

Global Money Notes #9

Research Analysts

Zoltan Pozsar
212 538 3779
zoltan.pozsar@credit-suisse.com

Excess Reserves and Global Dollar Funding

According to market lore, the recent collapse in the \$/¥ cross-currency basis was driven by a grand bargain brokered by the Bank of Japan between pension funds and megabanks. According to the bargain, pension funds agreed to swap their U.S. Treasuries for the JGBs of megabanks, and the megabanks used the Treasuries to tap repo markets in New York which have become cheap to fund in post-money fund reform. Megabanks lent the cheap dollars back to the pension funds via FX swaps, and helped them avoid having to deal with U.S. money center banks positioned to extract a pound of flesh.

There was no grand bargain.

Anecdotally, the price of the collateral swap to start this chain of trades is about 45 bps which would make the lending of dollars uneconomical compared to other alternatives. Furthermore, there was no meaningful increase in either tri-party or bilateral repo volumes since November, when the deal was struck.

According to another lore, the collapse of the \$/¥ basis was driven by the anticipated easing of Basel III in the U.S., which will free up balance sheets for arbitrage. That makes sense, but these changes are not imminent and will take time to implement. Three-month bases should not be influenced by them.

In this issue of Global Money Notes we explain how extraordinary measures taken by the U.S. Treasury to avoid the debt ceiling have flooded the system with \$400 billion in reserves which drove the recent collapse of the \$/¥ basis. These measures are temporary. Once reversed, the basis will widen again.

The broader lessons from our analysis is that the Fed only has limited room to shrink its balance sheet. The difference between key cross-currency bases trading at -100 or -25 bps is an extra \$400 billion of reserves in the system. Whether reserves are drained by Treasury boosting its cash balances, or by a runoff of the SOMA portfolio is the same thing. They both mean fewer reserves.

With every \$100 billion of reserves drained, the \$/¥ basis increases by 10 bps. With every \$100 billion of reserves drained, the world gets a 10 bps hike. And it's not just the Fed's decisions. Treasury needs to coordinate with the Fed regarding the impact of its cash management practices on financial conditions.

The Mistake of 1937 has often been cited as a cautionary tale to highlight the risks involved in premature rate hikes. Those comparisons never made sense.

The Mistake of 1937 revolved not around prices, but quantities.

The Fed raised reserve requirements which caused a recession. The parallel with today is a Fed hell-bent on shrinking its balance sheet. Without a meaningful dilution of Basel III, it won't be able to. Or if it does so nonetheless, another mistake may be upon us. Don't let the DSGE people hijack the Fed's balance sheet. Shrinking it is a matter of taste, not a matter of necessity.

Big is beautiful. Big is necessary. Learn to live with it...

Part 1 – Feast and Famine

The Basel III compliant global banking system passed its first liquidity stress test with flying colors.

During the weeks before the SEC's money fund reform deadline, twice as much money left prime money funds than during the weeks following Lehman Brothers' bankruptcy in 2008. While the outflows in 2008 caused panic and required the Federal Reserve to step in as dealer of last resort in the global dollar funding market, the financial system made hardly a peep this time around despite significantly greater outflows. We should not be surprised, as one key requirement of Basel III is that globally active banks hold a liquidity war chest of at least 30-days worth of net cash outflows in high-quality liquid assets (HQLA). In other words, global banks should be able to withstand a 30-day freeze in funding markets and "bleed" liquidity for 30-days before they pick up the phone to call the discount window.

Foreign banks, who were most dependent on prime money funds for funding, held most of their HQLA in the form of reserves at the Federal Reserve Bank of New York (FRBNY). During the outflows they simply ran down their reserve balances. On the flipside, the Fed, instead of being forced to step in to make markets and inflate its balance sheet on the spot to ease the pain from the loss of funding, stood ready with its enlarged balance sheet to ensure the seamless redistribution of liquidity across the system: from prime funds to government funds, and from foreign bank branches to U.S. banks and primary dealers.

We can identify two distinct flows related to money fund reform (see Figure 1).

First, the outflow of \$800 billion of client funds from institutional-class prime money funds (henceforth prime funds). The money that left appears unlikely to ever come back. For the portfolio managers (PMs) that run prime funds and for undiversified asset managers that depend heavily on fees from prime funds for revenues an era of "famine" has begun – assets under management by prime funds have collapsed back to levels last seen in 1993.

Second, the inflow of \$800 billion of client funds into institutional-class government-only money funds (henceforth government funds). The money that flowed in appears to have settled in its new habitat. For the PMs that run government funds and for asset managers that collect revenues from fees from government funds an era of "feast" has begun – assets under management by government funds are now at an all-time record \$2.2 trillion.

Going one level deeper, we can track these money flows on a sector by sector and instrument by instrument basis since April, 2016, when the outflows started (see Figure 2).

Unsecured funding markets got hit the most, where prime funds are lending \$600 billion less than a year ago. Foreign banks suffered \$450 billion of this loss and U.S. banks only \$40 billion (see Figure 3).¹ Primary dealers lost \$100 billion in secured (repo) funding.² The Federal Home Loan Bank system (FHLBs) and U.S. Treasury lost \$35 billion each. Funding to municipalities and supranationals accounts for the rest of the \$800 billion loss.

On the flipside, the \$800 billion that was absorbed by government funds was re-deployed more or less equally between the FHLB system, the repo market and the U.S. Treasury.

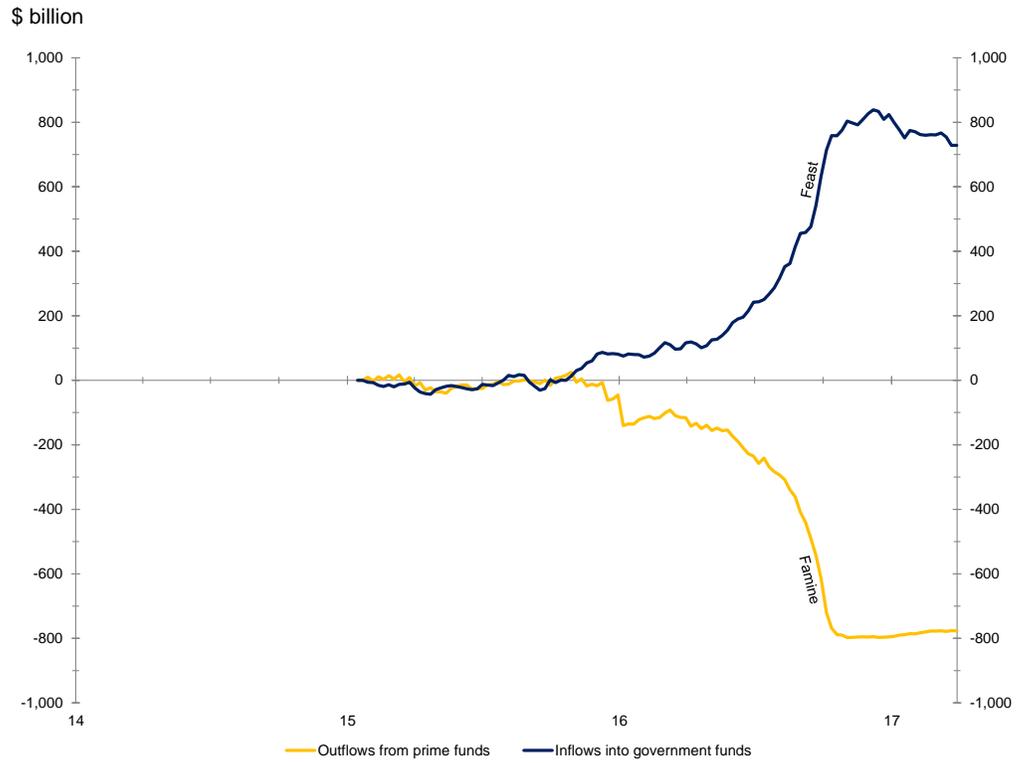
The FHLB system absorbed about \$250 billion of inflows. After accounting for the roughly \$35 billion of agency discount notes sold by prime funds, money fund reform netted a significant, just over \$200 billion in additional funding for the FHLB system. The FHLBs passed most of this new funding on to U.S. money center banks through advances.

The U.S. Treasury also absorbed about \$250 billion of inflows. After accounting for the \$35 billion of U.S. Treasury bills sold by prime funds, money fund reform delivered just

¹ In calculating the amount of on-balance sheet funding lost by banks we include time deposits, certificates of deposits (CD) and financial commercial paper (CP). We exclude asset-backed commercial paper (ABCP) which is an off-balance sheet form of funding. The rest of the funding loss (\$110 billion) fell on ABCP issuers and non-financial corporate issuers of commercial paper.

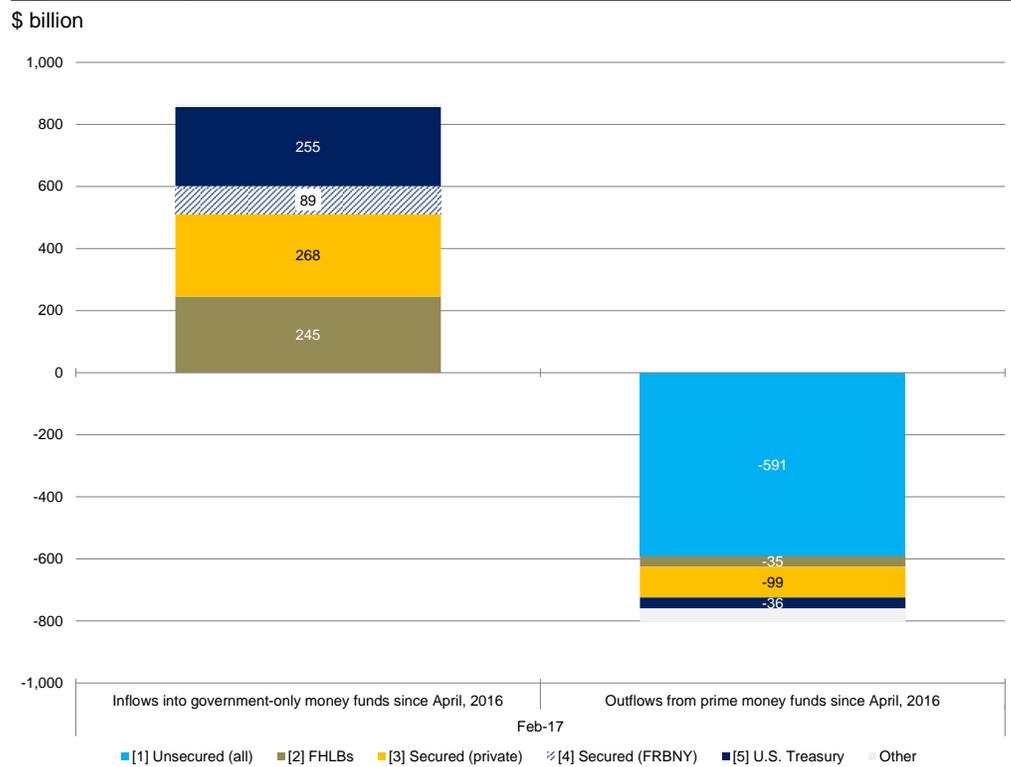
² Of this \$100 billion, \$70 billion was backed by government collateral and \$30 billion was backed by non-government collateral.

Figure 1: Feast and Famine



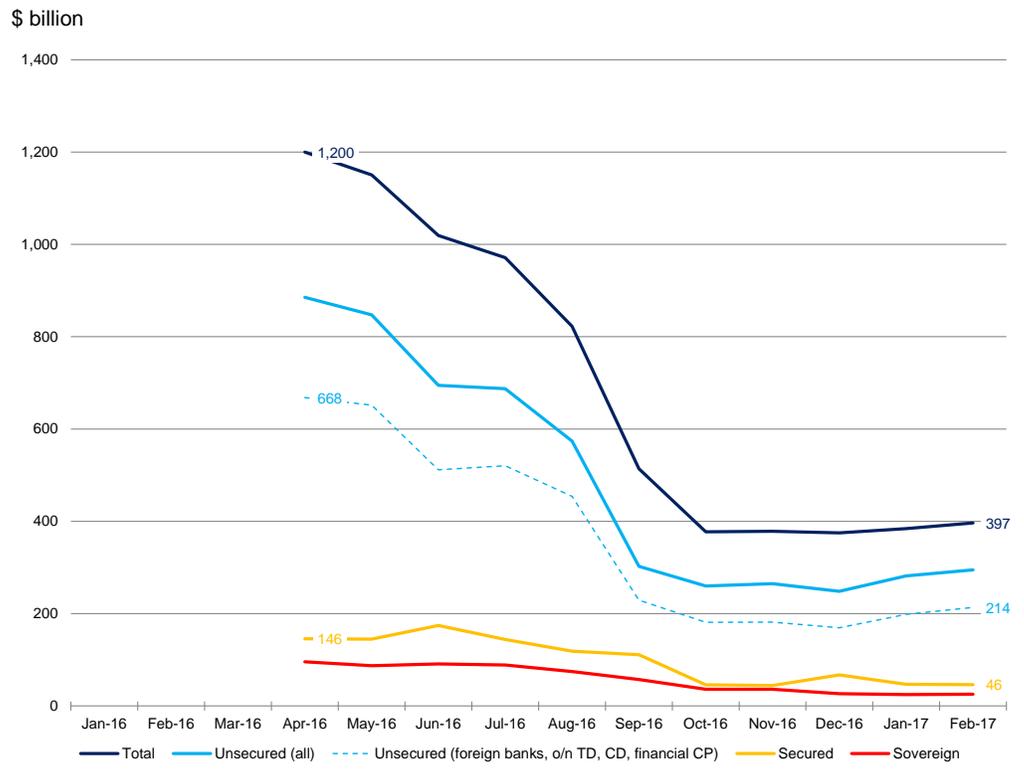
Source: ICI, Credit Suisse

Figure 2: Swaps of IOUs



Source: ICI, Credit Suisse

Figure 3: Prime Fund Assets



Source: ICI, Credit Suisse

over \$200 billion in net new demand for bills from government funds. Roughly one fifth of this demand was accommodated by the corporate treasury department of Microsoft Corp., which sold \$40 billion of bills and replaced them with longer-dated notes (see Figure 4).³

The repo market absorbed the remaining \$350 billion of inflows. FRBNY’s o/n RRP facility absorbed about \$100 billion, all of which represents net new demand as prime funds were never big investors in o/n RRP. Primary dealers absorbed most of the remaining \$250 billion of inflows.⁴ After accounting for the \$70 billion of government repos that prime funds traded out of as outflows mounted, money fund reform delivered just under \$200 billion in net new demand for government repos and hence financing for rates trading in general.

Putting the pieces together, of the \$500 billion in unsecured bank funding that was lost due to money fund reform, \$400 billion was intermediated back into the global funding market, but through a different set of intermediaries than before – U.S. money center banks (via the FHLBs) and primary dealers, as opposed to the New York branches of foreign banks.

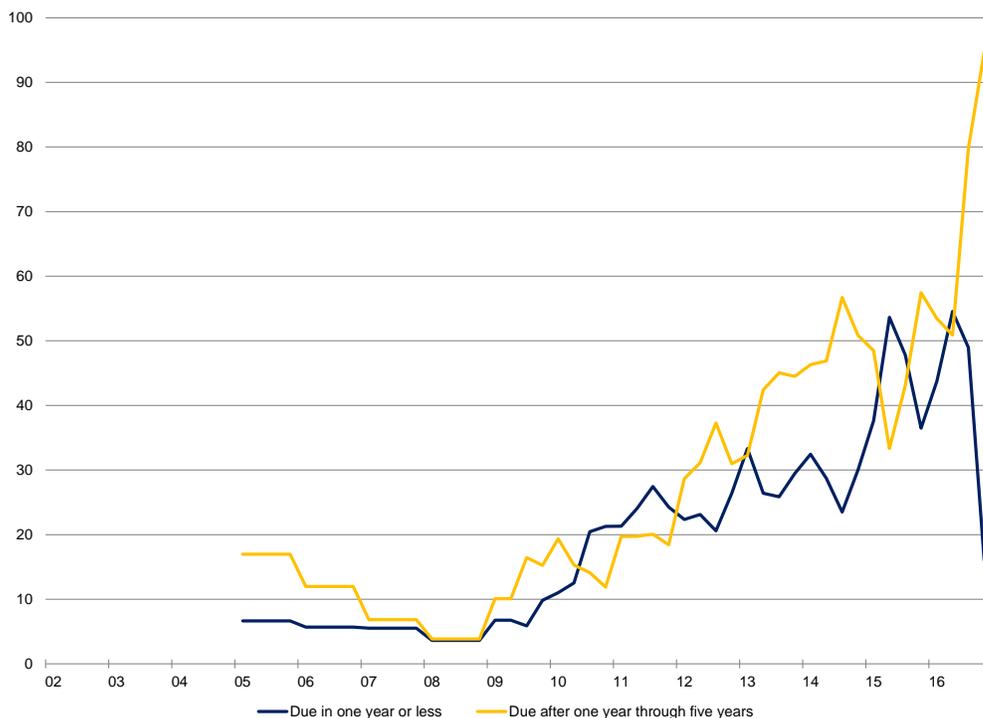
The individual “circumstances” of the new set of balance sheets that dominate the marginal price setting process in money markets are important to appreciate, because in a post-Basel III financial order, capital requirements, reporting rules, funding options and money market lending preferences baked into various balance sheets have an outsized impact on how money markets trade. And these “circumstances” are different for large U.S. banks and primary dealers than they are for the New York branches of foreign banks.

