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*CIP Deviations and Credit Swap Lines
during the COVID-19 Pandemic*

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1. Introduction

In December 2019, in Wuhan (CHI), the world has seen the first known case of Coronavirus Disease 2019, a contagious disease caused by acute respiratory syndrome; since then, the disease has spread worldwide, leading to the actual pandemic we are currently experiencing.

The global reach and the overall impact of the Covid-19 pandemic is unprecedented and brought hard challenges to policymakers and to analysts to understand and fight its effect in the global economy.

In this paper we are going to discuss the deviations from the Covered Interest Parity (henceforth CIP) during the COVID-19 global crisis and their possible link with the dollar swap lines between FED and G10 currencies' central banks (Central Bank of Europe, Bank of Japan, Bank of Canada, Bank of England and Swiss National Bank, Danmarks Nationalbank, National Australia Bank, Norges Bank, Bank of New Zealand, Sveriges Riksbank).

CIP is a no arbitrage condition, firstly theorized by Keynes in A Tract on Monetary Reform (1923) during the floating exchange rate period after WWI; it represents one of the most important and discussed block of International Finance, since it's a fundamental link between money markets and foreign exchange markets. CIP is a relationship between the spot exchange rate, the forward exchange rate and the nominal interest rates of two different currencies; more precisely, it equates the premium of a currency's forward over its spot exchange rate expressed as price of a foreign currency to its nominal interest rate advantage over that foreign currency.

Until Global Financial Crisis (GFC), CIP deviations existed, but they were rare and narrow, especially when searched among low frequency data. But, once GFC happened, CIP deviations became the normality. About this topic a lot has been already discussed in literature. However, even once the GFC came over, CIP deviations didn't go away.

In general, we can divide all the CIP literature in two parts: the first part starts from Keynes and lasts until the GFC, while the second part starts from that point until our

days. This division has not the only the sense in the difference between how well the CIP fitted empirical data then and now, but the very difference is the way the CIP has been discussed: after the GFC, many economists realized that LIBOR - largely used in the past (Frenkel, Levich (1975); Akram, Rime, Sarno (2008)) - wasn't the right benchmark to measure CIP with longer horizons (one year or more).

Du, Tepper, Verdelhan (2017) and Cerutti, Obstfeld, Zhou (2020), suggest that LIBOR still works as a good benchmark in short-term analysis, while over the 1-year horizon the CIP deviation based on Libor is given by the spread on the cross-currency basis swap (an exchange of cash flows linked to floating interest rates referenced to interbank rates in two different currencies or an exchange of principal in two different currencies at the inception and the maturity of the swap).

However, although interbank rates are not perfect as benchmark, CIP deviations exist beyond this imperfection: Du, Schreger (2021) showed that CIP deviations are even larger on average if we use Overnight Index Swap rates or repo rates.

The literature about this topic is also very focused on the explanation of the macroeconomic drivers of the CIP deviations and many studies show different, but often complementary, potential drivers. Ivashina, Scharfstein, Stein (2015), Du, Tepper, Verdelhan (2017), Rime, Schrimpf and Systrad (2017) demonstrate, in their works, how CIP deviations are usually not significant for arbitrageurs due to regulatory constraints or higher funding rates than policy rates; Augustin, Chernov, Schmid, Song (2019) document how USD appreciation impacting risk-taking banks' capacity or changes in banks' balance sheet.

A more direct driver of CIP deviations is also the difference of policy rates between different currencies and its impact on the FX market, as presented by Du, Tepper, Verdelhan (2017), Borio, Iqbal, McCauley, McGuire, Sushko (2018).

Du, Schreger (2021) showed that CIP deviations, are strongly related to currencies' interest rates: high-interest-rate currencies, such as the Australian Dollar and the New Zealand dollar, have positive cross-currency bases (synthetic dollar interest rate

in the FX swap market is lower than the direct dollar interest rate) and vice versa for low-interest-rate currencies, such as the EUR and the CHF.

Cerutti, Obstfeld, Zhou (2020) divide macroeconomic drivers of CIP deviations into:

- factors reflecting risk appetite and perceptions;
- factors reflecting monetary policies;
- factors reflecting financial regulations.

Du, Schreger (2021) showed that CIP deviations, are strongly related to currencies' interest rates: high-interest-rate currencies, such as the Australian Dollar and the New Zealand dollar, have positive cross-currency bases (synthetic dollar interest rate in the FX swap market is lower than the direct dollar interest rate) and vice versa for low-interest-rate currencies, such as the EUR and the CHF.

This paper will provide an empirical analysis on CIP deviations during COVID-19 pandemic and the effect of credit swap lines on CIP deviations.

Section 2 will explain how CIP works and will give relevant insight and information about the methodology used in the analysis. Section 3 will briefly explore the history of currency swap lines, especially between the Federal Reserve (FED) and Bank of Japan (BOJ), European Central Bank (ECB), Bank of London (BOL), Bank of Canada (BOC) and Swiss Central Bank (SCB). Section 4 will connect the result of the CIP deviations analysis with the access to USD liquidity by BOJ, ECB, BOL, BOC, SCB, DN, NAB, NB, BNZ and SR. Section 5 concludes.

2. CIP and CIP deviations

2.1. Covered Interest Parity Law

Spot and forward rates between two currencies are linked through a theoretical equilibrium condition called Covered Interest Parity. It assumes there is no arbitrage opportunity using forward contracts (which there often is).

The formula for CIP is:

$$(1 + i_d) = \frac{F}{S} (1 + i_f) \quad (1)$$

Where:

- i_d is the interest rate in the domestic currency;
- i_f is the interest rate in the foreign currency;
- F is the forward foreign exchange rate;
- S is the current spot exchange rate.

Equivalently, using logs, we can write CIP as:

$$r_d = f - s - r_f,$$

$$r_d - r_f = f - s$$

Or

$$x = r_d - r_f - f + s \quad (2)$$

Where:

- $r_d = \log (1 + i_d)$
- $r_f = \log (1 + i_f)$
- $f = \log F$
- $s = \log S$
- $x = \text{cross-currency basis}$

Under normal circumstances, a currency which offers lower interest rates is traded at a premium forward foreign exchange rate in relation to a currency which offers higher interest rates. CIP is used to determine the forward foreign exchange rate. We can also say that the interest rate differential between two currencies reflects the expected rate of depreciation of the exchange rate plus a risk premium.

Moreover, investors could hedge foreign exchange risk or unpredicted exchange rates fluctuations with forward contracts; from here, we call this condition “covered”. This condition could hold for a time, but is not generally always valid in time, especially in moments of large variations of interest rates.

CIP requires perfect substitutability and free flow of capital, and this is not always true.

2.2. Deviations from Covered Interest Parity

CIP is a theoretical no-arbitrage condition, which before GFC closely fitted empirical data since the deviations were very small and fluctuated around zero, coherently with the finding of Akram, Rime, Sarno (2008) and Frenkel, Levich (1975), and the log-difference between forward and spot rates was approximately equal to the difference in LIBOR between currencies, so that x in (2) was approximately equal to zero. We can say that x , the cross-currency basis, measure the deviation from CIP in a given period. Economically it can be seen as the difference between the direct dollar interest rate r_d from the cash market and the synthetic dollar interest rate obtained through swapping the foreign currency f from the swap market ($r_f + f - s$). If $x > 0$ (< 0), then the direct dollar interest rate is higher (lower) than the synthetic dollar interest rate. When $x = 0$, CIP holds.

After the GFC, “CIP condition is systematically and persistently violated among G10 currencies, leading to significant arbitrage opportunities in currency and fixed income markets since the 2008 global financial crisis”¹.

Following the analysis of Cerutti, Obstfeld, Zhou, during the GFC the dollar basis reached about -200 basis points, then most three-month dollar bases reverted to almost zero through 2013, widening again at the end of 2014.

To arbitrage CIP deviations, an investor should go long in the low-interest-rate currencies and short in the U.S. dollar, or short in the high-interest-rate currencies such as the AUD and NZD, while fully hedging against the foreign currency risk.

¹ Du W., Tepper A., Verdelhan A., “Deviations from Covered Interest Rate Parity”, National Bureau Of Economic Research, Working Paper 23170, Feb. 2018.

2.3. Methodology and data

To study the relationship between COVID-19 pandemic CIP deviations and Credit Swap Line we'll use the dataset provided by Du, Wenxin, Im and Schreger² updated to March 2021.

In this dataset, the deviation from CIP is measured from government bond yields in the United States and the other G10 currencies:

$$\varphi_{i,3M,t} = y_{i,3M,t}^{Govt} - \rho_{i,3M,t} - y_{USD,3M,t}^{Govt}$$

Where:

- $y_{i,3M,t}^{Govt}$ is the 3-month local-currency government bond yield in country i ;
- $\rho_{i,3M,t}$ is the 3-month market-implied forward premium for hedging the currency i against USD;
- $y_{USD,3M,t}^{Govt}$ is the 3-month US Treasury bond yield.
- $y_{i,3M,t}^{Govt} - \rho_{i,3M,t}$ is the foreign synthetic dollar 3-month yield in the country i ;

This Treasury CIP deviation measures the difference between the synthetic dollar interest rate created by swapping foreign government bonds into U.S. dollars and the yield on the U.S. Treasury bonds. It allows us, thus, to compare sovereign borrowing costs after swapping the promised cash flows of local currency sovereign bonds into USD.

The forward Premium for the 3-month maturity is calculated as the percentage difference between the outright forward and spot exchange rate:

$$\rho_{i,3M,t} = \frac{360}{n_t} (F_{i,3M,t} - S_t) / S_t$$

Where:

² Du W. and Schreger J., "Local Currency Sovereign Risk." Journal of Finance, 71, 1027-1070, Feb. 2016

Du W., Im J. and Schreger J., "The U.S. Treasury Premium." Journal of International Economics, 112, 167-181, May 2018.

- $F_{i,3M,t}$ is the 3-month outright forward exchange rate for the currency I against USD at time t ;
- S_t is the spot exchange rate at time t ;
- n_t is the number of days for a 3-month contract benchmark at time t (usually, but not always, around 90 days);

This dataset is obtained from Bloomberg. In the original dataset, available at <https://sites.google.com/view/jschreger/CIP?authuser=0>, it's possible to see the interest rate differential on government bonds in percentage points ($y_{i,3M,t}^{Govt} - y_{USD,3M,t}^{Govt}$) and the market implied forward premium in percentage points ($\rho_{i,3M,t}$). In our dataset, we will use the complete CIP deviations results $\varphi_{i,3M,t}$.

The main drivers of CIP deviations for government bond yields are the convenience yield differentials between U.S. and foreign government bonds, market segmentation and other financial frictions. Since we are analysing a short horizon and the deviations are measured for G10 currencies, default risk differentials between U.S. and foreign government bonds are not a main driver. For these currencies, indeed, sovereign default risk is negligible, especially at short horizons.

Our analysis will cover the period from 01/01/2014 from 01/03/2021. The tables and graphs shown, if without any different reference, are made using MATLAB on the dataset provided by Du, Wenxin, Im and Schreger.

3. Currency Swap Lines

3.1. Currency Risk

We define “currency risk”, or “exchange rate risk”, the risk deriving from the change in price of one currency in relation to another one.

Often both private and public investors have assets, in their portfolios, which are denoted in different currencies; they are thus exposed to specific risks related to the different currencies in their portfolios. To hedge this kind of risk, investors usually use forex, futures, options and other derivatives.

Over time, people and corporations started to focus more on hedging their currency risk, leading professional investors to mechanize this process. We call this mechanization, which can be implemented more rapidly than other hedging techniques, *dynamic hedging*³.

Dynamic hedging increases trading volume and strengthens price movements, finally contributing to momentary illiquidity. During a crisis, it reflects into the massive forward sell of the currency to the banking system, which often are not matched by other investors’ purchases, so the banks could be forced to hold those quantities of currency.

However, central banks don’t want to risk large capital losses having negative net foreign exchange positions: once the central banks stop to buy forward their own currency, they balance the long currency position with spot sales of the currency (to balance the net position) and currency swaps (to balance maturities).

Banks use currency forwards as an adjustment tool to their portfolios, since they don’t require the selling of cash assets held in the foreign currency, as would be implied by spot hedging transactions. A currency swap from a central bank has significant economic effects. On its balance sheet, when a central bank buys foreign currency with domestic currency and agrees to sell the same amount of foreign currency at a certain date in the future, the central bank “foreign assets” on the

³ Garber P. M. and Spencer M. G., “Foreign exchange hedging and interest rate defense”, International Monetary Fund. Research Dept. Volume 1995: Issue 003, Jan. 1995.

balance sheet increases, as well as must increase something on the liabilities side. If the counterpart is a central bank and those amounts of currency are not spent, there is no effect on currency circulation or banks' reserves; if the counterpart is the banking system, banks' reserves increase of the amount of domestic currency borrowed and foreign assets decrease: in this way, money reserve increases, resulting in an expansion of money supply.

This expansion has the effect of lowering interest rates, promoting investment and giving consumers the perception of being wealthier, leading to a spending stimulation. Firms react to this increasing production and thus they would need more labour, more capital goods, and more raw materials. This provokes a rise in stock market prices.

Subsequently to this rise, people begin to expect inflation, which make interest rates rise up to control the expected decline in purchasing power.

