The anatomy of a peg: lessons from China's parallel currencies

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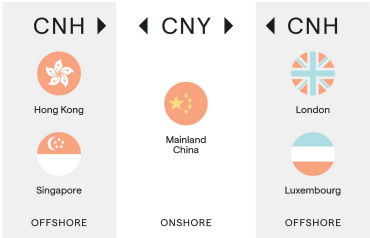
November 2023

China's large-scale monetary experiment



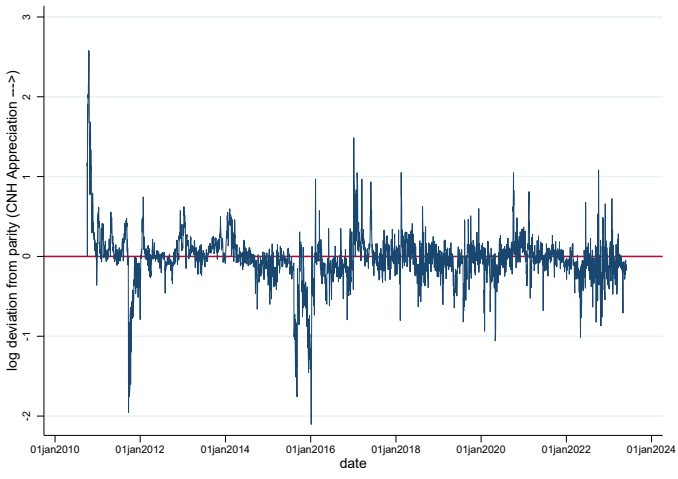
- CNY: mainland currency
- CNH: parallel currency
- Controls to convert CNH-CNY

Free current account, closed capital account

- No limits in using CNH for payments or in converting to foreign currency
- Only Chinese can use CNY, needed to invest in domestic assets and source of resources to invest abroad.
- Conversion: quotas for FDI and investment, as well as for household transfers. Firms can transfer CNH revenues to CNY against export invoices. Banks can borrow/lend in CNY/CNH with limits.

Gresham's law: the peg to parity and success

If $e = \ln(E) \neq 0$ for too long, capital controls will fail under the weight of arbitrage.



MONETARY POLICY OPERATIONS: TEXTBOOK

Central Bank

Assets	Liabilities
(A) Government Bonds	(D) Reserves
(B) Lending Facilities	(E) Bills
(C) FX and Other Assets	(F) Equity, Others

Commercial Banking System

Assets	Liabilities
(G) Government Bonds	(K) Demand Deposits
(H) Central Bank Bills	(L) CB Facilities
(I) Reserves	(M) Equity, Others
(J) Loans, Others	

- Open market operation: (A) up, (D) up, (G) down, (I) up.
- Money multiplier: (J) up and (K) up.

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- Reverse repurchase: (D) up, (E) down, (H) down, (I) up.
- Money multiplier: (J) up and (K) up.

MONETARY POLICY OPERATIONS: TEXTBOOK

Central Bank

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(J) Loans, Others	

- Lending facility: (B) up, (D) up, (I) up, (L) up
- Money multiplier: (J) up and (K) up.

MONETARY POLICY OPERATIONS: CNH

People's Bank of China

Assets	Liabilities
(a) CNY Assets	(c) CNY Onshore Reserves
(b) FX Assets	(d) CNY Clearing Bank Reserves
	(e) CNH Bills
	(f) Equity, Others

Offshore Clearing Banks

Assets	Liabilities
(g) CNY Clearing Bank Reserves	(i) CNH Commercial Bank Sight Deposits
(h) Other Assets	(j) CNH HKMA Deposits
	(k) CNY Equity, Others

Hong Kong Monetary Authority CNH

Assets	Liabilities
(l) Deposits at Clearing Banks	(p) Equity, Others
(m) PLP Balances	
(n) Liquidity Facilities	
(o) Other Assets	

Hong Kong Commercial Banks CNH

Assets	Liabilities
(q) Deposits at Clearing Banks	(t) Demand Deposits
	(u) PLP Balances
(r) PBoC Bills	(v) HKMA Facilities
(s) Loans, Others	(w) Equity, Others

- PBoC weekly manages M through bills: (e) falls (d) up; (g) up (i) up ; (q) up, (r) down.
- HKMA hourly manages M through lending facility: (l) down (m) up ; (q) up, (u) up.

