

Central bank swap lines during the Covid-19 pandemic

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Facing visible strain in dollar funding markets during the Covid-19 pandemic, the Fed lowered the rate on the swap lines it had with five other central banks, and opened new ones in nine other currencies. Some of these were used, some not. We use this variation to show the impact of the swap lines on CIP deviations across currencies. The results confirm the analysis in Bahaj and Reis (2019): the swap lines put a ceiling on CIP rates only around the time of an auction.

1. Introduction

Banks across the world have a total of \$12.8 trillion of US dollar-denominated borrowing used to fund international trade, financial investments, and a variety of dollar assets (Aldasoro and Ehlers, 2018). During financial crises, the money markets that lend dollars dry up, putting strains on the global banking system. The Covid-19 pandemic so far has been no exception. Given its size and global reach, this crisis has had an unusually large effect on foreign dollar funding and on the ability of private swap markets to absorb exchange-rate risk (Avdjiev et al., 2020). Preliminary data also show a sudden stop of funds to emerging economies of unprecedented size. The first, and so far largest, internationally coordinated economic policy response to the crisis was the expansion of the Federal Reserve's existing swap lines with five other central banks on 15th March, and the creation of new programmes with nine other countries on 19th March. This paper shows that these policies had a clear impact on covered interest parity (CIP) deviations with the US dollar. Since CIP deviations determine the additional

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cost of borrowing dollars for a firm with foreign-currency funding through the FX derivatives market, the swap line effectively lowers dollar funding costs. However, we also find that the effects are concentrated both in countries with active operation and on days where the swap line was actually drawn. These results are consistent with the Bagehot view of the swap lines as international lenders of last resort put forward in Bahaj and Reis (2019).

2. How the swap lines work and their effect

The Fed's central bank swap lines address the role of the US dollar in international funding markets. They work as follows: the Fed lends dollars to a foreign central bank at an interest rate set as a spread to the overnight index swap (OIS) rate of the relevant maturity (usually one week). The foreign central bank then lends these dollars to their financial institutions (choosing which are eligible), collects the collateral, and bears all the credit risk, as it does all the monitoring. This way, foreign banks receive the lending of last resort in dollars that they need. Against the loan of dollars, the Fed receives a deposit of foreign currency at today's spot exchange rate. At the end of the loan, the Fed gets its currency back (with interest) and gives the foreign currency back as well, because both commit now to re-sell their currencies at the original exchange rate. The foreign currency never enters circulation; it is as if it was never printed in the first place, so it has no monetary impact on the foreign countries. On the Fed's side, being structured as a swap, this operation has minimal risk.

In Bahaj and Reis (2019), we proved the following result: the spread that the Fed charges to a foreign central bank over the OIS rate puts a ceiling on deviations from CIP between that central bank's currency and the dollar. The intuition is the following. A financial institution can always deposit domestic currency at its central bank. The presence of the swap line enables it to borrow US dollars from its central bank. Then, borrowing dollars, converting them into domestic currency via an FX swap, and depositing the proceeds at the central bank provides a (near) risk-free arbitrage opportunity if CIP deviations overly exceed the Fed's spread on borrowing from the swap line. The presence of this arbitrage trade puts a ceiling on how high CIP deviations can rise. Depending on exactly how CIP is calculated, and on differences in collateral requirements, the ceiling may have other terms, but a cut in the Fed's spread unambiguously lowers it.

In Bahaj and Reis (2019), we further show that in the over-the-counter FX derivatives market, this cut in the ceiling should reveal itself in the distribution of observed CIP deviations by both truncating the distribution to the left, and causing a fall in its mean.

A third result concerning CIP is that the swap lines do not generate a standing facility for banks. Instead, the dollars are lent out by the foreign central banks on a weekly basis through a market operation that draws on the swap line. Only on the days of the operations does the arbitrage trade that created the ceiling become available, so only in those days should the ceiling have its strong effect. In the other days of the week, there is no strict ceiling, so CIP may spike over and beyond it, although the anticipation of an operation might still have an effect.

