Dollar Debt and the Inefficient Global Financial Cycle

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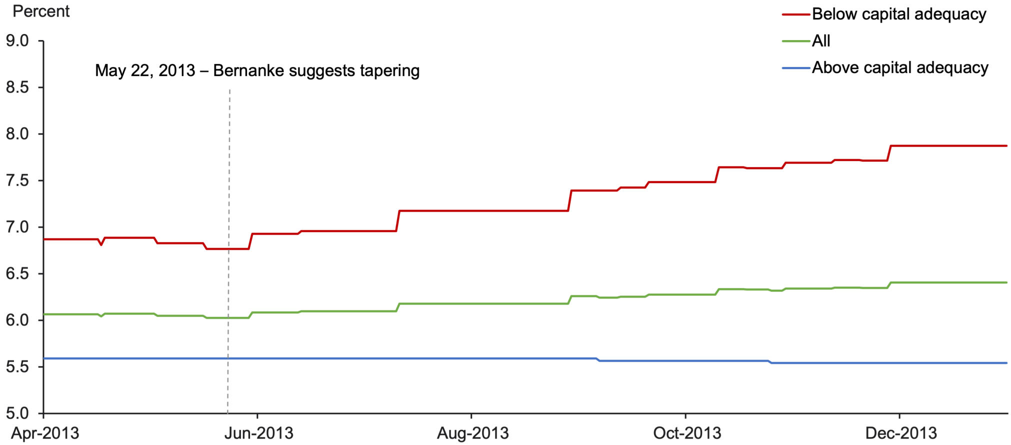
Motivation

- Global Financial Cycle — Rey (13)
  - U.S. monetary policy drives flows
  - Depreciations $\rightarrow$ Balance sheet effects — Cespedes et al. (04); Jiang et al. (24)
  - $\rightarrow$ Synchronized policy response

- Taper tantrum, recent round of EMEs tightening, ...

Emerging-Market Interest Rates Respond to Taper



Sources: Federal Reserve Board; International Monetary Fund; Federal Reserve Bank of Dallas.

EMEs considered: Turkey, Argentina, Brazil, Indonesia, South Africa, Chile, Colombia, India, Mexico, Russia, Thailand, Philippines, China

▸ More

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  - → Synchronized policy response
- Taper tantrum, recent round of EMEs tightening, ...
- EME central bank facing the GFC
  - Optimal monetary policy response?
  - Role of capital flows? Spillovers? Coordination?
  - Optimal ex-ante policy?

▸ Model Preview ▸ Results Preview ▸ Literature

References

- Global Financial Cycle:
  - Facts: **Rey (13)**; Chitu, Eichengreen & Mehl (14); Burger, Warnock & Warnock (18); Albagli et al. (19); Miranda-Agrippino & Rey (20; 22); Obstfeld & Zhou (23); Cesa-Bianchi et al. (25)
  - Theories: Bianchi, Bigio & Engel (21), Gopinath & Stein (21); Gourinchas & Rey (22); Jiang, Krishnamurthy and Lustig (24); Kekre & Lenel (24); Abadi et al. (25)
  - Dollar-denominated corporate borrowing in EMEs: Bruno & Shin (15); McCauley, McGuire & Sushko (15); Maggiori, Neiman & Schreger (20); Florez-Orrego et al. (23); Du & Huber (23)
- Policy under foreign-denominated debt:
  - Balance sheet effects: Krugman (99); Cespedes, Chang & Velasco (2004); Aghion, Bacchetta & Banerjee (04); Chamon & Hausmann (05); Wang (19); De Gregorio & Peña (24)
  - Monetary Policy: Engel (11); Devereux & Yu (19); Ottonello (21); Matsumoto (21); Coulibaly (21); **Bianchi & Lorenzoni (21)**; Basu, Boz, Gopinath, Roch, Unsal (23); De Gregorio (24)
  - Macroprudential Policy: Acharya & Krishnamurthy (18); Drenik, Kirpalani & Perez (22)
- Spillovers:
  - U.S. Monetary Policy Spillovers: Gourinchas (18); Devereux & Yu (18); Kalemli-Özcan (19); Jiang, Krishnamurthy and Lustig (24); Akinci & Queralto (21); Akinci, Kalemli-Özcan & Queralto (21)
  - Cooperation: Obstfeld & Rogoff (02); Devereux & Engel (03); Benigno & Benigno (06); Engel (15); **Korinek (17)**; Fornaro & Romei (22); Caballero & Simsek (20); Caballero, Farhi & Gourinchas (21)
  - Imperfections in Global Financial Markets: Kouri (77); **Gabaix & Maggiori (15)**; Fanelli & Straub (21); Itskhoki and Mukhin (23); Bianchi & Lorenzoni (21); Morelli, Ottonello & Perez (22); Du et al. (23); Coimbra & Rey (24); Kekre and Lenel (24)

More References · Contributions · Introduction

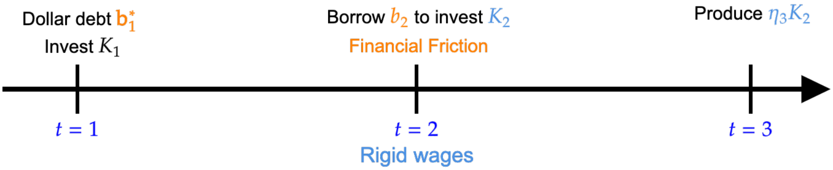
Outline

1. Model
2. (In)efficient Global Financial Cycle
3. Macroprudential Policy

Layout

- Small Open Economy
- **Households**:
  1. Supply labor
  2. Wage rigidity → Aggregate demand effects
- **Entrepreneurs**:
  1. Borrow in dollars and pesos to invest
  2. Produce non-tradable goods
  3. Financial frictions → Balance sheet effects
- Central bank sets the domestic interest rate / exchange rate
  – No access to other instruments

Korinek (17), Itskhoki and Mukhin (23)



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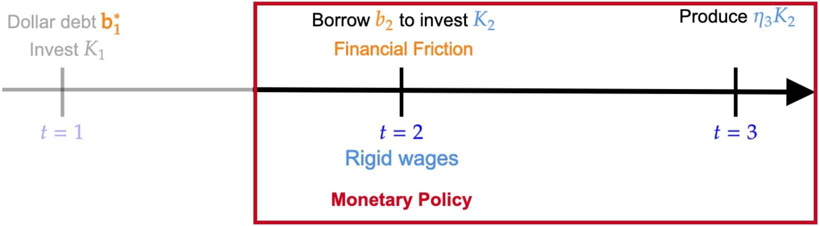

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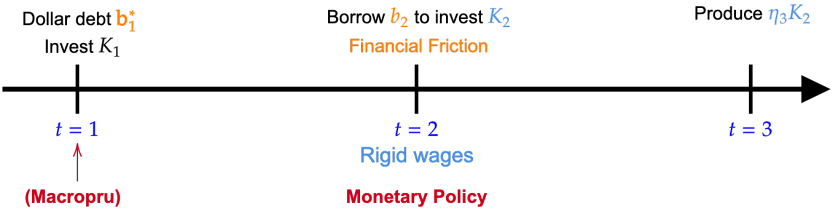


Time $t = 2$: Households & Production

- Goods: Tradables T & non-tradables N
- **Households**: ▸ Details

$$U_2 = \frac{1}{1-\rho}\Big((c_2^T)^{\phi}(c_2^N)^{1-\phi}\Big)^{1-\rho} + \beta\Big(c_3^N + c_3^T\Big)$$

