Week 5: Foreign Exchange (FX) Forecasting, Hedging, and Intervention

FINA3020

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CUHK Business School

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Today: Foreign Exchange (FX) Forecasting, Hedging, and Intervention

- Additional intuition on forecasting exchange rate movements
  - We will walk through additional examples of shocks and market responses, in each case assuming that all other policies and information are held constant: "ceteris paribus"
  - Warning: given the norm of using direct quotation $S_{\frac{H}{\mathcal{F}}}$ of how many units of home currency H per unit of foreign $\mathcal{F}$, an appreciation is a decrease in $S_{\frac{H}{\mathcal{F}}}$, which many find counter-intuitive
- Purchasing power parity (PPP) and real exchange rate (RER)
- FX swaps
- Governments' FX intervention
- Brief discussion of firms' FX hedging strategies (to be continued after the midterm in Week 7)

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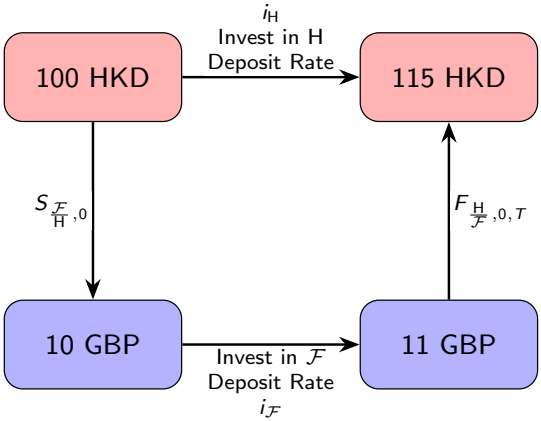
Revisiting CIP

CIP says that in an efficient market, when the return on deposits i from today to future time T is higher in home (H) vs foreign ($\mathcal{F}$) currency, then

- expected depreciation of the home exchange rate $\iff$ for 1 unit of foreign currency, you will need more home currency at time T and forward rate F than today at spot rate S

$$\frac{1+i_{\mathrm{H}}}{1+i_{\mathcal{F}}} = \frac{F_{\frac{\mathrm{H}}{\mathcal{F}},0,T}}{S_{\frac{\mathrm{H}}{\mathcal{F}},0}} \iff F_{\frac{\mathrm{H}}{\mathcal{F}},0,T} = \frac{1+i_{\mathrm{H}}}{1+i_{\mathcal{F}}} \times S_{\frac{\mathrm{H}}{\mathcal{F}},0}.$$



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Suppose there is an *unexpected* one-time tax benefit in home H for repatriating profits that firms planned to pay out anyways before time T. Firms respond by rushing to repatriate profits from foreign $\mathcal{F}$ to home H. What are the consequences?

- Firms sell $\mathcal{F}$ to buy H, *sudden* appreciation of H: spot rate $S_{\frac{\mathrm{H}}{\mathcal{F}},0} \downarrow$
- Firms want to deposit more in H, less in $\mathcal{F}$, so i_{H} decreases relative to $i_{\mathcal{F}}$ (next slide)

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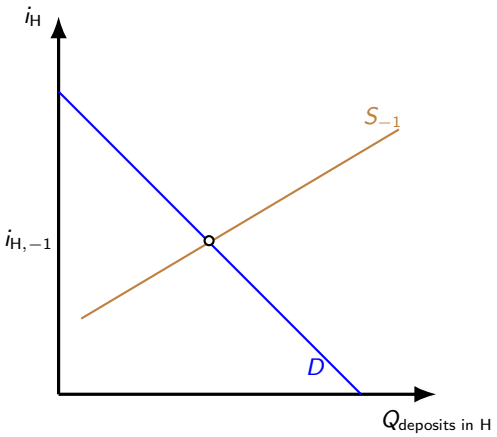
- The amount of expected depreciation $\downarrow$; forward rate $F_{\frac{\mathsf{H}}{\mathcal{F}},0,T} \Downarrow$

Revisiting CIP: Deposit Market Equilibrium for a Capital Flow Shock Today

1. Brown: Outwards shift in supply of deposits at home; firms want to deposit more [using their repatriated profits] for any given interest rate
2. Blue: No change in banks' demand for deposits by firms/investors/households to fund loans

Equilibrium deposit rate decreases in home currency H



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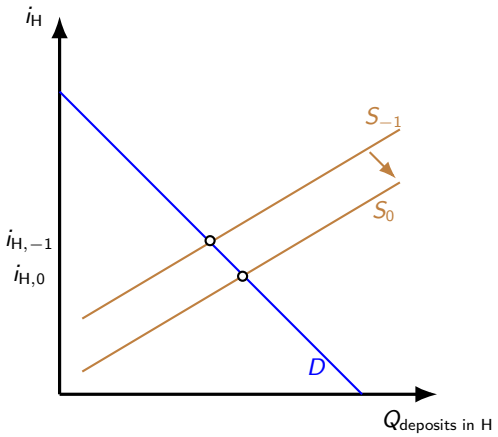

Revisiting CIP: Interest Rate Shock Today

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Suppose the home H central bank suddenly *unexpectedly* increases its overnight lending rate, so the deposit rate i_{H} increases. What are the consequences?

- Investors exchange $\mathcal{F}$ for H and deposit in H, *sudden* appreciation of H: spot rate $S_{\frac{\mathsf{H}}{\mathcal{F}},0} \downarrow$
- Although depositors want to deposit more in H, downwards pressure on the deposit rate (next slide), the first-order "supply" shift of monetary policy raising i_{H} outweighs the second-order "demand" response lowering i_{H}, so $\frac{1+i_{\mathsf{H}}}{1+i_{\mathcal{F}}} \uparrow$
- Ambiguous effect on forward rate F
  - the spot rate appreciation is smaller if home currency is liquid, like the USD, vs illiquid, like many emerging market (EM) currencies
  - by CIP, the forward rate F is more likely to depreciate $F_{\frac{\mathsf{H}}{\mathcal{F}},0,T} \uparrow$ for liquid currencies like the USD

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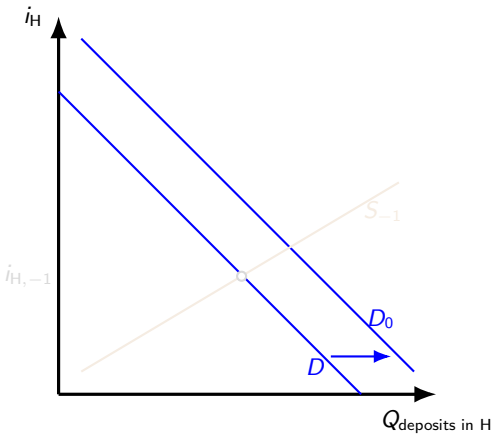
1. Blue: Central bank increase in overnight lending rate shifts upwards the deposit rate offered by banks, who demand deposits for funds to use for loans
2. Brown: There may be a second-order effect of shifting inwards the supply curve = investors would deposit less for fixed deposit rate because bond yield increases. Otherwise, the equilibrium simply "moves along the supply curve"