On the other side, a decrease in money supply will have the contrary effects, leading to periods of disinflation (small, but positive inflation) or deflation (negative inflation and thus lowering prices).

3.2. Central Bank Liquidity Swap and Currency Swap Lines

“A currency swap line is an agreement between two central banks to exchange currencies”⁴; thus, the currency swap line is a monetary policy instrument which has been used for decades from central banks, only for overnight and short-term lending. Most agreements are bilateral, between two central banks. The value is based on the market exchange rate at the time of the transaction and the two banks agree to swap back these quantities of their currencies at a specified date in the future, using the same exchange rate as in the first transaction. For this reason, these swaps usually don’t carry other market risks.

The historic aim of this operation is to keep liquidity available enough to make sure central banks can lend to private banks to maintain the reserve requirements. Moreover, it strengthens the market of that currency, since it acts as a stability signal and confirms that the central banks will keep up the supply of that currency. Even if, at first, swap lines were used to fund market interventions, they now represent a real economy protection tool from market tension and they work as an important help for financial stabilization.

⁴ ECB, “What are currency swap lines?” 27 Sep 2016 (updated on 22 Apr 2020),
< https://www.ecb.europa.eu/explainers/tell-me-more/html/currency_swap_lines.en.html >

3.3. Brief history of Currency Swap Lines

Already in the 19th century, central banks exchanged gold reserves, but the first usage of the currency swap line was in 1960s. The euro-dollar market came into existence in 1957⁵ and in 1962 had established itself in an interbank market in London. At first, it served as a help to arbitrage regulation for Bank of England, by later was used as a mean of harmonization of English regulation with US regulation in different fields: caps on yields on bank deposits, requirement for banks to hold non-interest-bearing reserves against them at the Fed and deposit insurance premia. The Fed understood that, in this way, dollar depositors could reach higher interest rates including at US-owned banks, at the price of a slightly higher country risk⁶.

Returning to the currency swap lines, in July 1962, the FRBNY⁷ set up USD/CHF swap lines with the SNB and BIS⁸ for \$100 million each. In this operation, the BIS bought CHF with gold by the Swiss National Bank and swap that amount of CHF for dollars with the FRBNY.

Later, in August 1965 another swap happened between BIS and FRBNY for other European currencies than CHF against dollars, mainly DM⁹, but in this case, differently from the CHF, DM only had the role of collateral.

The aim of the swap lines is made clear by the one of the first press release ECB published on its website, on the 13th of September 2001:

“In order to facilitate the functioning of financial markets and provide liquidity in dollars, the Federal Reserve and the European Central Bank (ECB) have agreed on a swap arrangement. Under the agreement, the ECB would be eligible to draw up to \$50 billion, receiving dollar deposits at the Federal Reserve Bank of New York; in exchange, the Federal Reserve Bank of New York will receive euro deposits of an equivalent amount at the ECB. The ECB will make these dollar deposits available to

⁵ Schenck C. R., “The Origins of the Eurodollar Market in London: 1955–1963”, *Explorations In Economic History* 35, 221–238, Article No. EH980693, 1988.

⁶ McCauley R N, Schenck C R. “Central bank swaps then and now: swaps and dollar liquidity in the 1960s”, *BIS Working Papers No 851*. Apr 2020.

⁷ Federal Reserve Bank of New York

⁸ Bank for International Settlements

⁹ Deutsche Mark

national central banks of the Eurosystem, which will use them to help meet dollar liquidity needs of European banks, whose operations have been affected by the recent disturbances in the United States. This swap line will expire in 30 days”¹⁰.

Then, in 2007, ECB established swap lines to provide currency liquidity in the Eurosystem with Bank of Canada, Bank of England, FED, and SNB¹¹.

After the collapse of Lehman Brothers in Sept. 2008, the ECB and the FED, to prevent extreme sales of USD-denominated assets and by the Euro area banks, set up a currency swap line.

¹⁰ECB, “Swap agreement with the federal reserve”, 13 Sept. 2001
https://www.ecb.europa.eu/press/pr/date/2001/html/pr010913_1.en.html

¹¹ ECB, “Measures designed to address elevated pressures in short-term funding markets”, 12 Dec. 2007 <https://www.ecb.europa.eu/press/pr/date/2007/html/pr071212.en.html>

3.4. USD Swaps

The most involved currency in swap lines is the USD, due to its position of world's dominant reserve currency, its high liquidity and the worldwide perception of dollar as a "safe currency", due to US economic strength.

Before autumn 2008, the cap for swap was \$24 billion; subsequently, due to the 2008 economic and financial crisis, the cap was extended to \$620 billion, then ECB, SNB, Bank of Japan and Bank of England, on October 2008, obtained unlimited dollar access.

These swap lines aim was to improve liquidity both in US and foreign markets, providing central banks the capacity to deliver USD.

As of August 2021¹², the national banks authorized to exchange currencies through the swap line mechanism are:

- Reserve Bank of Australia;
- Banco Central do Brasil;
- Bank of Canada;
- Danmarks Nationalbank;
- Bank of England;
- ECB;
- Bank of Japan;
- Bank of Korea;
- Banco de Mexico;
- Reserve Bank of New Zealand;
- Norges Bank;
- Monetary Authority of Singapore;
- Reserve Bank of New Zealand;
- Sveriges Riksbank;

¹² FED, "Federal Reserve announces the establishment of temporary U.S. dollar liquidity arrangements with other central banks", March 2020.

<https://www.federalreserve.gov/newsevents/pressreleases/monetary20200319b.htm>

FED, "Coordinated central bank action to further enhance the provision of U.S. dollar liquidity", <https://www.federalreserve.gov/newsevents/pressreleases/monetary20200320a.htm>

- Swiss National Bank.

However, for those banks which aren't included in credit swap lines agreements, the FED announced the FIMA repo facility with the aim of easing strains in global dollar funding and mitigate the financial global effects of the pandemic.

3.5. Non-USD Swaps

Even if, as we stated before, USD is without any doubt the most used currency in swap lines, there are also currency swap lines which does not involve FED at all. In particular, we remember the lines between ECB to Magyar Nemzeti Bank¹³, where EU lent EUR to MNB, and the one between SNB, Narodowy Bank Polski¹⁴ and MNB, where Poland and Hungary borrowed CHF in exchange of EUR, both during the European debt crisis.

Then, during the 2008-2011 Icelandic financial crisis, Central Bank of Iceland borrowed from Sweden, Norway and Denmark, together with Latvia (which borrowed only from Sweden and Denmark) and Estonia (which borrowed only from Sweden).

Moving from Europe to Asia, since 2009, the People's Bank of China had agreed swap lines with 41 countries¹⁵, they had been normally valid for a three-year period, but many arrangements have been repeatedly renewed. China used currency swap lines to increase its global influence in developing countries worldwide. The many swap lines between China and its counterparts are a natural reflex of China's effort to internationalise the RenMinBi, increasing the share of RMB denoted transaction in relation to USD share; moreover, the RMB swap lines encourages counterparts to rely on Chinese goods and buy them with RMB, strengthening Chinese real economy. For counterparts, a high share of RMB denoted transaction means great availability of RMB credit and swap lines; they even could, as Argentina did, acquire dollar using RMB.

¹³ Hungarian Central Bank, MNB from now on.

¹⁴ Polish Central Bank, NBP from now on.

¹⁵ Hong Kong, Malaysia, Indonesia, Argentina, Korea, Belarus, Iceland, Singapore, New Zealand, Uzbekistan, Mongolia, Kazakhstan, Thailand, Pakistan, UAE, Turkey, Australia, Ukraine, Brazil, UK, Hungary, Albania, EU, Switzerland, Sri Lanka, Russia, Qatar, Canada, Suriname, Armenia, South Africa, Chile, Tajikistan, Georgia, Morocco, Serbia, Egypt, Nigeria, Japan, Macao, Laos. Chandrasekhar C.P. and Ghosh J., "Bilateral swaps' role in China's rising global footprint", *The Hindu Business Line*, Dec. 2020.

Other Asian swap lines had been established between South Korea and Indonesia (2013), Qatar and Turkey (2018), Japan and India (2018).

3.6. Credit Swap Lines at the start of the COVID-19 pandemic

With the start of COVID-19 pandemic, USD funding costs rose sharply, reaching levels last reached during the GFC, in particular around the end of February 2020 when supply-demand imbalances led to rising funding premia amid volatile financial markets (as we can see in Graph 1).

As explained by the FED in a press note on its website¹⁶, on 19th of March 2020, the New York Fed entered opened credit swap lines, between others, con:

- Reserve Bank of Australia (\$60 billion);
- Danmarks Nationalbank (\$30 billion);
- Norges Bank (\$30 billion);
- Reserve Bank of New Zealand (\$30 billion);
- Sveriges Riksbank (\$60 billion).

These agreements between NYFED and these other central banks were designed to help lessen strains in global U.S. dollar funding markets, since always more institutional investors during COVID-19 pandemic asked USD denominated assets to hedge their currency risk.

These arrangements were agreed for at least six months, but they are all now extended at least until December 2021.

Moreover, FED was also standing liquidity swap line already in place to improve liquidity conditions in money markets (especially in these times of market stress) with:

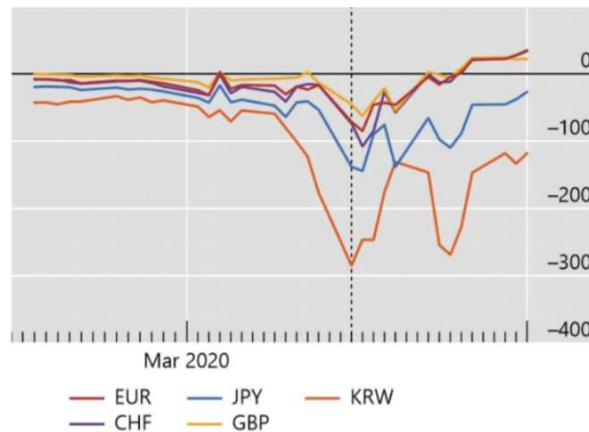
- Bank of Canada;
- Bank of England;
- Bank of Japan;
- European Central Bank;
- Swiss National Bank.

¹⁶ NYFED, “Central Bank Swap Arrangements”, 2020
<https://www.newyorkfed.org/markets/international-market-operations/central-bank-swap-arrangements>

USD swap lines operate by providing foreign central banks with the capacity to deliver USD funding to institutions in their jurisdictions and, vice versa, foreign-currency liquidity swap lines operate by providing the FED with the capacity to offer liquidity to US institutions in currencies of the counterparty central banks, mostly in CAD, GBP, JPY, EUR and CHF.

The FED since the GFC set up swap lines with foreign central banks, but this time it made the USD cheaper and the terms of borrowing less strict: it charged just 25 basis points above the OIS rate, while during OIC the price of borrowing USD was OIS plus 100 basis points (then reduced to 50).

The Federal Reserve is particularly willing to agree swap lines since the USD is nowadays the central currency on global funding markets (the United States accounts for about 15% of world trade and 25% of global GD and, according to BIS, around 50% of cross-border loans and debt instruments are denominated in USD, 85% of all FX transactions involve the USD, 60% of official FX reserve holdings are USD denominated as well as nearly half of international trade). Due to this, shocks on the international markets can easily spread to the US credit market and affect its financial stability. This may mean a credit crunch for US businesses and thus could affect the performance of the real economy in the U.S.



Graph 1: Three-month FX swap basis against the US dollar in March 2020¹⁷

¹⁷ Avdjiev S., Eren E. and McGuire P., *Dollar funding costs during the Covid-19*

3.6.1. Coordinated Central Bank Action to (Further) Enhance the Provision of U.S. Dollar Liquidity

On 20th of March 2020, BOC, BOE, BOJ, ECB and FED made a simultaneous press release to announce a coordinated action to help banks providing liquidity through USD credit swap lines to support the smooth functioning of USD funding markets. This has been the second announce: the first, on the 15th of March¹⁸, already provided the reopening of credit swap lines as they existed before. In particular, these central banks agreed to increase the frequency of seven-day maturity operations from a weekly frequency to a daily frequency. With this liquidity lines, the central banks' system was able to provide USD liquidity to national banks and institutional investors, both satisfying the immediate USD funding needs and supporting the market activity, making even banks more willing to intermediate and pass funds (borrowed directly from central banks and indirectly from the FED) to other market participants.

“The Bank of Canada, the Bank of England, the Bank of Japan, the European Central Bank, the Federal Reserve, and the Swiss National Bank are today announcing a coordinated action to further enhance the provision of liquidity via the standing U.S. dollar liquidity swap line arrangements.

To improve the swap lines' effectiveness in providing U.S. dollar funding, these central banks have agreed to increase the frequency of 7-day maturity operations from weekly to daily. These daily operations will commence on Monday, March 23, 2020, and will continue at least through the end of April. The central banks also will continue to hold weekly 84-day maturity operations.

The swap lines among these central banks are available standing facilities and serve as an important liquidity backstop to ease strains in global funding markets, thereby

crisis through the lens of the FX swap market, Bank for International Settlements, 1 Apr. 2020

¹⁸ FED, Coordinated Central Bank Action to Enhance the Provision of U.S. Dollar Liquidity, Mar. 2020. <https://www.federalreserve.gov/newsevents/pressreleases/monetary20200315c.htm>

helping to mitigate the effects of such strains on the supply of credit to households and businesses, both domestically and abroad”¹⁹.

