Internationalizing Like China

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October 2022

RMB Internationalization and Reserve Currency Competition

How do international currencies develop?

- Official Chinese government goal to be an international currency like the dollar
- Core strategy involves gradually liberalizing access to RMB bond market
- Goal: become store of value overcoming foreigners' fear of outflow restrictions

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How do international currencies compete?

- Competing issuers crowd each other out, lower incentives to build reputation

Stylized Facts and Theory

- Empirics: Three facts on internationalization of China's bond market
  1. Rise in foreign investment RMB-denominated bonds. Initial increase from stable-official holders and more recently by flightier private flows
  2. Foreign investor composition a deliberate policy choice of the Chinese government
  3. RMB bonds held by foreign investors as a mix of DM and EM currency bonds

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- Model: Dynamic theory of building reputation as global safe asset provider
  - Investors fear opportunistic govt might impose ex-post capital controls
  - At low reputation, optimal to only borrow from stable investors
  - As reputation improves, endogenously open-up to flighty investors
  - Act of opening up to flighty investors causes a jump in reputation
  - Tractable framework used to study competition, two-way flows

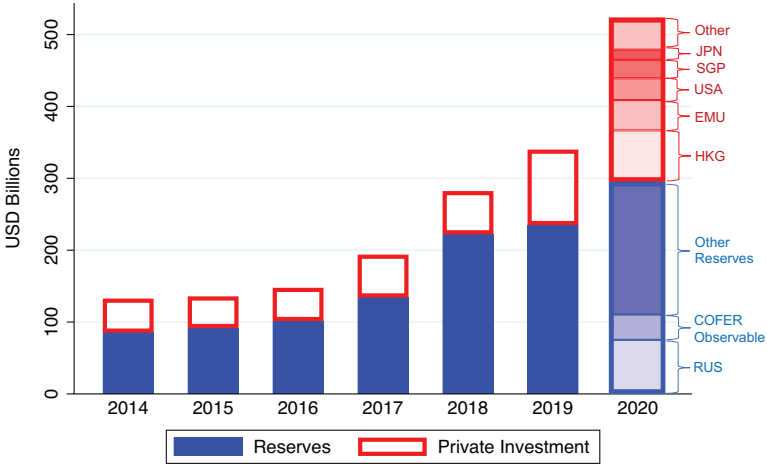
Literature Review

- **China's Financial Markets:** Prasad (2016), Amstad and He (2020), Brunnermeier, Sockin, and Xiong (2017, 2022), Lai (2021), Cerutti and Obstfeld (2018), Mo and Subrahmanyam (2020)

- **International Monetary System:** Eichengreen, Mehl, and Chitu (2017), Bahaj and Reis (2020), Farhi and Maggiori (2018), He, Krishnamurthy, and Milbrandt (2019), Gopinath and Stein (2021), Chahrour and Valchev (2021)

- **Dynamic Reputation:** Phelan (2006), Amador and Phelan (2021), Kreps and Wilson (1982), Milgrom and Roberts (1982), Mailath and Samuelson (2001), Diamond (1989, 1991), Barro and Gordon (1983)

Fact 1: Rise in Foreign Participation, Central Banks then Private



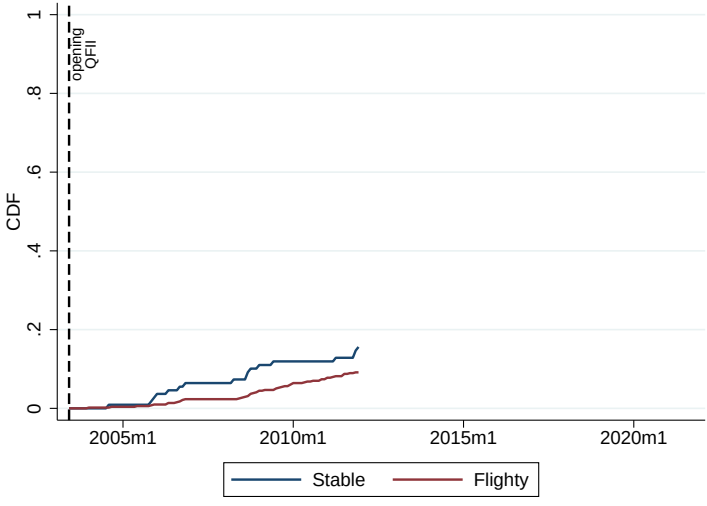
▸ EM ▸ Composition ▸ Outflows

China Staggered Investors' Market Access

- **Early phase:** 2002 Qualified Foreign Institutional Investor (QFII) program and then RQFII. Onerous approval, lock-in periods, only exchange bonds
- **Middle phase:**
  - 2013: QFII and RQFII extended to interbank bond market (CIBM). Some quotas, onshore, not compatible with trading platforms
  - 2015: Full access to CIBM without quotas for direct long-term investors ▸ Quote
  - Feb. 2016: CIBM Direct
- **Latest phase**
  - 2017 Bond Connect. No quotas, offshore, int. trading platforms
  - 2019-21 RMB-bonds entering bond indices (BBG, JP Morgan, FTSE)
  - 2022 Swap Connect (announced), allows interest rate derivatives

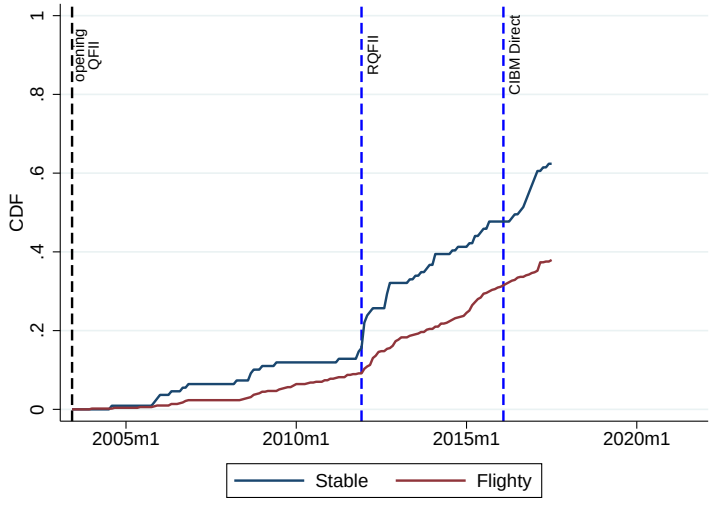
Fact 2: China Selected Investor Base

Early Phase: focused on stocks, long lock-up periods, strict quotas



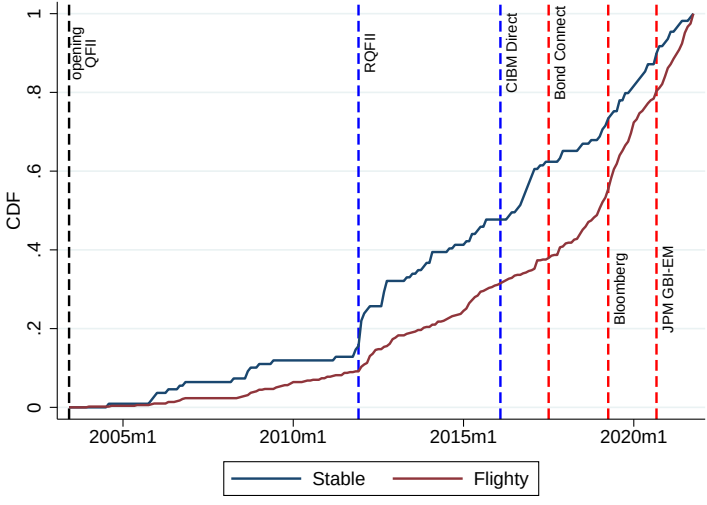
Fact 2: China Selected Investor Base

Middle Phase: Gives long-term investors direct access to onshore bond markets



Fact 2: China Selected Investor Base

Recent Phase: Gives flightier investors direct access to onshore bond markets



Do investors hold RMB more in EM or DM Bond Portfolios?