1. WHAT IS THE CAUSAL EFFECT OF M ON E?

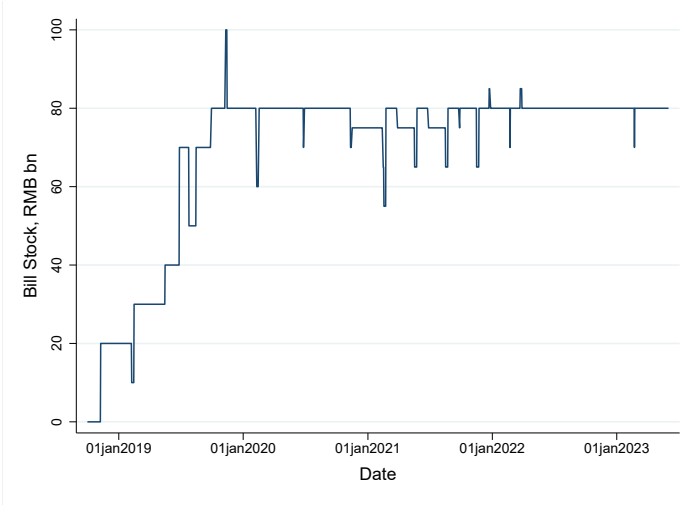
- UIP condition for banks who can have reserves in CNY or CNH

$$R^{m,o} - \phi^{o\prime}(m^o,) = \left(\frac{\mathbb{E}(E')}{E}\right)(R^m - \phi'(m, .))$$

- Key exchange rates question: is $\phi'(M, .) = 0$? Is money a pure financial asset? Is the demand for money horizontal or downward-sloping? Does UIP hold without liquidity effects?

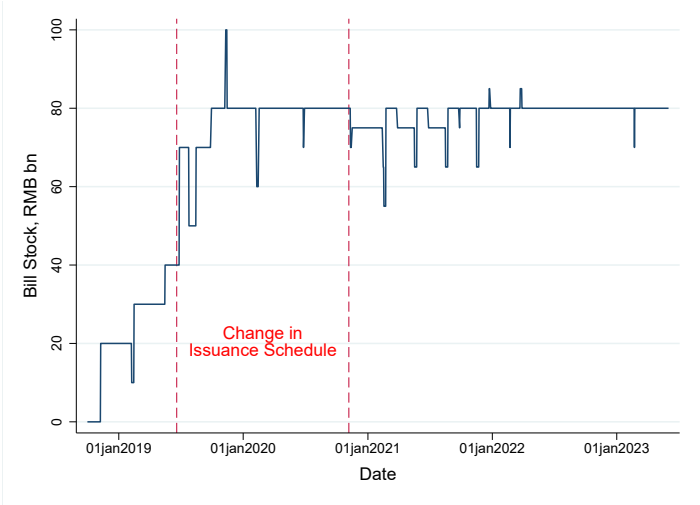
- CNH-CNY is a good testing ground because:
  1) CNH reserves are not remunerated $R^m = 1$, all action in M
  2) Onshore monetary policy independent of offshore exchange rate: $R^{m,o} - \phi^{o\prime}(.) = 1$
  3) Monetary policy rule is known and credible $\mathbb{E}(E') = 1$
  4) To test $E = 1 - \phi'(M, .)$ are there high-frequency (no ommitted macro variables), exogenous (no reverse causality from E) and anticipated and transitory (no effect on expectations) changes in M?

