The Synthetic Dollar Funding Channel of US Monetary Policy

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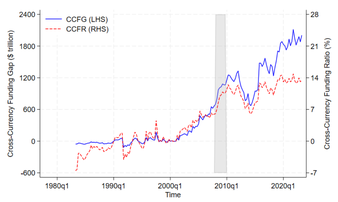
Motivation

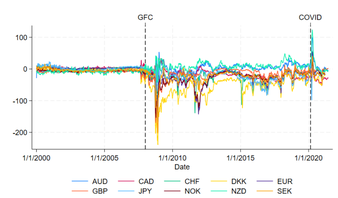
US monetary policy transmits to the global economy through dollar funding markets

- **Rising share of synthetic dollar funding** since 2000s (Barajas et al., 2020)
  - Many non-US financial institutions lack access to direct dollar funding
  - Synthetic dollar funding: dollar funding through the FX swap market
- **Emergence of CIP deviations** since the onset of the GFC (Du et al., 2018)
  - CIP deviation: gap between the cost of direct dollar funding and synthetic dollar funding

$$\text{CIP deviations} = \text{Direct dollar funding costs } (R_t^{\$}) - \text{Synthetic dollar funding costs } (R_t^* \frac{S_t}{F_t})$$



(a) Share of Synthetic Dollar Funding



(b) 3-month CIP Deviations

Research Question

Synthetic dollar funding channel: transmission channel through the FX swap market

- Effect of US monetary policy on CIP deviations
- Effect of CIP deviations on synthetic dollar funding and cross-border asset holdings
- Implication for the global economy: **amplification** of **spillover** (non-US) **spillback** (US)
  - Mainly through changes in CIP deviations and cross-border asset holdings

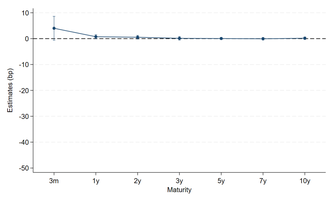
Empirical Evidence

Effects of a US monetary policy shock on CIP deviations

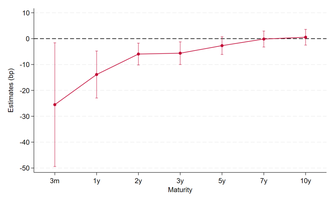
- Empirical strategy: For each maturity h from 3-month to 10-year,

$$\Delta cid_{t,h}^{j} = \alpha_j + (\beta_h^0 + \beta_h^1 PostGFC_t)\Delta mp_t + \epsilon_{t,h}^j$$

  - $\Delta cid_t^{j,h}$: 2-day changes in CIP deviations with maturities h from 3-month to 10-year
  - Δmp_t: high-frequency identified US monetary policy shock
  - $PostGFC_t$: capturing the structural break in CIP deviations since the GFC
  - α_j: currency fixed effects
- Data
  - Sample: G10 currencies/ Feb 2000 to Apr 2021
  - CIP deviations: IBOR-based cross-currency basis $r_t^{\$,h} - (r_t^{j,h} - \rho_t^{j,h})$ (Du et al., 2018)
  - Δmp_t: principal components from interest rate futures over 30-minute window around each FOMC announcement (Gürkaynak et al., 2005; Nakamura and Steinsson, 2018)
- Results: $\Delta mp_t \uparrow \implies$ CIP deviations widen ($\Delta cid_t^{j,h} \downarrow$) in the post-GFC periods
  - Insignificant effects in the pre-GFC periods
  - Robustness check: other choice of risk-free rate (overnight index swap) and information effect of US monetary policy



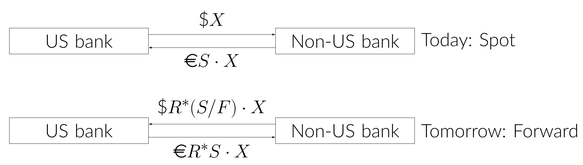
(a) Pre-GFC



(b) Post-GFC

Theoretical Model

Structure of a FX Swap Contract



US bank: supplies synthetic dollar funding as CIP arbitrageurs

Balance Sheet	
Asset	Liability
$Q_t K_{H,i,t}$	$D_{i,t}$
$X_{i,t}$	$N_{i,t}$

Flow of Funds		
	t	$t+1$
	$-\$Q_t K_{H,i,t}$	$+\$R_{K,t+1} Q_t K_{H,i,t}$
	$-\$X_{i,t}$	$+\$R_t^*(S_t/F_t)X_{i,t}$
	$+€S_t X_{i,t}$	$-€R_t^* S_t X_{i,t}$
	$-€S_t X_{i,t}$	$+€R_t^* S_t X_{i,t}$
	$+\$D_{i,t}$	$-\$R_t D_{i,t}$