  - $\rho \geq 1$
  - Inelastic supply of labor $l_2 \leq \bar{n}$
  - Peso-denominated bonds a_3 at i_2 $\rightarrow a_3 = 0$ in equilibrium
  - Dollar-denominated bonds a_3^* at i_2^* $\rightarrow$ dollar rate faced by EME
- **Production**:
  - Perfectly competitive continuum of firms
  - Linear technology $y_2^N = l_2$ to produce NT
  - Fully rigid wages at $\bar{w} = 1$ $\rightarrow$ involuntary unemployment
- T endowment y_2^T, law of one price: $p_t^T = e_t$

Time $t = 2$: Entrepreneurs

- Entrepreneurs enter with:
  - Capital stock K_1 producing η_2 of NT per unit
  - Peso debt b_1
  - Dollar debt b_1^*
- Entrepreneurs net worth:

$$n_2 = \eta_2 K_1 - b_1 - \mathbf{e_2} b_1^*$$

- After production, entrepreneurs hit by random shocks: Caballero & Krishnamurthy (03)
  - Fraction κ still productive
  - Can produce at $t = 3$ if maintain capital stock: productivity r_1
  - Must invest s of non-tradables per unit
  - Remaining $1 - \kappa$ unproductive: capital fully depreciates

Time $t = 2$: Financial Friction

- Productive entrepreneurs need to pay $s \cdot k_2$
- Can borrow from other unproductive entrepreneurs

Cost of Interest

- Classic monitoring problem (Tirole 10)

$$b_2 \leq r_0 k_2$$

  - r_0 pledgeable part of the project
  - $r_0 < s < 1$

- Constrained entrepreneurs:

$$k_2 = \frac{n_2}{s - r_0}$$

- Net worth multiplier $\implies$ role for monetary policy
  - Increase in domestic rate $i_2 \implies$ appreciates currency
  - Lowers the debt burden of entrepreneurs
  - Net worth multiplier $\implies$ more investment

Borrowing Currency
Currency Mismatch

Monetary Policy Tradeoff

- Central bank seeks to maximize welfare of the representative consumer
- **Aggregate demand effects**:

$$c_2^N = \left(\frac{1-\phi}{\phi} \frac{(1+i_2^*)}{(\mathbf{1}+\mathbf{i_2})} \right) c_2^T$$

  - Usual expenditure switching
  - With rigid wages, lowers employment
  - **Decreases** N output at $t = 2$
- **Balance sheet effects**:
  - UIP condition:

$$(\mathbf{1}+\mathbf{i_2}) = (1+i_2^*) \frac{e_3}{e_2}$$

  - Net worth multiplier (assume constrained entrepreneurs):

$$\frac{dK_2}{d\mathbf{i_2}} = \frac{e_2 \kappa b_1^*}{s - r_0}$$

  - **Increases** N output at $t = 3$

Currency Mismatch

Domestic Monetary Policy

- Dollar debt threshold $\tilde{b}^*(i_2^*)$
- Central bank allows under-employment when $b_1^* > \tilde{b}^*$:
  - i_2 strictly increasing in b_1^*
  - Involuntary unemployment: $l_2 < \bar{l}$
  - i_2 strictly increasing in i_2^*

Optimal Interest Rate

When $\rho = 1$, the central bank trades off aggregate demand and balance sheet effects according to:

$$1 + i_2^{opt} = \frac{\beta}{1-\phi}\left(r_1 \kappa \frac{b_1^*}{s - r_0}\right)(1 + i_2^*)$$

- i_2 strictly increasing in i_2^*
- **Synchronization $\implies$ GFC**

Expression

Outline

1. Model

2. (In)efficient Global Financial Cycle

3. Macroprudential Policy

Setup: World Economy

- Continuum of identical and symmetric SOEs
- Continuum of SOEs small relative to rest of the world
  - Price of tradables in dollars still set to 1
  - Spillovers not coming from tradable inflation
- Each SOE takes decisions given world equilibrium
- Frictional global financial markets
  - Gabaix & Maggiori (15); Bianchi & Lorenzoni (21); Coimbra & Rey (24)...
  - Global arbitrageur intermediates capital flows $a^*_{3,j}$
- Premium on dollar rate pinned down by:
  - Demand/supply imbalances
  - Limited balance sheet capacity of financiers
- Equilibrium relationship between dollar premium rates and aggregate flows:

$$i_2^* = i_2^{\$} + \Gamma\left(\int_j (c^T_{2,j} - y^T_{2,j})dj\right)$$

▸ Foundations ▸ Diagram ▸ Illustration

Limit Case: No Spillover

- $\rho = 1$ case
- Each country reacts to i_2^*:

$$1 + i_2^{opt} = \frac{\beta}{1-\phi}\left(r_1 \kappa \frac{b_1^*}{s - r_0}\right)(1 + i_2^*)$$

- Euler equation :

$$c_{2,j}^T = \frac{1}{\beta(1 + i_2^*)}$$

  - Changing i_2 impacts the exchange rate but not c_2^T
- Global intermediaries condition:

$$i_2^* = i_2^\$ + \Gamma\left(\frac{1}{\beta(1 + i_2^*)} - y_2^T\right)$$

- No spillover $\rightarrow$ (constrained) efficient GFC
- Efficiency breaks when i_2 impacts capital flows

Return

Inefficient Global Financial Cycle

- Trickling up equilibrium conditions:
  1. Fed decision $\rightarrow$ depreciationary pressures
  2. Balance sheet effects $\rightarrow$ increase in EMEs policy rate
  3. Attract capital flows $\rightarrow$ increase in dollar premium $i_2^* - i_2^\$$ through Γ
  4. Feeds back into depreciationary pressures

$$\frac{d\ln(1+i_{2,j})}{d\ln(1+i_2^*)} = \frac{\rho(1-\phi)+\phi}{\rho+(\rho-1)(1-\phi)}$$

$$c_{2,j}^T = \frac{\phi}{1-\phi}\frac{1+i_{2,j}}{1+i_2^*}c_{2,j}^N$$

$$i_2^* = i_2^\$ + \Gamma\int_j \left(c_{2,j}^T - y_{2,j}^T\right) dj$$

Inefficient Global Financial Cycle: Spillovers

- Trickling up equilibrium conditions:
  1. Fed decision $\rightarrow$ depreciationary pressures
  2. Balance sheet effects $\rightarrow$ increase in EMEs policy rate
  3. Attract capital flows $\rightarrow$ increase in dollar premium $i_2^* - i_2^\$$ through Γ
  4. Feeds back into depreciationary pressures

Bottleneck Externalities

Domestic decisions spill over to the world interest rate:

$$\mathscr{C}(i_2, i_2^*) = \frac{d\ln(1+i_2^*)}{d\ln(1+i_2)} = \Gamma(\rho - 1)\frac{c_2^T}{1+i_2^*}\frac{1-\phi}{\rho}$$

- **Necessary** ingredients:
  - $\rho > 1$: (i_2 changes capital flows) $\mathscr{C}(i_2, i_2^*) \xrightarrow[\rho \to 1]{} 0$
  - Γ: (frictional global markets) $\mathscr{C}(i_2, i_2^*) \xrightarrow[\Gamma \to 0]{} 0$

No Spillover Benchmark   Amplification

Gains From Coordination

- Spillovers → need for coordination

Global Coordinated Equilibrium

Global Social Planner implements a lower interest rate. Coordination equilibrium characterized by:

