Jump-starting an international currency

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Motivation: Central Bank Swap Line Network

Figure 1

The bilateral network of liquidity lines between central banks at the end of 2020. The bubble size reflects the sum of either the notional limit of all liquidity lines available to a country or, if the line is unlimited, the historical drawings. Bubble color indicates region (continent). **Figure 1** was created with data from Perks et al. (2021) and augmented to include the European Central Bank's bilateral repo lines, which are sourced from Albrizio, Kataryniuk & Molina (2021).
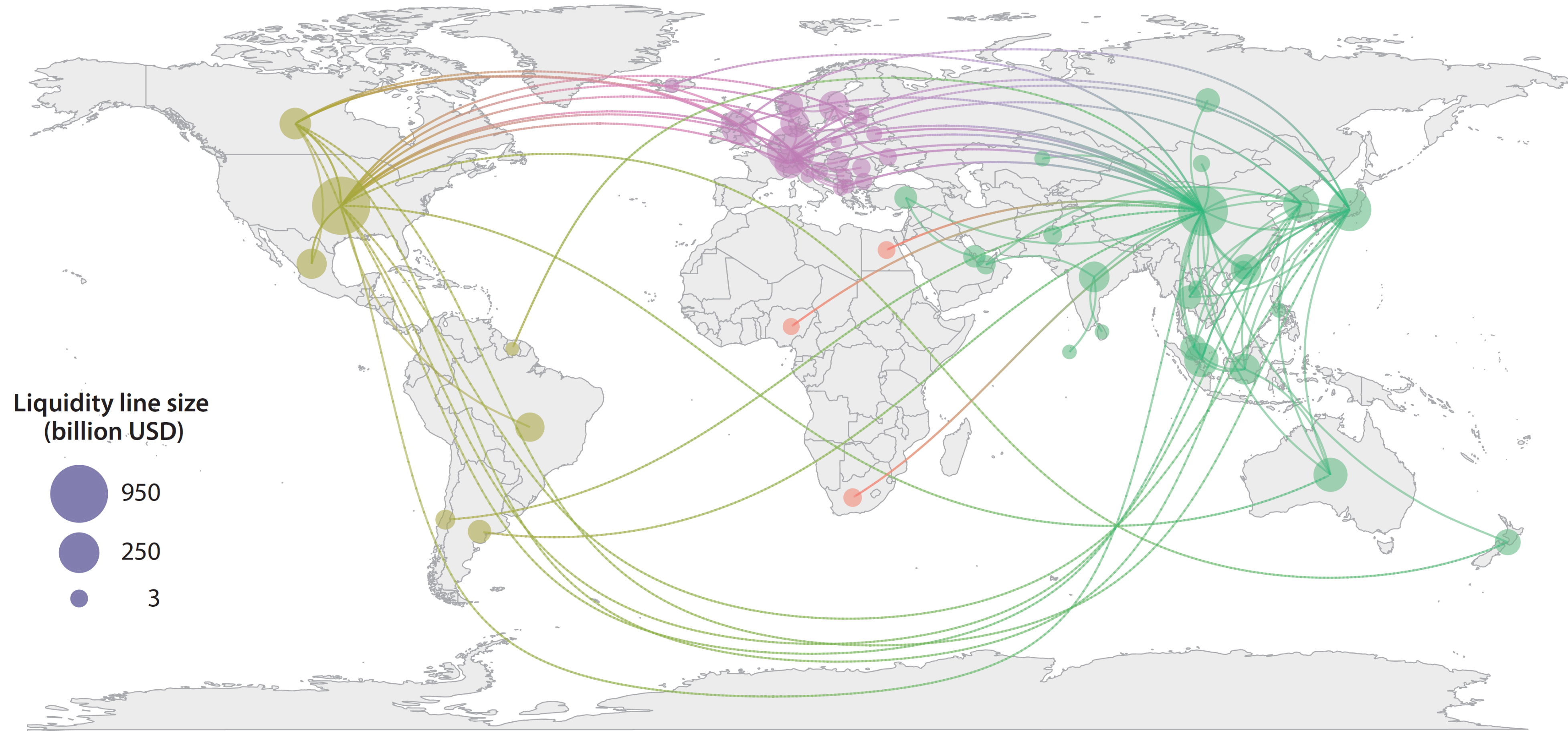
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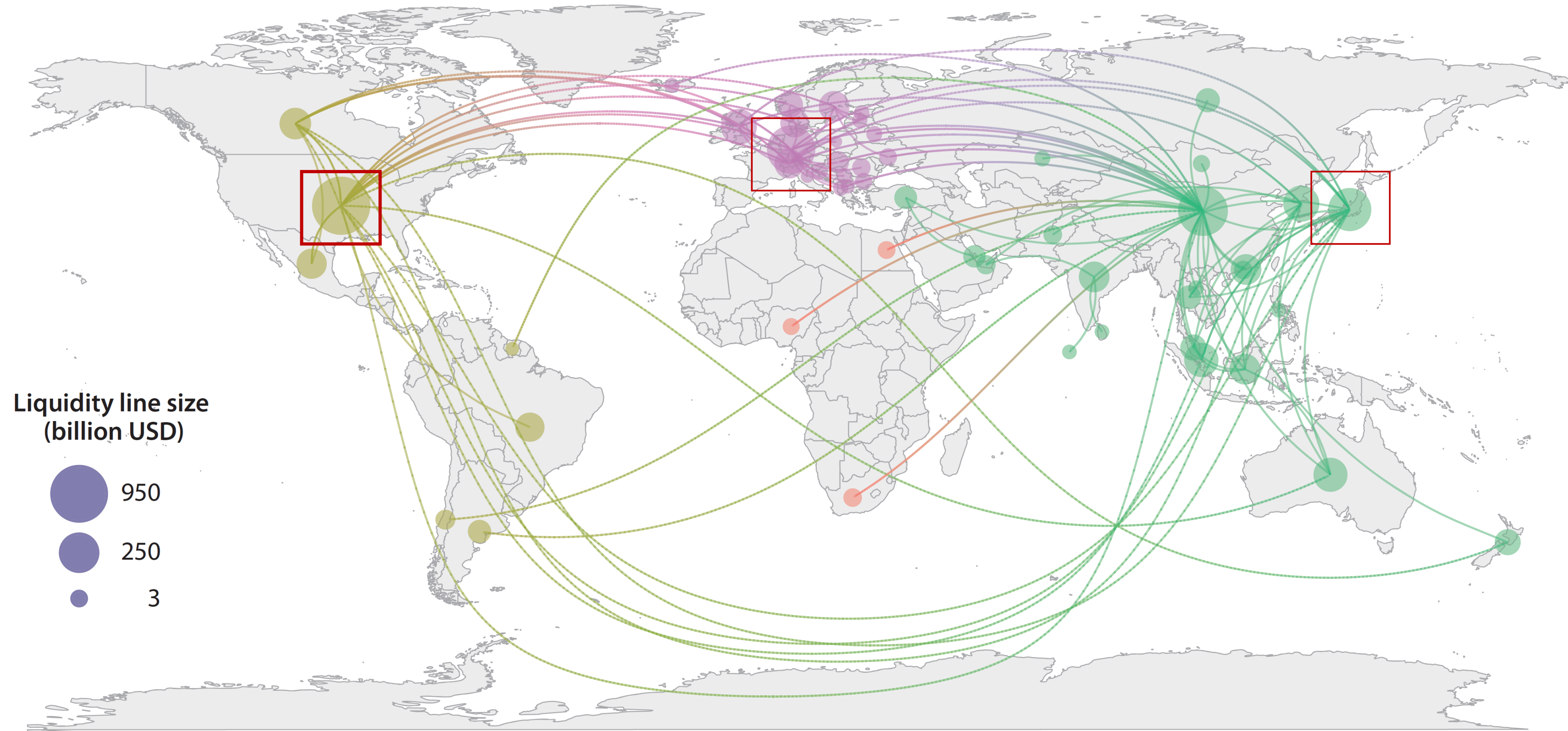# Motivation: Central Bank Swap Line Network