³ Microsoft is different from all other cash-rich corporations in that its cash balances are invested near-exclusively in U.S. Treasury securities as opposed to corporate bonds.

⁴ “Most” and not “all” because some of the increase in government funds’ repo lending went to foreign bank branches, not primary dealers. Furthermore, a small share went to the buy-side directly (notably Prudential, Annaly and Harvard’s endowment).

Figure 4: Windows and Treasuries

Microsoft's portfolio of U.S. Treasury securities, \$ billion



Source: Microsoft Corporation, Credit Suisse

In the following sections, we explore each of these differences in detail. Figure 5 (overleaf) is the centerpiece of our analysis and anchors our discussion for the remainder of this issue of Global Money Notes. It is a detailed map of the chains of money market trades that prime funds used to fund, and the chains of trades that replaced them post-reform.

Of all funding markets, these changes affected prices in the FX swap market the most. We will pay special attention to this market and how its dynamics are affected by developments in other funding markets and the quantity of reserves in the financial system.

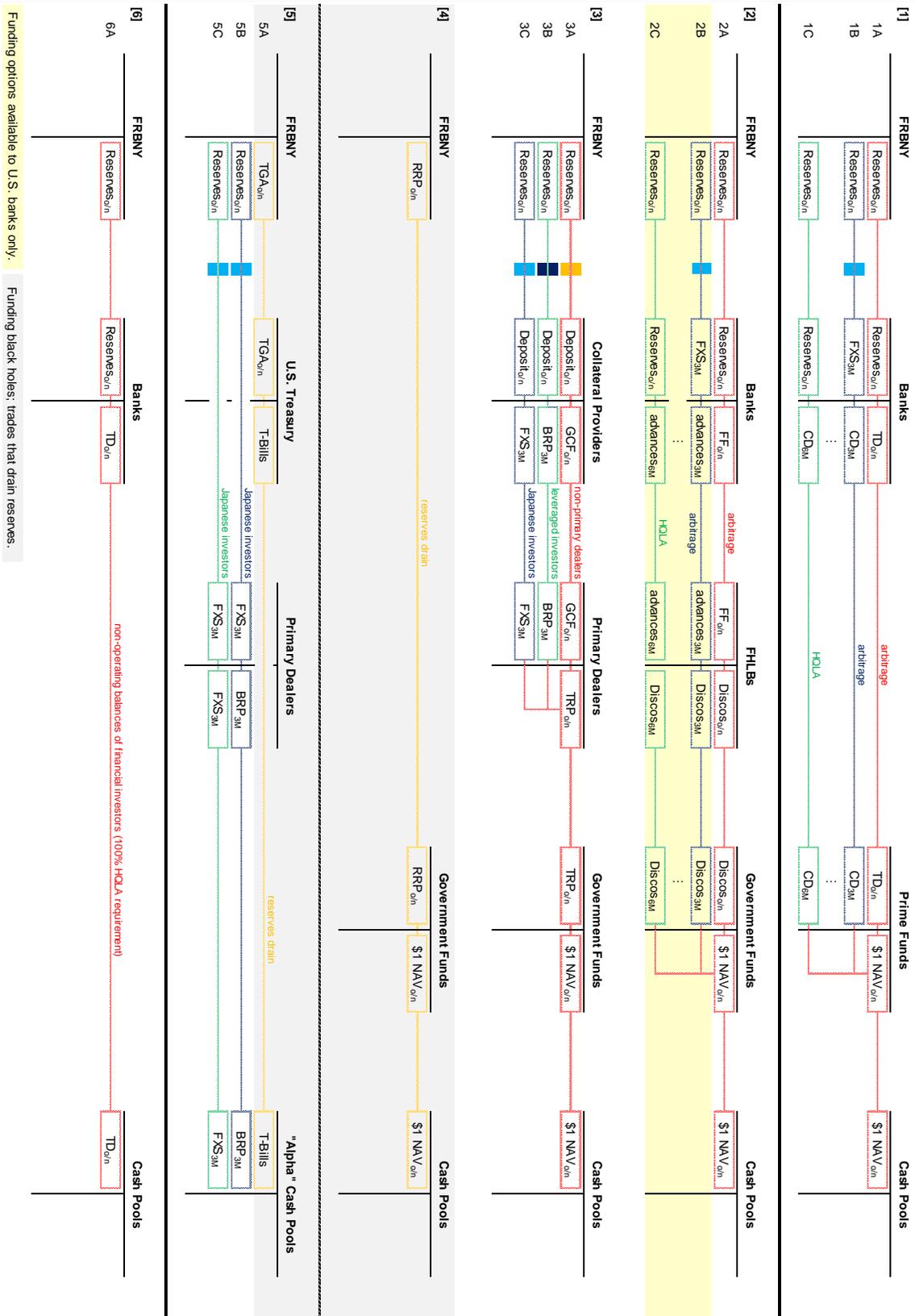
Part 2 – Prime Funds to Foreign Banks

Chain 1 shows how cash taken in o/n by prime funds is lent out either o/n or term. Overnight funds are typically lent to foreign bank branches through the Eurodollar market (via o/n time deposits), which foreign banks park at the Fed to earn interest on reserves (IOER; see Chain 1A). U.S. banks typically do not participate in these arbitrage trades because they are subject to daily average balance sheet reporting and so need at least a 60 bps spread to consider expanding their balance sheet on any given day.⁵ Currently, IOER arbitrage trades net about 9 bps. In contrast, foreign banks report balance sheet only on month-ends, and so have a lower threshold to expand balance sheet intra-quarter.

Term funds up to three-months are typically lent to foreign banks as well (mostly via CDs), which foreign banks use to arbitrage rates in the FX swap market (see Chain 1B). The ultimate borrower of dollars in such transactions is typically a foreign real money account from Japan or Europe without access to other funding markets. The very moment the real

⁵ We arrive at 60 bps by using the following parameters: a 10% return on equity target and a 6% leverage ratio.

Figure 5: Mapping the Global Dollar Funding Market



Source: Credit Suisse

money account receives the dollars via FX swaps, those will be in a deposit in its name at a clearing bank (J.P. Morgan Chase Bank, NA or The Bank of New York Mellon), and the clearing bank will keep every penny of that deposit in reserves at the Fed (not shown).⁶ Whether the real money account spends its deposit on U.S. Treasuries, MBS or credit is beyond the scope of this analysis, but when the dollars are spent, reserve balances will continue to travel from the clearing bank of the foreign real money account to the clearing bank of the entity that sold it some financial asset. This other clearing bank will be FRBNY in case the real money account purchased U.S. Treasuries directly from the U.S. Treasury at auction, or J.P. Morgan or BoNY if the securities were purchased from other market participants. Like in the previous example, U.S. banks typically do not participate in these arbitrage trades due to their daily balance sheet constraints. If they do participate, it is typically when cross-currency bases get wide enough (60 bps) to justify expanding their balance sheet.⁷ These opportunities typically arise around quarter-ends or during periods when foreign banks are unable to raise dollars from prime funds cheaply and on scale.

Term funds beyond three-months are lent to both foreign and U.S. banks, which banks use to fund HQLA portfolios. A large portion of these portfolios are held in reserves at the Fed (see Chain 1C). For reserves held at the Fed to count as HQLA, they must be funded on terms longer than 30 days. Anything shorter and reserves are parts of arbitrage trades.

Money market fund reform hit the funding of arbitrage trades the most (see Figure 6). The New York branches of foreign banks lost access to \$200 billion in o/n Eurodollar funding and issue that much less in o/n time deposits to fund IOER arbitrage trades. One and three-month funding (mostly CDs) declined by \$100 billion and \$150 billion, respectively. Finally, the availability of funding at longer tenors (typically six-months) declined by about \$60 billion. A breakdown between how much of these losses hit foreign versus U.S. banks is not available, but anecdotally the loss of o/n to three-month funding hit mostly foreign banks, and the loss of longer-dated funding hit mostly U.S. banks (\$40 out of \$60 billion).

Getting a clear sense of the amount of funding lost at each point along the benchmark unsecured funding curve (the U.S. dollar Libor curve) is important because it gives us a sense of the current depth of funding markets – that is the ability of changes in volumes to affect rates. Consider that the big moves we have seen in the three and six-month Libor fixings during the run up to the money fund reform deadline were on the back of losing a “mere” \$150 and \$60 billion of funding at each funding point, respectively. These are important pieces of information to keep in mind for analyses that will try to estimate the potential impact of U.S. corporate tax reform and the associated repatriation of corporate cash balances on U.S. dollar Libor fixings and global dollar funding markets in general.

We next look at the nationality of the New York bank branches that bore the brunt of the loss of unsecured funding between April, 2016 and February, 2017 (see Figure 7).

Scandinavian branches got hit the most, losing over \$100 billion in funding, most of which they used to fund o/n IOER arbitrage trades, and the rest to lend in the FX swap market. Appendix A1 shows the individual balance sheets of Swedish and Norwegian arbitrageurs where the declines are clearly visible. But the balance sheet data come with two caveats.

First, they are quarter-end snapshots as of June 30, 2016 and December 31, 2016, whereas the changes in funding volumes quoted above are on an intra-quarter basis.⁸ Because foreign bank balance sheets are significantly greater during the quarter than on quarter-ends, the decline in the size of balance sheets as reported in Appendix A1 (based on call reports) will always be smaller than the decline in intra-quarter volumes

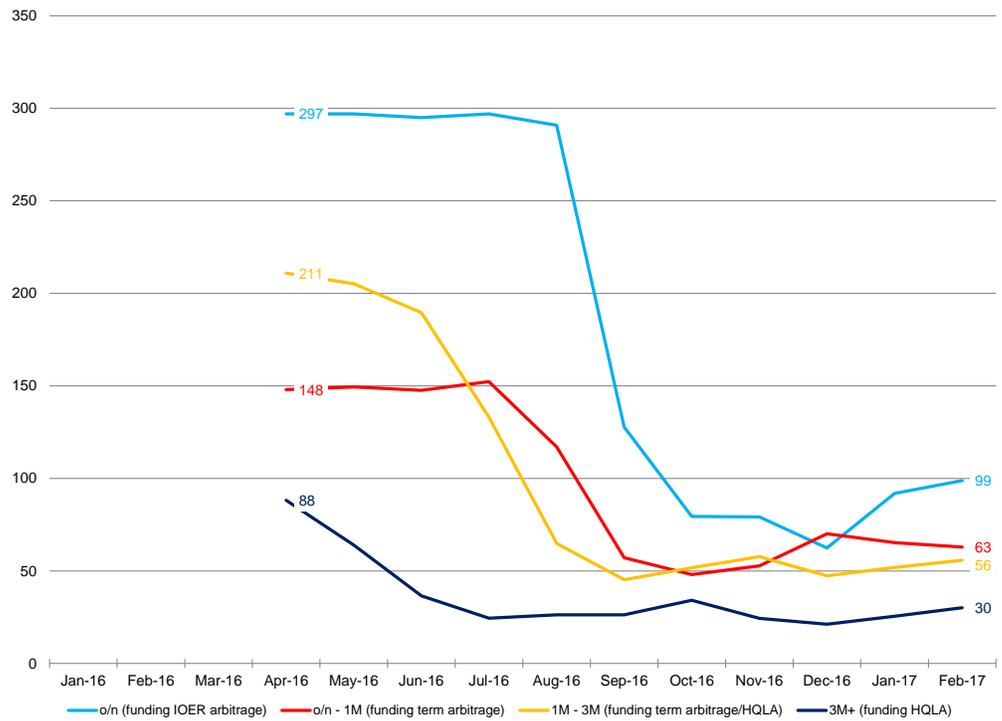
⁶ This is because the deposit in question is the non-operating deposit of a financial customer which has a 100% HQLA requirement under the liquidity coverage ratio (LCR) rules of Basel III.

⁷ In plain English, this means that U.S. banks tend to function as a lenders of “next-to-last-resort” to foreign banks and investors in the FX swap market. Colloquially, the last thing the system does before tapping FRBNY’s FX swap lines is tap J.P. Morgan...

⁸ The changes in volumes reported on previous pages were from April, 2016 to February, 2017, both intra-quarter months.

Figure 6: Less Funding for Arbitrage

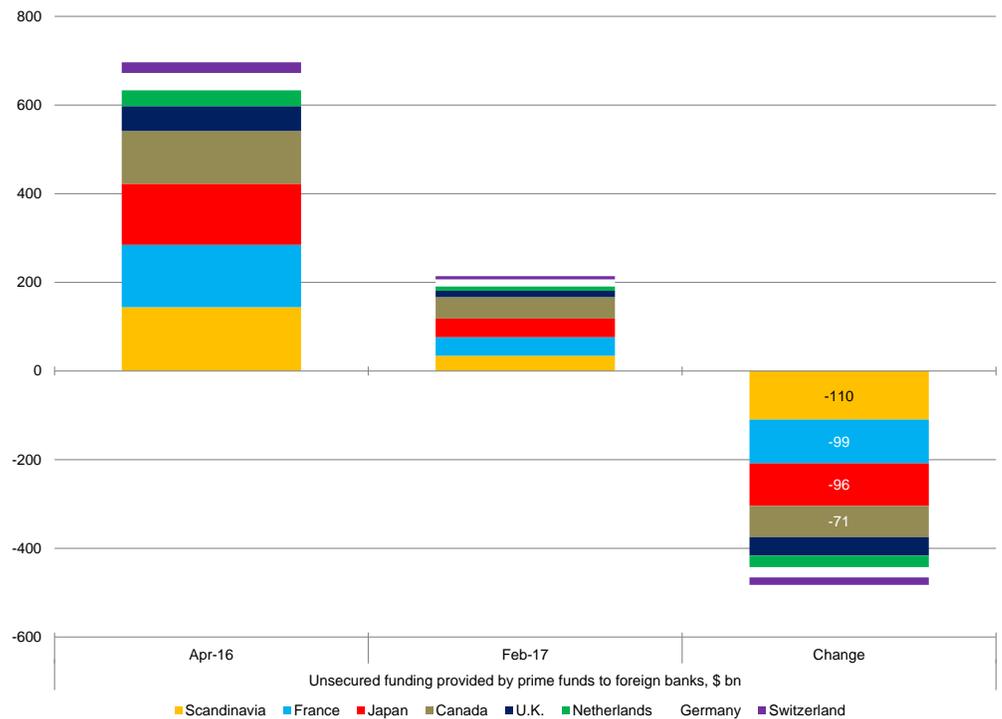
Loss of unsecured funding by tenor, \$ billion



Source: ICI, Credit Suisse

Figure 7: Loss of Unsecured Funding by Country

Loss of unsecured funding by country, \$ billion



Source: ICI, Credit Suisse

(based on money fund filings). In recent months, the intra-quarter versus quarter-end discrepancy has been at least \$150 billion mostly due to o/n arbitrage trades (see [here](#)).

Second, quarter-end balance sheet snapshots are not a reliable indicator of foreign banks' intra-quarter activity in the FX swap market. This is because quarter-end FX swap trades are HQLA swaps (reserves at the Fed for reserves at other central banks or foreign bills) that typically do not expand banks' balance sheets. But intra-quarter arbitrage trades do.

These two caveats will apply to all other balance sheets discussed below.

French branches lost \$100 billion in unsecured funding. Most of this was used to fund lending in the FX swap market (affecting the EUR and JPY cross-currency bases), and the rest to fund HQLA portfolios associated with French banks' broker-dealer operations in New York. Appendix A2 shows the individual balance sheets of French bank branches.

