EUROPEAN BANKS US DOLLAR LIABILITIES: BEYOND THE COVERED INTEREST PARITY

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Abstract

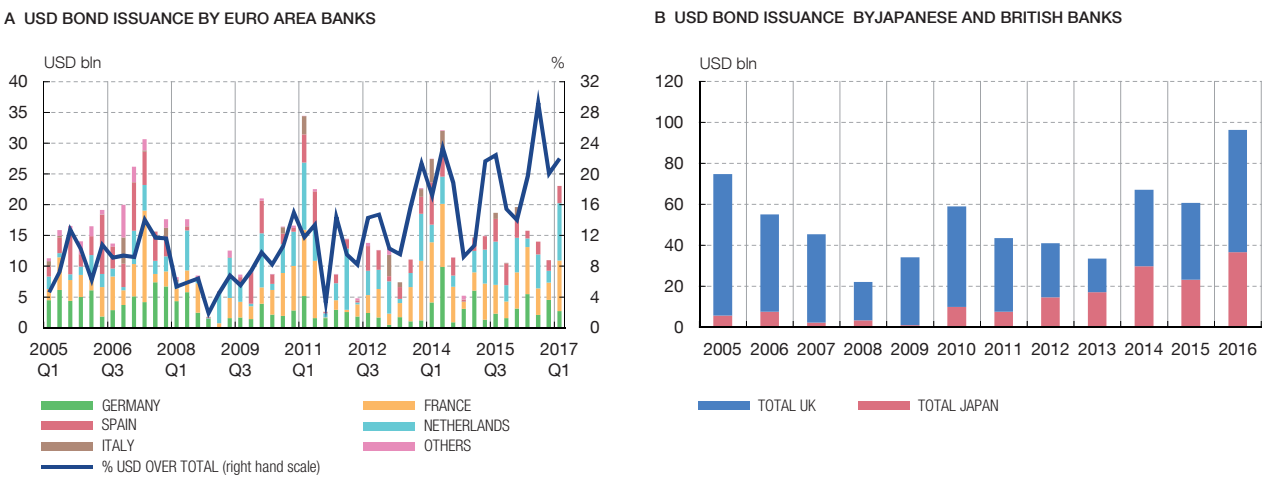
This article provides an update of the determinants of dollar-denominated long-term debt issuance by euro area banks, with a particular focus on deviations from Covered Interest Parity (CIP).These deviations, which have become more common since the global financial crisis, may have contributed to the so-called "covered cost savings" for banks issuing in US dollars at different moments in time. In contrast, negative savings may have deterred issuance in this currency during other periods. Since 2015, the relationship between covered cost savings and US dollar issuance seems to have weakened although "opportunistic" issuance may have persisted. We also document that recent regulatory reforms have enhanced the issuance of subordinated and other specific forms of long-term debt by euro area banks. These banks may have been incentivized to issue these bonds in US dollar, given the traditionally deep and wide US dollar investor base (i.e. strategic issuance). In addition to this, we investigate the possible reasons for CIP deviations as measured by the cross-currency basis swap. We conclude by analyzing possible financial stability consequences of the reliance of banks on US dollar markets and discuss how the supply of US dollars by non-banking entities, particularly those located in emerging economies, can create risks to the global financial system.

1 Introduction

Banks can choose between various currencies to fund their operations. The specific choice of the funding currency has not been investigated thoroughly for banks in the literature. This is somewhat surprising as some banks increasingly have been issuing in foreign currency. This article will investigate this issue in detail. More specifically, we shall focus on US dollar issuance by euro area banks.

The absolute amount of US dollar-denominated bonds issued by banks headquartered in the euro area totaled more than $60 billion in 2016, the fourth-largest yearly amount after 2007 and the second highest ever when only fixed-coupon bonds are considered. Moreover, the proportion of US dollar-denominated long-term debt over total issuance by

US DOLLAR-DENOMINATED BOND ISSUANCE BY NATIONALITY (a) CHART 1



SOURCE: Dealogic.

a Includes debt instruments with an original maturity of 18 months and longer. Securitizations, retained and government guaranteed bonds excluded. The nationality of a bank is defined as the country where the parent is headquartered.

euro area banks was around 19% in 2016, the highest relative amount on record. US dollar issuance by these banks was very strong during the first months of 2017 as well, both in absolute and in relative terms ($23 billion and 22%, respectively) (Chart 1, panel A). Recent large US dollar debt bank issuance is framed within the general trend towards heavier US dollar debt supply by euro area banks since the historical lows recorded during the global financial crisis (2%). Moreover, this tendency has held relatively steady in spite of high quarterly volatility and the negative impact of some periods of market distress. For instance, US dollar debt supply by euro area banks fell significantly during the euro area financial crisis in 2011-2012, during the rising geopolitical tensions at the end of 2014 and in parallel to the turbulences in the European Contingent Convertible Capital (CoCos) bond market at the beginning of 2016. An upsurge in US dollar borrowing usually followed these downturns, signaling the interest of euro area banks to further increase the importance of the US dollar in their long-term market funding operations.

By country, Germany was the largest issuer of US dollar-denominated bonds before the global financial crisis. However, the dominance of this country declined in line with total bond issuance activity of German banks after the abolishment of government guarantees for their regional banks (Landesbanken) in 2005 and the bankruptcies of some German banks in 2007-2009 [Van Rixtel et al. (2016) and Romo González (2016)]. After the crisis, the largest issuers were France and the Netherlands, being the latter the most important US dollar bond issuer in 2016. On the other hand, the share of Spanish and Italian banks within the euro area increased slightly after the crisis, but was in 2016 still below the pre-crisis levels.

Outside the euro area, US dollar long-term debt issuance by Japanese banks also has been very high in recent years. Japanese banks issued a historical record amount of almost $37 billion in 2016 (55% of their total bond issuance) (Chart 1, panel B). British banks, which were traditionally heavy issuers of US dollar debt in the past, have also increased their share of US dollar bond funding in recent years: more than 60% of total bonds issued by British banks in 2016 was denominated in US dollars, the highest proportion ever for these issuers.

What motivates a non-US bank to issue in US dollars? The US dollar is the dominant international currency, which explains the preference for US dollar debt borrowing and its' dominance in foreign exchange reserve holdings. For instance, the share of the US dollar in outstanding international debt securities and in the official holdings of foreign exchange reserves was around 60% and 64% in 2015, respectively [ECB (2016); see also Avdjiev et al. (2016)]. According to Shin (2016), the global banking system "runs in dollars", given the preeminent role of the US dollar in international transactions. However, the importance of the US dollar as the main anchor or international funding currency explains the level but not necessarily the developments in US dollar-denominated bond issuance by euro area banks in the last decade. In order to understand the latter, the specific literature on the determinants of foreign-currency denominated debt is more useful. The studies on the topic broadly point to three reasons for issuing foreign-currency debt: 1) on-balance sheet hedging of foreign currency exposures; 2) opportunistic issuance in order to realize lower issuance costs and 3) strategic drivers, linked to the characteristics of the investor base.

The most frequently mentioned motivation for the issuance of debt denominated in a foreign currency is that it serves as a natural hedge to assets that are denominated in a similar foreign currency i.e. to perform on-balance sheet hedging. Literature on the topic has mostly focused on non-financial firms, for which there is ample empirical evidence of

on-balance sheet hedging (e.g. Keloharju and Niskanen, 2001 and Allayannis et al., 2003). As for financial institutions, it can be considered that banks completely hedge their positions [e.g. McGuire and Von Peter (2009a and 2009b); Fender and McGuire (2010) and Ivashina et al. (2015)] and that they have regulatory incentives to do so. For example, Ivashina et al. (2015) argue that if banks were to leave currency risks unhedged, they would face an additional regulatory capital charge. However, banks do not necessarily need to fully match on-balance the currency denomination of their assets and liabilities. When assets denominated in a specific currency are larger than liabilities in the same currency for a bank, such as in the case of Japanese banks and some euro area banks (see sections 4 and 5), it is assumed that they use off-balance sheet instruments to hedge their currency risk [e.g. McGuire and Von Peter (2009a and 2009b) and Eklund et al. (2012)].

