Dual Approach for One Goal: The Internationalization of RMB during 2010-2021

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Outline

Outline

The dominance of the dollar

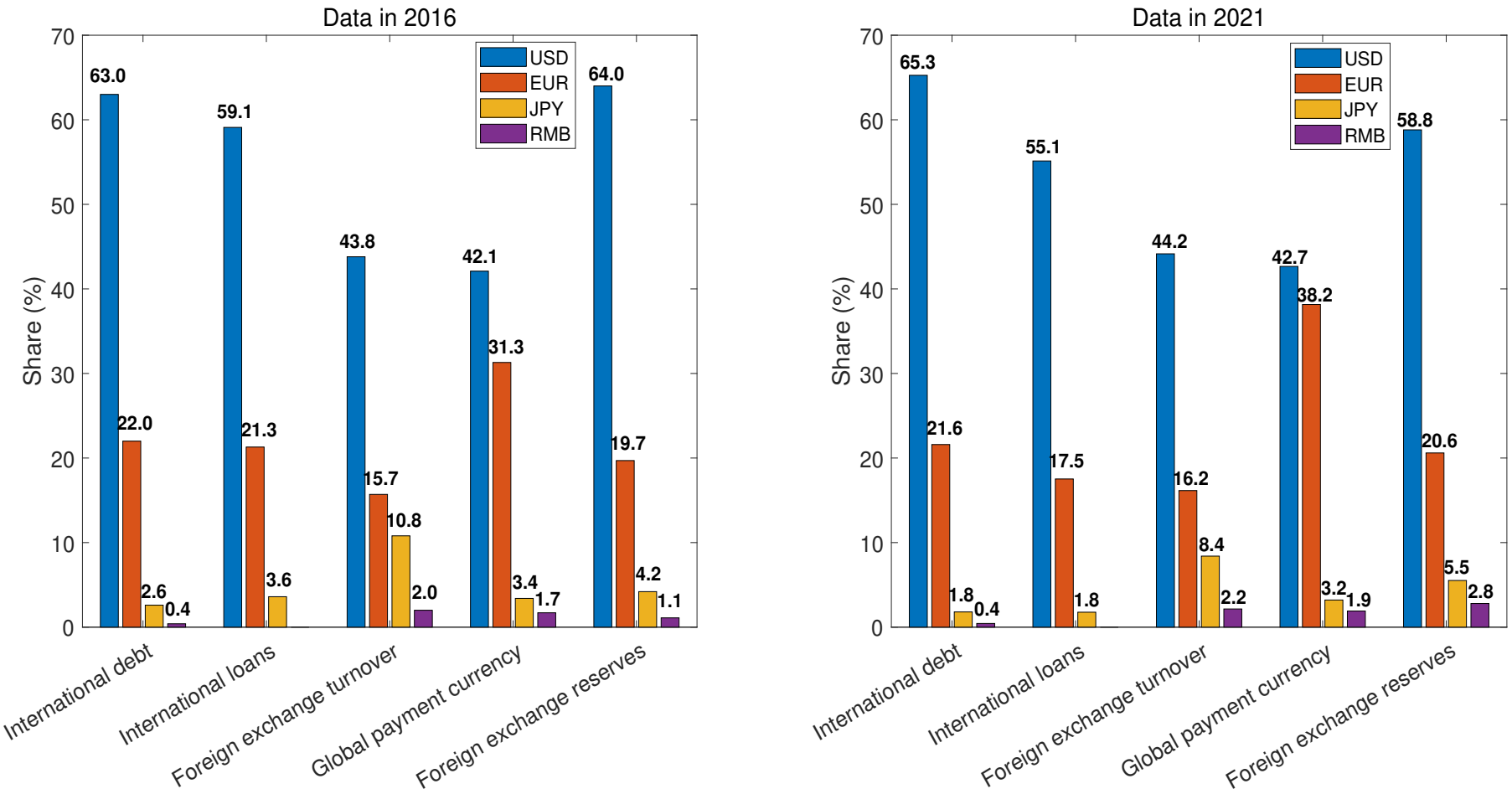


Figure 1: The dominance of the dollar

Note: Data in the left panel is data as at end-2016 or latest available by the end of 2016. For the right panel, foreign exchange turnover is data as of April 2019. Other statistics are data as of the last quarter or last month of 2021. Source: ECB Report on the international role of the euro, chart 1, ECB (2017), ECB Report on the international role of the euro, chart 2, ECB (2021), SWIFT, BIS, and IMF COFER database.

Issue

- The USD undoubtedly acts as the dominant currency
  - *Payment currency*; *Foreign reserve*; *International debt and loan*; *Unit of account*
- While China more important, RMB internationalization seems inevitable and comes naturally?
  - *Size or Export share* v.s. *Global Payment or Foreign reserve*
- It's retrospectively unsurprising, given that the USD surpassed the sterling by the late 1920s
  - ▸ Historical Context: Eichengreen and Flandreau, 2009, 2012, 2014
- Over the past decade, the Chinese gov. has introduced a series of policies to promote the role of RMB as a global currency

RMB Internationalization during 2010-2021

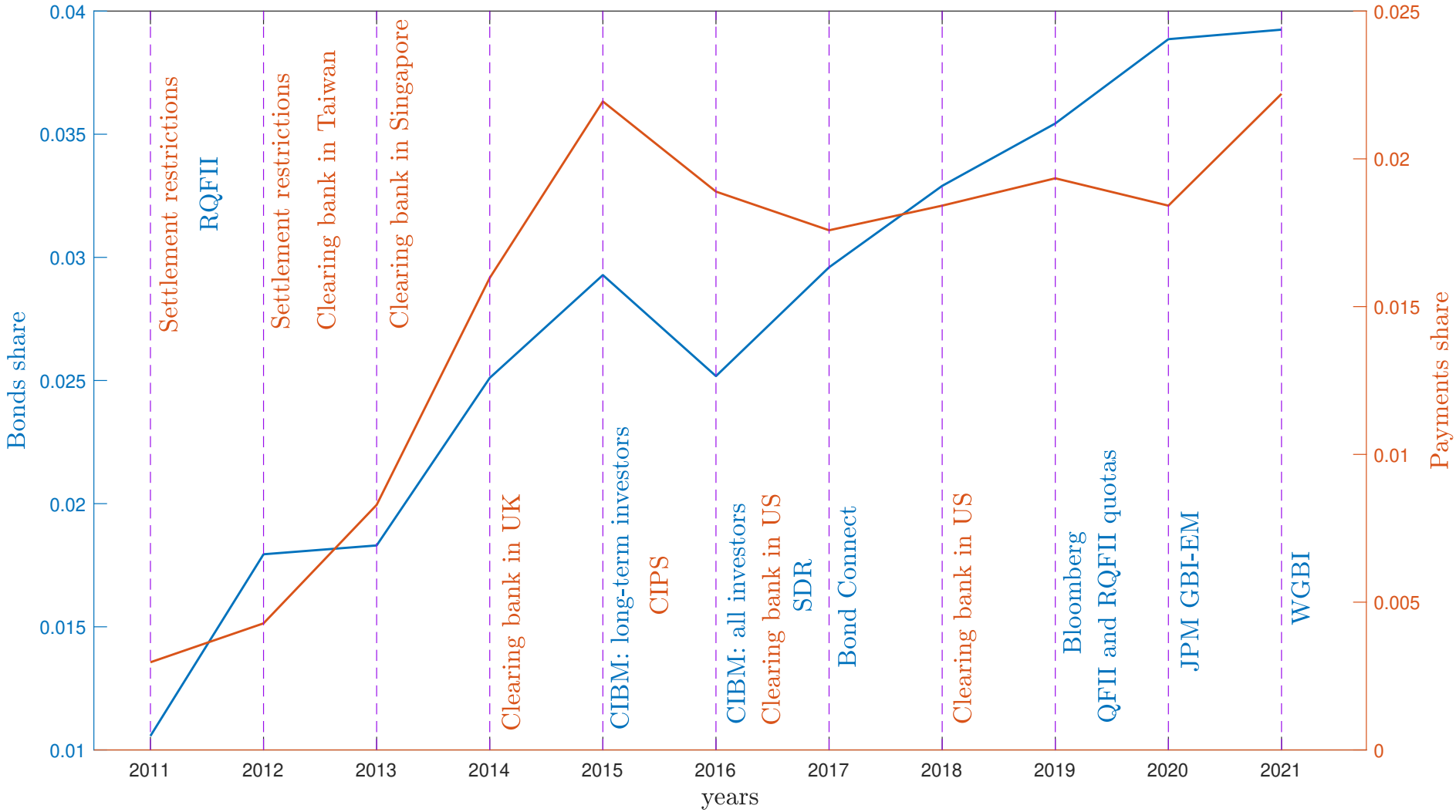


Figure 2: Bonds share and payments share during 2011-2021

Data source: SWIFT, International Investment Position Table, China Bond, and PBoC

