Intermediated Dollar Lending of Last Resort: from Dollar Safety to Treasury Fragility

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Dollar Dominance and Global Dollar Lending of Last Resort (LoLR): Background

- Dollar dominance in foreign (developed) economies leads to a demand for dollar assets
  - Dollar dominance in trade invoicing (e.g., Gopinath/Stein 21)
  - Dollar dominance in financial transactions (e.g., Coppola/Krishnamurthy/Xu 24)

- Lacking dollar deposits, foreign banks rely on wholesale dollar funding yet vulnerable to (both systemic and idiosyncratic) dollar funding shocks
  - Runs on MMFs (e.g., Ivashina/Scharfstein/Stein 15, Schmidt/Timmermann/Wermers 16)
  - Retreat of prime funds after the 2016 MMF Reform (e.g., Anderson/Du/Schlusche 21)
  - Reluctance of global banks in providing dollar liquidity (e.g., Correa/Du/Liao 22)

- "Scrambling for dollars" during both crisis and normal times

Economic Significance of Dollar LoLR and Short-Term Implications

- U.S. Fed's dollar swap lines as a commited global dollar LoLR
  - Helps to reduce CIP deviations (Bahaj/Reis 20)
  - Helps to stabilize dollar appreciation (Kekre/Lenel 22)
  - Helps to stabilize U.S. Treasuries (Duffie 23)

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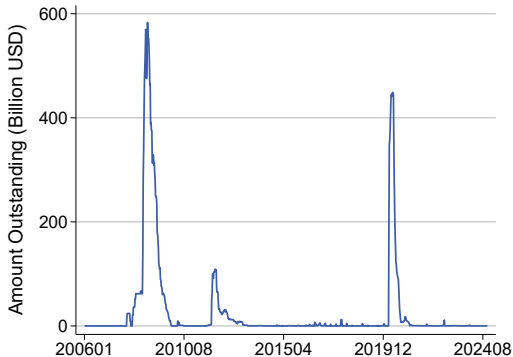

Data: FRED

Contribution: Long-Term Implications of Intermediated Dollar LoLR

What are the **long-term** implications on global banking, and ultimately, the U.S.?

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What are the **long-term** implications on global banking, and ultimately, the U.S.?

- Compositional shift in foreign Treasury holdings from more to less stable hands

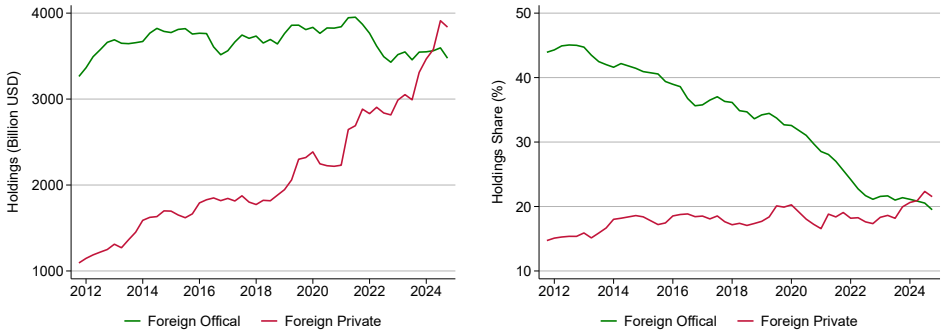


Figure plots foreign holdings of long-term Treasuries by official and private investors (left), divided by total long-term Treasuries outstanding, excluding those held by the Federal Reserve (right). Sources: Treasury MSPD, Treasury TIC, FRED.

Contribution: Long-term Implications of Intermediated Dollar LoLR

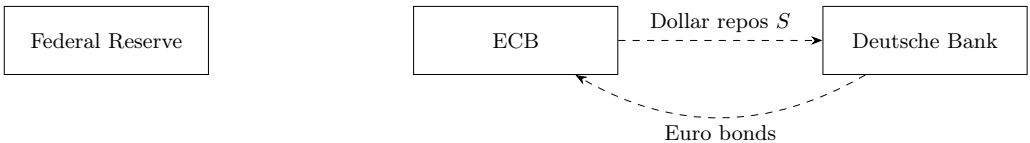
This paper: Formulate the idea of dollar safety to Treasury fragility in several steps