Regardless, the equilibrium deposit rate increases in home H. My personal view is that the demand curve shift should be small, so you can just focus on 1) and assume a movement along the demand curve



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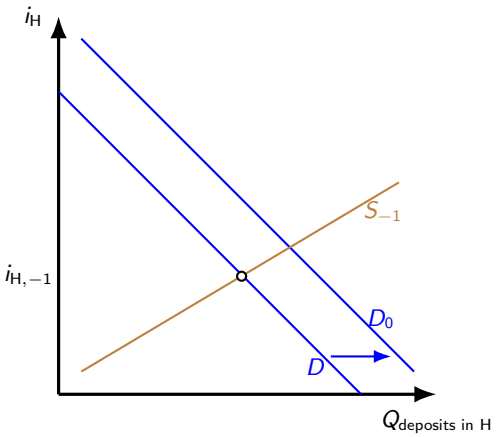

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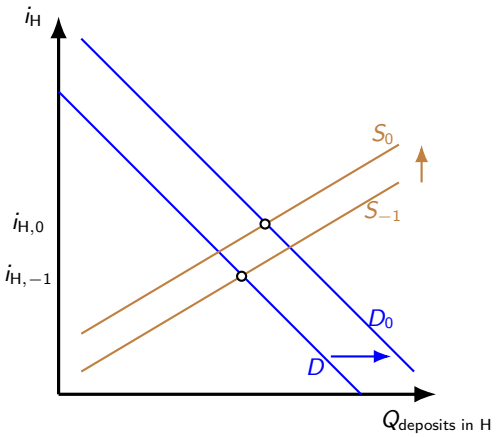

Revisiting CIP: Interest Rate Shock Announced Today for the Future

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Suppose the home H central bank announces that it will increase the overnight lending rate next month but not now. Focus on $T > 1$ month.

1. Key intuition: respond to new **information**, not only changes in actual policy
2. Anticipating financial inflows to H to chase the higher return next month, pressuring currency H to appreciate, speculators buy H today upon the announcement and hope to profit by re-selling in a month, similarly to a carry trade but focused on return on spot FX rather than return on deposits
   - The H spot rate appreciates modestly today: $S_{\frac{\mathsf{H}}{\mathcal{F}},0} \downarrow$, not as much as if the policy change were today
3. Interpreting the LHS as $\frac{1+i_{\mathsf{H},0,T}}{1+i_{\mathcal{F},0,T}}$, the home return on deposits increases because the time period from today to T includes the rate hike, so $\frac{1+i_{\mathsf{H},0,T}}{1+i_{\mathcal{F},0,T}} \uparrow$
4. For longer maturity T like 6-month or 1-year, the increase in deposit return outweighs the small appreciation of the spot rate, so the forward rate will depreciate: $F_{\frac{\mathsf{H}}{\mathcal{F}},0,T} \uparrow$

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Revisiting UIP: Exchange Rate Overshooting after an Interest Rate Shock

- Many goods & services prices are **sticky**, meaning they do not immediately adjust after a shock, either due to long-term contracts or behavioral reasons
- By contrast, asset markets (bonds, stocks, FX) adjust instantly
- UIP condition ignoring risk premium:

$$i_{\mathrm{H},t} - i_{\mathcal{F},t} \approx \frac{\mathbb{E}_t[S_{\frac{\mathrm{H}}{\mathcal{F}},T}] - S_{\frac{\mathrm{H}}{\mathcal{F}},t}}{S_{\frac{\mathrm{H}}{\mathcal{F}},t}}.$$

- Same monetary shock as a few slides ago: Central bank unexpectedly raises the overnight lending rate, so $i_{\mathrm{H},t} \uparrow$

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$$i_{\mathrm{H},t} - i_{\mathcal{F},t} \approx \frac{\mathbb{E}_t[S_{\frac{\mathrm{H}}{\mathcal{F}},T}] - S_{\frac{\mathrm{H}}{\mathcal{F}},t}}{S_{\frac{\mathrm{H}}{\mathcal{F}},t}}.$$

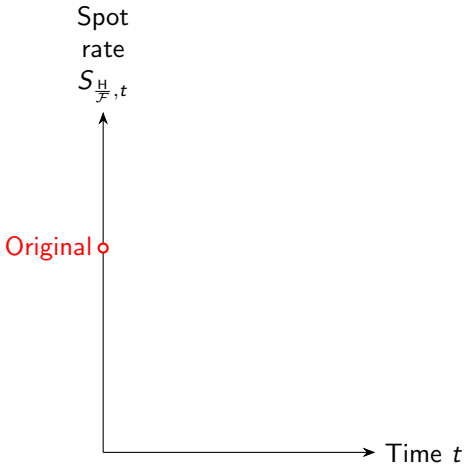
- Same monetary shock as a few slides ago: Central bank unexpectedly raises the overnight lending rate, so $i_{\mathrm{H},t} \uparrow$

Revisiting UIP: Exchange Rate Overshooting after an Interest Rate Shock

$$i_{\mathrm{H},t} - i_{\mathcal{F},t} \approx \frac{\mathbb{E}_t[S_{\frac{\mathrm{H}}{\mathcal{F}},T}] - S_{\frac{\mathrm{H}}{\mathcal{F}},t}}{S_{\frac{\mathrm{H}}{\mathcal{F}},t}}. \qquad \text{(UIP)}$$

- Higher i_{H} makes home deposits more attractive than foreign: $i_{\mathrm{H},t} - i_{\mathcal{F},t} \uparrow$, and inflows to H result in immediate appreciation $S_{\frac{\mathrm{H}}{\mathcal{F}},t} \downarrow$
- To satisfy UIP, $\mathbb{E}_t[S_{\frac{\mathrm{H}}{\mathcal{F}},T}] > S_{\frac{\mathrm{H}}{\mathcal{F}},t}$, so the long-run spot rate should depreciate (increase) relative to today in the immediate aftermath of the shock
  - In the long run, the home price level will rise, but with sticky prices, real money balances fall immediately $\iff$ prices don't adjust as quickly as the money supply

To reconcile, the exchange rate must **overshoot** its long-run level to induce expected depreciation



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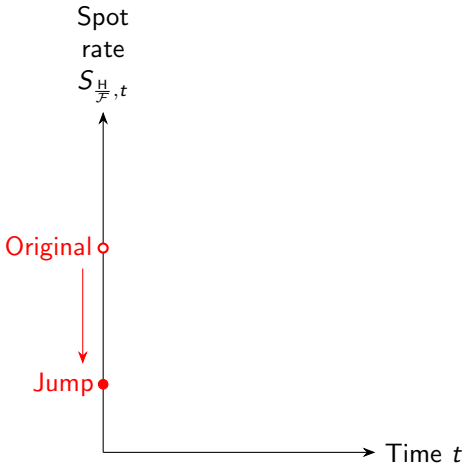

