

Commentary: Mind the Gap in Sovereign Debt Markets: The U.S. Treasury Basis and the Dollar Risk Factor

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I. Introduction

Arvind Krishnamurthy and Hanno Lustig have written an excellent paper on an extremely timely and important topic. The topic of the paper is on the “global financial cycle,” a term that has gained increasing prominence since H el ene Rey’s influential Jackson Hole paper in 2013. Rey focused on the global financial cycle in capital flows, asset prices and credit growth and considered the VIX index as a key risk barometer in global capital markets. In recent years, a growing body of work has been examining the role of the U.S. dollar in affecting the global financial cycle. This is the starting point of Krishnamurthy and Lustig’s paper: The global financial cycle is, in part, a global dollar cycle. The key contribution of the paper is to build a conceptual framework and a coherent empirical narrative to support the view that the global demand for dollar-denominated safe assets is a key driver of the global dollar cycle.

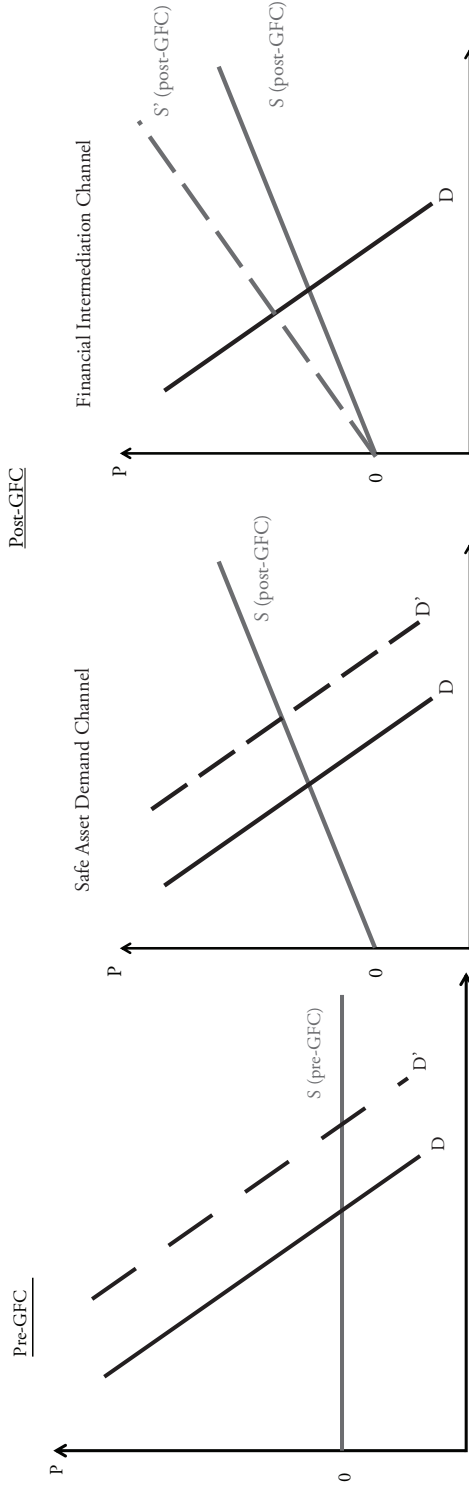
I fully agree that fluctuations in the dollar exchange rate are correlated with global financial conditions, and I also agree with Krishnamurthy and Lustig’s insights from the paper that the global dollar cycle in part operates through the dollar safe asset demand channel. However, in my remarks, I would like to highlight an equally

important and complementary channel for the global dollar cycle after the global financial crisis (GFC), which I refer to as the “financial intermediation channel.” Under the financial intermediation channel, balance sheet capacity of global financial intermediaries drives the price of dollar liquidity and the supply of dollar credit, which in turn affects global financial conditions more generally.

The relationship between the dollar safe asset demand channel and the financial intermediation channel can be seen in Chart 1, where I draw supply-demand diagrams for global dollar funding. The price of global dollar funding on the vertical axis is measured in terms of the “specialness” of the dollar funding relative to other currencies on the currency-hedged basis, an empirical observable in the financial market that I will explain later in my remarks. The quantity of global dollar funding is plotted on the horizontal axis. The safe asset demand channel is about shifters to the demand curve in the diagram (shown in black), because an increase in the demand for dollar assets is naturally accompanied by an increase in demand for dollar funding and hedging services. The financial intermediation channel is about shifters to the supply curve in the diagram (shown in gray). One important observation is that, pre-GFC, the supply curve was flat with the dollar funding specialness equal to zero at all times, regardless of demand shifters. Post-GFC, however, the supply curve becomes upward sloping: Dollar funding specialness increases with the quantity of dollar funding supplied. When the supply curve was flat pre-GFC, the supply of dollar funding by financial intermediary was unconstrained, and the financial intermediation channel was absent. Once the supply curve becomes upward sloping post-GFC, a feature that financial intermediaries are constrained, the financial intermediation channel is at work. Shifters to the supply curve result in fluctuations in the equilibrium price and quantity of dollar funding.