Other than the FED credit swap line, the ECB is involved into other swap lines agreements, as shown in Table 1.

<i>Non-euro area counterpart</i>	<i>Type of arrangement</i>	<i>Maximum borrowable amount (in EUR million)</i>	<i>Expiry date</i>	<i>Reciprocal</i>
<i>Българска народна банка (Bulgarian National Bank)</i>	Swap line	2,000	31 March 2022	No
<i>Danmarks Nationalbank</i>	Swap line	24,000	Standing	No
<i>Hrvatska Narodna Banka</i>	Swap line	2,000	31 March 2022	No
<i>Sveriges Riksbank</i>	Swap line	10,000	Standing	No
<i>Bank of Canada</i>	Swap line	Unlimited	Standing	Yes
<i>People's Bank of China</i> ²⁰	Swap line	45,000	08 October 2022	Yes
<i>Bank of Japan</i>	Swap line	Unlimited	Standing	Yes
<i>Swiss National Bank</i>	Swap line	Unlimited	Standing	Yes
<i>Bank of England</i>	Swap line	Unlimited	Standing	Yes
<i>Federal Reserve System</i>	Swap line	Unlimited	Standing	Yes
<i>Magyar Nemzeti Bank</i>	Repo line	4,000	31 March 2022	No
<i>Banca Națională a României</i>	Repo line	4,500	31 March 2022	No
<i>Bank of Albania</i>	Repo line	400	31 March 2022	No
<i>National Bank of North Macedonia</i>	Repo line	400	31 March 2022	No
<i>Central Bank of the Republic of San Marino</i>	Repo line	100	31 March 2022	No
<i>National Bank of Serbia</i>	Repo line	1,000	31 March 2022	No

Table 1: List of central bank liquidity lines the Eurosystem maintains under its main framework for swap and repo lines (as of March 2021)^{21 22}

¹⁹ <https://www.bankofcanada.ca/2020/03/coordinated-central-bank-action-further-enhance-provision-u-s-dollar/>

https://www.ecb.europa.eu/press/pr/date/2020/html/ecb.pr200320_1~be7a5cd242.it.html

<https://www.federalreserve.gov/newsevents/pressreleases/monetary20200315c.htm>

<https://www.bankofengland.co.uk/news/2020/march/coordinated-central-bank-action-to-further-enhance-the-provision-of-global-us-dollar-liquidity>

https://www.boj.or.jp/en/announcements/release_2020/rel200320a.pdf

²⁰ Maximum borrowable amount is set to CNY 350 billion when CNY is provided to the ECB.

²¹ The table does not include repo lines established with non-euro area central banks under EUREP, for which the ECB does not disclose its counterparties.

²² https://www.ecb.europa.eu/mopo/implement/liquidity_lines/html/index.en.html

3.6.2. Credit Swap Line between DNB and FED

On 19th and 20th March 2020, Danmarks Nationalbank released two announcements about credit swap lines:

- The first²³, on the 19th of March, stated that DNB had agreed with FED to establish a bilateral line to address the increasing need of short-term USD liquidity; the aim of this credit swap line was to improve liquidity condition in global financial markets. The credit swap line was agreed for \$30 billion for, at least, six months.
- The second²⁴, on the 20th of March, stated an increase to the already existent ECB DNB credit swap line from €12 billion to €24 billion, without any temporal constraint. The aim is to provide EUR liquidity to Danish financial institutions.

3.6.3. Credit Swap Line between Norges Bank and FED

The Norges Bank, similarly to other Scandinavian central banks, on the 19th of March 2020, agreed with FED on an USD swap line and communicated it through a press release on its website²⁵. NB specified, moreover, that the agreement even “lays down the principles for swap facilities between the Scandinavian central banks in their respective currencies if, in an extraordinary situation, one or more individual banks should need liquidity in a Scandinavian currency other than that of its home country” and that “the agreement complements the memorandum of understanding regarding banks with cross-border activities, which the Nordic and Baltic central banks signed in 2016” in November 2020²⁶.

3.6.4. Credit Swap Line between RBA and FED

On 20th of March 2020²⁷, even Australian central banks participated with the other central banks to the FED swap line agreement; this swap line allows the Reserve

²³ <https://www.nationalbanken.dk/en/pressroom/Pages/2020/03/DNN202005405.aspx>

²⁴ <https://www.nationalbanken.dk/en/pressroom/Pages/2020/03/DNN202005416.aspx>

²⁵ <https://www.norges-bank.no/en/news-events/news-publications/Press-releases/2020/2020-03-19-3-press-release/>

²⁶ <https://www.norges-bank.no/en/news-events/news-publications/Press-releases/2020/2020-11-10-valutabytte/>

²⁷ <https://www.rba.gov.au/media-releases/2020/mr-20-09.html>

Bank to access up to \$60 billion in exchange for AUD; USD have been made available to Reserve Bank Information and Transfer System members via repurchase agreements by auction²⁸.

3.6.5. Credit Swap Line between RBNZ and FED

On the 20th of March 2020, with a press release on its website²⁹, even the Reserve Bank of New Zealand announced the re-establishment of a temporary USD swap line with FED up to \$30 billion to ensure smooth market functioning.

In the same announcement, clarified the relationship between the central bank and national banks:

- The Term Auction Facility (TAF): a program that alleviated pressures in funding markets, giving to the banks the ability to access term funding, with collateralised loans available out to a term of 12 months; the TAF has been implemented to give confidence that the RBNZ will support the market if needed.
- Providing funding in FX swap markets, to ensure rates near to the Official Cash Rate;
- Supporting liquidity in the New Zealand government bond market;
- Ensuring a robust monetary policy implementation framework, removing the allocated credit tiers for Exchange Settlement Account System account holders meaning that all the ESAS credit balances are remunerated at the OCR.

Moreover, in August 2020, the Reserve Bank signed an agreement with The People's Bank of China to renew and extend a reciprocal NZD/renminbi (RMB) currency swap line up to RMB 25 billion, first agreed in 2011, to promote bilateral trade, direct investment between the two countries and support domestic financial stability.

3.6.6. Credit Swap Line between SRB and FED

In the same agreement between FED and Reserve Bank of Australia, Reserve Bank of New Zealand, Bank of Korea, Monetary Authority of Singapore, Danmarks Nationalbank and Norges Bank, even the Sveriges Riksbank, Sweden central bank,

²⁸ <https://www.rba.gov.au/mkt-operations/resources/tech-notes/us-dollar-repos.html>

²⁹ <https://www.rbnz.govt.nz/markets-and-payments/foreign-reserves>

announced temporary, mutual currency swap line. On its announcement³⁰, SRB pointed the aim of the facility at improving liquidity conditions on global financial markets. Citing even Bank of Canada, Bank of England, Bank of Japan, ECB and Swiss National Bank, SRB claimed that central banks were ready to work together during the shocks due to COVID-19 pandemic

³⁰ <https://www.riksbank.se/en-gb/press-and-published/notices-and-press-releases/press-releases/2020/central-banks-have-entered-into-swap-agreements-in-us-dollars-with-the-federal-reserve/>

4. Results of the analysis

4.1. General Data

Our analysis results are not surprising; they are, indeed, perfectly in line with literature.

Graphs 3 show how, since 2014 (the start of our analysis, but is largely documented and discussed in the already cited literature that the scenario after GFC has been almost the same until 2020) CIP deviations are systematically large for every one of the currencies analysed.

We can say, repeating the words of Du and Schreger³¹ that “the failure of the CIP condition has become the new normal”. Table 2 summarize the CIP deviations in the period analysed, with their variance and their standard error.

CURRENCY	MEAN	VARIANCE	STANDARD ERROR
AUD	-0,5542	344,6004	18,5634
CAD	37,4382	546,5203	23,3778
CHF	53,6448	965,3616	31,0703
DKK	47,7299	906,6266	30,1102
EUR	24,3982	734,9960	27,0942
GBP	25,9495	725,0018	26,9259
JPY	76,3483	254,09	50,4071
NOK ³²	22,9748	126,49	35,5652
NZD	-36,2829	424,6756	20,6077
SEK	-4,8221	649,5102	25,4844

Table 2: Mean, Variance and Standard Error of CIP Deviations between 01/03/2020 and 01/04/2020

³¹ Du W., Schreger J., “CIP Deviations, The Dollar, And Frictions In International Capital Markets”, National Bureau Of Economic Research Working Paper 28777, p.3, May 2021.

³² There are some missing values in CIP Deviation for the Norwegian currency in the months of March and April 2020, so the mean and the variance are computed with the MATLAB functions “nanmean” and “nanvar”

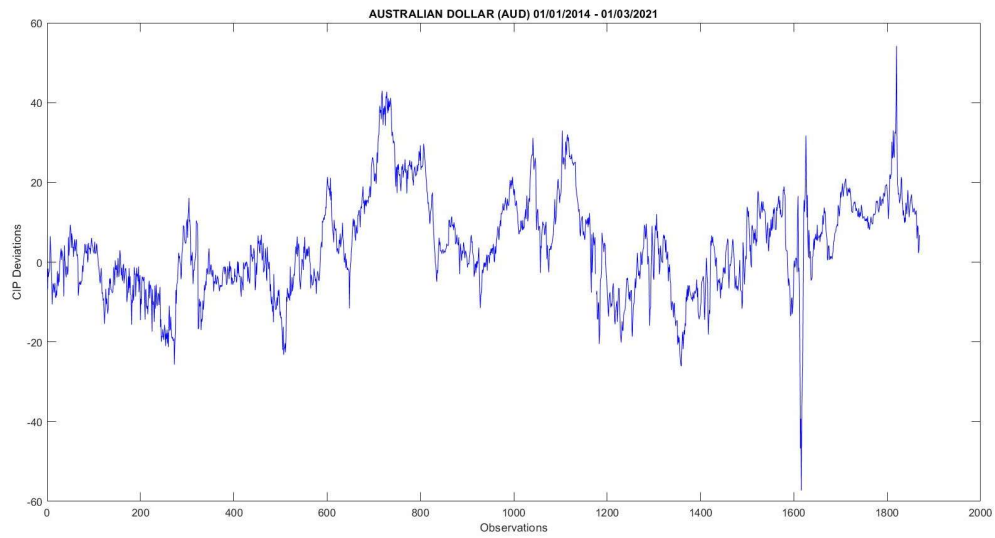
As we noted in our analysis, generally the cross-currency basis is generally positive, meaning that the direct dollar interest rate is higher than the synthetic dollar interest rate in the FX swap market.

This is true for Canadian Dollar (graph 2b), Danish Krone (graph 2c), Euro (graph 2d), Swiss Franc (graph 2e), Japan Yen (graph 2f) and Pound Sterling (graph 2g). Australian Dollar (graph 2a) and New Zealand Dollar (graph 2h) keep a permanent negative basis, meaning that for these currencies, the synthetic dollar interest rate in the FX swap market is higher than the direct dollar interest rate.

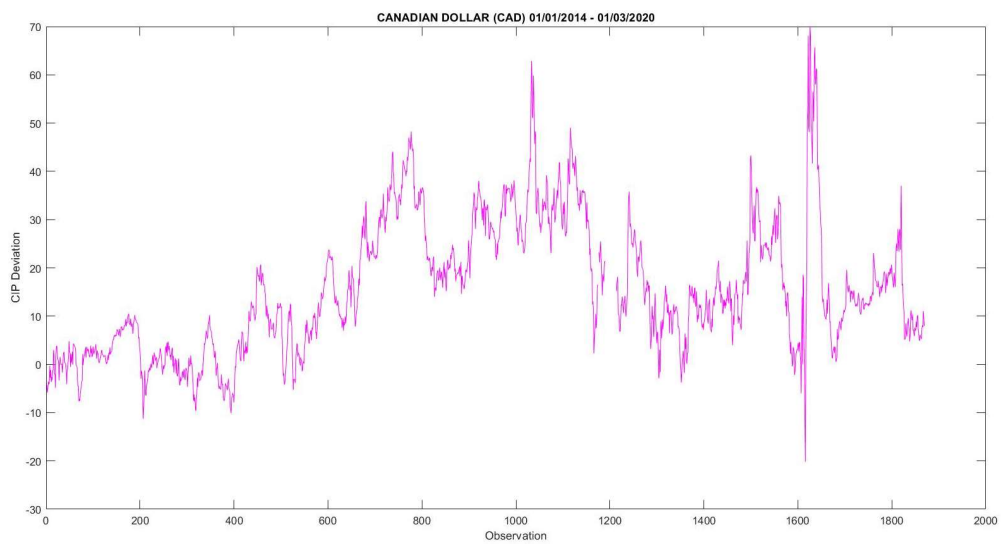
For Norsk Krone (graph 2i) and Svensk Krona (graph 2l), we can't say if during the period of the analysis the CIP deviations have been mostly positive or negative:

- The NOK in the period analysed has had a mean of -3.0054, varying between the range [-75.0071, 59.2891] with a variance of 216.7452 and a standard error of 14.7223;
- The SEK in the period analysed has had a mean of 8.0966, varying between the range [-65.3446, 72.7509] with a variance of 588.0869 and a standard error of 24.2505.