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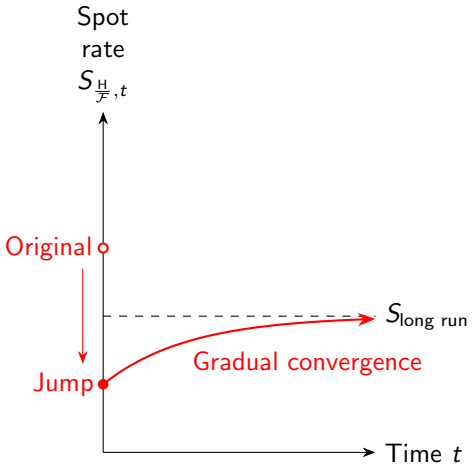

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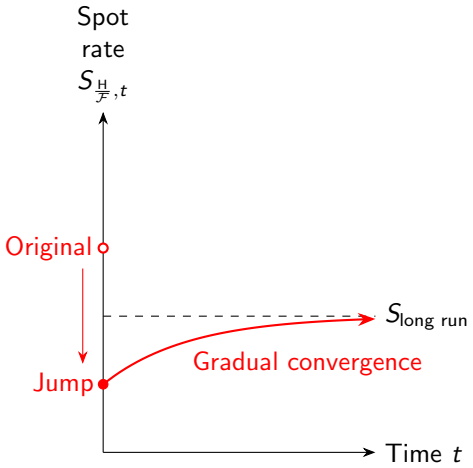

Exchange Rate Overshooting Conclusion

There is no violation of CIP; think of CIP as pinning down the forward rate today for settlement at future time T, while UIP pins down the *dynamic path* of how we expect the spot rate to change from today to T and beyond

- Overshooting explains why FX is more volatile than fundamentals
- Short-run: Exchange rate must move *beyond* its long-run value to satisfy UIP
- Long-run: Goods prices adjust and the future spot exchange rate should align with what is implied by fundamentals and the forward rate

In the last CIP scenario, an announcement of a future monetary policy change, there is still overshooting with UIP, but smaller magnitude than a policy change today

- Partially because there is already a modest change in the spot exchange rate today in anticipation of future flows

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Law of One Price (LOP)

If you could freely trade a good without trade costs, instantly, that good should have the same price everywhere

- Suppose a sweater has price 200 HKD in HK. If the exact same sweater sells for 30 USD in the US, and the FX market has tight bid-ask spread centered on $7.8 \frac{\text{HKD}}{\text{USD}}$, then
  - Buy the sweaters in HK, convert the purchase price of 200 HKD to $\frac{200\text{HKD}}{7.8 \frac{\text{HKD}}{\text{USD}}} = 25.64$ USD, and sell the sweaters in the US for any amount between 25.64 USD and 30 USD to undercut competitors
  - As long as the FX market is liquid and stable enough for you to convert your USD revenue back to HKD at a similar rate, you make a profit
  - When everyone does this, the equilibrium prices adjust, e.g. 218 HKD vs 28 USD
- Then, the exchange rate simply equals the ratio of prices of freely traded goods, $\frac{218\text{HKD}}{28\text{USD}}$

Of course, in reality, trade costs can be substantial, and people in different countries consume different goods, making it difficult to determine exchange rates solely through prices of traded goods & services

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Purchasing Power Parity (PPP)

Suppose there were a standard consumption basket (e.g. everyone spends 30% on housing, 10% on groceries, etc.). Let P_{US} be the price of the basket in USD in the US and let P_{HK} be the price of the basket in HKD in HK.

- PPP predicts an exchange rate of $S_{\frac{\text{HKD}}{\text{USD}}} = \frac{P_{\text{HK}}}{P_{\text{US}}}$
- Same intuition as Law of One Price, generalized across the consumption basket
  - If people in the US spend $P_{\text{US}} = \frac{3\text{k USD}}{\text{month}}$ and people in HK spend $P_{\text{HK}} = \frac{15\text{k HKD}}{\text{month}}$, then PPP predicts $S_{\frac{\text{HKD}}{\text{USD}}} = 5$
- PPP generally *does not hold* due to differences in prices of **non-tradeable** goods and services
  - Incomes are generally lower in HK than in the US at current exchange rates; haircuts are far cheaper in HK, and you cannot "trade" haircuts
- 2025 estimates: HK GDP per capita $= 440\text{k } \frac{\text{HKD}}{\text{year}} = 56\text{k } \frac{\text{USD}}{\text{year}}$; US GDP per capita $= 89\text{k } \frac{\text{USD}}{\text{year}}$
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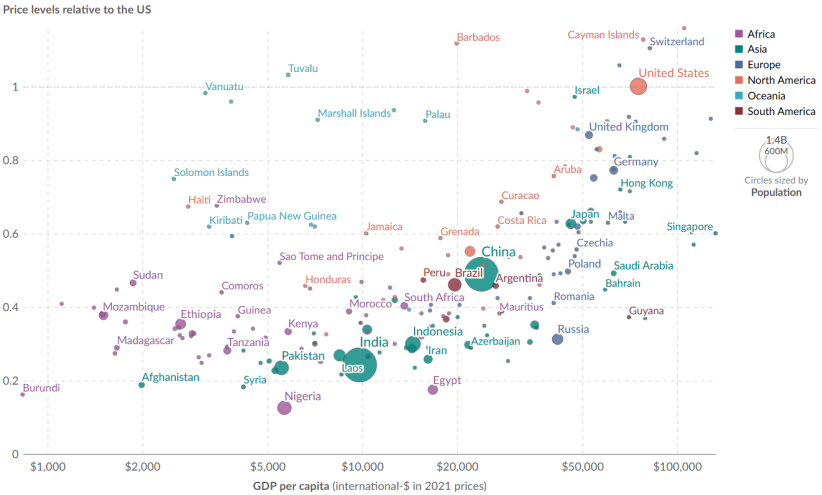

Countries with lower PPP GDP per capita (horizontal axis) tend to have lower price levels (vertical axis)

Outliers are small island countries, petrostates, and countries with severe political instability

Data source: World Development Indicators - World Bank (2025); Eurostat, OECD, IMF, and World Bank (2025) – Learn more about this data

Real Exchange Rate (RER): Definition

$$Q_{\frac{H}{F},t} \equiv S_{\frac{H}{F},t} \times \frac{P_{F,t}}{P_{H,t}} = \frac{\text{Price of foreign goods in H currency}}{\text{Price of home goods in H currency}}$$

- $Q_{\frac{H}{F},t} > 1$: foreign goods are relatively expensive $\Rightarrow$ home currency undervalued in real terms
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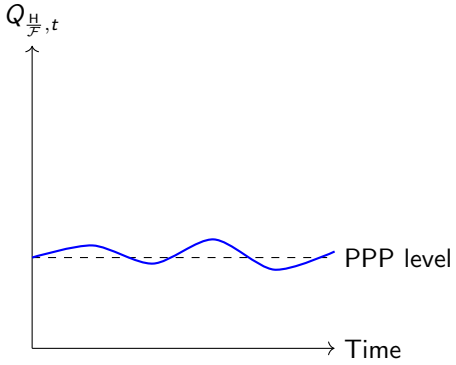
Real Exchange Rate (RER): Beyond PPP