TEST: HIGHER CNH MONEY SUPPLY LOWERS ITS EXCHANGE RATE



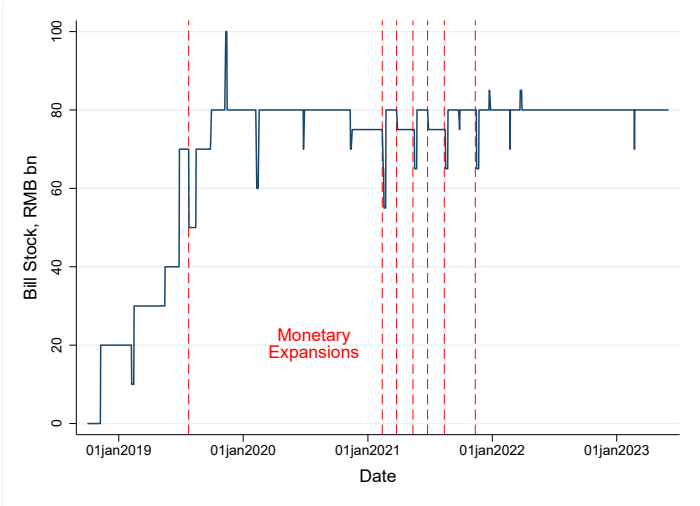
Bill issuance: November 2018 goal was 40bn of 3M bills and 10bn of 12M bills.

TEST: HIGHER CNH MONEY SUPPLY LOWERS ITS EXCHANGE RATE

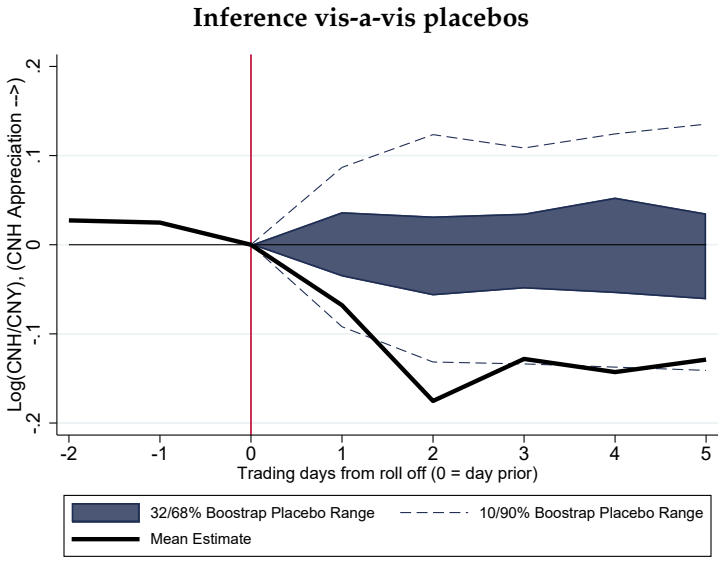


8 Aug 2019: new goal of 20bn of 3M and 6M and 40bn of 12M. 6 Nov 2020: switch to 10bn of 3M and 6M and 60bn of 12M

TEST: HIGHER CNH MONEY SUPPLY LOWERS ITS EXCHANGE RATE



MONEY SUPPLY SHOCKS: EVENT STUDIES



2. Model of money demand

- Banks supply deposits to fund loans (return 1) s.t. withdrawal shocks met with reserves:

$$\left(\frac{\mathbb{E}(E')}{E}\right)\left[R^d + \phi(m/d) - \left(\frac{m}{d}\right)\phi'(m/d)\right] = 1$$

- Households demand deposits for their liquidity services:

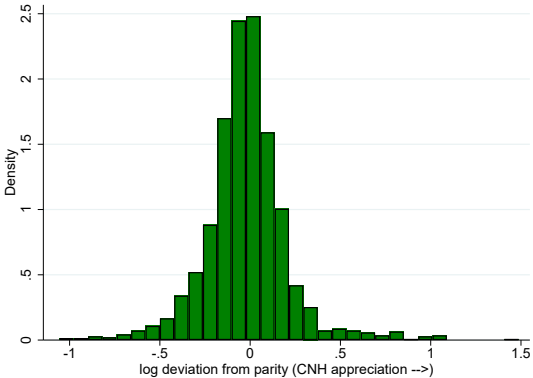
$$\left(\frac{\mathbb{E}(E')}{E}\right)R^d = 1 - vD^{-\alpha}$$

- Deposit market: supply equals demand. Model of Goodhart's law: $D \neq M$, combined with UIP, two equations to solve for E, D.