Japanese branches lost about \$100 billion in funding as well, but unlike other banks, they used most of these funds to lend in the real economy. Japanese branches managed to replace the funding they lost as they didn't shrink their balance sheets (see Appendix A3).

Canadian branches lost about \$70 billion in funding. Most of this was used to fund lending in the FX swap market (affecting the CAD cross-currency basis), and the rest to fund the HQLA portfolios of Canadian banks' dealer operations in New York (see Appendix A4).

The remaining roughly \$100 billion in funding was lost by U.K., Dutch, German, Swiss and Singaporean branches. U.K. branches lost \$40 billion and the rest about \$15 billion each, most of which went to the FX swap market (for selected balance sheets see Appendix A5).

Of the \$400 billion that is left with prime funds today, about one half is allocated to assets with less than seven days to maturity, and forms prime funds' liquidity portfolios. The other half is in term assets, and forms prime funds' term portfolios. Meaningful reallocations from the liquidity to the term portfolios are unlikely as the regulatory minimum for liquidity is 30% of total assets, and prime funds converged around their current liquidity allocation of just under 50% as the industry benchmark (see Figure 8). That is, unless prime funds attract inflows, foreign bank branches have lost \$250 billion in term unsecured funding, some of which has translated into a loss of their share of the FX swap market.⁹ "Some" and not "all" as some of the unsecured funding that foreign entities lost through branches were made up by tapping the tri-party repo market through their primary dealer arms (we will discuss the details of this funding switch and the net effects in Part 4 of our paper).

The fact that prime funds are unlikely to improve the depth of unsecured funding markets (by lending more into the one and three-month points by reducing their liquidity portfolios) doesn't bode well for the credibility of the three-month U.S. dollar Libor fixing. Beyond the \$150 billion decline in the market for three-month unsecured funds between foreign banks and money funds as described above, DTCC data suggests that there is barely any issuance at the three-month point in the CD and CP markets. In line with these trends, the fourth quarter volume [report](#) on Libor from ICE shows a 7.5 point decline in transaction versus model-based submissions from a year ago – today, only 30% of submissions for three-month U.S. dollar Libor are based on trades; the rest are model-driven (see Figure 9).

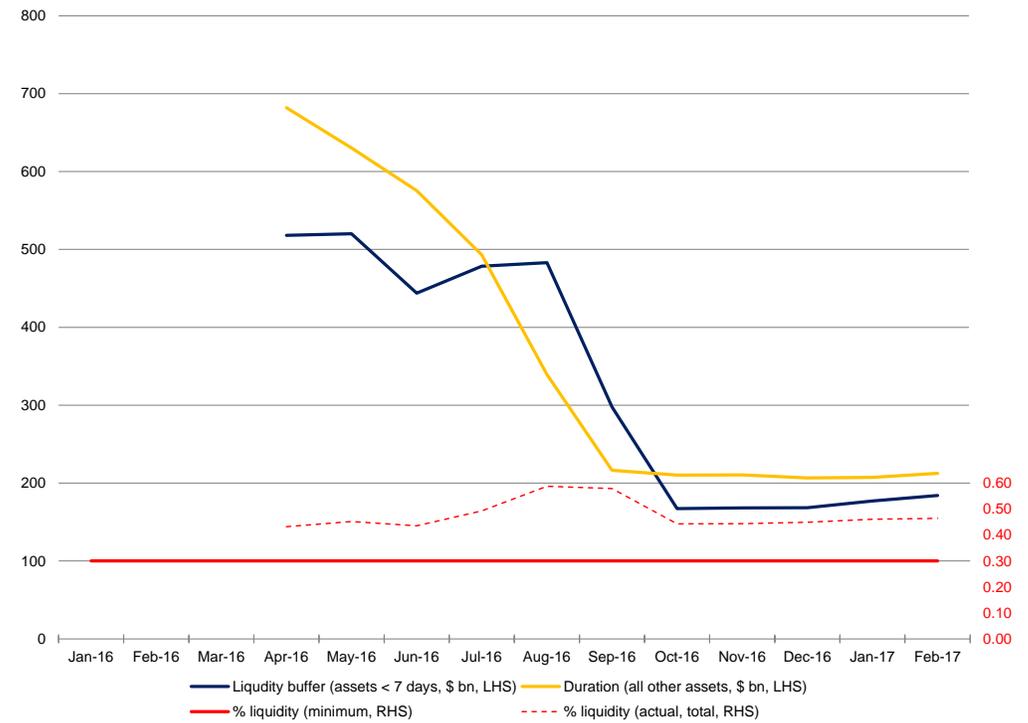
Three-month U.S. dollar Libor is slowly becoming an inactive funding point.

We'll return to this point in Part Six of our paper and discuss its implications for three-month Libor-OIS and cross-currency bases in light of developments in other funding markets.

⁹ We derive \$250 billion as the sum of \$100 and \$150 in one and three-month funding lost due to money fund reform (see above). We don't count the \$60 billion in six-month funding lost as a loss for foreign banks as those funds were lent mostly to U.S. banks.

Figure 8: Don't Expect a Miracle from WAM Extensions

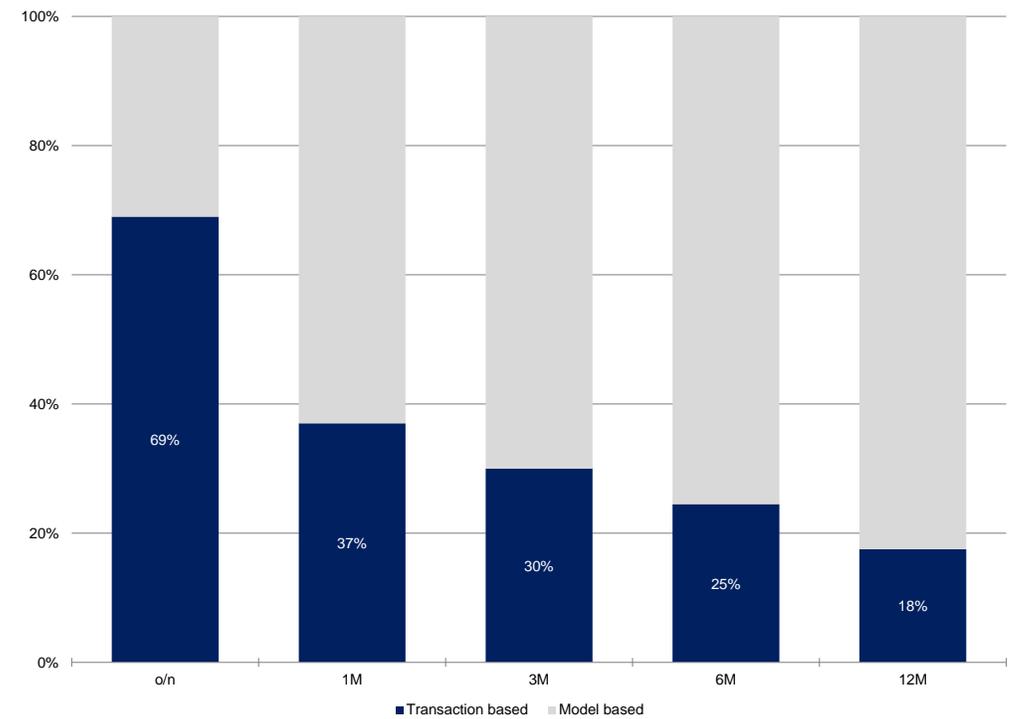
\$ billion (left-hand side) and percent (right-hand side)



Source: ICI, Credit Suisse

Figure 9: Science Fiction

Submissions by U.S. dollar Libor panel banks, percent



Source: ICE, Credit Suisse

Part 3 – Government Funds to U.S. Banks

Chain 2 shows how government funds lend cash either o/n or term to the FHLBs via agency discount notes and floating rate securities, and how the FHLBs pass these funds on to foreign banks via o/n fed funds trades and to U.S. money center banks via advances.

Overnight funds are lent via the purchase of o/n discount notes which the FHLBs use to lend o/n in the fed funds (FF) market. Such o/n FF trades form an integral part of FHLBs' liquidity portfolios, similar to the way o/n reserve balances form an integral part of U.S. and foreign banks' HQLA portfolios.¹⁰ The other side of these trades are a dozen or so foreign banks that are highly rated enough for the FHLBs to be able to lend to them on an unsecured basis (o/n FF trades are unsecured). Foreign banks typically deposit these funds at the Fed earning interest on reserves (see Chain 2A). In essence, these types of arbitrage trades are the same as the ones described in Chain 1A, except that the latter involves a longer list of counterparties. This is because prime funds' risk tolerance is greater than those of the FHLBs. Access to o/n FF market is limited only to the highest rated banks in the global financial system and that list includes banks from Canada, the Netherlands, Australia, France, Finland, Germany, Norway and Sweden (see Figure 10).¹¹ Similar to o/n Eurodollar trades, U.S. banks are notably absent from the o/n FF market.

Term funds are lent via the purchase of term discount notes which the FHLBs use to fund advances to member banks which are exclusively U.S. banks, but not foreign banks. From the perspective of one's ability to raise three-month funding in order to fund three-month lending in the FX swap market cheaply, U.S. banks have a very clear advantage over foreign banks. All U.S. money center banks are member banks of the FHLB system and so for example J.P. Morgan Chase Bank, NA of Columbus, OH can tap FHLB Cincinnati to raise cheap dollars to lend them via FX swaps to pension funds in Tokyo (see Chain 2B).

Figure 10: Leaning on the Rest of the World to Set the Fed Funds Rate

Ratings of unsecured investment credit exposure by domicile of counterparty, \$ million, December 31, 2016

Carrying Value(2)	Investment Grade			Unrated	Total
	Double-A	Single-A	Triple-B		
Domestic	\$ 680	\$ 6,063	\$ 3,106	\$ 130	\$ 9,979
U.S. subsidiaries of foreign commercial banks	—	297	—	—	297
Total domestic and U.S. subsidiaries of foreign commercial banks	680	6,360	3,106	130	10,276
U.S. branches and agency offices of foreign commercial banks					
Canada	1,913	8,460	—	—	10,373
Netherlands	—	6,579	—	—	6,579
Australia	5,948	—	—	—	5,948
France	—	5,319	—	—	5,319
Finland	4,695	—	—	—	4,695
Germany	500	3,223	—	—	3,723
Norway	—	3,575	—	—	3,575
Japan	—	2,322	—	—	2,322
Sweden	500	1,250	—	—	1,750
Total U.S. branches and agency offices of foreign commercial banks	13,556	30,728	—	—	44,284
Total unsecured investment credit exposure	\$ 14,236	\$ 37,088	\$ 3,106	\$ 130	\$ 54,560

Source: Office of Finance

¹⁰ In fact, these o/n fed funds trades are the only place where the FHLBs can park their cash while meeting two crucial requirements: (1) earning a non-zero rate of interest and (2) getting their cash back early. Although the FHLBs have reserve accounts at the Fed which provide near 24-hour access to cash, those accounts pay zero interest. The FHLBs also have access to o/n RRP's which pay interest, but give cash back only at 3:30 PM. Foreign banks have a captive audience in the FHLBs!

¹¹ Canadian banks include National Bank of Canada, Bank of Nova Scotia, Royal Bank of Canada and the Bank of Montreal. Dutch banks include Rabobank. Australian banks include National Australia Bank, Australia and New Zealand Bank, Westpac and Commonwealth Bank of Australia. French banks include BNP Paribas. Finnish banks include Nordea. German banks include DZ Bank, Bayerische Landesbank and Landesbank Baden-Württemberg. Norwegian banks include DNB Bank. Swedish banks include Svenska Handelsbanken, Skandinaviska Enskilda Banken (SEB) and Swedbank. Eighteen foreign banks in total.

Yet another advantage of U.S. banks over foreign banks is the ability of the former to tap six-month advances to fund HQLA portfolios (see Chain 2C). If a U.S. bank can issue fewer six-month CDs due to prime funds' diminished presence in the CD market, it did not necessarily lose that funding if the FHLBs are lending more via advances on the back of government funds' increased purchases of agency discount notes and floaters. But if foreign banks can issue fewer six-month CDs, their next port of call is the "outer rim" of funding markets – either the FX swap market or the debt capital market (see [here](#)).

Thus, while the FHLBs trade exclusively with foreign banks through their liquidity portfolio, they trade exclusively with U.S. banks through their loan portfolio (see Figure 11).

Of the \$200 billion in net new funding absorbed by the FHLBs due to money fund reform, about \$40 billion was absorbed by the FHLBs issuing more o/n discount notes. These fund o/n FF loans to highly-rated foreign banks and so indirectly IOER arbitrage trades. The increase in o/n lending by the FHLBs is visible in the increase in traded o/n FF volumes from \$60 billion before money fund reform to around \$90 billion today (see Figure 12).

The remaining \$140 billion in net new funding was directed at funding an expansion in lending to U.S. banks via advances. \$40 billion of this went to funding HQLA portfolios (offsetting the loss of term funding from prime funds) and the rest (likely) to fund U.S. banks lending dollars in the FX swap market, grabbing market share from foreign banks.

Part 4 – Government Funds to Primary Dealers

Chain 3 shows how government funds lend cash to primary dealers via tri-party repos. Nearly all the funds lent by government funds to primary dealers via repos are overnight.

Primary dealers lend these o/n balances either o/n or term in the GCF repo market to other primary dealers or in the bilateral repo market to customers (see Chains 3A and 3B). Similar to Chains 1B and 2B above, the very moment other dealers and customers raise funds via repo, those funds will be deposited in their name at a clearing bank and the clearing bank will keep those deposits in reserves at the Fed (not shown). When the deposits are spent, the reserve balances will travel from one clearing bank to another.

Primary dealers can also use the funds raised via o/n repos to lend in the FX swap market (see Chain 3C). Like before, how the funds lent into the FX swap market are spent by foreign real money accounts is beyond the scope of this analysis. The key lesson is that arbitraging the difference between onshore and offshore dollar funding rates can be funded in both unsecured and secured markets. Foreign banks fund unsecured and primary dealers secured. Prime funds fund the former and government funds the latter.

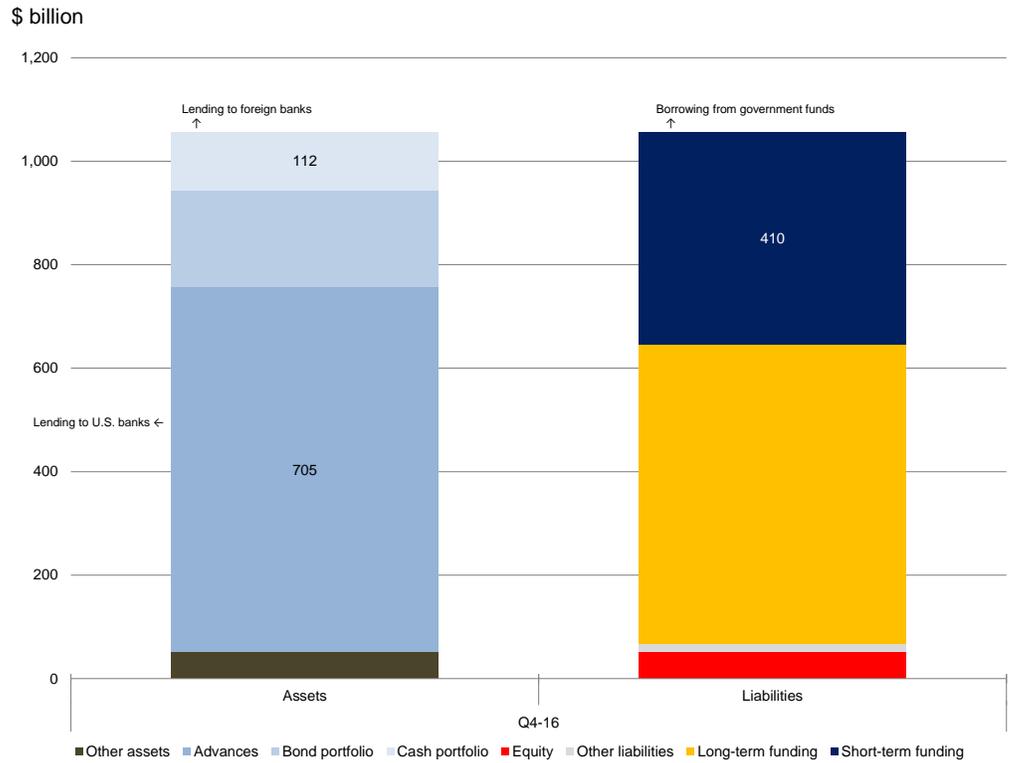
We next look at the nationality of primary dealers that absorbed most of the new repo funding between April, 2016 and February, 2017 (see Figure 13 and Appendix A6).