RMB's share as a global payments currency

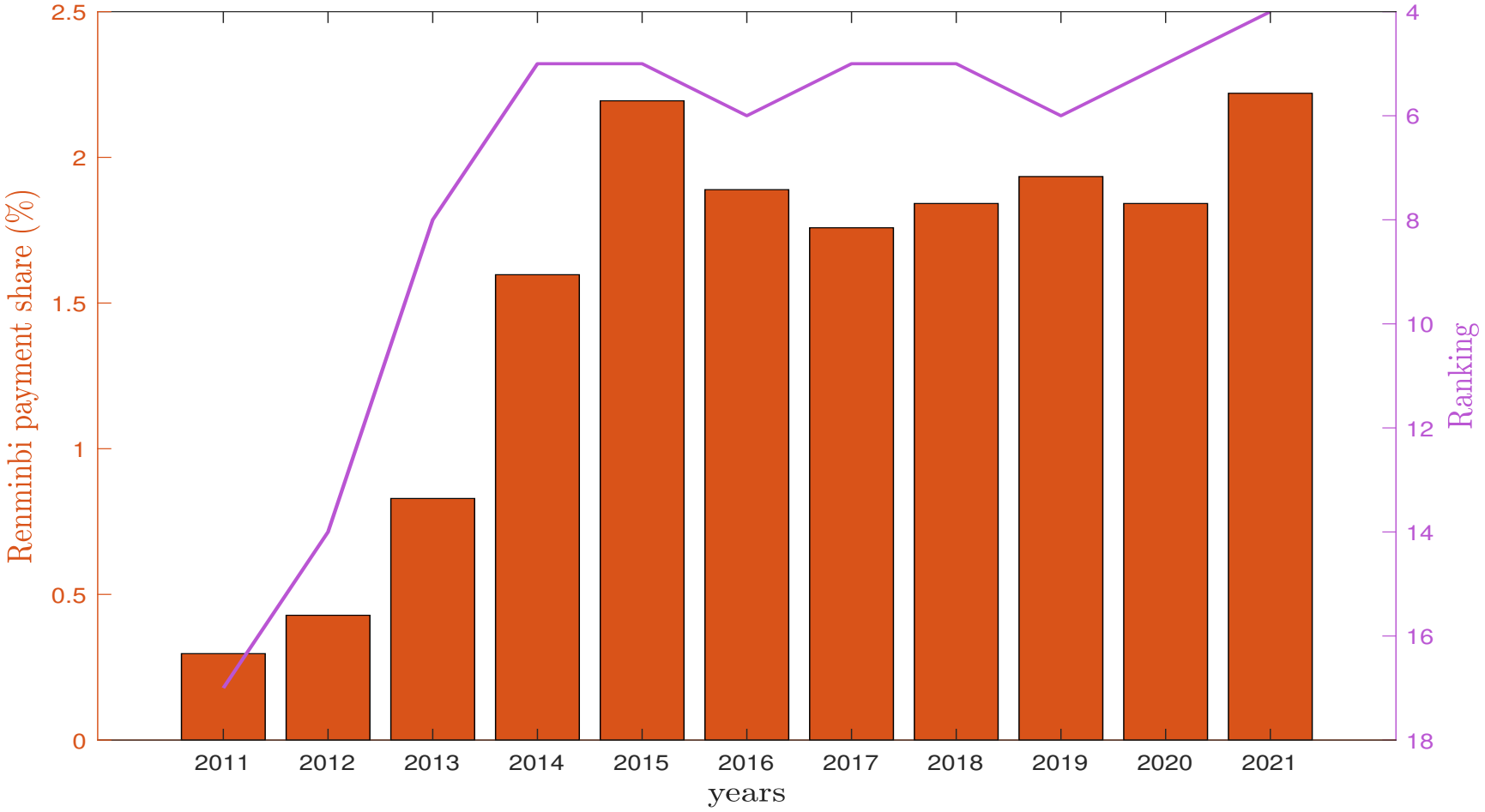
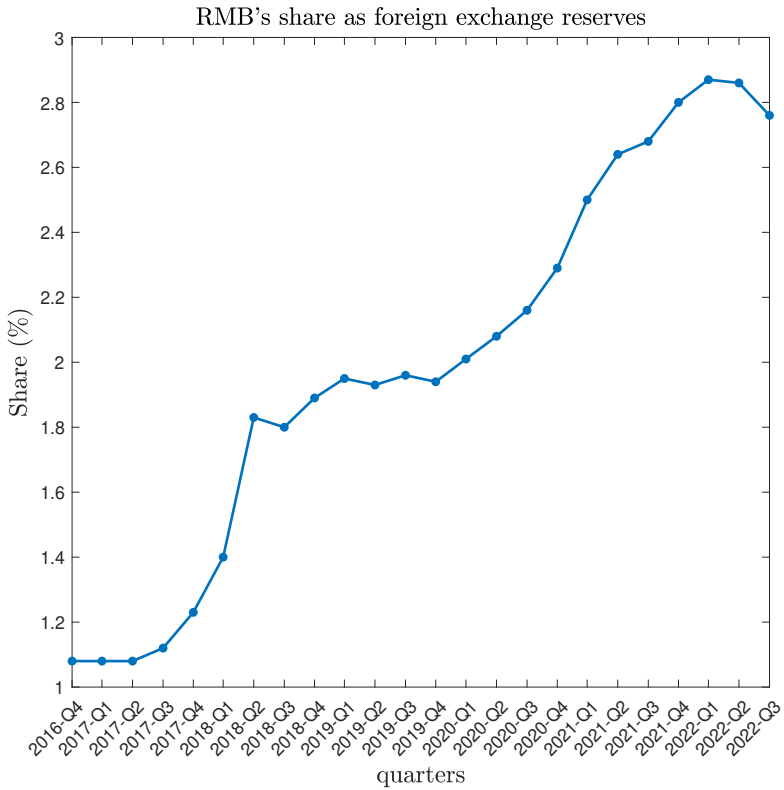