With this analytical framework in mind, the rest of my remarks are organized into three parts. First, I will discuss the relationship between the Treasury basis, the key variable of interests in Krishnamurthy and Lustig’s paper, and the Libor basis, a measure of dollar funding specialness. Second, I present empirical evidence supporting the view that these bases, or covered interest rate parity (CIP)

Chart 1
Supply and Demand for Global Dollar Funding



Notes: This figure shows supply-demand diagrams for global dollar funding. The price of dollar funding on the vertical axis P is measured as the magnitude of CIP deviations based on Libor. The quantity of dollar funding is shown on the horizontal axis. The supply curve was flat pre-GFC, and becomes upward sloping post-GFC.

deviations, in part reflect intermediary constraints. Third, I discuss that these CIP deviations pose unique challenges for monetary policy in the post-GFC environment and then conclude.

II. Treasury and Libor Basis

I first discuss how we measure the dollar funding specialness. The answer is that we measure it using CIP deviations for some bank rates, say Libor. I use the word “Libor” loosely to refer to benchmark interest rates faced by banks, especially large global banks. Why do we look at bank rates in particular? Going back to the textbook CIP condition, which is a no-arbitrage condition that requires dollar interest rates in the cash market equal dollar interest rate implied from the foreign exchange (FX) swap market. If the CIP deviation fails for bank rates, then there exists an arbitrage opportunity for banks to borrow at the lower rate and invest at the higher rate, with the foreign exchange rate risk fully hedged. The fact the CIP deviations exist and persist for banks highlight constraints faced by banks in doing the arbitrage.

If banks are constrained, then the Libor CIP condition can fail. The Libor basis measures deviations from the CIP condition for Libor. Taking the Japanese yen as an example, the Libor basis is given by

$$x_t^{Libor} = y_t^{Libor,\$} - (y_t^{Libor,\yen} - \rho_t^{\$/\yen}),$$

where $\rho_t^{\$/\yen} \equiv f_t^{\$/\yen} - s_t^{\$/\yen}$ is the dollar/yen forward premium equal to the log forward minus the log spot exchange rate, which measures the cost of swapping yen into dollars. A negative Libor basis implies that the U.S. dollar funding is special, as it is more expensive to obtain dollar funding by swapping from yen funding than obtaining the dollar funding directly. For offshore market participants without ready access to direct dollar funding, a more negative Libor basis corresponds to a higher cost of dollar funding from the FX swap markets. The magnitude of the Libor basis is an empirical observable for the price of global dollar funding we use in the supply–demand diagrams in Chart 1.

The U.S. Treasury basis examined in Krishnamurthy and Lustig’s paper measures deviations from the CIP condition for Treasury yields. Again, taking Japan as an example, the Treasury basis is given by

$$x_t^{Treas} = y_t^{Treas,\$} - (y_t^{Treas,\yen} - \rho_t^{\$/\yen}).$$

A negative Treasury basis indicates the specialness of the U.S. Treasury relative to the Japanese government bond in the sense that investors are willing to forgo some extra yields to hold U.S. Treasury securities, compared with holding the Japanese government bonds swapped into U.S. dollars. If we compare across the expressions for Libor and Treasury basis, we can see that the same FX forward premium, $\rho_t^{\$/\yen}$, which is offered by banks subject to banks' balance sheet constraints, also shows up in the definition for Treasury basis. Therefore, it is not possible to ignore the role of banks when we talk about Treasury basis.

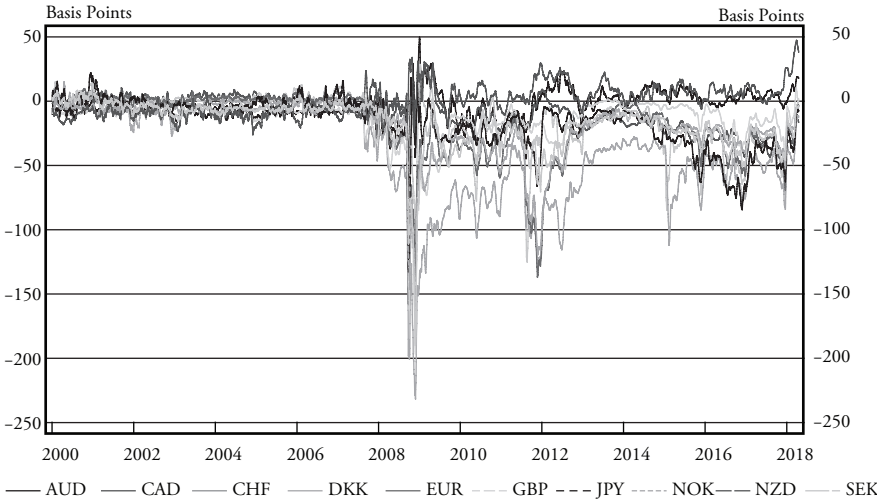
The Treasury and Libor basis are closely related. We can decompose the Treasury basis into the sum of the Libor basis and the difference in the government bond-Libor interest rate swap spread between the United States and Japan:

$$x_t^{Treas} = x_t^{Libor} + ss_t^{\$/\yen},$$

where $ss_t^{\$/\yen} \equiv (y_t^{Treas,\$} - y_t^{Libor,\$}) - (y_t^{Treas,\yen} - y_t^{Libor,\yen})$ is the relative Treasury-swap spread differential. In other words, we can view the Treasury basis, or the specialness of the U.S. Treasury, as the sum of the specialness of dollar funding (a term that should be close zero if banks were unconstrained), and how much extra special the U.S. Treasury is relative to dollar funding.