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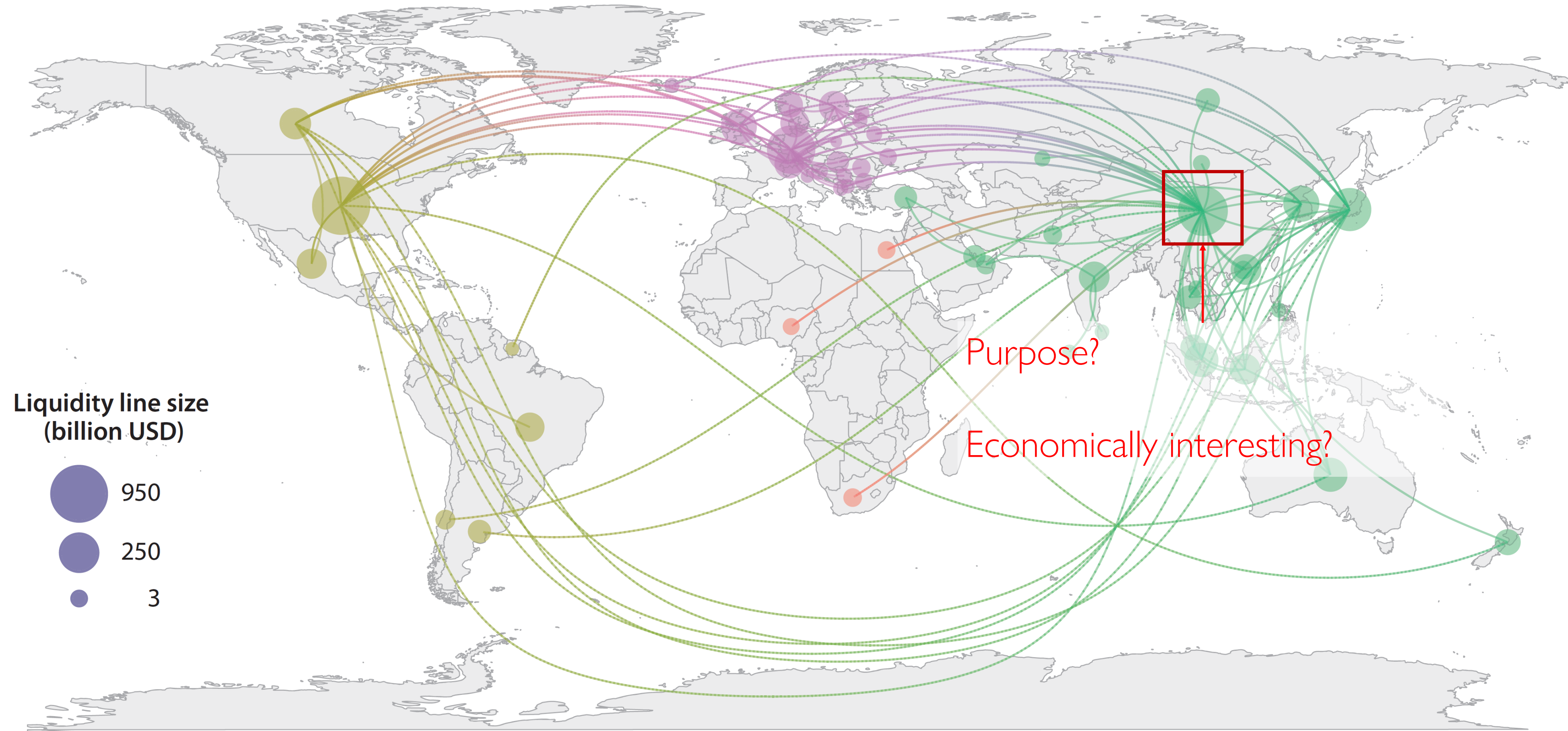
This talk

Outline

1. **Empirics:** PBoC swap lines 09-18 on RMB settlements, country level panel.

   - Signing a swap line associated with increased RMB use + lower synthetic borrowing costs.

2. **Model:** Understand the mechanism.

   - SoE with trading firms deciding denomination of trade credit and invoicing.

   - Compare rising and dominant currencies.

   - Can central bank policies jump-start currency use? When?

The lines and the data

The Policy:
- Loan from PBoC => Counterparty CB.

- Used to provide RMB credit to local banking system at known price. (organized facility or ad-hoc, insurance)

- In principle caps offshore borrowing costs.

The Data:
- Monthly swift data on bilateral payments (2010-2018).

- RMB share in cross border payments sent and received per month per country. Trade finance as robustness.

(a) Swap lines: number and amounts

RMB share of payments
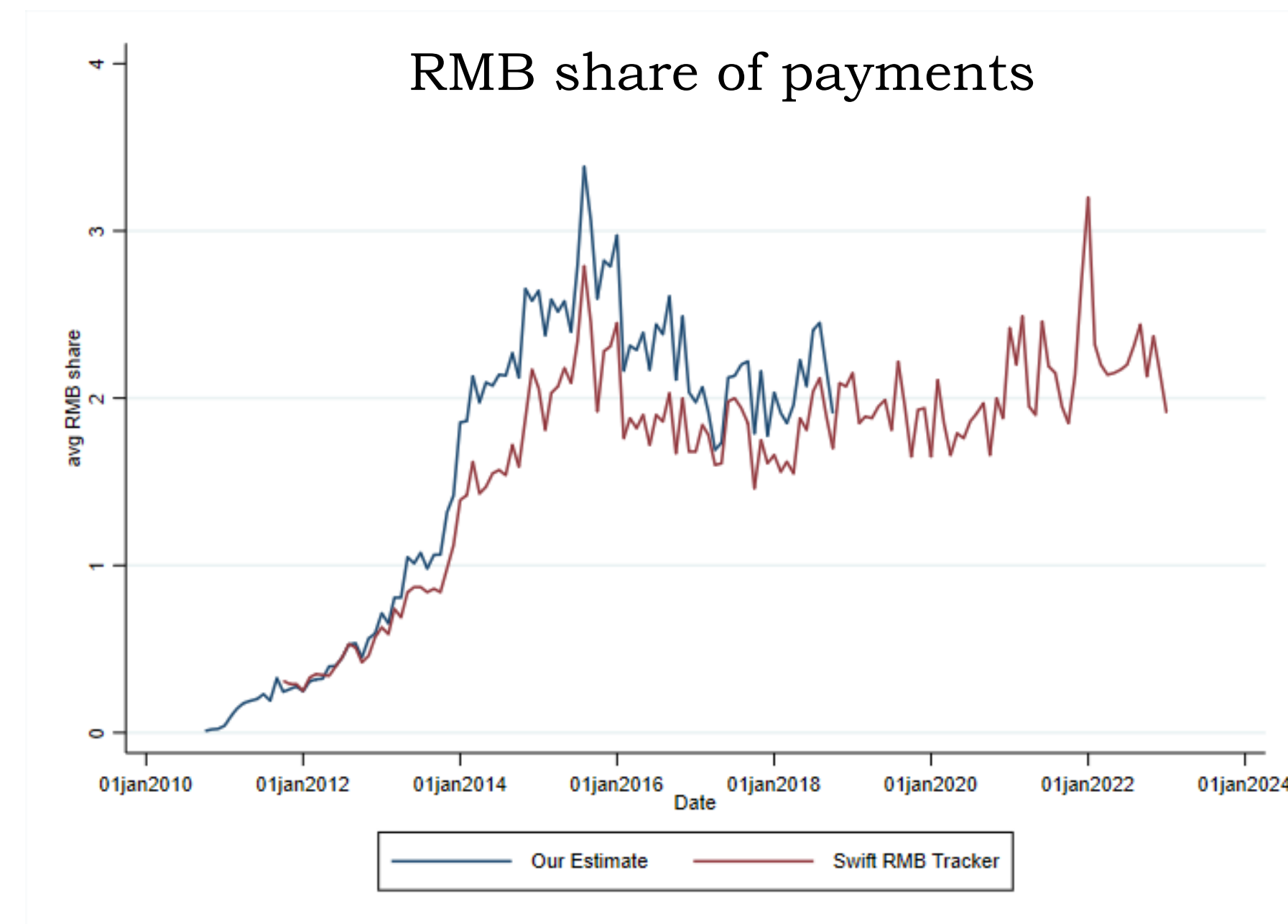
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RMB Share of trade finance