Figure 3: RMB's share as a global payments currency

Data source: SWIFT

RMB's share as foreign exchange reserves



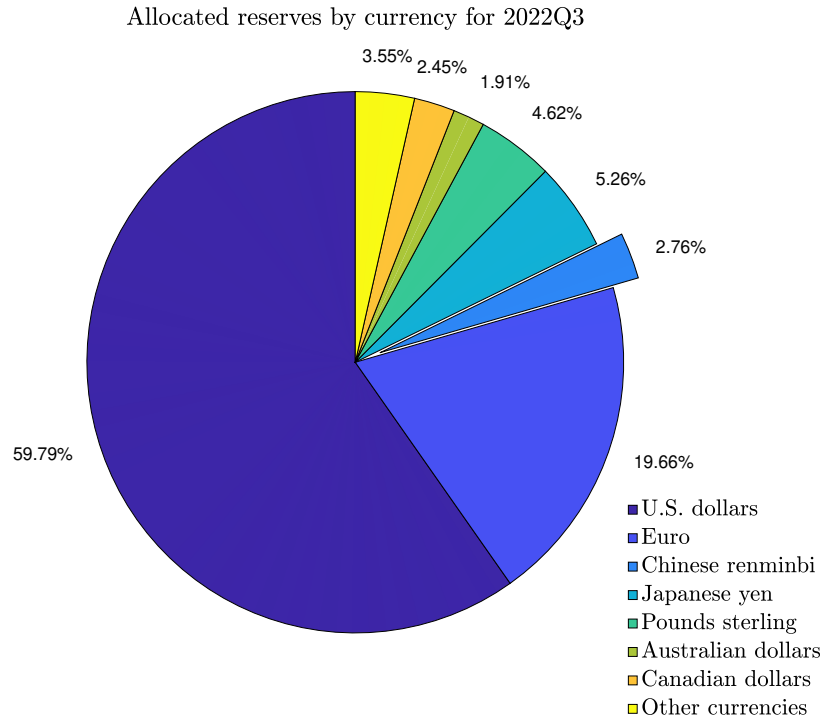
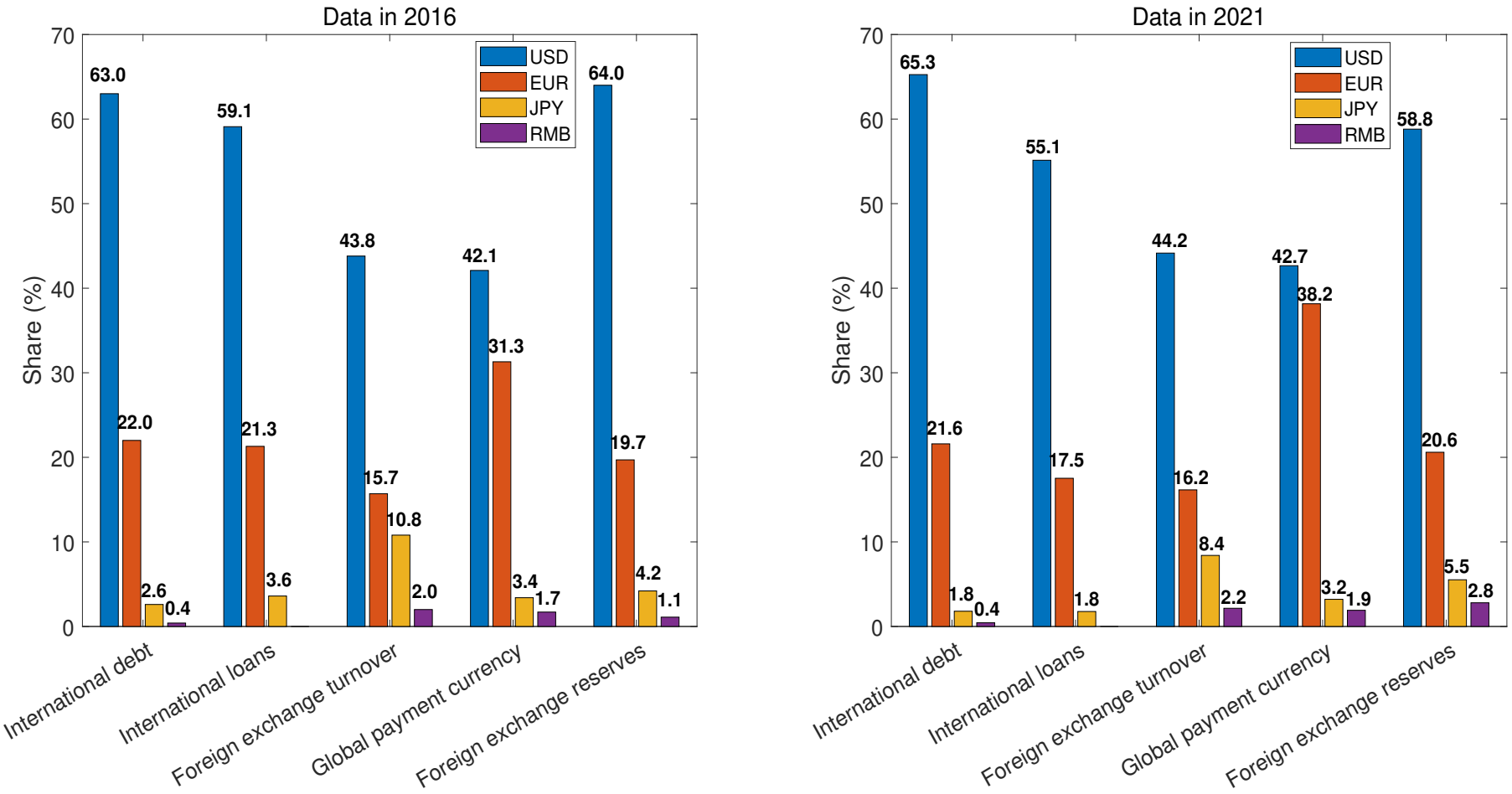


Figure 4: RMB's share as foreign exchange reserves

Data source: IMF COFER database

The dominance of the dollar



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Summary: Facts

- The following facts are presented:
  1. US dollar dominates by all functions of money
  2. While China playing more important role in world economy, RMB is still far from a global currency
  3. Chinese has initiated a series of policy reforms to facilitate RMB in both asset market and international trade
  4. Though little, we still evidence progress of RMB internationalization

Key Question

- **Key Question:**
  - How effective are the policies adopted by Chinese government?
- We focus on the period after 2010, since
  - most related policies implemented after 2010
  - data suggest a transition with increasing RMB payment and bonds share after 2010

Outline

This paper

- How effective are these policies? Why?
- Build a multi-country dynamic general equilibrium model
  - Store of value and medium of exchange
  - Large frictions in both bond market and trade market
    - strategic complementarity in currency choices
    - Multiple equilibria with different dominant currency exists if the strategic complementarities are sufficiently strong
- Focus on *policy complementarity*
  - Characterize the policy complementarity analytically
  - Quantify the dual efforts of gov. on both asset and trade markets

Preview of Quantitative Results

- Quantify importance of the policy complementarity
  - China's reform in the past decade has
    lowered the return wedge in RMB bond by 4.06%, and
    lowered the revenue wedge in RMB-settled trade by 0.86%
  - patterns of inferred wedges are consistent with the relevent policies
- Policy complimentarity is important
  - Complementarity b/w policies account for *50%* of policy effects
  - Single policy would *double* the costs compared to observed ones
- Policies promoting local currency are costly
  - the costs of achieving internationalization are about 0.1% of GDP

Outline

Literature

- Emergence of dominant currency
  - *Unit of account* (Engel, 2006; Gopinath et al., 2010; Doepke and Schneider, 2017; Mukhin, 2022)
  - *Medium of exchange* (Matsuyama et al., 1993; Devereux and Shi, 2013; Liu et al., 2019)
  - *Store of value* (Maggiori, 2017; He et al., 2019; Bocola and Lorenzoni, 2020; Eren and Malamud, 2021)
  - Complementarity (Gopinath and Stein, 2021; Chahrour and Valchev, 2022)
  - Contribution: policy complementarity, structural accounting
- Openness policies and international capital flows in China
  - Song et al. (2011), Song et al. (2014), Chang et al. (2015), Liu et al. (2021), Jermann et al. (2022)
  - Contribution: highlight the impact of these policies on RMB internationalization
- Policy to internationalize domestic currency
  - Georgiadis et al. (2021), Bahaj and Reis (2022), Clayton et al. (2022)
  - Contribution: focus on policy combination and provide quantitative assessment