In practice, the RER $Q_{\frac{H}{F},t}$ fluctuates due to:

- Non-tradeables
- Trade barriers, transport costs
- Exporters' currency choices and market competitiveness
- Long-run changes in productivity

RER summarizes the overall competitiveness of a country; RER devaluation promotes exports



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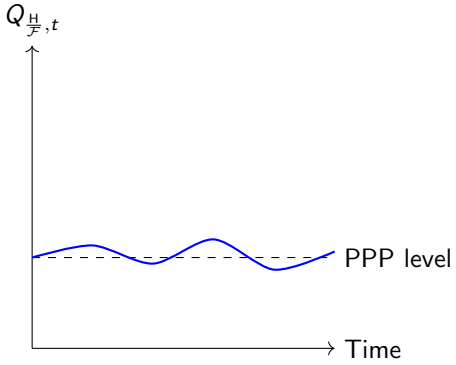

Long-Run RER

- **Relative demand** for home vs. foreign goods: ↑ demand for home output $\Rightarrow$ RER appreciation.
- **Relative supply** (productivity growth): ↑ home output supply $\Rightarrow$ RER depreciation.

Example: Suppose US = H, the USD depreciates 5% against GBP $\iff S_{\frac{H}{F},t} \uparrow$, and the UK has 3 percentage points higher inflation than the US $\iff \frac{P_{F,t}}{P_{H,t}} \uparrow$, then the real exchange rate $Q_{\frac{H}{F},t} \uparrow$ depreciates by approximately 8 percent.

In the long run, if the US has higher productivity growth than the UK, you expect *real depreciation* of USD against GBP because richer Americans consume more imported products, and productivity growth $\Longrightarrow$ GDP increases faster than the price level.

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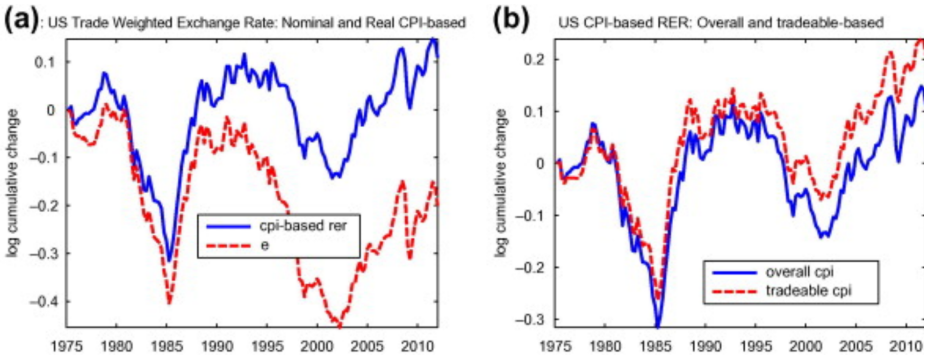
Real vs Nominal Exchange Rates for the US

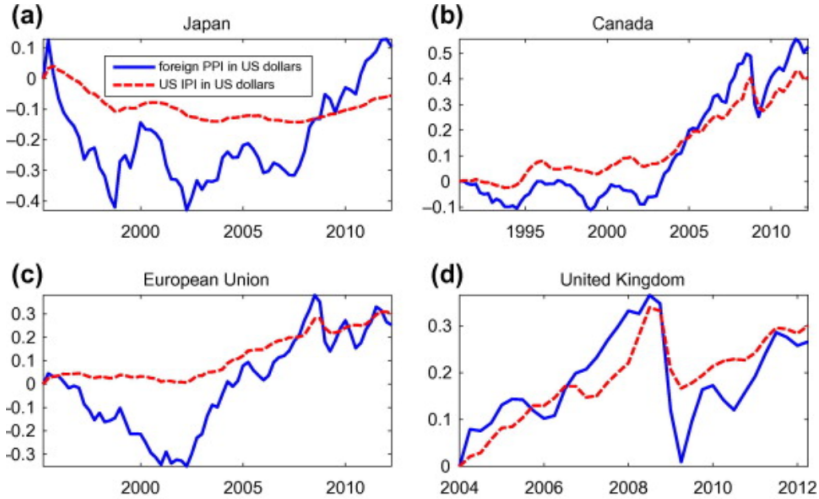
(a) Red shows the nominal exchange rate, blue shows the RER using consumer price indices (CPI), both against a trade-weighted basket of other currencies



Source: Burstein & Gopinath (2014)

(b) Similar RER whether you use all goods & services (red) or just tradable (blue)

Real Exchange Rates (RER) Across Countries



These figures show RER computed using producer price indices (PPI) compared to the US import price index (IPI). A higher value is a real appreciation of the given currency against USD. IPI varies by less, showing incomplete pass-through of RER

Source: Burstein & Gopinath (2014)

Inflation and RER Forecasting

$$i_{\mathrm{H},t} - i_{\mathcal{F},t} \approx \frac{\mathbb{E}_t[S_{\frac{\mathrm{H}}{\mathcal{F}},T}] - S_{\frac{\mathrm{H}}{\mathcal{F}},t}}{S_{\frac{\mathrm{H}}{\mathcal{F}},t}}. \tag{UIP}$$

- Start from the RER definition:

$$Q_{\frac{\mathrm{H}}{\mathcal{F}},t} = S_{\frac{\mathrm{H}}{\mathcal{F}},t} \times \frac{P_{\mathcal{F},t}}{P_{\mathrm{H},t}} \quad \Longleftrightarrow \quad \log Q_{\frac{\mathrm{H}}{\mathcal{F}},t} = \log S_{\frac{\mathrm{H}}{\mathcal{F}},t} + \log P_{\mathcal{F},t} - \log P_{\mathrm{H},t}$$

- Use the first-order Taylor expansion of the logarithm $\approx$ proportional change

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RER Forecasting and Real Interest Parity

$$\frac{\mathbb{E}_t[Q_{\frac{\mathrm{H}}{\mathcal{F}},T}] - Q_{\frac{\mathrm{H}}{\mathcal{F}},t}}{Q_{\frac{\mathrm{H}}{\mathcal{F}},t}} \approx (i_{\mathrm{H},t} - i_{\mathcal{F},t}) - \left(\pi^e_{\mathrm{H},t\to T} - \pi^e_{\mathcal{F},t\to T}\right).$$

Real Interest Parity (RIP) condition:

$$r^e_{\mathrm{H},t} - r^e_{\mathcal{F},t} \approx \frac{\mathbb{E}_t\left[Q_{\frac{\mathrm{H}}{\mathcal{F}},T}\right] - Q_{\frac{\mathrm{H}}{\mathcal{F}},t}}{Q_{\frac{\mathrm{H}}{\mathcal{F}},t}},$$

using the Fisher equation:

$$r^e_{\mathrm{H},t} = i_{\mathrm{H},t} - \pi^e_{\mathrm{H},t\to T},$$
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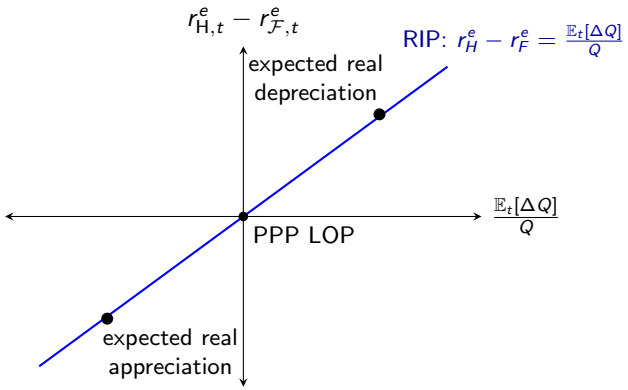

FX Forecasting: Simple Example

Scenario: Horizon $T = 1$ year, H = US, $\mathcal{F}$ = UK.