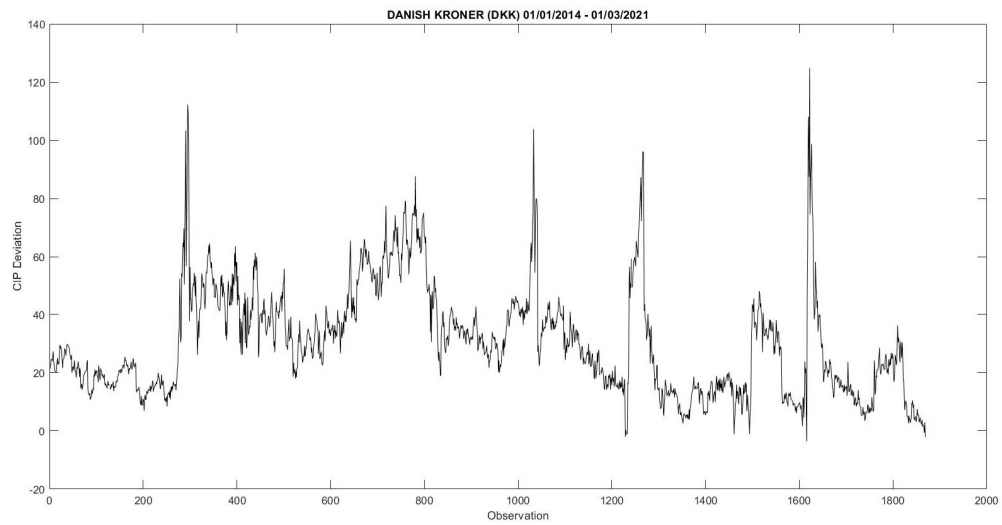
In this period, the JPY spot exchange rate is the one which appreciated the most (graph 3) and it simultaneously has had the most overvalued forward relative to spot; one notable phenomenon is the NOK, which had the largest spot price decline, but had little change in the currency basis: an explanation for the NOK's depreciation is that Norwegian economy largely depends on oil exports, which dramatically fell in the same period.



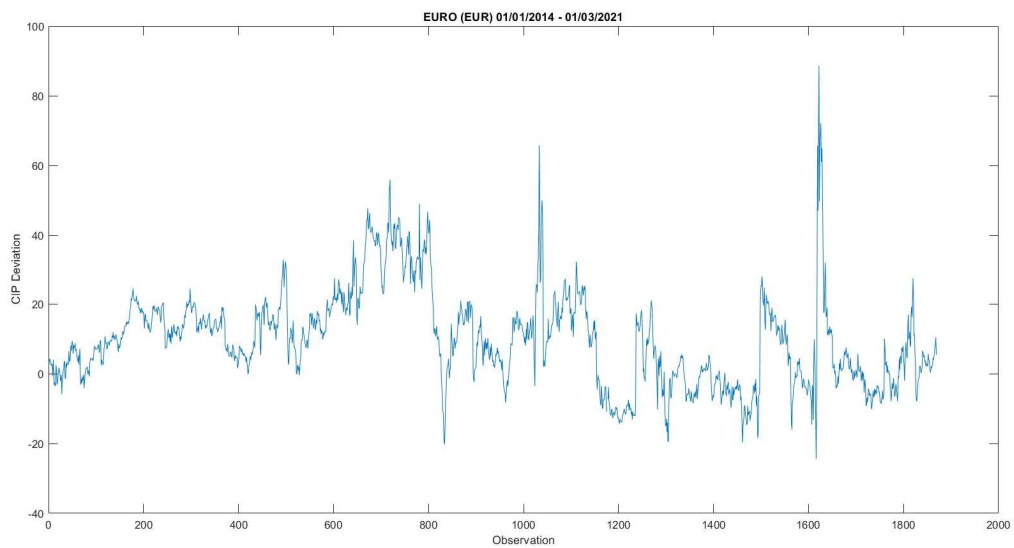
Graph 2a: CIP Deviatons (in bsp) from 01/01/2014 to 01/03/2021 for the Australian Dollar



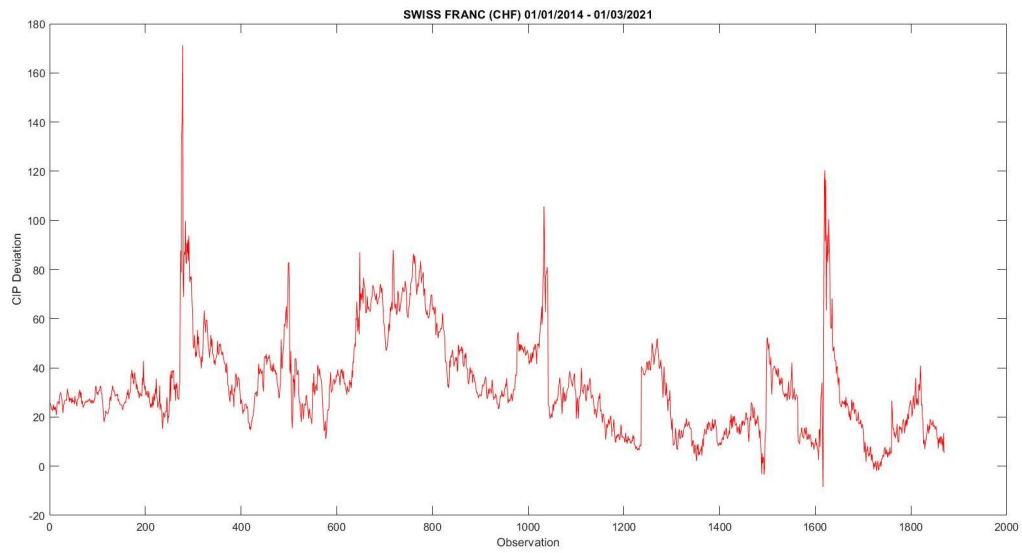
Graph 2b: CIP Deviatons (in bsp) from 01/01/2014 to 01/03/2021 for the Canadian Dollar



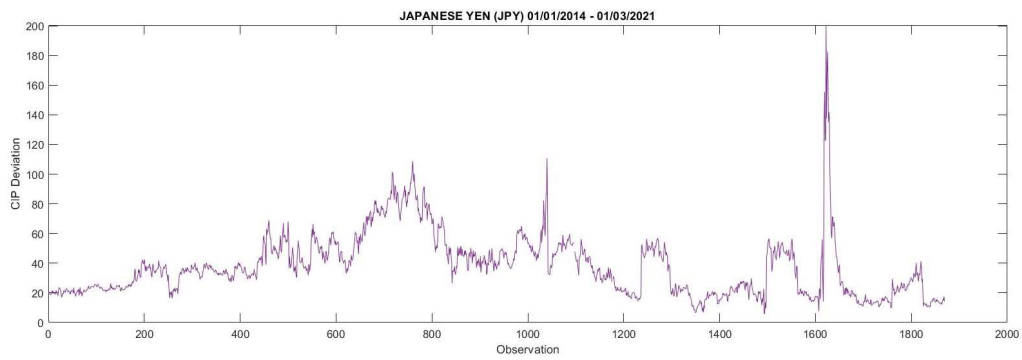
Graph 2c: CIP Deviatons (in bsp) from 01/01/2014 to 01/03/2021 for the Danish Kroner



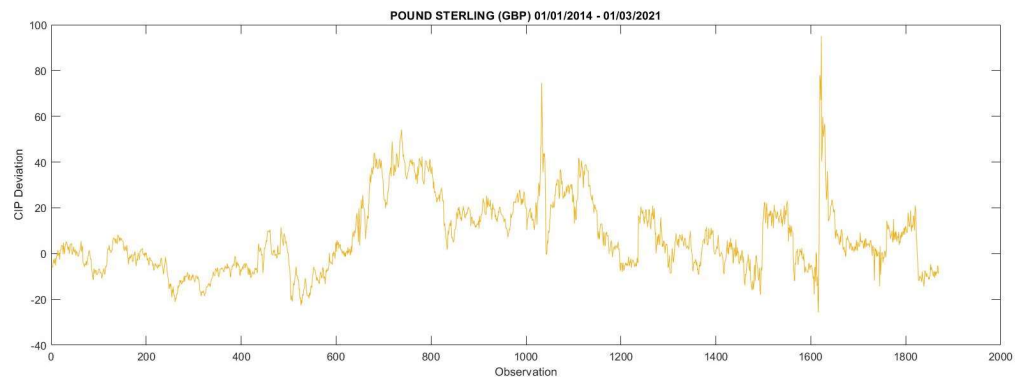
Graph 2d: CIP Deviatons (in bsp) from 01/01/2014 to 01/03/2021 for the EURO



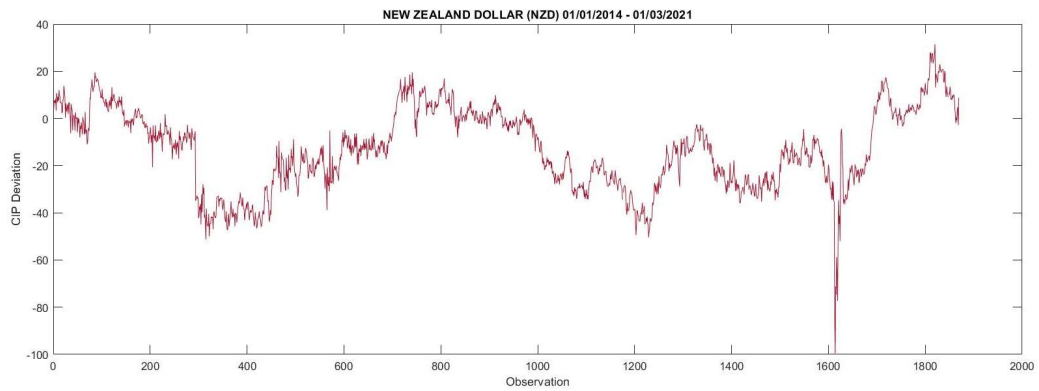
Graph 2e: CIP Deviatons (in bsp) from 01/01/2014 to 01/03/2021 for the Swiss Franc



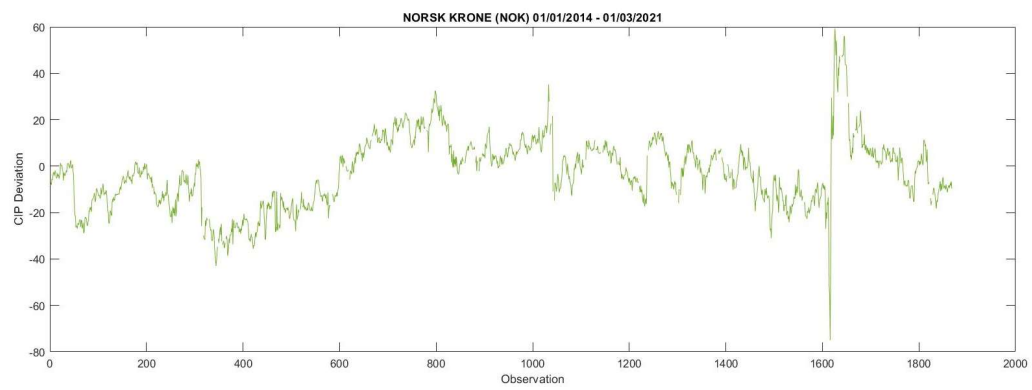
Graph 2f: CIP Deviatons (in bsp) from 01/01/2014 to 01/03/2021 for the Japanese Yen



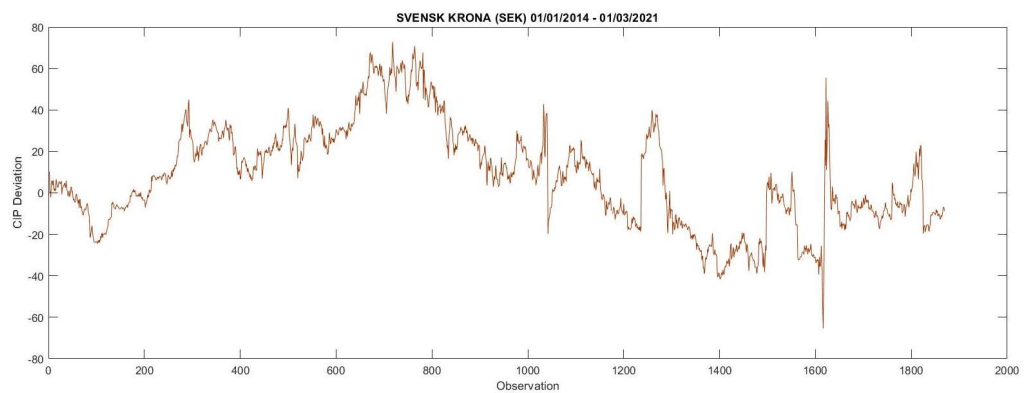
Graph 2g: CIP Deviatons (in bsp) from 01/01/2014 to 01/03/2021 for the Pound Sterling



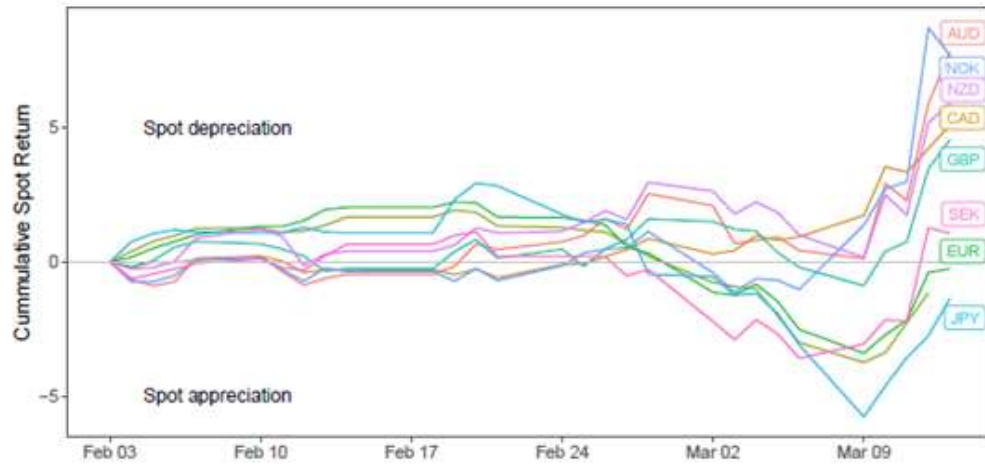
Graph 2h: CIP Deviatons (in bsp) from 01/01/2014 to 01/03/2021 for the New Zealand Dollar



Graph 2i: CIP Deviatons (in bsp) from 01/01/2014 to 01/03/2021 for the Norsk Krone



Graph 2l: CIP Deviatons (in bsp) from 01/01/2014 to 01/03/2021 for the Svensk Krona



Graph 3: Spot exchange carry trade returns³³

³³ Liao G., Zhang T., “The Hedging Channel of Exchange Rate Determination”, International Finance Discussion Papers 1283, Apr. 2020 (revised version of Aug. 2021).