1. Some more basics of intermediated dollar LoLR
   - Conceptualizing dollar LoLR as the Fed's commitment
2. Stylized facts on intermediated dollar LoLR
   - Substitution between private FX swaps and dollar LoLR
   - Substitution between central bank dollar reserves and dollar LoLR; hinting long-term effects
3. A model of intermediated dollar LoLR with headline results:
   - Encourages private dollar debt; crowds out official dollar reserves
   - Unintended compositional changes in Treasury holdings overseas: more private, less official
   - Not just standard moral hazard as in discount window or bailouts; intermediation chain matters

Basics: Intermediated Dollar LoLR

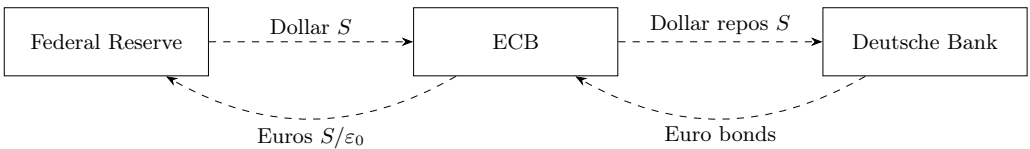
Intermediated Dollar LoLR: How It Works

- At time $t = 0$:



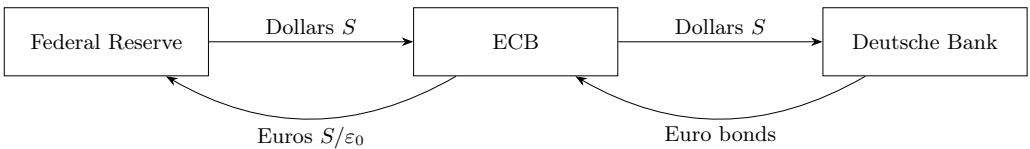
Intermediated Dollar LoLR: How It Works

- At time $t = 0$:



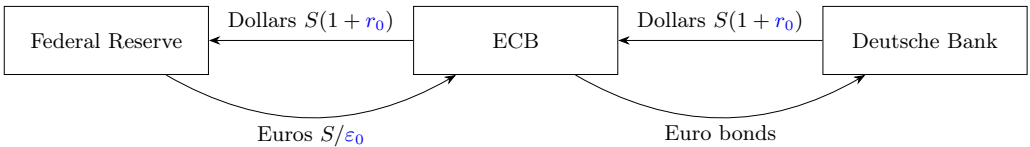
Intermediated Dollar LoLR: How It Works

- At time $t = 1$:



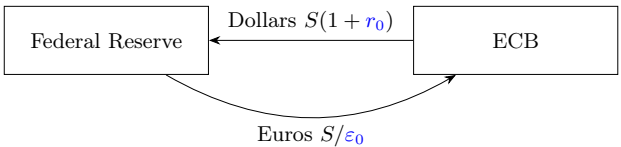
Intermediated Dollar LoLR: How It Works

- At time $t = 1 + m$:



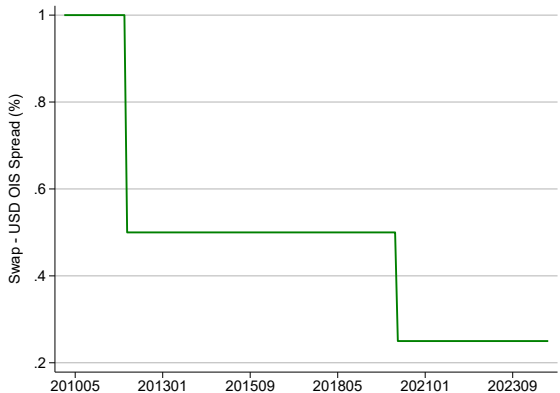
Intermediated Dollar LoLR: How It Works

- At time $t = 1 + m$:



How Does the Fed Price Dollar Swap Lines? A Markup View

- NY Fed sets: $r_0 = \underbrace{OIS_{\$}}_{\text{marginal cost}} + \underbrace{r_{\text{Fed}}}_{\text{markup}}$; same for all counterpart central banks



Data: NY Fed

Stylized Fact I: Substitution between FX Swaps and Swap Lines

Understanding Private and Public Dollar Funding Costs

For each pair between the U.S. and a swap line country, define (recall Du/Tepper/Verdelhan 18, for example):

$$\Delta \doteq \text{Market - Swap Line Spread} = \underbrace{(1 + OIS_{\$})\frac{F_{\$}}{\varepsilon_{\$}} - 1}_{\text{market dollar funding cost}} - \underbrace{(OIS_{\$} + r_{\text{Fed}})}_{\text{swap line dollar funding cost}} \tag{1}$$

