Multinational Banks and Financial Stability

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Introduction

- Large scale of international banking
  - >30% of claims on foreign counterparties (BIS CBS)
- International financial stability concerns
  - Regulation of foreign banks (Dodd-Frank)
  - Capital controls (Emerging Markets)
  - International cooperation (Basel III, European Banking Union)
- Two key questions
  1. What is the globally efficient allocation of banking activites?
  2. Is international cooperation required to implement it?

Model Environment and Results

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  - Country-level fire sales
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- Result #2: Non-cooperative quantity regulation *not* efficient
  - Unequal treatment, neglect foreign spillovers
- Result #3: Non-cooperative Pigouvian taxation efficient
  - ...if no monopoly rents

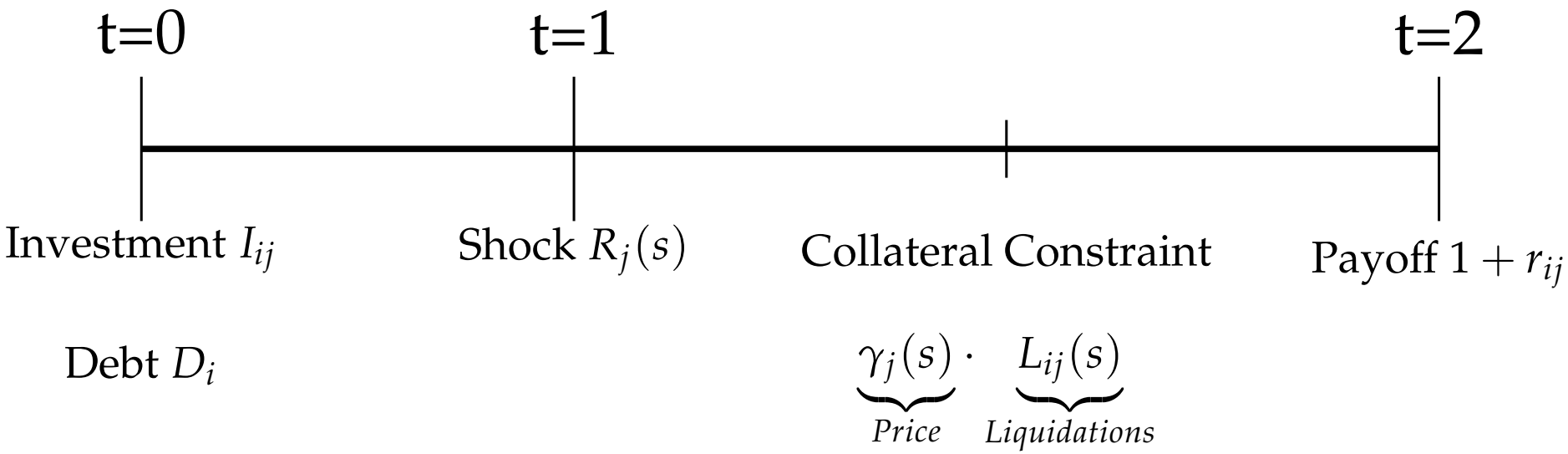
Related Literature

- Empirics on cross-border capital flows
  - e.g. Avdjiev et al (2018), Broner et al (2013), Coeurdacier and Rey (2013), Davis and Van Wincoop (2018), Forbes and Warnock (2012), Maggiori Neiman and Schreger (2019), Milesi-Ferretti and Tille (2011)
- Macroprudential regulation and capital controls
  - *Domestic/SOE*: e.g. Bianchi and Mendoza (2018), Caballero and Krishnamurthy (2001), Chari and Kehoe (2016), Dávila and Korinek (2018), Farhi and Tirole (2012), Gorton and Ordoñez (2014), Korinek and Simsek (2016), Lorenzoni (2008), Schmitt-Grohé and Uribe (2016)
  - *Cooperation*: e.g. Bolton and Oehmke (2019), Caballero and Simsek (2019), Farhi and Werning (2017), Farhi and Tirole (2018), Korinek (2017)
  - *General Common Agency*: e.g. Bernheim and Whinston (1986)
- Price versus quantity regulation
  - e.g. Weitzman (1974), Perotti and Suarez (2011)