2.1 The situation as of February 2020

At the start of 2020, and for the decade before, the Federal Reserve had standing swap arrangements with five other central banks – the Bank of Canada, the Bank of England, the Bank of Japan, the ECB, and the Swiss National Bank – as part of multilateral swap line network between the six central banks.

The swaps had maturities of one week and the swap line rate was 50 basis points (bps) over the one-week US dollar OIS rate. Operations had a fixed price with a full allotment, so foreign banks could borrow as much as they wanted from their central bank at the swap line rate, and there was no upper bound on the size of the drawings a central bank could make from the Fed.³ The bids for these operations were typically taken on Wednesdays with the dollars reaching the recipient banks on Thursdays – the settlement day.

Each foreign central bank could choose how to run its operations, including which collateral to accept, and which haircuts to charge. There were two notable idiosyncrasies in the network. First, the Bank of Canada had not conducted a single operation, justifying it with Canadian banks having a stable US dollar deposit base and access to the Federal Reserves lending facilities through their US operations. Second, the Bank of Japan had a two-day settlement cycle due to the time difference with New York, so bids were taken on Tuesdays and settled on Thursday.

2.2 The March 2020 policy changes

Following the outbreak of Covid-19 and the adoption of containment measures across developed economies, interest rates in many US markets and CIP deviations involving the US dollar spiked during the week of 9th-13th March.

On 15th March, the six members of the US dollar multilateral swap line network announced that the spread on the swap line over OIS rates would be cut to 25bps and that they would start conducting new weekly 3-month dollar operations. Operations at maturities longer than one week had also been conducted during

³ Still, every individual drawing was subject to approval by the Federal Reserve.

the global financial crisis and the European sovereign debt crisis (typically at a monthly frequency), but these were discontinued in 2014. The bids on the first operations at the new rate and at the longer maturity were taken on the 18th (17th for the Bank of Japan), and settled on 19th March. The Bank of Canada announced its intention to set up a US dollar facility should the need arise, but as of 31 March 2020 has not done so, and so continues to not use the swap line.

On 20th March, the central banks in the network announced that, commencing 23rd March, their one-week dollar repo operations would be conducted daily. This closed the gap in swap line availability discussed above, bringing the operations closer to a standing facility.

On 19th March, the Fed created a new swap line arrangements with nine other countries: Australia, Brazil, Mexico, Denmark, Korea, Norway, New Zealand, Singapore, and Sweden. Amongst these, as of 31 March, the central banks of Sweden, Norway, Denmark and Singapore were the only banks to have completed a dollar swap line operation. These were first conducted on the 26th of March (Singapore: 27th) and first settled on the 30th (Singapore: 31st).⁴ The terms of the swap line operations conducted by these four new central banks had two similar features to the ones in the original network: their maturity (three-month and weekly), and the credit risk and monitoring lying with the foreign central bank (in charge of determining eligibility and collateral criteria).

However, there are three significant differences with the four countries compared to the original network. First, the quantities that can be drawn have maxima attached. Second, and related, the operations are conducted as auctions, not full allotments. Therefore, the swap line rate forms the minimum bid rate rather than a fixed price. As an example, Singaporean banks paid on average 100bps above OIS in a 3-month operation on the 30th, rather than the fixed 25bps spread that a euro area bank would pay. Third, the frequency of the operations has yet to be determined.

3. The effect of the changes in the swap lines: quantities

Table 1 shows the quantities drawn in the new facilities by the ECB, the Bank of England, and the Bank of Japan. As a reference point to these flows, note that the peak balance, that is the stock, ever drawn at any one time from the swap lines by the three central banks was on the 10th of December of 2008 at \$476.4 billion. The table also lists the peak flows both during the financial and euro crises times, and in all the years ever since.