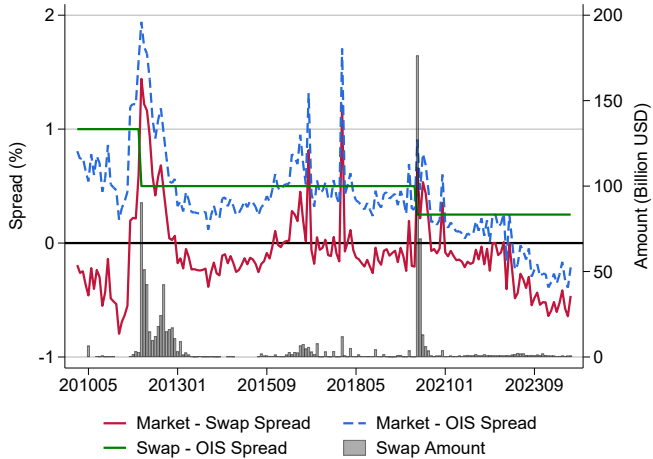
and

$$r_{\text{basis},\text{€},\$} = (1 + OIS_{\$})\frac{F_{\$}}{\varepsilon_{\$}} - (1 + OIS_{\text{€}})\,. \tag{2}$$

Plugging (2) into (1) to replace $F_{\$}/\varepsilon_{\$}$:

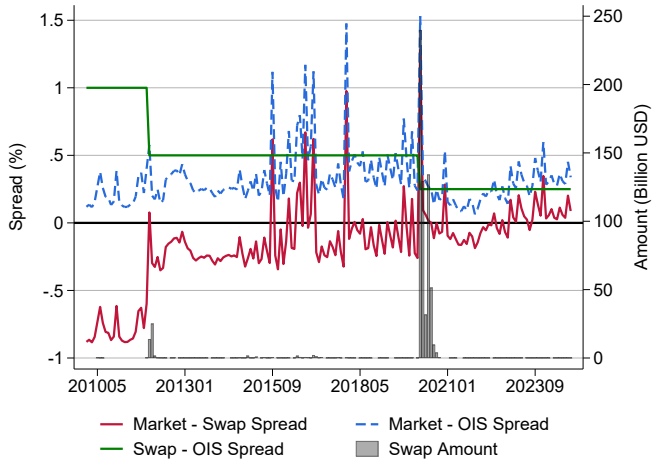
$$\Delta \doteq \text{Market - Swap Line Spread} = \underbrace{(OIS_{\text{€}} + r_{\text{basis},\text{€},\$})}_{\text{market dollar funding cost}} - \underbrace{(OIS_{\$} + r_{\text{Fed}})}_{\text{swap line dollar funding cost}}$$

Market v.s. Fed: A View of Prices and Quantities (Euro Zone)



Data: Bloomberg, NY Fed

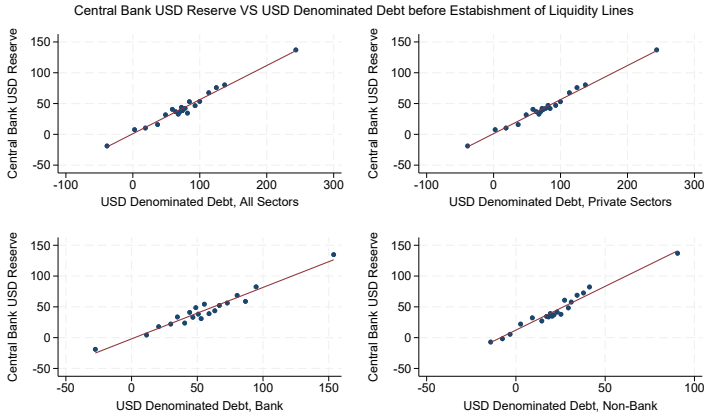
Market v.s. Fed: A View of Prices and Quantities (Japan)