4.2. CIP deviations drivers during COVID-19 pandemic

4.2.1. The “Principal Component”

CIP deviations have a precise factor structure: from the analysis of Du and Schreger, we know that the Cerutti, Obstfeld and Zhou³⁴ “principal component” (the safe haven currency factor) explain 51% of the total quarterly variation in the cross-currency basis. This is a strong signal that a great part of the overall deviation is given by a strong change in funding condition where various currencies are involved.

Let’s try to see what precisely happened during March 2020. To do this we have to define a structure for the USD lending/borrowing system:

1. The prime lenders are the households and corporates through their savings; these savings go to global banks through three ways: direct deposits, repos through government Money Market Fund (MMFs) and through unsecured Prime MMFs;
2. Then we have the global banking system, which of course implies both US and non-US banks, which occasionally receive USD liquidity from FED reserves and/or other central banks reserves through FX Swap;
3. Then, through repos and FX swaps, the global banking system passes the funds to banks, hedge funds, institutional investors and corporates, which are the ultimate USD borrowers.

So, large banks have a role of intermediation in the USD funding system.

The large need of USD funds came from the ultimate borrowers, which needed USD funds to hedge their currency risk.

When there is high demand for the USD from financial institutions and central banks, central banks need USD funding too, since they cannot satisfy the demand with their reserves.

In these periods, FED, through the credit swap lines, assumes the role of “lender of last resort”, as discussed by Bahaj and Reis³⁵.

³⁴ Cerutti E., Obstfeld M., Zhou H., “Covered interest parity deviations: Macrofinancial determinants”, *Journal of International Economics*, p.14, Jan. 2021

³⁵ Bahaj S., Reis R., “Central bank swap lines”, Bank of England, Staff Working Paper No. 741, Jul. 2018

As Du and Schreger suggest, this peak in USD demand and the reduction in USD funding supply result in high global funding crunches, which means a large spike in CIP deviation timeseries that reflect the difficult dollar funding and/or the high funding costs. Central swap lines are in this case a consequence, not a cause of CIP deviations.

The global funding crunches are only one of the main drivers of the CIP deviations observed in March 2020. In the next two paragraphs we'll explain the effect of the Leverage Ratio imposed by Basel III and the difference between LIBOR-based CIP deviations and Government Bond Yield-based CIP deviations.

4.2.2. Leverage ratio requirement

After the GFC, policymakers provided new frameworks for the financial system, to help it absorb and recover from the difficulties after a crisis. The Basel Committee on Banking Supervision introduced a minimum requirement on the leverage ratio defined as capital measure over exposure measure to act as a non-risk-weighted limit (since is related to the size of the bank rather than its balance sheet composition) to risk-weighted capital requirement.

The leverage ratio makes a bank less willing to conclude low-margin activities which require high turnover as the intermediation of FX swap and forwards since, even though the position is riskless, it increases the bank's balance sheet.

Because of this, to engage in these operations, banks, after 2014, require a premium, making it more difficult, in times of stress, to have access to USD funding.

Moreover, the leverage ratio restricts the ability of banks to engage in traditional CIP arbitrage since it requires to borrow USD in the cash market and borrow them in the FX swap market.

Cenedese, Della Corte and Wang provided evidence that the additional funding cost faced by international investors to borrow dollars through the foreign exchange

market is directly linked to the leverage ratio rule of dealer banks³⁶.

Even if the leverage ratio as a CIP driver isn't peculiar of the COVID-19 pandemic, it surely is a strong component of the cross-currency basis we have seen until March 2020, and then on.

4.2.3. Peculiar components of the government bond yield-based CIP deviations

The principal component and the leverage ratio components are valid both for LIBOR-based CIP deviations and government bond yield³⁷-based CIP deviations; but the nature of the two interest rates is different and, thus, the two measurements are subject to different drivers.

The first important CIP-related difference between risk free rates and GBY is that the second ones can be even lower, since could be other benefits to holding bonds, such as their high liquidity and collateral values. This yield difference is known as “convenience yield” of the government bond.

Then, the GBY has a premium component which represent the sovereign default risk.

Finally, GBY can differ from the risk-free rate due to countries-imposed capital control and the market segmentation between domestic and international markets.

Even if CIP could hold between risk-free rates, it could not hold in the same period for GBY, reflecting cross-country differences in one of these three components. Because of this CIP deviations in the international government bond markets not always mean arbitrage opportunity for banks.

So, for all the currencies which present an historical positive cross-currency basis, we can say that people are willing to pay a premium in bond yields to directly hold U.S. Treasury Bonds instead of other countries' government bonds (such as German on Japanese ones) and vice versa.

In time, after GFC, the convenience yield between US TB and other government

³⁶ Cenedese G., Della Corte P., Wang T., “Currency Mispricing and Dealer Balance Sheets”, Journal of Finance, Dec. 2020.

³⁷ From now on, “GBY”.

bonds generally narrowed, even if the long-term dollar funding kept being important for the global banks.

This contrast was particularly evidenced during COVID-19 pandemic, since the long-term yield on TB increased significantly on the mid of March 2020, while in the meantime short-term TB yield reached negative values.

The literature provides two complementary explanations about this phenomenon, but further research is needed to better understand the drivers of this trend. The two explanations are:

1. The faster U.S. debt-to-GDP ratio relative to other safe haven currencies post GFC; this implies a larger supply of U.S. TBs (Du, Im, Schreger³⁸ and Krishnamurthy, Vissing-Jorgensen³⁹);
2. The increased costs of intermediation due to global financial regulation post GFC (Duffie⁴⁰ and He, Nagel, Song⁴¹).

³⁸ Du W., Im J., Schreger J., “The US treasury premium”, *Journal of International Economics*, 2018.

³⁹ Krishnamurthy A., Vissing-Jorgensen A., “The aggregate demand for treasury debt,” *Journal of Political Economy*, 2012.

⁴⁰ Duffie D., “Still the World's Safe Haven? Redesigning the US Treasury Market After the COVID-19 Crisis”, *Hutchins Center Working Paper*, 2020.

⁴¹ He Z., Nagel S., Song Z., “Treasury inconvenience yields during the covid-19 crisis”, *NBER Working Paper*, 2020.

4.3. Difference between COVID-19 pandemic crisis and GFC in credit swap lines and CIP deviations

As we already said, the GFC has been a turnover point for the CIP deviations theory. But simply seeing the data we can observe a difference between GFC and COVID-19 crisis about CIP deviations: while, after GFC, CIP deviations did never turnback to their previous equilibrium (due to the shock which was followed by new regulation framework), after March 2020 the CIP deviations actually continued the pre-crisis path.

Moreover, during the COVID-19 crisis, the FED doubled the swap line maximal liquidity; this happened, as suggested by Aizenman, Ito, Pasricha⁴², because the GFC was a shock originated in the US financial system, while the COVID-19 pandemic hit worldwide.

Another important difference between GFC and COVID-19 pandemic is the amount of USD borrowed by the banks: during the GFC the European banks system, through the ECB, was the major demanding of USD; during the COVID-19 pandemic it was the BOJ which demanded the majority of USD, while the ECB, although the better condition of the swap line, drawn a lesser amount – but still significant – than during the GFC: between the 1st of March and the 31st of October 2020, the Japanese banking system drew \$225 billion, while the ECB drew \$144 billion, while in 2008 it drew more than \$300 billion (the daily amounts of USD borrowed by ECB and BOJ are presented in Tables 3).

This difference is easily explained if we look at the dollar exposures of BOJ and ECB and their evolution in these last twelve years: while European banks reduced their exposure, Japanese banks increased it; insurers, on the other hand, both Japan and Europe based, increased the amount of USD exposure⁴³, but still Japanese insurers did it at a faster pace, doubling it in the last five years.

⁴² Aizenman J., Ito H., Pasricha G.K., “*Central Bank Swap Arrangements In The Covid-19 Crisis*”, National Bureau Of Economic Research, Aug. 2021

⁴³ Gislén M., Hansson I., Melander O., “Dollar liquidity from the Federal Reserve to other central banks”, Sveriges Riksbank Economic Review, 2021.

BIS, “US dollar funding: an international perspective”, CGFS Papers no. 65., 2020.

IMF, “Global Financial Stability Report”, Oct. 2019

Operation Date	Settlement date	Term	Amount lent (\$bn)
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

Peak operation (2008-2010): \$170.9bn (15/10/2008)

Peak operation (2011-2019): \$50.7bn (7/12/2011)

Table 3a: Amount of dollar borrowed during March 2020 by the ECB⁴⁴

⁴⁴ Bahaj S., Reis R., “Central Bank swap lines during the Covid-19 pandemic”, Centre for Economic Policy Research, Apr. 2020.

Operation Date	Settlement date	Term	Amount lent (\$bn)
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	01/03/2020	7	24.10

Peak operation (2008-2010): \$50.2bn (21/10/2008)

Peak operation (2011-2019): \$12.6bn (10/01/2012)

Table 3a: Amount of dollar borrowed during March 2020 by the BOJ⁴⁵

⁴⁵ Bahaj S., Reis R., “Central Bank swap lines during the Covid-19 pandemic”, Centre for Economic Policy Research, Apr. 2020.

4.4. Timing

To specify the link between CIP deviations and credit swap line we have to look at the timing of the coordinated action of central banks: in particular, analysing March 2020, we can see that, generally, even for the currencies with negative basis, the CIP deviations increased in absolute values: this is not surprising, since, as we noticed before, the main driver of CIP deviation is the “safe-heaven” component, which rise sharply in times of crisis. These results are clearly visible in Graphs 4, where are presented the CIP deviation in basis points of March 2020⁴⁶.

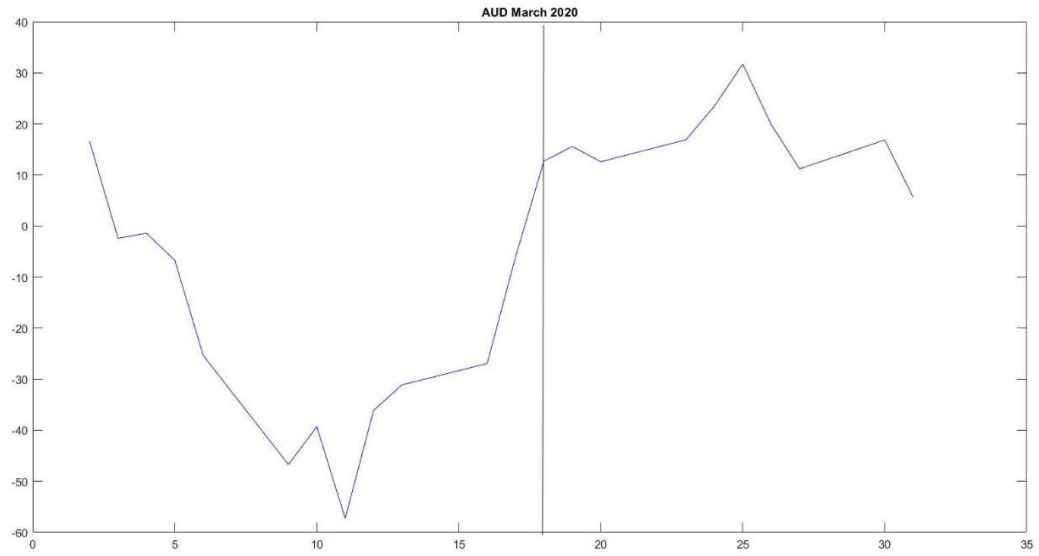
We can see that when the “new” credit swap lines are made available by FED (18th - 20th of March), the CIP deviation stops to increase sharply and, for some currencies it remains more or less constant with slight variations and only for those currencies which an historical negative cross-currency basis, it keep rising, even if at a slower pace than the 10th – 17th of March period. These results are clearly visible in Graphs 9.

We can conclude that this effect happened since the favourable pricing condition as of 18 March produced a significant relief for short-term USD funding in the FX swap market (longer maturities were less affected though).