- Higher employment
- Higher output
- Less depreciation in EMEs
- Lower i_2^*

- Dampens the GFC

Illustration Expression

Discussion of Results

1. Condition (i): monetary tightening brings capital flows
   - In general, need elasticity of intertemporal substitution $< T$ - NT substitution
   - Can also come from financial frictions on intermediation of dollar savings DSS
   - See also Bianchi & Coulibaly (22); Matschke, Sattiraju & von Ende-Becker (23) ...
2. Condition (ii): size of aggregate flows matters Alternative
   - Need global arbitrageurs to view flows as substitutes Diagram
   - Importance of investor base in generating spillovers
   - Cross-elasticities: see also An & Huber (24), Rey et. al (24), Nenova (24)
   - **Do not need**:
     - Tradable good market clearing condition
     - Balanced trade among EMEs
3. Condition (iii): Synchronization of monetary policies ?
   - Not the only way to arrive at this result
   - See also Bianchi & Coulibaly (23); Itskhoki & Mukhin (23); Fornaro & Romei (22) ...
   - Dollar debt:
     - Synchronization vis-a-vis **US monetary policy shock**
     - Study **ex-ante policies + moral hazard**

Outline

1. Model
2. (In)efficient Global Financial Cycle
3. Macroprudential Policy

Macroprudential Policy: Trade-Off

- Tax dollar debt issuance
  - Acharya & Krishnamurthy (2018)
  - Hike less at $t = 2$
  - Trade-off: more expensive to finance investment

Show expressions

(Privately) Optimal Macroprudential Policy

When $\rho = 1$, the optimal tax on dollar issuance reduces the amount issued in dollars, b_1^*, such that:

$$\frac{1-\phi}{b_1^*} = -\beta \frac{r_1 \kappa}{s - r_0} \frac{db_1}{db_1^*}$$

- Left side: benefits of relaxing MP trade-off
  - Less hiking at $t = 2$
  - Higher employment
- Right side: costs of lower investment at $t = 2$
  - Lower net worth at $t = 2$
  - Lower NT production at $t = 3$

Macroprudential Policy: Spillovers

- Tax dollar debt issuance
  - Hike less at $t = 2$
  - Trade-off: more expensive to finance investment
  - GFC dampened

Show expressions

Macroprudential Policy Spillovers

$$\frac{d(1+i_2^*)}{db_1^*} = \Gamma(\rho - 1)\frac{(1-\phi)}{\rho + (\rho-1)(1-\phi)}\frac{b_1^*}{c_2^T}$$

- Positive Spillovers
  - Less hiking at $t = 2$
  - Less congestion in capital flows
  - No coordination required
- Ameliorates the trade-off that all central banks face in the future
- Bergant, Grigoli, Hansen & Sandri (2024)

Debt Issuance Externalities Moral Hazard

Extensions

1. Intermediary Capacity and the Dollar
2. Asymmetric Effects of Dollar Shocks
3. Tradable price inflation
4. Tractability: financial wedge and separable preferences
5. General currency mismatch
6. Cost of interest for firms
7. FX Interventions
8. Cyclicality and the Short Rate Disconnect

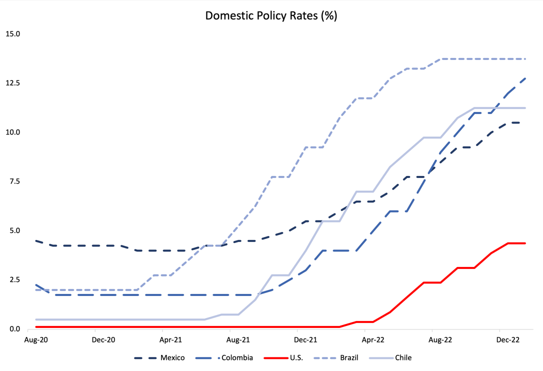
Conclusion

1. Dollar debt in EMEs $\implies$ Bottleneck Externalities
   - Requires **frictional** global financial markets

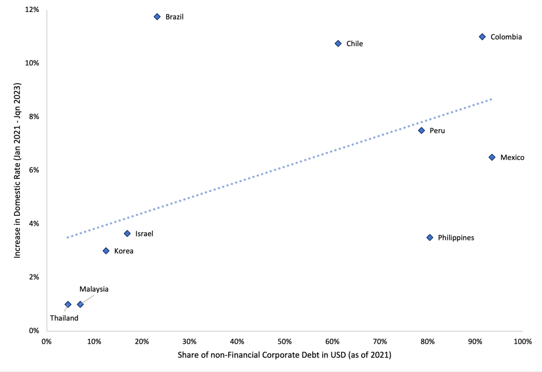
2. Inefficient GFC, requires monetary policy coordination between EMEs

3. Macroprudential policy: positive spillovers to discourage dollar issuance
   - **Dampens** the GFC
   - Even more needed when the central bank has access to **FXI**

Appendix Slides



Domestic Policy Rates (%)
15.0
12.5
10.0
7.5
5.0
2.5
0.0
Aug-20
Dec-20
Apr-21
Aug-21
Dec-21
Apr-22
Aug-22
Dec-22
Mexico
Colombia
U.S.
Brazil
Chile



Brazil
Chile
Colombia
Peru
Mexico
Israel
Philippines
Korea
Malaysia
Thailand
12%
10%
8%
6%
4%
2%
0%
Increase in Domestic Rate (Jan 2021 - Jqn 2023)
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Share of non-Financial Corporate Debt in USD (as of 2021)

▸ Return

This Paper

- Small Open Economies model:
  - Entrepreneurs borrow in dollars and local currency — Florez-Orrego et. al (23)
  - Nominal rigidities → Aggregate demand effects — Schmitt-Grohe & Uribe (06)
  - Financial friction → Balance sheet effects

- Imperfect global financial markets: — Gabaix & Maggiori (15)
  - Global arbitrageur intermediates capital flows with the U.S.
  - Size of flows determines the premium on the dollar rate

- Central banks:
  - Set the domestic nominal interest rate
  - No access to other instruments — Korinek (17), Itskhoki and Mukhin (23)
  - Ex-ante policy? FXI?

▸ Introduction

Results Preview

1. Corporate dollar debt ties the hands of central banks
   - Trade-off aggregate demand and balance sheet effects
   - Involuntary unemployment and output gap
   - EMEs must respond to U.S. monetary policy
     - Synchronized response of EMEs → **GFC**
2. GFC is inefficient when global markets are frictional
   - EMEs seek to attract capital flows at the expense of one another
   - Bottleneck externality
   - Gains from monetary policy coordination
     - Coordinated equilibrium: higher employment and output
     - Dampens the GFC
3. Macroprudential policy optimal
   - Discourage dollar-denominated issuance
     - Solves moral hazard
     - Dampens the GFC
   - Positive spillovers
   - Even more needed when access to FXI

References: Extended

- Models of the GFC : Miranda-Agrippino & Rey (22); Bianchi, Bigio & Engel (21); Gopinath & Stein (21); Jiang, Krishnamurthy & Lustig (21); Farhi & Maggiori (18); Kekre & Lenel (21); Gourinchas & Rey (2022)
- Dollar Issuance : McKinnon & Pill (98); Burnside, Eichenbaum & Rebelo (01); Schneider & Tornell (04); Caballero & Krishnamurthy (03); Jeanne (2002); Bocola & Lorenzoni (20); Coppola, Krishnamurthy & Xu (23); Eren, Malamud & Zhou (23)
- Monetary Policy under financial fragility : Boissay, Collard, Galí & Manea (21); Farhi & Werning (20); Asriyan, Fornaro, Martin & Ventura (21)
- Macroprudential policy in open economies : Bianchi (11); Farhi & Werning (16); Bianchi & Mendoza (18); Jeanne & Korinek (19); Acharya & Vij (24) Under-borrowing : Benigno, Chen, Otrok, Rebucci & Young (13); Acharya & Bengui (18); Schmitt- Grohé & Uribe (21)
- FXI : Ghosh, Ostry & Chamon (2016); Amador, Bianchi, Bocola & Perri (2020); Fanelli & Straub (2021); Bacchetta, Benhima & Berthold (2023); Ottonello, Perez & Witheridge (2023); Davis, Devereux & Yu (23)

▸ Main Literature ▸ Motivation

References

1. Global Financial Cycle:
   - Rey (13); Jiang, Krishnamurthy and Lustig (24); Maggiori, Neiman & Schreger (20) ...
2. Policy under foreign-denominated debt:
   - Cespedes, Chang & Velasco (2004); Bianchi & Lorenzoni (21) ...