⁴ The Bank of Mexico and the Bank of Korea are due to conduct operations that will be settled in April.

| Operation date | Settlement date | Term (days) | Amount lent (\$bn) |
|---|-----------------|-------------|--------------------|
| European Central Bank | | | |
| 11/03/2020 | 16/03/2020 | 7 | 0.05 |
| 18/03/2020 | 19/03/2020 | 7 | 36.27 |
| 18/03/2020 | 19/03/2020 | 84 | 75.82 |
| 23/03/2020 | 24/03/2020 | 7 | 0.02 |
| 24/03/2020 | 25/03/2020 | 7 | 4.12 |
| 25/03/2020 | 26/03/2020 | 7 | 17.27 |
| 25/03/2020 | 26/03/2020 | 84 | 27.81 |
| 26/03/2020 | 27/03/2020 | 7 | 3.21 |
| 27/03/2020 | 30/03/2020 | 7 | 2.17 |
| 30/03/2020 | 31/03/2020 | 7 | 6.65 |
| <i>Peak operation (2008-2010): \$170.9bn (15/10/2008)</i> | | | |
| <i>Peak operation (2011-2019): \$50.7bn (7/12/2011)</i> | | | |
| Bank of England | | | |
| 11/03/2020 | 12/03/2020 | 7 | 0.00 |
| 18/03/2020 | 19/03/2020 | 7 | 8.21 |
| 18/03/2020 | 19/03/2020 | 84 | 7.25 |
| 23/03/2020 | 24/03/2020 | 7 | 0.01 |
| 24/03/2020 | 25/03/2020 | 7 | 3.56 |
| 25/03/2020 | 26/03/2020 | 7 | 7.71 |
| 25/03/2020 | 26/03/2020 | 84 | 6.69 |
| 26/03/2020 | 27/03/2020 | 7 | 9.05 |
| 27/03/2020 | 30/03/2020 | 7 | 0.50 |
| 30/03/2020 | 31/03/2020 | 7 | 5.01 |
| <i>Peak operation (2008-2010): \$76.3bn (15/10/2008)</i> | | | |
| <i>Peak operation (2011-2019): \$0.02bn (21/08/2019)</i> | | | |
| Bank of Japan | | | |
| 10/03/2020 | 12/03/2020 | 7 | 0.00 |
| 17/03/2020 | 19/03/2020 | 7 | 2.05 |
| 17/03/2020 | 19/03/2020 | 84 | 30.27 |
| 23/03/2020 | 25/03/2020 | 7 | 34.85 |
| 24/03/2020 | 26/03/2020 | 7 | 15.47 |
| 24/03/2020 | 26/03/2020 | 84 | 73.81 |
| 25/03/2020 | 27/03/2020 | 7 | 4.95 |
| 26/03/2020 | 30/03/2020 | 7 | 2.27 |
| 27/03/2020 | 31/03/2020 | 7 | 13.10 |
| 30/03/2020 | 01/04/2020 | 7 | 24.10 |
| <i>Peak operation (2008-2010): \$50.2bn (21/10/2008)</i> | | | |
| <i>Peak operation (2011-2019): \$12.6bn (10/01/2012)</i> | | | |

Table 1 Central bank US dollar operations, 2nd half of March 2020–

The effect of the Covid-19 crisis is striking. UK banks, which had last borrowed a meaningful amount of US dollars in June 2010, borrowed positive amounts in operations in every single day since the crisis flared up and the new terms were announced. The two operations conducted by the Bank of Japan on the 24th of March lent a total of \$89 billion, almost double the previous peak of \$50 billion on 21st October 2008; the ECB's 19th March operation was the largest since 2011. The combination of a cut in the interest rate, and the funding needs associated with the crisis, have sprung the swap line back into action. Consistent with it being a lending of last resort facility, the swap lines become active during crises.

