Global Rates Viewpoint

FX-Sofr primer

Primer

Key takeaways

- The FX swap market had a record daily OTC turnover of USD 3.8trn in April 2022
- This primer details the basic theory, market liquidity, and drivers of the FX-Sofr basis
- We provide a global insight across the US, Euro area, Japan, UK, Australia, and Canada

Understanding the FX swap market

The FX swap market one of the world's most liquid and essential for providing liquidity across a range of currencies. The relative demand for one currency over another may result in large and persistent deviations from covered interest rate parity (CIRP). This primer details how the market generally trades, key players in the FX swap market, and drivers of the FX-secured overnight financing rate (Sofr) basis with a focus on developed market currencies.

After risk free rate reforms

The first section of this primer provides the basic theory of FX swaps, taking into account of the risk free rate (RFR) reform in recent years. One consequence of the RFR reform is that the measure of US dollar premium in the FX swap market is now captured by the FX-Sofr basis, rather than the FX-overnight index swap (OIS) and FX-London interbank offered rate (Libor) basis.

Daily OTC turnover at record high

The second section of our primer provides an overview of FX swap market liquidity. Over-the-counter (OTC) FX swap turnover on a net-net basis reached USD 3.8trn in April 2022, based on triennial surveys by the Bank of International Settlement (BIS). Most OTC FX swaps are conducted on a cross-border basis, by banks and dealers, and are concentrated at the very front-end of the curve.

Global FX-Sofr basis drivers

The third, and main, section of our primer looks at six drivers of the FX-Sofr basis: 1) institutional investors, 2) regulatory requirements, 3) US bank reserves, 4) bank treasuries and dealers; 5) reserve managers' cash deposits, and 6) central bank US dollar swap lines. We provide examples of market participants from the US, Euro area, Japan, the UK, Australia, and Canada that may play a role in these drivers.

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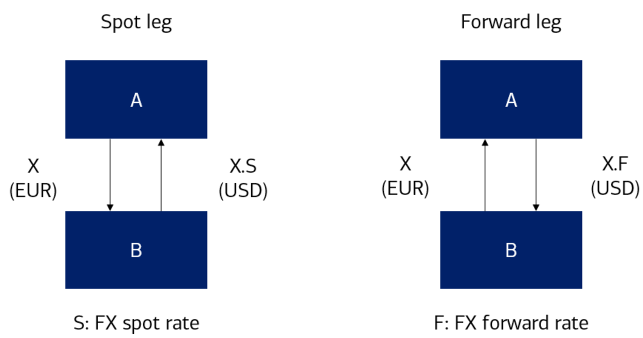
Basic theory

FX swaps allow market participants to borrow or lend foreign currencies. They comprise two transactions. The first transaction is the spot leg, which is an exchange of currencies using the spot exchange rate. The second transaction is the forward leg, which is a reversal of the exchange at a predetermined future date and at the forward rate (Exhibit 1).

Exhibit 1: FX swaps have two transactions
FX swaps allow market participants to borrow or lend foreign currencies



Source: BofA Global Research

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The CIRP states the difference between the interest rate of two currencies should equal the difference between the forward and spot exchange rate. This primer mainly uses focuses on EURUSD FX swaps for illustration purposes and will include other currencies where appropriate.

For a USD-based investor, the CIRP states the investor should make the same return from:

- Investing USD at interest rate r_{USD}, and
- Buying EUR with USD in the spot market at $EURUSD_{spot}$, lending the EUR at interest rate r_{EUR}, and repurchasing USD at the forward rate of $EURUSD_{forward}$ entered at the start of the investment

Formulaically:

$$1 + r_{USD} = \frac{(1 + r_{EUR}) * EURUSD_{forward}}{EURUSD_{spot}}$$

$$\frac{EURUSD_{forward}}{EURUSD_{spot}} = \frac{1 + r_{USD}}{1 + r_{EUR}}$$

The interest rate used for the US dollar and euro are based off their respective RFR curves. In the US, this is the Sofr curve; in euro, this is the euro short-term rate (€str) curve. It also means the day count convention for interest calculations is actual number of days divided by 360 (ACT/360), following the convention from the RFR swaps. Most developed market currencies use RFR as the reference interest rate (Exhibit 2).

Exhibit 2: Reference interest rate in FX swap
Overnight rates typically used, AUD and NZD are key exceptions

	Reference interest rate
USD	Sofr
EUR	€str
GBP	Sterling overnight index average (Sonia)
JPY	Tokyo overnight average rate (Tonar)
AUD	Three-month bank bill swap rate (BBSW)
NZD	90-day Bank Bill Benchmark Rate (BKBM)
CAD	Canadian overnight repo rate average (Corra)

Source: BofA Global Research

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The CIRP does not hold in practice because there is an imbalance between demand and supply of one currency relative to another. This imbalance is captured by the FX-Sofr basis. Formulaically, the EUR FX-Sofr basis, *b*, is derived from:

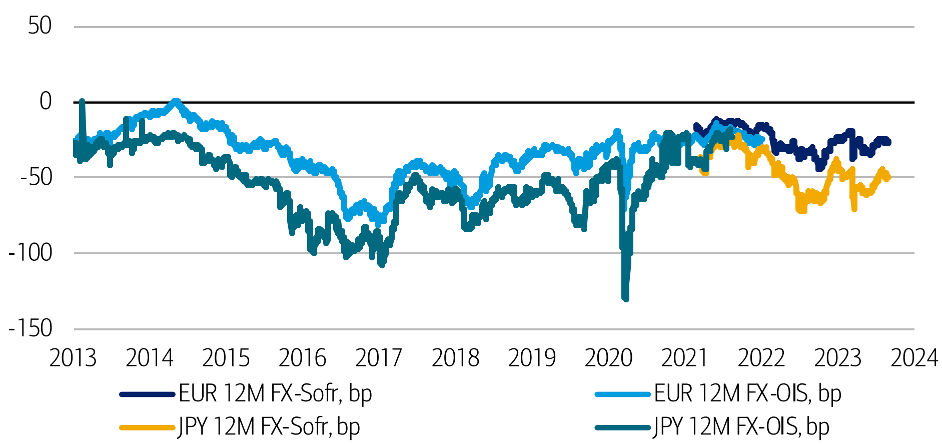
$$\frac{EURUSD_{forward}}{EURUSD_{spot}} = \frac{1 + \frac{ACT}{360} r_{USD}}{1 + \frac{ACT}{360}(r_{EUR} + b)}$$

Where r_{USD} is the annualised Sofr rate, r_{EUR} is the annualised €str rate.

By convention, the FX-Sofr basis is applied to the non-dollar interest rate. In the case of EUR FX-Sofr, a negative EUR FX-Sofr basis represents more demand for (or less supply of) USD relative to demand for (or supply of) EUR; and vice versa.

Prior to the introduction of RFRs, the reference interest rates in FX swaps were based off the OIS or Libor rates. Even so, the consistent negative basis shows that the USD commands a premium in the FX swap market (Exhibit 3).