Other studies suggest that firms issue foreign currency debt opportunistically to take advantage of Covered Interest Parity (CIP) and Uncovered Interest Parity (UIP) deviations in international markets. These deviations can create so-called "covered" or "uncovered" cost savings or "bargains" when issuing debt [McBrady and Schill (2007) and Habib and Joy (2010)]. When firms issue on an unhedged basis, they borrow in the currency with the lower interest rate and do not buy any protection against the appreciation of that currency, in spite of UIP theory predicting exactly that outcome. It constitutes a sort of carry trade [Liao (2016)]. We assume that banks are more receptive to reap the benefits from covered cost savings than uncovered cost savings, given their better knowledge of and access to derivatives markets. Moreover, it is unlikely that banks leave open currency positions or expositions to currency fluctuations, given high regulatory costs, as explained above. Hence, they will probably hedge any US dollar funding operation rather than leaving it unhedged. In fact, some anecdotal evidence points to positive covered cost savings as the main drivers of US dollar debt issuance by banks [e.g. Moody's (2011) and JP Morgan (2015)]. However, other studies yield different results, based on banks adopting a counterparty position in currency swaps [McBrady and Schill (2004) and Habib and Joy (2010)]. More recently, Liao (2016) points to large public firms from developed countries issuing opportunistically more frequently on a hedged than on an unhedged basis.

Finally, companies may strategically issue in a foreign currency to gain access to deeper, more liquid or more complete markets or to a wider investor base [Keloharju and Niskanen (2001)]. Given that transaction costs in more liquid markets are lower (as long as these costs are a decreasing function of volumes), firms would prefer to issue foreign currency denominated debt in related liquid markets over more illiquid options [Munro and Wooldridge (2009) and Hale et al. (2014)]. For instance, Hale and Spiegel (2009) consider that foreign "vehicle currencies" such as the US dollar are useful to reduce administrative costs, given their economies of scale. Interestingly, the issuance of debt for strategic reasons may constitute a long-term funding strategy for banks which may lead them to deviate from pure opportunistic issuance in some cases, given the importance of maintaining their presence in a certain market [e.g. as described for US dollar-denominated covered bonds in ECBC (2016)].

In Romo González (2016), we provided an econometric analysis of the main drivers of US dollar-denominated debt issuance for a sample of banks located in the euro area, Switzerland and the UK between 2005 and the beginning of 2013. We find evidence supporting the hypothesis that banks issued US dollar-denominated debt for opportunistic reasons. More specifically, we show that European banks took advantage of CIP deviations and find support for the on-balance sheet hedging hypothesis and, to a certain extent, for strategic motivations. Moreover, we also show that high financial distress in markets

reduced the access to US dollar markets of European banks and that banks perceived as stronger (e.g. higher-rated) had better access to US dollar markets than weaker banks. In this article we will summarize some of the findings in Romo González (2016) and we add a descriptive update of the newest developments in US dollar-denominated long-term debt issuance by euro area banks and of covered cost savings. Hence, the structure of this article is as follows. Section 2 gives a theoretical explanation of the short-run and long-run CIP and the connection of CIP with the concept of covered cost savings. Section 3 explains the developments of covered cost savings for euro area banks with a particular focus on the developments between 2013 and 2016, when US dollar-denominated bond issuance by euro area banks increased to new record highs. We find some evidence that this trend overall has been less driven by opportunistic motivations, particularly since 2015 and more driven by strategic and regulatory factors. This notwithstanding, opportunistic motivations could explain to a certain extent the preference for US dollar denomination of some bonds issued by euro area banks. Section 4 analyzes the motivations for CIP deviations provided by the literature on the topic, with a particular focus on the most recent studies. Section 5 reflects on the consequences to financial stability related to banks' cross-border activities and US dollar funding as well as the possible new risks created by non-bank providers of US dollars in the FX swap market for the financial system. Finally, section 6 concludes.

2 An introduction to CIP and covered cost savings

A non-US bank may issue US dollar denominated debt "opportunistically" whenever US dollar borrowing is less costly on a hedged basis than borrowing in the domestic currency. The CIP is a no- arbitrage condition or condition of indifference such that when it holds, both funding options are cost-equivalent and the bank would be indifferent between one and the other. More specifically, at short maturities, CIP defines "the relationship among the spot exchange rate, the interest rate in two countries, and the forward rate... (which) implies that a borrower who hedges in the forward exchange market realizes the same domestic borrowing rate whether borrowing domestically or in a foreign country" [Fabozzi and Modigliani (2008), p. 659]. Short-term CIP in simple terms is defined as [see Popper (1993)]:

$$(1 + r^{€}_{t,t+n})\, F_{t,t+n}/S_t = (1+r^{\$}_{t,t+n}) \tag{1}$$

where $r^{€}_{t,t+n}$ and $r^{\$}_{t,t+n}$ are the domestic currency respectively foreign-currency risk-free rates for the period between t and t+n, S_t is the spot exchange rate at t (US dollar per unit of euro) and $F_{t,t+n}$ is the outright FX forward rate at t expiring at t+n. The left-hand side of the equation would represent the FX swap implied US dollar rate from the euro [Baba and Packer (2009)].[1] If CIP does not hold, we should add a non-zero basis (x) to Formula (1) such that:

$$(1 + r^{€}_{t,t+n} + x)\, F_{t,t+n}/S_t = (1+r^{\$}_{t,t+n}) \tag{2}$$

If we apply logs to (2) and rearrange the terms, we have the following expression of short-term CIP:

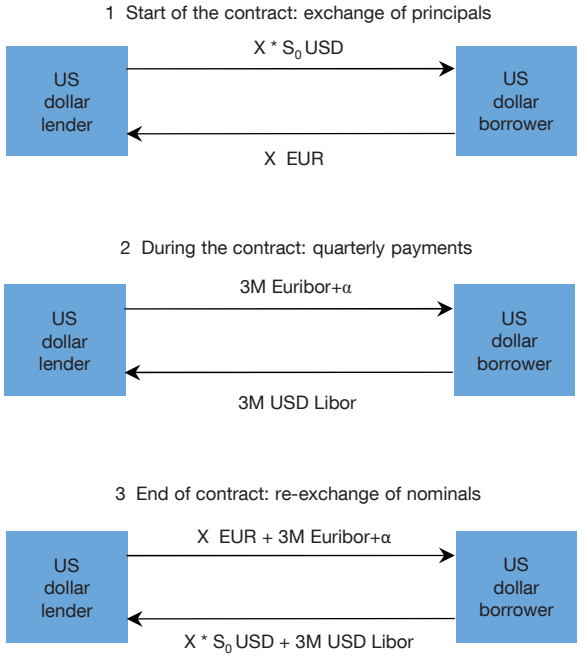
$$x = r^{\$}_{t,t+n} - (r^{€}_{t,t+n} + f - s) \tag{3}$$

1 The CIP condition can be also explained using an FX outright forward contract, which is defined as an agreement to exchange two currencies at a future date at an agreed upon exchange rate [Foreign Exchange Committee (2010)]. A FX swap is defined as a contract in which a party borrows one currency from, and simultaneously lends another to the counterparty, being the amount of repayment fixed at the FX forward rate [see Baba et al. (2008)].

Where f and s are the log equivalents of $F_{t,t+n}$ and S_t, respectively.[2] If x is negative, direct borrowing in euros in the cash market is more expensive than borrowing in US dollars and converting the proceeds to euros through a FX swap (i.e. direct euro borrowing is more expensive than "synthetic euro borrowing").

FX swaps are liquid only for terms below 1 or 2 years [Baba et al. (2008) and Popper (1993)]. Hence, at longer maturities, investors and borrowers may rather use currency swaps to hedge currency risk.[3] A currency swap is an agreement, usually ranging between 1 and 30 years, in which two parties agree to exchange a series of interest payments in different currencies (in contrast to FX swaps, where there are no periodical interim payments). These payments can be fixed or referenced to a floating rate and, in contrast to interest rate swaps (IRS),[4] notional principals can be exchanged at the beginning of the contract based on the initial spot exchange rate, S_t, and exchanged back at the maturity date at the same spot exchange rate S_t.[5] There are several kind of currency swaps, but in what follows we will focus on the so called cross-currency basis swaps (CCBS), in which floating interest rates in different currencies (e.g. 3-month Euribor and US dollar LIBOR) are exchanged periodically, as in Figure 1. In this case, following market convention the basis or spread α is added to the domestic currency floating reference.[6] Interestingly, a negative α would be detrimental for counterparty demanding US dollars in the CCBS (it receives 3-month Euribor "minus" α). Likewise, the counterparty providing US dollars in the CCBS benefits from a negative α, given that its' periodic payments will be lower than the 3-month

FUNCTIONING OF A NON-MARK TO MARKET CROSS-CURRENCY BASIS SWAP FIGURE 1



SOURCE: Adapted from Baba et al. (2008).