As shown in Du, Tepper and Verdelhan (2018), the persistence of dollar funding specialness is a new phenomenon after the GFC. Chart 2 plots the three-month Libor basis, which was very close to zero for all major currencies pre-GFC and has been nonzero since the GFC and sizable in magnitude. Furthermore, as shown in Avdjiev, Du, Koch and Shin (forthcoming) with the key figure of the paper reproduced in Chart 3, the Libor basis is highly correlated with the dollar exchange rate post-GFC. A stronger dollar corresponds to wider Libor CIP deviations, or a more negative Libor basis. These empirical findings support the analytical framework I presented in Chart 1 in the sense that the supply of global dollar funding was perfectly elastic and unconstrained pre-GFC and became constrained

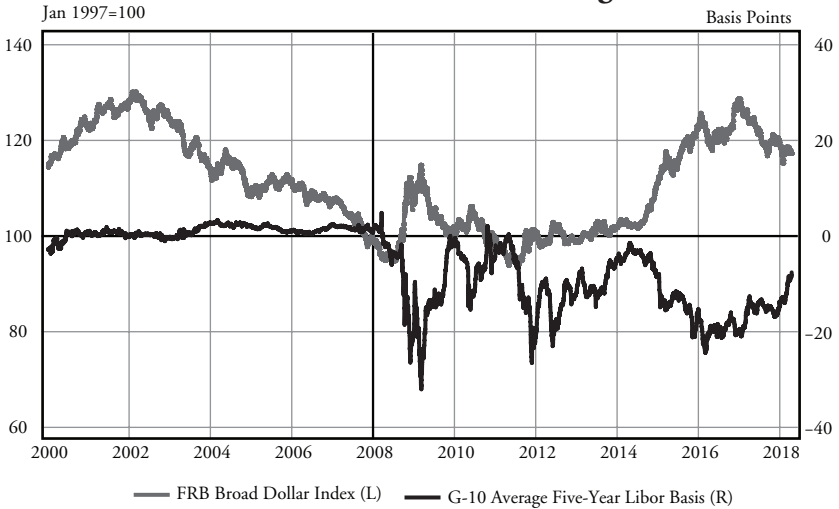
Chart 2 Three-Month Libor Cross-Currency Basis



Note: This chart plots two-week moving averages of the three-month Libor cross-currency basis against major currencies.

Source: Du, Tepper and Verdelhan (2018).

Chart 3 Libor Basis and the Dollar Exchange Rate



Note: This chart plots the Federal Reserve Board broad dollar index (in gray) and the average five-year Libor cross-currency basis against G-10 currencies (in black).

Source: Avdjiev, Du, Koch and Shin (forthcoming).

after the GFC. The price of the dollar liquidity measured by the magnitude of the Libor CIP deviation is equal to zero pre-GFC and waxes and wanes with the dollar cycle post-GFC.

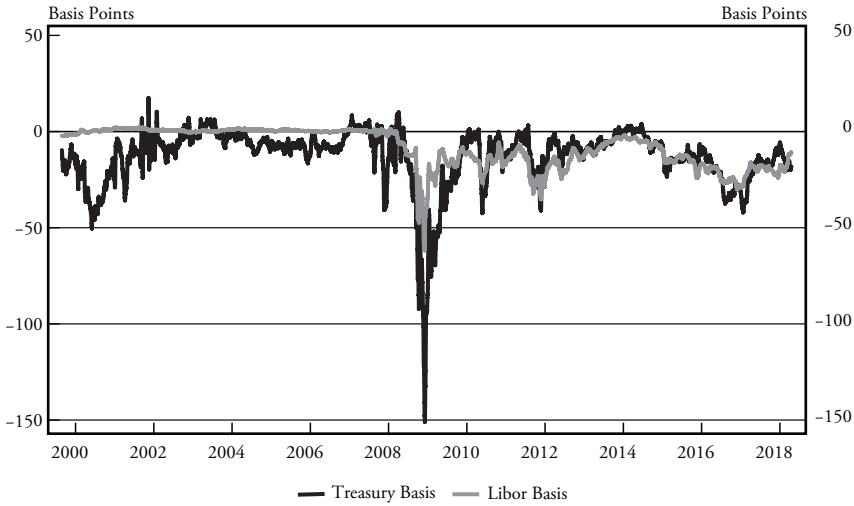
How about the Treasury basis? Chart 4 shows a comparison between the one-year average Libor and Treasury basis against G-10 currencies. Pre-GFC, the Treasury basis was nonzero, despite the fact that the Libor basis was zero. This comparison suggests that the safe asset demand channel could be at work in the absence of the financial intermediation channel. However, post-GFC, the Treasury basis closely tracks the Libor basis at short maturities. In order to fully account for the dynamics of the global dollar cycle, we have to pay close attention not just to global investors and issuers of dollar-denominated assets, but also to global financial intermediaries.