Data: Bloomberg, NY Fed

Stylized Fact II: Substitution between CB Reserves and Swap Lines

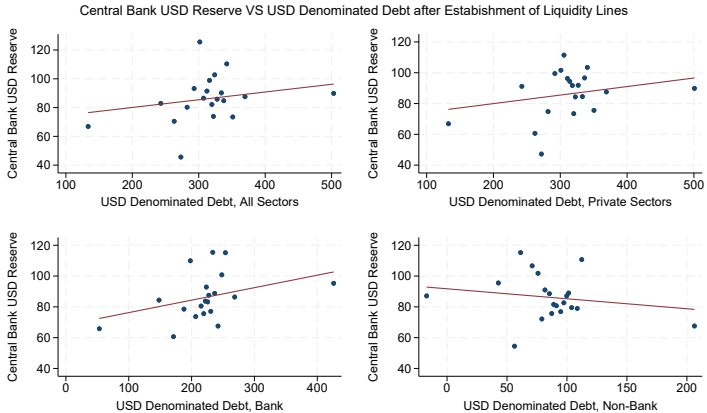
Reserves against Dollar Debt before Dollar LoLR



Data sources: Chinn/Ito/McCauley, IMF, BIS, Bahaj/Fuchs/Reis (swap + FIMA)

- USD-denominated debt ↑ ⇒ Foreign central bank dollar reserves ↑

Reserves against Dollar Debt after Dollar LoLR



Data sources: Chinn/Ito/McCauley, IMF, BIS, Bahaj/Fuchs/Reis (swap + FIMA)

- But relationship gone after establishment of dollar LoLR

USD Reserves v.s. USD Denominated Debt: Regressions

Table: USD Reserves v.s. USD Denominated Debt before Liquidity Lines

	(1) All	(2) Private	(3) Banks	(4) Nonbanks
USD-Denominated Debt	0.55***	0.55***	0.83***	1.42***
	(0.02)	(0.02)	(0.03)	(0.05)
Country FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
N	149	149	149	149
Adjusted R^2	0.952	0.952	0.935	0.952

Table: USD Reserves v.s. USD Denominated Debt after Liquidity Lines

	(1) All	(2) Private	(3) Banks	(4) Nonbanks
USD-Denominated Debt	0.05	0.06	0.08	-0.06
	(0.04)	(0.04)	(0.06)	(0.10)
Country FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
N	160	160	160	160
Adjusted R^2	0.866	0.867	0.868	0.866

Taking Stock: From Dollar Safty to Treasury Fragility

- So far, we understand:
  1. Dollar swap lines as dollar lending of last resort
  2. Dollar swap lines as imperfect substitution with FX swaps and foreign dollar reserves
  3. Dollar swap lines impact dollar debt and CB reserves in the long term

- A model of global banking and dollar LoLR encompassing both short- and long-term effects
  - Dollar exchange rate, CIP deviation, and U.S. Treasury price
  - Foreign dollar debt issuance and foreign dollar reserves
  - Compositional changes in Treasury holdings overseas

Model: Long-Term Implications of Intermediated Dollar LoLR

Setup

- Built upon Lorenzoni 08; extended to two-country setup with asymmetry
- Three dates, $t = 0, 1, 2$, and two sets of countries, the U.S. and a continuum of "Japan"
  - The spot real exchange rate $\varepsilon_{\$,1}, \varepsilon_{\$,2}$ at $t = 1, 2$ and the real forward rate $f_{\$}$ at $t = 1$ are expressed in Japanese yen per \$1
- Each country: a continuum of risk-neutral banks and a central bank
  - Banks maximize their date-2 profits
  - Net world interest rate r^* for Japan and normalized to zero for the U.S.
- A sector of competitive, risk-averse global financiers (à la Gabaix/Maggiori 15)
- A single asset class in the world economy: U.S. Treasuries
  - Banks invest dollars in Treasuries according to a production function $g(\cdot)$ which is increasing, strictly concave, and satisfies the Inada conditions
  - U.S. Treasuries mature at $t = 2$, unit value normalized to one dollar

US Banks

- At $t = 0$, the representative U.S. bank issues dollar deposits b_0 in order to invest in U.S. Treasuries:
$$q_0 = g(b_0)$$
- At $t = 1$, U.S. bank receives additional dollar endowment z_1, repays old deposits b_0, and issues new deposits b_1

- Portfolio choice between investing domestically or abroad
  - Purchasing additional U.S. Treasuries $\Delta q = q_1 - q_0$
  - Serve as a dollar provider to the Japanese bank by supplying s_1 synthetic dollars in the FX swap market (à la Du/Tepper/Verdelhan 18)
    - Converts $\$s_1$ to $¥s_1\varepsilon_{\$,1}$ at the spot exchange rate $\varepsilon_{\$,1}$
    - Enters a forward contract at the forward rate $f_\$$
    - At $t = 2$, returns $¥s_1\varepsilon_{\$,1}$ to the Japanese bank and receives $\$s_1\varepsilon_{\$,1}/f_\$$ in return