RMB payment share after swap line signed

Median

Mean
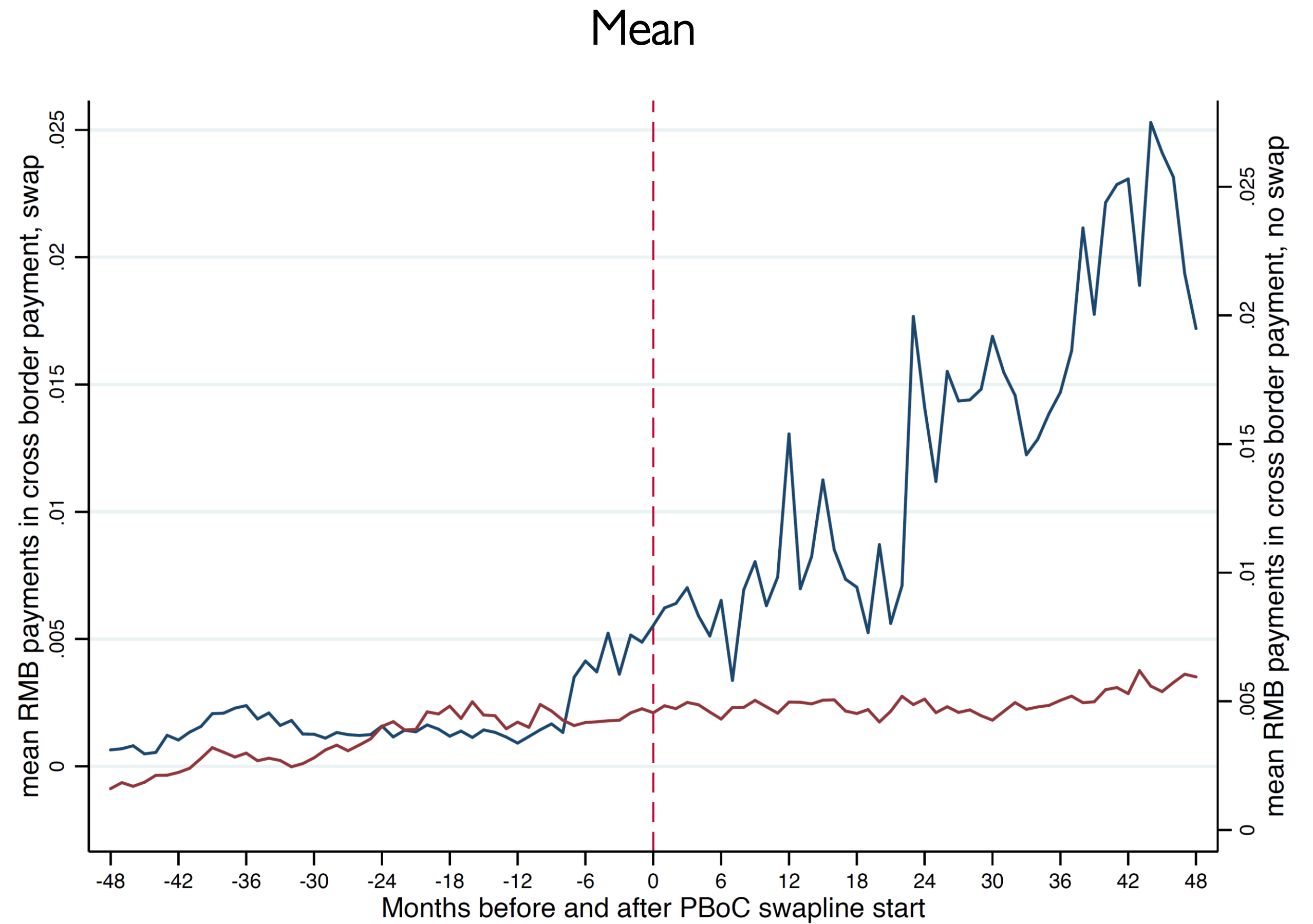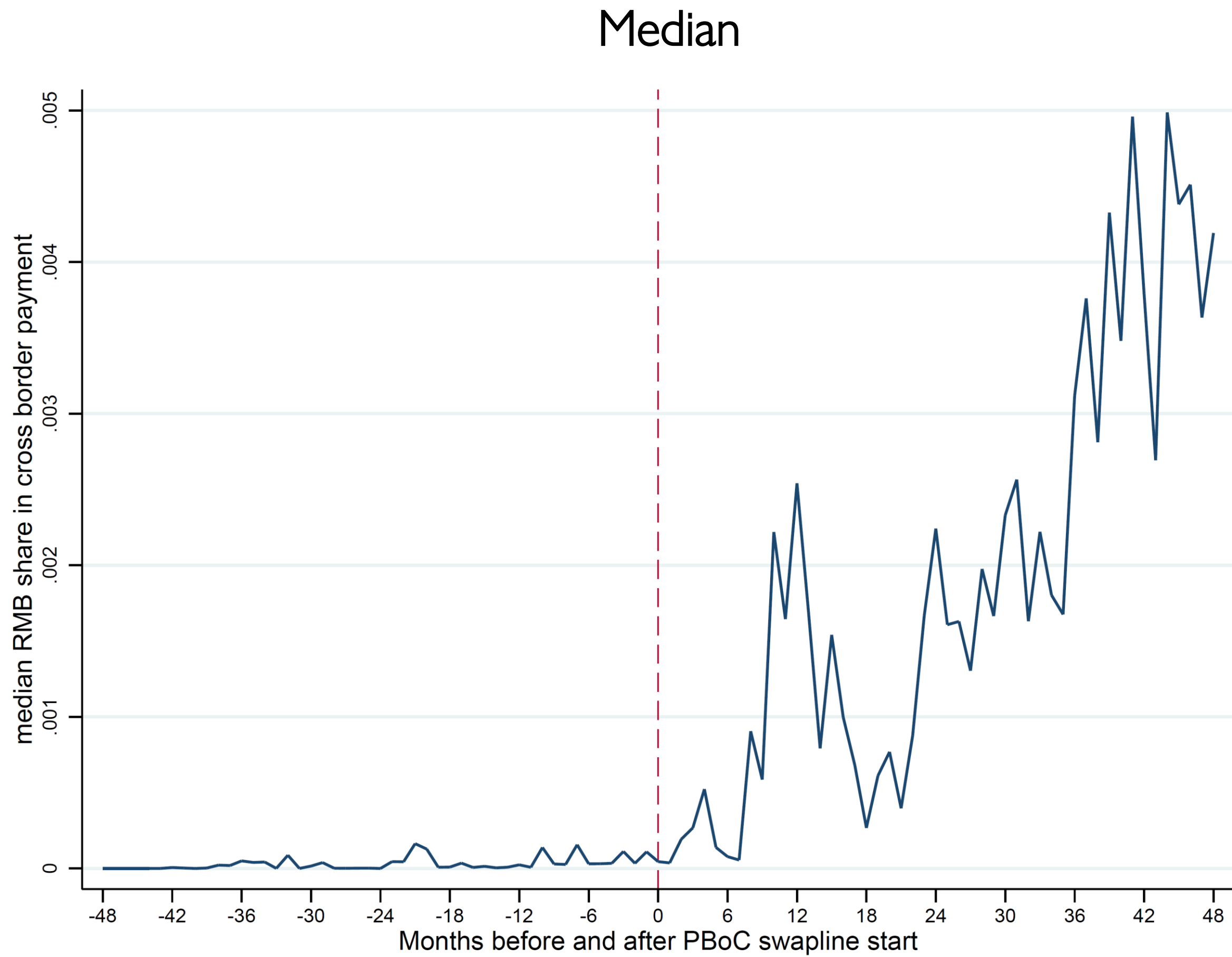
Event Study Plots