Model

- $t = 0, 1, 2$
- Countries $i \in [0, 1]$. Need not be symmetric
- Representative bank and arbitrageur in each country
  - Risk neutral, no discounting
- State of the world $s \in S$ realized at date 1, density $f(s)$

Bank Investment and Financing



- I_{ij} – country i bank investing in country j project
- Home bias (e.g. French and Poterba 1991)
  - Mass *domestic* investment I_{ii}
  - Density *foreign* investment I_{ij}

Bank Investment and Financing

- Initial debt financing

$$\underbrace{\Phi_{ii}(I_{ii}) + \int_j \Phi_{ij}(I_{ij})dj}_{\text{Total Investment Cost}} \leq \underbrace{A_i}_{\text{Initial Resources}} + \underbrace{D_i}_{\text{Debt}}$$

- But, date 1 collateral constraint

$$\underbrace{D_i}_{\text{Outstanding Debt}} \leq \underbrace{\gamma_i(s)L_{ii}(s) + \int_j \gamma_j(s)L_{ij}(s)dj}_{\text{Liquidate Assets to Repay Debt}}$$

For exposition today, no debt rollover at all

Equilibrium

Banks

$$\max_{c_i, D_i, I_i, L_i} \int_s c_i(s) f(s) ds$$

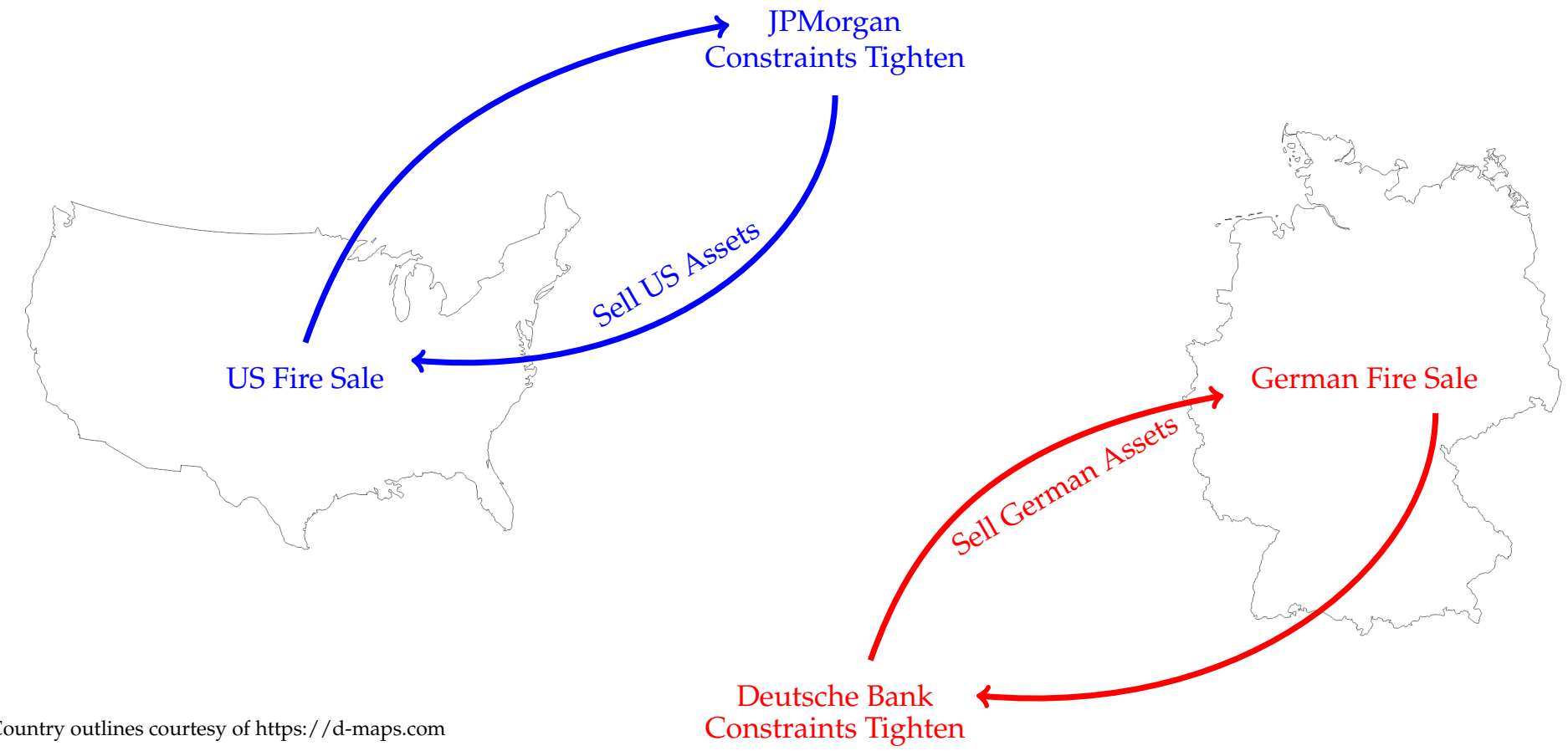
Arbitrageurs (second best users)