- Denote the net return of synthetic dollar provision by μ; effectively capturing CIP deviation

US Banks

- Financial frictions
  1. Additional fraction ξ of the arbitrage position as capital cost
  2. Limited commitment constraint on b_1:

$$b_1 \leq \theta p + s_1$$

- At $t = 1$, U.S. bank faces budget constraint:

$$g^{-1}(\Delta q) + (1 + \xi)s_1 + b_0 \leq z_1 + b_1$$

- At $t = 2$, profit is given by

$$\Pi_2 = q_1 + (1 + \mu - \xi)s_1 - b_1$$

Global Financiers

- At $t = 1$, the representative global financier analogous to the financier in Gabaix/Maggiori 15 and Itskhoki/Mukhin 21 also supplies dollars on the spot market
- At $t = 2$, the global financier is effectively risk-averse in that its profit is given by

$$\widehat{\Pi_2} = (1 + r^*)d_1\varepsilon_{\$,1} - d_1\varepsilon_{\$,2} - \frac{1}{2}\psi d_1^2$$

  - A value-at-risk constraint can micro-found ψ

- Can define UIP deviation as:

$$\nu = (1 + r^*)\varepsilon_{\$,1} - \varepsilon_{\$,2}$$

Japanese Banks

- At $t = 0$, the representative Japanese bank issues (wholesale) dollar bonds b_0^* in order to invest in U.S. Treasuries:
$$q_0^* = g(b_0^*)$$
- At $t = 1$, also receives additional dollar endowment z_1^*, repays old dollar bonds b_0^*, and issues new deposits b_1^* but in yen only — dollar funding shortage
- Portfolio choice between liquidating Treasuries or dollar borrowing
  - Liquidate Treasury holdings by $\Delta q^* = q_0^* - q_1^*$ at market price p
  - Issue new deposits b_1^* denominated in yen and demand $d_1^* + s_1^*$ total dollars

$$(1 + r^*)b_0^* \leq z_1^* + \frac{b_1^*}{\varepsilon_{\$,1}} + p\Delta q^*$$

where

$$\frac{b_1^*}{\varepsilon_{\$,1}} \leq \theta^* p \text{ and } \frac{b_1^*}{\varepsilon_{\$,1}} = d_1^* + s_1^*$$

Japanese Banks

- At $t = 2$, bank profit, denominated in dollars, is given by

$$\Pi_2^* = q_1^* + \left(d_1^* - \frac{d_1^* \varepsilon_{\$,1}}{\varepsilon_{\$,2}} \right) + \left(s_1^* - \frac{(1 + r^*) s_1^* \varepsilon_{\$,1}}{f_{\$}} \right) - \frac{(1 + r^*) b_1^*}{\varepsilon_{\$,2}}$$

Market Clearing

1. Treasury market clears at $t = 1$:
$$\Delta q^* = \Delta q$$

2. FX spot market clears at $t = 1$:
$$d_1^* = d_1$$

3. Synthetic dollar market (i.e., FX swap market) clears at $t = 1$:
$$s_1^* = s_1$$

- Joinly pin down p for Treasuries, ν for dollars, and μ for FX swaps (i.e., synthetic dollars)

Policy Tool I: BoJ Dollar Reserves

- At $t = 0$, BoJ taxes d^R from Japanese depositors to invest in q^R U.S. Treasuries:

$$q^R = g(d^R)$$

- At $t = 1$, sells them and lends to Japanese banks
- At $t = 2$, rebates any remaining proceeds from maturing Treasury holdings to Japanese banks
- Date-1 budget constraint of the representative Japanese bank becomes:

$$(1 + r^*)b_0^* \leq z_1^* + \frac{b_1^*}{\varepsilon_{\$,1}} + p\Delta(q^* + q^R)$$

- BoJ chooses d^R to maximize the date-2 profit of the representative bank minus the deadweight cost of taxation $\frac{1}{2}\tau(d^R)^2$

Policy Tool II: Fed Dollar Swap Lines

- At $t = 1$, Fed borrows s^L from U.S. depositors and lends to BoJ
  - Not capital or taxation costs; effectively a form of QE to foreigners
- At $t = 2$, Fed receives repayment of s^L; rebated to U.S. banks
- Date-1 budget constraint of the representative Japanese bank becomes:

$$(1 + r^*)b_0^* \leq z_1^* + s^L + \frac{b_1^*}{\varepsilon_{\$,1}} + p\Delta(q^* + q^R)$$