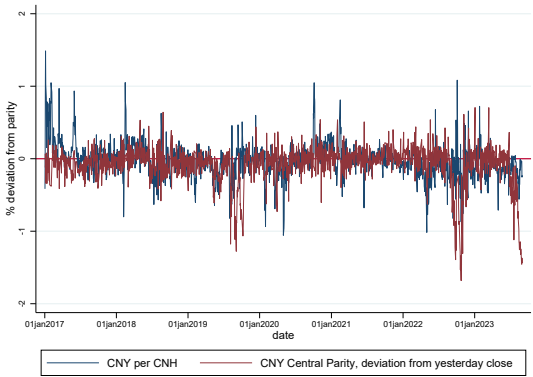
- Higher demand for CNH deposits v: banks also hold more reserves, appreciate E. Followed by increase in M to re-establish parity.

TEST: DEVIATIONS FROM PEG AS SHOCKS TO MONEY DEMAND

Histogram of e

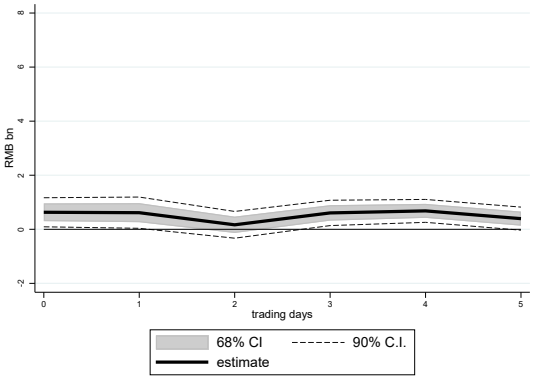


Instrument for deviations from parity

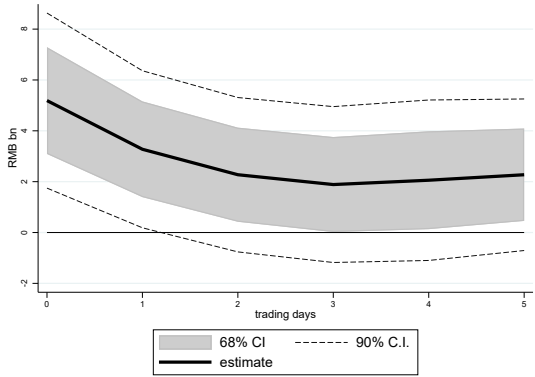


RESPONSE OF M TO MONEY DEMAND SHOCK

Local Projection



LP-IV



If z is PLP drawing, then plot from regression $z_{t+h} = \beta_h e_t + \gamma_h e_{t-1} + \delta_h z_{t-1} + \text{error}$

3. Digging deeper on the liquidity costs $\phi(.)$

- Random withdrawal shocks from $\Omega(\omega)$, match in interbank market with $\Psi_+(\theta), \Psi_-(\theta)$ with tightenss θ and pay $R^f(\theta)$ or go to HKMA discount window and pay R^z.