Not reported in the table are the new swap lines. By the end of March banks had borrowed \$6.9 billion from the Monetary Authority of Singapore over three operations where the maximum on offer was \$30bn. Swedish, Danish and Norwegian banks borrowed \$2.0 billion, \$2.9 billion and \$1.1 billion respectively, in operations with \$10 billion, \$20 billion and \$5 billion, respectively, on offer.

4. The impact on market prices

We compute CIP deviations using data on interest rates and forward markets at a daily frequency from Bloomberg (last accessed on 31st March 2020) following the standard approach in the literature (e.g., Du et al. 2018). We use 3-month tenor rates, matching the expansion of the swap line to 3-month operations on 15th March, with the exception of the Indian rupee (INR), for which Bloomberg does not report a reliable 3-month forward exchange, so we report the 1-year tenor for it instead. They are LIBOR-equivalent interest rates, because these are available across many currencies, with and without access to the swap line, including some in emerging markets. We omit the Brazilian real from the analysis, despite it receiving a swap line, because we could not find reliable data with which to compute the CIP deviations. CIP deviations are computed such that a positive figure is consistent with it being profitable to borrow in dollars and lend in the domestic currency (this is the negative of the cross-currency basis typically reported in the financial press).

Each figure that follows shows the daily CIP deviations for the four weeks starting 2nd March and ending 27th March 2020, with weekends shaded in grey. Each of them highlights three key dates: the date of the last auction before the policy changes (for the original swap line members), the date the new facilities were announced, and the date of the first operation after the change. Note that the predictions for theory are that: (i) CIP deviations should spike above the ceiling after the first date, (ii) they might fall after the announcement,

and (iii) they should fall below the ceiling after the operation. This is in cases where market equilibrium price was close to (or above) the ceiling; otherwise, the effect should be negligible as the ceiling would almost never bind.

4.1 Impact on the original active network

Figure 1 shows the CIP deviations for the currencies of the four members of the original network, excluding Canada, since it did not conduct operations on its swap line. The red lines draw a hypothetical ceiling given the prevailing spread on the swap line, although note that differences between LIBOR and OIS rates as well as possibly binding collateral requirements would imply that in reality the ceiling would be higher. So, observing CIP deviations above the ceiling that is drawn in the figure only says that for that currency the equilibrium was close to the actual ceiling.

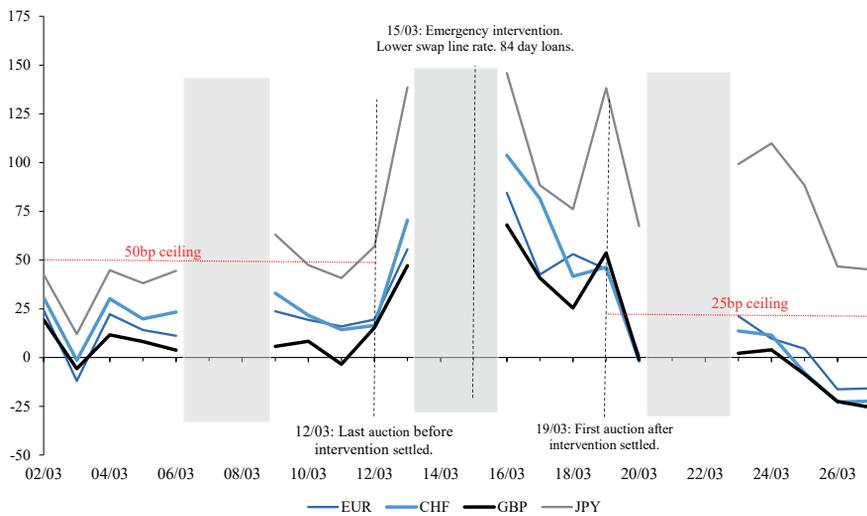


Figure 1 CIP deviations among the original network members conducting operations

In spite of the financial crisis brewing across US financial markets, the CIP deviations stayed contained by the swap line rate as late as 12th March, when the weekly swap line operation was settled. But, the day right after, CIP deviations spiked. The ceiling is likely breached on Friday 13th March across currencies as the swap line was not open that day.