Payment Share
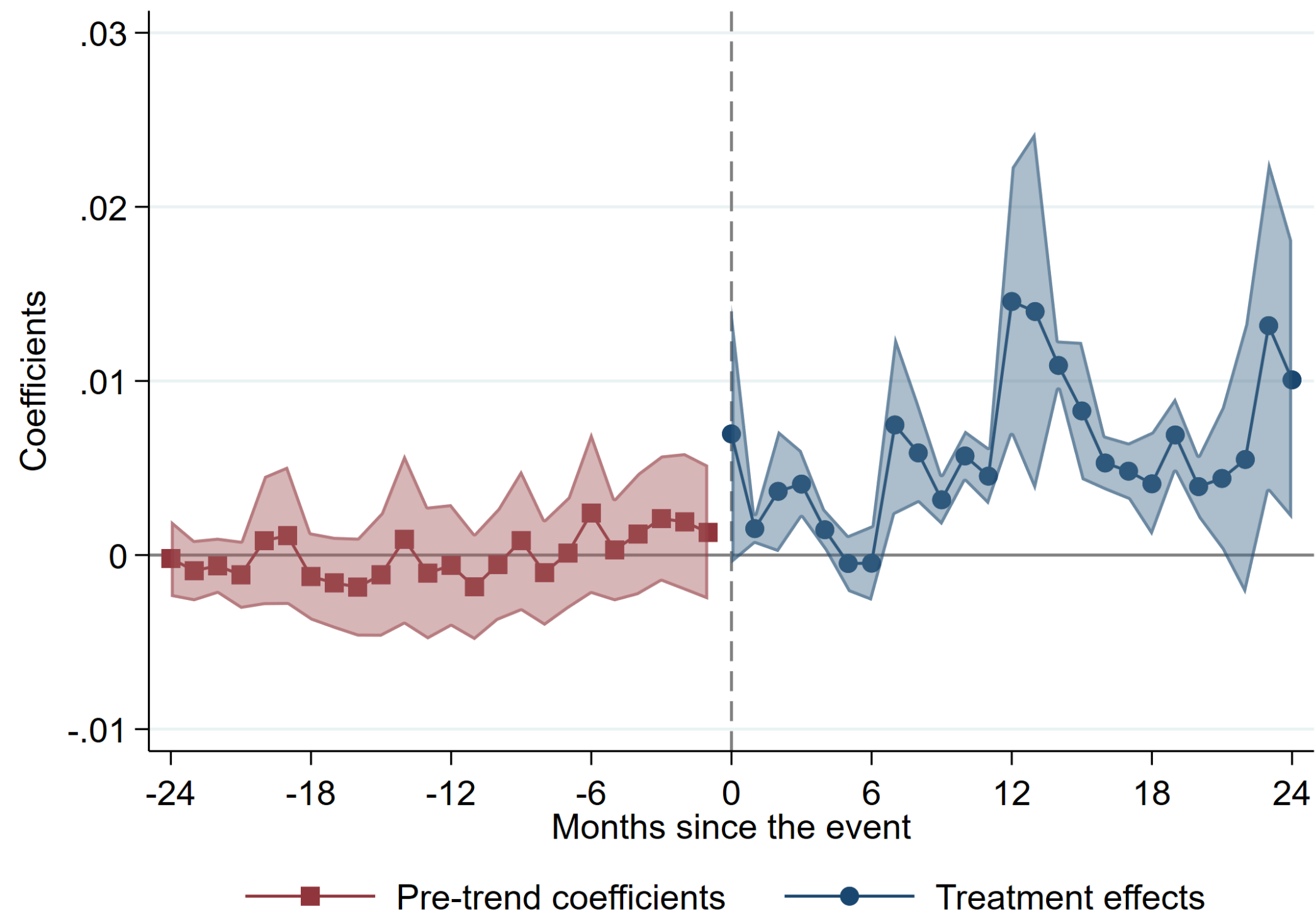
Probability of use
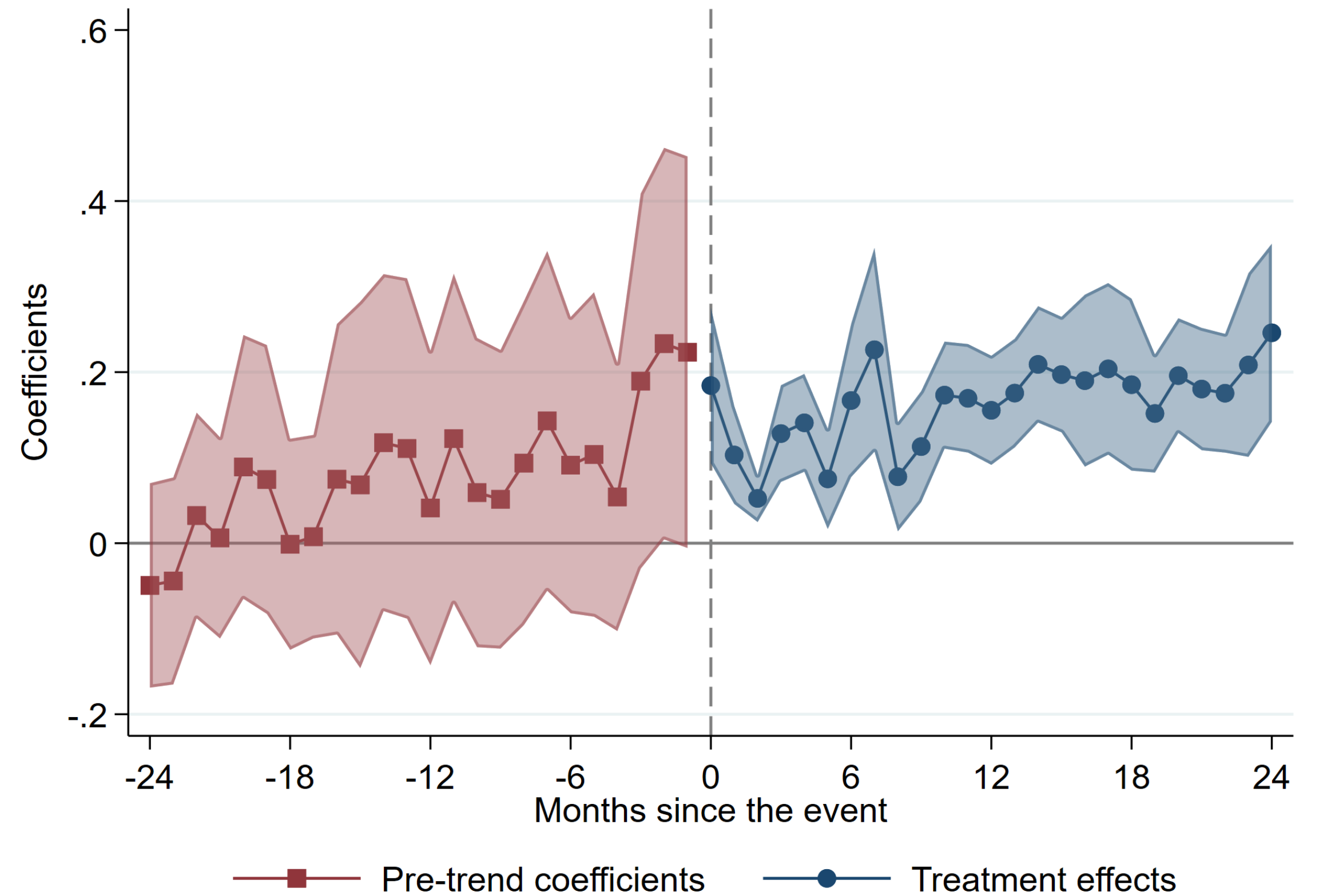
Conditional on trade and financial linkages with China and other Chinese intergration policies.

Other results in the paper

Reduction in Synthetic RMB borrowing costs.

Results hold:

- Ex-payments to China.

- For payments sent, received, just for trade purposes

Identification

- No effect on trade (just denomination).

- Synthetic control.

- Spillover onto neighbors.

- IV based around timing of state visits.

Small open economy, 3 periods

| Period 0: Pricing Choices | Period 1: Production | Period 2: Delivery |

Each firm chooses:

1. <u>Technology</u>: composition of inputs, x_r versus x_d

2. <u>Sticky price</u>: it will charge in which currency (in different markets).