Exhibit 3: 12M FX-Sofr and FX-OIS basis for EUR and JPY
Consistent negative basis shows USD commands a premium



Source: BofA Global Research, Bloomberg

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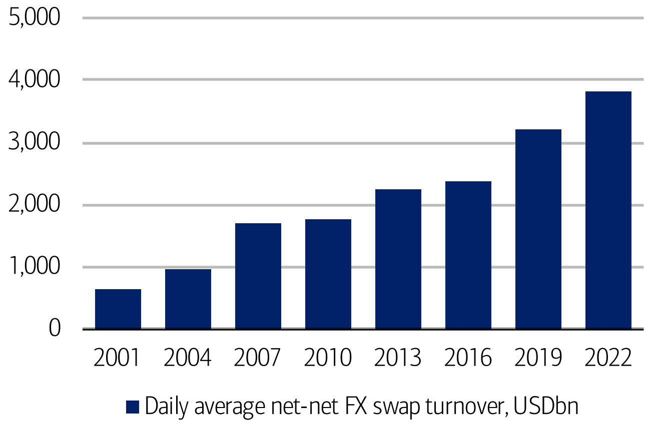
Market liquidity

Daily turnover in FX swaps has grown consistently over the years. OTC FX swap turnover on a net-net basis reached USD 3.8trn in April 2022, based on triennial surveys by the BIS (Exhibit 4). Net-net basis adjusts for local and cross-border inter-dealer double-counting.

The daily average turnover of FX swaps containing the US dollar was USD 3.5trn, its large share of total turnover reflecting its global dominance (Exhibit 5). The euro consistently has the second largest turnover at USD 1.3trn in April 2022.

Exhibit 4: Daily turnover of EUR FX swap
Daily turnover of FX swap exceeded USD 3.8trn in 2022



Source: BIS. Data shows daily average in April of that year.
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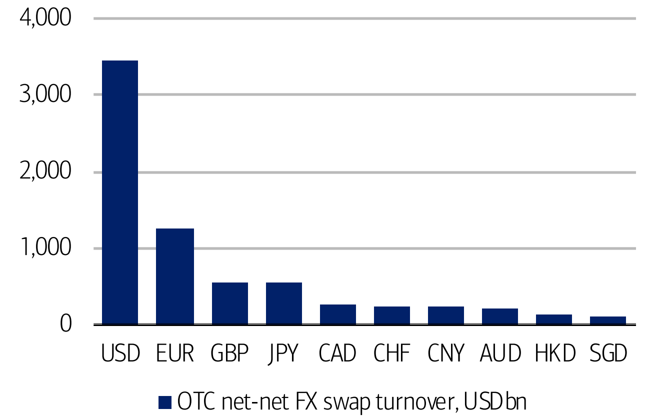
Exhibit 5: OTC net-net FX swap turnover by currency in April 2022
USD the dominant currency in FX swaps



Source: BIS
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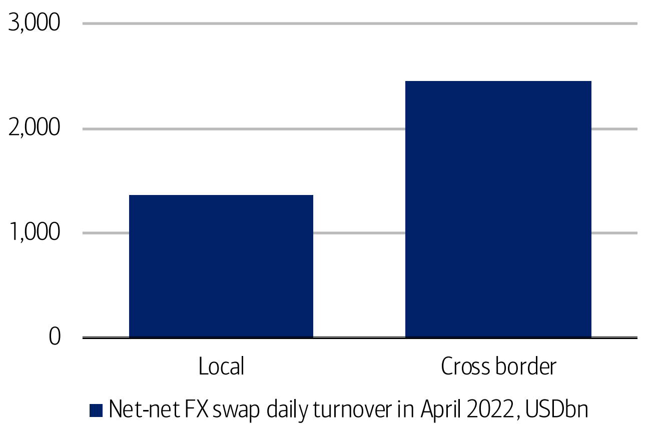
By location of counterparty, 64% of average daily turnover in OTC FX swaps were conducted on a cross-border basis in April 2022 (Exhibit 6). In the case of the euro, cross-border transactions include intra-euro area trades, i.e. between two counterparties located in different euro area member states.

Exhibit 6: FX swap turnover by counterparty location
Cross-border trades accounted for 64% of EUR FX swap turnover



Source: BIS
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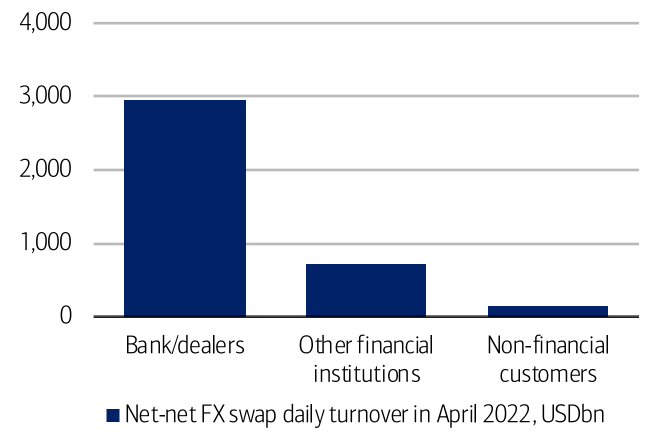
Exhibit 7: FX swap turnover by counterparty type
Banks and dealers account for most daily turnover



Source: BIS
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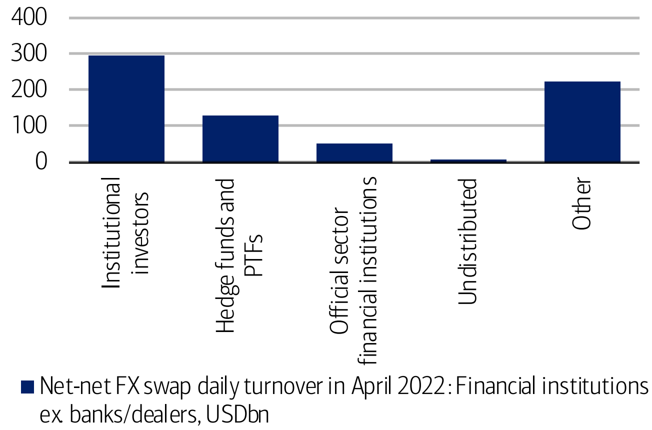
By type of counterparty, banks and dealers accounted for 77% of FX swap turnover in April 2022 (Exhibit 7). Other financial institutions (excluding banks and dealers) accounted for 19%, while non-financial customers accounted for 4%. Non-financial customers include corporations, non-financial government entities, and private individuals who directly transact with reporting dealers for investment purposes.

Among other financial institutions, institutional investors (real money investors) accounted for the largest share of average daily FX swap turnover with USD 298bn (Exhibit 8). Hedge funds and proprietary trading firms (PTFs) accounted for USD 130bn. Official sector financial institutions – central banks, sovereign wealth funds, international financial institutions in the public sector, development banks and agencies – accounted for USD 55bn.