Over the weekend on the 15th, the policy of cutting the swap line rate and extending maturities was announced, but this only came into effect at the time of the next operation, which was settled on Thursday the 19th. CIP deviations rose further on the 16th, in spite of the new policy, since the swap line was closed. Only as the operation date approached did they fall. They went below the new ceiling right after the auction was settled on Friday.

From the 23rd onwards, the central banks switched to daily US dollar operations. Since then, the deviations have stayed below the hypothetical ceiling.

The Japanese yen is an exception. The higher swap line ceiling for yen CIP deviations is not specific to the Covid-19 episode; it was also a finding in Bahaj and Reis (2019). One explanation is that the two-day settlement cycle weakens the link between daily CIP deviations and the swap line rate. Regardless, once the BoJ's record operations on the 24th were settled on the 26th, yen CIP deviations fell sharply.

4.2 Impact on the new active network

Figure 2 shows the CIP deviations in the four currencies that have joined the US dollar swap network and that have used it: the Swedish krona, the Danish krona, the Norwegian krona, and the Singaporean dollar. The CIP deviations rose during the week of 9th-14th. They fell after the announcement of the first policy change affecting the original members of the network. They fell decisively once the new swap line was announced. However, it was only when bids are taken for the first operation that the DKK CIP deviation fell below the new ceiling.

4.3 Impact on the new inactive network: negative CIP deviations

Figure 3 shows the CIP deviations for the new members of the the network for which we have data, and which did not need a swap line according to the theory, namely, the Australian dollar and the New Zealand dollar. For both currencies, the CIP deviations have been negative for a long time, and they continued to be so during this month. That is, it is borrowing in these currencies and lending in dollars that creates an arbitrage opportunity for these two currencies. The swap line does not affect this.

Consistent with the swap line not being needed, these central banks have not conducted any US dollar operations. The swap line is unused. Consistent also with the theory, the policy changes in March had no appreciable effect on the market prices.

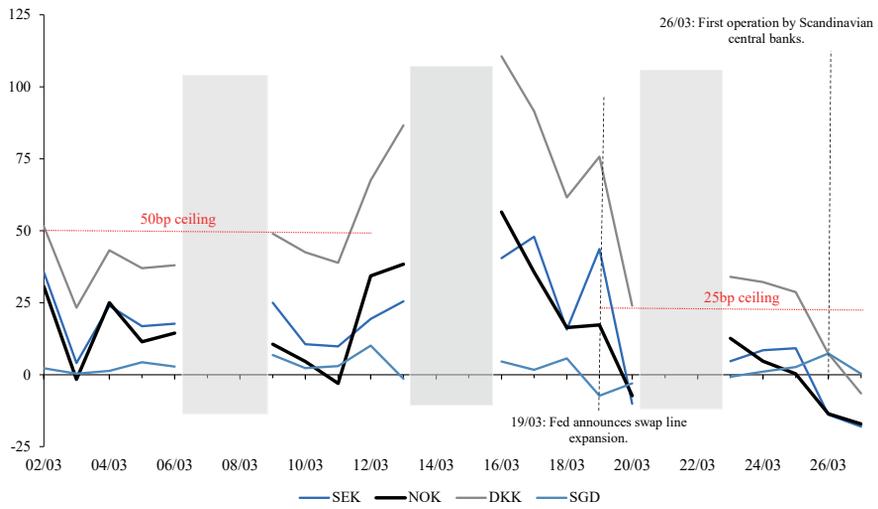


Figure 2 CIP deviations among the new swap line currencies that conducted an operation