III. CIP Deviations and Financial Intermediary Capacity

CIP deviations reflect not only global dollar asset demand, but also financial intermediary capacity. Balance sheet constraints of financial intermediaries, which can be both self-imposed or regulatory in nature, limit the size and exposure that can be taken to narrow CIP deviations. Under the financial intermediation channel, rather than thinking about these cross-currency bases as a “convenience yield” on dollar assets, we can think about them as an “intermediation fee” earned by financial intermediaries for intermediating global dollar funding. Furthermore, these fees are equal to the shadow cost of the balance sheet constraints associated with these dollar intermediation activities.

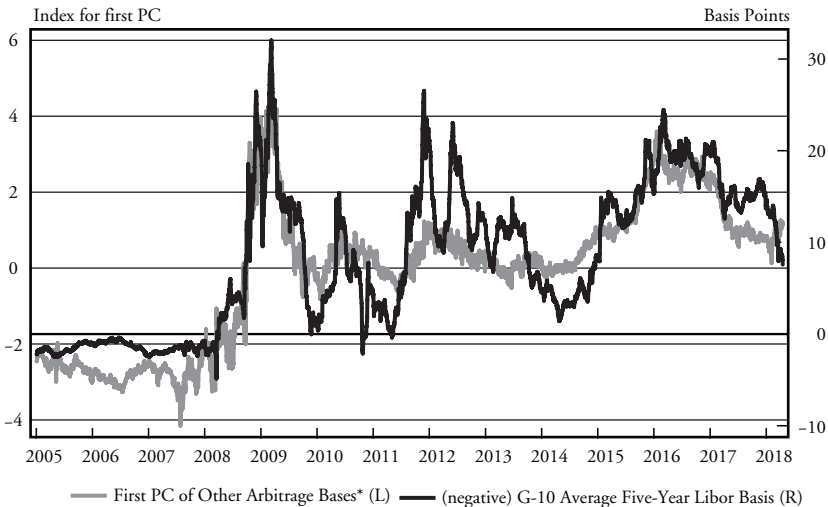
Intermediary constraints, if present, should affect many financial markets beyond the dollar funding markets. Following an exercise done by Du, Hébert and Huber (2019) in Chart 5, we plot the average Libor CIP deviations against G-10 currencies, together with the first principal component of several other near-risk-free arbitrage bases, including the bond-CDS basis, the CDS-CDX basis, the 30year Treasury-swap spread, Libor tenor basis and the U.S. Treasury futures implied repo rate over the overnight index swap rate. We can see that Libor CIP deviations and the common component of the other arbitrage bases follow broad similar trends. Since the demand shocks to each of these arbitrage bases are rather distinct, the

Chart 4 G-10 Average One-Year Libor and Treasury Basis



Note: This chart plots the average Libor basis and Treasury basis against G-10 currencies.
Source: Du, Im and Schreger (2018).

Chart 5 Libor Basis and First Principal Component of Other Arbitrage Bases



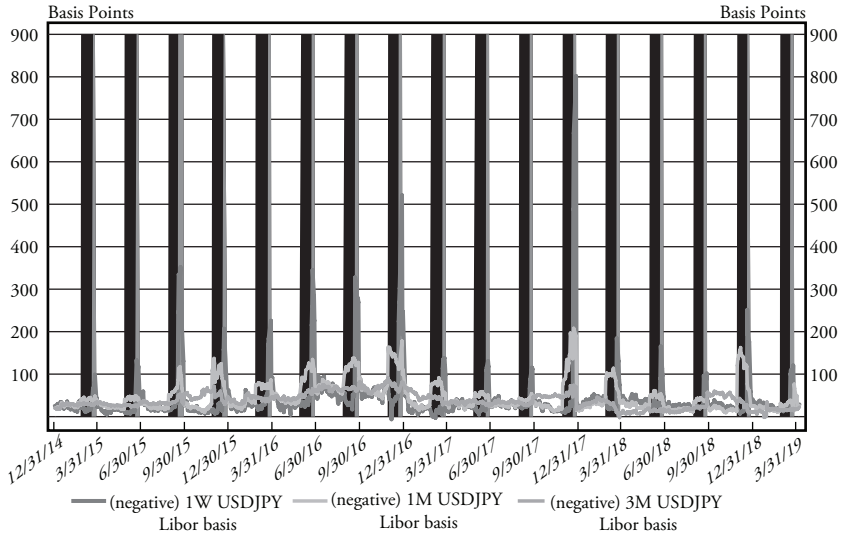
Notes: This chart plots the negative value of the average five-year Libor cross-currency basis against G-10 currencies, and the first principal component of five other arbitrage bases, including the five-year bond-CDS basis, the five-year CDS-CDX basis, the five-year one-month versus three-month Libor tenor basis, the 30-year Treasury-interest rate swap spread, and the 10-year Treasury note implied repo rate over the overnight index swap rate.
Source: Du, Hébert and Huber (2019).

co-movement between the CIP deviations and the common component of other arbitrage bases likely reflect the correlated supply shocks due to variations in financial intermediary capacity.