By tenor, daily turnover is concentrated at the very front-end of the curve. In April 2022, 71% of FX swap turnover was accounted for by original maturity of up to seven days (Exhibit 9). The second highest share was in the over one month and up to three months bucket. The lowest turnover was recorded in the over six months bucket.

Exhibit 8: FX swap turnover by other financial institutions
Institutional investors account for most turnover after banks and dealers



Source: BIS

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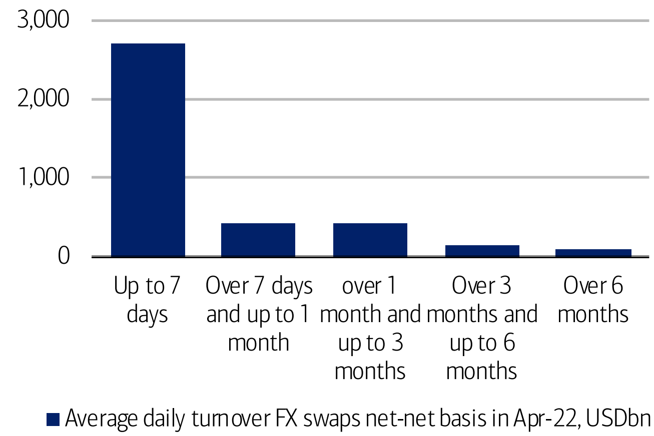
Exhibit 9: FX swap turnover by original maturity
Turnover is concentrated at the very front-end of the curve (Up to 7 Days)



Source: BIS

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Drivers

We detail six drivers of the FX-Sofr basis, oftentimes using the EUR FX-Sofr basis to illustrate the associated flows (Exhibit 10):

- Institutional investors
- Regulatory requirements
- US bank reserves
- Bank treasuries and dealers
- Reserve managers' cash deposits
- Central bank US dollar swap lines

Exhibit 10: Summary of FX-Sofr basis drivers
Typical motivations and pressure on FX-Sofr basis

Drivers	Motivation	Typical pressure on FX-Sofr basis	Typical maturities
Institutional investors	FX hedge investment in non-domestic assets	Widening / Tightening	One month to three months
Regulatory requirements	Banks reduce exposure on key reporting dates	Widening	Mainly three month or less
US bank reserves	Impact from monetary and fiscal policy	Widening / Tightening	Across the curve
Bank treasuries and dealers	Manage short-term liquidity needs	Widening / Tightening	Very short-term
	Arbitrage of funding costs in different repo markets	Widening / Tightening	Varies
Reserve managers' cash deposits	FX hedged yield and diversification	Widening / Tightening	Varies
Central bank dollar liquidity swap lines	Backstop to USD funding pressures	Tightening	7 and 84 days

Source: BofA Global Research

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When we discuss the associated pressure from each type of flow, we assume all other things are equal.

FX swap flows terminology

- Sell/buy EURUSD = sell EUR and buy USD in spot leg; buy EUR and sell USD in the forward leg at a pre-determined rate
- Buy/sell EURUSD = buy EUR and sell USD in the spot leg; sell EUR and buy USD in the forward leg at a pre-determined rate
- Wider EUR FX-Sofr basis = more negative EUR FX-Sofr basis
- Tighter EUR FX-Sofr basis = more positive EUR FX-Sofr basis

Institutional investors

Institutional investors include asset managers and pension funds. Overseas debt securities investments may be FX hedged using FX swaps, with typical tenors being between one month and three months. The share of overseas debt securities that is FX hedged depends on each investor's strategy, which may include a full, partial, and non-FX hedging ratio. Where there is a maturity mismatch between the underlying debt holding and the FX swap, the investor is subject to rollover risks from the FX swap.

In the case of euro area investors investing in non-euro area debt securities, this would lead to sell/buy EURUSD FX swap flows, which could put **widening** pressure on the EUR FX-Sofr basis (Exhibit 11 depicts the flows for a euro area investor purchasing a USD-denominated asset on a FX hedged basis). In the case of non-euro area investors investing in euro area debt securities, the flows would be in the opposite direction, putting **tightening** pressure on the EUR FX-Sofr basis.

Exhibit 11: Mechanics of euro area investors FX hedging USD assets
Increase in activity would put widening pressure on EUR FX-Sofr basis

Source: BofA Global Research

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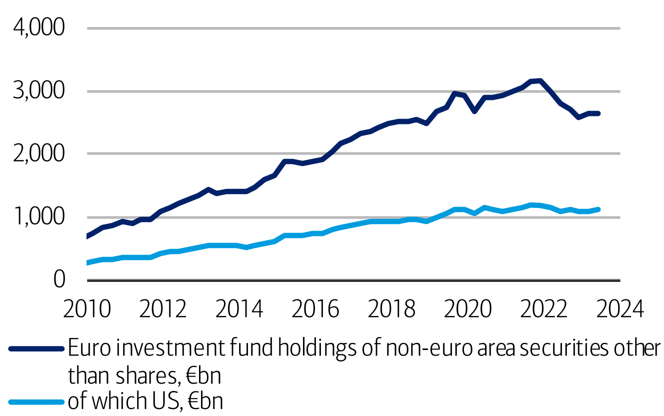
Euro area institutional investors

Holdings of non-euro area debt securities by euro area investment funds, which include institutional investors, hedge funds, and other funds, fell from over €3trn at the end of 2021 to around €2.7trn in June 2023 (Exhibit 12). The decline was driven by a reduction in non-US securities as the amount of US securities held by euro institutional investors remained steady over the same period.

Exhibit 12: Holdings of foreign bonds by euro area investment funds
The US accounts for the largest share of non-euro area debt holdings



Source: ECB

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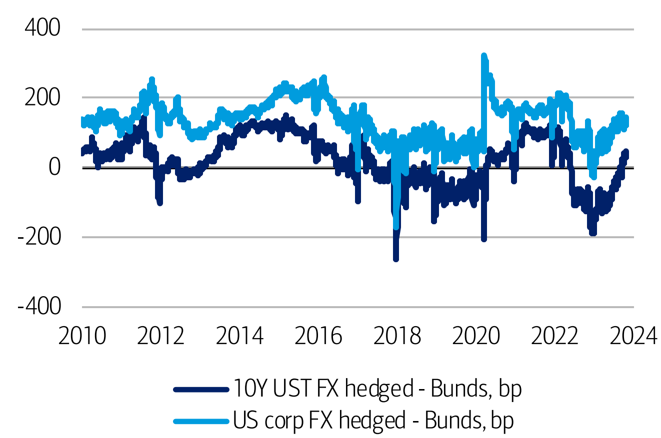
Exhibit 13: Pick up of FX hedged US bonds over Bunds
FX hedged US bonds can be attractive relative to Bunds



Source: BofA Global Research, Bloomberg, ICE data indices, LLC
US corp represented by the ICE BofA US Corporate Index. FX hedge uses 1M EURUSD FX swap.

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Exhibit 13 plots the historical pick-up of 10Y US Treasuries and US corporate bonds, FX hedged using the 1M EURUSD FX swap, over Bunds. In 2014 and 2016, US Treasuries provided a FX hedged pick-up of over 100bp over Bunds; but between 2018 and 2020, the pick-up was negative. For US corporate bonds, their higher yields relative to 10Y US Treasuries meant the pickup generally stayed above Bunds on a similar FX hedged basis.