Scandinavian banks absorbed nothing as they do not run dealer operations in the U.S., and their branches did not substitute unsecured funding with secured funding. They didn't, as the assets they funded (reserves) cannot be pledged as collateral. This is because repos involve the trading of securities for cash, and as the highest form of cash in the global financial system, reserves cannot be traded for anything better in money markets.

French entities absorbed \$60 billion. Roughly \$40 billion of this net new repo funding was absorbed by one entity, the primary dealer arm of BNP Paribas; the New York branches of French banks absorbed the rest. After accounting for the loss of about \$100 billion in unsecured funding, reform meant the net loss of \$40 billion of funding for French entities.

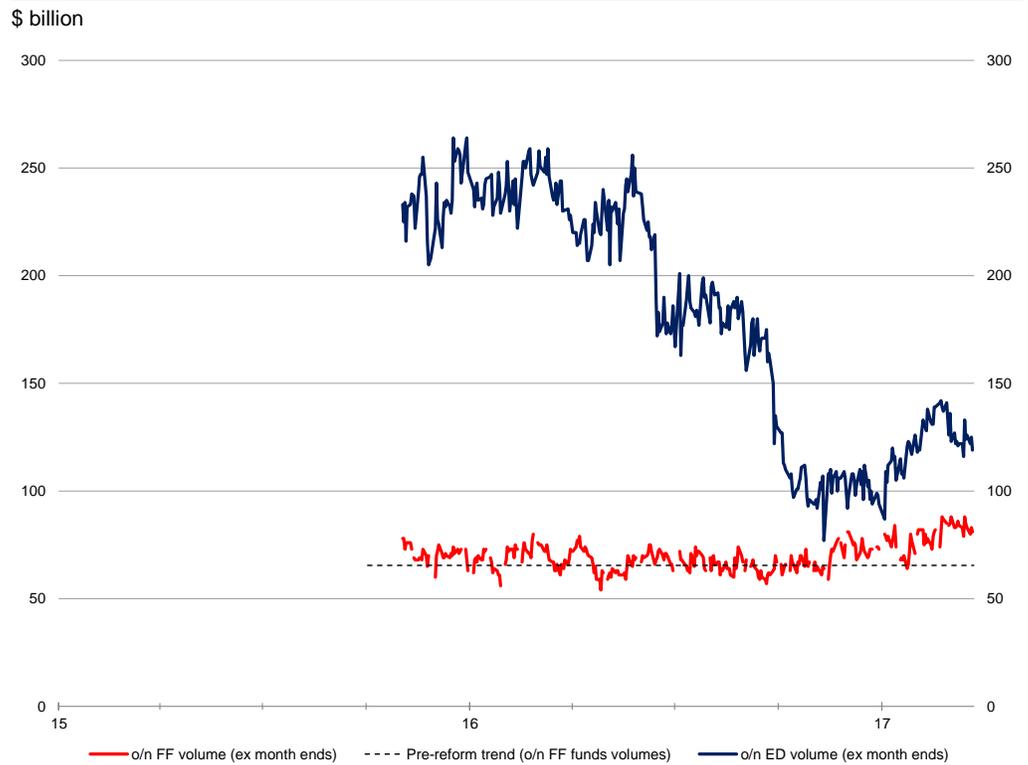
Japanese entities absorbed another \$60 billion. New York branches of Japanese banks accounted for about a half of this increase, which was a direct response to the loss of unsecured funding (see Appendix A3). That Japanese banks could tap the repo market on

Figure 11: The FHLBs Are a Key Cog of Global Dollar Funding Markets



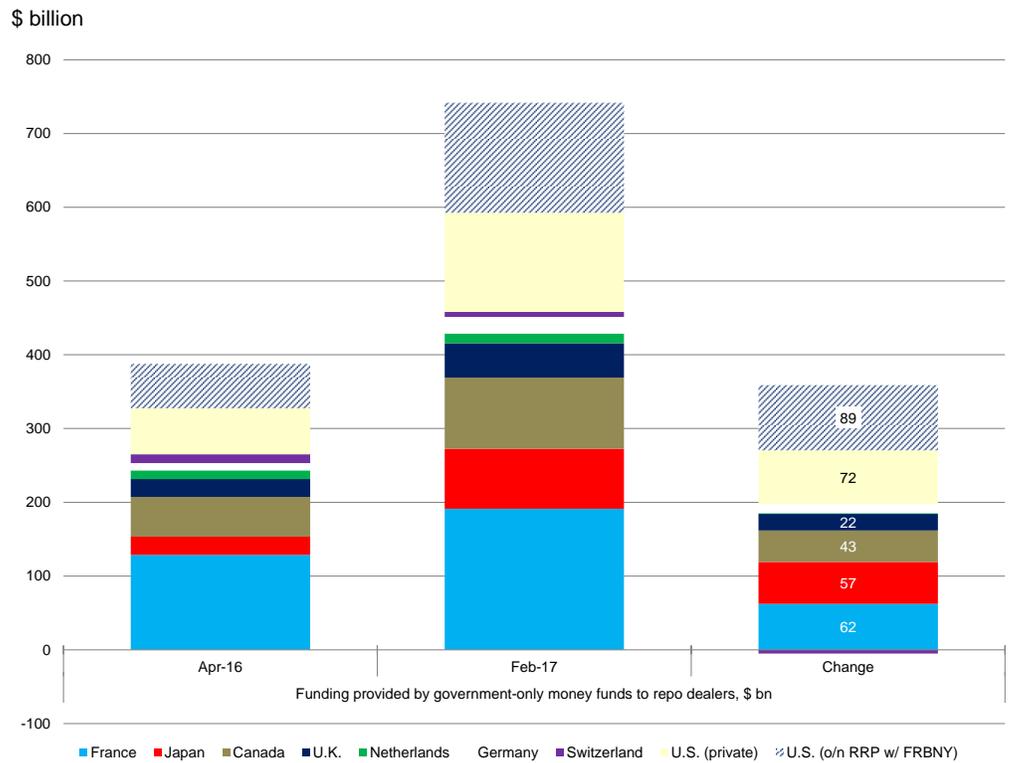
Source: Office of Finance, Credit Suisse

Figure 12: Money Fund Reform Boosts o/n Fed Funds Volumes



Source: FRBNY, Credit Suisse

Figure 13: Gains of Secured Funding by Country



Source: ICI, Credit Suisse

this scale without breaching their LCR was because one of the banks (Norinchukin) is not subject to Basel III and another (Sumitomo) had an LCR well above the minimum.¹² Japanese banks' primary dealer operations absorbed the rest. After accounting for the loss of \$100 billion in unsecured funding, reform meant the net loss of about \$40 billion in funding for Japanese entities onshore in the U.S. But given that Japanese banks did not shrink their dollar books globally (see the [speech](#) by Deputy Governor Nakaso), they must have replaced this loss with funding raised outside New York (see [this](#) piece by the BIS).

Canadian entities absorbed about \$40 billion. The New York primary dealer arm of the Royal Bank of Canada absorbed about \$10 billion, and the Chicago branch of BMO about \$20 billion. Bank of Nova Scotia's New York agency appears not to have pursued recent inflows to the repo market. After accounting for the \$70 billion in unsecured funding lost, reform meant the net loss of \$30 billion in funding for Canadian entities in the U.S.

U.K. primary dealers absorbed \$20 billion. The New York primary dealer arms of Barclays and HSBC absorbed the bulk of this and the New York primary dealer arm of RBS the rest. After accounting for the \$40 billion in unsecured funding lost, money fund reform meant the net loss of about \$20 billion in funding raised by U.K. entities onshore in the U.S.

Swiss primary dealers absorbed nothing, they lost market share over the period.

U.S. primary dealers absorbed about \$70 billion in new repo funding. The bulk was absorbed by J.P. Morgan Securities, Bank of America Merrill Lynch and Morgan Stanley, and \$10 billion was absorbed by Goldman, Sachs & Co. and Citigroup Global Markets.

¹² In other words, they had room for their LCR to fall as they pledged U.S. Treasuries from their HQLA portfolio in the repo market.

After accounting for the loss of about \$40 billion in unsecured funding and the gain of about \$140 billion in net new funding via advances from the FHLBs (see above), money fund reform netted \$170 billion in net new funding for U.S. banks and primary dealers. We mapped \$130 billion of this gain to the loss of French, Japanese, Canadian and U.K. banks above, and the remaining \$40 billion can be traced to German and Dutch banks.

Figure 14 provides a big picture summary of the flows we've discussed so far. Going from left to right, foreign bank branches have lost around \$400 of unsecured funding due to money fund reform, on net. Some of their losses due to outflows from prime money funds were moderated by increased lending of o/n fed funds (FF) by the FHLB system.

Money fund reform netted \$200 billion in new repo funding for foreign primary dealers. This increase reduced by half the net loss of unsecured funding by foreign bank branches.

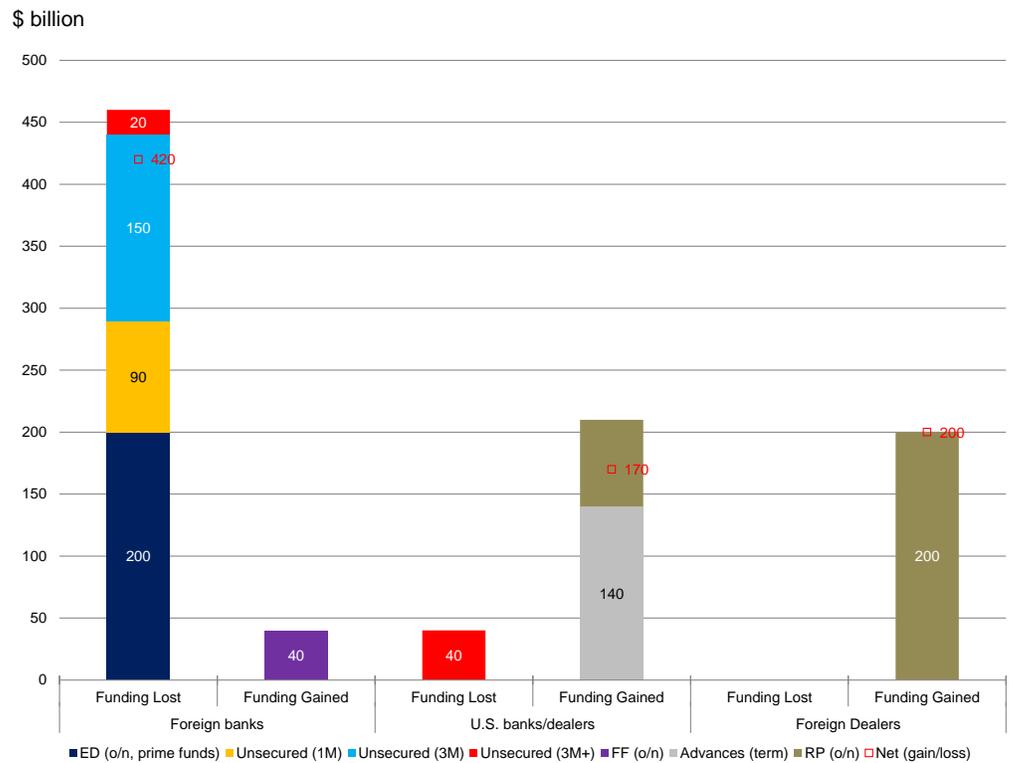
Money fund reform netted \$100 billion in new funding for U.S. banks and \$70 billion in new repo funding for U.S. primary dealers (middle columns), for a total gain of \$170 billion. This is the funding grab by U.S. intermediaries from foreign intermediaries we predicted [here](#).

In the grand scheme of things, money did not disappear from the system, it's just flowing through a different set of balance sheets. Money fund reform has changed where the marginal FX swap trades are being funded and where the marginal prices are being set...

Money fund reform-related flows all ran their course by early November.

All the interesting price action (the narrowing of Libor-OIS spreads and the collapse of cross-currency bases) that happened in funding markets since then had little to do with reform as a catalyst. The debt ceiling was the show...

Figure 14: The Big Picture



Source: ICI, FRBNY, Credit Suisse

Part 5 – Funding Black Holes

Every funding chain discussed above had one unifying purpose: to arbitrage rates across various segments of the money market – secured and unsecured, onshore and offshore. The protagonists were money dealers – foreign banks' New York branches, the FHLBs, U.S. banks and primary dealers (both U.S. and foreign). Their market making activities give rise to the flow of reserves across hundreds of different reserve accounts on the balance sheet of FRBNY, and across thousands of customer deposits at clearing banks.

Drain some reserves and funding rates will respond...

Chain 4 shows a simple transaction that drains reserves from the banking system and hence money dealers. It shows governments fund putting cash in the Fed's RRP facility.

Government funds typically do this when they have nowhere else to put their money – government funds typically work the markets hard to get as many U.S. Treasury bills and discos as they can, and have a very strong aversion to using the o/n RRP facility on days other than quarter-ends. This is visible from the fact that when faced with the choice of lending to the Fed (via the o/n RRP facility) or to primary dealers (via o/n tri-party repos) at the same rate, they will choose dealers over the Fed as they've done since November.¹³

Just like light from a black hole, funds placed with the Fed via o/n RRP facilities never escape. They don't because the Fed is not a money dealer in normal times, only in crisis times. Unlike banks and dealers, which trade money on both sides of their balance sheet, the Fed just takes money in, but it does not lend it out on the other side of its balance sheet.

If reserves are drained, dollars are "off the grid" and funding conditions tighten...

Of the \$800 billion that flowed into government funds, only \$100 billion went into the o/n RRP facility. As such, the associated tightening in funding conditions has been marginal.

But o/n RRP facilities are not the only way to drain reserves from the system. For example, reserves are also drained when foreign official and supranational accounts place cash with FRBNY via the foreign RRP facility, or when the U.S. Treasury increases its cash balances at its Treasury General Account (TGA) at FRBNY. Balances in the foreign RRP facility have been stable at around \$250 billion since the beginning of 2016, but TGA balances have seen a \$400 billion swing recently, with a big impact on funding conditions.

Balances in the TGA are an asset of the U.S. Treasury and every asset needs funding. Given that the TGA earns zero interest, Treasury funds them with bills to minimize negative carry. Since November, the Treasury reduced its cash balances by \$400 billion and reduced bill issuance by the same amount. Both developments were related to the extraordinary measures taken by Treasury to avoid the debt ceiling. Importantly, government funds did not see a corresponding decline in their bill holdings (see Figure 15).

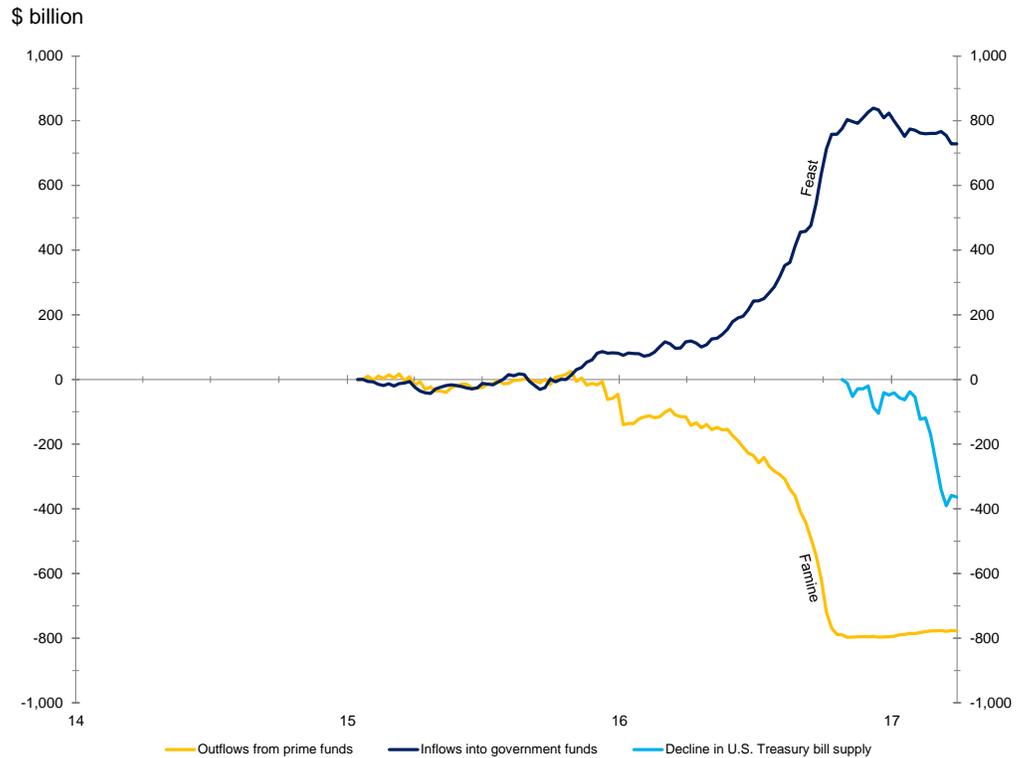
If government money funds did not give up bills, who did and where did the money go? That is the \$400 billion question hanging over the \$/¥ cross-currency basis. The answer:

...a bit to the bilateral repo market and a lot the FX swap market.