This paper: **1 & 2 + GM $\Longrightarrow$ Bottleneck Externalities**

3. Spillovers:
   - Fornaro & Romei (22); Itskhoki & Mukhin (23) ...

This paper: **Spillovers even among small set of EMEs**

Main Literature Motivation

Households: Details

$$U_2 = \frac{1}{1-\rho}\left((c_2^T)^{\phi}(c_2^N)^{1-\phi}\right)^{1-\rho} + \beta\left(c_3^N + c_3^T\right)$$

- Linearity delivers closed-form solutions
- Budget constraints:

$$p^T c_2^T + p^N c_2^N = e_2 y^T + w_2 l_2 + \frac{1}{1+i_2} a_3 + \frac{1}{1+i_2^*} e_2 a_3^* + \Pi_2$$
$$p_3^N c_3^N + p_3^T c_3^T + a_3 + e_3 a_3^* = p_3^T y_3^T + \bar{w}\bar{l} + \Pi_3$$

- Optimization for NT demand:

$$c_2^N = \left(\frac{\phi}{1-\phi}\frac{p_2^N}{p_2^T}\right)^{-1} c_2^T = \left(\frac{\phi}{1-\phi}\frac{\bar{w}}{e_2}\right)^{-1} c_2^T$$

Return

Synchronization

- i_2 strictly increasing in i_2^*
- **Synchronization** $\implies$ **GFC**

Corollary: GFC

The sensitivity of the domestic interest rate in a EME with respect to the US interest rate is given by:

$$\frac{d\ln(1+i_2)}{d\ln(1+i_2^*)} = \frac{\rho(1-\phi)+\phi}{\rho+(\rho-1)(1-\phi)}$$

- Spillovers? Coordination?

Return: Optimal Policy

Global Intermediaries: Foundations from Bianchi & Lorenzoni (22)

- Frictional global financial markets: Gabaix & Maggiori (15)
  - Global arbitrageur intermediates capital flows $a^*_{3,j}$
  - Dollar-denominated bonds at rate i^*_2.
  - Global arbitrageur have access to the the Fed at $i^\$_2$
- Follow Bianchi & Lorenzoni (22)
  - Quadratic cost function for intermediation of flows

$$\Phi\left(\int_j cf_{3,j}dj\right) = \frac{\Gamma}{2}\left(\int_j cf_{3,j}dj\right)^2$$

- Net profits:

$$\int_j (1+i^*_2)cf_{3,j}dj - (1+i^\$_2)\int_j cf_{3,j}dj - \Phi\left(\int_j cf_{3,j}dj\right)$$

- Maximization leads to

$$i^*_2 = i^\$_2 + \Gamma\left(\int_j c^T_{2,j} - y^T_{2,j}dj\right)$$

Return Illustration

Global Intermediaries: Foundations from Gabaix & Maggiori (15)

- Financiers maximize value of the firm:

$$V = (i_2^* - i_2^\$)q$$

- Financial constraint:

$$V \geq |q|\Gamma|q| = \Gamma q^2$$

- Financiers want to borrow or lend as much as possible for any non-zero return $(i_2^* \neq i_2^\$)$
- Constraint binds:

$$(i_2^* - i_2^\$)q = \Gamma q^2$$

- Replace q by net flows:

$$i_2^* = i_2^\$ + \Gamma \left(\int_j c_{2,j}^T - y_{2,j}^T dj \right)$$

Return Illustration

Global Intermediaries: Foundations from Fanelli & Straub (21)

- Frictional global financial markets: Gabaix & Maggiori (15)
  - Global arbitrageur intermediates capital flows $a^*_{3,j}$
  - Dollar-denominated bonds at rate i^*_2.
  - Global arbitrageur have access to the the Fed at $i^{\$}_2$
- Follow Fanelli & Straub (21)
  - Continuum of intermediaries g
  - Subject to net open position limit $\Gamma^{-1} > 0$
  - Heterogeneous participation costs g per dollar Alvarez et al. (09)
- Intermediary g solves:

$$\max_{x_g \in [-\Gamma^{-1}, \Gamma^{-1}]} x_g (i^*_2 - i^{\$}_2) - g|x_g|$$

- Marginal intermediary verifies: $\bar{g} = |i^*_2 - i^{\$}_2|$
- World equilibrium relationship between interest rates and aggregate flows:

$$i^*_2 = i^{\$}_2 + \Gamma \left(\int_j \frac{a^*_{3,j}}{1 + i^*_2} dj \right)$$

Return Illustration

Global Intermediaries: Foundations from Coimbra & Rey (24)

- Global intermediaries subject to a VaR constraint Stulz (16)
  - Invest q in EMEs $\implies$ face random compliance costs $q^2\xi$
  - Probability of negative return needs to be less than α

$$Pr\left(q(i_2^* - i_2^\$) - q^2\xi \leq 0\right) \leq \alpha$$

- Assume ξ follows a uniform distribution on $[0, \Xi]$
  - Ξ large enough such that $\Xi > \alpha$
  - Maximizing profits:

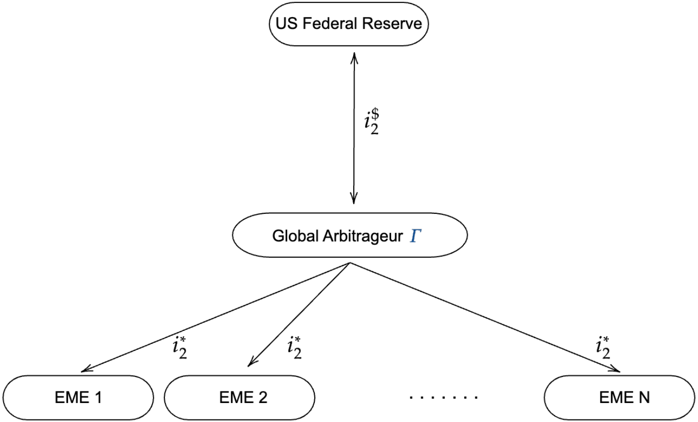
$$\Xi - \frac{i_2^* - i_2^\$}{q} = \alpha$$

- Define $\Gamma = \Xi - \alpha$:

$$i_2^* = i_2^\$ + \Gamma \left(\int_j \frac{a_{3,j}^*}{1 + i_2^*} dj \right)$$

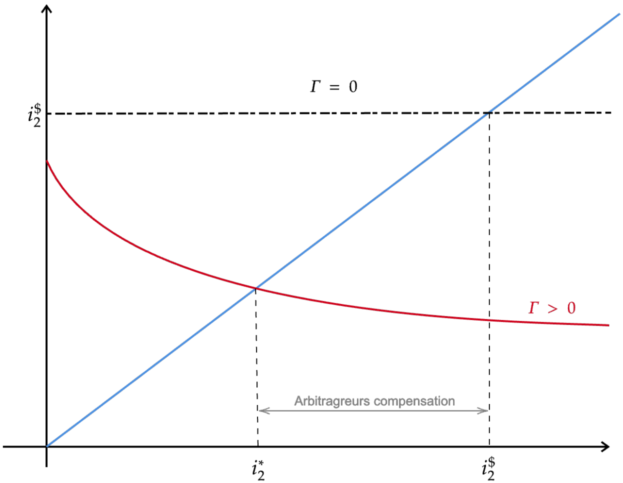
Return Illustration

Architecture of the Global Financial System



Return: Setup Return: Discussion

Interest Rate Intermediation



Aggregate Capital Flows and Equilibrium Interest Rate

▸ Return

Inefficient Global Financial Cycle: Amplification

- Round of amplification for monetary policy:
  1. Fed decision → tightening i_2 to counter balance sheet effects
  2. Γ friction → Bottleneck externality
  3. Higher i_2^* → depreciation of currency
  4. Tighten further to appreciate