Japanese institutional investors

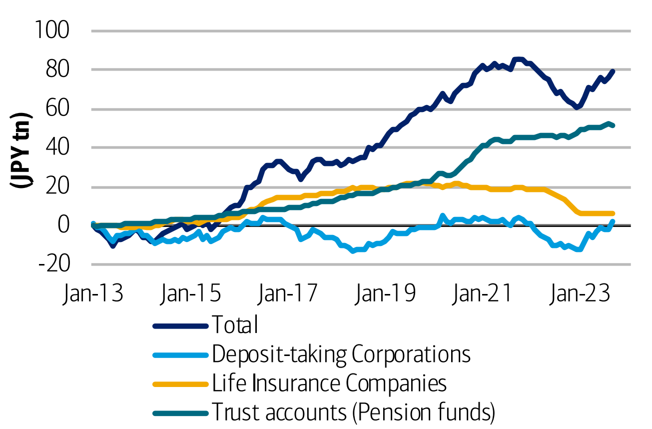
Japanese institutional investors' appetite for FX-hedged foreign bond investment is weak as JPY FX-Sofr basis has been deeply negative.

- **Pension funds**: Japanese institutional investors' foreign bond investments are mainly driven by pension funds' portfolio rebalances (Exhibit 14). Japanese pension funds treat FX-hedged foreign bonds as domestic bonds. Thus, Japanese pension funds' foreign bond investment is mainly without FX hedging.

- **Banks**: Japanese banks may not have a strong incentive to invest in foreign bonds. They may invest in US corporate bonds with FX hedges, but the pick-up in FX-hedged US Treasuries (USTs) over Japanese government bonds (JGBs) has been negative. Thus, we can say that Japanese banks are not enthusiastic about FX-hedged foreign bond investments. Despite this, Japanese banks keep investing in foreign bonds. There is an unusual divergence between their positioning and the market direction, with the banks going against their traditional trend-following behaviour. This may contribute to long-duration positioning in the US rates market even in a UST sell-off environment, for example in 2023 (Exhibit 15). Additionally, Japanese banks tend to borrow USD cash via the repo market and participate less in FX swap markets.

- **Life insurance companies**: Japanese life insurance companies reduced holdings of FX-hedged foreign bonds in 2022. Investment plans in this sector reveal that major lifers are waiting for further Bank of Japan (BoJ) policy normalisation and plan to increase superlong JGBs rather than foreign bonds since they no longer need to search for yield.

Exhibit 14: Cumulative outward bond investment by investor type
Japanese outward investment is driven by pension funds



Source: MoF, BofA Global Research

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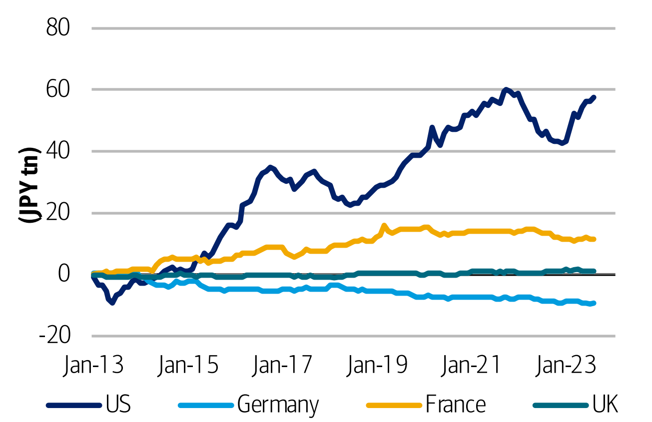
Exhibit 15: Cumulative outward bond investment by country
US has been the largest destination for Japanese outward bond investment



Source: MoF, BofA Global Research

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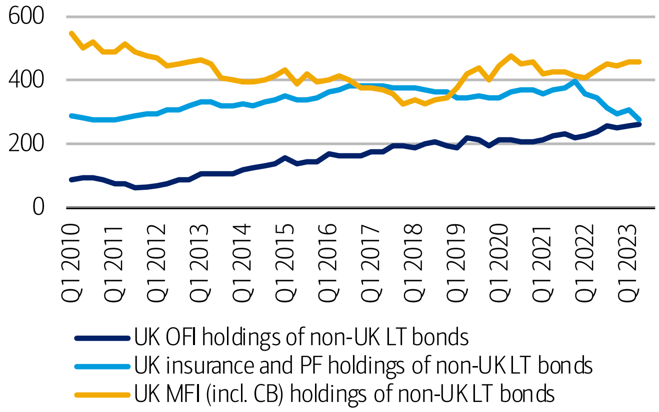
UK institutional investors

Holdings of non-UK debt securities by UK insurance and pension funds (PF) have been in decline since Q1 2022. Disposal of foreign long-term (LT) bonds was likely the result of Liability Driven Investment (LDI) funds raising cash to meet collateral calls in a rising yield environment. As of Q2 2023, insurance and pensions held around £277bn of non-UK long-term bonds, similar to the amount of other financial intermediaries' (OFI) holdings of foreign debt (Exhibit 16).

Exhibit 17 plots the historical pick-up of 10Y US Treasuries and US corporate bonds, FX hedged using the 1M GBPUSD FX swap, over Gilts. From 2016 to 2020, US Treasuries provided a FX hedged pick-up of as much as 160bp over Bunds; but the pick-up has recently turned negative. For US corporate bonds, their higher yields relative to 10Y US Treasuries meant the pickup generally stayed above Gilts on a similar FX hedged basis.

Exhibit 16: Holdings of foreign bonds by UK investors, £bn
UK insurance and pension fund holdings in decline since the start of 2022



Source: ONS, BofA Global Research

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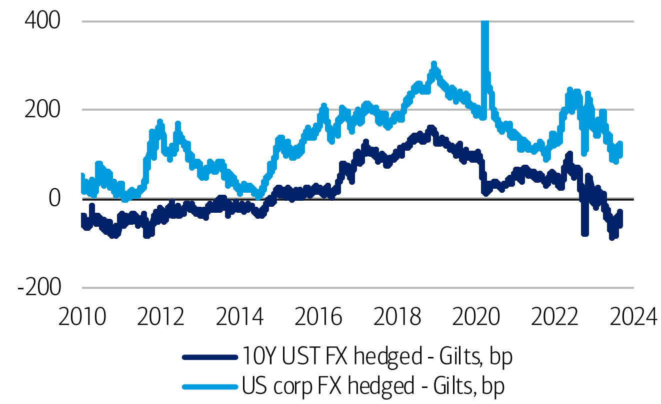
Exhibit 17: Pick up of FX hedged US bonds over Gilts
FX hedged US bonds can be attractive relative to Gilts