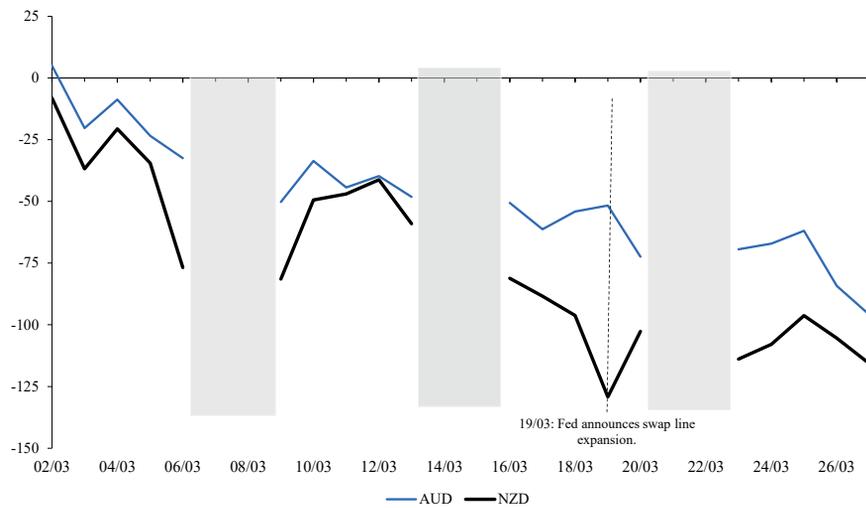


Figure 3 Swap line currencies with negative CIP deviations and no operation

4.4 Impact on the inactive network: positive CIP deviations

For completeness, the final group of countries in the swap line network is those who, as of the end of March 2020, had not yet completed a swap line operation to allow their banks to borrow the US dollars, even though the size of the CIP deviations could justify it. These are South Korea and Mexico among the newcomers, and Canada from the original network.⁵ Their CIP deviations are plotted in Figure 4.

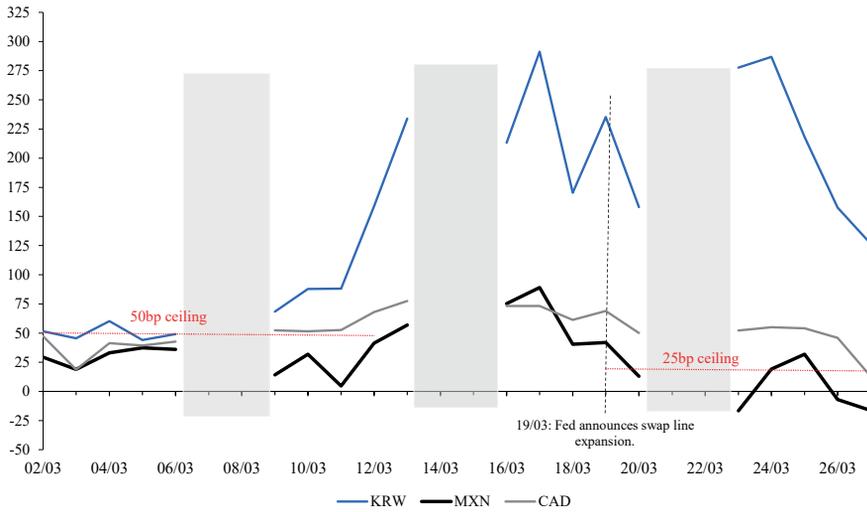


Figure 4 Swap line currencies with positive CIP deviations and no operation

4.5 Life outside of the network

Finally, Figure 5 shows the CIP deviations for four central banks that are not part of the swap line network, and which seem unlikely to join. This provides a control group for comparison with the treated groups by the policy intervention that we have discussed so far. The currencies are: the (offshore) Chinese yuan, the Taiwanese dollar, the Hong Kong dollar, and the Indian rupee.

⁵ CAD CIP deviations measured using OIS rates rather than Libor rates are below the ceiling. This could also justify the Bank of Canada not conducting operations.