More specifically, global banks lie at the center of global capital markets. Constraints on the leverage and the composition of the bank balance sheet post-GFC crisis have direct effects on the level of CIP deviations. I first discuss the effect of the constraint on the size and leverage of the bank balance sheet. One direct way for global banks to narrow CIP deviations is to borrow dollars directly in the cash market at the lower rate and lend dollars in the FX swap market at the higher rate. Even though such a position entails very little risk, it expands the size of the bank balance sheet and makes the leverage ratio requirement more binding. Therefore, constraints on the leverage of bank balance sheets limit these arbitrage and intermediation activities. The pricing and quantity effects of these constraints is best illustrated through the quarter-end dynamics in CIP deviations. As documented in Du, Tepper and Verdelhan (2018), shown in Chart 6, the CIP deviations for positions that appear on the quarter-end bank balance sheets are significantly larger than the ones that do not appear on the quarter-end balance sheets.¹

The underlying reason for these quarter-end patterns is that key regulatory ratios, such as the Basel III leverage ratio, have been largely based on the quarter-end snapshot of bank balance sheets in non-U.S. jurisdictions. As a result, non-U.S. banks significantly deleverage on quarter-ends in order to have more favorable regulatory ratios. In Chart 7, reproduced from Anderson, Du and Schlusche (2019), we plot the time series for the unsecured short-term wholesale dollar funding outstanding based on the fed funds market and the U.S. commercial paper market, as well as the eurodollar and certificate-of-deposit markets for U.S. banks and foreign banking organizations in the United States. In addition, we also plot secured dollar funding outstanding from the U.S. triparty repo market. From these two plots, we can see clear deleveraging on quarter-ends among non-U.S. banks in terms of total wholesale dollar funding outstanding.² Non-U.S. banks play a key role in global dollar intermediation. As they withdraw their dollar intermediation activities on quarter-ends, the quarter-turn premium in the price of dollar funding begins to appear.

Chart 6
Quarter-End Dynamics in Libor CIP Deviations

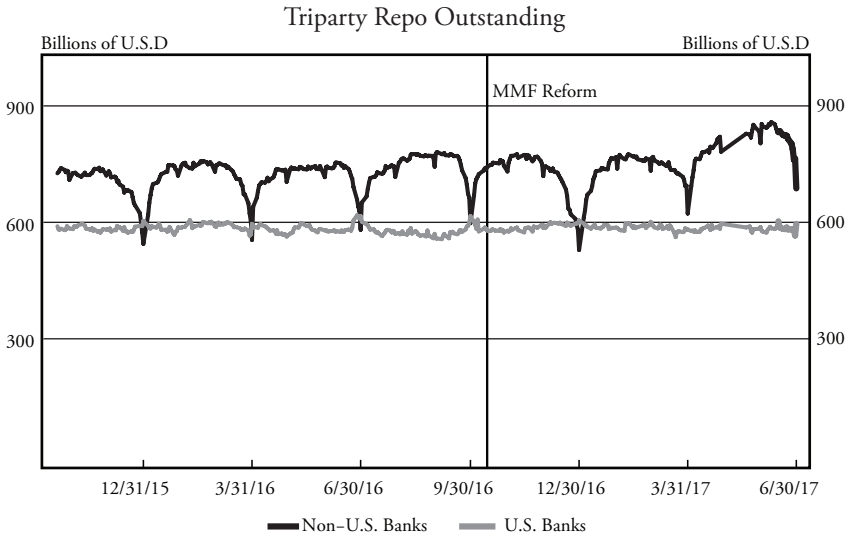
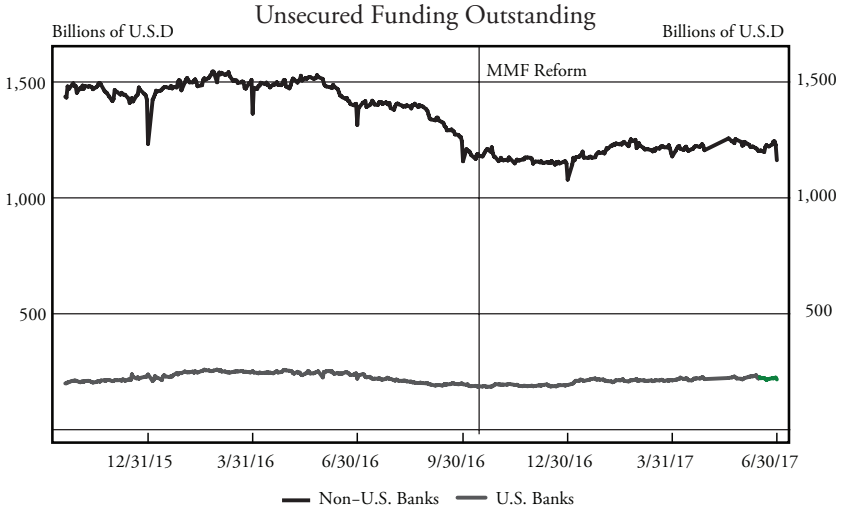