$$\max_{L_i^A(s)} \mathcal{F}_i(L_i^A(s), s) - \gamma_i(s) L_i^A(s)$$

Equilibrium price

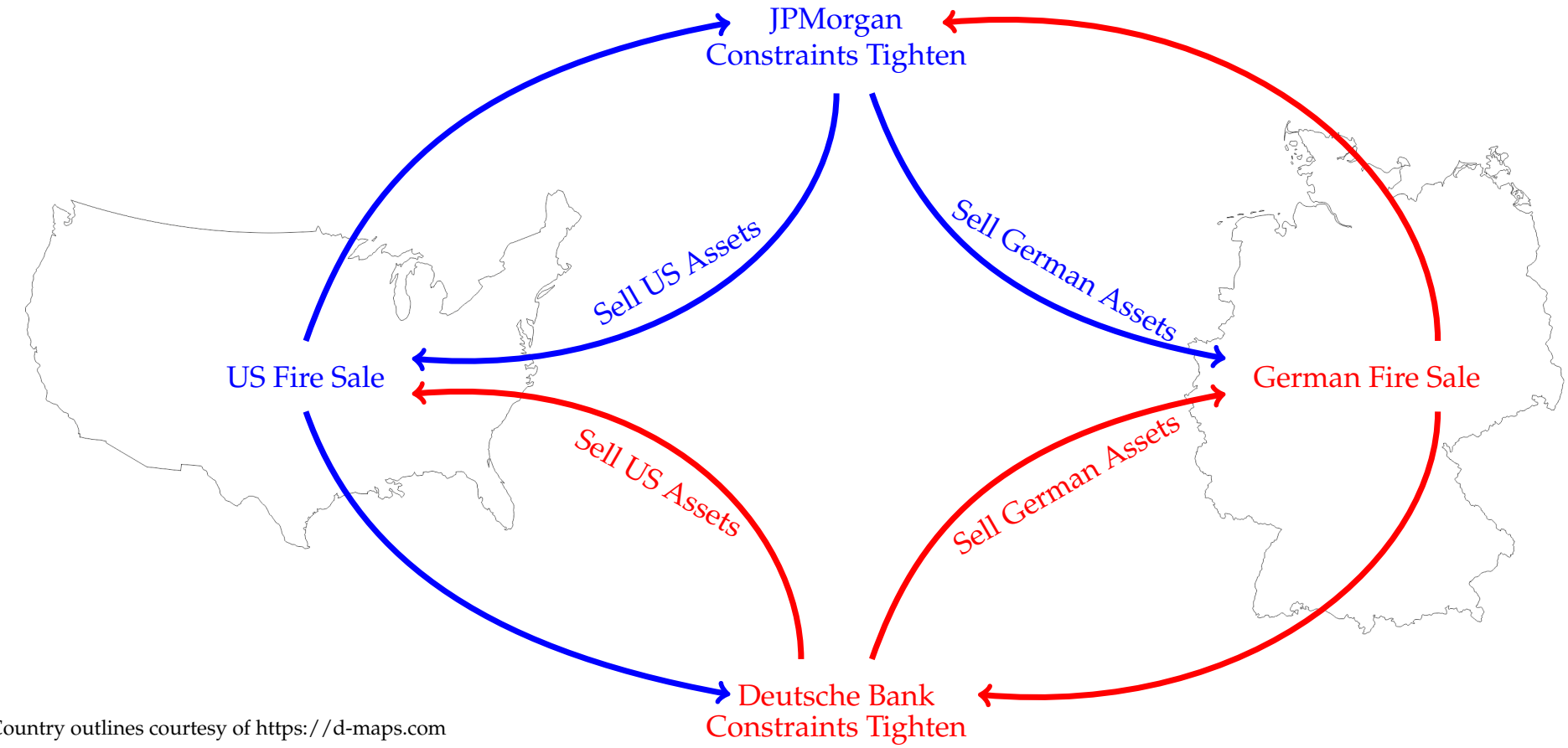
$$\gamma_i(s) = \frac{\partial \mathcal{F}_i(s)}{\partial L_i^A(s)}, \qquad L_i^A(s) = \underbrace{\overbrace{L_{ii}(s)}^{\text{Domestic}} + \overbrace{\int_j L_{ji}(s) dj}^{\text{Foreign}}}_{\text{Total Bank Liquidations}} \tag{γ}$$