- Expected US inflation: 3%
- Expected UK inflation: 2%
- Macro model suggests real depreciation of USD vs GBP due to faster productivity growth in the US: 2%

Step 1. Inflation gap:

$$\pi^e_{\mathrm{H}} - \pi^e_{\mathcal{F}} = 3\% - 2\% = 1\%.$$

Step 2. Add expected real depreciation to obtain the expected nominal depreciation: $1\% + 2\% = 3\%$.

Forecast: Dollar expected to *depreciate 3% against GBP*.

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Scenario: Real exchange rate $Q_{\frac{\text{USD}}{\text{GBP}},t}$ is 10% above its long-run average

- Interpretation: UK goods are relatively cheap compared to US goods, so US exports more to the UK and US imports less from the UK
  - Puts pressure for "mean reversion" for Q to return to its long-run average $\bar{Q}$ determined by relative productivity and monetary policy
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If there is no inflation gap $\pi^e_{\text{H}} - \pi^e_{\mathcal{F}} \approx 0$, then the USD is forecast to appreciate in nominal terms too

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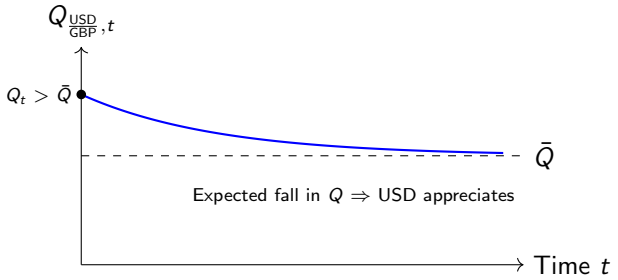

Example: Forecasting USD/GBP with Parity Conditions

Setup': 1-year horizon with

- US nominal deposit rate: $i_{\$,0\to1} = 5\%$
- UK nominal deposit rate: $i_{£,0\to1} = 3\%$
- Expected US inflation: $\pi^e_{\$,0\to1} = 2\%$
- Expected UK inflation: $\pi^e_{£,0\to1} = 1\%$
- Current spot: $S_{\frac{\$}{£},0} = 1.20$

Step 1: Higher return on home deposits leads to nominal depreciation by UIP:

$$i_{\$} - i_{£} = 5\% - 3\% = 2\% \implies \mathbb{E}\left[\frac{\Delta S}{S}\right] \approx 2\%.$$

Step 2: Get the real returns from Fisher:

$$r^e_{\$} = 5\% - 2\% = 3\%, \qquad r^e_{£} = 3\% - 1\% = 2\%.$$

Step 3: Real depreciation using RIP:

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Conclusion: New spot rate is

$$S_{\frac{\$}{£},1} \approx S_{\frac{\$}{£},0} \times 1.02 = 1.224$$

US trade deficit will probably decrease a bit in magnitude due to RER depreciation, and US net financial inflows will also decrease a bit

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Summary of Parity Conditions

Nominal parity and inflation

- **CIP** (covered): $(1 + i_{\mathrm{H},t}) = \dfrac{F_{\frac{\mathrm{H}}{\mathcal{F}},t,T}}{S_{\frac{\mathrm{H}}{\mathcal{F}},t}} (1 + i_{\mathcal{F},t})$.
- **UIP** (uncovered): $i_{\mathrm{H},t} - i_{\mathcal{F},t} \approx \dfrac{\mathbb{E}_t[S_{\frac{\mathrm{H}}{\mathcal{F}},T}] - S_{\frac{\mathrm{H}}{\mathcal{F}},t}}{S_{\frac{\mathrm{H}}{\mathcal{F}},t}}$.
- **Fisher** (expected): $i_{\cdot,t} \approx r^e_{\cdot,t} + \pi^e_{\cdot,t\to T}$.

Real parity and decomposition

- **RER**: $Q_{\frac{\mathrm{H}}{\mathcal{F}},t} = S_{\frac{\mathrm{H}}{\mathcal{F}},t} \times \dfrac{P_{\mathcal{F},t}}{P_{\mathrm{H},t}}$.
- **RIP**: $r^e_{\mathrm{H},t} - r^e_{\mathcal{F},t} \approx \dfrac{\mathbb{E}_t[Q_{\frac{\mathrm{H}}{\mathcal{F}},T}] - Q_{\frac{\mathrm{H}}{\mathcal{F}},t}}{Q_{\frac{\mathrm{H}}{\mathcal{F}},t}}$.

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  - Meese–Rogoff (1983) puzzle: Fundamentals do not predict FX well on short horizons
- Investor focus: *rank-ordering returns* across currencies to build profitable portfolios
  - Melvin, Prins, Shand: compare spot FX to PPP fair value (RER intuition), rank currencies by deviations, ensure overall portfolio is most long the most undervalued currencies
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Building and Evaluating Currency Portfolios

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  - Risk model (covariance matrix, factor structure)
  - Transaction cost model (spreads, market impact)
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  - Tilt = static exposures to factors (carry, trend, value)
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Contract combining

- a spot exchange of two currencies today,
- with a forward contract to reverse the exchange at a future date (no FX risk)

Example: US firm owes 1M EUR for imports in 10 days, expects to receive 1M EUR from exports in 20 days

- Enters an FX swap today: selling 1.1M USD to receive 1M EUR spot, agreed to sell 1M EUR at forward rate for 1.095M USD in 30 days

Note: Different concept from other swaps in finance (e.g. credit default, interest rate) that have "fixed" vs "floating" legs and different hedging motivation