Notes: This chart plots the negative of the one-week, one-month and three-month USDJPY Libor cross-currency basis, respectively. The gray area denotes one week before the end of the quarter and the black area denotes one month before the end of the quarter.

Source: Du, Tepper and Verdlehan (2018).

Furthermore, beyond balance sheet leverage constraints, banks face additional constraints on the composition of bank balance sheets. We note that global banks can support additional dollar lending in the FX swap market by reducing their existing holdings of dollar cash assets and increasing their holdings of non-dollar cash assets, while holding the total size of the balance sheet constant. We illustrate constraints on the composition of bank balance sheet through the pricing and allocation of excess reserves balances across major central banks. Under unconventional monetary policy post-GFC, global banks have accumulated large amounts of excess reserves in all major currencies. Reserve balances at major central banks have the same regulatory treatment under the Basel III liquidity coverage ratio (all considered level-1 high quality liquid assets). Moreover, among all of the available safe assets, reserve balances are the most liquid and easiest to move around. However, we note that even though the European Central Bank (ECB) and the Bank of Japan (BOJ) have negative deposit rates on excess reserve balances, the euro and yen central bank deposit rates swapped into dollar terms are significantly

Chart 7
Wholesale Dollar Funding Outstanding for U.S.
and Non-U.S. Banks



Notes: The top panel plots the unsecured dollar wholesale funding outstanding for U.S. and non-U.S. banks, including instruments from the fed funds market, the U.S. commercial paper market and the euro-dollar (ED) market, and the certificate of deposits (CD) market. The ED and CD data are only collected for U.S. banks and foreign banking organizations in the United States. The bottom panel plots the U.S. triparty repo outstanding for U.S. and non-U.S. banks.

Sources: Anderson, Du and Schlusche (2019).

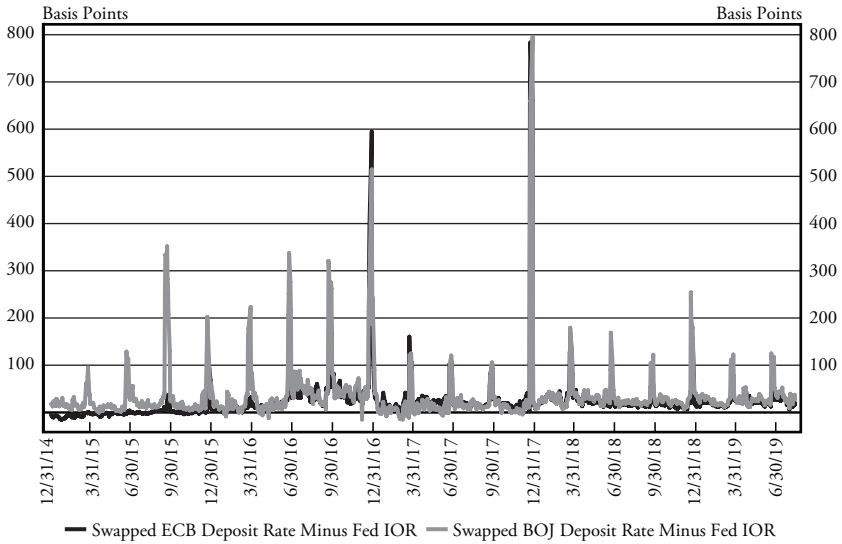
more attractive than interest rates on excess reserves at the Fed in recent years (shown in Chart 8). In addition, the quarter-end premium in the CIP deviations for interests on excess reserves is just as significant as in the Libor CIP deviations, and can easily go up to a few percentage points.