For all four of them, CIP deviation rose throughout this period, starting in the week of 9th-14th March just as it did for the treated currencies, with the exception of the rupee. However, unlike the swap-line countries, for these, the following two weeks show no significant reversal of the increase (perhaps with the exception of Taiwan in the very end of the sample, but it is hard to tell without more data).

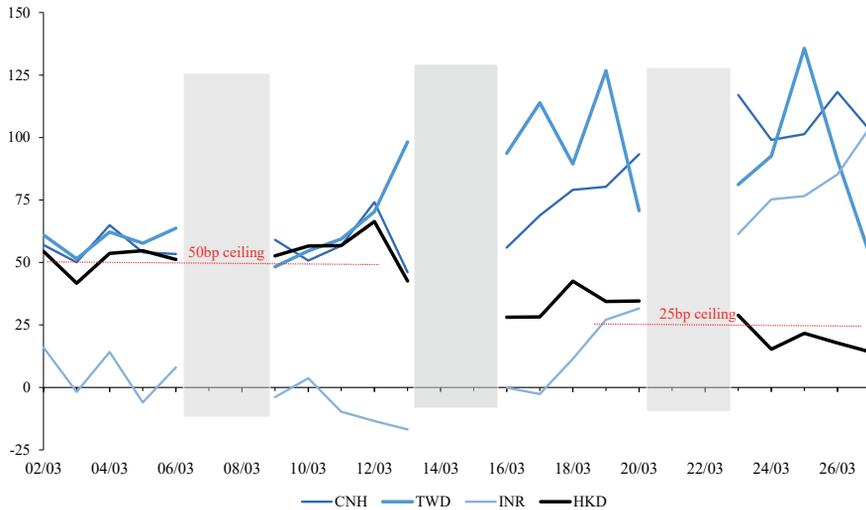


Figure 5 Currencies without access to a US dollar swap line

5. Conclusion

This paper has evaluated the behaviour of a key market price – the deviation from covered interest parity – to a major policy announcement in response to the Covid-19 crisis, namely, the extension of US dollar swap lines involving the Federal Reserve and 14 other central banks around the world. This was the first major coordinated economic policy response to the crisis. It affected different countries in different ways, depending on: (i) whether they were already in the network before or they were new, (ii) whether their deviations from CIP were positive or negative, and (iii) whether they had operations set up or not. Comparing these different cases shows signs that the swap lines are effective in providing lender of last resort to foreign financial markets, particularly when they are actually used. Since the swap line rate cut and extension lowered the cost of dollar funding in the markets that used them, they relieved some of the stress in those funding markets.

At the same time, the estimates leave a few unanswered questions: Why were some central banks able to set up dollar operations sooner than others? The criteria behind inclusion in the network have not been stated, and there is no robust correlation with need or size of private dollar funding. Will the effects persist? Theory suggests they will, since if CIP deviations rose further, an arbitrage trade would arise. At the same time, financial markets are severely disrupted right now (as is all economic activity) so that even arbitrage opportunities may be able to survive for longer than they normally would.

A bigger question is whether the swap network be further extended or complemented with other arrangement that also constrain deviations from CIP. Tooze (2020) argues that the current crisis will lead to a large collapse in emerging markets. Since these countries do not have access to the swap line, there is a case for creating some substitute access to US dollars, which perhaps could involve the IMF (Reis, 2019). At the same time, the Federal Reserve introduced on 31st March 2020 a new foreign and international monetary authorities repo facility, which lends dollars against Treasuries collateral and is open to most central banks. This is different from the swap lines, but complementary to them.

A final question is whether, while the swap lines are effective, are they welfare enhancing? Especially if they contribute the primacy of the US dollar and encourage foreign banks to ex ante accumulate large FX exposures? The narrative evidence that we showed above cannot answer this but, at the very least, it illustrates how important this topic is.

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