- Use micro-data on fund positions to decompose portfolio shift:
  - Security-level mutual fund and ETF holdings from Morningstar, US insurance company holdings from NAIC filings
  - Security-level pricing data from various commercial data sources
- Measure what other type of foreign currency bonds funds holding a particular currency are likely to hold
- For each investor i, measure shares in currency c and in DM currencies

$$\alpha_{c,i} = \frac{\sum_{b \in B_c} MV_{b,i}}{AUM_i} \qquad \alpha_{DM,i} = \frac{\sum_{b \in B_{DM}} MV_{b,i}}{AUM_i(1 - \alpha_{c,i})}$$

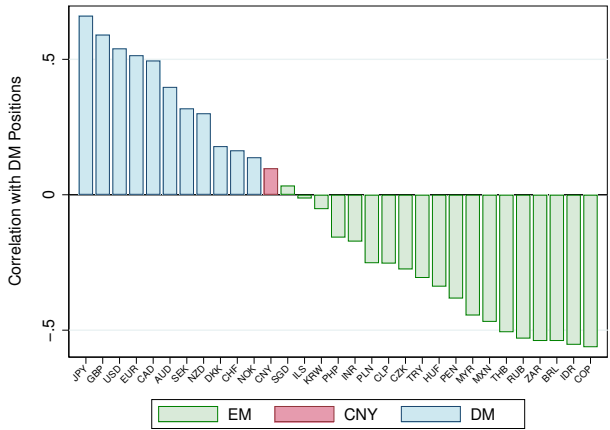
- Correlation between c and DM measures distance from DM bonds:

$$corr(\alpha_{c,i}, \alpha_{DM,i})$$

- Measure makes sense if investors specialize

Fact 3: RMB Bonds Held as Part of EM/DM Portfolios

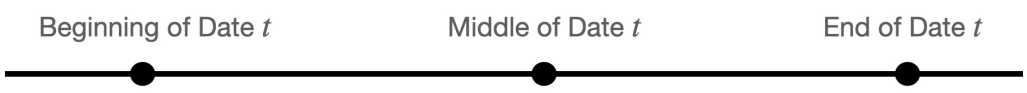
- RMB appears in DM investment portfolios as in between EM and DM currencies



Equity

Model Overview

- Infinite horizon, discrete time
- Risk-neutral governments. Committed or opportunistic
- Stable and flighty investors
- **Within date:** Borrowing and costly liquidation subgame
- **Across dates:** Reputation building game



Intermediation Payoff

- Payoff of intermediation sector

$$U_t = QI_t - L_t - (1-\tau)D_t^L$$

- Beginning of period budget constraint of intermediary

$$I_t = A + D_t, \qquad \text{where } D_t = D_t^s + D_t^f$$

- Middle of date budget constraint

$$D_t^L + \gamma L_t = R_t D_t$$

- Middle of date collateral constraint, assume always binds, $\tau = \{0, \bar{\tau}\}$

$$(1-\tau)D_t^L \leq (1-h_t)(QI_t - L_t)$$

- Substituting all in, payoff is Interest rate L High State

$$U_t = \underbrace{\frac{h_t}{\gamma - \frac{1-h_t}{(1-\tau)}}}_{\text{Net Worth Multiplier}} \underbrace{\left(\gamma QI_t - R_t D_t\right)}_{\text{Liquidation Value of Inside Equity}}$$

Investor Types

Two types of investors: Stable (s) and Flighty (f)

- Flighty investors require higher haircut $h^f > h^s$
- All investors treated pari-passu
  - $h_t = h^s \ \ if \ \ D_t^f = 0$
  - $h_t = h^f \ \ if \ \ D_t^f > 0$
- Idea of $h^f > h^s$ is that market reforms needed to attract investment from flightier private investors makes it easier for foreign investors to flee in crises

Investor Preferences and the Debt Supply Schedule

- Risk-neutral, disutility over quantities, supply short-term debt

$$\max_{D_t^i} \; E[\tilde{R}_t^i - \bar{R}]D_t^i - \frac{1}{4} b\, \omega(M_t) D_t^{i2}$$

$$\implies E[\tilde{R}_t^i] = \bar{R} + \frac{1}{2} b\, \omega(M_t) D_t^i$$

- Initial lenders receive $\tilde{R}_t^i(\tau) = R_t^i(1-\tau)$ Details
- For each class of investors, the interest rate schedule is:

$$R_t^i = \frac{\bar{R} + \frac{1}{2} b\, \omega(M_t) D_t^i}{1 - (1 - M_t)\bar{\tau}}$$

  where $M_t = \Pr(\tau = 0)$ is **reputation**

- $\omega(M_t)$ weakly decreasing, captures higher demand for safer assets

Committed Government Preferences and Policy Choices

Committed government chooses amount of debt to issue to each investor type to maximize static intermediation payoff

$$\max_{D_t^s, D_t^f} \left(\frac{h_t}{\gamma - (1 - h_t)} \right) (\gamma Q I_t - R_t D_t)$$

subject to

$$R_t^i \left(D_t^i, M_t \right) = \frac{\overline{R} + \frac{1}{2} b \, \omega \left(M_t \right) D_t^i}{1 - (1 - M_t) \, \bar{\tau}}, \quad i \in \{s, f\}$$

$$h_t = \begin{cases} h^s & D_t^f = 0 \\ h^f & D_t^f > 0 \end{cases}$$

where $D_t \equiv D_t^s + D_t^f$ and $R_t \equiv \dfrac{R_t^s D_t^s + R_t^f D_t^f}{D_t^s + D_t^f}$

Optimal Debt Issuance Policy of the Committed Type

Lemma

There exists an opening up threshold $M^* \in [0,1]$ *such that optimal policies are:*

$$D^s(M) = \frac{1}{b\ \omega(M)}\left[\gamma Q(1-(1-M)\bar{\tau}) - \bar{R}\right]$$

$$D^f(M) = \begin{cases} 0, & M \leq M^* \\ D^s(M), & M > M^* \end{cases}$$

$$R(M) = \frac{1}{2}\frac{\bar{R}}{(1-(1-M)\bar{\tau})} + \frac{1}{2}\gamma Q$$

▸ Heterogeneous Investors ▸ Generalized Demand Function

Opportunistic Government: Choosing Capital Controls

- Opportunistic type debt issuance always optimally mimics committed policy
- Opportunistic type also chooses whether to set $\tau = \{0, \bar{\tau}\}$
- Denote $V(M_t)$ as indirect utility of committed:

$$V(M_t) = \frac{h(M_t)}{\gamma - \frac{1 - h(M_t)}{R^L}} \left(\gamma Q\left(A + D(M_t)\right) - R(M_t) D(M_t)\right)$$