- Fed maximizes U.S. banks' date-2 after-rebate profits
- How committed is the Fed?
  1. Discretionary lending s^L at $t = 1$; "ex-post intervention" (Farhi/Tirole 12, Bocola/Lorenzoni 20)
  2. Optimally committed lending $s^L(z_1, z_1^*)$ at $t = 0$ (Kydland/Prescott 77, Barro/Gordon 83)

The "Dash-for-Dollar" Episode

Proposition

For any given b_0, there exists a "dash-for-dollar" equilibrium at $t = 1$ in which $p < 1$, $\nu > 0$, and $\mu > 0$ without foreign dollar reserves or dollar swap lines, if and only if the following holds:

$$-\frac{g''(b_0)}{g'(b_0)^2}\left(\left((1+\xi)+\xi(1+\psi)\right)\theta+(1+\psi)\theta^*\right) > 1 \tag{3}$$

- More severe "dash-for-dollar" when:
  - U.S. Treasury market shallower
  - Collateral constraints facing Japanese banks tighter
  - Value-at-risk constraints facing the global financier tighter
  - Capital costs for U.S. banks higher

The Short-Term Effects of Swap Lines

Proposition

When condition (3) *holds, a higher provision of dollar swap lines leads to a higher U.S. Treasury price* p*, dollar depreciation (i.e., a lower UIP deviation captured by* ν*), and a lower CIP deviation captured by* μ*:*

$$\frac{\partial p}{\partial s^L} > 0\,, \frac{\partial \nu}{\partial s^L} < 0\,, \text{ and } \frac{\partial \mu}{\partial s^L} < 0\,. \tag{4}$$

- Larger U.S. swap line provision leads to:
  - Higher U.S. Treasury price
  - Lower UIP and CIP deviations
- Key: relaxing Japanese bank collateral constraints

Long-Term Effects of Dollar Lending of Last Resort

Proposition

When the Fed designs swap lines in a discretionary manner at $t = 1$, Japanese banks borrow more b_0^*, purchase more U.S. Treasuries q_0^*, and the BoJ accumulates lower q^R at $t = 0$ compared to both the case without swap lines and the first-best.

- U.S. dollar swap line as a dollar LoLR leads to, ex-ante:
  - Excessive dollar deposit-taking by Japanese banks; higher private Treasury holdings
  - Insufficient dollar reserves by the BoJ; lower official Treasury holdings
- Key: pecuniary externalities
- Implication: inefficient redistribution of U.S. Treasury holdings
  - Rising share of Treasuries held by foreign mutual funds and hedge funds (Vissing-Jorgensen 21, Kashyap/Stein/Wallen/Younger 25)
  - Shorter liabilities and higher price elasticities (Jansen/Li/Schmid 24, Koijen/Yogo 24, Chaudhary/Fu/Zhou 25)

Long-Term Effects of Dollar Lending of Last Resort

Proposition

When the Fed designs swap lines under a committed rule at $t = 0$, Japanese banks borrow more (less) b_0^*, purchase more (less) U.S. Treasuries q_0^*, and the BoJ accumulates lower (higher) q^R compared to the case without swap lines (with discretionary swap lines). However, the allocation does not implement the first-best.

- A "committed" commitment helps, but can't restore first-best

Conclusion

- Conceptualizing dollar swap lines as intermediated dollar lending of last resort
- Short-term: dollar LoLR addressing dollar funding shortages
- Long-term: higher foreign dollar debt, lower foreign dollar reserves, and inefficient redistribution of Treasury holdings

- Does dollar LoLR ultimately help the dollar?
  - Not necessarily; time-inconsistency problem facing the Fed
  - Intermediation chains further complicate the situation

- John Connally: “Our dollar, your problem.”
- “Our dollar, our problem?”

Appendix

How Foreign Central Banks Distribute and Monitor Dollars

1. What private entities are eligible?
   - Commercial banks and dealer banks
   - Non-banks generally ineligible except for brokers/dealers
2. What collaterals are required at what haircuts?
   - (Local) government bonds or other high-quality bonds
   - Usual haircut between 5% and 10%
3. What mechanism is used by foreign CBs in allocating the dollars?
   - Fixed rate auction under ECB and BoJ; bidders always filled in full
   - Dutch auctions under BoE and BoK
   - Swaps happen after auctions under $t + 1$ settlement