Fire Sale Spillovers



Country outlines courtesy of https://d-maps.com

Fire Sale Spillovers



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Global Planning Problem (Efficient Benchmark)

$$\max_{c,D,I,L} \int_i \omega_i \left[\int_s c_i(s) f(s) ds \right] di$$

Internalize effects of L^A on γ, but no controls over arbitrageurs

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Internalize effects of L^A on γ, but no controls over arbitrageurs

Proposition: The globally efficient allocation can be decentralized using liquidation wedges

$$\tau_{ji}^L(s) = - \underbrace{\Omega_{i,i}(s)}_{\text{Domestic Spillovers}} - \underbrace{\int_{i'} \Omega_{i',i}(s) di'}_{\text{Foreign Spillovers}} \quad \underbrace{\forall j}_{\text{Equal Treatment}}$$

Formal Characterization of $\Omega_{i,j}(s)$

Country Social Planners

$$\max_{c_i, D_i, I_i, L_i} \int_s c_i(s) f(s) ds$$

- Set wedges on
  - *All* activities of domestic banks: $\tau^c_{i,i}(s)$, $\tau^D_{i,i}$, $\tau^I_{i,ij}$, $\tau^L_{i,ij}(s)$
  - *Domestic* activities of foreign banks: $\tau^I_{i,ji}$ and $\tau^L_{i,ji}(s)$
  - Nash equilibrium. See paper for implementability

Implementability

- Study two instruments
  - Quantity Regulation: wedges revenue-neutral
  - Pigouvian Taxation: wedges not revenue-neutral

Remission Rules

Equilibrium under Quantity Regulation

Proposition: Under non-cooperative quantity regulation

1. The domestic liquidation wedges on domestic banks are

$$\tau^{L}_{i,ii}(s) = -\underbrace{\Omega_{i,i}(s)}_{\text{Domestic Spillovers}}$$

Under-Regulation: Basel III, EU BU

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   Under-Regulation: Basel III, EU BU