- Static intermediation value for opportunistic type:

$$V^{Opp}(M_t, \tau) = \begin{cases} V(M_t), & \tau = 0 \\ g\left(h(M_t)\right) V(M_t), & \tau = \bar{\tau} \end{cases}$$

with $g(h(M_t)) = (\gamma - \frac{1-h(M_t)}{R^L})(\gamma - \frac{1-h(M_t)}{R^L(1-\bar{\tau})})^{-1} > 1$

Reputation Game

- Government type follows Markov process (Phelan (2006), Amador Phelan (2021))
- Committed type dies with prob ϵ^c, Opportunistic type dies ϵ^o
  - Replaced with other government type
- Investors update beliefs of facing committed type (π_n) using Bayes rule
  - If no capital control:

$$\pi_{n+1} = \epsilon^O + (1 - \epsilon^C - \epsilon^O)\frac{\pi_n}{M_n}$$

$$M_n = \pi_n + (1 - \pi_n)m_n$$

  - If capital control: revert to $\pi_0 = \epsilon^O$

Strategic Choices of Opportunistic Government

- Value of not imposing capital control ($\tau = 0$) at step n

$$W^0(M_n) = V(M_n) + \beta W(M_{n+1})$$

- Value of imposing capital control ($\tau = \bar{\tau}$) at step n

$$W^{\bar{\tau}}(M_n) = g(h_n)V(M_n) + \beta W(M_0)$$

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$$W^{\bar{\tau}}(M_n) = g(h_n)V(M_n) + \beta W(M_0)$$

- Value function $W(M_n) = \max\left\{W^0(M_n)\ ,\ W^{\bar{\tau}}(M_n)\right\}$
- Mixed strategy requires $W^0(M_n) = W^{\bar{\tau}}(M_n)$
- Pure strategy of deviate requires $W^{\bar{\tau}}(M_n) \geq W^0(M_n)$

Sketch of Model Solution

- Conjectured Markov equilibrium: ▸ Markov Equilibrium Definition
  - Opening-up step N^* when let in flighty investors
  - Graduation step N when all remaining opportunistic types deviate
- Flow utility dynamics

$$V(M_{n+1}) = \frac{g(h_n)}{g(h_{n+1})}\rho(h_n)V(M_n) + \frac{g(h_0)}{g(h_{n+1})}V(M_0)$$

  - AR(1) implies entire path of reputation increasing in initial reputation M_0
  - Bayes' rule implies belief path π_n decreasing in M_0
  - Equilibrium requires $m_N = 0$, that is $M_N = \pi_N$
- Homogeneous haircuts: prove existence/uniqueness
- Heterogeneous haircuts: uniqueness conditional on N^*

Dynamics of Reputation Building with Heterogenous Haircuts

1. Before opening up, faster rate of convergence

$$V(M_{n+1}) = \rho(h^s)V(M_n) + V(M_0)$$

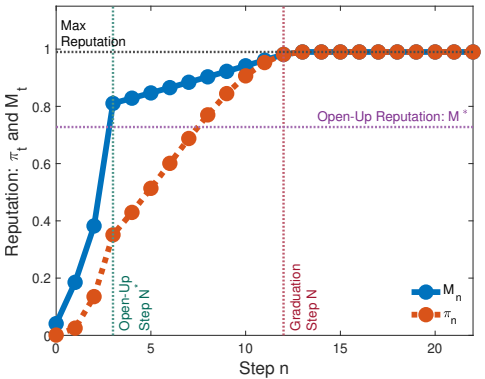
2. **At opening up, upward jump in dynamics**

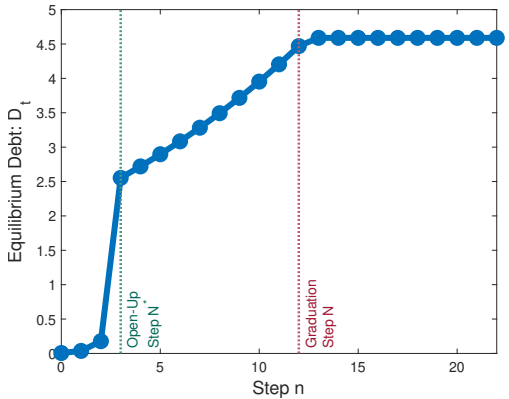
$$V(M_{n+1}) = \frac{g(h^s)}{g(h^f)}\left[\rho(h^s)V(M_n) + V(M_0)\right]$$

3. After opening up, slower rate of convergence

$$V(M_{n+1}) = \rho(h^f)V(M_n) + \frac{g(h^s)}{g(h^f)}V(M_0)$$

The Dynamics of Reputation and Debt





International Currency Competition with Heterogeneous Investors

- Countries indexed by $j \in [0,1]$, each small and of equal measure
- Assume $h^s = h^f$
- Investors $i \in 1, \ldots, \mathcal{I}$, with heterogeneous taste $\omega_i(M_j)$, and preferences

$$\max_{S_i, \{D_{i,j}\}} \left(R^S - \overline{R}\right) S_i + \int_j E\left[\tilde{R}\left(M_j\right) - \overline{R}\right] D_{i,j} dj - \frac{1}{8} b \left(\lambda S_i + \int_j \omega_i\left(M_j\right) D_{i,j}^2 dj\right)^2$$

where S is an outside asset in fixed supply with an endogenous return

- Investor FOC

$$E\left[\tilde{R}_j\left(M_j\right)\right] = \bar{R} + \frac{1}{2} b^* \omega_i\left(M_j\right) D_{i,j}$$

$$\text{where } b^* \equiv 4(R^s - \bar{R}) = \frac{b}{\mathcal{I}} \sum_{i \in \mathcal{I}} \left(\lambda S_i + \int_j \omega_i\left(M_j\right) D_{i,j}^2 dj\right)$$

International Currency Competition with Heterogeneous Investors

- Restrict to symmetric equilibria for issuers, aggregate to representative investor

$$E\left[\tilde{R}(M)\right] = \bar{R} + \frac{1}{2} b^* \omega(M) D(M)$$

$$b^* \equiv b\left(\lambda \bar{S} + \int \frac{1}{2} \omega(M) D(M)^2 \, d\mu(M)\right)$$

- Issuance choice modifies no-competition (NC) model, $R(M)$ unchanged

$$D(M) = \frac{b}{b^*} D^{NC}(M)$$

- Modified transition dynamics for a given b^*

$$V(M_{n+1}) = \rho v A \frac{b^* - b}{b} + \rho V(M_n) + V(M_0)$$

$\bar{S} = \frac{1}{\mathcal{I}} \sum_{i \in \mathcal{I}} S_i$, $\frac{1}{\omega(M)} = \frac{1}{\mathcal{I}} \sum_{i \in \mathcal{I}} \frac{1}{\omega_i(M)}$, $D(M) \equiv \frac{1}{\mathcal{I}} \sum_i D_i(M)$