Know:

- Average interest rate
- Relative cost of inputs

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Firm:

1. Buys inputs using the committed composition
2. Borrows to pay for them in matching currency

Risk realises:

- <u>Firm-specific interest rate</u>
- Exchange rates

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Firm:

1. Sells goods to each market, collect revenue.

2. Repays debt (credibly), distributes profits.

Mechanical period

Firms and geography

- <u>Firms</u>: $j \in [0,1]$

- <u>Markets</u>: dominant **D**; rising **R**; $i \in (0,1)$ other SOEs; bilateral FX s_i, s_d, $s_r \in S$.
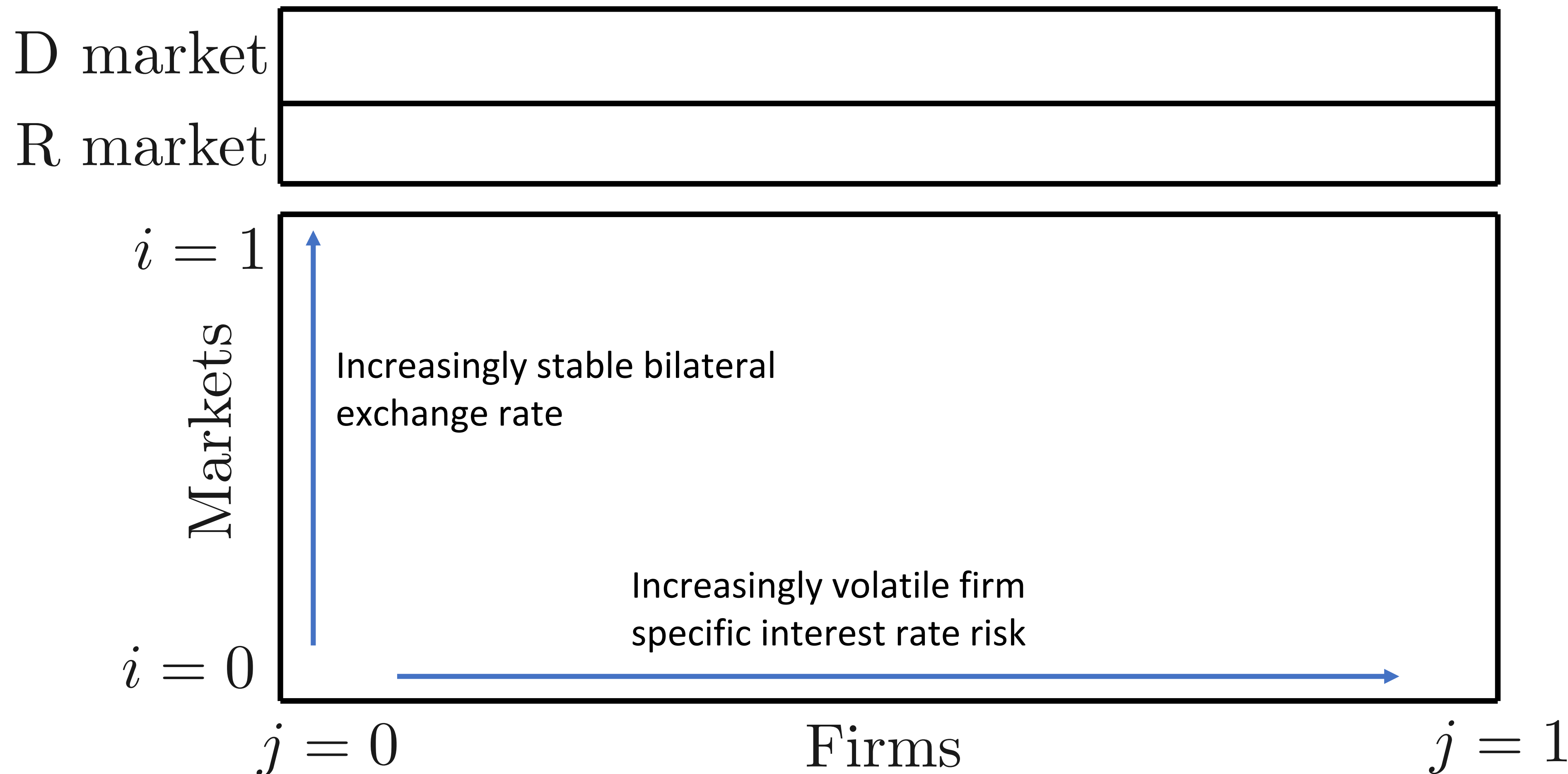
Technologies and cost function

Each firm chooses production technology η^j

$$x^j = \min \left\{ \frac{x_r^j}{\eta^j}, \frac{x_d^j}{1 - \eta^j} \right\}$$

$$y^j = (x^j)^\alpha (l^j)^{1-\alpha}$$

- x inputs different prices + cost of credit (matched credit).

- Terms of borrowing in R stochastic: $\varepsilon_j \sim G(\varepsilon_j)$

- Non-credit input, stochastic: w

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Period-1 MC $\propto \left[\eta^j s_r \times \underbrace{\textbf{Effective r-price of } x_r}_{} + (1-\eta^j)s_d \times \textbf{Effective d-price of } x_d\right]^\alpha w^{1-\alpha}$

RMB borrowing cost shock moves this

Period 0 choice of pricing

For each market, choose sticky price and pricing technology:

$$\mathcal{P}_i^j \in \{PCP, LCP, DCP, RCP\}$$

Market demand has constant elasticity of demand $\boldsymbol{\theta}$.

Log-normal joint pdf, $H(S, w)$, mean $\boldsymbol{\mu}$, variance Σ. (elements $\boldsymbol{\sigma}$)

Assume: $\boldsymbol{\mu}_d = \boldsymbol{\mu}_r$ & $\boldsymbol{\sigma}_d = \boldsymbol{\sigma}_r$.

Ex post deviations from a constant markup over marginal cost lead to lower profits. Shocks to exchange rates, cost of inputs, borrowing costs, affect profits differently depending on the firm's choice of currency for credit and pricing.

Forces in the model

Proposition 1.

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$$\theta \left(\sigma_r^2 - \sigma_{rd} \right) > (1 - \alpha)(\sigma_{rw} - \sigma_{dw}) + \theta \left(\sigma_{ri} - \sigma_{di} \right) \tag{10}$$

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Benefit from aligning denomination of marginal cost to price.

Potential cost if d currency is a better operational hedge.

Assum. 1: Neither r nor d currency has a hedging advantage.

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(c) *If the firm chooses r-credit, and the d and r currencies are otherwise identical in terms of mean and variance, then RCP is preferred to LCP in market i if the variance of the local exchange rate is sufficiently high:*

$$\sigma_i^2 - 2\alpha\sigma_{ir} - 2(1 - \alpha)\sigma_{iw} \geq \Phi \equiv \sigma_r^2 - 2\alpha\sigma_r^2 - 2(1 - \alpha)\sigma_{rw}. \tag{11}$$

Period 0 choice of credit

Proposition 2. *The firm will choose r-credit ($\eta^j = 1$) if*

$$\left(\int \left(\varepsilon^j \right)^{\alpha} dG^j(\varepsilon^j) \right)^{1/\alpha} \leq \text{relative prices absent borrowing cost shock} \times \Psi(\mu, \Sigma, \mathcal{P}^j)$$

Otherwise, it will choose d-credit. Under assumption 1, $\Psi(\mu, \Sigma, \mathcal{P}^j)$ is equal to one if the r and d markets are equal in size. Starting from this point, $\Psi(\mu, \Sigma, \mathcal{P}^j)$ is <u>increasing in the size of the r-market</u>.

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Swap line shifts the effective distribution of borrowing costs to

$$\tilde{G}^j(\varepsilon^j) = \begin{cases} 1 & \text{if } \varepsilon^j \geq \varepsilon^{swap} \\ G^j(\varepsilon^j) / G^j(\varepsilon^{swap}) & \text{if } \varepsilon^j < \varepsilon^{swap} \end{cases}$$

so that $\tilde{G}^j(\varepsilon^j)$ is first-order stochastically dominated by $G^j(\varepsilon^j)$ under the new distribution.