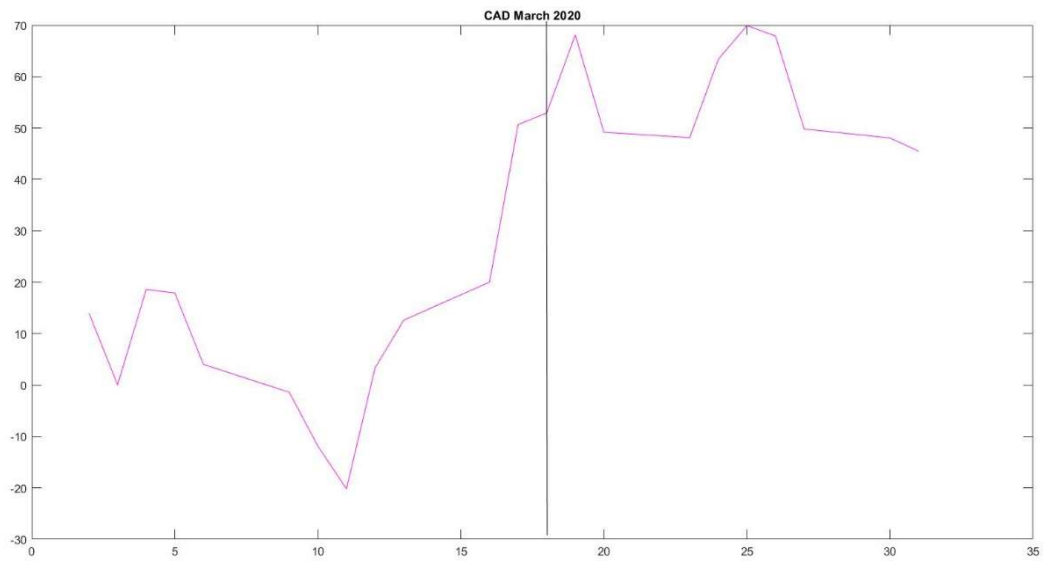
The allotment of USD between 18th and 20th of March reached peaks that were not seen worldwide since the GFC.

After the announcements of the operations, the overnight FX Swap basis spread fell by 476 basis points to 168 basis points, while the three-month FX swap basis spread tightened from 157 basis points to 107 basis points (but rose again to 144 basis points).

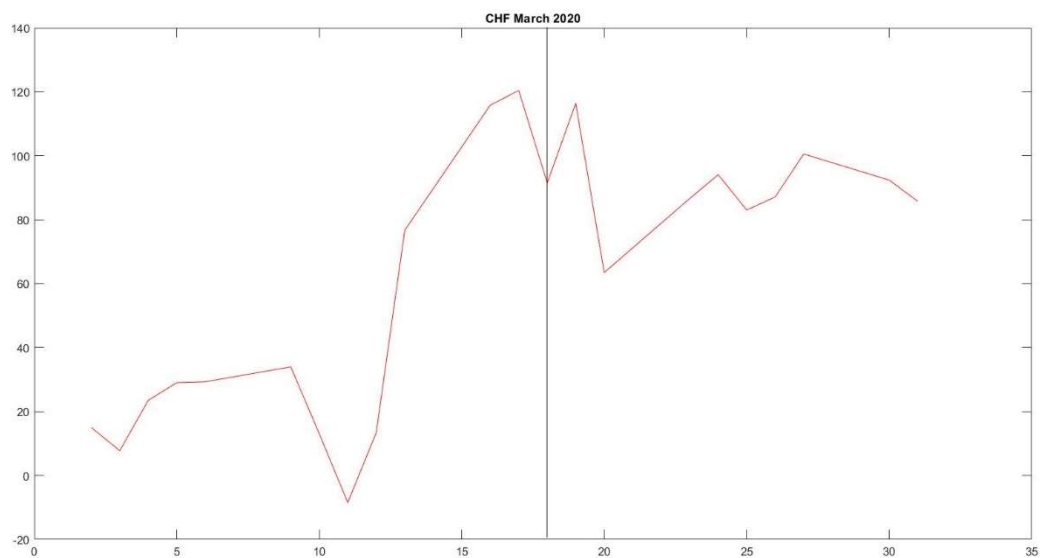
⁴⁶ The black line in every graph stands for 18 March 2020.



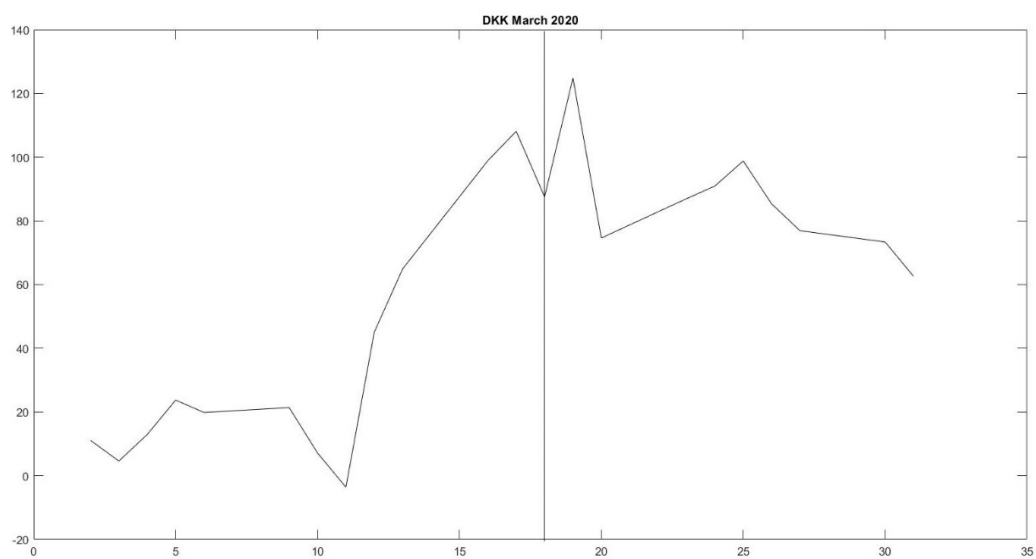
Graph 4a: CIP Deviations (in bsp) during March 2020 for the Australian Dollar



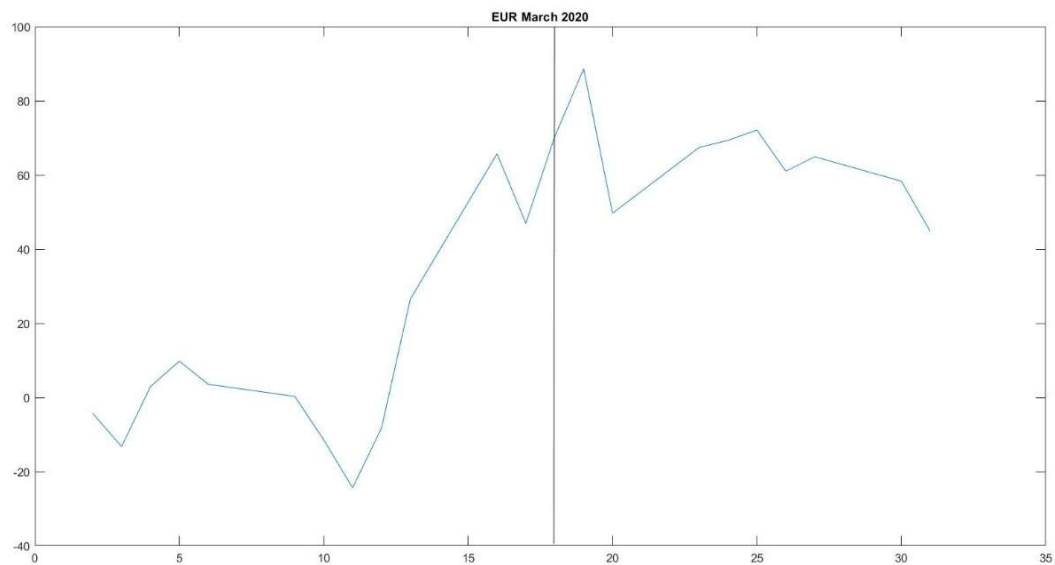
Graph 4b: CIP Deviations (in bsp) during March 2020 for the Canadian Dollar



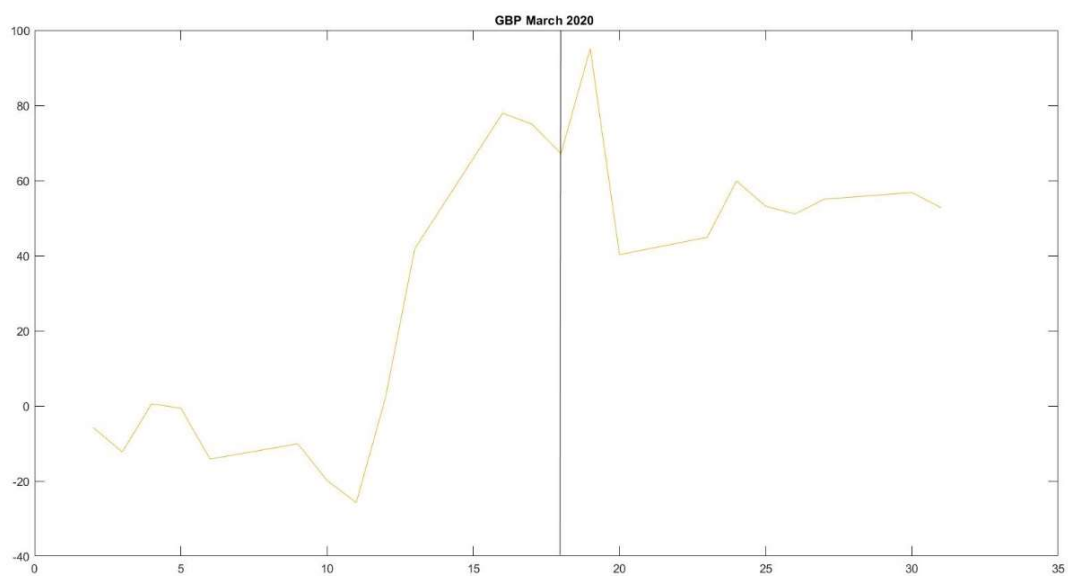
Graph 4c: CIP Deviations (in bsp) during March 2020 for the Swiss Franc



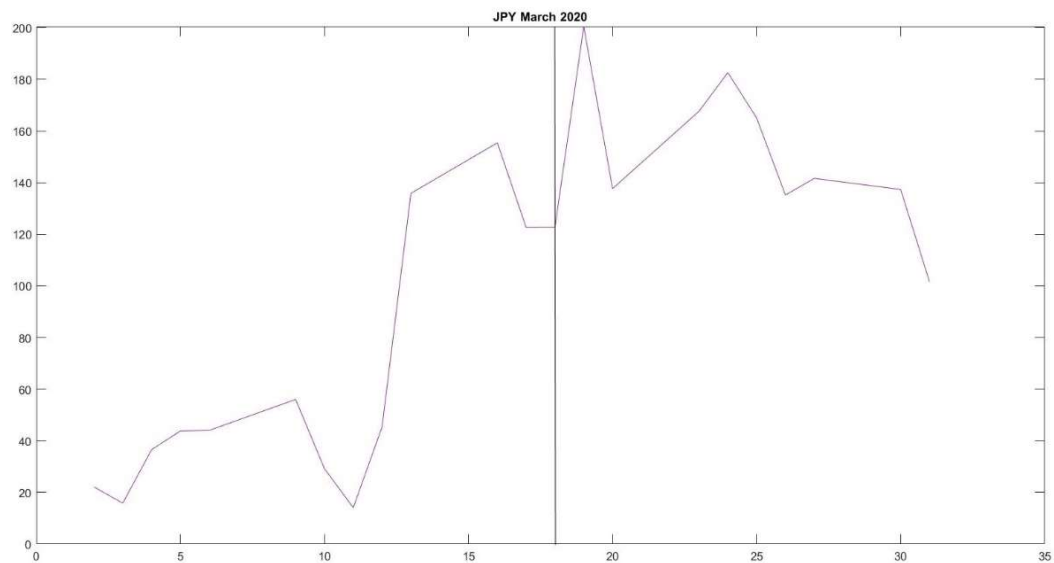
Graph 4d: CIP Deviations (in bsp) during March 2020 for the Danish Kroner