- Expected liquidity costs:

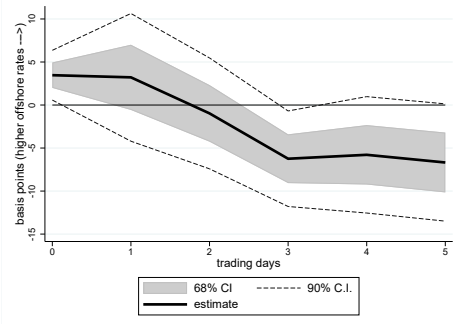
$$\phi(m/d)d = -\underbrace{\Psi_+(\theta)}_{\text{prob. find borrower}} \times \underbrace{(R^f(\theta) - R^m)}_{\text{lending profit}} \times \underbrace{\int_{\bar{\omega}}^{\infty} s(\omega) d\Omega(\omega)}_{\text{liquidity surpluses}}$$

$$- \left[\underbrace{\Psi_-(\theta)(R^f(\theta) - R^m)}_{\text{interbank borrowing}} + \underbrace{(1 - \Psi_-(\theta))(R^z - R^m)}_{\text{CB borrowing}} \right] \underbrace{\int_{-1}^{\bar{\omega}} s(\omega) d\Omega(\omega)}_{\text{liquidity deficits}}$$

- Increase in demand for CNH deposits: v rises.
  - $\rightarrow$ Tightness rises in interbank market: θ rises (bid rate for bills falls)
  - $\rightarrow$ Interbank rate rises: $R^f(\theta)$ up (3M market rate rises)
  - $\rightarrow$ Less use of intraday facility.

TEST: THE INTERBANK MARKET AND THE BILL AUCTIONS

3M interbank interest differential

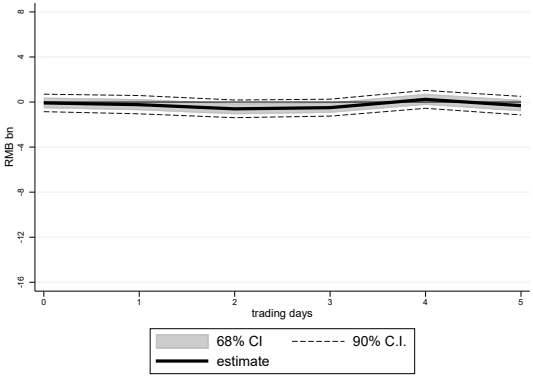


Regression of bill auction subscription rate (bids / bills auctioned) on the exchange rate

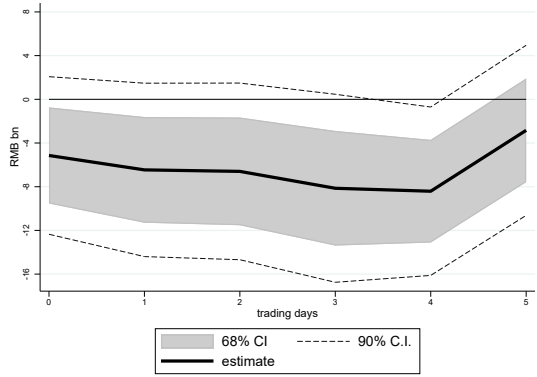
bill maturities	All	12M	6M	3M
	(1)	(2)	(3)	(4)
$\frac{1}{5}\sum_0^4 e_{t-h}$	-2.76***	-3.38***	-2.78***	-3.38***
	(0.93)	(1.10)	(0.93)	(1.12)
Auctions	35	19	16	19
R^2	0.142	0.335	0.131	0.324

TEST: RESPONSE OF DISCOUNT WINDOW DRAWINGS TO SHOCK

Local Projection



LP-IV



z is intraday facility drawing, plot from regression $z_{t+h} = \beta_h e_t + \gamma_h e_{t-1} + \delta_h z_{t-1} + \text{error}$

4. The CNY-USD exchange rate and financial innovation

- $\hat{E}$ from offshore to foreign, E from onshore to offshore.

- Modified UIP for USD exchange rate $\hat{E}$

$$\frac{\mathbb{E}(\hat{E}')}{\hat{E}} = \frac{R^{m,\text{RoW}} + w}{E + \phi'(M/D) - \phi'(M^{\text{RoW}}/D^{\text{RoW}})}.$$

- E can absorb some of $\hat{E}$: why they move together in the data.