2 We assume that Ln (1 + r) ≅ r.
3 Market players can, alternatively, roll-over short-term FX swaps to cover a currency risk for the long-term. The roll-over strategy can be profitable for some investors, such as Japanese pension and insurance investors [BofAML (2017)].
4 In a plain vanilla interest rate swap (IRS), two counterparties exchange a stream of interest payments, one fixed and other floating, in a common currency. The interest rate payments are based on a notional principal but the parties do not exchange the notional principal.
5 This is the description of a non-mark to-market CCBS. In a mark-to-market CCBS, principals are reset periodically [Credit Suisse (2013)].
6 The CCBS basis α is different to the basis x in Formulas 2 and 3. As explained below, whereas x measures deviations from CIP in the short-run, CCBS basis α measures deviations from CIP in the long-run.

Euribor. Hence, every time the basis α is negative, a potential profitable arbitrage strategy consists on lending US dollars in the CCBS until the basis α is near or equal to zero.

For the reasons mentioned above, the long-run CIP condition requires currency swaps, in what Popper (1993) calls the "swap-covered interest parity condition". Given that the focus of our study is long-term bond issuance by banks, the long-run version of CIP based on currency swap rates is more useful for our study than the short-run CIP version [see also Habib and Joy (2010) and McBrady and Schill (2007)]:

$$r^{€}_{t,t+k} - c^{€}_{t,t+k} = r^{\$}_{t,t+k} - c^{\$}_{t,t+k} \quad (4)$$

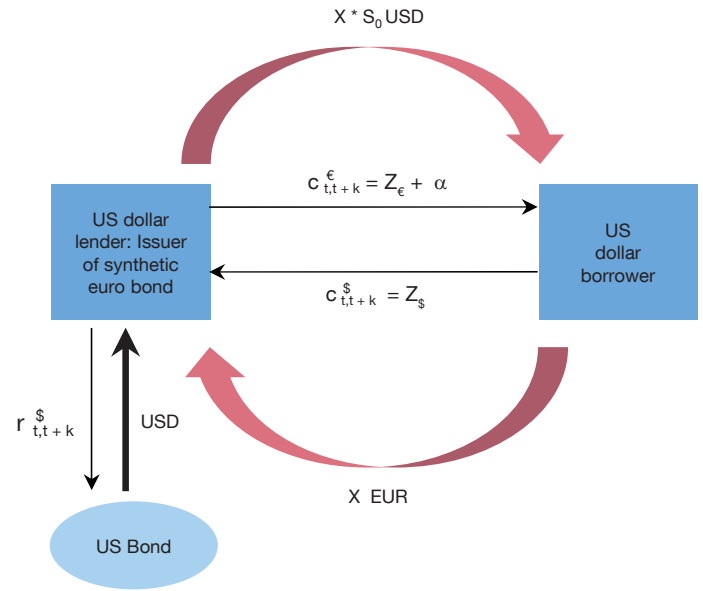
where $r^{€}_{t,t+k}$ and $r^{\$}_{t,t+k}$ are the domestic currency and foreign-currency rates between t and t+k, respectively; $c^{€}_{t,t+k}$ is the domestic (fixed) currency swap yield at maturity k and $c^{\$}_{t,t+k}$ is the foreign currency (fixed) currency swap yield at maturity k. As explained in Romo González (2016), $c^{€}_{t,t+k}$ is a combination of the domestic currency IRS fixed rate ($Z_€$) and the CCBS basis α, and $c^{\$}_{t,t+k}$ is equivalent to the US dollar IRS fixed rate ($Z_\$$) (See Figure 2 horizontal arrows). Equation (4) implies the following: if long-run CIP holds, a bank which covers its position through currency swaps should be indifferent between borrowing in the domestic currency (e.g. the euro) or in the foreign currency on a hedged basis (e.g. the US dollar). If CIP does not hold, a bank would have an opportunity to make riskless profits through arbitrage until the cost of borrowing in domestic currency equals the cost of hedged borrowing in US dollars. For example, if a euro area bank observes the following in the market:

$$r^{€}_{t,t+k} - c^{€}_{t,t+k} > r^{\$}_{t,t+k} - c^{\$}_{t,t+k} \quad \text{or} \quad r^{€}_{t,t+k} > r^{\$}_{t,t+k} - c^{\$}_{t,t+k} + c^{€}_{t,t+k} \quad (5)$$

It would be more expensive to issue a euro denominated-long term bond (pay $r^{€}_{t,t+k}$) than issuing a "synthetic euro denominated bond" (paying $r^{\$}_{t,t+k} - c^{\$}_{t,t+k} + c^{€}_{t,t+k}$, see Figure 2), that is, than issuing an US dollar-denominated long-term bond on a hedged basis. Notice that this is called a synthetic euro denominated bond, because the US dollar lender is replicating the payments of an euro-denominated bond through a swap.

ISSUING A SYNTHETIC EURO-DENOMINATED BOND

FIGURE 2



SOURCE: Author's elaboration.

In equation (3) we gave the general definition for the short-run CIP basis (x) based on risk-free rates (as if borrowers could borrow at risk-free rates). CCBS basis α stands for the long-run CIP basis when the interest rates are IRS rates.[7] However, banks usually pay a premium over IRS rates when borrowing in the long-term debt markets (i.e. they pay a positive "swap spread"). Hence, we define a specific long-term basis for euro area banks such that:

$$B = r^{\$}_{t,t+k} - c^{\$}_{t,t+k} + c^{€}_{t,t+k} - r^{€}_{t,t+k} \quad (6)$$

$$c^{€}_{t,t+k} = Z_{€} + \alpha$$

$$c^{\$}_{t,t+k} = Z_{\$}$$

When B is negative (or when the basis "widens" or there are CIP deviations, in what follows), we would be back to the situation described by Formula (5) in which it is more expensive to issue a euro- denominated bond than to issue a US dollar-denominated bond on a hedged basis (i.e. create a "synthetic euro denominated bond"). Hence, we expect that when B is below zero, euro area banks are more inclined to issue US dollar-denominated long-term debt and swap the proceeds to euro through a combination of IRS and CCBS (or directly through a fixed-for-fixed currency swap). When B is positive, on the contrary, there should be more bonds issued in euros in relative terms. When B is close to zero, we say that there are no CIP deviations for euro area banks. Notice in Formula (6) and Figure (2) that when the CCBS basis α is negative, the lender of US dollars in the CCBS has a benefit over the borrower of US dollars because it will pay less than the euro IRS. A euro area bank issuing in US dollars to lend them in the CCBS may obtain a profit. Moreover, a more negative basis α makes the basis B even more negative.

In Romo González (2016) we defined "covered" (borrowing) cost savings [following e.g. Habib and Joy (2010)]. Covered cost savings are just the negative of B and measure the borrowing costs savings that any euro area bank could make by issuing a US dollar-denominated bond and swapping the proceeds into euros, instead of issuing directly in euros. Hence, a negative B is equivalent to positive covered cost savings and when the basis is close to zero, covered cost savings of issuing in US dollars on a hedged basis are close to zero as well. If covered cost savings are zero, we assume that there are no CIP deviations:

$$\varepsilon^{C} = (r^{€}_{t,t+k} - c^{€}_{t,t+k}) - (r^{\$}_{t,t+k} - c^{\$}_{t,t+k}) \quad (7)$$

Where again:

$$c^{€}_{t,t+k} = Z_{€} + \alpha$$

$$c^{\$}_{t,t+k} = Z_{\$}$$

In what follows, we will focus on the covered cost savings for euro area banks instead of on the basis. We expect a positive relationship between covered cost savings and the ratio of US dollar debt issued by banks over total issuance.[8] In order to calculate covered cost savings for euro area banks, we use the yields of several investment grade indices from Markit and Bank of America Merril Lynch (BofAML). These indices provide a measure for the costs for financial companies and banks in euros and US dollars. Ideally, a yield

7 See Du et al. (2016) for further detail.

8 We obtain a similar picture when comparing US dollar total issuance over total issuance of bonds denominated in euros controlling for the spot exchange rate variations over time.

comparison should be drawn on a bond by bond basis, comparing US dollar and euro-denominated bonds of similar rating and maturity issued by the same bank. Hence, the indices used here are mere approximations,[9] although similar methods are used in some investment banks' reports and studies [e.g. BofAML (2017) for calculations on investors' demand for US dollar assets and Liao (2016).[10] We will use 10 year CCBS and IRS swaps to match the average maturity of US dollar fixed-coupon bonds since 2005.[11]

3 Covered cost savings and US dollar issuance

Chart 2, panel A, shows general covered cost savings for euro area banks for "synthetic euro bonds" vis-à-vis direct issuance in euros[12] as well as the relative amount of US dollar-denominated bond issuance by euro area banks over total issuance in all currencies. As expected, the Chart shows a positive correlation between both variables during most of the period considered. Covered cost savings were negative but relatively close to zero between 2005 and 2007, when markets were still enjoying relative good funding conditions and arbitrage by market players was effectively keeping the basis near zero.[13] However, since 2007 the level and the development of covered cost savings have varied substantially. We can classify covered cost savings for euro area banks into three different periods since the global financial crisis, depending on the general behavior of the variable.