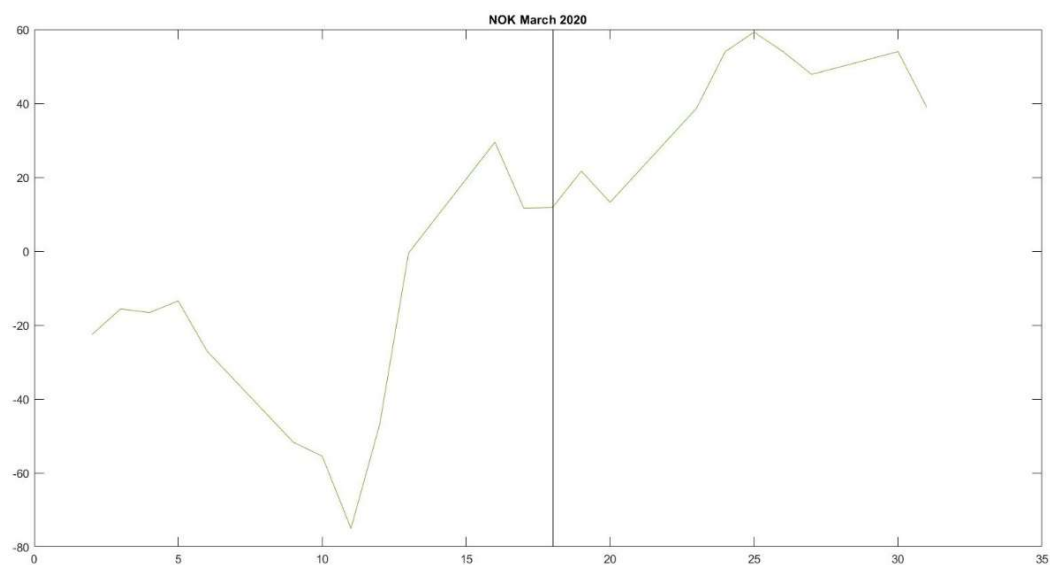
Graph 4e: CIP Deviations (in bsp) during March 2020 for the EURO



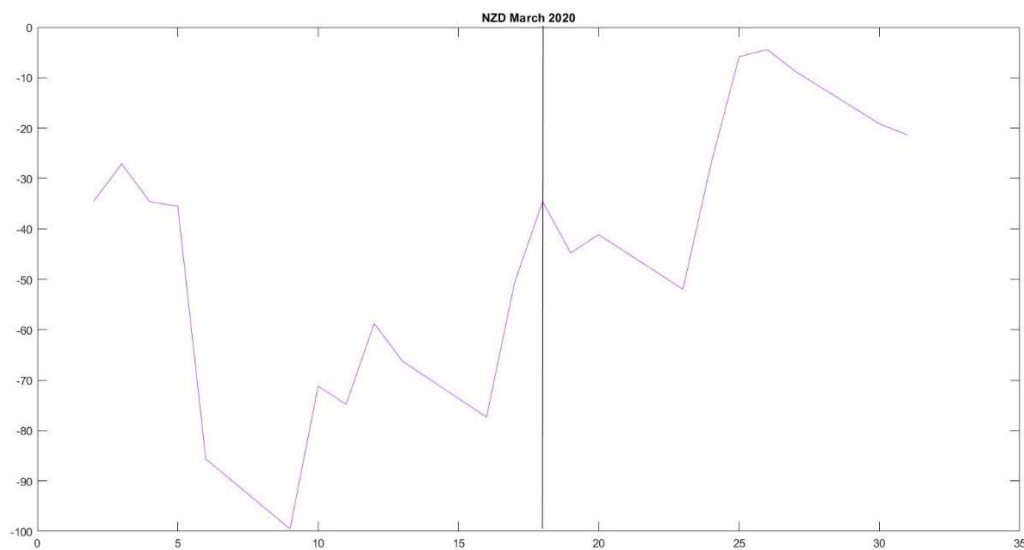
Graph 4f: CIP Deviations (in bsp) during March 2020 for the Sterling Pound



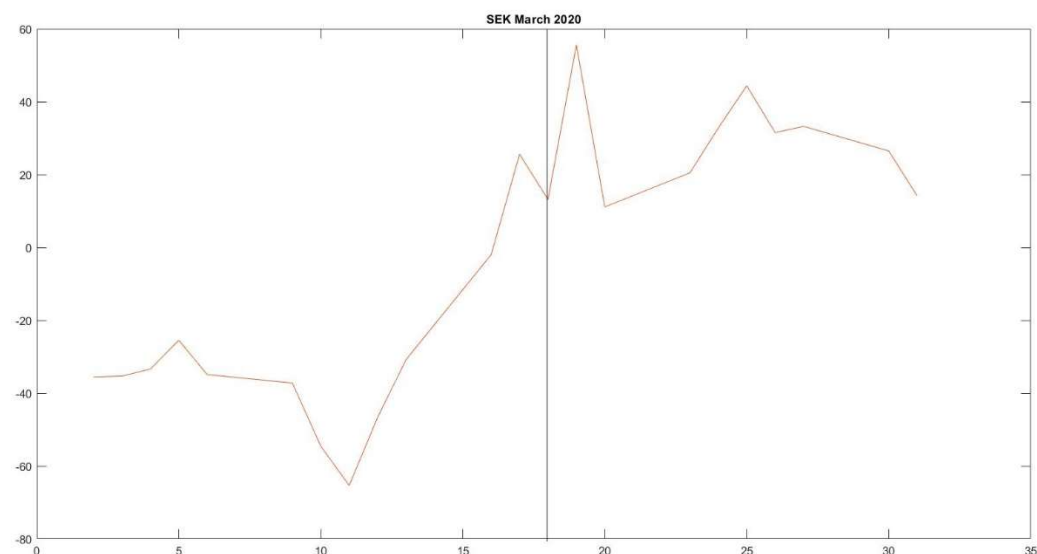
Graph 4g: CIP Deviations (in bsp) during March 2020 for the Japanese Yen



Graph 4h: CIP Deviations (in bsp) during March 2020 for the Norsk Krone



Graph 4i: CIP Deviations (in bsp) during March 2020 for the New Zealand Dollar

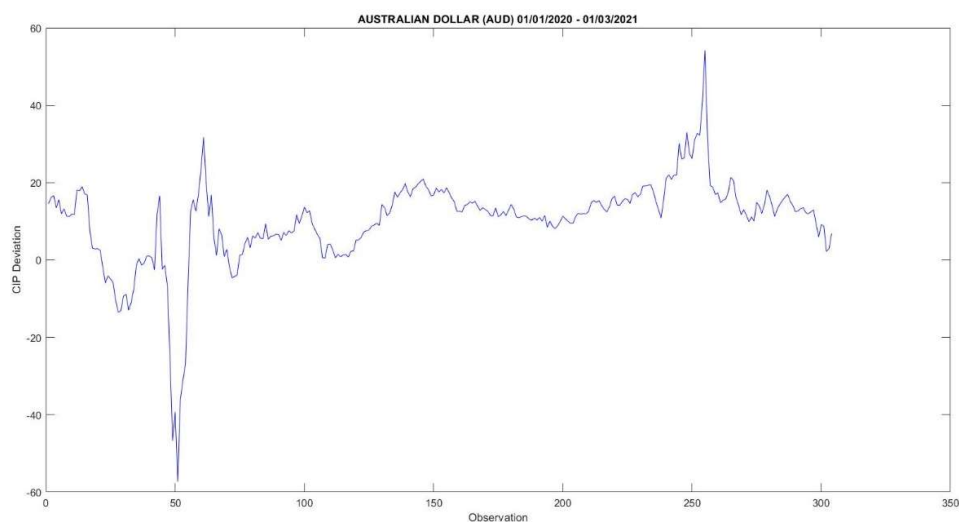


Graph 4l: CIP Deviations (in bsp) during March 2020 for the Svensk Krona

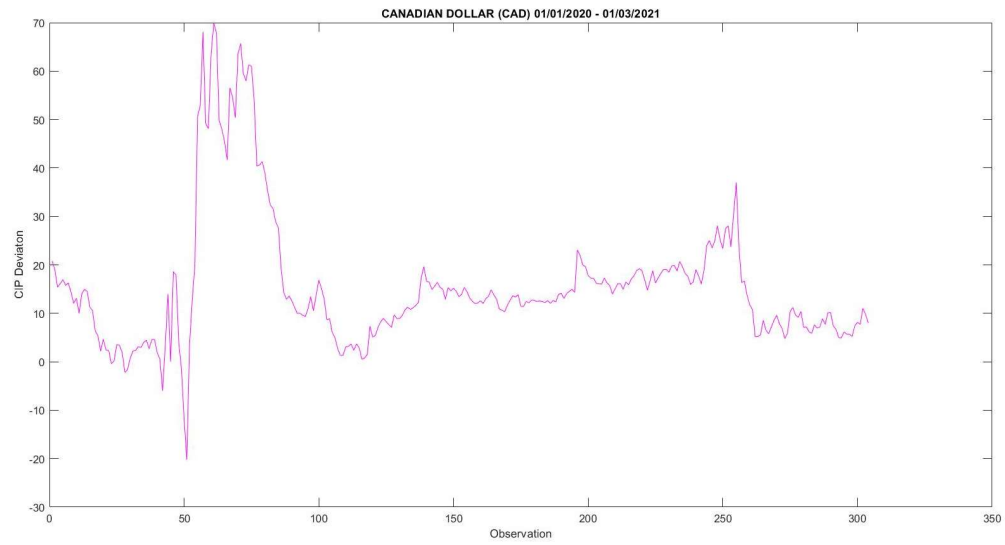
However, we can see that USD funding costs (and, thus, CIP deviations) remained high if compared to first days of the year (these results are shown in the Graphs 5). This is because, in most countries, the banks need to report certain regulatory ratios at the quarter-ends (so, in this case, at the end of March) and in these periods they are

reluctant to expand their balance sheet for this kind of intermediation activities. The overnight spread at the end of March reached 209 basis points (at the quarter-end of March 2019, it was 121 basis points) and the three-months spread in the last week of March reached an average of 95 basis points, nearly five times as large as average recorded in February 2020.

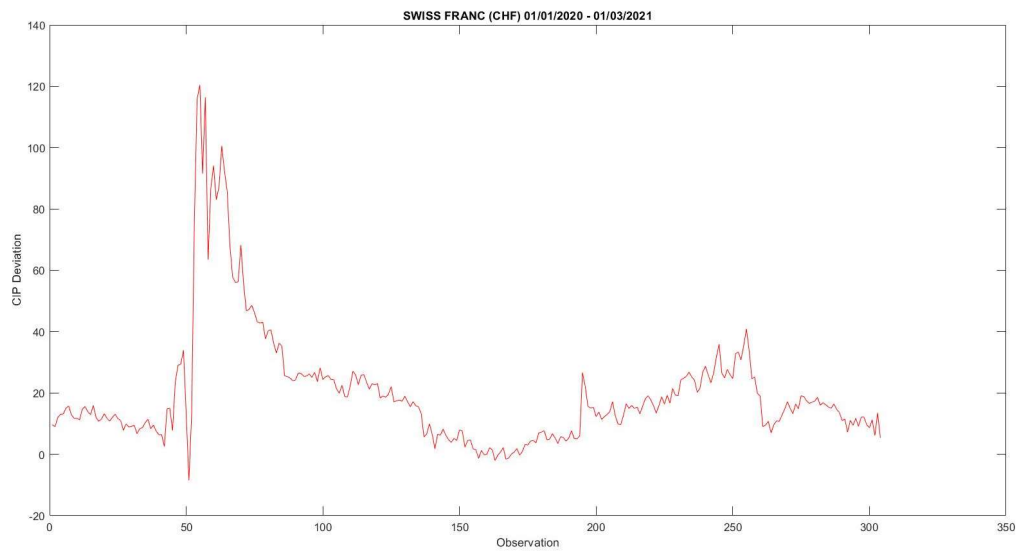
After the quarter-end, the cross-currency basis gradually normalised throughout the next months (as shown in the Graphs 5); short-term US dollar funding premia declined, reaching the pre-crisis values in mid-April. Longer-term FX premia took until the end of April to normalise.



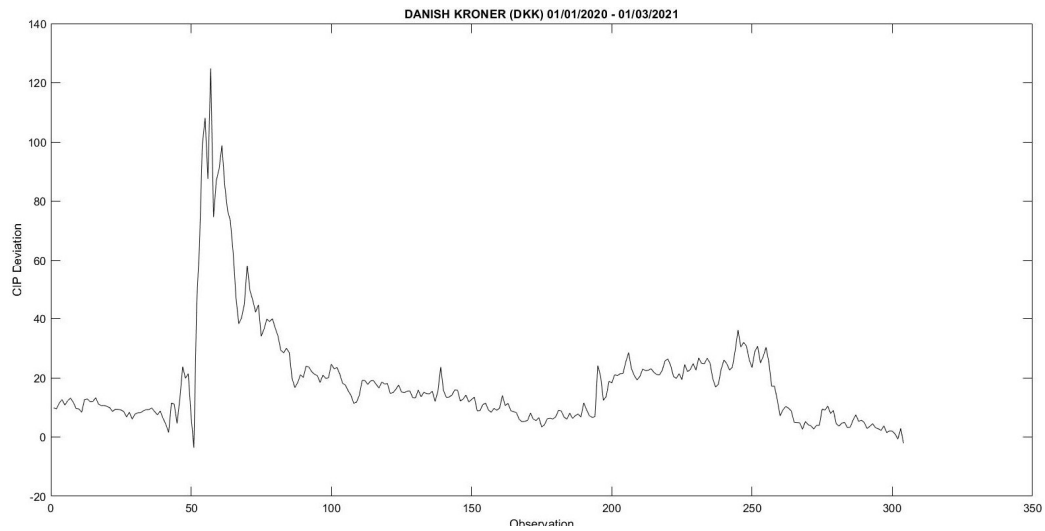
Graph 4a: CIP Deviations (in bsp) from 01/01/2020 to 01/03/2021 for the Australian Dollar