Starting point, dominant currency

D Market | *DCP*
R Market | *RCP*

$i = 1$

LCP

i_d^*

Markets

DCP

$i = 0$

$j = 0$ Firms $j = 1$
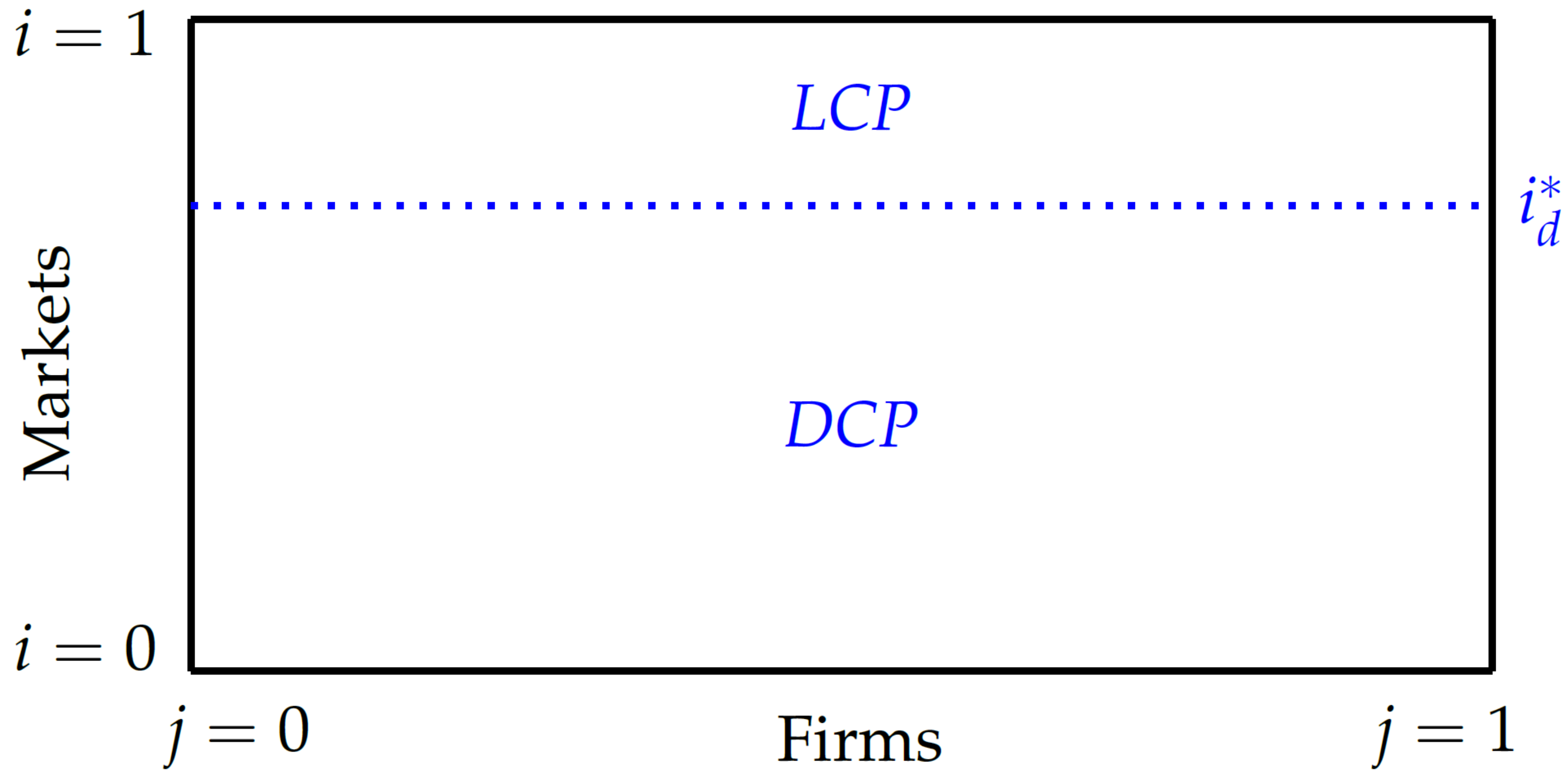
Add a swap line

D Market	DCP
R Market	RCP

$i = 1$

LCP LCP

i_r^* i_d^*

Markets

RCP DCP

$i = 0$

$j = 0$ j^* Firms $j = 1$
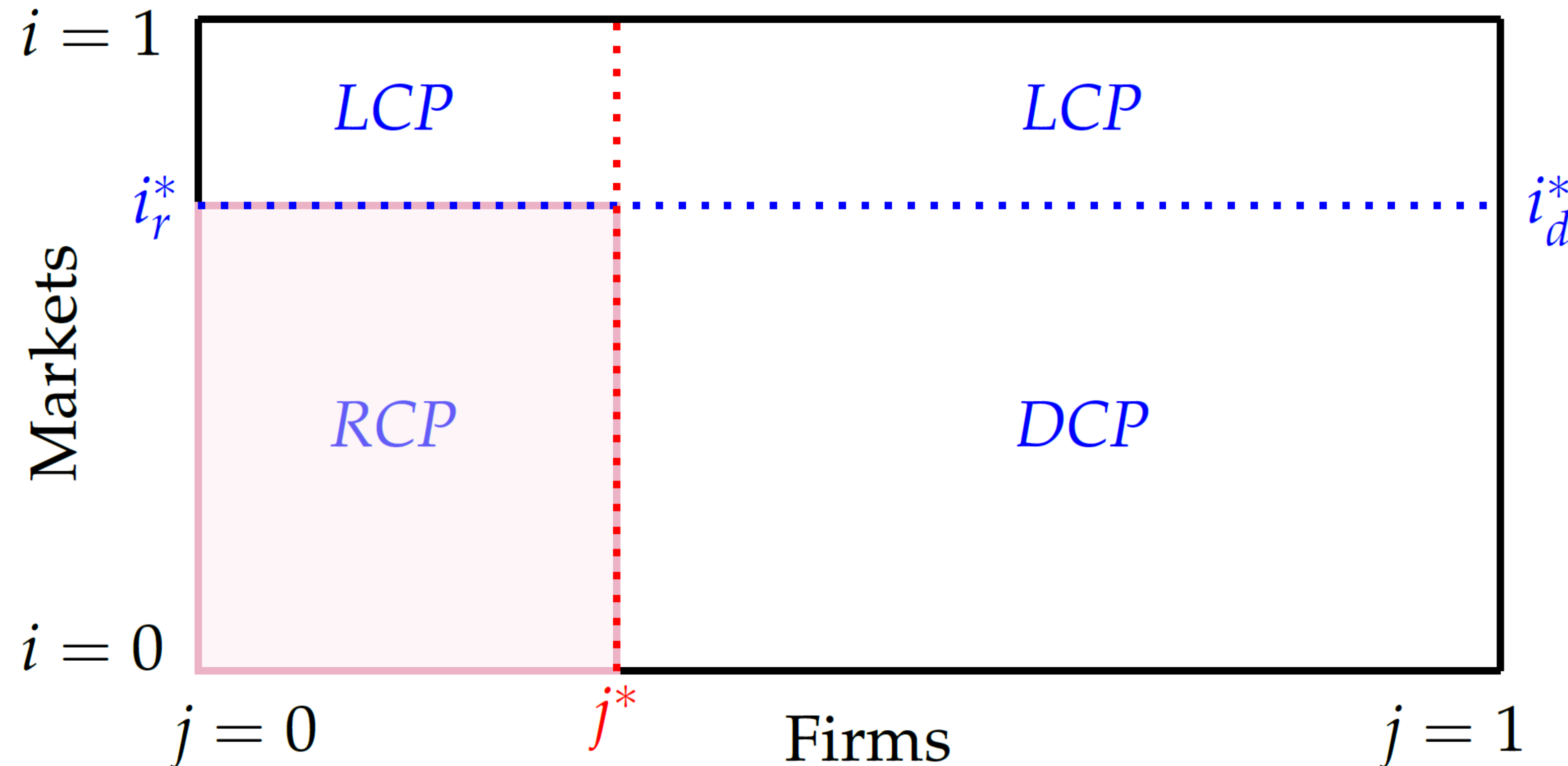
- Holding $\mathcal{P}^j$ fixed some firms cross threshold Ψ

- Choose RCP over LCP if local currency sufficiently volatile (threshold Φ)

- Choose RCP over PCP if strong enough correlation with local inputs:

$$\sigma_{rw} \geq \Omega \equiv \sigma_r^2 \left(\frac{0.5 - \alpha}{1 - \alpha} \right)$$

- Complementarity: Ψ is lower the more RCP is used (primitive: size of r-market).

Why so few international currencies?

- Country small as a share of a market for goods. Weakens complementarity.

- Exchange rate too volatile, prefer LCP over RCP. .

- Currency uncorrelated with other inputs. PCP preferred.

- Credit denominated in the currency too expensive (or volatile).