The first period covers approximately the global financial crisis, which was essentially a US centered crisis or a US dollar crisis. It was characterized by very negative covered cost savings, which sunk to historical record lows at the beginning of 2009 (some time after the fall of Lehman Brothers in September 2008) and remained very negative until the end of 2010. Negative covered cost savings were mainly driven by the large spread differentials between the US dollar and the euro. This can roughly be approximated by the spreads between the yields and the IRS rates for each currency. According to this measure, long-term funding in US dollars relative to euros became very expensive (see Chart 4, panel A). Even when the CCBS basis α was negative, signaling profitable opportunities for CIP arbitrage (see Formula 7), high funding costs for euro area banks at that time might have made the arbitrage through US dollar bond issuance unprofitable for them. In consequence, relative total US dollar debt issuance by euro area banks was only around 2% on average by mid-2009.

9 For example, the BofAML and Markit indices are based on bonds issued by entities from different nationalities e.g. the investment grade US dollar BofAML banking index include US dollar bonds issued by non-euro area banks; similarly, the euro banking BofAML index includes euro bonds issued by non-euro area banks. Thus, these indices may not be fully representative of the real interest rates faced by euro area banks or financial companies during our sample period. Second, the bonds included in these indices do not necessarily have a ten year maturity, as is the case of the currency and interest rate swaps used for the approximation. Moreover, even though all bonds included are investment grade, differences in costs may arise between banks rated near the AAA or AA marks and banks closer to the below investment-grade threshold. The former is solved by using the different maturity and rating structures of Markit, although in this case, we take into account funding costs of all financial companies and not only banks (see Chart 3 panel B).

10 Du et al. (2016) provide a detailed explanation on their method for calculating long-term CIP deviations for KfW, an agency fully backed by the German government considered to be risk-free. They use zero-coupon yield curves and swap rates as proxy for CIP measures. In one of their appendices they explain how to exactly calculate the basis for coupon bearing bonds.

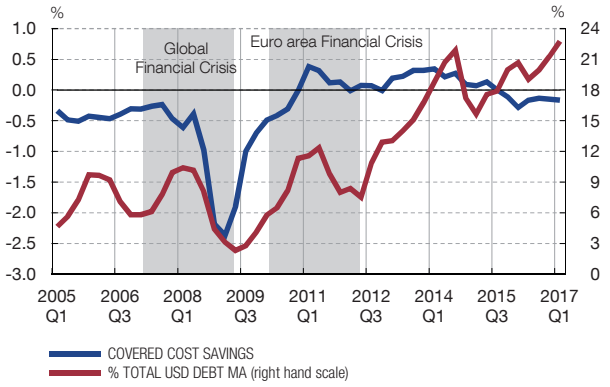
11 Generally similar results, with only some exceptions, are obtained when 5-year swaps are used for the period between 2005 and 2013. This would roughly match the median maturity of US dollar bonds issued by euro area banks.

12 Here we used the banking BofAML indices to track the performance of euro and US dollar investment-grade debt, respectively, publicly issued by banks. To qualify for these indices, the bond must have at least 18 months to final maturity when issued (which matches the maturity of our sample) as well as a fixed-coupon schedule and a certain minimum amount outstanding. The US dollar banking BofAML index includes investment-grade US dollar-denominated bonds issued in the US market by US and non-US banks. As with all approximations, using alternative indices or alternative calculation methods provide some changes in the levels of Covered Cost Savings, but overall trends are similar. Bond issuance includes fixed-coupon instruments only.

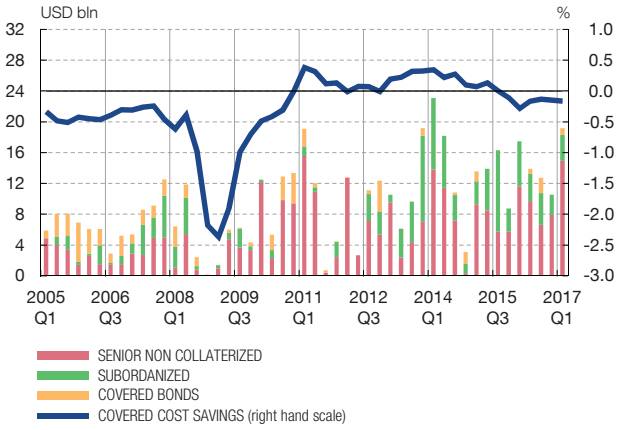
13 For the calculations of the basis we are not taking into account transaction costs in derivative markets as in Du et al. (2016) or Pinnington and Shamloo (2016).

US DOLLAR-DENOMINATED BOND ISSUANCE AND COVERED COST SAVINGS (a) CHART 2

A USD BOND ISSUANCE BY EURO AREA BANKS AND COVERED COST SAVINGS



B USD BOND ISSUANCE BY EURO AREA BANKS BY INSTRUMENTS AND COVERED COST SAVINGS



SOURCES: Dealogic, BofAML, author's calculations.

a USD debt includes fixed-coupon debt instruments with an original maturity of 18 months and longer. Securitizations, retained and government guaranteed bonds excluded from total USD bond issuance. Covered cost savings calculated as quarterly averages using 10 year swaps.

In contrast, covered cost savings turned positive during the euro area financial crisis, which started in May 2010 with the announcement of the first bail-out package to Greece. Covered cost savings reached a historical high at the beginning of 2011. In parallel, US dollar total debt issuance recovered from its 2009 lows and accounted for a 12% of total issuance by euro area banks on average in mid-2011. US dollar total debt activity fell afterwards, affected by the spillover of sovereign tensions to the banking sector and the increase of currency redenomination risk. As during the global financial crisis, credit spread differentials were significant drivers of the covered cost savings of banks. Given that the focus of the financial crisis was located on Europe, euro-denominated long-term funding costs for banks increased significantly and were at times even higher than costs of funding in US dollars. Volatility was very high during this period as banks tapped markets whenever a window of opportunity opened, coinciding with the brief periods of lower risk aversion in international markets.

Covered cost savings were positive until around mid-2015 when US dollar debt issuance accounted for around 18% of total debt issuance on average by euro area banks. However, the positive correlation between these savings and US dollar funding seems to have weakened since then: covered cost savings started to decrease due to higher US dollar funding costs, in parallel to the end of the quantitative easing policies by the Fed by the end of 2014 and the enactment of very accommodative policies by the ECB. Interestingly, US dollar bond issuance activity continued trending higher and reached a new historical record high in the third quarter of 2016 in relative terms (29%). The obvious question is what drove this huge growth of US dollar denominated debt issuance by euro area banks in recent years. To answer this, we need to take a look at the composition of the US dollar debt issued by banks, in which the share of subordinated debt has increased substantially (Chart 2, panel B).

One of the biggest drivers of the upsurge in US dollar funding by euro area banks between 2013 and 2016 was the issuance of subordinated long-term debt. Subordinated[14] US dollar denominated-bond issuance has rapidly increased since 2010, from around $1 bln to almost

14 We consider here fixed-coupon subordinated bonds only.

$22 bln in 2015 (Chart 2, panel B). Although it decreased in 2016, total issuance was still more than $16 bln that year, well above the historical average. In relative terms, the share of US dollar subordinated bonds represented around 30% of total US dollar bond issuance in 2016, which compares to only 3% in 2010 (Chart 3, panel A). The trend towards higher issuance of subordinated bonds by euro area banks has not been exclusively limited to US dollar long-term debt: banks needed to issue subordinated debt in order to meet the new capital requirements stipulated by Basel III and the Capital Requirements Directive (CRD IV) in the EU. Moreover, subordinated debt is required to build the new TLAC and MREL buffer requirements, which have already entered into force, or will do so very soon.[15] That said, subordinated debt accounted only for 11% of total euro denominated-bond issuance in 2016. Even if euro denominated covered bonds are excluded (which account for 43% of the total euro bank bond universe), subordinated debt still has a lower weight in total euro denominated bond issuance than its US dollar equivalent. In consequence, there seems to have been a bias towards subordinated long-term issuance in US dollars by euro area banks.