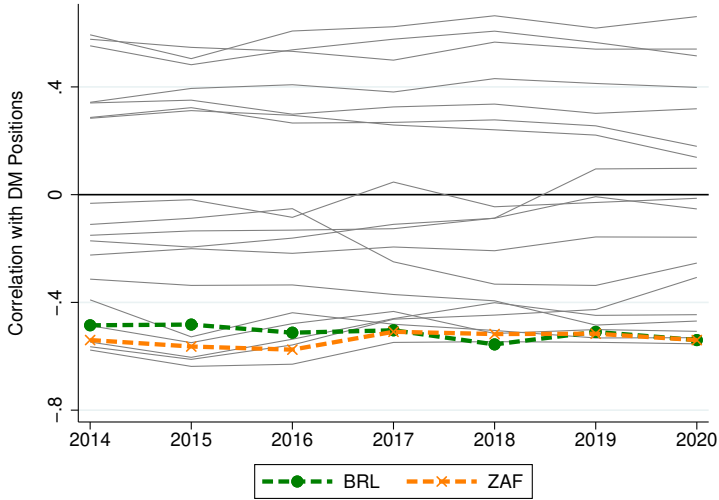
Measuring Reputation in a Multi-Currency Framework

- Portfolio share of investor i in currency c: $\alpha_{c,i} = \dfrac{MV_{c,i}}{AUM_i}$
- An observable measure of reputation rank:

$$corr(\alpha_{c,i}, \alpha_{DM,i}) = corr\left(\frac{1}{\omega_i(M_c)}, \frac{1}{\omega_i(M_{DM})}\right)$$

- Portfolio share correlation increases as reputation of currency c converges to that of developed countries reference set DM
- Can be estimated using private investors bond holdings

Tracking China's Changing Reputation: From Theory to Data



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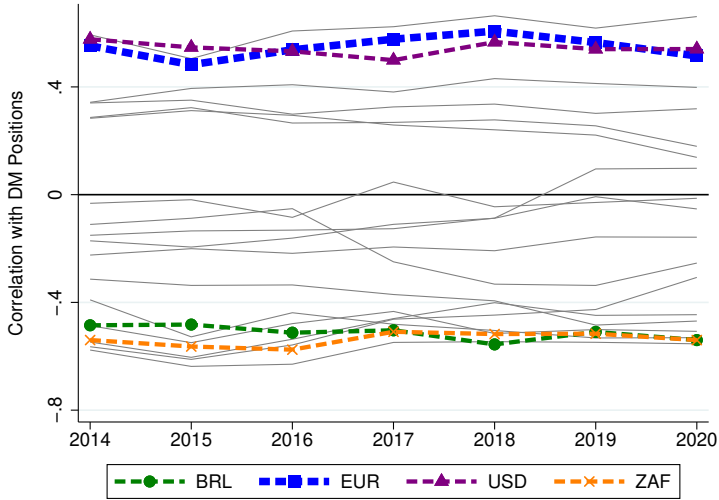

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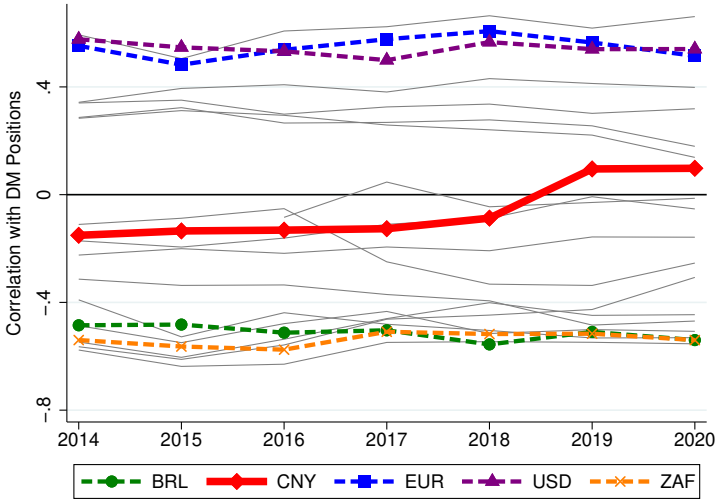
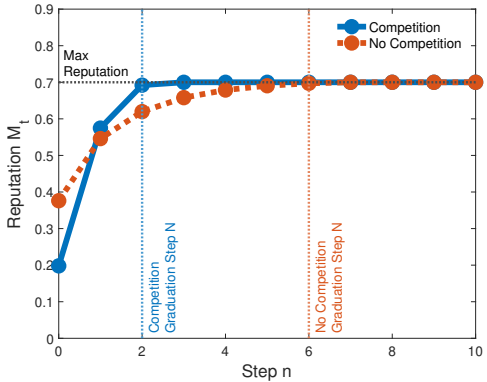
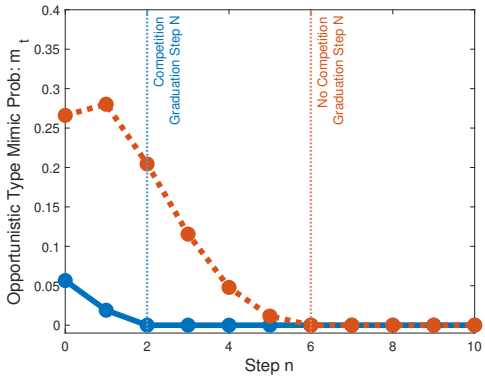
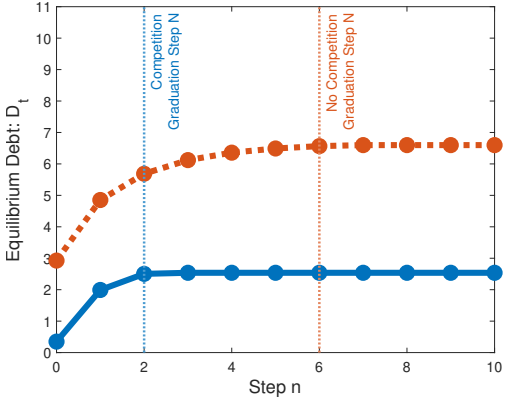


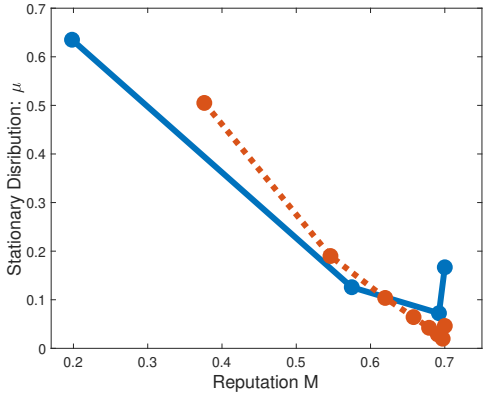
Competition and Reputation Building





Competition and Stationary Distribution





Competition and Reputation-Building

- If competition is sufficiently fierce ($b^* > \bar{b}^*$) countries immediately graduate
  ▸ Prop. 5
- Higher issuance of safe assets reduces probability that an opportunistic competitor will advance to step $n > 0$ of the cycle ▸ Prop. 6
- Suppose a large country ("US") internalizes impact of own issuance on reputation building incentives of other countries ("China")
  - Model US as issuing outside asset S as Stackelberg leader
- **Implication:** US can flood market with safe assets, undercutting incentives of new entrants like China to build reputation
  - Abstracts from loss of US safety from increased issuance