Parting thoughts

- International currency status depends on: (i) financial markets, working capital credit, (ii) <u>policy</u> central bank actions

- <u>Empirics</u>: RMB swap line by removing right-tail risk of RMB financing increased probability a country making or receiving RMB payments.

- <u>Model</u>: complementarity between credit and invoicing. Three thresholds that most countries do not meet. Some do, and policy can cause jumpstart.

- <u>Further rise of RMB</u>? Still far from the USD.

USD in 1912

- **Start:** World's largest exporter, but USD 0% of trade finance. All in sterling, in London

- Federal Reserve Act (and Strong at FRBNY)

  - De-regulate: US banks branches abroad

  - Stable exchange rate and inflation

  - Liquid secondary market and Fed has buyer of last resort of trade acceptances

- By 1925 USD very large, by 1945 dominant

  - Policy?

  - Luck (war) over London?

  - Inevitable as US became world creditor?

RMB in 2009

- **Start:** largest goods exporter, world creditor, RMB not used at all given capital controls

- Policies starting in July 09:

  - De-regulate: trade settlement pilot scheme

  - Market: CNH in HK offshore market

  - Stable exchange rate: dollar peg

  - Buyer of last resort: PBoC swap lines

- Outcomes:

  - 2016, IMF includes it in SDR basket

  - 2019, 2% of official foreign exchange rate reserves.

  - Coincidence, luck, policies?

Appendix Material

Table 1: Summary statistics: main regression sample

	mean	p50	min	max	sd
RMB payments					
RMB payment sent/received $(1(\text{Rpayment}_{i,t} > 0))$	.258	0	0	1	.438
RMB payment sent/received excluding to/from China	.133	0	0	1	.340
RMB payment sent	.257	0	0	1	.438
RMB payment received	.258	0	0	1	.438
RMB trade credit sent/received (MT400 or MT700)	.050	0	0	1	.217
RMB share in all payments $(\text{Rshare}_{i,t})$	.004	0	0	.925	.033
Economic Linkages with China					
Goods exports to China (% GDP)	.095	.026	0	.964	.158
Goods imports from China (% GDP)	.128	.112	0	.787	.082
Chinese direct investment (% GDP)	.017	0	0	24.64	.262
Neighbor Variables					
Share of neighbors using RMB $(\text{Neighbor Use}_{i,t})$	.271	.2	0	1	.267
Share of neighbors with swap line $(\text{Neighbor Swap}_{i,t})$	.099	0	0	.8	.156
China policies					
Has a PBoC Swap Line $(\text{SwapLine}_{i,t})$	.091	0	0	1	.287
Membership of AIIB	.067	0	0	1	.251
Has RMB Clearing Bank	.018	0	0	1	.134
Has Free Trade Agreement	.009	0	0	1	.093
Cumulative number of state visits	.136	0	0	6	.456
Country Characteristics					
Intermediate input share	.466	.473	.076	.802	.112
Export working capital needs	.150	.151	.080	.206	.021
Observations	12804				

Excluding China

	No controls (1)	Time & Seasonal f.e. (2)	Incl. Neigh. Share (3)	Incl. China Trade (4)	Incl. China Policy (5)
SwapLine$_{i,t}$	0.2382***	0.1173***	0.1066***	0.1097***	0.1072***
	(0.045)	(0.034)	(0.029)	(0.029)	(0.027)
Country f.e.	Yes	No	No	No	No
Country×Seasonal f.e.	No	Yes	Yes	Yes	Yes
Time f.e.	No	Yes	Yes	Yes	Yes
Neighbor Use Control	No	No	Yes	Yes	Yes
China Trade Controls	No	No	No	Yes	Yes
China Policy Controls	No	No	No	No	Yes
Observations	13192	13192	13192	13192	13192

S.E. clustered by country and time in parentheses, * $p < 0.1$, **,$p < 0.05$, *** $p < 0.01$

Payment Types

	payments rec'd		payments sent		trade credit (MT 400 and 700)	
	f.e. only	all controls	f.e. only	all controls	f.e. only	all controls
	(1)	(2)	(3)	(4)	(5)	(6)
$SwapLine_{i,t}$	0.1403***	0.1501***	0.1416***	0.1513***	0.1474***	0.1217***
	(0.044)	(0.042)	(0.044)	(0.042)	(0.011)	(0.017)
Country f.e.	No	No	No	No	No	No
Country×Seasonal f.e.	Yes	Yes	Yes	Yes	Yes	Yes
Time f.e.	Yes	Yes	Yes	Yes	Yes	Yes
Neighbor Use Control	No	Yes	No	Yes	No	Yes
China Trade Controls	No	Yes	No	Yes	No	Yes
China Policy Controls	No	Yes	No	Yes	No	Yes
Observations	12804	12804	12804	12804	12804	12804

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Dynamic effects

	Time & Seasonal f.e. (1)	All Controls (2)	Pre-Periods (3)
SwapLine: first 12 months$_{i,t}$	0.1251***	0.1339***	0.1499***
	(0.033)	(0.034)	(0.035)
SwapLine: after 12 months$_{i,t}$	0.1433***	0.1500***	0.1631***
	(0.049)	(0.047)	(0.045)
SwapLine: 6 months prior$_{i,t}$			0.0918***
			(0.028)
SwapLine: 12-7 months prior$_{i,t}$			0.0462
			(0.029)
Country f.e.	No	No	No
Country×Seasonal f.e.	Yes	Yes	Yes
Time f.e.	Yes	Yes	Yes
Neighbor Use Control	No	Yes	Yes
China Trade Controls	No	Yes	Yes
China Policy Controls	No	Yes	Yes
Observations	12804	12804	12804

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Effect on trade with China

	Trade Shares with China			
	Imports		Exports	
	Time & Seasonal f.e.	Incl. Controls	Time & Seasonal f.e.	Incl. Controls
	(1)	(2)	(3)	(4)
$\text{SwapLine}_{i,t}$	-0.0023	-0.0017	-0.0093	-0.0090
	(0.003)	(0.004)	(0.006)	(0.006)
Country f.e.	No	No	Yes	No
Country×Seasonal f.e.	Yes	Yes	No	Yes
Time f.e.	Yes	Yes	No	Yes
Neighbor Trade Control	No	Yes	No	Yes
China Policy Controls	No	Yes	No	Yes
Observations	12804	12804	12804	12804