Despite the large quarter-end premium, in ongoing work, Correa, Du, Liao and Pettit (2019) document limited quarter-end rebalancing of excess reserve balances across major central banks among the largest U.S. banks, the globally systematically important banks in the United States (U.S. GSIBs). U.S. GSIBs are the most natural intermediaries for global dollar funding because of their access to a broad dollar deposit base and their high levels of dollar excess reserve balances. Chart 9 shows that on an average quarter-end over the past few years, U.S. GSIBs reduce their dollar reserves by about \$50 billion and increase their euro and yen reserves by less than \$10 billion each. These numbers actually overstate the extent of cross-currency safe asset rebalancing on quarter-ends, because the changes in reserve balances are partly offset by changes in the reverse repo positions in the respective currency. When we compare these changes to about \$1 trillion average combined reserve balances in dollars, euros and yen in recent years, this observed quarter-end reallocation of excess reserves is rather limited. Why are not U.S. GSIBs rebalancing their reserve balances more aggressively on quarter-ends when facing with a few percentage point risk-free return differentials? One key reason is that regulatory and self-imposed liquidity requirements exist, which require U.S. GSIBs to hold liquidity in entities and jurisdictions where the bank has significant operations, i.e., inside the United States.

IV. Challenges for Monetary Policy and Conclusions

Regarding the theme of this year's symposium, the persistence of CIP deviations poses unique challenges for the external transmission of monetary policy post-GFC. The Fed targets the overnight fed funds rate, which then passes through into other U.S. dollar interest rates in the cash market. As shown in Chart 10, the offshore dollar funding costs implied from FX swaps coincide with the dollar

Chart 8 CIP Deviations for Interests on Excess Reserves



Notes: This chart plots the spread between the swapped ECB deposit rate in dollars over the interest rate on reserves (IOER) at the Fed (in black), and the spread between the swapped BOJ deposit rate in dollars over the IOER at the Fed (in gray). The one-week FX swap rates are used in the calculations.
 Sources: Bloomberg and author's calculations.

Chart 9 Quarter-End Changes in Excess Reserve Balances for U.S. GSIBs

Reserves: U.S. dollar

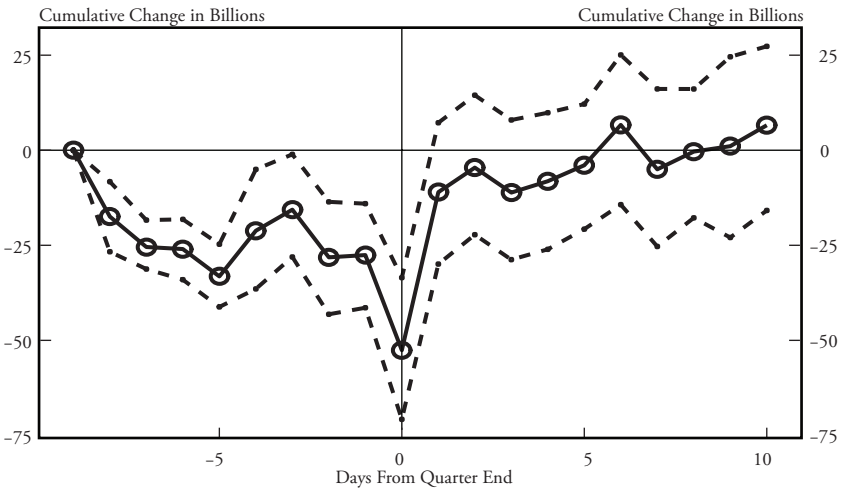
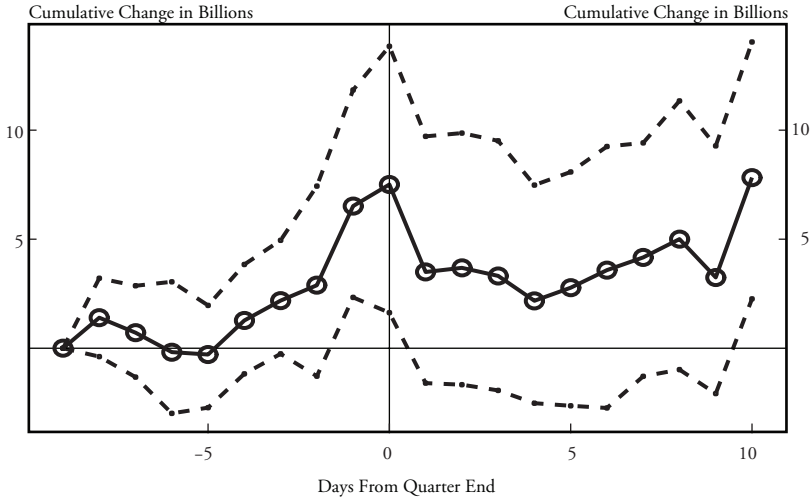
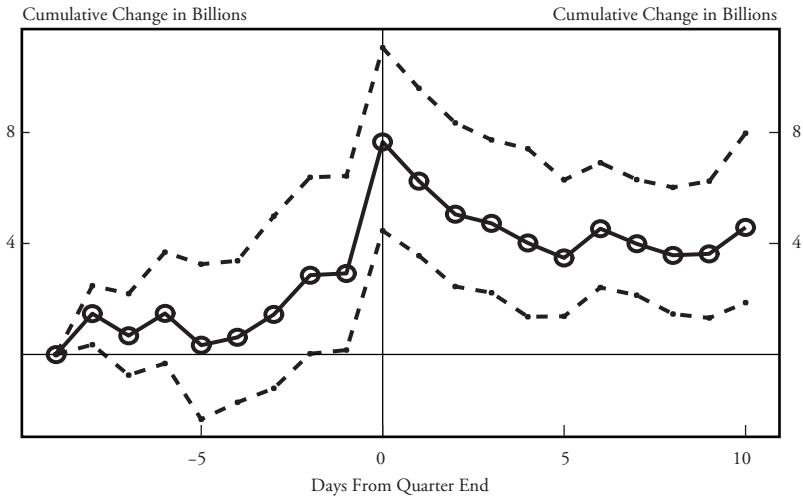