Spillovers and Tighter Monetary Policy

The response of individual EMEs is amplified by the intermediation friction Γ on global financial markets:

$$\frac{d\ln(1+i_2)}{di_2^{\$}} = \frac{\frac{d\ln(1+i_2)}{di_2^*}}{1-\mathscr{C}(i_2, i_2^*)}$$

- Each EME responds **more** to a US monetary policy shock:
  - Higher unemployment in each EME
  - Amplification exactly quantified by bottleneck externality

▸ Return: Bottleneck Externality

Inefficient Global Financial Cycle: Coordination

- Optimal monetary policy with coordination:
  1. implements a lower interest rate
  2. reacts less to US monetary policy shocks

Coordinated Monetary Policy

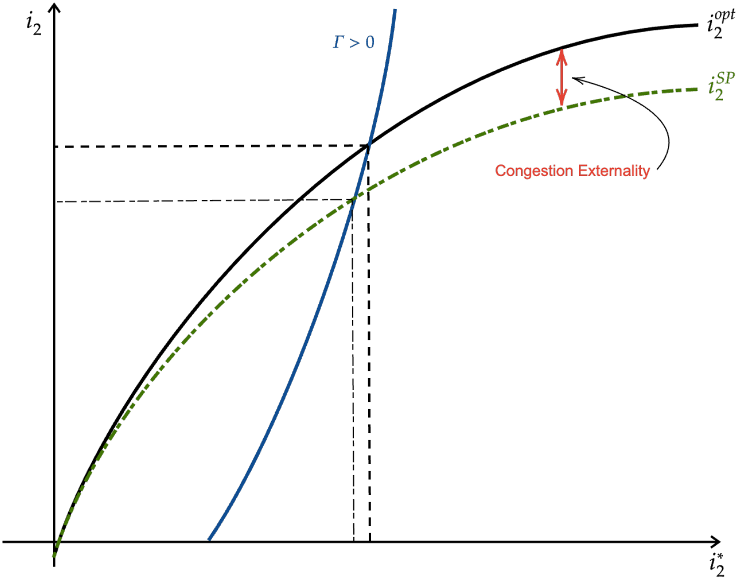
Around an equilibrium where $a_3^* = 0$, the difference between the optimal interest rate with coordination, i_2^C, and the decentralized interest rate i_2^{unC} evaluated for a same i_2^* is:

$$i_2^{unC} - i_2^C \approx \frac{\Gamma}{e_2} \frac{c_2^T (1-\phi)^2 (\rho - 1)^2}{(2(1-\phi)(\rho-1)+1))^3}$$

- Other intuition:
  - Full employment interest rate is an absolute level
  - Exchange rate muting balance sheet effects is a relative level that depends on the action of others

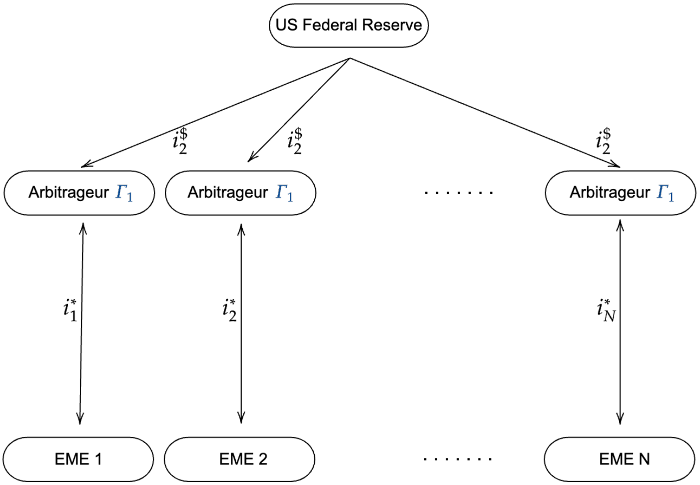
Return: Gains from Coordination

Coordinated and Uncoordinated Equilibria



Return

Architecture: Alternative



Return

Dollar Debt Issuance: $t = 1$

- Go back to $t = 1$
- Entrepreneurs:
  - Must finance fixed size K_1
  - Can issue in pesos (b_1) or dollars (b_1^*)
  - Interest rate $\widehat{i}_1$ or $\widehat{i}_1^*$
- Lenders compensated with a premium

$$\frac{b_1^*}{1+\widehat{i}_1^*} = \omega^*(\widehat{i}_1^* - i_1^*) \quad \text{and} \quad \frac{b_1}{1+\widehat{i}_1} = \omega(\widehat{i}_1 - i_1)$$

- Minimize repayments:

$$\min_{b_1, b_1^*} \quad b_1 + \mathbf{e_2} b_1^*$$

$$\text{s.t.} \quad \frac{b_1}{1+\widehat{i}_1} + \frac{e_1 b_1^*}{1+\widehat{i}_1^*} = K_1$$

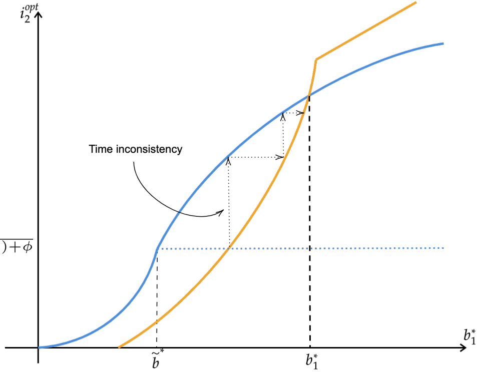
Solution   Return: Macroprudential Policy

Frictionless case: Equilibrium

- $\Gamma \to 0$
- Complements:
  - b_1^* ties the hands of the central bank
  - Raising i_2 makes it more attractive to issue in dollars

$$b_1^* = \omega^* \frac{K_1\left(K_1 + \omega^* e_1(1+i_1^*) + \omega(1+i_1)\right)}{\left(\omega \frac{e_2^{opt}}{e_1} + e_1\omega^*\right)^2}$$

$$e_2^{opt} = \Omega^{-1}\left(r_1 \kappa \frac{b_1^*}{s - r_0}\right)^{\frac{-\rho}{\rho-1+\rho(1-\phi)+\phi}} (1+i_2^*)^{-\frac{\rho-1}{\rho-1+\rho(1-\phi)+\phi}}$$



Return: Macroprudential Policy

Frictionless case: Externalities

- $\Gamma \to 0$

Dollar Debt Issuance Externalities

Dollar issuance reduces future employment in equilibrium:

$$\frac{dl_2}{db_1^*} = -\frac{1}{\rho + (\rho - 1)(1 - \phi)} \left((1 + (\rho - 1)\phi) \frac{c_2^N}{b_1^*} + (\rho - 1)(1 - \phi) \frac{s\kappa}{s - r_0} e_2^{opt} \right)$$