Source: Bloomberg, BofA Global Research

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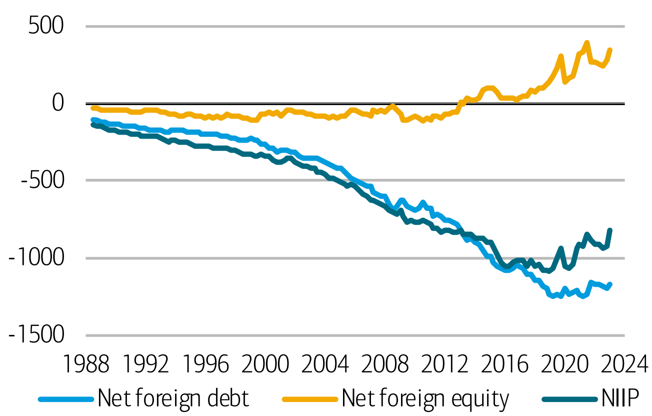
Australian institutional investors

The growth in Australian investors' non-AUD holdings accelerated over the past decade alongside faster growth in superannuation balances. Employers' minimum contribution to Australian employees' retirement accounts has increased since 2013, which will gradually rise to 12% of an employees' salary by 2025. Coupled with a substantial and, to an extent, unforeseen increase in the working population, an increase to guaranteed superannuation contributions has boosted superannuation system balances significantly.

Consequently, we have seen a meaningful turnaround in Australia's net international investment position over the past decade (Exhibit 18). Unanticipated fiscal surpluses and a robust trade surplus since 2021 also supported positive net debt and equity flows (i.e., excluding FX and valuation changes).

More recently, flatter curves in the US and Europe, along with higher FX hedging costs, has seen the percentage of assets held in core markets decline (Exhibit 19). For the superannuation system, non-AUD bonds as a percentage of total investments has fallen from its 2019 peak, which suggests most new flows have been directed to risk assets.

Exhibit 18: Australia's net international investment position, AUDbn
Rising superannuation balances have lifted non-AUD holdings



Source: BofA Global Research, Australian Bureau of Statistics (ABS)

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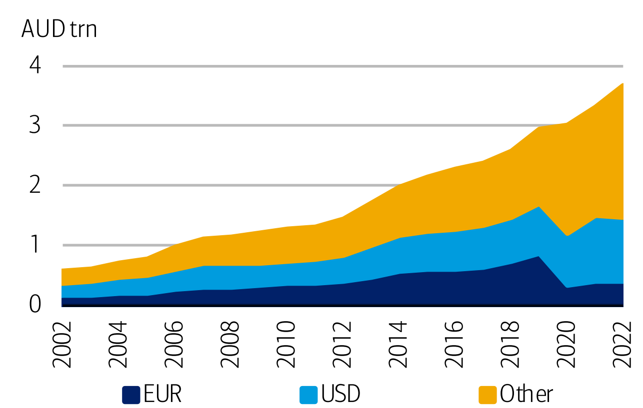
Exhibit 19: Foreign assets by destination
Superannuation system growth has supported diversification



Source: BofA Global Research, ABS

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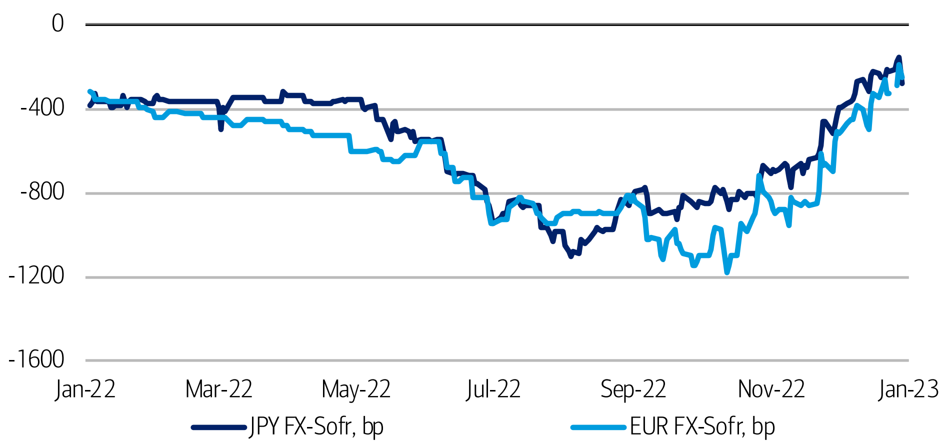
Regulatory requirements

Basel III rules established after the 2008 global financial crisis increased capital requirements for banks. Some of these requirements, such as the leverage ratio and surcharge for global systemically important banks (G-SIB), are a function of banks' total exposure. The FX-Sofr basis can be impacted by these requirements, especially for year-end, due to window dressing activities by banks on key reporting dates (Exhibit 20). These activities typically cause the FX-Sofr basis to **widen** as banks may charge a higher intermediation spread to justify any increase in cost from a larger balance sheet.

Exhibit 20: FX-Sofr basis priced for 2022 year-end turn, bp
Basis can widen meaningfully as market prepares for year-end



Source: BofA Global Research

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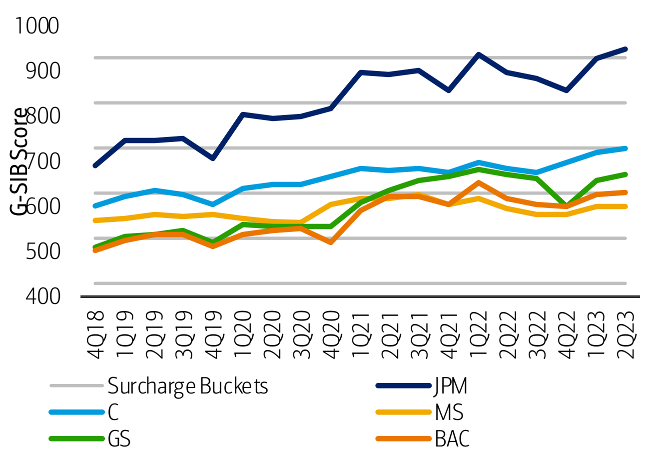
US banks

In the US, banks have an incentive to manage down their balance sheet and financial intermediation at year-end (Exhibit 21). This reflects a desire of US banks to reduce their G-SIB score, which is measured on an annual basis at year-end and takes into account of size, interconnectedness, and other factors. A higher G-SIB score would increase a bank's capital surcharge. Banks may also reduce their FX-Sofr market making activity as they seek to reduce their risk weighted asset (RWA) measures.