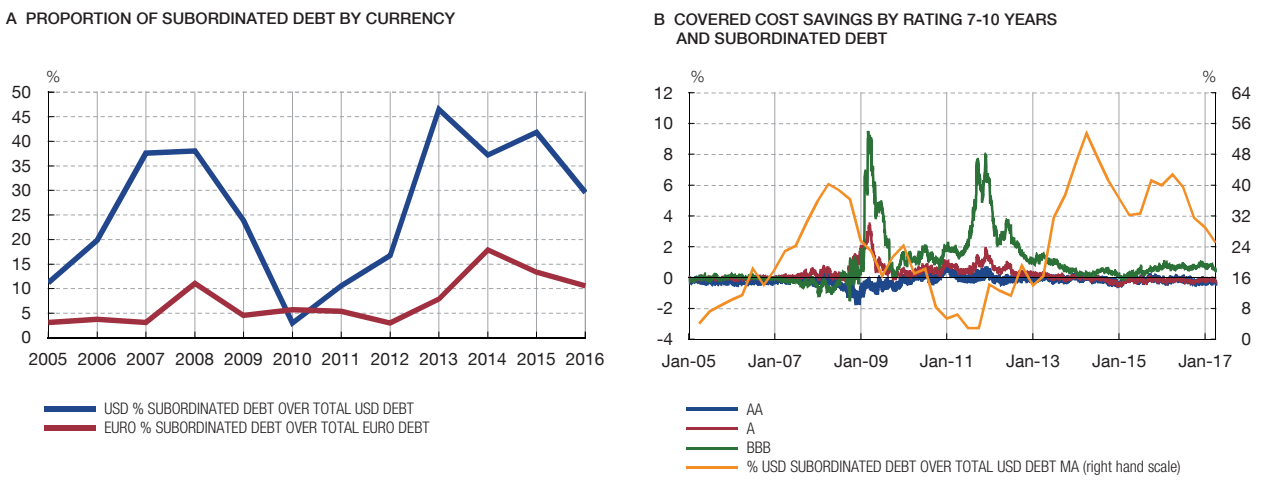
Why did euro area banks start to issue this large amount of US dollar-denominated subordinated bonds? A couple of possible drivers come to mind. First, as mentioned before, euro area banks needed to meet the new capital and bail-in regulatory requirements. Second, strategic motivations related to issuance in the US dollar could have played a very important role. According to several market reports, euro area banks have been taking advantage of the traditionally deep and wider US dollar investor base, particularly during times of market uncertainty [see for example Fitch Ratings (2016)].[16] Moreover, US dollar investors have been more receptive to European banks' new regulatory bonds than other investors, due to the perception of improving credit fundamentals of European banks, although some concerns for profitability and bad loans still exist [Goldman Sachs (2017)]. Finally, pricing considerations could have been important as well. Many of the US dollar denominated-subordinated bonds issued by euro area banks since 2012 have been issued at maturities of 10 years or longer. Moreover, most have been rated in the BBB bucket. Chart 3, panel B, shows covered cost savings for bonds issued by financial companies as reported by Markit. Covered cost savings are currently positive for BBB bonds in the 7 to 10 year maturity bucket. Hence, even though the positive correlation between covered cost savings and total US dollar debt issuance has been not so clear since mid-2015 (recall Chart 2, panel A), a further breakdown of these savings by rating and maturity shows that opportunistic funding of subordinated debt probably continued to be a important driver of US dollar long-term debt issuance.

Finally, strong issuance of US dollar-denominated subordinated bonds by euro area banks decelerated in 2016 and in the first quarter of 2017. This was most likely due to the sell-off in the CoCo market at the beginning of 2016 and political uncertainties in Europe, such as the UK referendum in June to leave the EU and the elections in several European countries in the first half of 2017 [for more details, see Fuertes et al. (2017) and LBBW (2017)]. In general, issuance of subordinated bonds is traditionally more affected by market turmoil and financial distress than other kinds of debt perceived by investors to be safer, such as covered bonds, regardless of opportunistic pricing considerations. This can be seen in the low overall issuance of subordinated bonds in the period between 2009 and 2012.

15 The Financial Stability Board (FSB) issued the final Total Loss-Absorbing Capacity (TLAC) standard for global systemically important banks (G-SIBs) in November 2015. European GSIBs will be required to meet TLAC since January 2019. In addition to this, the Bank Recovery and Resolution Directive (BRRD) requires adequate "bail-in" capital for all banks in the EU since January 2016 (the minimum requirement for own funds and eligible liabilities or MREL). The goal of both requirements is very similar (that banks have enough loss-absorbing capacity in case of resolution) although there are differences with respect to some of their features.

16 Europeans banks have also issued large quantities of US dollar-denominated "Formosa" bonds since 2014 i.e. bonds sold in Taiwan. Strategic motivations seem to have driven this trend as well.

SUBORDINATED BOND ISSUANCE BY CURRENCY AND COVERED COST SAVINGS (a) CHART 3



SOURCES: Dealogic, Markit, authors' calculations.

a USD debt includes fixed-coupon debt instruments with an original maturity of 18 months and longer. Securitizations, retained and government guaranteed bonds excluded from total USD bond issuance. Covered cost savings using Markit yield financial indices.

Interestingly, another positive factor driving US dollar bond issuance by euro area banks in 2016 may have been the replacement of US Money Market Funds (US MMFs) funding with more long-term US dollar denominated debt (see section 5).[17] Moreover, since the beginning of 2017, issuance of senior non-preferred bonds by euro area banks has picked up, which are also needed to comply with TLAC/MREL buffer requirements.[18] As with subordinated debt, the tapping of the liquid and diversified US dollar investor pool has been an important motivation to increase issuance of these bonds denominated in US dollars.

4 Developments in the cross-currency basis swap markets and covered cost savings

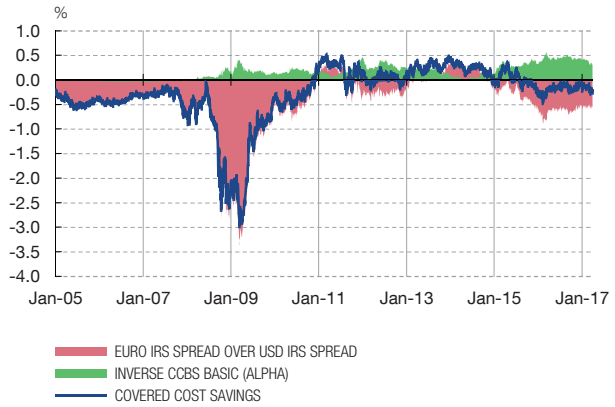
As discussed before, changes in the cross-currency basis swap (CCBS basis α) are a driver of covered cost savings of euro area banks or of the "bank basis" B (see components in Formulas (6) and (7) and Chart 4, panel A). More specifically, a negative basis α in the currency swap markets for some currencies such as the euro and the yen against the US dollar enlarge the cost savings that euro area (Japanese) banks can realize by issuing in US dollars on a hedged basis (by issuing "synthetic euro bonds"). Therefore, in this section we will focus on the developments in global financial markets that drove deviations in CIP as measured by the CCBS basis. As we shall discuss, several studies suggest that the factors driving these deviations since mid-2014 are different to those driving the basis during the crises periods of 2007-2008 and 2010-2012. In general, both policy and academic studies have concentrated on deviations from CIP, particularly since 2007, as measured by the CCBS basis and the shorter-term FX swap basis (basis α and x in section 2). In relation to this, the CCBS basis regained importance in the breakdown of covered cost savings since the end of 2014 (Chart 4, panel A).

17 US dollar short-term lending by US MMFs was negatively affected by the US MMF reform effective in October 2016. This reform affected mostly the so called institutional prime MMFs, which were heavy investors on short-term debt securities issued by US and non-US banks. This reform, which had the goal to avoid market disruptions as seen during the global financial crisis, implied the adoption of floating net asset value for institutional prime MMFs, among other measures. This reduced the attractiveness of prime funds vis-à-vis other MMFs such as institutional government MMFs, not affected by these reforms. As a result, prime MMFs in the US substantially reduced their holdings of short-term debt securities issued by banks.

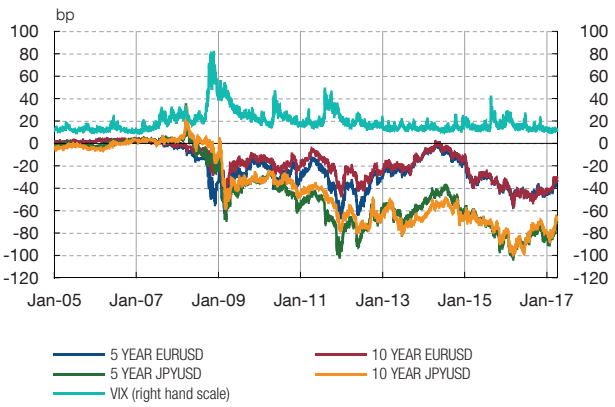
18 The EU is currently working on harmonizing the different approaches inside the EU on bank creditors' insolvency ranking. The European Comission announced in November 2016 its' support for the "contractual subordination" option or the "un-preferred tier senior debt" as a way to harmonize the building of TLAC buffers inside the EU [European Commission (2016) and LBBW (2017)].