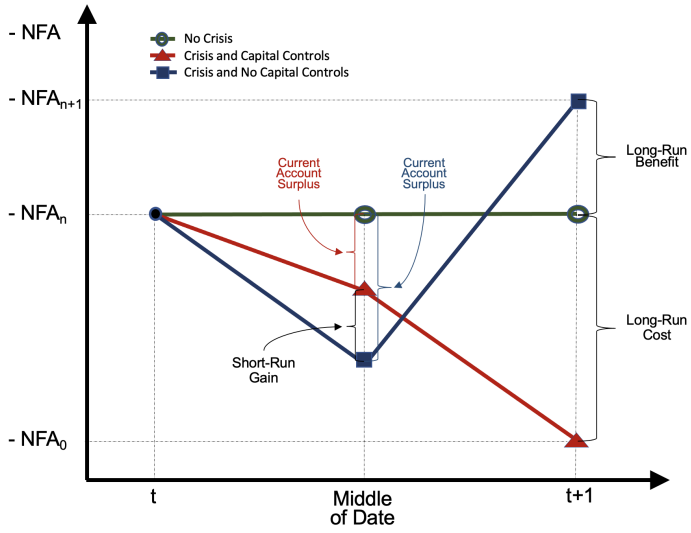
Two-Way Capital Flows: From Net Foreign Creditor to Debtor

- Internationalizing a currency not about current account per se, but gross flows
- Extend model to also allow domestic capital to go abroad
- NFA position *deteriorates* as reputation builds-up
  - Creditor at low reputation, debtor at high reputation
- Intuition: reputation is like a pledgable asset. Valuable because one can borrow against it. The higher the reputation, the more the country optimally leverages in international capital markets

Two-Way Capital Flows

- As foreigners come into domestic bond market, domestic capital goes abroad
- In model: households have domestic wealth in outside asset and equity of intermediation sector $W + E_t$
- Can invest an amount K_t (fraction k_t) in illiquid foreign assets, which pay out R^K
- Adjustment cost leads to private optimal outflow $\Psi'(k_t) = R^K - 1$
- Government has a proportional benefit B from all savings kept at home, which yields a total benefit to the government of $B(1 - k_t)(W + E_t)$
  - B>0: government private benefits $\Rightarrow$ limit outflows
  - B<0: government internalizes liquidity benefits $\Rightarrow$ incentivize outflows
- Optimal domestic outflow control is $\Psi'(k_t) = R^K - (1 + B)$

NFA Dynamics

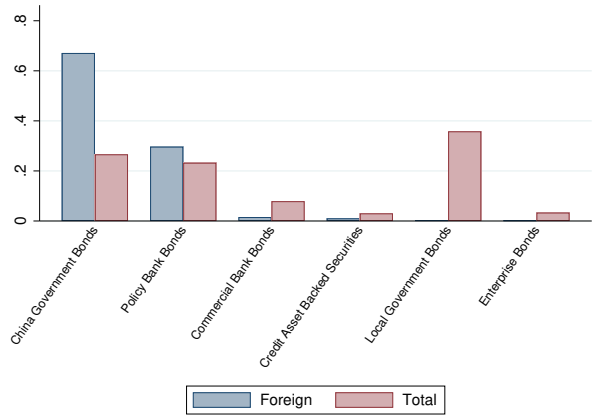


Conclusion

- The integration of China's bond market and currency into global financial system
  - Rise in foreign investment, official then private
  - Staggered entry of investor types a policy choice
  - RMB bonds held in both DM and EM portfolios
- Framework of building reputation as international currency provider
- Early in process: model consistent with slow progress and setbacks, difficult road
- Competition, especially from large incumbents like US, can make it difficult to build reputation for newcomers

Foreigners Are Buying the Safest Local Bonds

- Foreigners concentrated in government and policy banks bonds (implicit guarantee)
- Little holdings in some large market segments: local govt and corporate bonds



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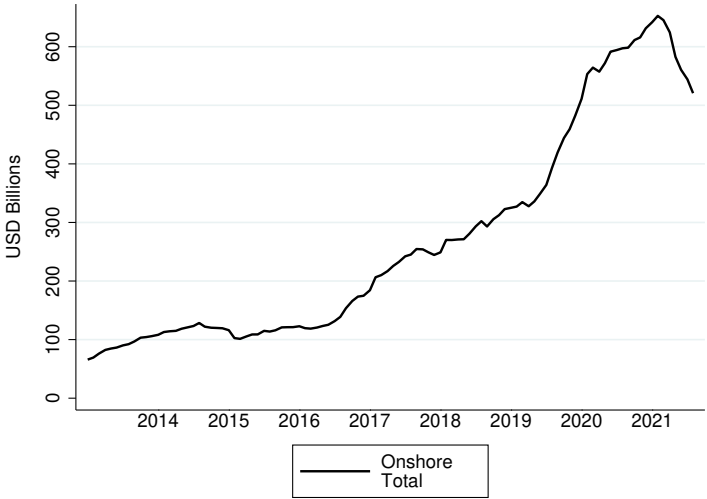
Fact 1: Rise in Participation and Recent Outflows



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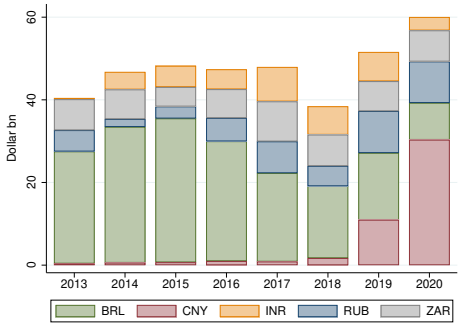
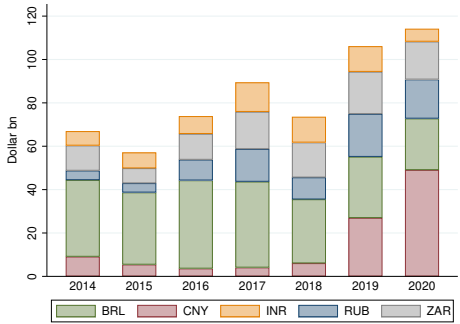
China in the BRICS

- In early phase of internationalization, much room for foreign holdings to grow
- Still, exposure to RMB bonds is already bigger than biggest emerging markets