Exhibit 21: G-SIB score and surcharge buckets
Banks typically manage down their balance sheets in Q4



Source: BofA Global Research, FFIEC, Bloomberg

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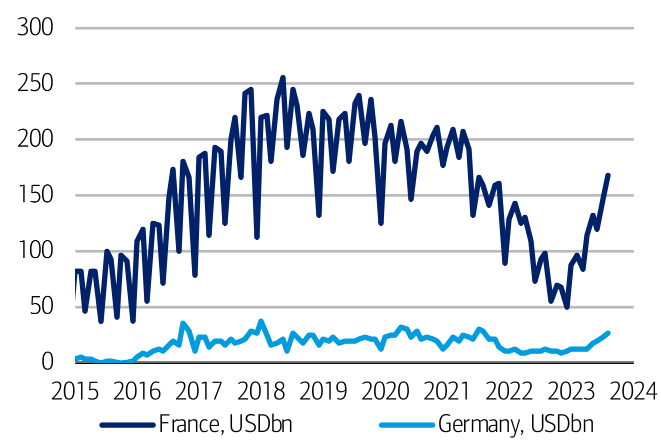
Exhibit 22: US MMF bank repo French and German counterparties
Strong pullback by French MMFs over key reporting dates



Source: Securities and Exchange Commission

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Euro area banks

Euro area banks have an incentive to reduce their balance sheet and financial intermediation due to leverage ratio requirements and G-SIB. The leverage ratio in the euro area is reported on a quarter-end basis and on a daily average basis; which is different from banks in the US that report their supplementary leverage ratio (SLR) on a daily average basis. This means there is still an incentive for euro area banks to conduct window dressing activities on reporting quarter-end dates.

One example is a pullback of USD lending by euro area banks on key reporting dates (Exhibit 22). Foreign banks, in particular French banks, play a role in facilitate USD cash lending by US money market funds (MMFs) and USD borrowers such as broker/dealers and hedge funds via offsetting repo trades.

Japanese banks

The leverage ratio in Japan is reported on a quarter-end basis. However, the leverage ratio for each Japanese bank is well above its requirement. Thus, Japanese banks do not have a strong incentive to conduct window dressing activities while reporting at quarter-end dates. Widening of JPY FX-Sofr basis during quarter-end and year-end are primarily driven by USD-related factors.

UK banks

The UK GSIB and leverage ratio rules are similar to the EU. The UK the Prudential Regulatory Authority (PRA) prohibit short-term balance sheet management to temporarily boost leverage ratios. The PRA requires firms to report all leverage templates on a quarterly basis, with a remittance of 42 calendar days.

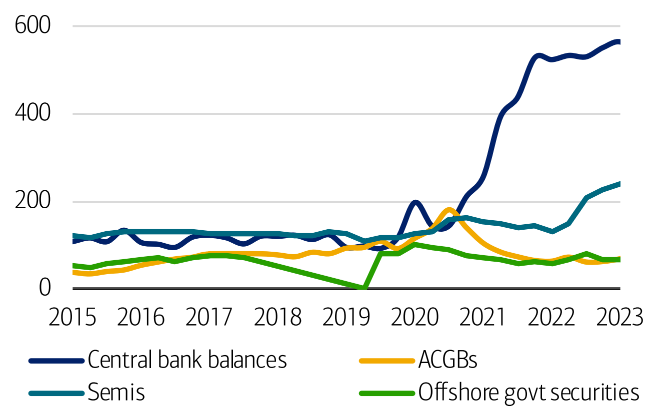
Australian banks

Australian banks issue around USD 100bn in term funding each year. Banks issue across the curve but typically aim to match the duration of Australian mortgages (around 5y) by issuing 3y-5y paper. In addition, banks maintain an active presence in the short end, taking advantage of unique depth in US money markets to plug any gaps in their liquidity requirements. The bulk of issuance is undertaken by Australian's four major banks, which also own the major banks in New Zealand. Banks ordinarily pay 6m-1y basis to hedge their money market issuance and 3y-5y basis to hedge their term funding.

Bank regulation in Australia minimises bank balance sheets' demand for non-AUD and non-government securities. The Australian Prudential Regulatory Authority (APRA) has restricted the definition of High Quality Liquid Assets (HQLA) that banks can hold to meet regulatory requirements. In Australia, APRA restricts banks operating in Australia to holding Australian Commonwealth Government Bonds (ACGBs) and semi-government bonds (semis) or cash/ central bank balances as HQLA for the purposes of meeting regulatory requirements like the Liquidity Coverage Ratio (LCR). As a result, these instruments are dominant in bank portfolios and there are few offshore assets to hedge (Exhibit 23).

Consequently, during periods of global stress when demand for USD typically rises, the opposite trend is typically visible in Australia and New Zealand. Demand for AUD and NZD rises as banks step up their short-term funding in deep capital markets abroad, which may lead to **tightening** of the AUD and NZD FX-Sofr basis, or dampen the magnitude of widening driven by global USD demand. The divergence between AUD/NZD basis and EUR/JPY basis during global banking stress in March 2023 is exemplary of this dynamic (Exhibit 24).

Exhibit 23: HQLA of Australia's banks, AUDbn
AU banks principally hold cash, semis and ACGBs



Source: BofA Global Research, APRA

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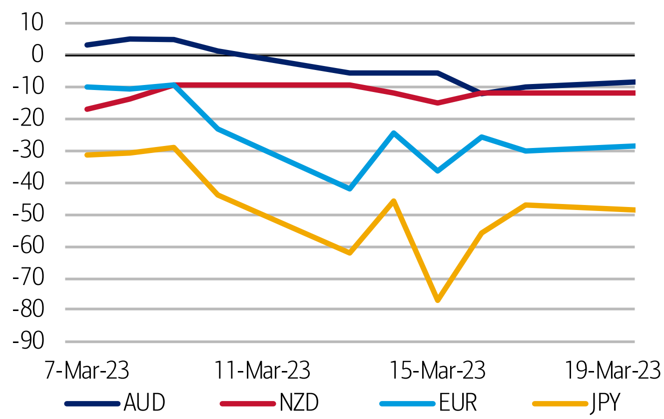
Exhibit 24: AU/ NZ 3m basis driven by bank paying in crises, bp
Banks tap US money markets in periods of funding stress



Source: BofA Global Research, Bloomberg

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US bank reserves

Changes in US bank reserves could impact the availability of USD funding from banks. All other things being equal, a surplus of US bank reserves would put **tightening** pressure on the FX-Sofr basis; whereas a shortage would put **widening** pressure on the FX-Sofr basis.

Bank reserves are a liability of the Federal Reserve. But it is not the only liability. If other non-reserve Federal Reserve liabilities are rising, it generally means that reserves are falling; and vice versa. Other Federal Reserve liabilities that may impact the level of bank reserves are: 1) the Treasury General (TGA), 2) the System Open Market Account (SOMA), and 3) the overnight reverse repo facility (ON RRP).

Treasury General Account

The TGA holds the Treasury's cash balance at the US Federal Reserve. This cash balance could be impacted by various factors, including net funds raised from US Treasuries and tax payment flows. A given net inflow into the TGA would typically be matched by a net outflow of equivalent magnitude from US banks' reserves putting widening pressure on the FX-Sofr basis; and vice versa. Market participants in FX-Sofr should be mindful of potential drivers of TGA, including US debt limit dynamics, mid-April tax date, quarterly corporate tax payment dates, and large US Treasury settlements or paydowns.