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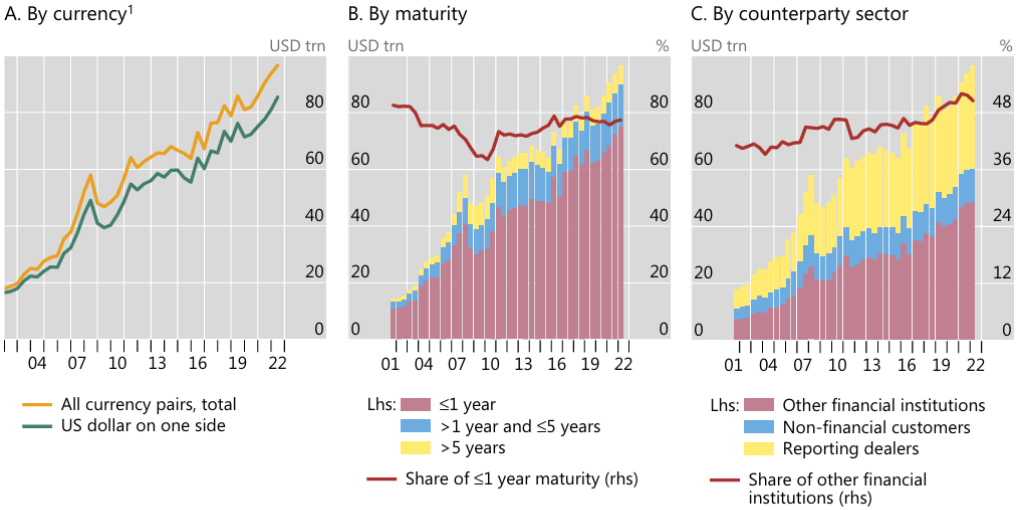
Most FX Swaps Involve the USD, are Short-Term

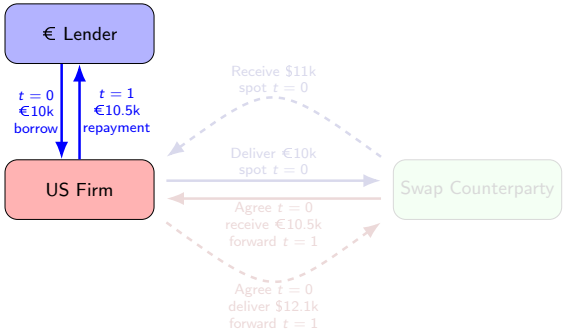


[1] The gold line is the aggregate of FX swaps, FX forwards and currency swaps. The green line is contracts in which US dollars are exchanged.

Source: BIS OTC derivatives statistics.

FX Swap Example: US Firm Receives EUR Loan

Assume zero spreads, so lending rate = deposit rate. US firm decides to borrow in € but wants $



- € interest rate is 5%, $ interest rate is 10%
- Swap has spot leg at €1 = $1.10 ...
- ... and forward leg whose size is spot + interest, at the forward rate €1 = $1.15

$$€10.5k = 10k \times 1.05 \text{ interest in } €$$
$$\$12.1k = \$11k \times 1.10 \text{ interest in } \$$$

- The firm uses the € from the forward leg to repay the € lender

Note that if CIP holds and spreads are equal, meaning lending rate = deposit rate + c for same c in both countries, then this is equivalent to the firm borrowing in USD at 5% rate: borrow $11k, repay $12.1k

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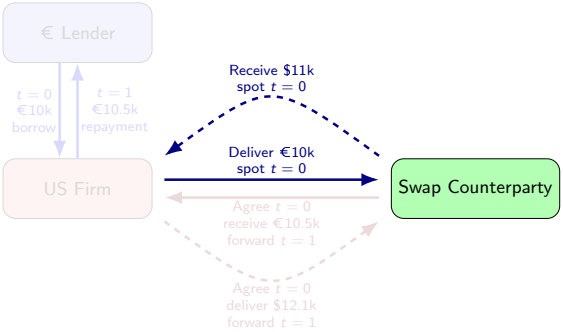

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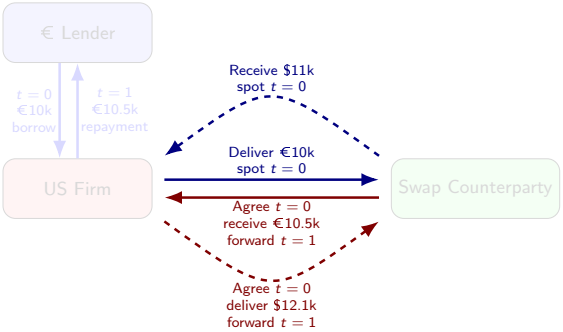

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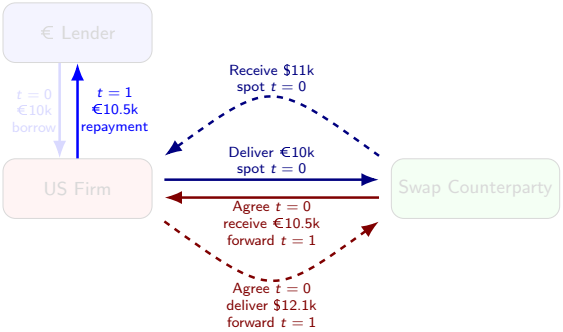

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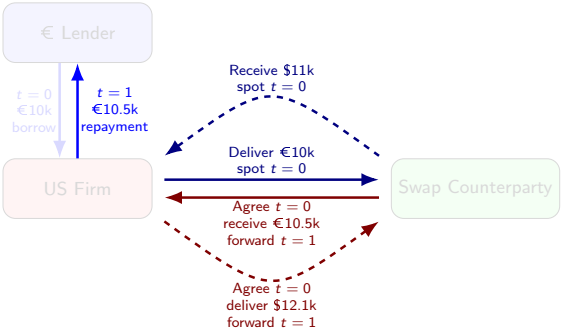

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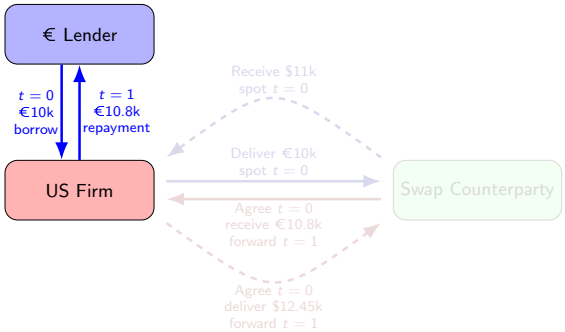
FX Swap Example: US Firm Receives EUR Loan with Lower Spread

Now suppose that the **deposit** rates are 5% in € and 10% in $, but the **spread** between lending and deposit rates is higher in the US than EU: 6% spread in $ vs 3% spread in €. Suppose CIP holds.