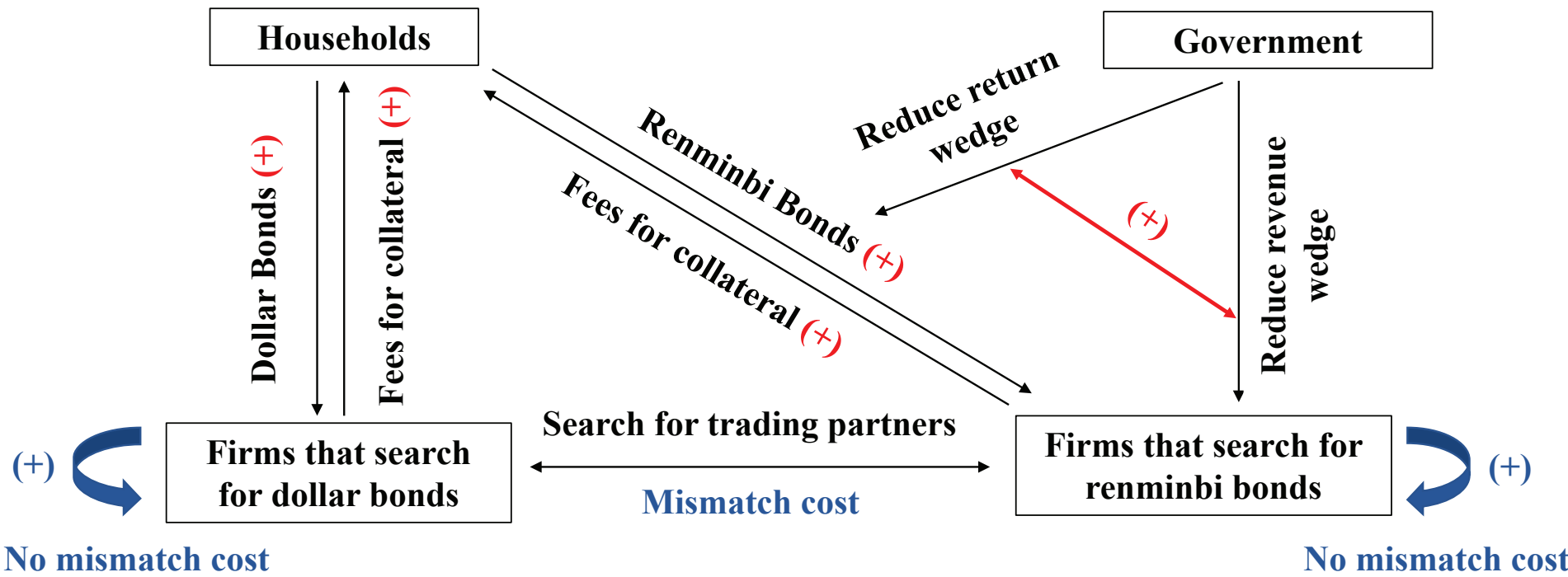
Outline

Model

- Multi-country dynamic general equilibrium model:
  - the U.S., China, and the ROW
- Two types of bonds, each denominated in either dollar or RMB
- Firms in each country seeking international trade with traders from other countries
  - trade finance is required and using bonds as collateral
- Households consume and hold a portfolio of bonds
- Large frictions in both bond market and trade market

Policy Complimentarity

- Search frictions in both bond mkt and international trade mkt



Households

- Representative household in country $j \in \{us, cn, rw\}$:

$$\max \left\{ E_0 \sum_{t=0}^{\infty} \beta^t \frac{C_{jt}^{1-\sigma}}{1-\sigma} \right\} \qquad \text{s.t.}$$

$$P_{jt}C_{jt} + \left(1 - \Delta_{jt}^{USD}\right) P_{us,t}^{us} Q_t^{USD} B_{jt}^{USD} + \left(1 - \Delta_{jt}^{RMB}\right) P_{cn,t}^{cn} Q_t^{RMB} B_{jt}^{RMB} + \psi_{jt}$$
$$= P_{us,t}^{us} B_{jt-1}^{USD} + P_{cn,t}^{cn} B_{jt-1}^{RMB} + P_{jt}^{j} Y_{jt} + \Pi_{jt}^{T} + T_{jt}$$

  - Δ_{jt}^{i}: liquidity premia for bonds i in country j
  - $\psi_{j,t}$: country-j's bond adjustment cost for bonds i

$$\psi_{j,t} \equiv P_{i,t}^{i} Q_t^{i} \frac{\bar{\tau}}{2} \left(\left(\frac{B_{j,t}^{i}}{\underline{B}_j^{i}} - 1 \right) \right)^2 \underline{B}_j^{i}$$

  - $\underline{B}_j^{RMB}$: country-j household's willingness to hold RMB bonds

▸ proposition

Optimal Conditions

- Euler equations:

$$1=\beta E_t\left[\left(\frac{C_{j,t+1}}{C_{j,t}}\right)^{-\sigma}\frac{P_{j,t}}{P_{j,t+1}}\frac{P^{us}_{us,t+1}}{P^{us}_{us,t}}\frac{1}{Q^{USD}_t\left(1-\Delta^{USD}_{j,t}+\tau'\left(B^{USD}_{j,t},\underline{B}^{USD}_{j,t}\right)\right)}\right]$$

$$1=\beta E_t\left[\left(\frac{C_{j,t+1}}{C_{j,t}}\right)^{-\sigma}\frac{P_{j,t}}{P_{j,t+1}}\frac{P^{cn}_{cn,t+1}}{P^{cn}_{cn,t}}\frac{1}{Q^{RMB}_t\left(1-\Delta^{RMB}_{j,t}+\tau'\left(B^{RMB}_{j,t},\underline{B}^{RMB}_{j,t}\right)\right)}\right]$$

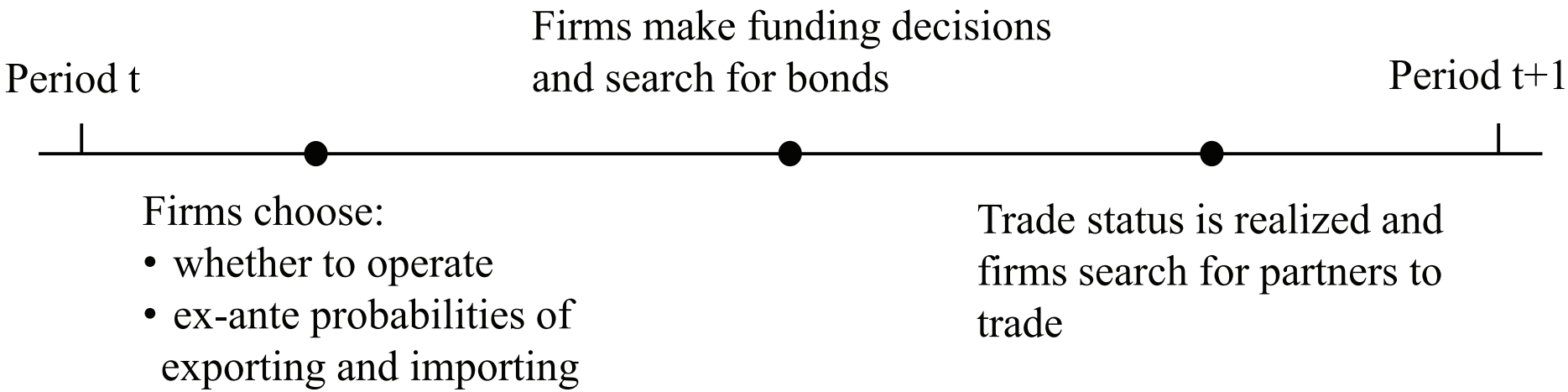
where

$$\tau'\left(B^{RMB}_{j,t},\underline{B}^{RMB}_{j,t}\right)\equiv\bar{\tau}\left(\frac{B^{RMB}_{j,t}}{\underline{B}^{RMB}_{j,t}}-1\right),\quad j\in\{us,rw\}$$

is **bond return wedge** in RMB bond.