The bilateral repo market is a market between primary dealers and large asset managers and hedge funds. PIMCO for example is famous for refusing to lend cash on the tri-party

¹³ Money funds' aversion has to do with counterparty limits, stigma and an unwillingness to upset the relationship with their primary dealer customer base. Tri-party repo is a relationship business where the ability to get funding when needed and the ability to get collateral when needed are key pillars of the harmony between government funds and dealers. If government funds were to upset the dealers (for example, by abandoning them for the Fed when spreads are nonexistent), they may not get product from the dealers when the tides change. In contrast, the inter-dealer GCF repo market is a blind-brokered market where relationships do not exist (they don't because in a blind-brokered market you do not know who you are lending to). Because of this feature, the nature of trading in the GCF repo market is defined by an "extract a pound of flesh" mentality when opportunities arise. The rules of the game in the tri-party market are different – "relationships first". Civil, as opposed to opportunistic. For richer, for poorer.

Figure 15: If Money Funds Did Not Give Up Bills, Who Did?



Source: ICI, FRBNY, Credit Suisse

platform. It lends exclusively on a bilateral basis. Similarly, the largest hedge funds lend their cash via bilateral repos as they don't have access to tri-party repos to begin with.

The benefits of bilateral trades over tri-party trades are their put option features: whereas tri-party repos return cash at 3:30 PM, bilateral repos are negotiated either with an 8:30 AM cash return or a put option which can be exercised at anytime during the business day. This put option mimics one's ability to trade bills for cash intra-day with "t+0" settlement.

Bills and bilateral repos are viewed as very close substitutes. As a general rule of thumb, when the supply of Treasury bills falls, the bilateral repo market absorbs cash, and when the supply of Treasury bills increases, the reverse is true. Substitution between the two is seamless not because the maturity of bilateral repos can be tailored to mimic those of bills, but also because both instruments provide intra-day liquidity without major restrictions.¹⁴

The market has a unique dynamic to it.

Its players are among the most sophisticated traders of money markets. Those who play in the bilateral repo market as cash investors never "farm out" their cash management function to money funds. In fact, many of them manage their cash in house because they do not want to be constrained by the rules imposed on money funds. It is helpful to think about these market participants as "alpha" cash pools that aim to beat the benchmark returns in money markets, in contrast to "regular" cash pools content with the benchmark returns offered by most money funds (the concept of "alpha" cash pools versus "regular" cash pools is analogous to the concept of the "alpha" male versus the average Joe).

For example, some of the excess returns to trading money markets could come from "alpha" cash pools hoarding U.S. Treasuries with a few months to maturity, in anticipation of a reduction in bill issuance due to the debt ceiling and government funds scrambling for

¹⁴ The same cannot be said about tri-party repos or FRBNY's o/n RRP facility, as they provide liquidity only after 3:30 PM.

bills in response. Selling into government funds' frenzied search for bills would yield profits, similar to the way Microsoft Corp.'s selling of U.S. Treasury bills into the flows from prime funds to government funds between June and November turned a profit. The only difference is that while Microsoft Corp. bought U.S. Treasury notes with the proceeds, "alpha" cash pools recycled the proceeds back into the money market via bilateral repos.

Anecdotally, the preferred lending habitat of "alpha" cash pools is three-months and in. Their options are bills, quasi bills (bilateral repos) or synthetic bills (lending via FX swaps). Chain 5 shows what happens when "alpha" cash pools switch between these instruments.

In the first example (see Chain 5A), "alpha" cash pools hold bills which fund TGA balances at the Fed. When these balances increase, reserves get drained from the financial system, similar to the way o/n RRP's drain reserves. Both places are "funding black holes".

Draining a lot of reserves through the TGA is a big deal because it takes reserves out of the financial system and away from the banks and primary dealers that arbitrage various corners of the global dollar funding market and intermediate dollars – or more precisely, reserves – from those who have them to those who need them. The cases to remember from earlier pages are Chain 1B where foreign banks were intermediating dollars raised from prime funds (via CDs) to real money accounts in regions with negative interest rates; Chain 2B where U.S. banks were intermediating dollars raised from government funds (via the FHLBs) to the same real money accounts; and Chain 3C where primary dealers were intermediating dollars from government funds (via repos) to similar types of accounts.

In the second example (see Chain 5B), bilateral repos substitute for U.S. Treasury bills. The "alpha" cash pools, instead of channeling billions of dollars into the black hole via bills, are lending to primary dealers instead via bilateral repos and reserves find their way back into the global financial system through chains similar to Chain 3C (and also 2B and 1B).

In the third example (see Chain 5C), "alpha" cash pools are lending of dollars directly in the FX swap market (via market maker's matched books; for details see the Appendix to the previous issue of Global Money Notes [here](#)). FX swaps substitute for repos. Instead of funding dealers harvesting cross-currency bases, "alphas" are harvesting the bases directly.

Whether "alpha" cash pools are in one instrument versus another depends on their preferred lending habitat, risk tolerance and market views. Some are only comfortable to toggle between bills and repos, and some also dabble in FX swaps. When bills are in short supply, "alphas" toggle between repos and FX swaps according to their tastes and views.

The size of the bilateral repo market is big.

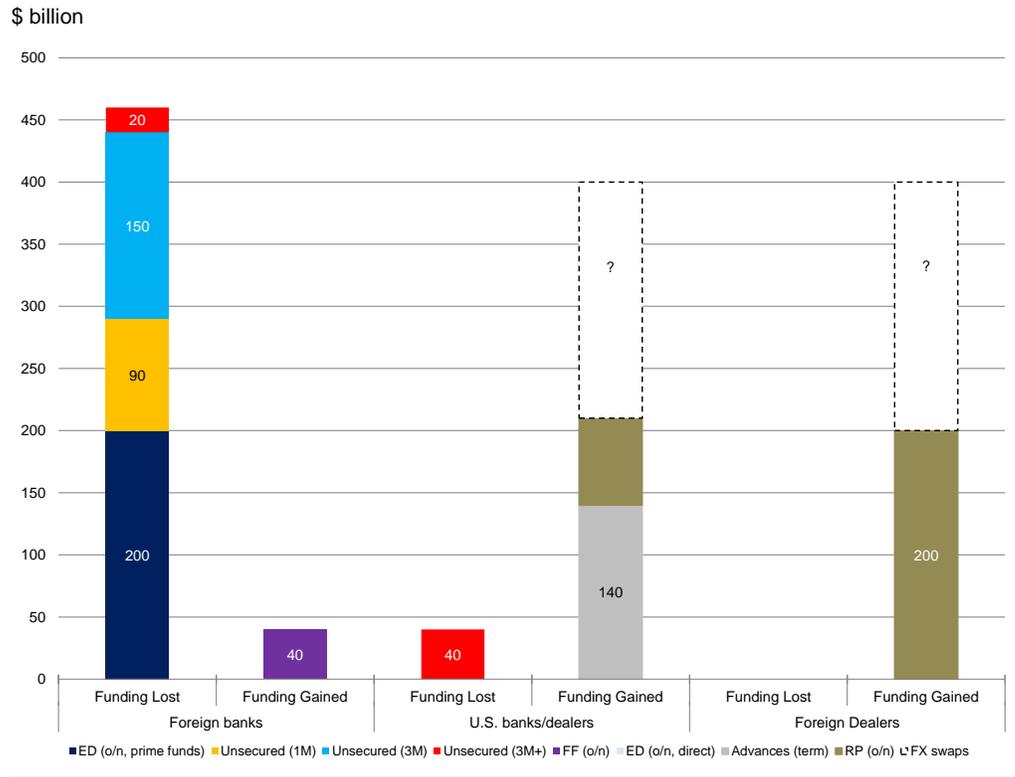
According to FRBNY's FR2004 survey, the size of the entire repo market is circa \$2 trillion (U.S. Treasury and MBS collateral only). In comparison, the size of the tri-party repo market between dealers and government funds (U.S. Treasury and MBS collateral also) is only \$600 billion. Most of the difference between the two numbers accounts for the size of the bilateral repo market between dealers and large asset managers and hedge funds.¹⁵

Because public data on the size of the bilateral repo market does not exist, the best thing we can do is to use the FR2004 survey to infer the size and direction of change since November. It's up, but not by \$400 billion. And this means that most of the \$400 billion that left the bill market went into the FX swap market via matched books like in Chain 5C.

Figure 16 (overleaf) helps visualize the increase in the volume of funding raised via FX swaps as bill supply shrank by \$400 billion since November. The lesson here is that [data](#) on money funds' portfolio holdings only helps to track funding flows in the tri-party repo market, but not the bilateral repo market or the FX swap market (a currency repo market). And as it happens, the bilateral flows are more important to understand recent price action in money markets than tri-party flows. Adjust your radar to capture more of the landscape.

¹⁵ "Most" and not "all" as there are other cash lenders in the tri-party repo market other than money funds (seclenders, for example)

Figure 16: The Bigger Picture



Source: ICI, FRBNY, Credit Suisse

Figure 17 (overleaf) shows the total amount of reserves that have been drained from the system through various measures since December 10, 2014 – the peak date of reserves. Once we control for quarter-end dynamics, the total amount of reserves drained from the financial system peaked at just under \$800 billion last November. The main contributors to this drainage were J.P. Morgan pushing out \$200 billion in non-operating deposits in 2015 into the bill market with help from the U.S. Treasury, which increased its TGA balances by \$100 billion that year, and FRBNY, which uncapped the foreign RRP facility it maintains for foreign official accounts. Once in motion, these dynamics intensified during 2016, with the Treasury increasing TGA balances by an extra \$300 billion and foreign official accounts (mostly Japan’s Ministry of Finance) putting \$250 billion into the foreign RRP facility.¹⁶

But the flows took a sharp turn in November, when Treasury started to burn through its TGA balances in order to avoid the debt ceiling. TGA balances collapsed by \$400 billion and the amount of reserves drained over the previous two years was quickly cut in half. Dollars that were formerly off the grid, found their way back into the financial system.

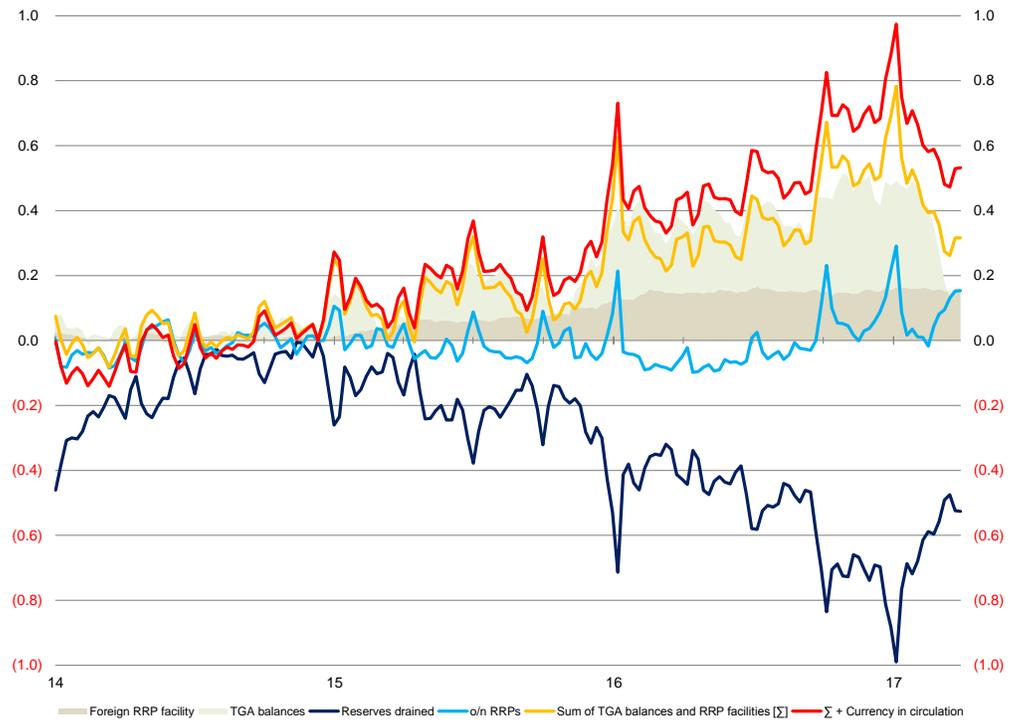
Famine, followed by plenty...

Figure 18 shows how the three-month \$/¥ cross-currency basis responded to these flows. As reserves were drained, its trading range went from -10 to -40 basis points (bps) in 2014, to -20 to -60 bps in 2015, and to -40 to -90 in 2016. With every \$400 billion drained, the trading range of the basis sank by about 40 bps. And when the flows turned and reserves became plentiful again, the basis duly collapsed by a whopping 60 bps since November.

¹⁶ In Figure 17, the red and dark blue lines are mirror images of each other. The orange line is the sum of the outstanding balances in the o/n RRP facility, the foreign repo facility and the TGA. The red line is the sum of the orange line and currency in circulation.

Figure 17: Reserves...

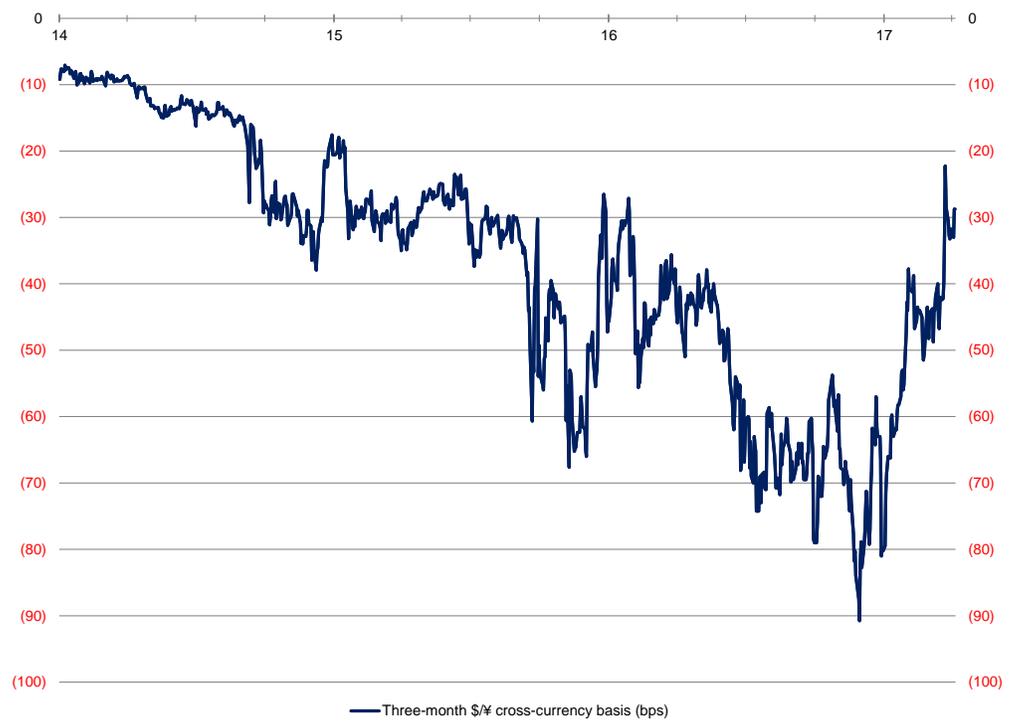
Base = 0, December 10, 2014, \$ trillion



Source: FRBNY, Credit Suisse

Figure 18: ...and the Cross-Currency Basis

Basis points



Source: ICI, FRBNY, Credit Suisse

Part 6 – Libor-OIS and the Cross-Currency Basis

The \$200 billion in extra repo funding absorbed by primary dealers since April, 2016 did not overwhelm o/n markets initially – primary dealers competed hard for the new funds until about November (see Figure 19). This is what the roughly 5 basis point spread of o/n tri-party repos over the Fed's o/n RRP rate tells us. On the other side of primary dealers' matched repo books, the inter-dealer o/n GCF repo rate was trading close to IOER also until about November. This was indicative of primary dealers having ample opportunities to lend cash – some of it to foreign banks who tried to balance the replacement of unsecured funding from prime funds with operating deposits or term debt (both of which take time).