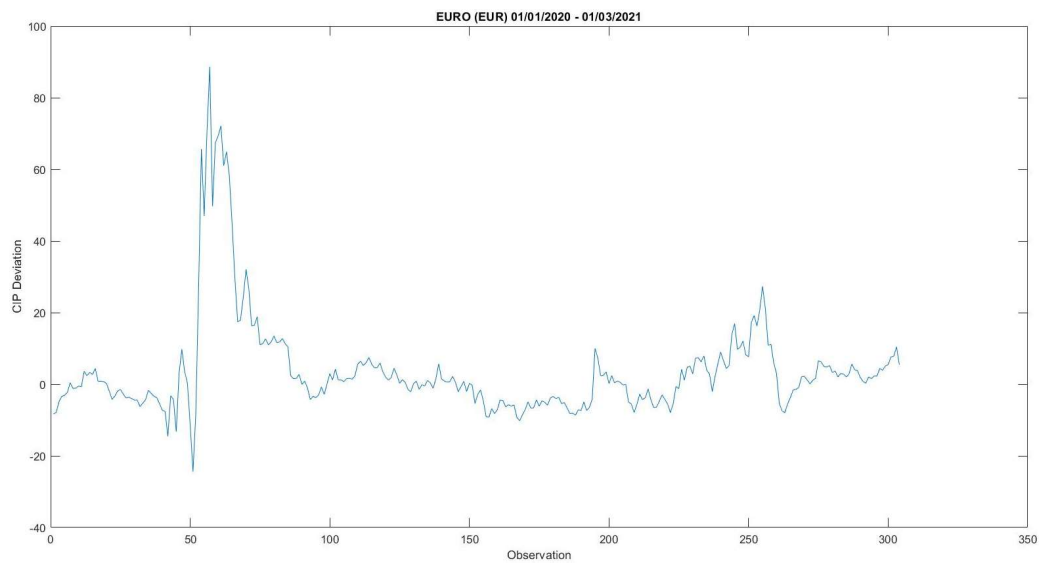
Graph 4b: CIP Deviations (in bsp) from 01/01/2020 to 01/03/2021 for the Canadian Dollar



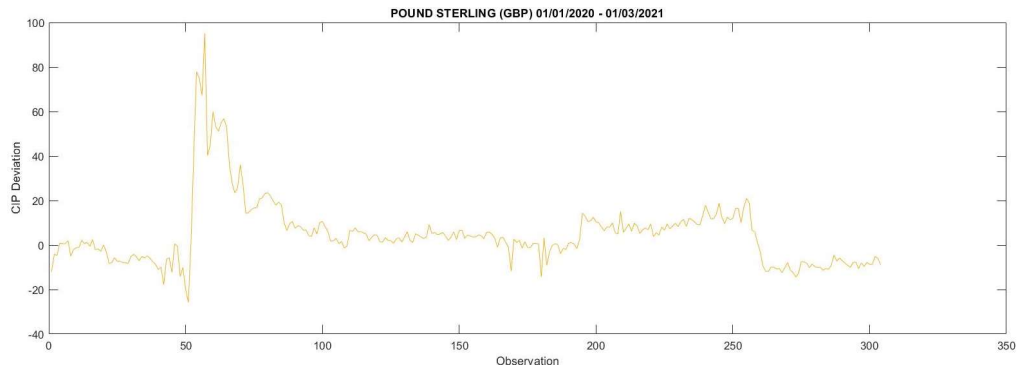
Graph 4c: CIP Deviations (in bsp) from 01/01/2020 to 01/03/2021 for the Swiss Franc



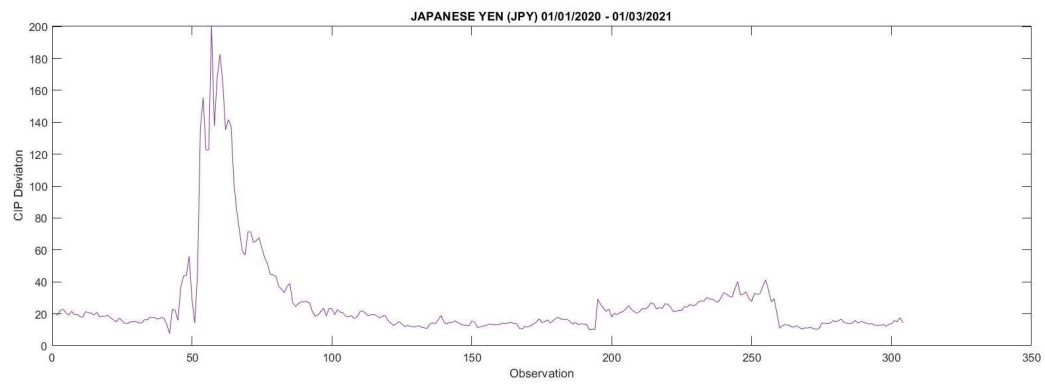
Graph 4d: CIP Deviations (in bsp) from 01/01/2020 to 01/03/2021 for the Danish Kroner



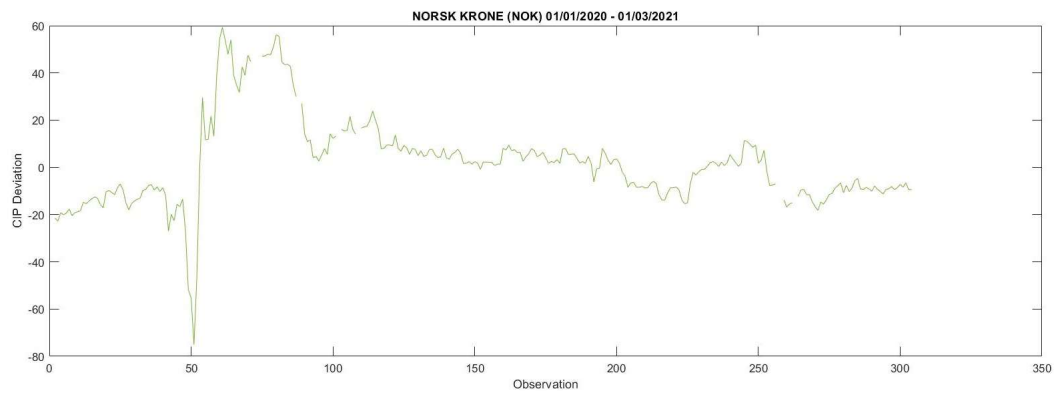
Graph 4e: CIP Deviations (in bsp) from 01/01/2020 to 01/03/2021 for the EURO



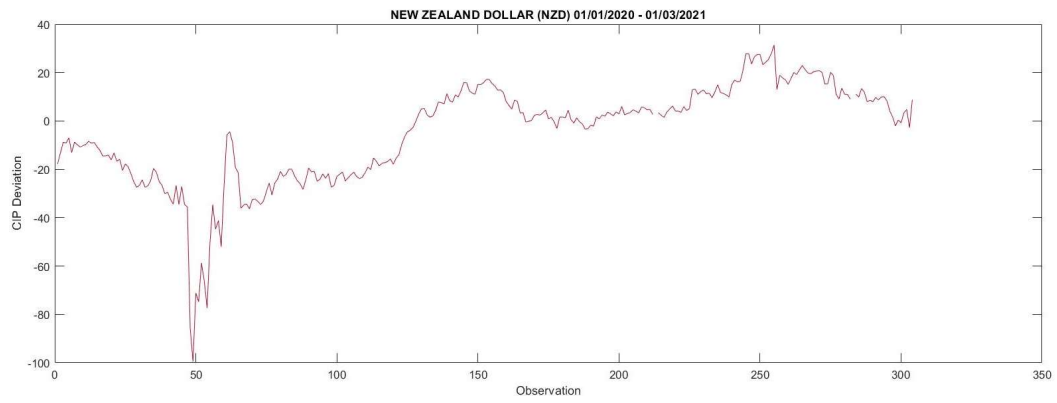
Graph 4f: CIP Deviations (in bsp) from 01/01/2020 to 01/03/2021 for the Pound Sterling



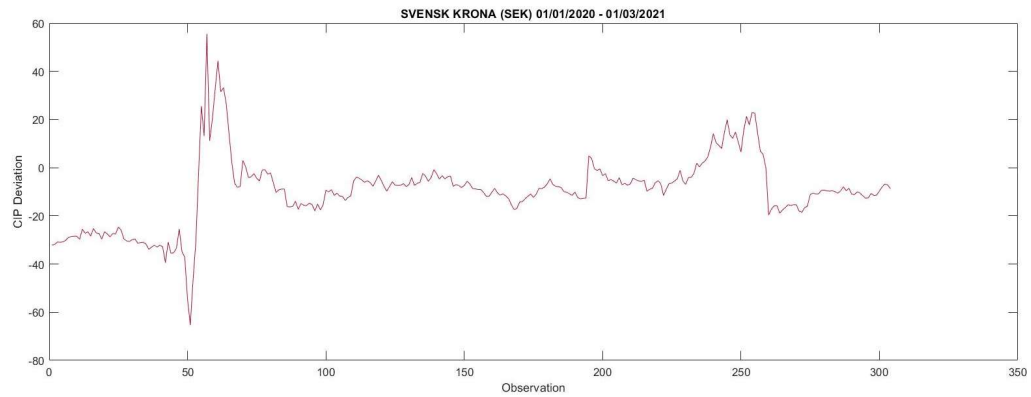
Graph 4g: CIP Deviations (in bsp) from 01/01/2020 to 01/03/2021 for the Japanese Yen



Graph 4h: CIP Deviations (in bsp) from 01/01/2020 to 01/03/2021 for the Norsk Krone



Graph 4i: CIP Deviations (in bsp) from 01/01/2020 to 01/03/2021 for the Norsk Krone



Graph 4l: CIP Deviations (in bsp) from 01/01/2020 to 01/03/2021 for the Australian Dollar

5. Conclusion

We have seen how CIP deviations behaved in the COVID-19 pandemic: the general trend was already upward in January and February 2020 (as shown in graphs 4), but in March we had the highest peak in the cross-currency basis for all the currencies analysed, except for the Australian Dollar and the New Zealand Dollar, the only currencies between those in the G10 which have an historical negative cross-currency basis against the USD.

Then, after the coordinated action of the central banks and the announcement of the new credit swap lines, the trend upward still continued, but at a slower pace: this happened since banks, after Basel III, are subjected to a balance sheet's limit, the leverage ratio, which is computed each quarter-end.

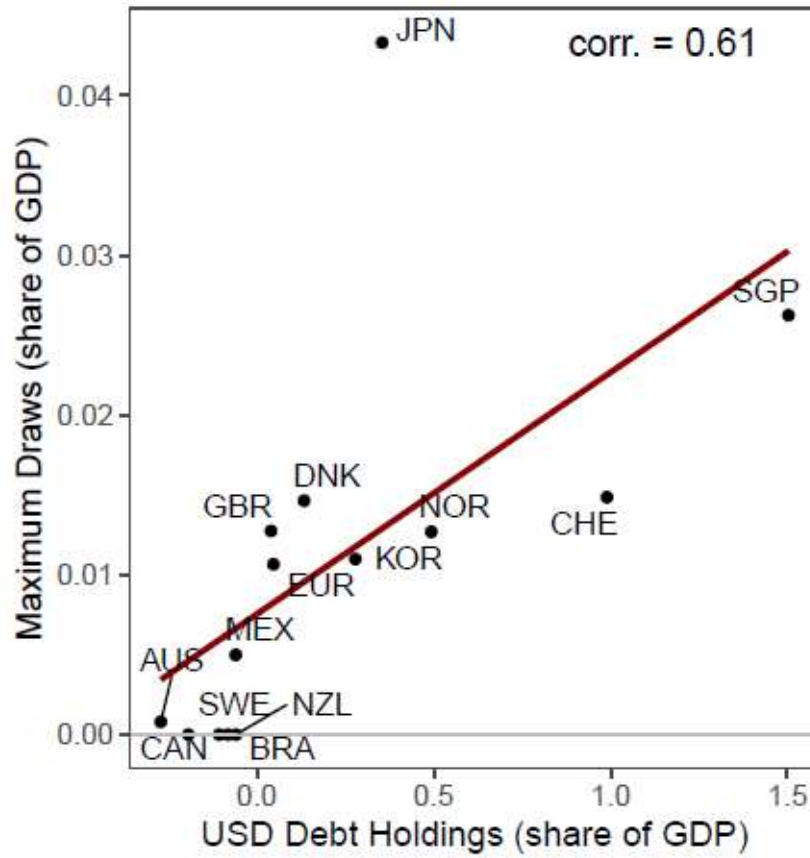
After the end of the quarter, cross-currencies basis for most currencies returned to its pre-crisis level.

The announcement of swap lines affects the determination of exchange rate and, thus, the CIP deviations by instilling confidence in the financial sector, potentially lowering hedging demand.

The use of central swap lines differs according to countries' external imbalances:

- Countries with positive external imbalances, such as Japan and Eurozone, benefit from the swap line injecting USD which lowers the cost of producing local currency forwards;
- Countries with low or negative external imbalances, such as New Zealand and Australia, do not benefit from dollar injection and exhibited little draws on their swap lines, thus lowering the effect of credit swap lines on their cross-currency basis.

There is thus a positive relationship between the maximum swap draws since March 2020 and the net dollar external debt holdings, as shown in the Graph 5.



Graph 5: Relationship between the relative amount of USD drawn and the net dollar external debt holdings⁴⁷

⁴⁷ Liao G., Zhang T., “The Hedging Channel of Exchange Rate Determination”, International Finance Discussion Papers 1283, Apr. 2020 (revised Aug. 2021).

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