Firms

- Firm makes three decisions within each period
  - entry decision
  - exporting/importing decision
  - currency choice



Firms: Search and Trade

- Matching function (den Haan et al., 2000):

$$M(u,v) = \frac{uv}{\left(u^{\frac{1}{\varepsilon}} + v^{\frac{1}{\varepsilon}}\right)^{\varepsilon}}$$

- Trade between exporter and importer:
  - Random search between trading firms
  - Profit loss upon currency mismatch
  - Split the surplus of their transaction via Nash bargaining

Currency choice

- Probability of finding RMB bonds:

$$p_{jt}^{RMB} = \frac{M^F(\overbrace{m_{jt}(1-X_{jt})}^{\text{mass of firms}}, \overbrace{\nu P_{cn,t}^{cn} Q_t^{RMB} B_{jt}^{RMB}}^{\text{value of bonds}})}{m_{jt}(1-X_{jt})}$$

- Currency choice based net profits

$$\Pi_{jt}^{RMB} = p_{jt}^{RMB}\left(\widetilde{\pi}_{jt}^{RMB} - r + \mathbb{1}_{\{j\in\{rw\}\}}\tau_{f,t},\right)$$

  - p_{jt}^{RMB}: probability of finding RMB bonds
  - $\widetilde{\pi}_{jt}^{RMB}$: trading profit
  - r: funding fee
  - $\tau_{f,t}$: reduction in revenue wedge

The Rest of the Model

- Random search between households and firms

$$\Delta_{jt}^{RMB} = \frac{M^F(\overbrace{m_{jt}(1-X_{jt})}^{\text{mass of firms}}, \overbrace{\nu P_{cn,t}^{cn} Q_t^{RMB} B_{jt}^{RMB}}^{\text{value of bonds}})}{P_{cn,t}^{cn} Q_t^{RMB} B_{jt}^{RMB}} r$$

$\Longrightarrow$ *liquidity premium*

- Random search between different firms

$\Longrightarrow$ *probability of mismatch*

- Cost upon currency mismatch
- Government in U.S. and China issue government bonds
- Market clearing:
  - goods market and bond market

Outline

Analytical analysis

- Analytical analysis in SS with following simplification:
  - no mismatch cost
  - exogenous trading profit
  - exogenous currency choices of firms of the two large economies
  - set the matching elasticity to 1
- Key equations:

$$\underbrace{\frac{1}{1+\bar{B}^{RMB}-\frac{\mu_{rw}}{\mu_{cn}}B_{rw}^{RMB}}}_{\Delta_{cn}^{RMB}}r=\underbrace{\frac{1-X_{rw}}{1-X_{rw}+B_{rw}^{RMB}}}_{\Delta_{rw}^{RMB}}r-\underbrace{\bar{\tau}(\frac{B_{rw}^{RMB}}{\underline{B}_{rw}^{RMB}}-1)}_{\tau'(B_{rw}^{RMB},\underline{B}_{rw}^{RMB})}$$

$$X_{rw}=(1+\exp(\sigma_\theta(\underbrace{p_{rw}^{RMB}(\pi-r+\tau_f)-p_{rw}^{USD}(\pi-r)}_{\Pi_{rw}^{RMB}\text{-}\Pi_{rw}^{USD}})))^{-1}$$

Local analysis

Proposition 1. *Starting from a dollar-dominant steady state with* $(\underline{B}_{rw}^{RMB}, \tau_f) = (\underline{B}_{rw,0}^{RMB}, \tau_{f,0})$*, an increase in* $\underline{B}_{rw}^{RMB}$ *or* τ_f *decreases* X_{rw}*. The marginal effect of* τ_f *could be written as a function of* $(B_{rw,0}^{RMB}, X_{rw,0}, \tau_{f,0})$*, which increases in* $B_{rw,0}^{RMB}$*.*

Implication:

- A reduction in the wedge of bond return or firm revenue associated with a currency increases share of that currency
- Marginal effect of reducing revenue wedge increases in initial bond holding

Global analysis

Proposition 2. *If $\pi - r > \underline{\pi}(\underline{B}_{rw,0}^{RMB}, r)$, combined policies can achieve the symmetric steady state with a lower government spending than the single policy to reduce revenue wedge, where $\underline{\pi}(\underline{B}_{rw,0}^{RMB}, r)$ is increasing in $\underline{B}_{rw,0}^{RMB}$ and r.*

- The condition in the proposition is more likely to be satisfied with:
  - higher net trading profit $\pi - r$
  - lower $\underline{B}_{rw}^{RMB}$ and lower r ▸ model

Implication:

- Cost of achieving status of a global currency by using combined policies is lower than doing so by reducing revenue wedge alone

Outline

Quantification Overview

- Accounting exercise:
  - setting $\underline{B}_t^{RMB}$ and $\tau_{f,t}$ to match foreign holding of RMB bonds and RMB payment share *exactly*
- Also match other moments:
  - GDP, gov. bonds, markup, trade/GDP
- Measurements:
  - Inferred reductions in wedges
- Two Exercises on *Policy evaluation*:
  1. Decomposing single policy effects and policy complementarity
  2. Cost effectiveness of combined v.s single policies

Outline

Calibration

- We gauge the quantitative importance of the policy complementarity and assess the optimality of observed policies by taking the model to China's experience during 2010-2021
- We solve the full transition path, which calibrates parameters and solve the transition path simultaneously
- Along the transition path, we calibrate parameters to match
  - share of foreign holdings of RMB bonds
  - RMB payment share
  - share of China's holdings of foreign bonds
  - growth rates of endowments
  - government bonds over GDP in China and the U.S.
  - and some moments in initial year

Calibration

Table 1: Predetermined parameters

Parameters	Description	Value
β	Discount factor	0.9600
μ_{us}	Population share of the U.S.	0.1946
μ_{cn}	Population share of China	0.0449
κ	Mismatch cost	0.0100
σ	Risk aversion coefficient	1.0000
r	Funding fee	0.0050
ν	Velocity	8.0000
α	Exporters bargaining parameter	0.5000
σ_θ	Scale parameter of Gumbel distribution	2000
ε_T	Matching elasticity for trade	0.0100
$\bar{\tau}$	Bond adjustment costs	0.0400

Calibration

Table 2: Calibrated Parameters

Parameters	Description	Target	Value
a_h	Home bias	RoW trade/GDP	0.7207
ϕ_{us}	Fixed entry costs for U.S. firms	Import markup for U.S. goods	0.0006
ϕ_{cn}	Fixed entry costs for Chinese firms	Import markup for Chinese goods	0.0040
ϕ_{rw}	Fixed entry costs for RoW firms	Import markup for RoW goods	0.0177
ε_F	Matching elasticity for bonds	USD usage	0.3482
$\theta_{us}^{\text{diff}}$	shifted mean for U.S. firms	U.S. USD usage	-0.0033
$\theta_{cn}^{\text{diff}}$	shifted mean for Chinese firms	CN USD usage	-0.0362

Table 3: Targeted Moments

Moment	Data	Model
RoW trade/GDP	0.5424	0.5424
Import markup for U.S. goods	1.1000	1.1000
Import markup for Chinese goods	1.1000	1.1000
Import markup for RoW goods	1.1000	1.1000
US USD usage	0.9991	0.9991
CN USD usage	0.8500	0.8500
RoW USD usage in initial year	0.9990	0.9990