TIC: US Holdings



Morningstar: All Countries



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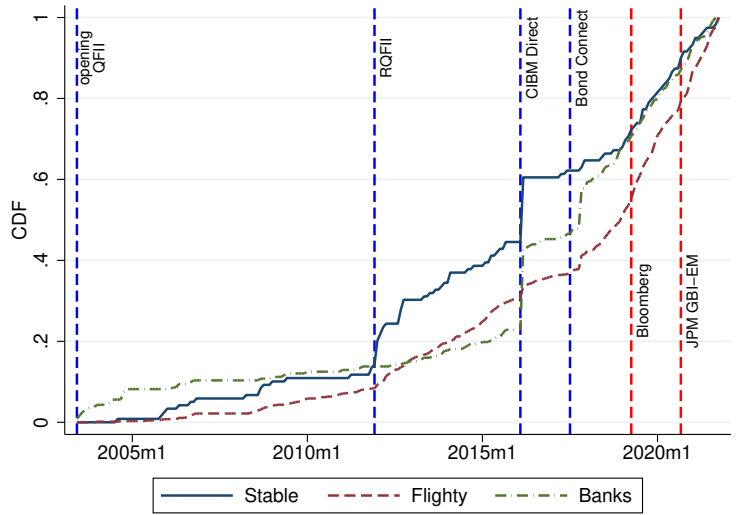
Tracking Investor Access to Chinese Market Including Banks



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SAFE Comments about Cross-Border 2015 Outflows

We have noted that the central bank and the SAFE have recently introduced a series of policies against the volatility in cross-border capital flows. What would you say about the effect of these policies? If the volatility continues to be heightened, will the SAFE adopt capital controls to control such volatility?

> *(...) the policy orientation of foreign exchange administration to support the development of the real economy and promote trade and investment facilitation remains unchanged.* ***This way of administration will continue for ongoing and ex-post regulation, so as to build a macro-prudential management framework, rather than the traditional capital control model.*** *Unlike capital control, (...) macro-prudential management is to impact borrowing behaviors of market players by economic means or legal authorization, and increase the cost for speculation by those who make excessive speculation, so as to curb impulse for making excessive loans and crack down on asset price speculation.* ***Along with the capital account liberalization and the RMB internationalization, China will improve management under the macro-prudential framework in the future.***

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SAFE Comments about Cross-Border 2015 Outflows

The two-way fluctuations of the RMB exchange rate are obvious at present. What is the SAFE's plan to strengthen the building of the foreign exchange markets? How will the SAFE guide companies and help them mitigate risks?

> *First,* ***continuing to promote the in-depth development of foreign exchange markets and opening up to the inside and outside. Diversifying transaction categories, expanding market players and improving market infrastructure*** *- all will improve the conditions for companies to manage foreign exchange rate risks. (...) So far, 16 overseas central banks have become members of the inter-bank foreign exchange markets in three batches. Overseas banks participating in the purchases and sales of RMB can also become members of the inter-bank foreign exchange markets after filing and interfacing systems with China Foreign Exchange Trade System (CFETS) to conduct RMB foreign exchange transactions to support China's efforts to unify RMB exchange rates both at home and abroad.*

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SAFE Comments about Cross-Border 2015 Outflows

Will the SAFE introduce new management measures in respect of cross-border capital flows? Will measures be taken to restrict purchases of foreign exchange and capital outflows?

> *Given the current situation of cross-border capital flows, the logic that the risk bottom line should be safeguarded while the overall principle of supporting reform and opening up should be followed in foreign exchange administration will remain unchanged. (...) This is the direction that has been followed in foreign exchange administration as boosting reform while guarding against risks have been the responsibilities and primary tasks of foreign exchange authorities.*

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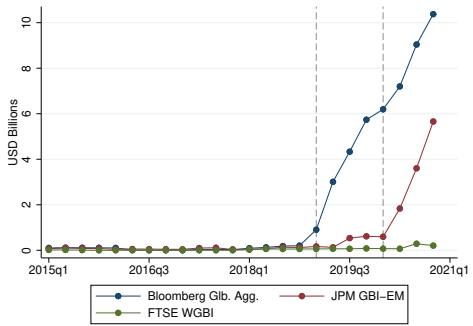
China's Entrance in Major Bond Indices

Chinese RMB bonds were added to:

- Bloomberg Global Aggregate Bond Index in April 2019
- JP Morgan Government Bond Index - Emerging Markets in February 2020
- FTSE World Government Bond Index in October 2021



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PBC No. 220, July 14, 2015

Notice of the People's Bank of China (PBC) on Issues Concerning Investment of Foreign Central Banks, International Financial Institutions and Sovereign Wealth Funds with RMB Funds in the Inter-bank Market

> *With a view to enhancing efficiency of foreign central banks or monetary authorities, international financial institutions, and sovereign wealth funds (hereinafter referred to as relevant overseas institutional investors) investing in the Chinese inter-bank market...* ***Relevant overseas institutional investors shall act as long-term investors, and conduct trading based on reasonable needs for preserving or increasing the value of their assets****. The PBC will, in accordance with the reciprocity principle and macro-prudential requirements, regulate trading behavior of relevant overseas institutional investors.*

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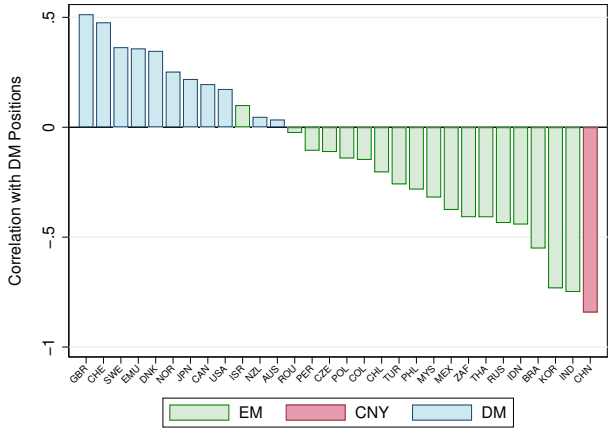
China with EMs for Equity



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Understanding the Portfolio Shift into RMB

- Index inclusion + Bond Connect lowers cost to private sector of investing in RMB in 2019 and 2020. What does RMB replace in their portfolios?

$$\Delta MV_{t,f,b} = F^{Within}_{t,f,b} + F^{Between}_{t,f,b} + VE_{t,f,b} + F^{NewFunds}_{t,f,b} + F^{Residual}_{t,f,b}$$

- Within-fund portfolio change $F^{Within}_{t,f,b} = \widetilde{AUM}_{f,t}\left(\widetilde{\omega}_{t,f,b} - \omega_{t-1,f,b}\right)$
  - $\tilde{x}$ is x measured at last period price
- Mostly a within-fund portfolio shift Decomposition Equations Back

Decomposing the Portfolio Shift into RMB

$$\Delta MV_{t,f,b} = F^{Within}_{t,f,b} + F^{Between}_{t,f,b} + VE_{t,f,b} + F^{NewFunds}_{t,f,b} + F^{Residual}_{t,f,b}$$

- Total change in market value $\Delta MV_{t,f,b} = P_{t,b}Q_{t,f,b} - P_{t-1,b}Q_{t-1,f,b}$
- Within-fund portfolio change $F^{Within}_{t,f,b} = \widetilde{AUM}_{f,t}\left(\widetilde{\omega}_{t,f,b} - \omega_{t-1,f,b}\right)$
- Between-funds portfolio change $F^{Between}_{t,f,b} = \omega_{t-1,f,b} \cdot Inflow_{t,f}$
- Valuation effect $VE_{t,f,b} = \left(P_{t,b} - P_{t-1,b}\right) Q_{t,f,b}$