In November, however, the repo market started to trade very differently. The spread between the o/n tri-party repo rate and the Fed's o/n RRP rate collapsed to nothing, as did the spread between the o/n GCF repo rate and the o/n tri-party repo rate. The former was indicative of primary dealers proactively trying to deflect o/n money coming to them (basically by refusing to pay more than the rate paid by the Fed's RRP facility), and the latter was indicative of dealers struggling to find opportunities to lend cash to other dealers and customers at attractive spreads. Two events explain these market dynamics.

First, the Treasury starting to burn through its TGA balances starting in early November and reduce its issuance of bills due to the debt ceiling (see previous section). As the supply of bills fell, "alpha" cash pools put some money into the market for bill equivalents – the bilateral repo market. This depressed o/n bilateral rates. In turn, o/n tri-party rates followed o/n bilateral rates which then compressed the o/n tri-party – o/n RRP spread.

Second, the election victory of Donald J. Trump in early November, causing an 80 bps selloff in the 10-year U.S. Treasury yield by mid-December. This mini-bear market in U.S. Treasuries led to a reduction in dealers' U.S. Treasury inventories and reduced appetite among the buy-side to put on financed long positions in U.S. Treasuries. Fewer bids for cash in exchange for U.S. Treasury collateral meant that primary dealers had fewer outlets for the funds that came in via o/n repos. And as cash got "trapped" in the inter-dealer market, the spread between the o/n tri-party and o/n GCF rates collapsed. By this time, foreign banks' bids for cash in the GCF and bilateral repo markets also faded completely.

Depressed o/n rates bled through to term repo rates as well, which in turn made term repo rates trade lower relative to term unsecured rates as measured by Libor (see Figure 20).

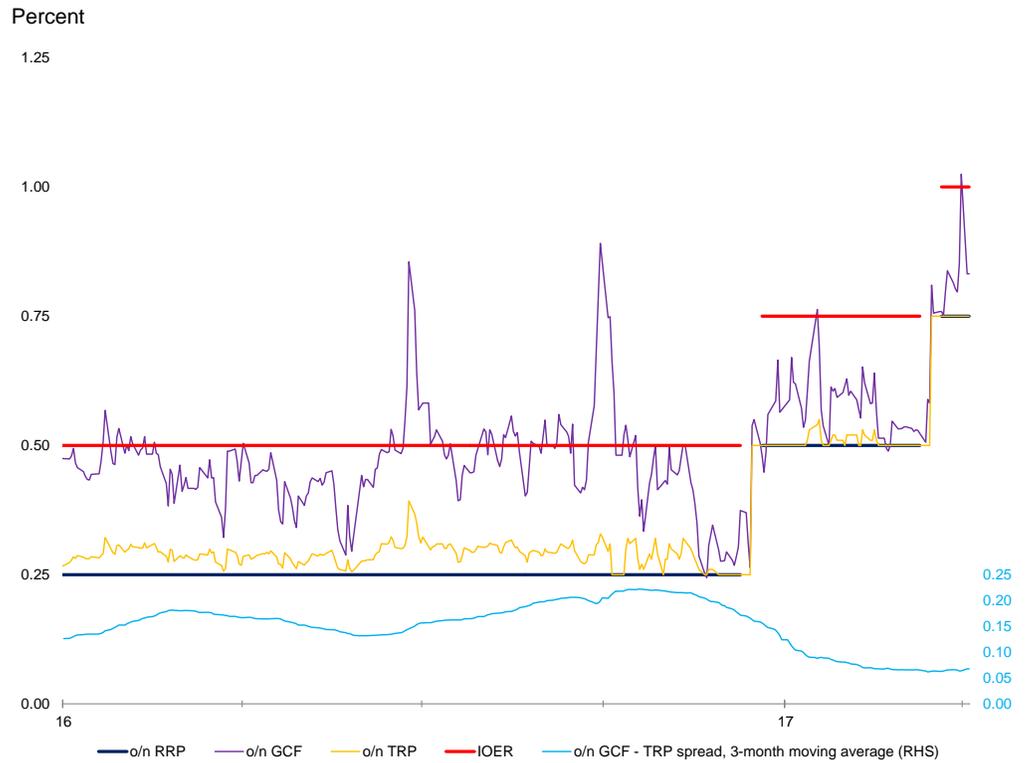
Three-month GC repo rates are typically about 10 bps lower than comparable Libor rates, but as the decline in bill supply flooded the bilateral market with cash since November (both o/n and term), three-month GC rates declined by 40 bps relative to three-month Libor. This funding advantage lasted through February and narrowed to 30 bps by early April.

Figure 20 also shows the funding advantage that opened up for U.S. banks with access to advances from the FHLBs.¹⁷ This funding advantage was nonexistent before June, but as flows from prime funds to government funds cumulated, three-month U.S. dollar Libor rose but advance rates did not (thanks to government funds' strong demand for agency discos). U.S. banks funding advantage peaked at 30 bps, just before the recent Fed hike.

To sum up, first money fund reform, and then extraordinary measures by the Treasury opened up significantly cheaper sources of funding to lend dollars in the FX swap market. U.S. banks funded via the FHLB system and primary dealers via bilateral repos to arbitrage implied rates in the FX swap market. These new, and significantly cheaper funding "pipes" for dollars account for roughly one half of the correction in the three-month cross-currency basis. The other half is explained by the reduced presence of foreign real money accounts in the U.S. Treasury and MBS markets (also due to Trump) and hence lower hedging needs. Foreign banks that scrambled for dollars in the midst of prime fund outflows by tapping the FX swap market have also faded as they refinanced with term debt.

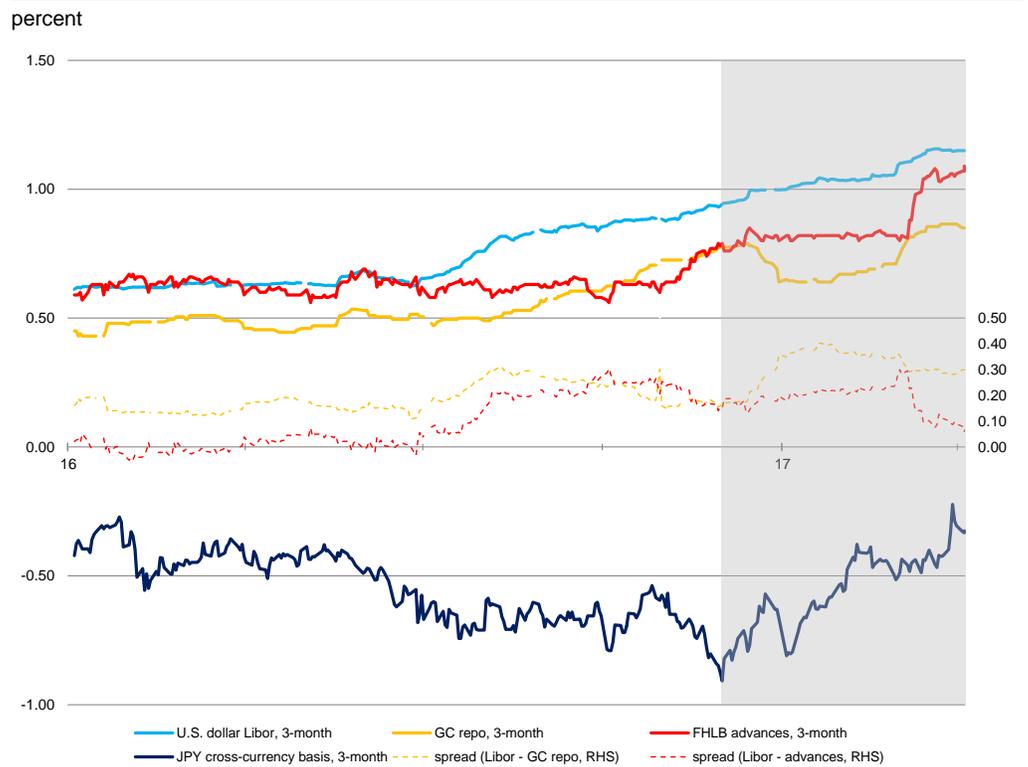
¹⁷ We derive the three-month advance rate by adding a 30 bps spread to the three-month agency discount rate.

Figure 19: Price Action in o/n Money Markets



Source: FRBNY, Credit Suisse

Figure 20: Price Action in Term Money Markets



Source: FRBNY, Credit Suisse

Figure 20 also helps inform our earlier point that three-month U.S. dollar Libor is slowly becoming an inactive funding point.

In the post-Basel III funding market order, three-month unsecured funding is typically used for arbitrage, and arbitrage typically involves the lending of U.S. dollars via FX swaps. This can be funded via CDs (at rates close to three-month Libor), via advances (at rates 20 bps below three-month Libor), or via repos (at rates 30-40 bps below three-month Libor). Unless the funding advantage of U.S. banks (with access to FHLB advances) or primary dealers (which fund via repos) both shrink back to their historical norms, intermediaries that can only fund FX swap trades via unsecured markets won't get their chance to fight: U.S. banks and dealers will always crowd them out with significantly cheaper dollars.

Since the Fed's recent hike, U.S. banks' funding advantage (via FHLB advances) appears to have closed. Furthermore, the three-month cross-currency basis at -30 bps is now well below the 60 bps spread that's needed for U.S. banks to expand their balance sheet. As such, the main market makers in the FX swap market are primary dealers at present. In turn, the funding advantage of primary dealers is a function of TGA balances and bill supply. Should U.S. Treasury decide to ramp up its cash balances to \$400 billion again over the coming weeks and months, repo rates would back up and three-month Libor will become an active funding point again. Currently we are about 20 bps away from that.

Increased bill supply is the factor that binds everything together. We have deduced in the previous section that most of the \$400 billion that left the bill market was put back into funding markets via matched FX swap books. An increase in matched book volumes helps markets clear "organically" and reduces the need for dealers to tap funding markets (i.e. to bid for CDs, repos or advances) to smooth imbalances in order flows by scaling up speculative books.¹⁸ In recent years, these imbalances were on the bid side of the market – there were more borrowers of dollars via FX swaps than lenders of dollars via FX swaps.

Take a lot of reserves out quickly and you'll tip the balance the market has been moving toward since November. Were that to happen, repo and advance rates will converge with Libor rates as dealer tap these funding markets to build up their speculative books. Once all three rates converge, watch for three-month U.S. dollar Libor-OIS to widen again.

Conclusions

Our mental image of "excess reserves" is one of banks parking large pools of cash at the Fed doing nothing with them. This issue of Global Money Notes debunked that image.

Reserves are far from being "excess" – they are needed and are being traded actively.

U.S. Treasury's extraordinary measures to avoid the debt ceiling have put \$400 billion in reserves back into the financial system, which drove the collapse of cross-currency bases.

What this tells us is that the Fed has only limited room to shrink its balance sheet.

Whether reserves are drained by U.S. Treasury boosting its cash balances or by a passive runoff of the SOMA portfolio is the same thing. They both mean fewer reserves.

With every \$100 billion of reserves drained, cross-currency bases increase by 10 bps. With every \$100 billion of reserves drained, the rest of the world gets a 10 bps rate hike. And it's not just the Fed's balance sheet decisions. Treasury needs to coordinate with the Fed regarding the impact of its cash management practices on global financial conditions.

Don't let the DSGE people hijack the Fed's balance sheet.

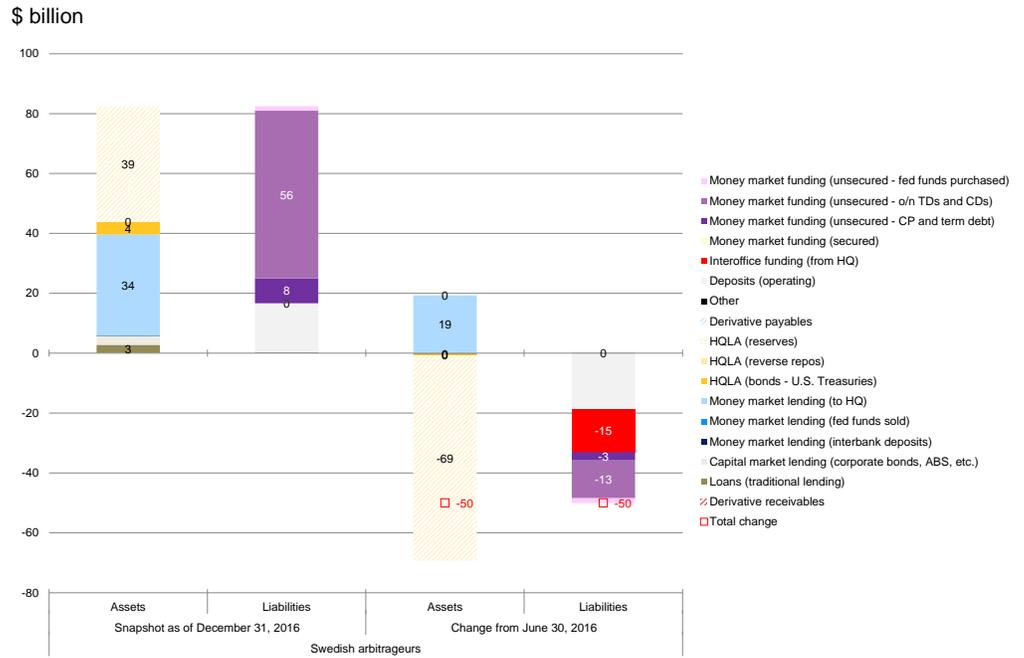
Shrinking it is a matter of taste, not a matter of necessity.

Big is beautiful. Big is necessary. Learn to live with it...

¹⁸ Matched books are FX swap to FX swap trades. Speculative books are made up of CD to FX swap and repo to FX swap trades.