Corollary: Welfare Losses

When $\rho = 1$, an increase in b_1^* yields welfare losses at $t = 2$ equal to:

$$\frac{d\mathcal{W}}{db_1^*} = -\frac{1 - \phi}{b_1^*}$$

Return: Macroprudential Policy

Debt Issuance: Expressions

- Equilibrium interest rates:

$$1+\widehat{i}_1 = \frac{K_1 + \omega(1+i_1) + e_1\omega^*(1+i_1^*)}{\omega + e_1\omega^* \frac{e_1}{e_2}}$$

and:

$$1+\widehat{i_1^*} = \frac{K_1 + e_1\omega^*(1+i_1^*) + \omega(1+i_1)}{\omega\frac{e_2}{e_1} + e_1\omega^*}$$

- Dollar debt issuance:

$$b_1^* = \omega^* \frac{K_1 + e_1\omega^*(1+i_1^*) + \omega(1+i_1)}{\left(\omega\frac{e_2}{e_1} + e_1\omega^*\right)^2}\left(K_1 + \omega\left(1 + i_1 - \frac{e_2}{e_1}(1+i_1^*)\right)\right)$$

Return

Macropru: Expressions

- The amount of dollar debt that needs to be paid back at $t = 2$ is given by:

$$b_1^* = \omega^* \frac{K_1 + e_1\omega^*(1+i_1^*) + \omega(1+i_1) - \tau\omega\frac{e_2}{e_1}}{\left(\omega\frac{e_2}{e_1} + e_1\omega^*\right)^2}\left(K_1 + \omega\left(1 + i_1 - \frac{e_2}{e_1}(1+i_1^*+\tau)\right)\right)$$

- Peso debt to pay back is:

$$b_1 = \omega \frac{K_1 + \omega(1+i_1) + e_1\omega^*(1+i_1^*) + \tau e_1\omega^*\frac{e_1}{e_2}}{\left(\omega + e_1\omega^*\frac{e_1}{e_2}\right)^2}\left(K_1 + e_1\omega^*\left(1 + i_1^* - \frac{e_1}{e_2}(1+i_1-\tau)\right)\right)$$

- The optimal tax on dollar issuance lowers the amount issued in dollars, b_1^*, such that:

$$\frac{1-\phi}{2\sigma - 1 + \sigma\psi}\left(\beta\Omega_\psi\left(\frac{1+i_2^\$}{s-r_0}\right)^{\frac{\sigma}{2\sigma-1+\sigma\psi}}\right)^{-\frac{1-\sigma}{\sigma}}(b_1^*)^{-\sigma\frac{1+\psi}{2\sigma-1+\sigma\psi}} = \frac{\beta\rho\kappa}{s-r_0}\frac{dn_2}{db_1^*}$$

▸ Return

Deposit Channel for Dollar Savings

- Drechsler, Savov & Schnabl (17)
- Assume:
  - Banks with **market power** offer dollar deposits — Montamat (20)
  - Banks have access to the global intermediaries at i_2^*
  - Banks offer spread s^*
  - Households value liquidity and domestic bonds paying i_2

$$s^* = M \cdot i_2$$

- Households face dollar savings rate:

$$1 + \hat{i}_2^* = 1 + i_2^* - M \cdot i_2$$

- Capital flows:

$$\frac{1}{1+i_2^*} a_{3,j}^* = \left(\beta \phi \frac{1}{1 + i_2^* - M \cdot i_2} \right)^{\frac{1}{\sigma}} + b_{1,j}^* - y_{2,j}^T$$

$\Longrightarrow$ Monetary tightening attracts capital inflows

Data   Discussion of Results

Financial Wedge

$$U_2 = \frac{1}{1-\sigma}\left(\phi(c_2^T)^{1-\sigma} + (1-\phi)(c_2^N)^{1-\sigma}\right) + \beta\Big(c_3^N + c_3^T\Big)$$

- Dollar savings intermediated by domestic banks Montamat (20)
  - Perfectly competitive banks
  - Opportunity costs of holding reserves:

$$c_{\$,j} = (1+i_2)^{\psi}$$

- Effective dollar interest rate on savings:

$$(1+\widehat{i_2^*}) = (1+i_2^*)(1+i_2)^{-\psi}$$

- Frictional UIP condition: Itskhoki & Mukhin (21)

$$1+i_2 = \left((1+i_2^*)\frac{e_3}{e_2}\right)^{\frac{1}{1+\psi}}$$

Domestic Monetary Policy with ψ

- Dollar debt threshold $\tilde{b}^*(i_2^*)$
- Central bank allows under-employment when $b_1^* > \tilde{b}^*$

Optimal Interest Rate

Central bank trades off aggregate demand and balance sheet effects:

$$1 + i_2^{opt} = \Omega \left(\frac{(1 + i_2^*) b_1^*}{s - \rho_0} \right)^{\frac{\sigma}{2\sigma - 1 + \sigma\psi}}$$

- with $\Omega = \left(\sigma(1+\psi)\rho\kappa\beta^{\frac{1-\sigma\psi}{\sigma}} \right)^{\frac{\sigma}{2\sigma-1+\sigma\psi}}$
- Consequences:
  - i_2 strictly increasing in b_1^*
  - Involuntary unemployment: $l_2 < \bar{l}$
  - i_2 strictly increasing in i_2^*
  - **Synchronization $\Longrightarrow$ GFC**

Benchmark: No Spillover

- Assume $\psi = 0$ here
- Non-separable preferences:
  - Consumption of T:

$$c^T_{2,j} = \left(\frac{\phi}{1-\phi}\frac{1+i_2}{1+i_2^*}\right)^{\frac{1}{\sigma}} \left(\frac{(1-\phi)\beta}{1+i_2}\right)^{\frac{1}{\sigma}}$$

  - Independent of policy rate i_2
- Capital flows independent of policy rate

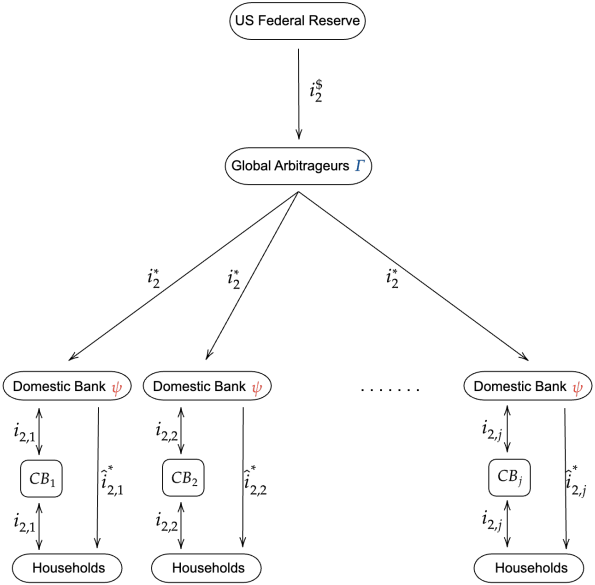
$$\frac{1}{1+i_2^*} a^*_{3,j} = \left(\beta\phi\frac{1}{1+i_2^*}\right)^{\frac{1}{\sigma}} + b^*_{1,j} - y^T_{2,j}$$

- No spillover $\rightarrow$ (constrained) efficient GFC
- Efficiency breaks when i_2 impacts capital flows
  - Non-separable preferences
  - Financial wedge (tractable!)