System Open Market Account

The SOMA is a portfolio of the US Federal Reserve that contains USD-denominated assets acquired by the US Federal Reserve through open market operations, as well as the Federal Reserve's foreign currency reserves. SOMA changes driven by USD-denominated assets could impact the level of bank reserves in the US. An increase in SOMA would typically increase bank reserves, i.e. when the US Federal Reserve buys Treasuries from banks or non-banks, which would put tightening pressure on the FX-Sofr basis; and vice versa. Quantitative tightening (QT) by the Federal Reserve is currently reducing SOMA size, which would typically place downward pressure on reserves over time / widening pressure on FX-Sofr.

Overnight reverse repo facility

The Fed's ON RRP facility is a supplementary tool to prevent the effective Federal Funds Rate (EFFR) from trading below the bottom of the 25bp target range. It can be thought of as an investment option of last resort for eligible counterparties that cannot earn the interest on reserve balance (IORB). An ON RRP eligible counterparty would only invest with the Federal Reserve if there were no other readily available higher yielding alternative investments.

The ON RRP facility means that changes in SOMA may not necessarily have a one-for-one relationship with bank reserves. A higher ON RRP balance generally implies more excess liquidity in the system and lower money market rates, including tighter FX-Sofr basis; and vice versa. QT by the Federal Reserve has recently been meaningfully reducing the ON RRP balance. Pressure on money market would be clearer and widening pressures on FX-Sofr would be more evident as the ON RRP balance reaches near zero.

Bank treasuries and dealers

Short-term liquidity needs

Bank treasuries may use FX swap markets to manage short-term liquidity needs. Such transactions are typically conducted at the very front-end of the curve. The impact on the FX-Sofr basis would depend on the currency of the liquidity needed.

For example, if banks need to raise short-term EUR funds using USD, then these could involve buy/sell EURUSD FX swap and put **tightening** pressure on the EUR FX-Sofr basis. On the other hand, if banks need to raise short-term USD funds using EUR, then these could involve sell/buy EURUSD FX swap and put **widening** pressure on the EUR FX-Sofr basis.

Foreign banks in the US may turn to the FX swap market for USD funding if market conditions are difficult for them to raise US dollars via CP issuance in the US. Previous declines in foreign financial CP outstanding have been associated with widening of the EUR FX-Sofr basis (Exhibit 25).

Arbitrage between different repo markets

Dealers, such as bank treasuries and repo desks, may find arbitrage opportunities between different repo markets.

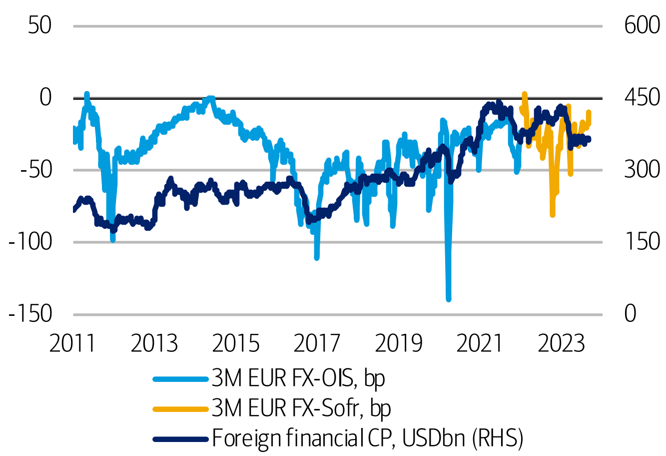
In the case of potential arbitrage opportunities between US and Euro repo markets, participants may consider borrowing EUR collateral in the EUR repo market, swapping their EUR collateral for USD collateral, lend the USD collateral for USD cash via the repo market, and then conduct a buy/sell EURUSD FX swap to raise EUR funds to lend against the EUR collateral it initially received (Exhibit 26).

Such transactions would in part take advantage of the USD premium in the FX swap market, and relatively high repo rates in the euro area when compared with the US. These transactions could put **tightening** pressure on the EUR FX-Sofr basis. The extent to which these transactions are placed is also a function of the fee charged in the swap between EUR and USD collateral, and the US and EUR repo rate.

Conversely, if US repo rates were relatively high vs Euro repo rates and the USD premium in the FX swap market was sufficiently low, then the flows could be reversed. The associated arbitrage flows may then put **widening** pressure on the EUR FX-Sofr basis.

Exhibit 25: Foreign financial CP and FX-Sofr basis

Difficulty in raising USD via CP may prompt USD borrowing via FX swaps



Source: BofA Global Research, Bloomberg

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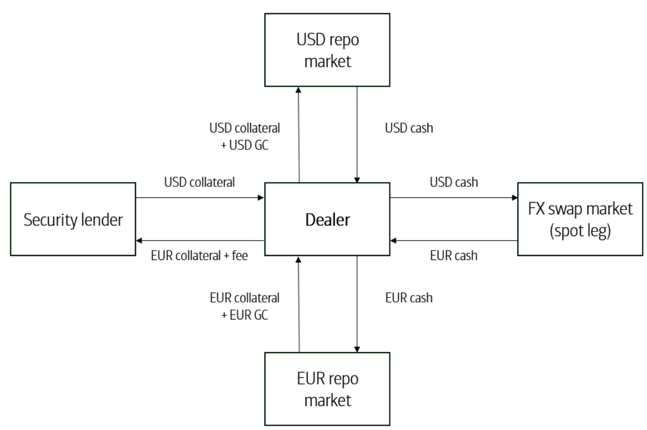
Exhibit 26: Mechanics of arbitrage between repo markets

Increase in activity could put tightening pressure on FX-Sofr basis



Source: BofA Global Research

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Reserve managers' cash deposits

Central banks may allow foreign reserve managers to deposit cash with them. The extent to which foreign reserve managers deposit cash at central banks is arguably a function on the respective remuneration rate on such deposits.

For reserve managers that primarily hold USD, this may involve use of FX swaps to raise the local currency to deposit local currency cash with a central bank outside the US. A very negative FX-Sofr basis, which would imply high USD premium in the FX swap market, may also increase the attractiveness of raising such local currency to deposit at the local central bank than comparable USD assets. Such flows would put **tightening** pressure on the FX-Sofr basis.

Conversely, if remuneration rates offered by local central banks were less than that offered by comparable USD assets, reserve managers invested in non-USD assets may reallocate towards USD assets. If such reallocation involved FX swaps for currency conversion, this would put **widening** pressure on the FX-Sofr basis.

Selected developed central banks that allow deposits from foreign central banks and/or reserve managers:

- US Federal Reserve: foreign reverse repo facility. Remuneration rate is generally equivalent to the overnight reverse repo rate.
- Eurosystem: reserve management service. Remuneration rate not disclosed, but generally assumed to be close to the remuneration rate on domestic government deposits.
- Bank of Japan: banking and Custody Services. Remuneration rate is decided by the BoJ based on the prevailing market rate for sale of Japanese government securities under repurchase agreement less 5bp. If, however, the Counterparty Central Banks request 0.0% to be applied, then the rate shall be 0.0%.
- Bank of England: term deposits from central bank customers to support sterling as a global reserve currency and the reserve management requirements of other central banks are placed on a secured basis. The renumeration rates are not disclosed.
- Reserve Bank of Australia: foreign central banks and reserve managers cannot place deposits with the Reserve Bank of Australia.
- New Zealand: foreign central banks and reserve managers cannot place deposits with the Reserve Bank of New Zealand.
- Bank of Canada (BoC): Canadian-dollar cash accounts. Allows foreign central banks and official international financial organizations to deposit Canadian-dollars at a rate equivalent to the BoC overnight deposit rate.