Outline

Transition path: inferred reductions in wedges

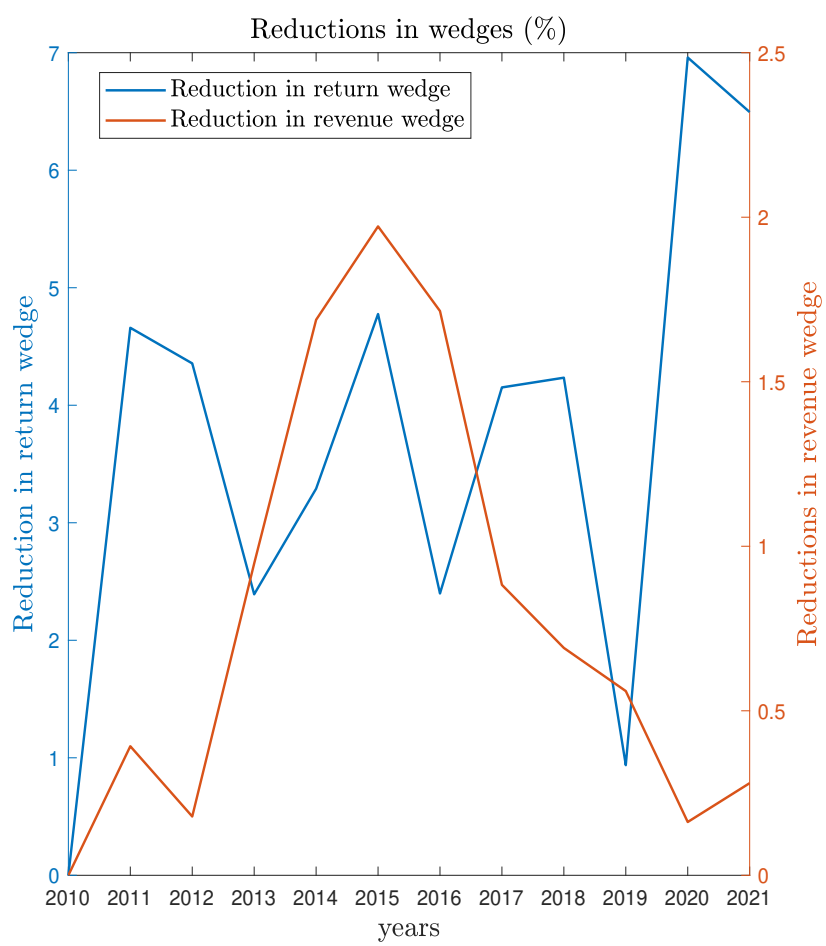


Figure 5: Inferred reductions in wedges along the transition path

RMB Internationalization during 2010-2021

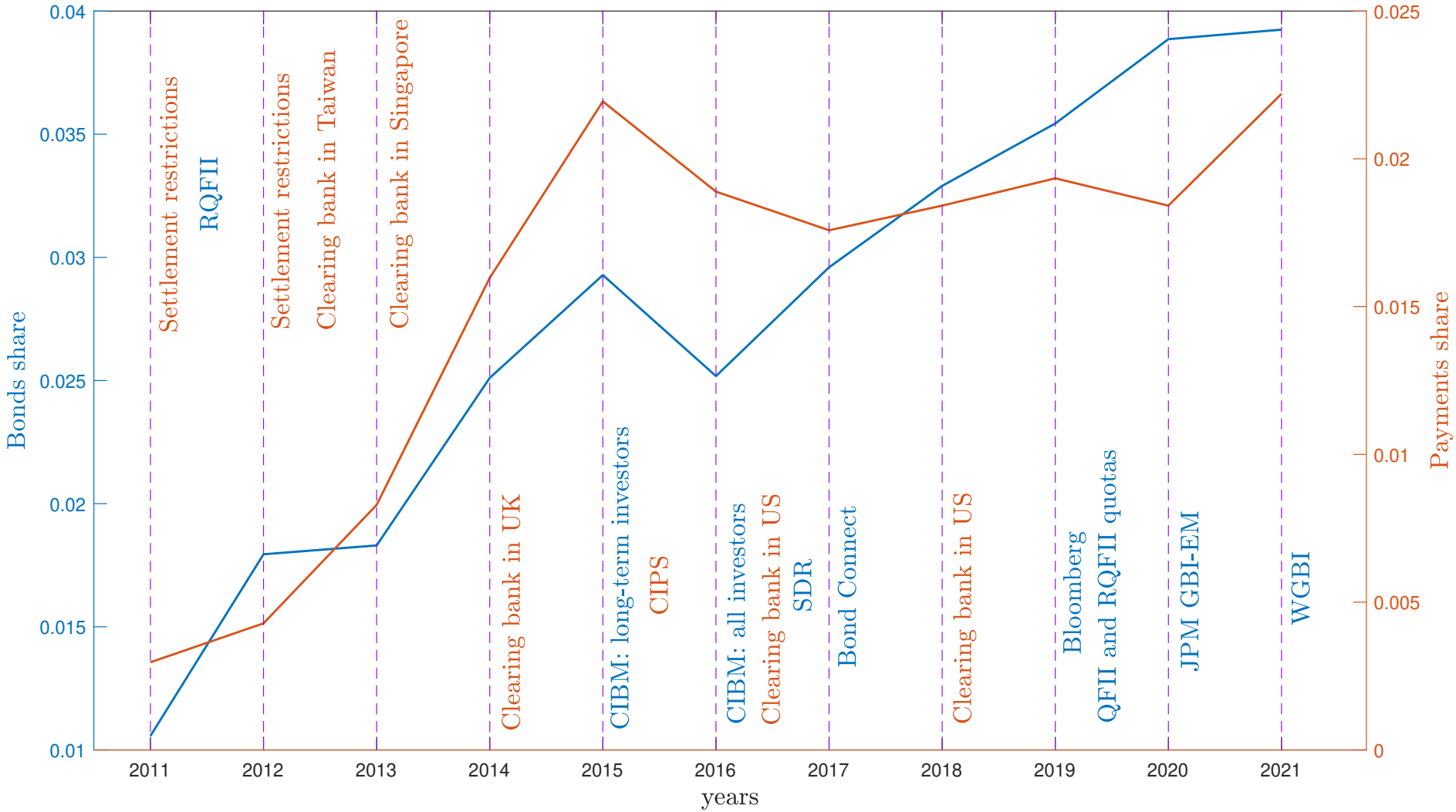


Figure 2: Bonds share and payments share during 2011-2021

Data source: SWIFT, International Investment Position Table, China Bond, and PBoC

The Inferred $\Delta\tau_{f,t}$ Make Sense?

- RMB borrowing rates:
  - Signing a swap agreement is associated with an 0.8% fall in average RMB borrowing rates (Bahaj and Reis, 2022)
- Settlement frictions:
  - $2-3$ days saved after facilitating cross-border RMB business according to some narratives
  - Each day is worth $0.6\% - 2.1\%$ of goods value (Hummels and Schaur, 2013)
- Our estimation of average reductions in revenue wedge: 0.86%