▸ Return

▸ Extensions

Architecture of the Global Financial System



Inefficient Global Financial Cycle

- Trickling up equilibrium conditions:
  1. Fed decision $\rightarrow$ depreciationary pressures
  2. Balance sheet effects $\rightarrow$ increase in EMEs policy rate
  3. Attract capital flows $\rightarrow$ increase in i_2^*
  4. Feeds back into depreciationary pressures

$$1 + i_{2,j} = \Omega_\psi \left(\frac{b_{1,j}^*(1 + i_2^*)}{s - r_0} \right)^{\frac{\sigma(1+\psi)}{2\sigma(1+\psi)-1}} \tag{1}$$

$$1 + \widehat{i}_{2,j}^* = (1 + i_2^*)(1 + i_{2,j})^{-\psi} \tag{2}$$

$$\frac{a_{3,j}^*}{1 + \widehat{i}_{2,j}^*} = \left(\frac{\beta\phi}{1 + \widehat{i}_{2,j}^*} \right)^{\frac{1}{\sigma}} + b_{1,j}^* - y_{2,j}^T \tag{3}$$

$$i_2^* = i_2^\$ + \Gamma \left(\int_j \frac{a_{3,j}^*}{1 + i_2^*} dj \right) \tag{4}$$

Inefficient Global Financial Cycle

- Trickling up equilibrium conditions:
  1. Fed decision $\rightarrow$ depreciationary pressures
  2. Balance sheet effects $\rightarrow$ increase in EMEs policy rate
  3. Attract capital flows $\rightarrow$ increase in i_2^*
  4. Feeds back into depreciationary pressures

Bottleneck Externalities

Domestic decisions spill over to the world interest rate:

$$\mathscr{C}(i_2, i_2^*) = \frac{d\ln(1+i_2^*)}{d\ln(1+i_2)} = \frac{\psi}{\frac{\sigma}{\Gamma(\beta\phi)^{\frac{1}{\sigma}}} \frac{(1+i_2^*)^{\frac{\sigma+1}{\sigma}}}{(1+i_2)^{\frac{\psi}{\sigma}}} + 1}$$

- **Necessary** ingredients:
  - Γ: (frictional global markets) $\mathscr{C}(i_2, i_2^*) \xrightarrow[\Gamma \to 0]{} 0$ (Itskhoki & Mukhin 22)
  - ψ: (i_2 changes capital flows) $\mathscr{C}(i_2, i_2^*) \xrightarrow[\psi \to 0]{} 0$

Extensions

Gains From Coordination

- Spillovers $\rightarrow$ need for coordination

Global Coordinated Equilibrium

Global Social Planner implements a lower interest rate:

$$1 + i_2^{SP} = \Omega_\psi \left(\frac{b_1^*(1+i_2^*)}{s - \rho_0} \right)^{\frac{\sigma}{2\sigma - 1 + \sigma\psi}} \left(1 - \frac{1}{1+\psi} \mathscr{C}(i_2^{SP}, i_2^*) \right)^{\frac{\sigma}{2\sigma - 1 + \sigma\psi}}$$

- Difference quantified by the bottleneck externality
- Coordination equilibrium characterized by:
  - Higher employment
  - Higher output
  - Less depreciation in EMEs
  - Lower i_2^*
- Dampens the GFC

Extensions

Financial Wedge: References

$$c_{\$,j} = (1 + i_2)^{\psi}$$

- Speech by Schnabel (23):

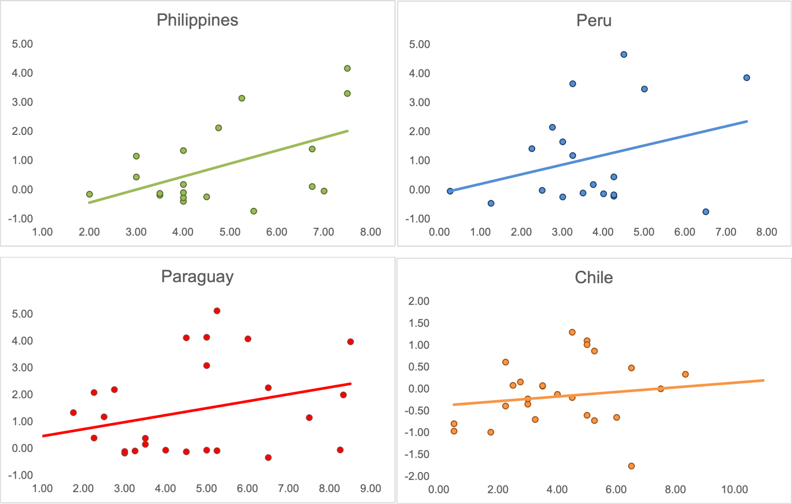
  The reason is that monetary policy tightening typically reduces intermediaries' risk-bearing capacity, thereby raising the compensation they require for warehousing risk, over and beyond changes in the quality of borrowers' balance sheet.

  - Money Market Contact Group meeting, 2023

- Also models of Gertler & Karadi (11), Adrian & Shin (14), and Vayanos & Vila (21)
- Drechsler, Savov & Schnabl (17): model with market power in deposit markets.
  - show that when the Fed funds rate rises, banks widen the spreads they charge on deposits

Return Extensions

ψ in the Data



$$i^* - \widehat{i} = \psi i$$

▸ Return ▸ Extensions

Currency Mismatch

- Assumption in main framework is extreme currency mismatch
  - Entrepreneurs' production at $t = 2$ is in NT only
  - $n_2 = \eta_2 K_1 - b_1 - \mathbf{e_2} b_1^*$
  - Exchange rate moves only costs
- General currency mismatch:
  - Entrepreneurs' capital yields η_2 of NT and $\iota\eta_2$ of T
  - $n_2 = \eta_2 + \mathbf{e_2}\iota K_1 - b_1 - \mathbf{e_2} b_1^*$
  - Exchange rate moves income and costs
- Net worth multiplier (assume constrained entrepreneurs):

$$\frac{dK_2}{\mathbf{i_2}} = (1 - \iota)\frac{e_2 \kappa b_1^*}{s - r_0}$$

References: Currency Mismatch

- Harvey and Roper (99) : Balance sheet effects driven by high leverage in foreign currency and subdued profitability played a significant role in propagating the Asian financial crisis.
- Aguiar (05) : Studies the case of the Mexican peso crisis of 1994 and finds that firms with heavy exposure to short-term foreign currency debt before the devaluation experienced relatively low levels of post-devaluation investment.
- Kim, Tesar and Zhang (15) : Holdings of foreign-currency denominated debt negatively affected the economic performance of small firms during the 1997–1998 crisis.
- Bruno and Shin (20) : "Currency Depreciation and Emerging Market Corporate Distress". Nonfinancialfirms that exploit favorable global financing conditions to issue U.S. dollar bonds are also those whose share price is most vulnerable to local currency depreciation.
- Amado (22) : Nontradable firms that do not use FX derivatives in Peru. 30% of loans to small firms are in dollars and more than 50% for large firms.
- Garcia, Levin-Konigsberg, Lopez & Stein (23) : Narrow framing in hedging decisions.
- Acharya & Vij (24) : Carry trade borrowers are more adversely affected during the taper tantrum stress period.