2. Domestic liquidation wedges on foreign banks generate an allocation rule

$$\underbrace{L_{ji}(s)\Omega_{i,i}(s)}_{\text{Ban Foreign Liquidations}} = 0$$

   Unequal Treatment: Ring fencing, capital flow barriers

Equilibrium under Pigouvian Taxation

Proposition: Under non-cooperative Pigouvian taxation

1. The domestic liquidation wedges on domestic and foreign banks are

$$\tau^L_{i,ii}(s) = \tau^L_{i,ji}(s) = \underbrace{-\Omega_{i,i}(s)}_{\text{Domestic Spillovers}} \underbrace{- \int_{i'} \Omega_{i',i}(s) di'}_{\text{Foreign Spillovers}} \underbrace{\forall j}_{\text{Equal Treatment}}$$

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2. The wedges on domestic investment by foreign banks are

$$\tau^I_{i,ji} = \underbrace{\frac{\partial^2 \Phi_{ji}}{\partial I^2_{ji}} I_{ji}}_{\text{Monopolist Motive}} \geq 0$$

Pigou **efficient** if monopoly rents are 0! (eg high investment mobility)

Intuition

- Foreign banks get benefit, but impose a social cost

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$$\begin{aligned}\text{Marginal Social Cost} &\leq \text{Marginal Bank Benefit} \\ &= \text{Tax Rate} \\ &= \text{Marginal Tax Revenue} \\ &= \text{Marginal Social Benefit}\end{aligned}$$

Intuition

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- Domestic fire sale $\Rightarrow$lower marginal bank benefit $\Rightarrow$ lower tax rate

Implications

- Banking Regulation
  - Price-based regulation and capital controls efficient
  - e.g. residency based transaction tax, tax on debt

- Beyond Bank Regulation (see paper)
  - Quantity regulation: generically inefficient
  - Pigouvian taxation: two requirements for efficiency
    1. No monopoly rents
       –Doesn't fix terms-of-trade manipulation
    2. Form of externality
       –Local externalities (credit crunch, river pollution)
       –Local externalities spread to foreign banks (fire sales)
       –But not global externalities (climate change, global pollution)

Conclusion

- International banking: non-cooperative quantity regulation not efficient
- Optimal cooperative agreement resembles real-world regimes
- But, *non-cooperative* Pigouvian taxes can implement cooperative outcome

Thank you!

Appendix: International Bank Claims

Table: Bank Claims as Share of Total Claims on Host Country

Home\Host	US	Germany	UK	France	Japan
US	0.64	0.04	0.08	0.03	0.02
Germany	0.02	0.79	0.06	0.03	0.00
UK	0.05	0.02	0.54	0.05	0.01
France	0.03	0.03	0.05	0.77	0.01
Japan	0.10	0.02	0.04	0.04	0.94

Source: BIS CBS

Back

Appendix: Fire Sale Spillovers

Lemma: Spillover effect on country i bank value from an increase $d\gamma_j(s)$

$$\Omega_{i,j}(s) = \underbrace{\frac{\partial \gamma_i(s)}{\partial L_i^A(s)}}_{\text{Price Impact}} \left[\underbrace{\frac{\lambda_i^1(s)}{\lambda_i^0} L_{ij}(s)}_{\text{Liquidation Losses}} + \underbrace{\frac{\Lambda_i^1(s)}{\lambda_i^0} \left[L_{ij}(s) + (1 - h_j(s)) \left[R_j(s) I_{ij} - L_{ij}(s) \right] \right]}_{\text{Collateral Constraint Spillover}} \right]$$

Back

Appendix: Implementability

Lemma: Under both quantity regulation and Pigouvian taxation, country planner i can directly choose the domestic allocations of foreign banks, with implementing wedges

$$\tau^I_{i,ji} = -\tau^I_{j,ji} - \frac{\partial \Phi_{ji}}{\partial I_{ji}} + E\left[\frac{\lambda^1_j}{\lambda^0_j}(1+r_{ji})R_i\right] + \frac{1}{\lambda^0_j}E\left[\Lambda^1_j(1-h_i)\gamma_i R_i\right]$$

$$\tau^L_{i,ji}(s) = -\tau^L_{j,ji}(s) + \frac{\lambda^1_j(s)}{\lambda^0_j}\left(\gamma_i(s) - (1+r_{ji})\right) + \frac{1}{\lambda^0_j}\Lambda^1_j(s)h_i(s)\gamma_i(s)$$

where the Lagrange multipliers and the foreign wedges $\tau_{j,ji}$ are constants from the perspective of country planner i.