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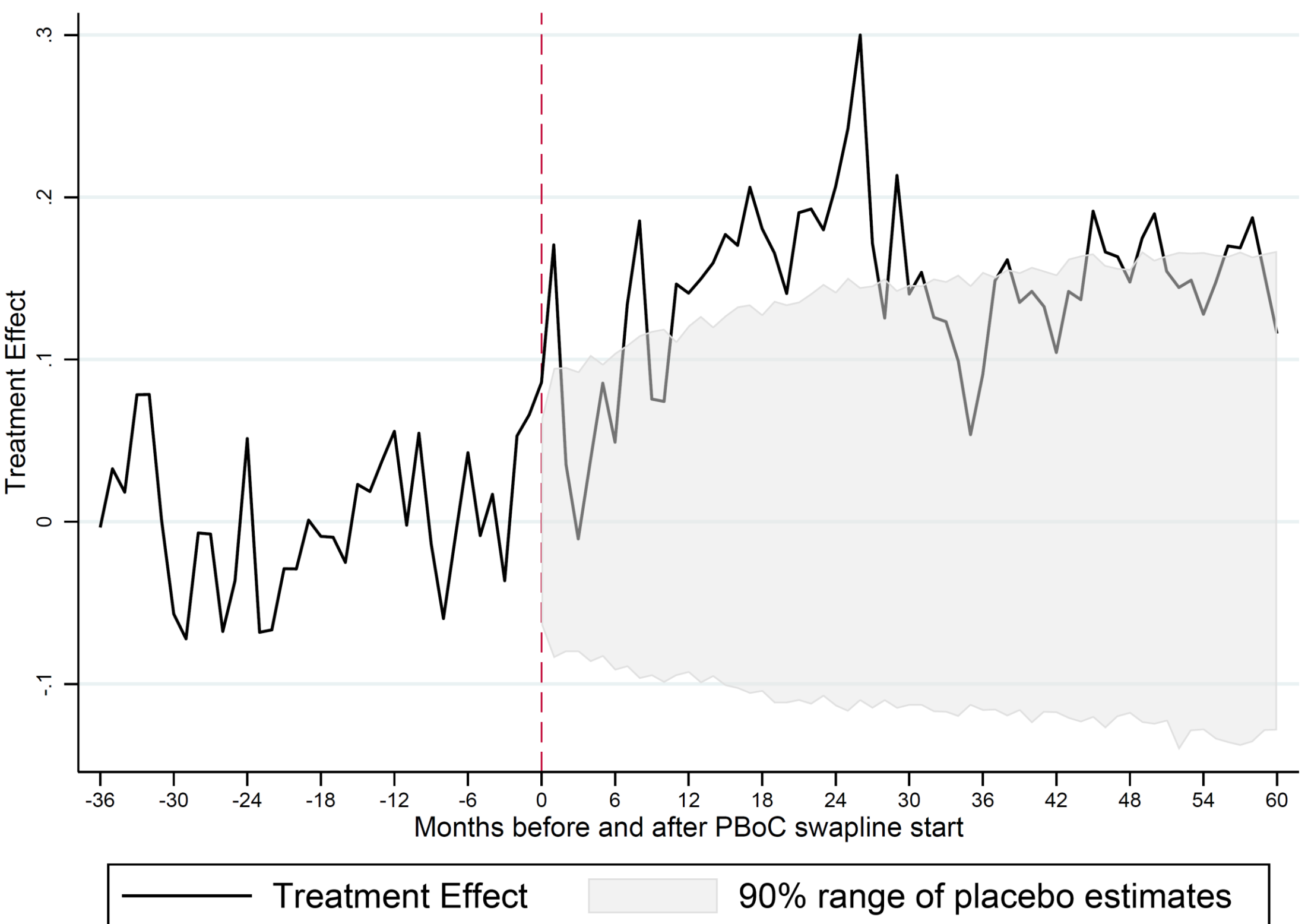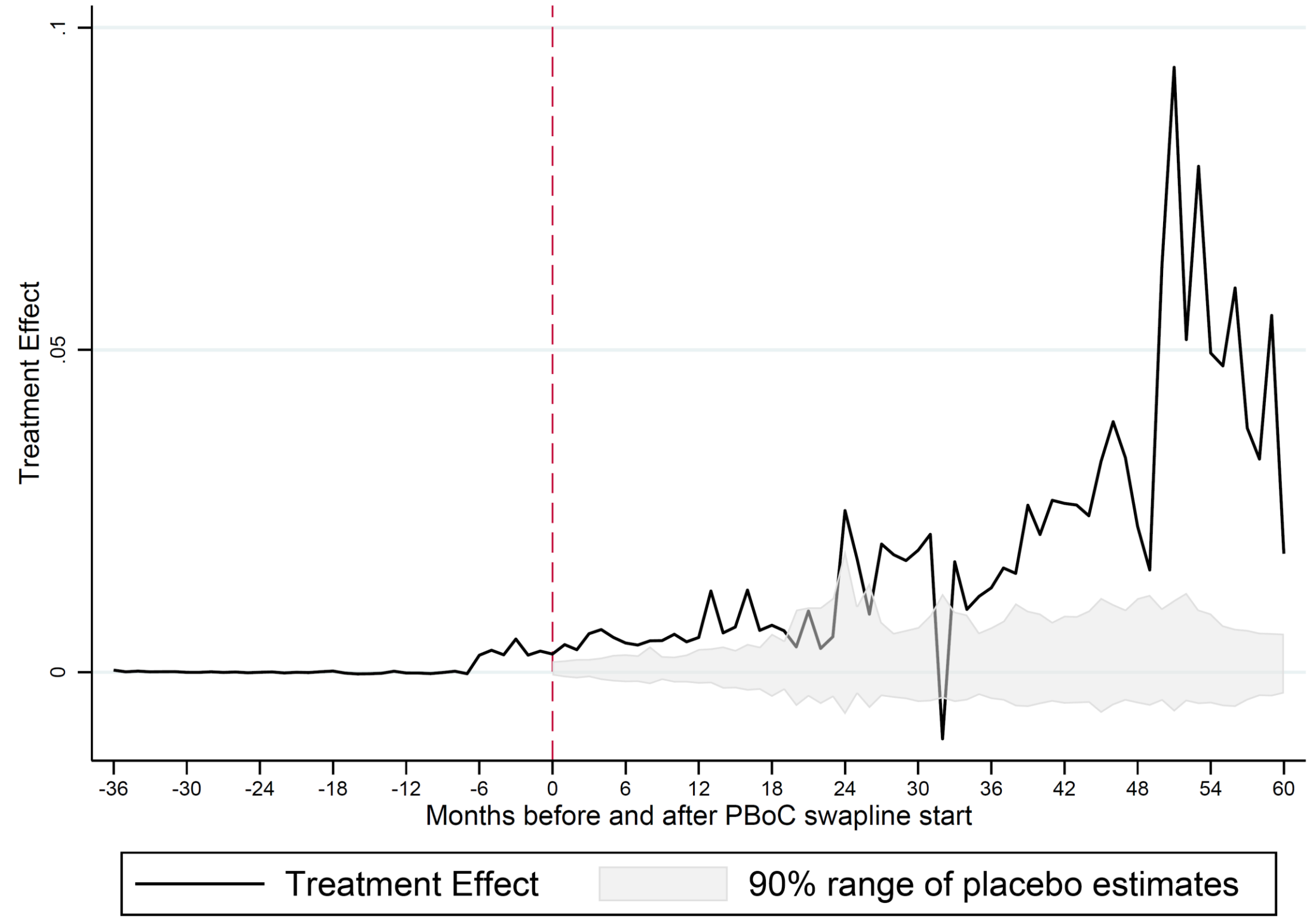# Synthetic control estimates

$1(\mathrm{Rpayment}_{i,t} > 0)$

$\mathrm{Rshare}_{i,t}$

Cavello et al (2013) approach. Match on control variables.

Spillover effects

Outcome Variable:	Neighbor Use$_{i,t}$		1(Rpayment$_{i,t} > 0$)		Rshare$_{i,t}$	
	All Neighbors	Ex. Neighbors with Swapline	Time & Seasonal f.e.	Incl. Controls	Time & Seasonal f.e.	Incl. Controls
	(1)	(2)	(3)	(4)	(3)	(4)
SwapLine$_{i,t}$	0.1381***	0.0984***	0.1363	0.1513	0.0082**	0.0079**
	(0.015)	(0.018)	(0.123)	(0.126)	(0.004)	(0.004)
SwapLine$_{i,t} \times$			0.3124	0.3009	0.0163	0.0174*
Neighbor Swap$_{i,t}$			(0.425)	(0.457)	(0.010)	(0.009)
$(1 - $SwapLine$_{i,t}) \times$			0.4566***	0.4445**	-0.0036	-0.0028
Neighbor Swap$_{i,t}$			(0.172)	(0.170)	(0.005)	(0.005)
Country f.e.	No	No	No	No	No	No
Country$\times$Seasonal f.e.	Yes	Yes	Yes	Yes	Yes	Yes
Time f.e.	Yes	Yes	Yes	Yes	Yes	Yes
China Trade Controls	No	No	No	Yes	No	Yes
China Policy Controls	No	No	No	Yes	No	Yes
Observations	12804	12804	12804	12804	12804	12804

S.E. clustered by country and time in parentheses, * $p < 0.1$, **,$p < 0.05$, *** $p < 0.01$

IV timing of state visits

	full sample	
	Time & Seasonal f.e.	All controls
	(1)	(2)
SwapLine$_{i,t}$	0.1878**	0.1875
	(0.082)	(0.128)
Country f.e.	No	No
Country×Seasonal f.e.	Yes	Yes
Time f.e.	Yes	Yes
Neighbor Use Control	No	Yes
China Trade Controls	No	Yes
China Policy Controls	No	Yes
First stage F-stat	111.3	74.6
Observations	12804	

S.E. clustered by country and time in parentheses
* $p < 0.1$, **,$p < 0.05$, *** $p < 0.01$

Needs to be correlated with the signing of a swap line in a particular month, while not directly correlated with the share of RMB being used for payments.

Arranged state visits, timing is arguably orthogonal.