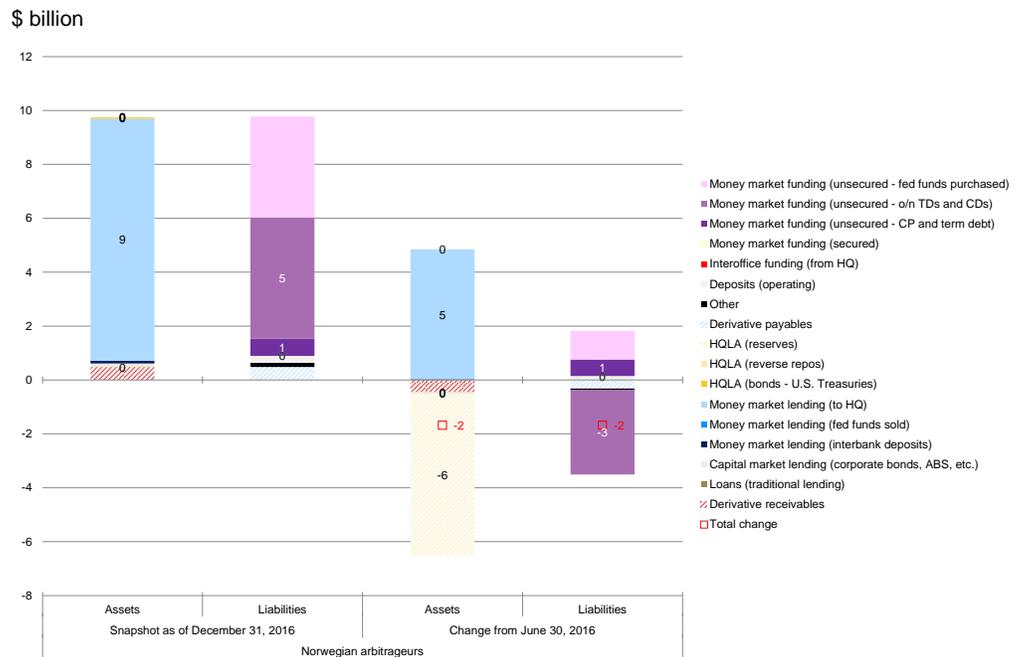
Appendix A1 – Scandinavian Arbitrageurs

Figure A1-1: Swedish Arbitrageurs



Source: FFIEC002, Credit Suisse

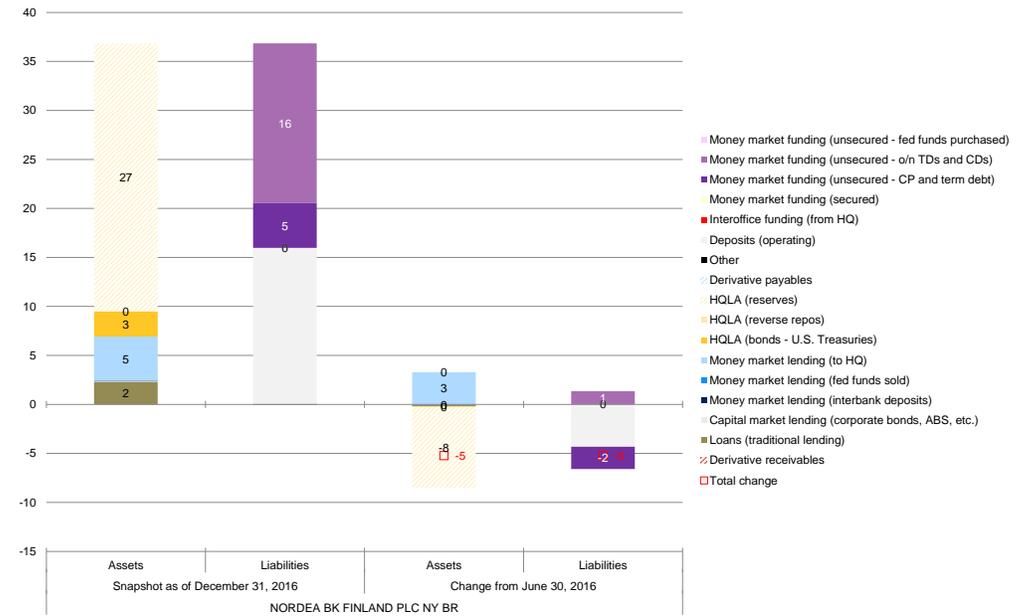
Figure A1-2: Norwegian Arbitrageurs



Source: FFIEC002, Credit Suisse

Figure A1-3: Nordea

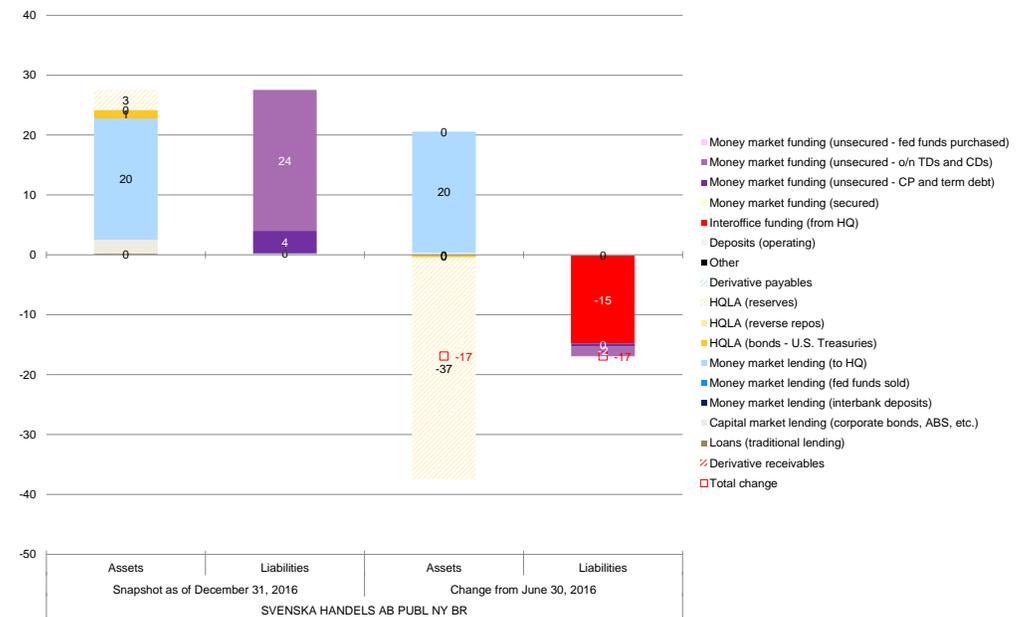
New York branch, \$ billion



Source: FFIEC002, Credit Suisse

Figure A1-4: Svenska Handelsbanken

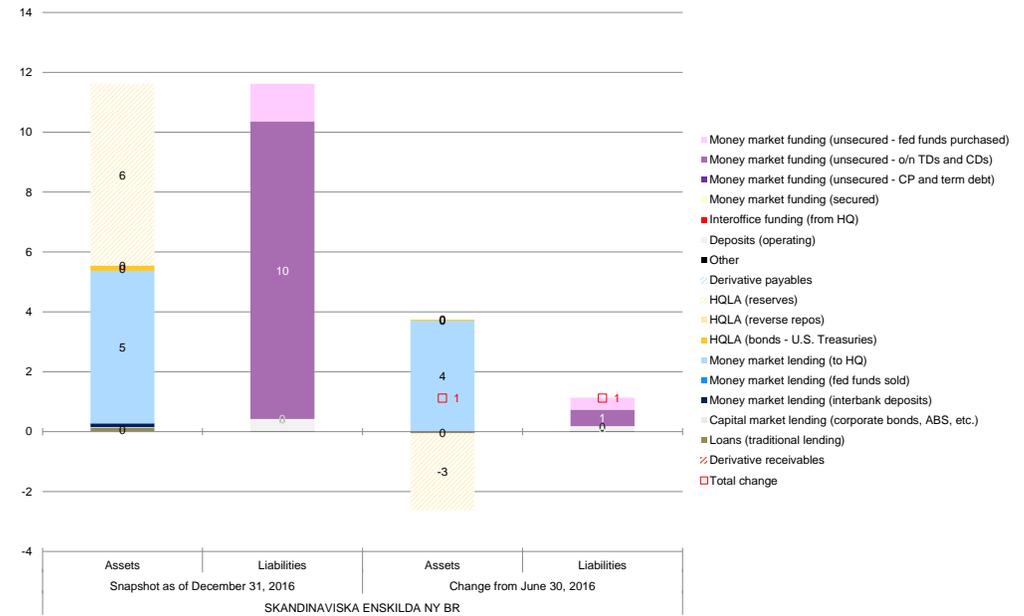
New York branch, \$ billion



Source: FFIEC002, Credit Suisse

Figure A1-5: Skandinaviska Enskilda Banken

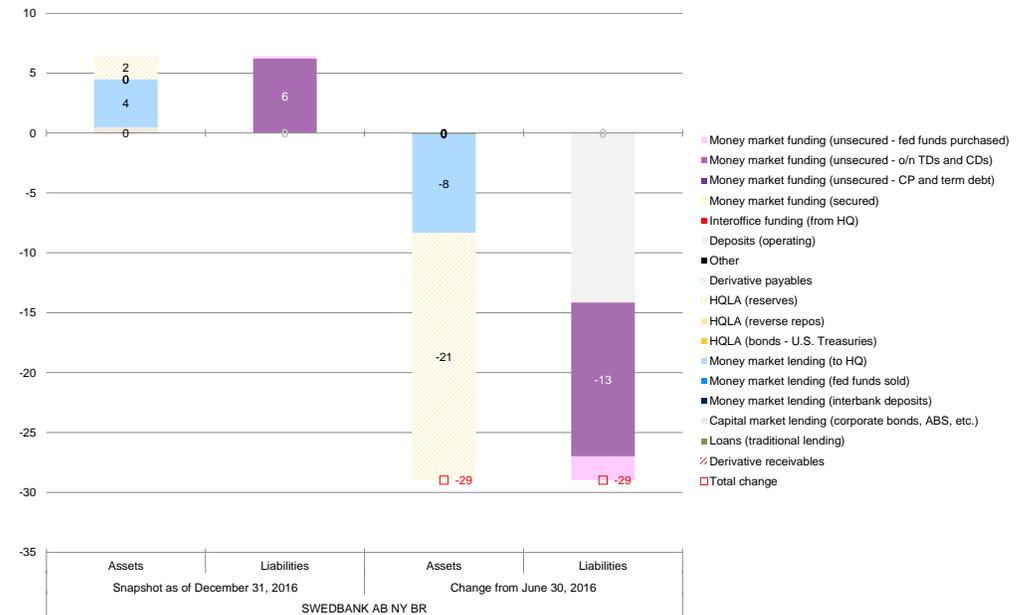
New York branch, \$ billion



Source: FFIEC002, Credit Suisse

Figure A1-6: Swedbank

New York branch, \$ billion

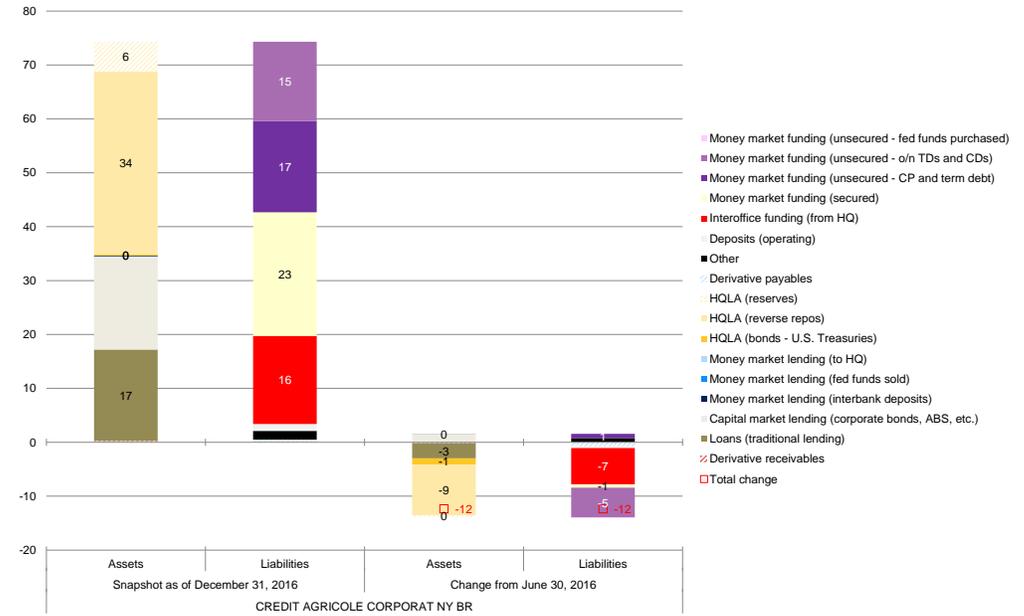


Source: FFIEC002, Credit Suisse

Appendix A2 – French Banks

Figure A2-1: Credit Agricole

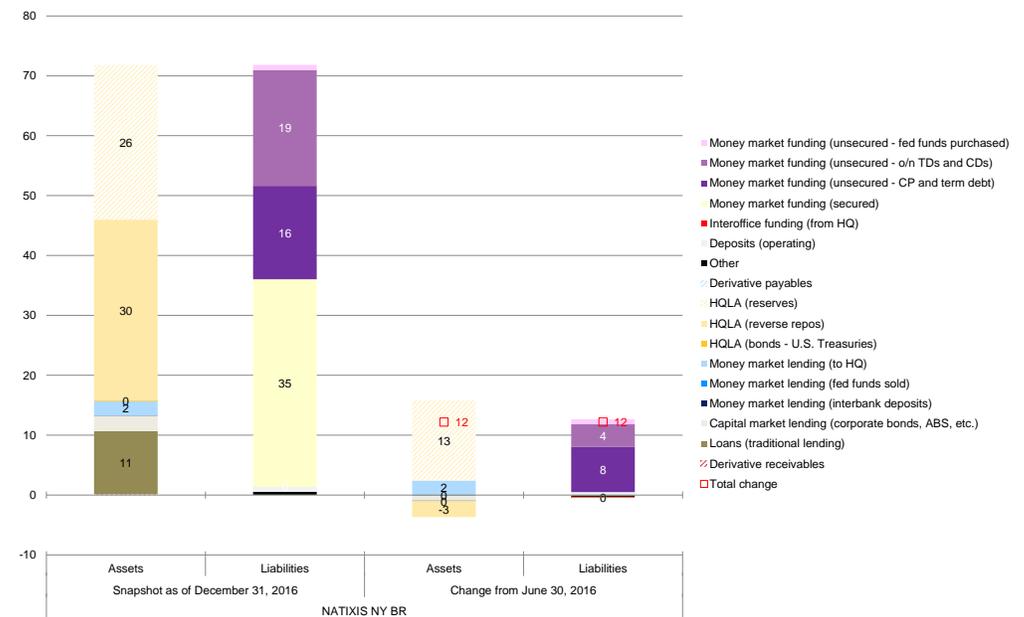
New York branch, \$ billion



Source: FFIEC002, Credit Suisse

Figure A2-2: Natixis

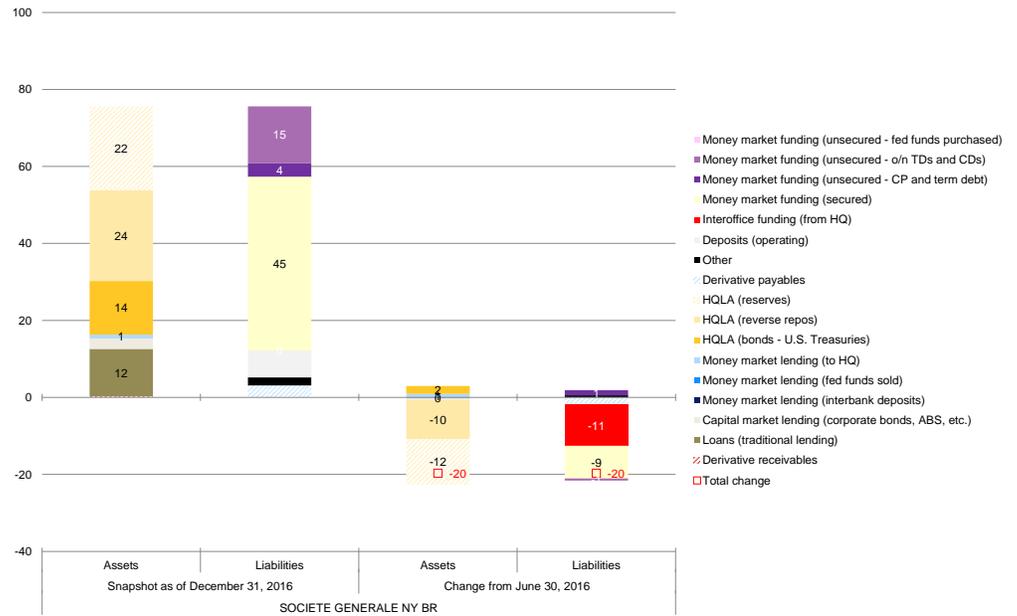
New York branch, \$ billion



Source: FFIEC002, Credit Suisse

Figure A2-3: Societe Generale