DECOMPOSITION OF COVERED COST SAVINGS AND CROSS-CURRENCY BASIS SWAP (a) CHART 4

A BREAKDOWN OF COVERED COST SAVINGS



B CROSS-CURRENCY BASIS SWAPS FOR EUR AND JPY AGAINST THE USD



SOURCES: Datastream, BofAML, authors' calculations.

a Covered cost savings calculated using 10 year swaps and daily data.

Chart 4, panel B, shows the development of the CCBS basis from 2005 up to 2017 for the euro and the yen against the US dollar for 5- and 10-year maturities. In the pre-crisis period, the basis was very small and close to zero, which implies that profitable deviations in the CIP were transitory [Akram et al. (2008)]. Large CIP deviations between 2008 and 2012 (i.e. widening of the basis or a more negative basis) were linked to episodes of US dollar funding and liquidity distress, large dollar shortages, heightened transaction costs and the deterioration of the creditworthiness of non-US banks in need of US dollars. For instance, during the global financial crisis and the euro area financial crisis, deviations of CIP were the result of the heavy borrowing of US dollars in FX swap markets by (mostly) non-US banks to compensate for the loss of access to the US dollar interbank market and US MMFs [see Nakaso (2017); BIS (2016) and Pinnington and Shamloo (2016)]. The introduction of central bank US dollar swap lines and the adoption of measures to reduce liquidity and credit risk possibly were effective in narrowing the basis at that time [Baba and Packer (2009)]. However, in spite of no apparent funding or liquidity distress, the basis started to widen again in mid-2014 and has stayed persistently away from zero ever since then. Moreover, CIP deviations persist even after controlling for credit risk and transaction costs, which point to real arbitrage opportunities for market players [Du et al. (2016)].

According to the literature on the topic, CIP deviations since mid-2014 mainly have been driven by large demand and supply imbalances in the FX and currency swap markets, or as Du et al. (2016) show, by a combination of "global imbalances" and costly financial intermediation. On the one hand, there has been an excess demand for US dollars in the FX derivative markets against some other currencies, driven by monetary policy divergences across countries. On the other, high demand has not been met with enough supply of US dollars (i.e. not enough lenders of US dollars). As a result, the basis is large and negative for some currencies such as the euro and the yen, signaling a significant and persistent premium for borrowing US dollars against these currencies in the FX swap and the cross-currency basis swap markets. Interestingly, and as Borio et al. (2016) points out, whereas demand factors explain why the basis opens up, supply factors explain why it does not close.

Turning first to *demand imbalances,* which mainly consist of an excessive demand for US dollars, the main driver has been probably the monetary policy divergence between the US vis-à-vis the ECB and the BOJ, particularly since 2014 [Iida et al. (2016)]. This is not a

mere coincidence: the Federal Reserve (Fed) ended bond purchases in 2014 after gradually reducing them since the end of 2013 ("Fed tapering"). The tightening of the Fed contrasted with further easing by the ECB and the BOJ. For instance, in September 2014 the ECB announced its ABS purchase programme and a refi rate cut. Later on, at the beginning of 2015, the ECB announced a QE programme. Finally, the ECB corporate bond purchase programme, announced at the beginning of 2016, helped reducing bond spreads in the euro area further. Monetary policy divergences across areas created incentives for investors located in the euro area and Japan to acquire US dollar denominated-assets in a "search for yield" behavior, and made it more attractive for (non-financial) companies located in the US to issue in foreign-currencies ("reverse Yankees"[19]). At least some of these investors and issuers hedged their assets and liabilities through FX and currency swaps.[20] Evidence in favor of divergent monetary policies driving CIP deviations has been found by e.g. Du et al. (2016), Avdjiev et al. (2016) and Iida et al. (2016). Liao (2016) points to cross-currency issuance by non-financial companies as an independent driver of long-term CIP deviations.

In addition, another important source of US dollar hedging demand has been attributed to banks [Borio et al. (2016), Sushko et al. (2016), BIS (2016) and Barclays (2015)]. This can be proxied by large US dollar funding gaps, or US dollar mismatches between assets and liabilities, of certain banks,[21] which have been particularly large for Japanese banks. Currency mismatches of these banks were already large before the crisis and continued to increase in recent years, in parallel to monetary policy divergences between Japan and the US. By contrast, some euro area banks have changed their role after the crisis from arbitrageurs of the CIP (i.e. lenders of US dollars) to that of borrowers of US dollars (see Chart 5 in section 5). Hence, even if large opportunistic US dollar bond issuance by euro area banks in recent years could have increased their supply of US dollars in the FX swap and the currency swap markets, on a net basis, euro area banks currently demand more US dollars than what they supply in these markets. This has been further exacerbated by monetary policy divergences as well as potentially by some regulatory reforms, such as the US MMF reform. The latter reform, which became effective in October 2016, increased the cost of acquiring US dollars as prime MMFs in the US substantially reduced their holdings of short-term debt securities issued by banks (such as commercial paper and certificates of deposits), particularly by French and Japanese banks. This could have added more pressure to the short-term basis, as banks in net demand of dollars may have turned to FX swap markets to obtain US dollar funding.[22]

We turn now to *supply imbalances* in FX and currency swap markets as an explanation of the persisting deviations from CIP. These imbalances have been linked mostly to regulatory changes affecting banks, as well as tighter risk management by banks and more scrutiny

19 Reverse Yankees are one example of synthetic US dollar funding, in which a non-financial company located in the US issues in euros given its lower cost vis-à-vis funding in US dollars. These issuers would transform the euro denominated bond into a synthetic US dollar bond using a cross-currency swap by borrowing US dollars, contributing to put further downward pressure on the basis. Reverse Yankee issuance by US non-financial corporations increased from €32 bln in 2013 to € 70 bln in 2016, the highest amount ever, probably enhanced by the ECB corporate purchase programme. However, issuance in yen by US non-financial corporations has been more modest (around € 1 bln in 2016), given perhaps the smaller size of the Japanese corporate bond market (Borio et al., 2016).

20 According to Liao (2016), whereas debt issuers tend to match the maturity of the swap to that of their foreign-currency denominated bonds, institutional investors use short-dated FX forwards and roll them over.

21 As mentioned before, whenever on-balance sheet US dollar assets (such as loans and bonds) are larger than US dollar liabilities, it is assumed that this mismatch is offset with off-balance sheet hedging instruments such as FX and currency swaps.

22 However, according to some analysts [JP Morgan (2016)], it is unlikely that banks completely replaced their prime MMF funding with FX swaps, given their high cost.

by the public to banks since the crisis [Du et al. (2016), Iida et al. (2016) and Liao (2016)]. Regulatory changes may have created balance-sheet constraints for arbitrage activities of banks. In other words, global banks may not only have contributed to a wider basis by hedging their large US dollar investments through the FX and cross-currency swap markets, but also they may not have been able to actively arbitrage the basis, as they used to do before the crisis [e.g. Du et al. (2016)]. Hence, in spite of large opportunistic issuance of US dollar-denominated debt by euro area banks (see section 3), this has not been enough to close the basis, potentially due to regulatory constraints of banks. This notwithstanding, Iida et al. (2016) propose that these regulatory reforms also could have reduced the link between CIP deviations and non-US banks' credit risk, potentially avoiding wide deviations of CIP during periods of stress. Moreover, banks are perceived as safer, given higher and stricter regulatory requirements.

Recent studies suggest that there are various regulatory reforms which could negatively affect arbitrage in the FX and currency swap markets. First, the Basel III leverage ratio, to be implemented from 2018 onwards, requires banks to maintain at least 3% of Tier 1 equity over their an exposure measure, which includes both on-balance and off-balance sheet items as well as derivatives [BCBS (2011 and 2016)]. Moreover, the systematically important financial institutions in the US need to meet the enhanced "Supplementary Leverage Ratio", which settles a higher threshold and may further impede upon arbitrage in FX and cross-currency swap markets. Du et al. (2016) show larger quarter-end deviations of the (short-term) basis since 2015, when European banks started to calculate their leverage ratio based on their quarter-end balance sheets.