Key property: activities in foreign countries is marginal. One foreign country has marginal effect on entire contract, so Lagrange multipliers taken as given.

Back

Appendix: Regulation Formal Problem

- Let (τ_i^I) and (τ_i^L) denote the implementability conditions
- Wealth level of country i banks (net of foreign taxes)

$$A_i - \int_j \left[\tau_{j,ij}^I I_{ij} + \tau_{j,ij}^L I_{ij}^L \right] dj$$

  appears in (BC-0). $\tau_{j,i}$ taken as given
- Country i planner solves

$$\max_{c_i, D_i, I_i, I_i^L, \{I_{ji}, I_{ji}^L\}, \tau_i} \int_s c_i(s) f(s) ds \quad \text{s.t. (BC-0), (BC-1), (CC), } (\gamma), (\tau_i^I), (\tau_i^L)$$

- τ_i^I, τ_i^L only appear in (τ_i^I), (τ_i^L). Set to clear implementability but don't affect welfare

Back

Appendix: Pigou Formal Problem

- Implementability result the same
- Tax collections from foreign banks

$$T_i^* = \int_j \left[\tau_{i,ji}^I I_{i,ji} + \tau_{i,ji}^L I_{ji}^L \right] dj$$

- Bank wealth (after foreign revenue remissions) $A_i^* = A_i + T_i^*$
- Planner i optimization problem is

$$\max_{c_i, D_i, I_i, I_i^L, \{I_{ji}, I_{ji}^L\}} \int_s c_i(s) f(s) ds \quad \text{s.t. (BC-0), (BC-1), (CC), } (\gamma)$$

where the difference is that the implementing wedges $\tau_{i,ji}$ now appear in (BC-0) through T_i^*

Back

Appendix: General Model Spillover

$\Omega_{i,j}(m)$ equivalent variation of change $da_j^A(m)$

$$\Omega_{i,j}(m) = \underbrace{\frac{\omega_i}{\lambda_i^0}\frac{\partial U_i}{\partial u_i^A}\frac{\partial u_{ij}^A}{\partial a_j^A(m)}}_{\text{Utility Spillovers}} + \underbrace{\frac{1}{\lambda_i^0}\Lambda_i\frac{\partial \Gamma_i}{\partial \phi_i^A}\frac{\partial \phi_{ij}^A}{\partial a_j^A(m)}}_{\text{Constraint Set Spillovers}}$$

Back

Appendix: Quantity Regulation versus Pigouvian Taxation

- Quantity regulation: Wedges revenue neutral

$$\underbrace{A_i^*}_{\text{Equilibrium Bank Wealth}} = A_i - \underbrace{\int_j \left[\tau_{j,ij} I_{ij} + \tau_{j,ij}^L L_{ij}\right] dj}_{\text{Foreign Wedge Burden}} + \underbrace{\mathcal{T}_i^*}_{\text{Foreign Remissions}}$$

- Pigouvian taxation: Wedges not revenue neutral

$$\underbrace{A_i^*}_{\text{Equilibrium Bank Wealth}} = A_i - \underbrace{\int_j \left[\tau_{j,ij} I_{ij} + \tau_{j,ij}^L L_{ij}\right] dj}_{\text{Foreign Wedge Burden}} + \underbrace{\int_j \left[\tau_{i,ji} I_{ji} + \tau_{i,ji}^L L_{ji}\right] dj}_{\text{Revenue from Foreign Banks}}$$

Back