- Law of motion for net worth:

$$\frac{N_{i,t+1}}{N_{i,t}} = (R_{K,t+1} - R_t)\phi_{H,i,t} + \underbrace{\left(R_t^* \frac{S_t}{F_t} - R_t\right)}_{=-cid_t} \underbrace{\phi_{X,i,t}}_{\text{supply}} + R_t$$

- Key financial friction: leverage constraint (à la Gertler and Kiyotaki, 2011)

$$\nu_t \geq \left(\theta_{H1} + \theta_{H2}\frac{Q_t K_{H,t}}{P_t}\right)\phi_{H,i,t} + \left(\theta_{X1} + \theta_{X2}\frac{X_t}{P_t}\right)\phi_{X,i,t}$$

  - θ_{X1}, θ_{X2}: limit on CIP arbitrage (pre-GFC: $\theta_{X1} = \theta_{X2} = 0$)
- Supply function: For the Lagrangian multiplier $\mu_t > 0$,

$$\underbrace{E_t\left[\Omega_{t,t+1}\right]}_{\text{Bank SDF}} \underbrace{\left(R_t^* \frac{S_t}{F_t} - R_t\right)}_{=-cid_t} = \mu_t \left(\theta_{X1} + \theta_{X2}\frac{X_t}{P_t}\right)$$

  - Increasing in $-cid_t$
  - As $\mu_t \uparrow$, CIP deviations widen, *i.e* $-cid_t \uparrow$

Non-US bank: demands synthetic dollar funding for currency matching

Balance Sheet	
Asset	Liability
$Q_t^* K_{F,i,t}^*$	$D_{i,t}^*$
$S_t Q_t K_{H,i,t}^*$	$S_t \tilde{X}_t^*$
	$N_{i,t}^*$

Flow of Funds		
	t	$t+1$
	$-€Q_t^* K_{F,i,t}$	$+€R_{K,t+1}^* Q_t^* K_{F,i,t}^*$
	$-\$Q_t K_{H,i,t}$	$+\$R_{K,t+1} Q_t K_{H,i,t}^*$
	$+\$x_{i,t}^* Q_t K_{H,i,t}^*$	$-\$R_t^*(S_t/F_t)x_{i,t}^* Q_t K_{H,i,t}^*$
	$-€S_t x_{i,t}^* Q_t K_{H,i,t}^*$	$+€R_t^* S_t x_{i,t}^* Q_t K_{H,i,t}^*$
	$+€S_t \tilde{X}_{i,t}^*$	$-€R_t^* S_t \tilde{X}_{i,t}^*$
	$+€D_{i,t}^*$	$-€R_t^* D_{i,t}^*$

- Law of motion for net worth:

$$\frac{N_{i,t+1}^*}{N_{i,t}^*} = (R_{K,t+1}^* - R_t^*)\phi_{F,i,t}^* + \frac{S_{t+1}}{S_t}\left(R_{K,t+1} - R_t^* \frac{S_t}{S_{t+1}}\right)(1 - x_{i,t}^*)\phi_{H,i,t}^* + \frac{S_{t+1}}{S_t}\left(R_{K,t+1} - R_t^* \frac{S_t}{F_t}\right)\underbrace{x_{i,t}^* \phi_{H,i,t}^*}_{\text{demand}} + R_t^*$$

- Key financial friction:

$$\nu_t^* \geq \left(\theta_{F1}^* + \theta_{F2}^* \frac{Q_t^* K_{F,t}^*}{P_t^*}\right)\phi_{F,i,t}^* + \left(\theta_{H1}^* + \theta_{H2}^* \frac{(1 - x_t^*) S_t Q_t K_{H,t}^*}{P_t^*}\right)(1 - x_{i,t}^*)\phi_{H,i,t}^* + \left(\theta_{X1}^* + \theta_{X2}^* \frac{x_t^* S_t Q_t K_{H,t}^*}{P_t^*}\right) x_{i,t}^* \phi_{H,i,t}^*$$