Decomposition of effects of policies on RMB usage

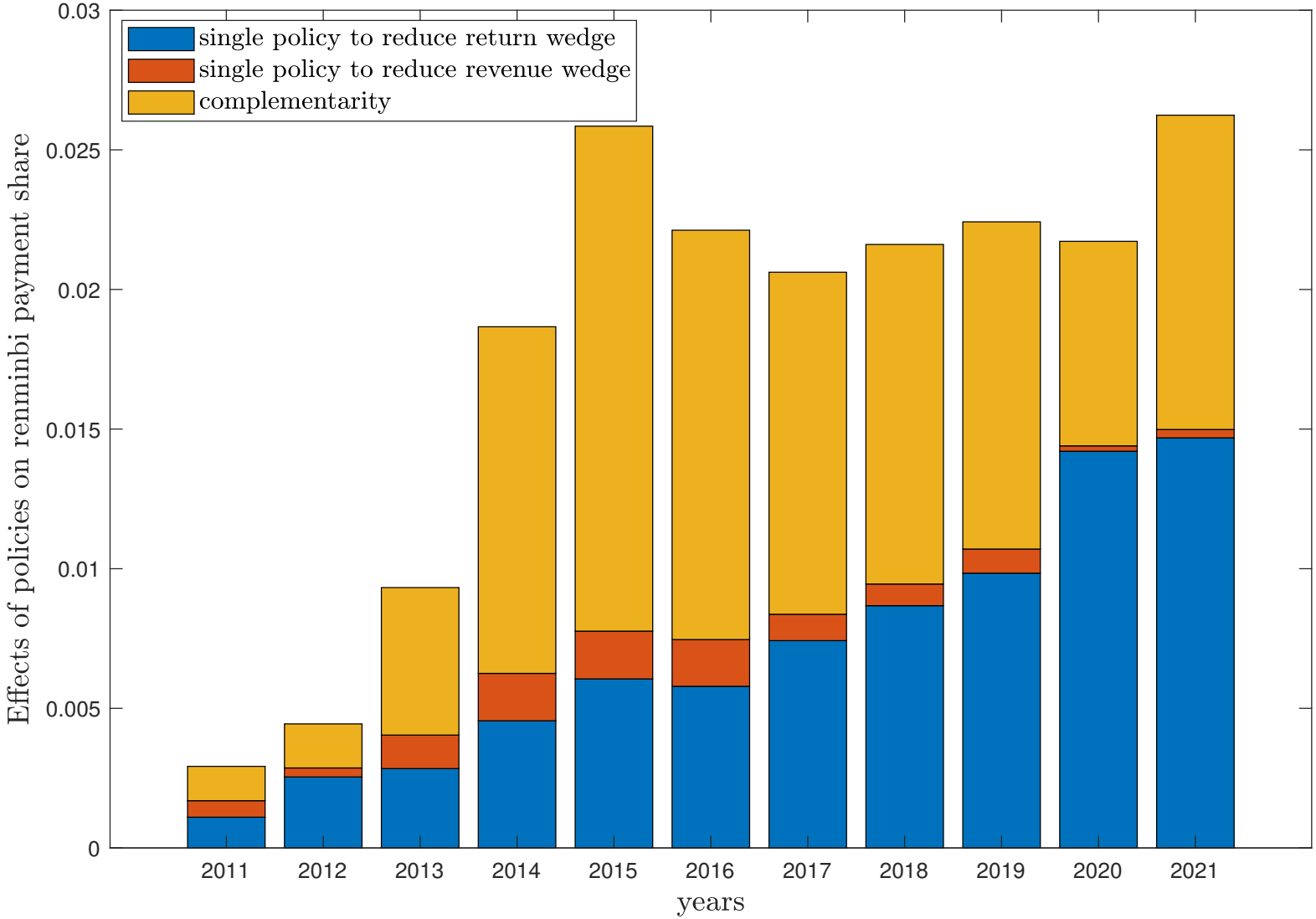


Figure 6: Decomposition of effects of policies on RMB usage

Outline

Counterfactual analysis: single policy

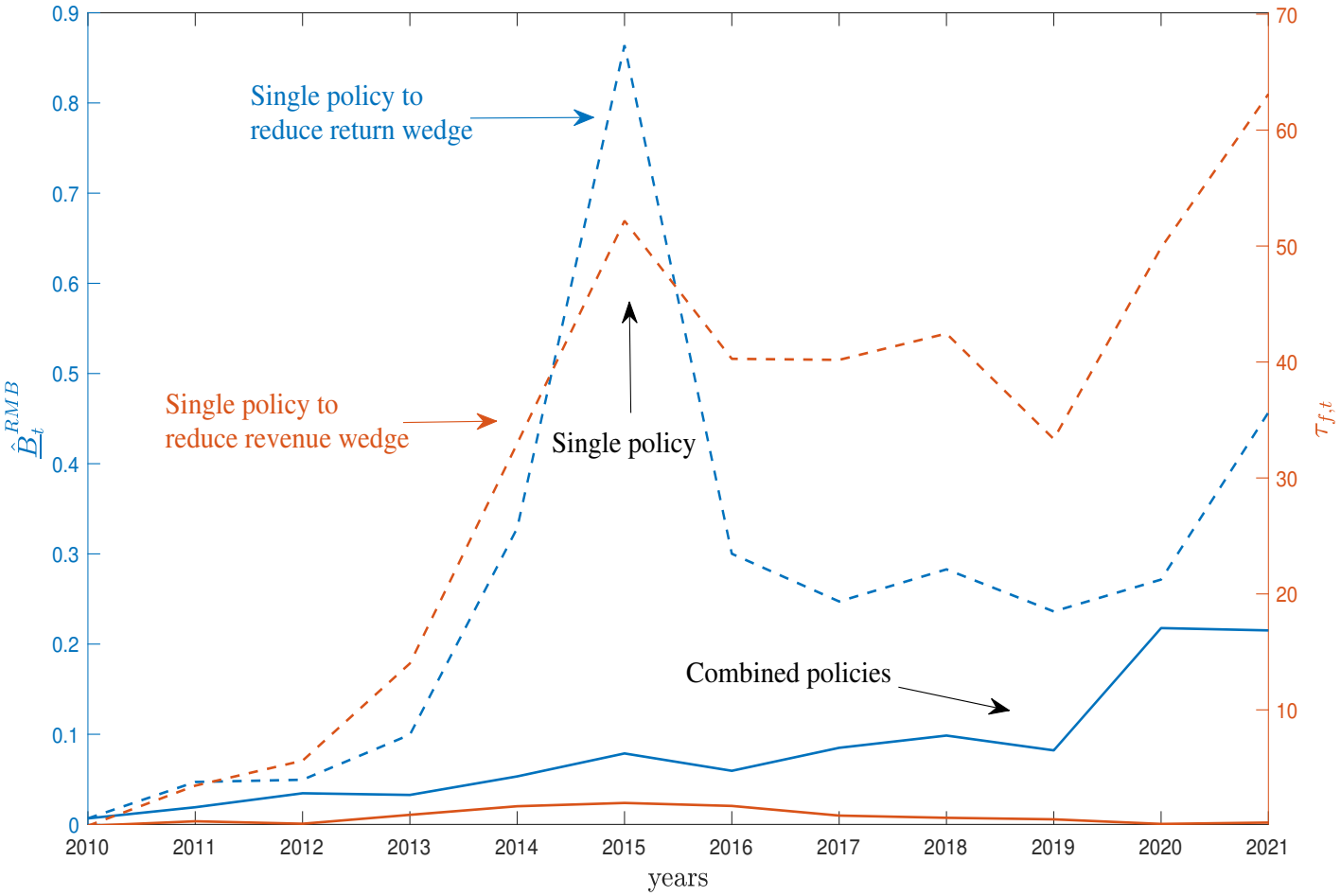


Figure 7: $\hat{\underline{B}}_t^{RMB}$ and $\tau_{f,t}$ along the transition path

