrow \Rightarrow y_{NT,0}^i \uparrow \) (AD externality)

3-4) \( d_{1,b,i}^i \uparrow \Rightarrow c_{T,1}^i \downarrow \Rightarrow P_{NT,1}^i / P_{T,1}^i = p_1^i \downarrow \)

- collateral constraint gets tighter: \( d_{1,b,i}^i \leq \theta^i g'[G(k_0^i)] a / y_{NT,1}^i \) \( G(k_0^i) p_1^i \)
  (negative pecuniary externality)

- SAIA constraint gets looser: \( c_{T,1}^i + c_{NT,1}^i p_1^i \leq d_{1,c,i}^i \)
  (positive pecuniary externality)

5) \( d_{1,b,i}^i \uparrow \Rightarrow c_{T,0}^i \uparrow \Rightarrow c_{NT,0}^i \uparrow \) because \( P_{NT,0}^i / P_{T,0}^i \) – fixed

\( \Rightarrow y_{NT,0}^i \uparrow \) (AD externality)
Optimal Coordinated Policy

Objective: $\int \omega^i U^i di$

Constraints: all local equilibrium conditions and international market clearing

Tools: $\{\tau^b,i\}$ and $i_0$
Optimal Coordinated Policy

- **Objective:** \( \int \omega^i U^i di \)
- **Constraints:** all local equilibrium conditions and international market clearing
- **Tools:** \( \{\tau^b,i_0\} \) and \( i_0 \)

Proposition 2.

- **Monetary policy:** \( \int \omega^i \tau^i_0 di = 0 \)
Objective: \( \int \omega^i \mathcal{U}^i di \)

Constraints: all local equilibrium conditions and international market clearing

Tools: \( \{\tau_{b,i}^0\} \) and \( i_0 \)

Proposition 2.

- Monetary policy: \( \int \omega^i \tau_0^i di = 0 \)
- Macroprudential policy

\[
\tau_{b,i}^0 = \frac{1}{1 - \tau_0^i} \left( \frac{\tau_A^i \epsilon_i^i}{1 + \tau_A^i} - \tau_0^i Z_2^i + Z_3^i d_1^{b,i} - Z_3^i d_1^{c,i} - \frac{a}{1 - a} \tau_0^i Z_4^i + Z_5^i \tilde{\psi}_0 \right), \quad Z_5^i > 0
\]
International Spillovers

Intuition
International Spillovers

Intuition

1-2) \[ \tau_{0,b,i} \uparrow \Rightarrow d_{1,b,i} \downarrow \Rightarrow c_{T,1} \uparrow \Rightarrow c_{T,1} \downarrow \Rightarrow p_{j} \downarrow \]
International Spillovers

Intuition

1-2) $\tau_{0}^{b,i} \uparrow \Rightarrow d_{1}^{b,i} \downarrow \Rightarrow c_{T,1}^{i} \uparrow \Rightarrow c_{T,1}^{j} \downarrow \Rightarrow p_{1}^{j} \downarrow$

- collateral constraint in country $j$ gets tighter:

$$d_{1}^{b,j} \leq \theta_{j} \frac{g'[G(k_{0}^{j})]}{a/y_{NT,1}^{j,*}} G(k_{0}^{j})p_{1}^{j} \text{ (negative externality)}$$
International Spillovers

Intuition

1-2) $\tau_{0}^{b,i} \uparrow \Rightarrow d_{1}^{b,i} \downarrow \Rightarrow c_{T,1}^{i} \uparrow \Rightarrow c_{T,1}^{j} \downarrow \Rightarrow p_{1}^{j} \downarrow$

- collateral constraint in country $j$ gets tighter:
  
  $$d_{1}^{b,j} \leq \theta_{j} g'(G(k_{0}^{j})) a/y_{NT,1}^{j,\ast} G(k_{0}^{j})p_{1}^{j}$$

  (negative externality)

- SAIA constraint in country $j$ gets looser:
  
  $$c_{T,1}^{j} + c_{NT,1}^{j} p_{1}^{j} \leq d_{1}^{c,j}$$

  (positive externality)
International Spillovers

Intuition

1-2) \[ \tau_{b,i}^0 \uparrow \Rightarrow d_{1}^{b,i} \downarrow \Rightarrow c_{T,1}^{i} \uparrow \Rightarrow c_{T,1}^{j} \downarrow \Rightarrow p_{1}^{j} \downarrow \]

- collateral constraint in country \( j \) gets tighter:
\[
d_{1}^{b,j} \leq \theta_{j}^{j} \frac{g'[G(k_{0}^{j})]}{a/y_{NT,1}^{j,*}} G(k_{0}^{j})p_{1}^{j} \quad \text{(negative externality)}
\]

- SAIA constraint in country \( j \) gets looser:
\[
c_{T,1}^{j} + c_{NT,1}^{j}p_{1}^{j} \leq d_{1}^{c,j} \quad \text{(positive externality)}
\]

3) \[ \tau_{b,i}^0 \uparrow \Rightarrow d_{1}^{b,i} \downarrow \Rightarrow c_{T,0}^{i} \downarrow \Rightarrow c_{T,0}^{j} \uparrow \Rightarrow c_{NT,0}^{j} \uparrow \]

because \( P_{NT,0}^{j}/P_{T,0} \) fixed \( \Rightarrow y_{NT,0}^{j} \uparrow \)

(AD externality)
Proposition 3.
If $\tau_0 = 0$ and $d_1^b > ad_1^c$, then $\tilde{\psi}_0 < 0$ (local regulator overregulates its financial sector).

Draghi wants banks to issue even more safe debt when they already issue lots of safe debt.
**Optimal Coordinated Policy**

**Symmetric Countries**

**Proposition 3.**
If \( \tau_0 = 0 \) and \( d^b_1 > ad^c_1 \), then \( \tilde{\psi}_0 < 0 \) (local regulator overregulates its financial sector).

- Draghi wants banks to issue even more safe debt when they already issue lots of safe debt

**Proposition 4.**
If \( \tau_0 > \bar{\tau}_0 > 0 \), then \( \tilde{\psi}_0 > 0 \) (local regulators underregulate financial sectors).

- Draghi wants to impose tighter financial regulation due to the ZLB in the Eurozone
CONCLUSION

1. Optimal macroprudential and monetary policy in MU

2. Macroprudential policy
   - takes into account 2 AD and 3 pecuniary externalities

3. Gains from policy coordination
   - regional regulators overregulate when banks are large
   - regional regulators underregulate in the ZLB