Chart 9 continued

Reserves: Euro



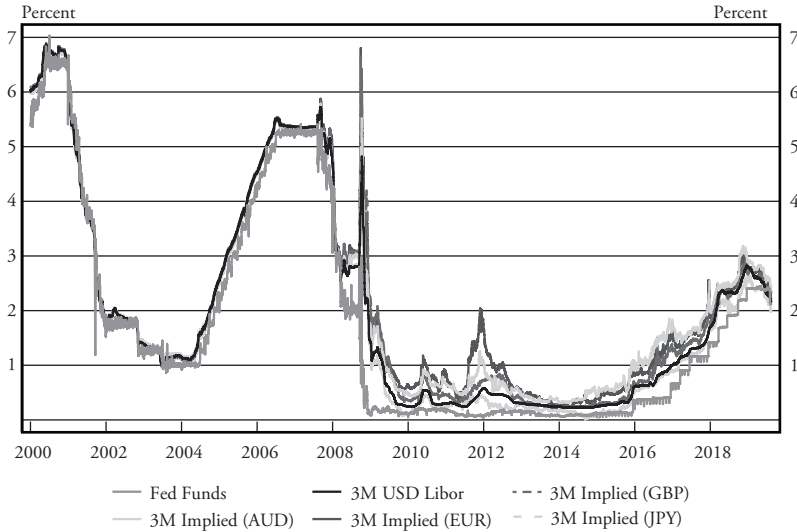
Reserves: Japanese yen



Notes: This chart plots changes in the reserve balances in U.S. dollars, euros and yen, respectively, near quarter-ends for U.S. GSIBs. The dashed lines show the 95 percent confidence interval based on bootstrapped standard errors. The sample period is from December 2015 to January 2019.

Source: Correa, Du, Liao and Pettit (2019) based on FR 2052a.

Chart 10
Direct and Implied Dollar Funding Costs



Notes: This chart plots the fed funds rate (in gray) and the three-month U.S. Libor (in black). It also plots the implied dollar funding cost from FX swap markets for AUDUSD (in gray), EURUSD (in dark gray), GBPUSD (dark dashed gray) and USDJPY (light dashed gray).
Sources: Bloomberg and author's calculations.

funding cost in the cash market pre-GFC, but diverged significantly post-GFC. To use the term “pass-through efficiency” introduced by Duffie and Krishnamurthy’s Jackson Hole paper in 2016 (Duffie and Krishnamurthy 2016), the global pass-through efficiency of U.S. monetary policy has been significantly weakened post-GFC. In terms of the direction, offshore dollar funding conditions are generally tighter than the dollar funding condition in the cash market, but exactly how much tighter depends on the interaction between dollar asset demand and financial intermediary capacity.

In summary, the U.S. dollar exchange rate has become a risk barometer of the global financial markets. When the dollar is strong, financial conditions are tight. The safe asset demand channel takes the view that a stronger dollar corresponds to a higher convenience yield that global investors are willing to forgo to hold dollar safe assets. The financial intermediation channel takes the view that a stronger dollar also corresponds to lower intermediary capacity and a higher intermediation fee. Both channels operate simultaneously post-GFC and reinforce each other.

A better understanding of the global dollar cycle is also important because of its broader macroeconomic implications. Some recent works on the topic include the implications for trade and investment (Bruno, Kim and Shin 2018, and Avdjiev, Bruno, Koch and Shin 2019), corporate issuance patterns (Liao 2019), the dominant currency (Gopinath and Stein 2018), and even U.S. credit conditions (Niepmann and Schmidt-Eisenlohr 2018). Krishnamurthy and Lustig's paper is an excellent contribution to this important research agenda, and will surely have significant impacts.

Author's Note: I am grateful to Gordon Y. Liao at the Federal Reserve Board for insightful discussions about these remarks.

Endnotes

¹For example, the one-week CIP deviation spikes exactly one week before the end of the quarter, and the one-month CIP deviation spikes one month before the end of the quarter. Since a three-month position has to appear on one quarter-end balance sheet regardless of the execution date within the quarter, it does not have any particular quarter-end dynamics.

²It is also worth noting that after the U.S. money market fund reform in 2016, most of the quarter-end declines in dollar wholesale funding volume occur in the repo market instead of unsecured funding markets due to the diminishing role of U.S. prime money market funds in supplying unsecured dollar funding to global banks.

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