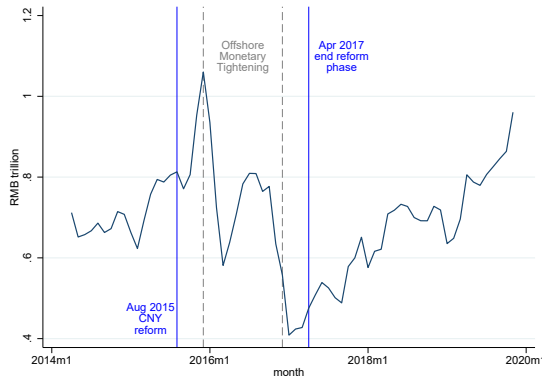
- Goodhart's law as changes in $\phi'(.)$: easier to match in interbank markets, less tightness there.

- Policy responses: liquidity tools that restrict the flow of reserves/deposits can bring it back in line. (There are better tools: discount window, bill auctions, reserve requirements).

The 11/8/2015 depreciation and tightening liquidity

CNH/USD and CNY/USD exchange rates

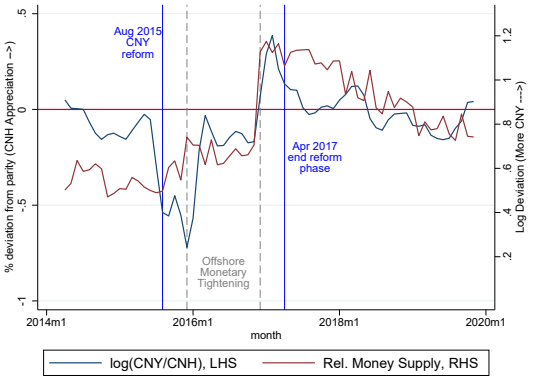
RMB flows from onshore to offshore



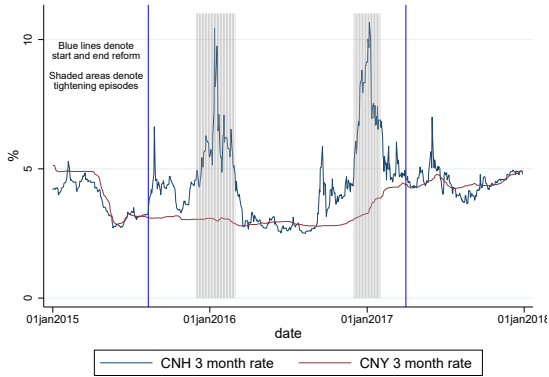
THE 11/8/2015 DEPRECIATION AND TIGHTENING LIQUIDITY

Deposits fall, interbank rate rises

Relative stock of CNH-CNY deposits and e



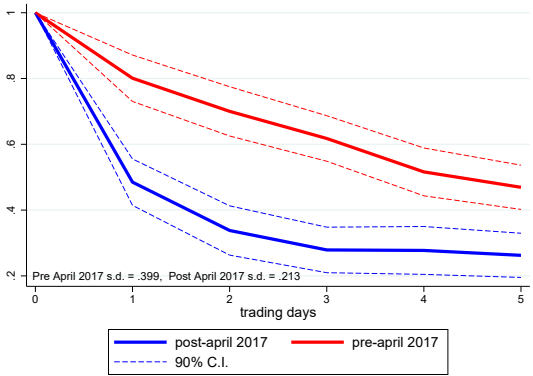
3-month interbank rates for CNH and CNY



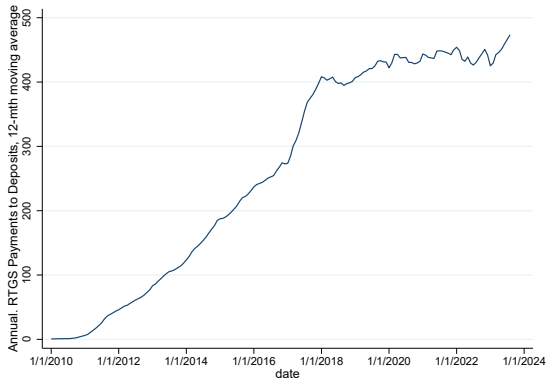
The 11/8/2015 depreciation and tightening liquidity