Central bank US dollar liquidity swap lines

USD liquidity swap lines between central banks help to ease strains in cross currency funding markets. These swap lines give foreign central banks the capacity to deliver USD funding to institutions in their jurisdiction and provide a backstop for USD funding by helping to fulfil increased USD demand. For the FX-Sofr basis, this would imply **a reduction in widening** pressures.

Exhibit 27 illustrates usage of central bank dollar liquidity swap lines by the ECB with simplified balance sheets:

- Step 1: swap line used. The Federal Reserve conducts an FX swap with the Eurosystem. The increase in the Federal Reserve's assets in the form of EUR reserves at the Eurosystem is matched by an increase in liabilities in the form of USD reserves to the Eurosystem. Similarly, for the Eurosystem, their assets increase in the form of USD reserves at the Fed matched by an increase in liabilities in the form of EUR reserves to the Federal Reserve.

- Step 2: transfer of USD by the Eurosystem to European bank. The Eurosystem instructs the US Federal Reserve to transfer the USD reserves to a US bank. This US bank is typically an affiliate of the European bank and has an account with the Federal Reserve. The European bank then has a cross border claim on the USD at the US bank (i.e. its US-based affiliate), which is matched by a USD liability to the Eurosystem.

Exhibit 27: Illustration of balance sheet changes from usage of central bank dollar liquidity swap lines

Two broad steps typically taken to provide USD funding to local jurisdictions via swap lines

	Federal reserve		Eurosystem		US bank (typically an affiliate of the European bank)		European bank	
	Assets	**Liabilities**	**Assets**	**Liabilities**	**Assets**	**Liabilities**	**Assets**	**Liabilities**
1. Swap line used	+ EUR reserves at Eurosystem	+ USD reserves to Eurosystem	+ USD reserves at Fed	+ EUR reserves to Fed				
2. Transfer of USD to European bank		- USD reserves to Eurosystem + USD reserves to US bank	- USD reserves at Fed + USD claim on European bank		+ USD reserves at Fed	+ USD due to European bank	+USD claim on US bank	+ USD due to Eurosystem
Net position	+ EUR reserves at Eurosystem	+ USD reserves to US bank	+ USD claim on European bank	+ EUR reserves to Fed	+ USD reserves at Fed	+ USD due to European bank	+USD claim on US bank	+ USD due to Eurosystem

Source: BofA Global Research

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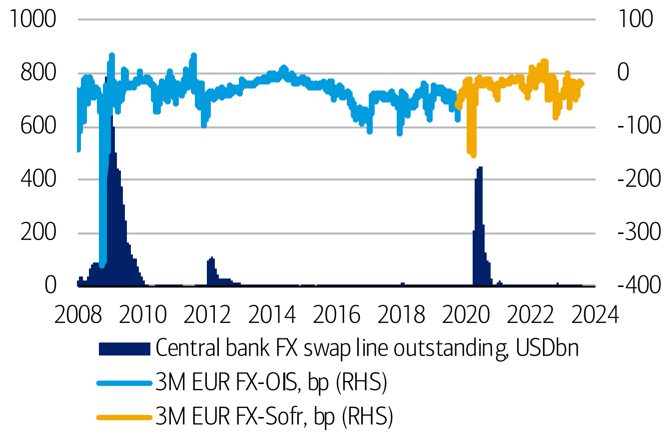
Use of these facilities is typically near zero, but has risen in the past during periods of increased USD demand: the 2008 global financial crisis, the European sovereign debt crisis, and the Covid-19 crisis (Exhibit 28). Outside crisis times, these USD swap lines are unlikely to have a large impact on funding markets due to their short tenor, costs, and potentially negative stigma.

The Federal Reserve has standing swap lines with the Bank of Canada, Bank of England (BoE), Bank of Japan, European Central Bank (ECB), and Swiss National Bank (SNB). These swap lines are unlimited in size and the rate is currently OIS + 25bp, although there is also a collateral haircut applied by the local central bank that does the FX swap with the US Federal Reserve. These haircuts vary by central banks but could add to the cost of tapping the USD liquidity swap lines.

In response to March 2020 market illiquidity, the US Federal Reserve established temporary swap lines with nine other central banks. These other central banks can use the swap lines in USD 30bn or USD 60bn amounts, depending on the bank. Most recently, the BoJ and ECB have been the largest users of the FX swap lines (Exhibit 29). The latest usage can be tracked via the Bloomberg tickers in Exhibit 30.

Exhibit 28: 3M EUR FX-OIS/Sofr and central bank USD swap line usage
Usage of swap lines alleviated widening pressure on basis



Source: BofA Global Research, Bloomberg, Federal Reserve

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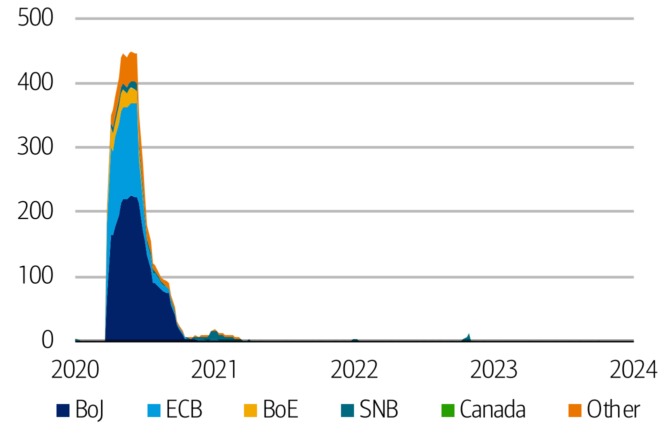
Exhibit 29: Central bank swap line breakdown, USDbn
The ECB and BoJ have been the largest users of swap lines in 2020



Source: Federal Reserve

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Exhibit 30: Federal swap lines and Bloomberg tickers
Tracking usage of central bank swap lines

Central bank	Bloomberg ticker for usage
Total	FESLTOTL Index
Active	
BoE	FESLBOE Index
SNB	FESLSNB Index
ECB	FESLECB Index
BoC	FESLBOC Index
BoJ	FESLBOJ Index
Expired	
Banco de Mexico	FESLMXCO Index
Monetary Authority of Singapore	FESLSING Index
RBNZ	FESLBONZ Index
Banco Central Do Brasil	FESLBRAZ Index
Danmarks National Bank	FESLDNM Index
Bank of Korea	FESLKORE Index
Norges Bank	FESLNB Index
RBA	FESLRBA Index
Riksbank	FESLSRB Index

Source: BofA Global Research, Bloomberg

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