  - $\theta_{H1}^* > \theta_{X1}^*$: stricter regulation on currency mismatch $\implies$ demand currency matching
- Demand function: For the Lagrangian multiplier $\mu_t^* > 0$,

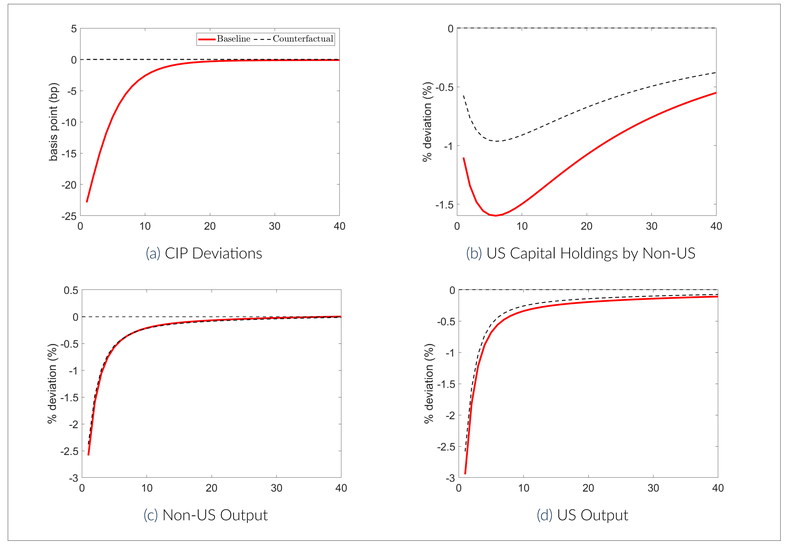
$$E_t\left[\Omega_{t,t+1}^* \frac{S_{t+1}}{S_t} \underbrace{\left(R_{K,t+1} - R_t^* \frac{S_t}{F_t}\right)}_{R_{K,t+1} - (R_t - cid_t)}\right] = \mu_t^* \left(\theta_{X1}^* + \theta_{X2}^* \frac{x_t^* S_t Q_t K_{H,t}^*}{P_t^*}\right)$$

  - Decreasing in $-cid_t$

Impulse Responses

Baseline vs. Counterfactual ($\theta_{X1} = \theta_{X2} = 0$)

- CIP deviations widen due to tighter limit on CIP arbitrage
  - Match the empirical estimate of the impact response as an *untargeted* moment
- Synthetic dollar funding $\downarrow \implies$ cross-border capital holdings $\downarrow$ (global retrenchment)
- Amplification of spillover ($\because$ CIP deviations widen) and spillback ($\because$ synthetic dollar funding $\downarrow$)
  - Output, investment, inflation: declines are amplified (10 - 20%)
  - Consumption: US (Non-US) consumption becomes higher (lower) since CIP deviations are transfers of wealth from the non-US to the US



(a) CIP Deviations

(b) US Capital Holdings by Non-US

(c) Non-US Output

(d) US Output

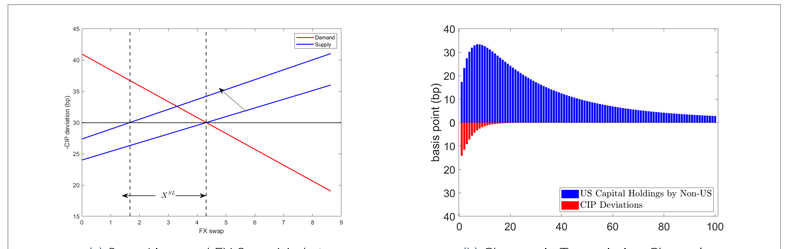
Central Bank Swap Lines and Transmission Channel

Central bank swap lines: international liquidity facility (lender of the last resort)

- Modeling strategy

1. Swap spread: $-cid_t \leq ss_t$ (Bahaj and Reis, 2022)
2. FX swap market equilibrium: $X_t + X_t^{SL} = x_t^* Q_t K_{H,t}^*$
3. Complementary slackness condition: $(cid_t + ss_t)X_t^{SL} = 0$

- Result: amplification effects $\downarrow$ by preventing the widening of CIP deviations



(a) Swap Lines and FX Swap Market

(b) Changes in Transmission Channel