Counterfactual analysis: single policy

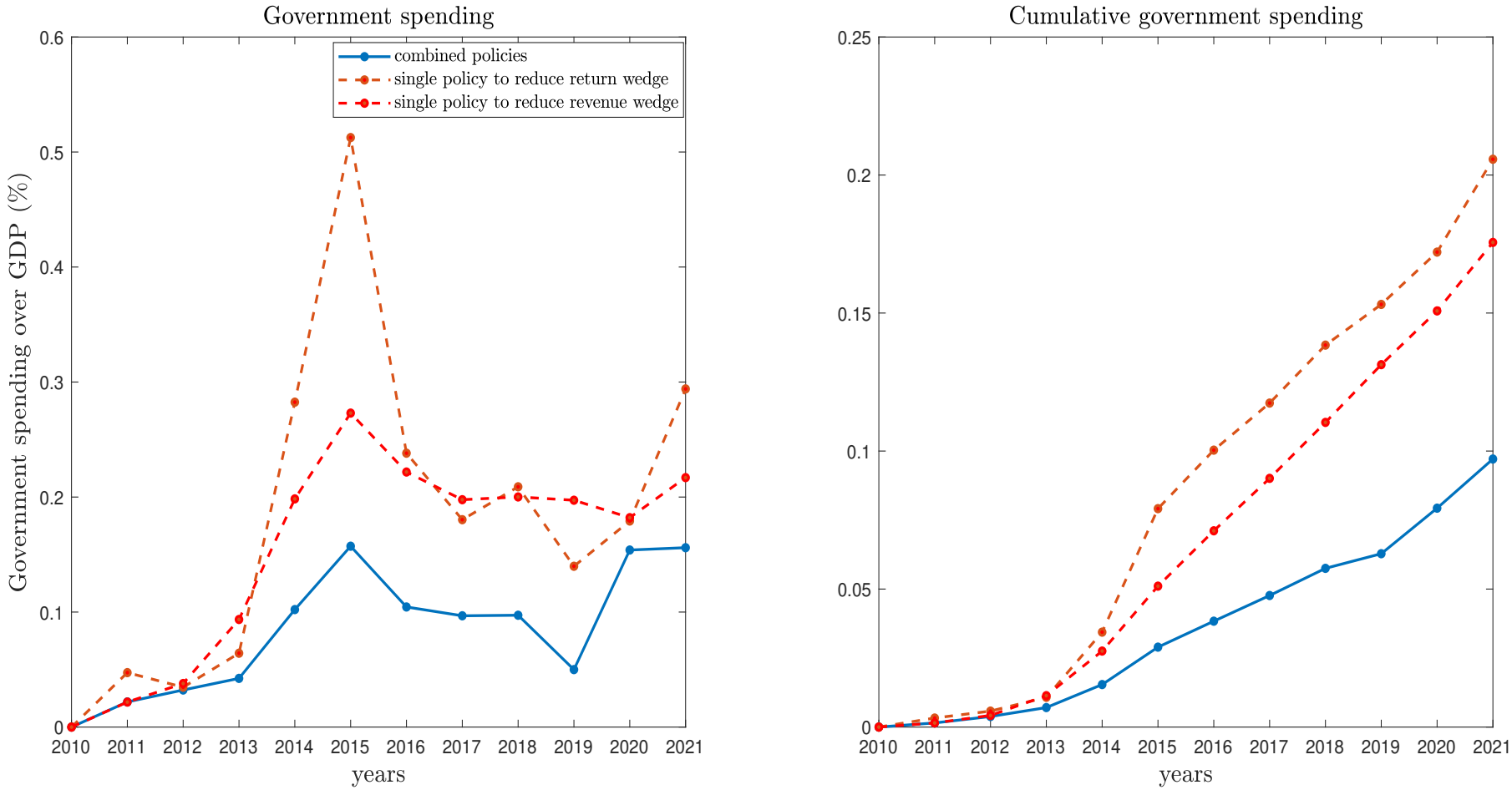


Figure 8: Government spending on policies

Counterfactual analysis: no policy reforms

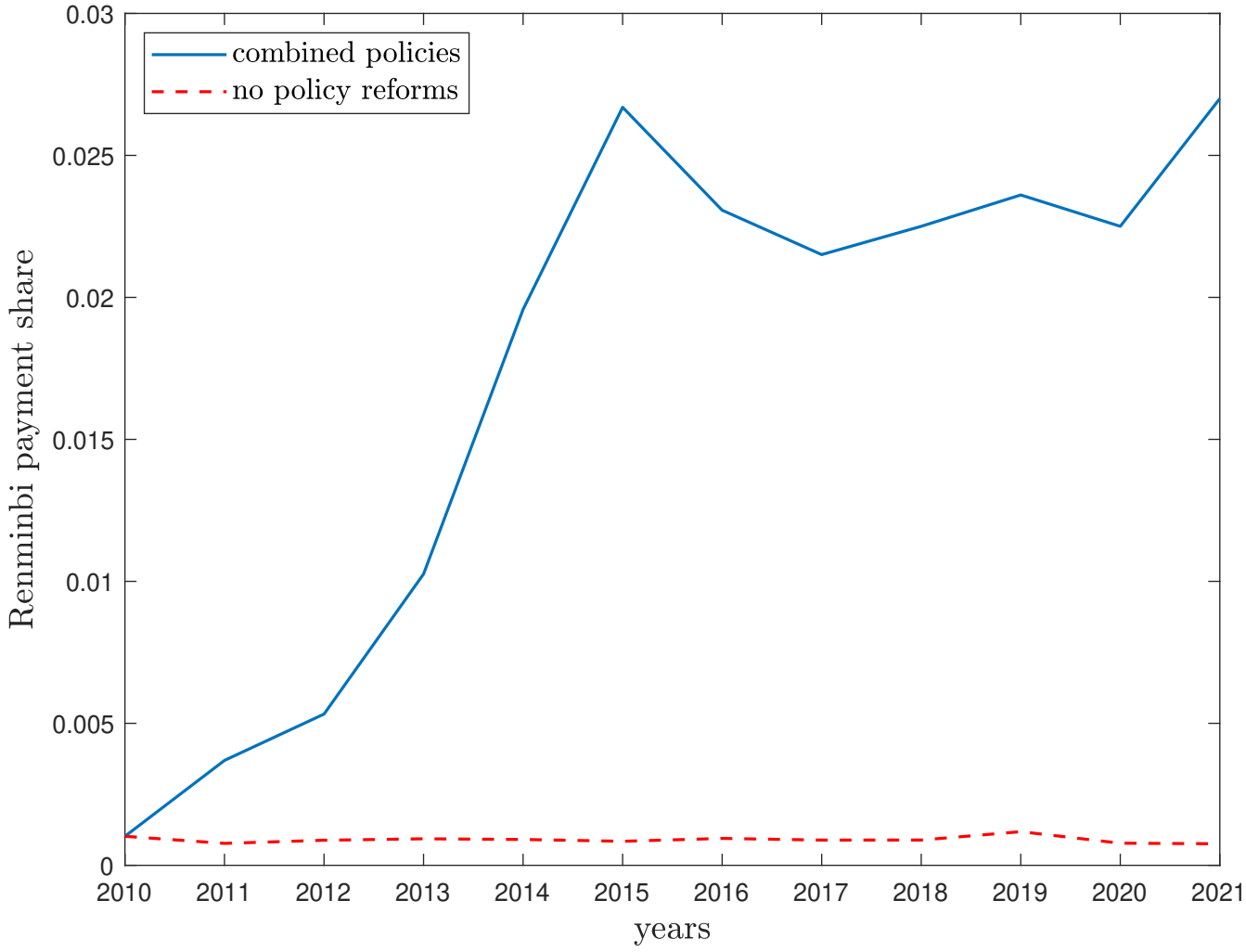


Figure 9: Transition path without the policy reforms

Outline

Conclusion

- Build multi-country dynamic general equilibrium model with endogenous currency choices and emergence of global currency
- Quantify policy effects on promoting local currencies
  - case study on China
  - demonstrate that combined policies are more effective
  - dual-approach reform adopted by Chinese gov. in last decades has been largely optimal
- Highlight the difficulty facing by catching-up country aiming to internationalize its currency

Historical Context of USD overtaking British pound

- By 1912 the U.S. was the leading trading nation, but dollar's share in trade finance was virtually 0
- The *Federal Reserve Act of 1913*
  - Allowed U.S. banks to open branches abroad
  - Removed the restrictions on U.S. banks' involvement in trade acceptances
  - Fed as market-maker of last resort of trade acceptances
- Large share of the dollar in trade finance and global bond market in the 1920s
- Using combined policies to boost an international currency isn't unique to the dollar
  - Dutch; the pound sterling

goto Issue