Death of the Hong Kong market and reform of the framework

Persistence of e pre and post April 2017

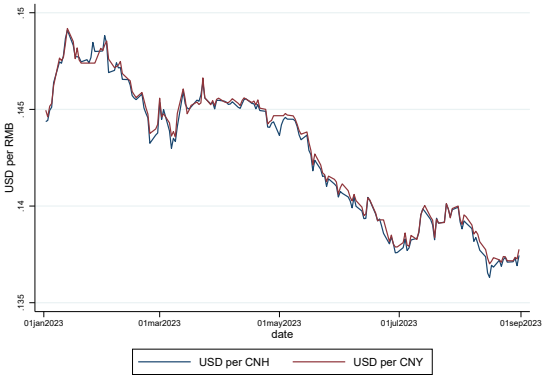


CNH velocity

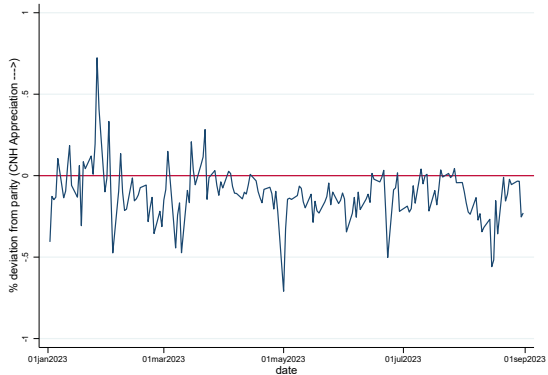


MAY-AUGUST 2023 DEPRECIATION WITH BETTER FRAMEWORK

CNH/USD and CNY/USD exchange rates



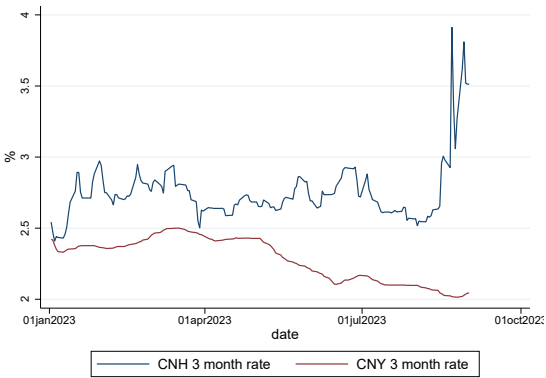
CNH/CNY exchange rate



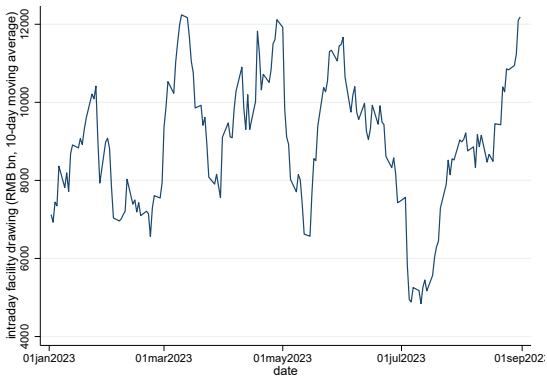
May-August 2023 depreciation with better framework

Framework holds up.

3-month interbank rates for CNH and CNY



Intraday liquidity facility borrowing



Conclusion

- China has offshore currency to enforce capital controls while allowing for an open current account and internationalization of the yuan.
- Exogenous transitory increases in the money supply depreciate the exchange rate.
- Peg has been successful because the central banks involved have responded to increases in the demand for money by raising the money supply.
- Liquidity wedge and CNH-CNY exchange rate used to manage foreign exchange rate.
- New liquidity framework seems up to the task.