Assumes all trades at beginning of period. $\tilde{x}$ is x measured at last period price

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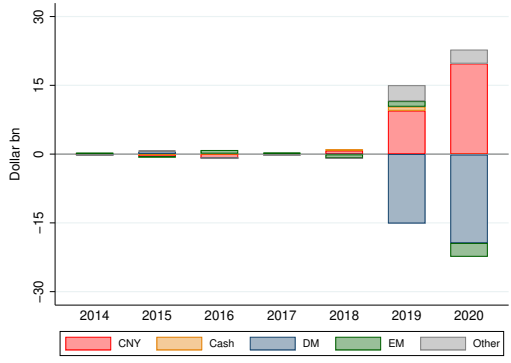
Fact 3: RMB Substitution Coming out of DM

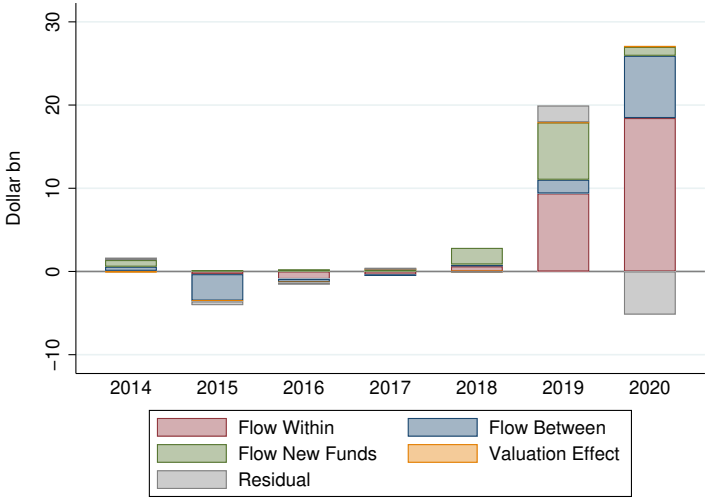
- Flows into RMB bonds come from sales of DM currency bonds



$$F^{Within}_{t,f,CNY} + \sum_{b \neq CNY} F^{Within}_{t,f,b} = 0$$

▸ Back ▸ Indexation ▸ Price Evidence: Betas ▸ Price Evidence: Mean-Variance

Mostly A Within Fund Portfolio Shift



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Interest Rate Determination

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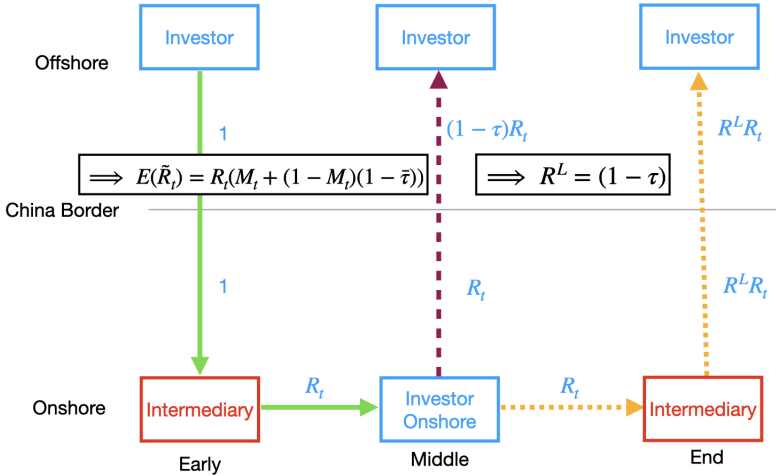

Debt rollover, liquidations, and capital controls

- In low state, need to roll over or repay

$$R_t D_t = D_t^L + \gamma L_t$$

- Substitute into collateral constraint,

$$L_t = \frac{\frac{R_t D_t}{QI_t} - \frac{1-h_t}{R^L(1-\tau)}}{\gamma - \frac{1-h_t}{R^L(1-\tau)}} QI_t$$

  L_t rises with debt-asset ratio $R_t D_t / QI_t$, interest rate $(1-\tau)$, and haircut h_t

- Capital control $\tau = \overline{\tau}$ reduces interest rate $\Rightarrow$ fewer forced liquidations, more debt rollover

Investor Demand Heterogeneity and Limited Capital

- For each class of investors, the interest rate schedule is:

$$R_t = \frac{R^i + \frac{1}{2} b^i D_t^i}{1 - (1 - M_t)\bar{\tau}}$$

- Stable investors have a cap at $\bar{D}^s$ and are cheaper $R^s + \frac{1}{2} b^s \overline{D}^s \leq R^f$

- Interest rate schedule across two investor types is

$$R_t = \begin{cases} \frac{R^s + \frac{1}{2} b^s D_t}{\mathcal{M}_t}, & D_t \leq \overline{D}^s \\ \frac{R^f + \frac{1}{2} b^f (D_t - \overline{D}^s)}{\mathcal{M}_t} & D_t > \overline{D}^s \end{cases}$$

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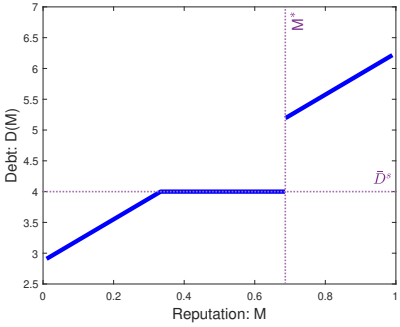
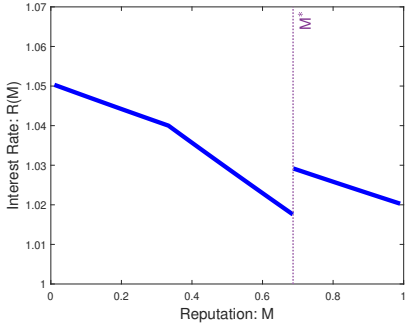
Investor Demand Heterogeneity and Limited Capital

Foreign Debt Policy



Interest Rate on Debt



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Optimal Debt Issuance Policy of the Committed Type

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Utility: $U(M_t, R_t, D_t^i)$, $i \in \{s, f\}$

Assume: U satisfies $\frac{\partial^2 U}{\partial D_t^i \partial R_t} > 0$ and $\frac{\partial^2 U}{\partial D_t^i \partial M_t} > 0$.