US firm issues a € bond but wants $

- FX swap uses interbank rates ≈ deposit: € deposit rate is 5%, $ deposit rate is 10%
- But firm borrows at higher lending rates: € lending rate is 8%, $ lending rate is 16%
- Swap still has spot leg at €1 = $1.10 ...
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- Had the firm directly borrowed $11k USD, it'd repay $11k × 1.16 = $12.76k USD

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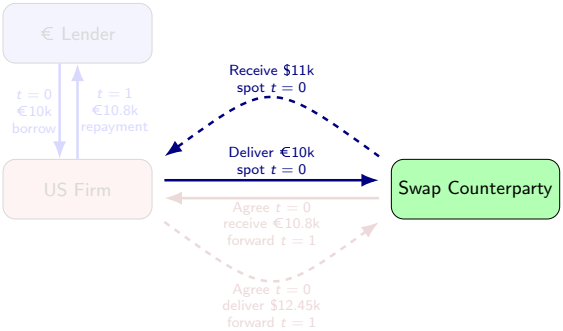

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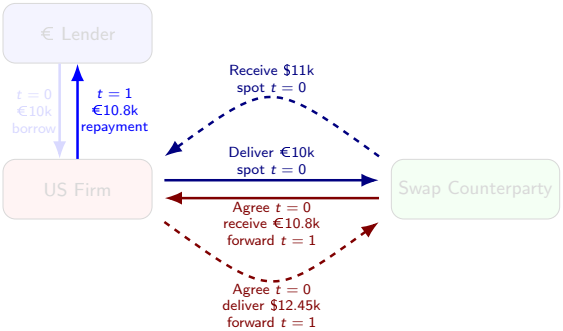

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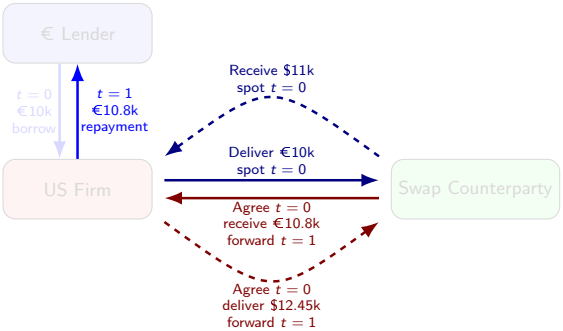

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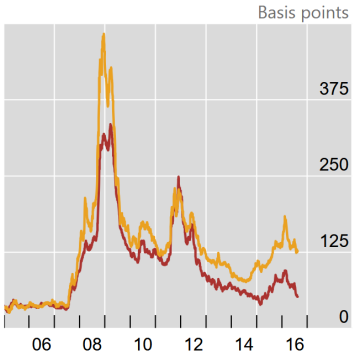
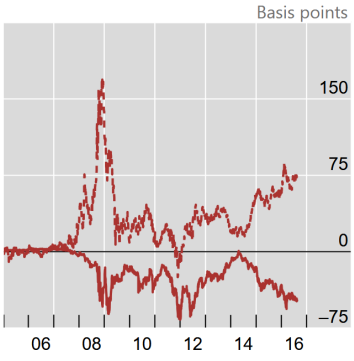
Firms Use FX Swaps When Borrowing in Foreign Currencies

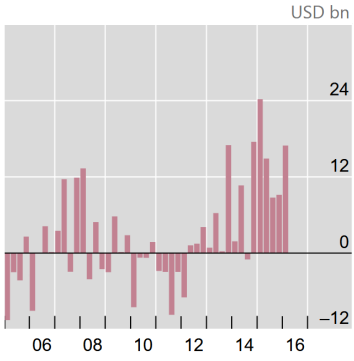
Corporate asset swap spread



Spread differential and the basis



US non-financial firms' EUR debt issuance



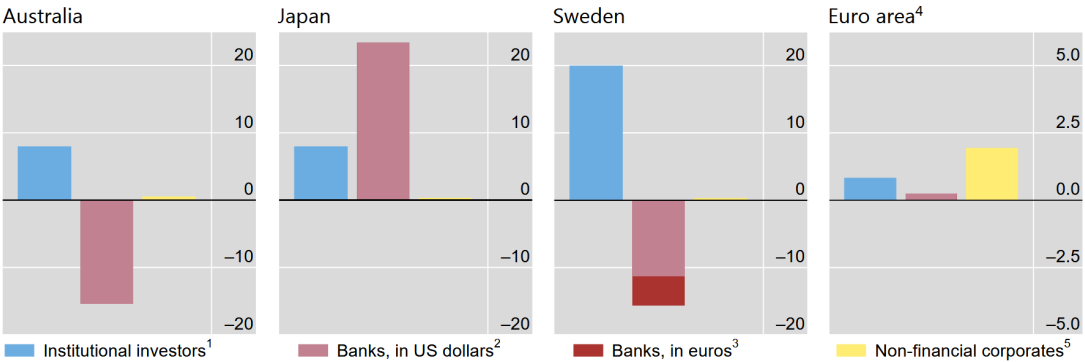
Source: BIS using data from Bank of America Merrill Lynch and Bloomberg

CIP Deviations Follow Banks' FX Swap Demand to Hedge Lending

Currency hedging by banks, institutional investors and non-financial corporates

As a percentage of 2015 GDP

Graph 2



[1] Foreign currency securities holdings of institutional investors (eg pension funds and insurance companies) multiplied by the respective currency hedge ratios; for the euro area, US dollar debt securities holding only, assuming 100% currency hedge ratios. [2] Each jurisdiction's BIS reporting banks' consolidated net US dollar assets. [3] Each jurisdiction's BIS reporting banks' consolidated net euro assets. [4] 2015 quarterly average. [5] Local currency debt outstanding issued by US non-financial corporations.

Central Banks and FX Swaps

- Provide foreign-currency liquidity to domestic banks during crises
  - E.g. Fed swap lines (USD) with ECB, BoJ, BCB (2008, 2020)
- Smooth disorderly FX market conditions without selling reserves outright
- Support monetary policy by avoiding spillovers from USD shortages

- Spot leg: Fed provides USD and receives local currency
- Forward leg: Fed receives USD and returns local currency at pre-set rate
- Settlement types:
  - *Deliverable*: currencies exchanged at both spot and forward maturities
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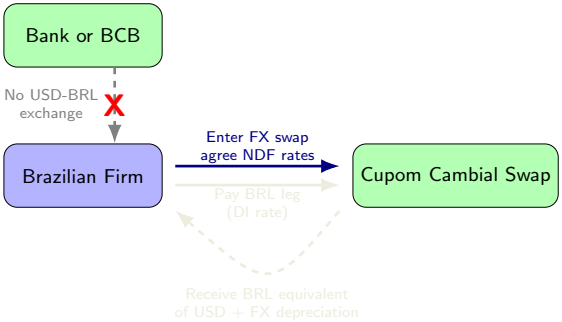

Non-Deliverable Forward (NDF): agree to size (e.g. 1M USD) and

- Initial spot rate
- Domestic BRL interest leg on overnight rate (DI)
- Foreign USD interest leg

Implicitly specifies forward rate through CIP:

$$F_{\frac{\mathrm{H}}{\mathcal{F}},0,T} = \frac{1+i_{\mathrm{H}}}{1+i_{\mathcal{F}}} \times S_{\frac{\mathrm{H}}{\mathcal{F}},0}$$

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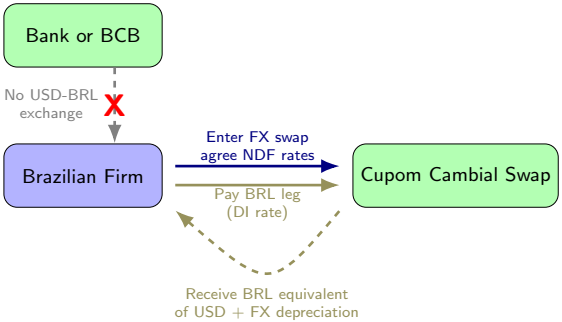