Borrowing in Dollars at $t = 2$

- Assumption in main framework is borrowing at $t = 2$ is in local currency
- Not important for results
  - Dollar borrowing at $t = 2$
  - Collateral is in NT-goods
  - Borrowing constraint:

$$b_2^* \leq \frac{r_0 k_2}{\mathbf{e_2}}$$

- Similar investment level for constrained entrepreneurs:

$$k_2 = \frac{n_2}{s - r_0}$$

- Net worth multiplier:

$$\frac{dK_2}{\mathbf{i_2}} = \frac{e_2 \kappa b_1^*}{s - r_0}$$

Financial Friction

Collateral Valued at $t = 3$

- Depending on micro-foundations for borrowing constraint, can have:

$$b_2^* \leq r_0 k_2 \implies n_2 + e_2 r_0 k_2 = s k_2$$

- Investment level for constrained entrepreneurs:

$$k_2 = \frac{n_2}{s - e_2 r_0}$$

- Secondary effect of interest rate policy
  - Currency depreciates
  - Makes collateral more valuable relative to next period
  - Increases investment

$$\frac{dK_2}{d\mathbf{e_2}} = \frac{-b_1^* s + r_0(\eta_2 K_1 - b_1)}{(s - e_2 r_0)^2}$$

Intermediary Capacity and the Dollar

- Literature: Bruno and Shin (15a); Bruno and Shin (201); Shin (16); Avdjiev, Du, Koch and Shin (19)
- Recall for instance micro-foundation from Coimbra & Rey (24) :
  - Γ linked to tightness of VaR constraint: $\Gamma = \Xi - \alpha$
  - Dollar appreciation $\implies$ fall in α $\implies$ increase in Γ
- Spillovers:

$$\mathscr{C}(i_2, i_2^*) = \frac{d\ln(1+i_2^*)}{d\ln(1+i_2)} = \Gamma(\rho-1)\frac{c_2^T}{1+i_2^*}\frac{1-\phi}{\rho}$$

  - Stronger with high Γ
  - GFC more exacerbated

Extensions

Asymmetric Effects of Dollar Shocks

- Literature: Bruno and Shin (15a); Bruno and Shin (201); Shin (16); Avdjiev, Du, Koch and Shin (19)
- Recall for instance micro-foundation from Coimbra & Rey (24) :
  - Γ linked to tightness of VaR constraint: $\Gamma = \Xi - \alpha$
  - Dollar appreciation $\implies$ fall in α $\implies$ increase in Γ
- Asymmetric effects of dollar shocks:

$$i_2^* = i_2^\$ + \Gamma \left(\int_j \frac{a_{3,j}^*}{1 + i_2^*} dj \right)$$

  - Wedge increases with higher Γ
  - If net borrowers, face higher i_2^* and hence currencies depreciate
  - If net savers, face **lower** i_2^* and hence currencies appreciate
- Does **not** depend on individual position
  - Clientele effects
  - Effect of shocks determined by all EMEs net position

Extensions

Tradable Price Inflation

- Main framework assumed a fixed price for T
  - Set of EMEs considered too small
  - Relax this assumption
- ROW: linear demand for T

$$D_2^T = D_2 - \delta P_2^T$$

- New source of spillovers
  - Change in demand of $T \implies$ change in P_2^T
- Goes in opposite direction
  - Tighten to appreciate
  - Raises price of T since synchronized
  - Attenuates expenditure switching effect
  - Less capital flows attracted for same appreciation
- Paper shows that dampening coefficient is at most $1/(1+\phi)$

Extensions

FXI: Setup

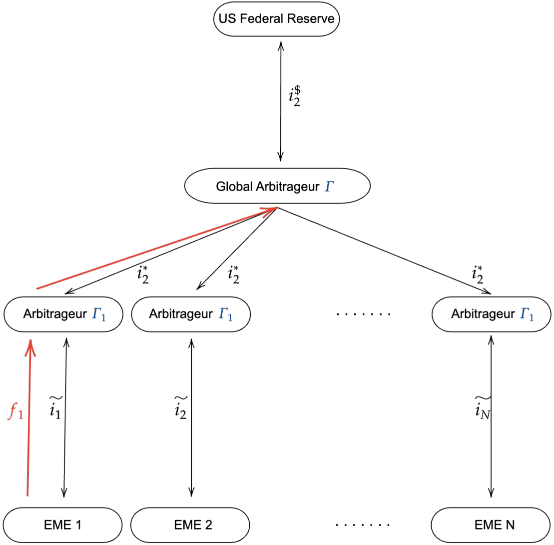
- Inefficiencies stem from use of single instrument Korinek (17)
- What about **FXI?**
  - Act directly on the exchange rate
  - Relax the central bank trade-off
  - But what if reserves are constrained?
- **Setup**:
  - Add a layer of intervention: local + global intermediary
  - i_2^* is the rate offered by the global intermediary
  - $\tilde{i}_{2,j}$ is the rate offered by the local intermediary j

$$\tilde{i}_{2,j} = i_2^* + \gamma_j \left(\frac{a_{3,j}^*}{1 + \tilde{i}_{2,j}} \right) \quad ; \quad i_2^* = i_2^{\$} + \Gamma \left(\int_j \frac{a_{3,j}^*}{1 + \tilde{i}_2^*} dj \right)$$

- Reserves $\bar{f}$
- Intervene by selling $f_{2,j} \in [0, \bar{f}]$
- Change in flows $\implies$ change in $e_{2,j}$

Return: Extensions

Architecture: FXI



Optimal Use of FXI

- Inefficiencies stem from use of single instrument Korinek (17)
- If reserves are unconstrained
  - $\bar{f}$ large enough
  - Two instruments, two targets
  - $\implies$ efficiency
  - Full employment at $t = 2$

Optimal Use of FXI

- Inefficiencies stem from use of single instrument Korinek (17)
- If reserves are unconstrained
  - $\bar{f}$ large enough
  - Two instruments, two targets
  - $\implies$ efficiency
  - Full employment at $t = 2$
- If constrained, i.e. $f_{2,j} = \bar{f}$:

1. i_2 lower than without FXI
2. Still under-employment
3. Currency more appreciated
4. Positive spillovers across countries

Return: Extensions

Moral Hazard & FXI

- Use of FXI result in expectation of appreciated currency
- $\implies$ more ex-ante dollar debt issuance b_1^*
  - Worsens future trade-off of central bank
  - Can go as far as lowering welfare!
- **Why?**
  - Interest rate policy also creates moral hazard
  - But costly: aggregate demand
  - Gives some commitment power
  - **Not the case for FXI** (in this model)
- Macroprudential policy more needed with FXI Acharya & Krishnamurthy (18); Chitu (21)
- Das, Gopinath, Hall, Kim & Stein (24): externalities in accumulating reserves

Return: Extensions

Cost of Interest

- Financial friction now:

$$b_2(1+\zeta r_2) \leq r_0 k_2$$

- Linearized level of investement:

$$k_2 \approx \frac{n_2}{s-r_0} - \frac{n_2}{(s-r_0)^2}\zeta i_2$$

- Central bank now factors in that tightening i_2 also reduces investment
- Optimal Policy Solution:

$$1+i_2 = \frac{\beta r_1 \kappa}{1-\phi}\frac{b_1^*(1+i_2^*)}{s-r_0} - \frac{\zeta}{(s-r_0)^2}\left(\beta r_1 \kappa n_2 - b_1^* i_2\right)$$

Cyclicality & Disconnect

- De Leo, Gopinath & Kalemli-Ozcan (24)
  - EMEs ease policy as a reponse to US monetary policy tightening
  - Market rates however increase
- Add trade channel :
  - US tightening $\implies$ negative aggregate demand shock in EMEs
  - P_2^T increases with $i_2^\$$ Ozhan (20); Brauning & Sheremirov (23)
- $\rightarrow$ i_2 decreasing in $i_2^\$$ if trade channel dominates

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  - P_2^T increases with $i_2^\$$ — Ozhan (20); Brauning & Sheremirov (23)
- $\rightarrow$ i_2 decreasing in $i_2^\$$ if trade channel dominates
- But spillovers are still present!
  - Under-employment because of balance sheet mismatch
  - Would like to ease more but want to avoid depreciation
  - Cares about the *absolute* level of e_2
  - Same pressure on aggregate capital flows
- **Disconnect**: Dollar shock increases intermediation friction Γ
  - Higher i_2^*
  - Exacerbated global externalities

Return: Discussion Return: Extensions