Second, Basel III has not only increased capital requirements of banks, but also it has introduced a capital charge for potential mark-to-market losses of "Over-The-Counter" (OTC) derivatives [Accenture (2015) and EBA (2015)]. This, combined with more cautious management practices, has led arbitrageurs to take into account both market and counterparty risk in the valuation of their derivative portfolios, increasing de-facto banks' balance sheet constraints and driving the basis wider [Suhko et al. (2016) and Borio et al. (2016)]. Moreover, risk management practices based on Value at Risk (VaR) frameworks have also contributed to deviations from CIP, as they put constraints on bank balance sheets and reduced bank-related arbitrage activities in FX swap markets [Avdjiev et al. (2016) and Du et al. (2016)].

Third, Basel III has increased liquidity requirements for banks through the Liquidity Coverage Ratio (LCR), which has been binding since 2015. This ratio requires that banks have sufficient high-quality liquid assets to cover potential outflows of liabilities for a 30-day period. This could mean that there is potentially less cash available to take positions in currency swap markets, as these funds may be invested in other liquid assets in order to meet the LCR requirements [Barclays (2015)]. Finally, Arai et al. (2016) and Iida et al. (2016) suggest that regulatory reforms may have discouraged market-making by banks in the FX swap market, reducing liquidity in these markets and increasing transaction costs. Du et al. (2016) also mention the prohibition of US banks to engage in proprietary trading in FX forwards and swaps (Volcker Rule) and OTC derivative reforms as responsible for increasing the costs of arbitrage in the FX swap and currency swap markets of banks [see also IMF (2017)].

The question arises as to whether there are other non-bank market players that are less affected by regulation, which potentially could arbitrage the basis and help putting an end to CIP deviations. It has been documented that high-grade entities, such as supranational

organizations and national agencies, may act as arbitrageurs of the basis through the issuance of synthetic domestic currency debt (i.e. issuance of hedged US dollar bonds) [e.g. Barclays (2015)]. Real money investors, which comprise asset managers, sovereign wealth funds (SWFs) and foreign official reserve managers, in many cases located in emerging market economies, could also play a role, although doubts arise with respect to their stability as US dollar providers in the derivatives markets (see section 5) [Iida et al. (2016)]. In any case, the fact that the basis is still considerably in negative territory shows that arbitrage by banking and non-banking entities is still not sufficient to close the gap. Hence, more research is needed to identify the barriers hindering arbitrage of CIP deviations for several currencies.

5 Spillovers to international financial stability

In previous sections we have described the reliance of euro area banks on US dollar markets, which points to growing international connections of banks, in spite of the recent crises. Hence, it seems important to carefully analyze the access of European and other non-US banks to the various US dollar funding markets from a financial stability point of view: monitoring only the domestic currency funding environment would provide a partial picture of banks' potential vulnerabilities and of potential spillovers to the stability of the whole financial system.[23] Of course, funding in US dollars by banks is linked directly to their assets in this currency and their asset-liability management practices. Hence, we begin this section providing an overview of the development of US dollar mismatches of euro area and Japanese banking systems and their reliance on FX swaps and currency swaps to obtain US dollars. Second, we will reflect on how alternative non-bank providers of US dollars, particularly in the FX swap markets, can create additional risks to the financial system, given that little is known about their behavior in case of market distress or in case of tighter US monetary policy.

Chart 5 shows the difference between US dollar denominated-foreign liabilities for euro area and Japanese banks and their US dollar denominated-foreign claims (i.e. US dollar lending). The difference is negative, particularly for Japanese banks, which means that these banks have a "US dollar funding gap", meaning that their liabilities in US dollars are not enough to cover their assets in US dollars. Hence, in spite of large US dollar bond issuance by euro area banks since 2011, their US dollar denominated liabilities are currently lower than their US dollar denominated assets.[24] In addition, on aggregate for all non-US banks, the difference between their foreign claims and foreign liabilities in US dollars has rapidly increased from the lows recorded during the global financial crisis and the euro area financial crisis [Nakaso (2017)]. In general, a US dollar funding gap can be problematic in two ways. First, the most obvious risk is that when non-US banks cannot obtain US dollars to fund their US dollar assets, their domestic central bank has to step in to provide limited US dollar liquidity assistance[25] [IMF (2017)]. The second problem arises from the growing reliance of non-US banks on the FX swap and currency swap markets to fund or hedge their US dollar mismatches.

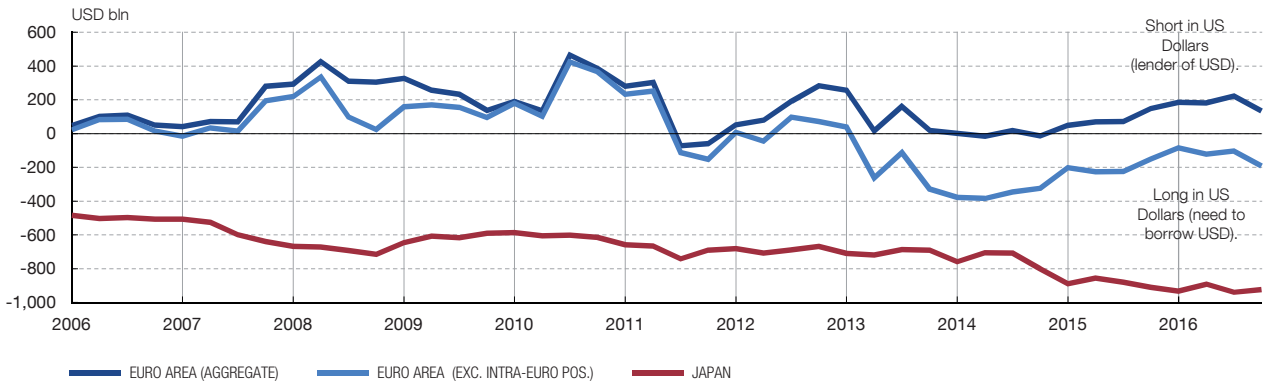
Even if banks are able to obtain these US dollars through FX and currency swaps, these instruments create a whole new set of specific risks for banks. We will focus on just two of them [for the full overview, see Eklund et al. (2012)]. The first one is *counterparty risk,* that is, the risk that the counterparty in the swap defaults on its payments. Counterparty risk

23 This has been recently and explicitly acknowledge by the Nakaso (2017).

24 This is of course in aggregated terms, as net positions at the euro area country level vary considerably.

25 In fact, the US dollar swap lines established for the first time in 2007 and 2008 between the Fed and several other central banks alleviated this problem in the context of US dollar shortage during the global financial crisis.

NET DOLLAR LIABILITIES BY BANKING SYSTEM (a) CHART 5



SOURCES: BIS Locational Banking Statistics by nationality and Consolidated Banking Statistics, immediate counterparty basis.

a Excluding inter-office positions.

increases with the term of the swap, as the volatility of the currencies exchanged grows over time. The second risk is *refinancing or rollover risk.* In general, refinancing risk arises every time one entity funds long-term assets with shorter-term liabilities, as sometime in the future the entity needs to obtain new financing to fund its assets. A European or Japanese bank with a long-term US dollar denominated-asset may decide to hedge it with a shorter-term FX swap and roll it over until the asset matures. This creates a "US dollar maturity mismatch" and exposes the bank to the risk that the counterparty does not want to renew the swap or the costs of renewing the FX swap increase substantially. In that case, the bank may be forced to sell the US dollar asset, which may be difficult in case of market distress [McGuire and Von Peter (2009b)]. The second option is to match the maturity of the asset with a longer-term cross-currency swap. Of course, the longer the term of the swap, the lower the refinancing risk. But as we have seen, the longer the tenor of the swap, the greater the counterparty risk is too.

In case many banks follow a similar hedging pattern, this can create risks for the whole financial system. For instance, before the global financial crisis, Japanese and some European banks did not only have a "US dollar funding gap", but had a "US dollar maturity mismatch" as well. According to McGuire and Von Peter (2009a and 2009b), the large increase of US dollar denominated assets before the crisis for some European banking systems was mostly funded through short-term liabilities such as FX swaps, interbank loans and central bank borrowings. The increase in liquidity and counterparty risk since mid-2007, linked to the global financial crisis, led to severe dislocations in the FX swap and other short-term markets. This, coupled with less funding from US MMFs for European banks, forced them to either sell their structured products at large discounts or to lengthen the maturity of their assets, further contributing to global US dollar shortages. Fender and McGuire (2010) show that maturity mismatches of those European banking systems that were long in US dollars at that time fell right after the crisis, but did not disappear completely. As of today, foreign currency maturity mismatches continue to persist for banks in advanced economies [IMF (2017)].