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Banco Central do Brasil (BCB) auctions FX swaps

- **Not** to provide actual dollars, but to manage BRL volatility
- Non-deliverable with settlement only in BRL
- Creating synthetic USD exposure for domestic institutions
  - By selling more FX swaps, the BCB incentivizes Brazilian banks to borrow USD offshore and bring onshore to Brazil to increase USD liquidity in Brazil
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In weeks 6 and 7, we will discuss firms' hedging and FX exposure, so today we will just see a brief overview:

Why forecast FX:

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- Financing choice (currency, loan/bond/equity) depends on expected FX costs
- Hedging decisions for payables and receivables with different timing
- Earnings repatriation timing influenced by expected FX movements

How firms forecast FX:

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- Call option protects against home currency depreciation
- Put option protects against home currency appreciation
- Options are often more costly with less liquidity than forwards, but flexible for risk management

Example: US firm expects to pay €5m to a German supplier in T =3 months, worried USD will depreciate against EUR

- Current spot $\frac{1.10\text{USD}}{\text{EUR}}$, forward rate $\frac{1.11\text{USD}}{\text{EUR}}$
- Buy a 3-month euro call option with strike 1.11, premium 0.02
- If spot FX at $T = 1.18$: option exercised, effective FX 1.13, total \$5.65M
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- Call option protects against home currency depreciation
- Put option protects against home currency appreciation
- Options are often more costly with less liquidity than forwards, but flexible for risk management

Example: US firm expects to pay €5m to a German supplier in $T = 3$ months, worried USD will depreciate against EUR

- Current spot $\frac{1.10\text{USD}}{\text{EUR}}$, forward rate $\frac{1.11\text{USD}}{\text{EUR}}$
- Buy a 3-month euro call option with strike 1.11, premium 0.02
- If spot FX at $T = 1.18$: option exercised, effective FX 1.13, total \$5.65M
- If spot FX at $T = 1.05$: option expires, pays spot FX 1.05, plus premium, total \$5.35M

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Onshore vs Offshore FX Markets

Onshore claims:

- Banks inside the currency area lending to residents (domestic intermediation).
- Includes cross-border claims of resident banks on non-residents.

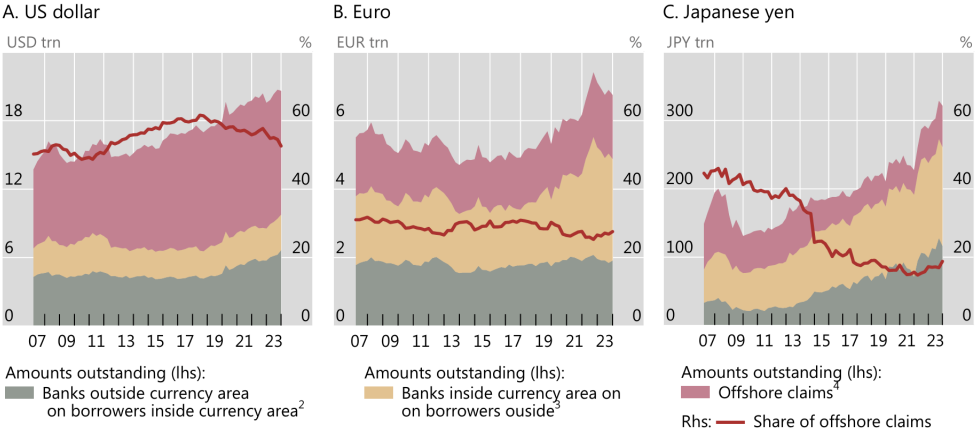
Offshore claims:

- Claims booked by banks *outside* the currency area.
- Reflects global use of a currency beyond its borders.
- Key for understanding global funding markets and FX turnover.

Why do we care?

- Higher offshore share $\Rightarrow$ more globalized currency (e.g. USD).
- Offshore dominance complicates monetary policy transmission.

Cross-Border Claims by Currency

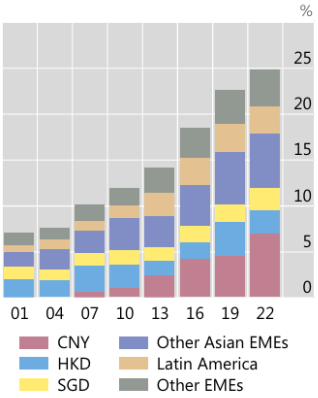


[1] International claims comprise cross-border claims and local claims (on residents) in foreign currencies (including intragroup claims). Panel B excludes intra-euro area cross-border claims. [2] Cross-border claims on residents of the currency area reported by banks abroad. [3] Cross-border claims booked by banks in the currency area on counterparties outside the currency area. [4] Claims booked by banks located outside the currency area on counterparties outside the currency area.

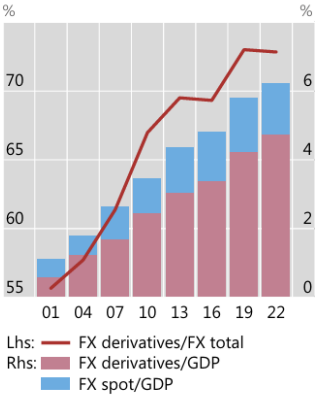
Source: BIS

Increase in EM FX and Portfolio Investment

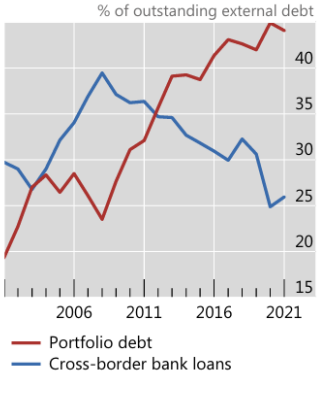
A. EME currencies' share of global FX turnover increased



B. Led by derivatives, FX turnover rose as a share of EMEs' GDP[2]...



C. ... on the back of a shift towards portfolio investment[2]



[1] See technical annex for details. [2] Median of EME currencies.

Sources: IMF, *Balance of Payments Statistics*; IMF, *World Economic Outlook*; national data; BIS Triennial Central Bank Survey; authors' calculations.

Source: BIS

Conclusion

- Parity conditions:
  - CIP links spot, forward rates, and interest differentials
  - UIP links expected spot changes to interest differentials, can explain overshooting dynamics
  - RIP connects real interest differentials to real exchange rate movements, explain whether a currency is "under-valued" in purchasing power
- FX Forecasting:
  - PPP and RER useful benchmarks, but limited in short-run prediction
  - FX seems to behave like a random walk, though relative signals can guide portfolios
- Swaps and FX intervention:
  - FX swaps allow for synthetic foreign currency borrowing
  - Central banks use swaps to smooth markets and manage volatility

Thursday: Multinational firms and midterm review