Denote: $D^i(M_t, R_t)$ investor i's debt demand function

Lemma

There exists a unique opening up threshold $M^* \in [0, 1]$ such that:

1. *The interest rate policy $R(M_t)$ is the solution to*

$$\left[\gamma Q - R(M_t)\right] \frac{\partial D^s(M_t, R(M_t))}{\partial R} = D^s(M_t, R(M_t))$$

2. *The stable investor debt policy is $D^s(M_t) = D^s(M_t, R(M_t))$*
3. *The flighty investor debt policy is*

$$D^f(M_t) = \begin{cases} 0, & M_t \leq M^* \\ D^s(M_t), & M_t > M^* \end{cases}$$

High State

- In middle of date, if High (H) state: new investment opportunity at rate $R_H > \frac{1}{\gamma}$, debt rolled over at rate R_H

$$V_t^H = R^H \underbrace{\left(\gamma Q I_t - R_t D_t\right)}_{\substack{\text{Liquidation Value of} \\ \text{Inside Equity}}}$$

$$E[\tilde{V}_t] = p_H V_t^H + (1 - p_H) V_t^L = \left(p_H R^H + (1 - p_H) \frac{h_t}{\gamma - \frac{1 - h_t}{(1-\tau)}}\right)\left(\gamma Q I_t - R_t D_t\right)$$

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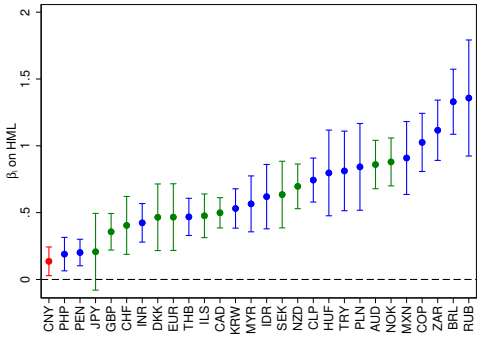
Fact 3: RMB Bonds Behave Like DM Bonds, Prices

Back

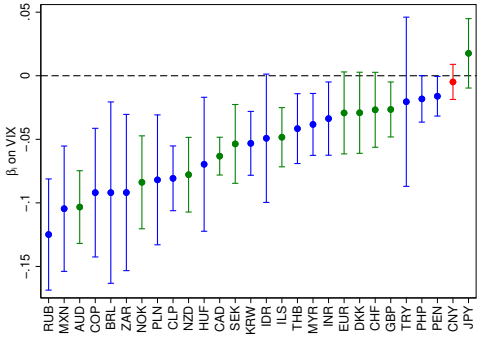
- RMB loading on global risk (HML, VIX) closer to safe DM than median EM

$$R_{i,t+1} = \alpha_i + \beta_i f_{t+1} + \epsilon_{i,t+1}$$

Loading on Carry Trade (HML)



Loading on VIX



Fact 3: RMB Bonds Behave Like DM Bonds, Prices

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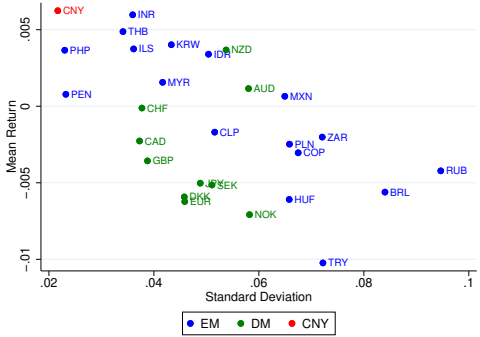
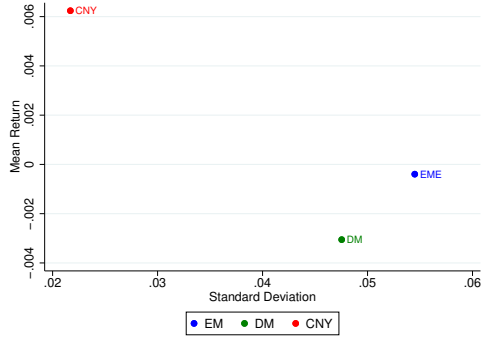
- Mean and Standard Deviation of Returns

All Currencies



Averaging EM and DM



Debt Supply: Details

- First generation lends at Beginning of period, Second at Middle
- Two sources of losses from capital control to first generation
- Direct loss $(R_t D_t - D_t^L)\tau$
- Indirect loss from bargaining τD_t^L
- Second generation has outside option 1, interest rate is $1 - \tau$
- Compensatory payment τD_t^L from first generation to second
- Putting it together,

$$\tilde{R}_t(\tau) = \frac{R_t D_t - (R_t D_t - D_t^L)\tau - \tau D_t^\tau}{D_t} = R_t(1 - \tau)$$

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Markov Equilibrium

A Markov equilibrium of the model is a strategy of debt issuance of the committed government (D_n^s, D_n^f) that satisfies optimality for committed government, a strategy of debt purchases for flighty and safe investors that satisfies their optimality conditions, an interest rate R_n that clears debt markets, a strategy $\{m_n\}_{n=1}^{\infty}$ of opportunistic governments, a path of investor beliefs $\{\pi_n\}$, and a path of reputation $\{M_n\}$ such that:

1. m_n is an optimal strategy of the opportunistic government at n
2. π_n is consistent with Bayes' rule, with $\pi_0 = \epsilon^O$
3. Reputation M_n is consistent with (m_n, π_n)

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Numerical Solution: One Investor

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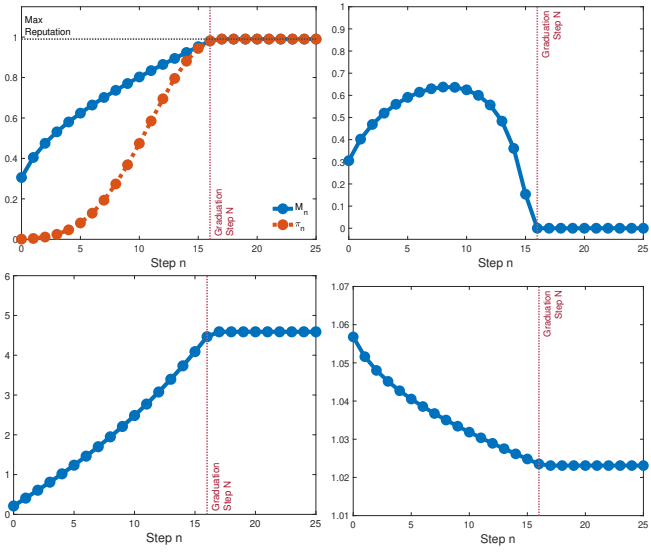

Proposition 5

Proposition

There exists a threshold $\overline{b}^*$ such that if and only if $b^* > \overline{b}^*$, there is a crowd out equilibrium of the competition model in which $\boldsymbol{M} = \{\epsilon^W, 1 - \epsilon^C\}$ and all opportunistic governments immediately graduate.

Intuitively, competition in this case is sufficiently fierce that opportunistic governments cannot build sufficient value from reputation. As a result, they immediately impose capital controls and graduate. Proposition 5 expresses the result in terms of a threshold on the sufficient statistic b^*. This threshold is given by

$$\overline{b}^* = \left(1 + \frac{V(1-\epsilon^C) - (1+\rho)V(\epsilon^O)}{\rho v A}\right) b.$$

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Proposition 6

Proposition

The probability that an opportunistic government (e.g. China) starting at step 0 *reaches step* n *of its reputation cycle decreases in competition* b^* *for any* $n \geq 1$*, that is* $\frac{\partial \delta_n}{\partial b^*} < 0$.

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