In order to avoid an excessive reliance of non-US banks on FX and currency swap markets and an escalating pressure on the basis, having accessible alternative US dollar funding markets is of vital importance. This was recently epitomized by the US MMF reform, where there is some evidence that non-US high-grade banks may have replaced partly their US dollar denominated commercial paper and certificates of deposits with longer-term debt

securities, avoiding a US dollar funding shortage [BIS (2017)].[26] This could have helped driving US dollar debt issuance by banks higher in 2016 [Reuters (2016); see also section 3]. In this line, Nakaso (2017) shows that following the reform, Japanese banks mostly replaced MMF funding with more US dollar-denominated deposits, bonds and repos. All in all, it is important to monitor US dollar funding conditions and markets in general and not focus on just one specific source of US dollar funding.

Another potential source of vulnerabilities to the financial system is related to non-bank arbitrageurs of CIP deviations. As mentioned before, banks are not the only market players with the ability to arbitrage the basis by supplying US dollars in the FX and currency swap markets. There is certain evidence, particularly for the Yen/USD FX swap market, of a greater weight of other suppliers of US dollars such as real money investors [Iida et al. (2016), Arai et al. (2016) and Nakaso (2017)].

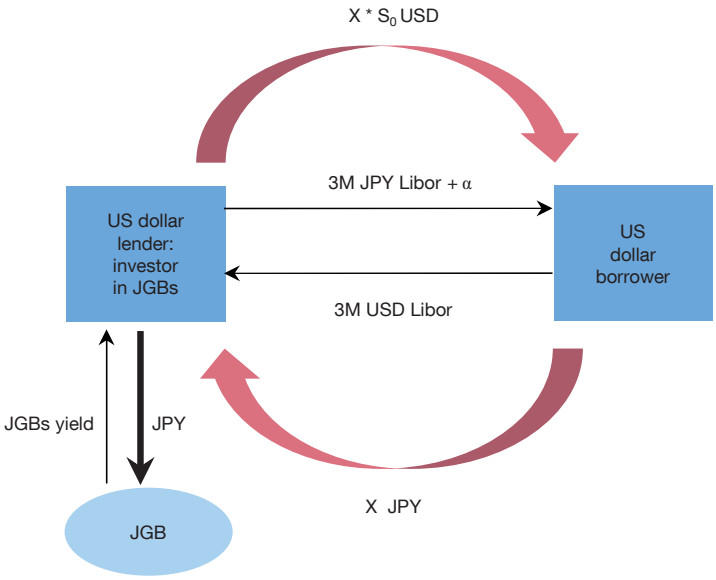
The main problem is that it is unclear how stable these suppliers of US dollars are in the long-run. Actually, there are some signs suggesting that these investors as not very reliable, meaning that they could rapidly withdraw their supply of US dollars in certain circumstances [Iida et al. (2016)]. For instance, it has been documented that real money investors have increased their investments in Japanese government bonds (JGBs) on a FX hedged basis [Arai et al. (2016)]. The arbitrage works in a similar way to the issuance of "synthetic euro bonds" by euro area banks, as documented in section 2. Real money investors investing in JGBs would obtain yen funding through the FX swap or currency swap market and exchange US dollars in return.[27] This means that the real money investor would be paying the "negative" basis and earn a positive hedged return through the investment in JGBs, equal to or even higher than that of investing in US Treasury securities, in spite of very low or even negative yields on JGBs (see Figure 3).[28] Of course, it is clear that these investors are only willing to swap their US dollar holdings in the FX or currency swap markets as long as these trades are profitable. When this is no longer the case, they may disappear as a source of dollar funding. In general, real money investors, particularly those located in emerging economies, could cut their US dollar lending in FX swap markets in times of market distress. For instance, it seems that emerging market foreign exchange reserve managers tend to reduce their US dollar supply in the FX swap markets when they need to defend their currencies [Iida et al. (2016)]. In the same vein, there are signs that sovereign wealth funds reduce their supply of US dollars in the FX swap markets when the fiscal situation of their countries worsen, for example due to lower commodity prices [Arai et al. (2016)].

This has led some to wonder what will happen when the tightening cycle of the Fed progresses further, causing higher funding costs and a stronger US dollar. As Nakaso (2017) explains, a tightening by the Fed may have a negative impact on the economic growth of emerging countries by reducing oil prices and unleashing capital outflows and depreciation pressures on their currencies. This would lead to lower supply of US dollars in the FX swap markets by real money investors located in these countries, causing larger CIP deviations, a wider basis (i.e. higher costs for obtaining US dollars in FX currency swap markets) and higher costs of US dollar funding for banks (both directly in cash

26 According to the BIS (2017), non-US banks also replaced their US MMF funding with dollar deposits and excess reserves at the Fed.

27 Evidence point to arbitrage mainly through the shorter-term FX swap market, but in order to make it clearer for the reader and consistent with previous figures, Figure 3 depicts a CCBS instead. The underlying idea would be the same in both cases.

28 These potential positive hedged returns of investing in JGBs could explain the rapid increase in China's holdings of Japanese debt securities in 2015 and 2016 [Van Rixtel and Xu (2017)].



SOURCE: Author's elaboration.

markets and in the FX swap and currency swap markets). This would reduce US dollar-denominated lending, also to entities located in emerging economies, contributing to lower economic growth, which would reduce further the supply of US dollars in the FX swap markets from investors based in these countries. In this line, Avdjiev et al. (2016) and Shin (2016) show that an appreciation of the dollar is associated with more pronounced deviations from CIP. In all this, monetary policy and differences in the monetary policy stance of the major central banks play a crucial role. He et al. (2015) empirically show the expansionary effect of the unconventional monetary policy by the Federal Reserve on the supply of cross-border credit by global banks. Interestingly, the authors conclude that the negative effects on global liquidity of a tightening by the Federal Reserve would be partly offset by the expansionary monetary policies of the ECB and BOJ: abundant and cheap supply of domestic currency would provide collateral for euro area and Japanese banks in the FX swap markets. The net effect would depend, however, on whether the tightening by the Fed would increase global risk aversion in international markets or not.

In conclusion, deviations from CIP as measured by the US dollar FX swap and CCBS basis are indicators of the risks to the global banking system derived from banks' international activities, which generate cross-currency funding needs that are to a large extent denominated in US dollars. Moreover, deviations from CIP can also be used as a measure for the "procyclicality of international financial intermediation" driven by the interconnection of banks and non-bank US dollar providers in the FX swap markets [Nakaso (2017)]. Careful monitoring of cross-border activities of banks as well as their dependency on non-banking providers of US dollars would further contribute to the safety of the financial system.

6 Conclusions

In this article we have described how US dollar long-term funding by euro area banks has been increasing since the global financial crisis, particularly in relative terms. In Romo González (2016), which studies US dollar bond issuance by European banks between 2005 and the beginning of 2013, it is shown that banks could have issued US dollar-denominated debt for opportunistic factors, as well as for other reasons. In this article we provide a brief theoretical update of Romo Gonzalez (2016) and describe US dollar bond

issuance by euro area banks since 2013 up until the first quarter of 2017. We find some evidence that high US dollar-denominated bond issuance by euro area banks since 2013 mainly has been motivated by regulatory developments and strategic drivers, as euro area banks would have been benefiting from the appetite of a liquid and diversified US dollar investor base. Moreover, the positive correlation between covered cost savings and US dollar bond issuance as found in Romo González (2016) seems to be less strong since 2015. That said, this relationship could still exist for certain bonds, such as those with a lower rating and a specific maturity. Moreover, given the close connection between covered cost savings for euro area banks and the deviations of CIP, we document the drivers of CIP deviations as measured by the CCBS basis. According to the latest research on the topic, CIP deviations since mid-2014 have been driven by a combination of demand and supply factors. These factors are linked to monetary policy divergences across regions, to their impact on global imbalances and possibly to new regulations mainly affecting banks.

In addition to this, we discuss how impaired access to US dollar markets by non-US banks may have negative consequences for the stability of the global financial system. This is so because some euro area and Japanese banks still have a large amount of US dollar-denominated assets which need to be funded in the same currency to avoid "US dollar mismatches" or "US dollar funding gaps". Moreover, US dollar maturity mismatches caused by non-US banks hedging long-term US dollar assets with shorter-term FX swaps need to be monitored as well, as epitomized by the global financial crisis. Finally, there is some evidence pointing to a bigger role of "alternative" US dollar providers located in EMEs, particularly in some FX swap markets. Little is known about how reliable these US dollar suppliers are in case of market distress. Negative spillovers to EMEs of higher US dollar interest rates could disrupt the supply of US dollars coming from these agents. Should other agents not be willing to step in, scarcity of US dollars could create risks for the global financial system and central banks would need to step in as during the global and the euro area financial crises. All these tensions would be reflected in wider CIP deviations, which constitutes an excellent measure of the risks to the global banking system derived from non-US banks' international activities.

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