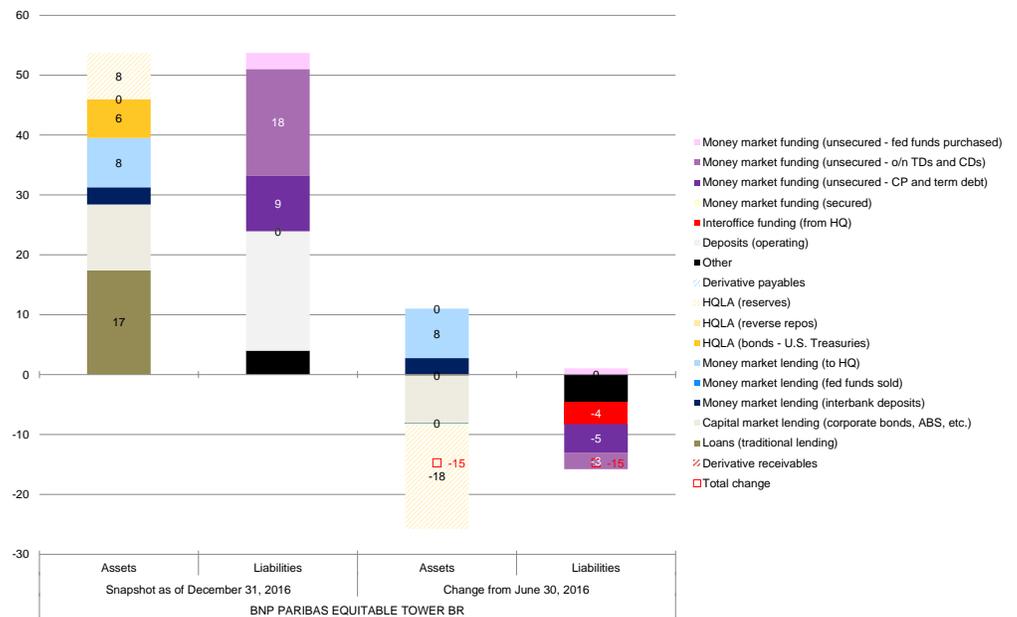
New York branch, \$ billion



Source: FFIEC002, Credit Suisse

Figure A2-4: BNP Paribas

New York branch, \$ billion

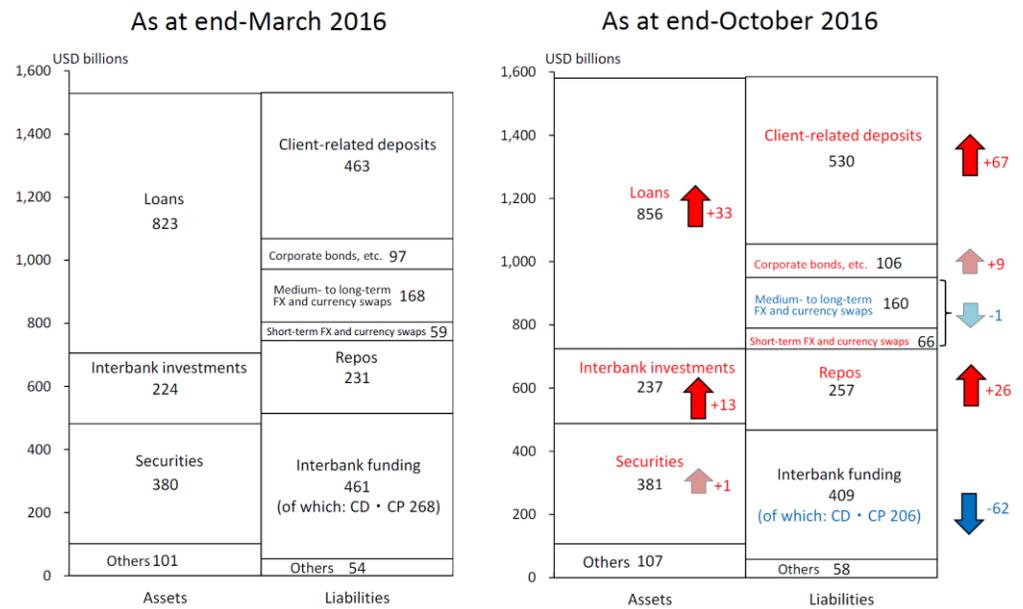


Source: FFIEC002, Credit Suisse

Appendix A3 – Japanese Banks

Figure A3-1: Japanese Banks' Global Dollar Book

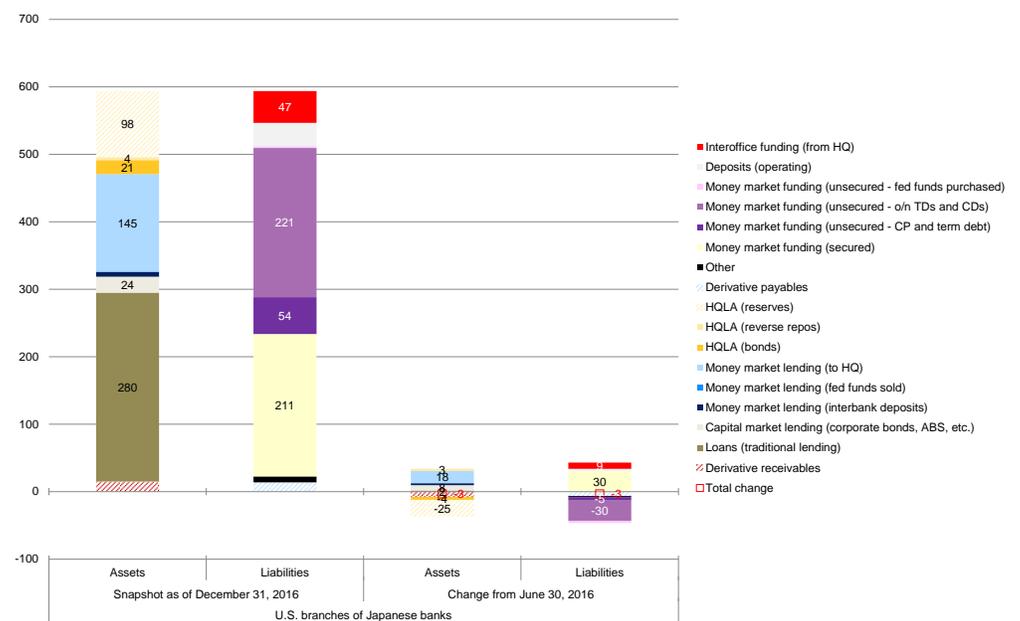
\$ billion



Source: Bank of Japan

Figure A3-2: Japanese Banks' New York Dollar Book

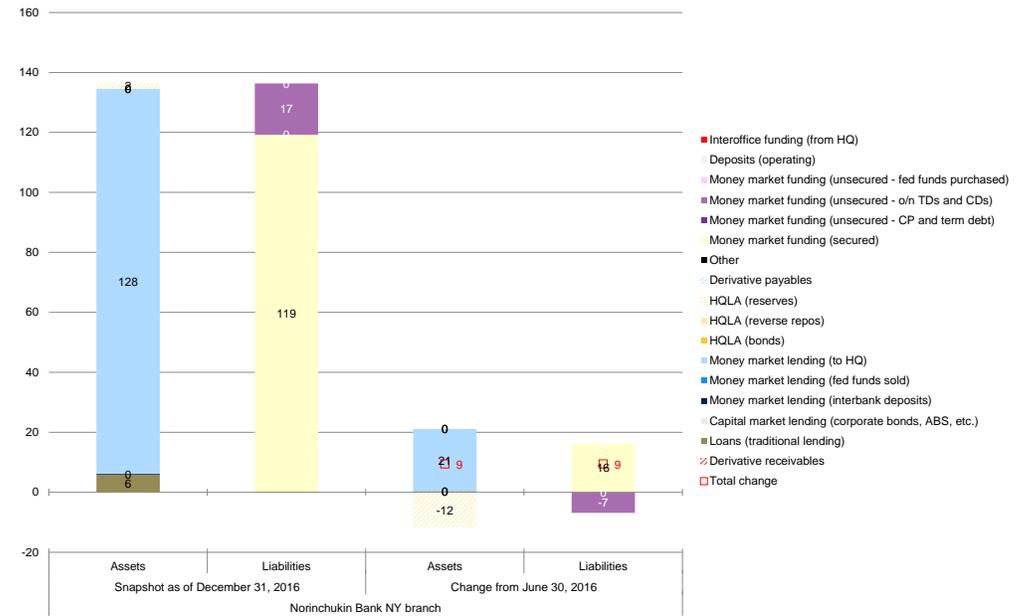
\$ billion



Source: FFIEC002, Credit Suisse

Figure A3-3: Norinchukin Bank

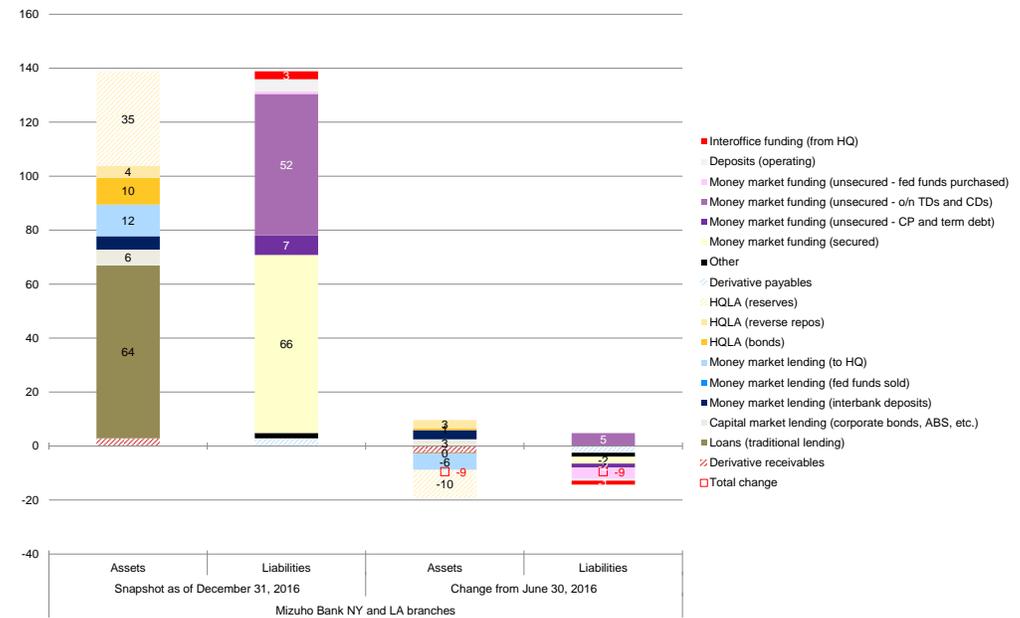
New York branch, \$ billion



Source: FFIEC002, Credit Suisse

Figure A3-4: Mizuho

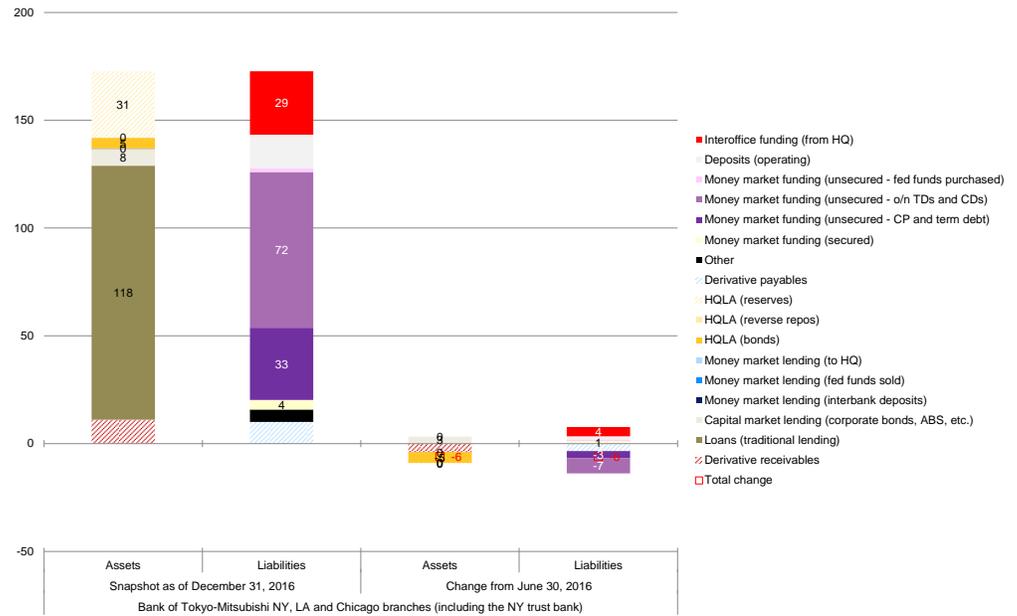
New York and Los Angeles branches, \$ billion



Source: FFIEC002, Credit Suisse

Figure A3-5: Bank of Tokyo-Mitsubishi

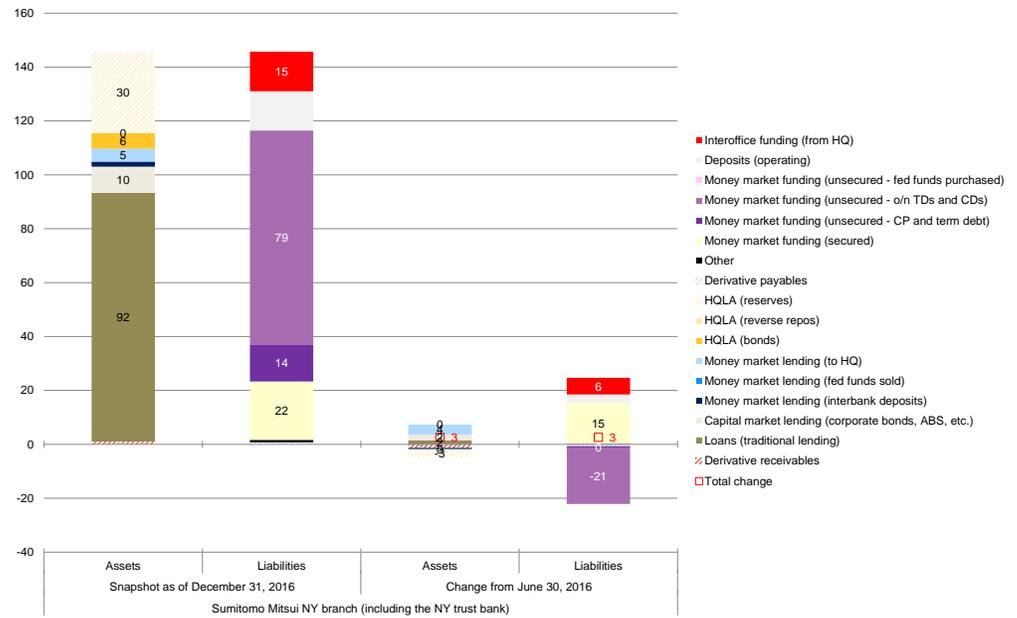
New York, Los Angeles and Chicago branches, \$ billion



Source: FFIEC002, Credit Suisse

Figure A3-6: Sumitomo Mitsui

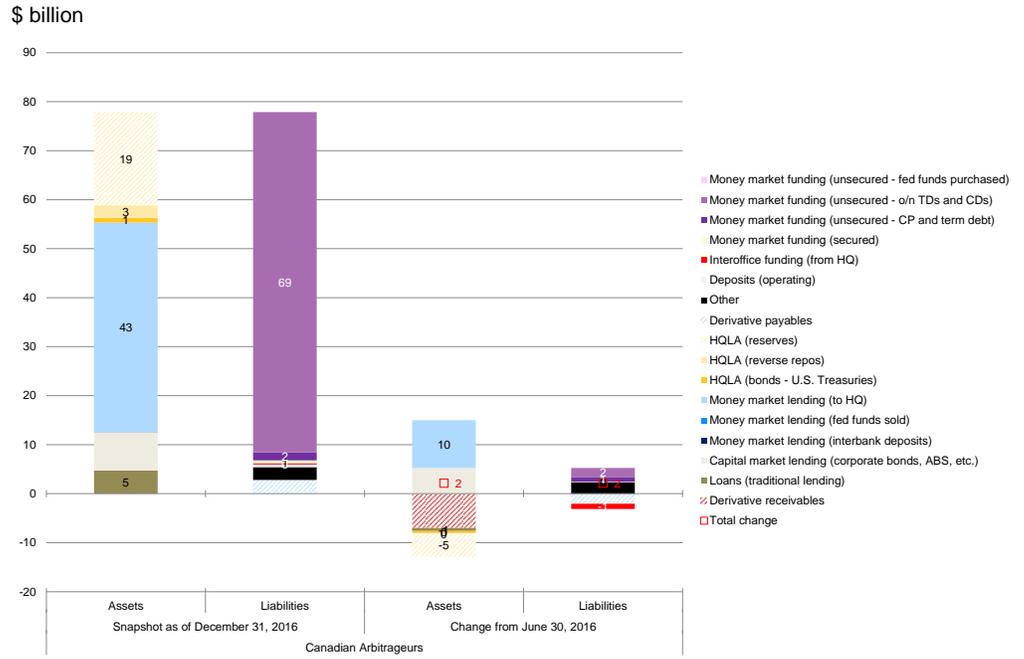
New York branch, \$ billion



Source: FFIEC002, Credit Suisse

Appendix A4 – Canadian Banks

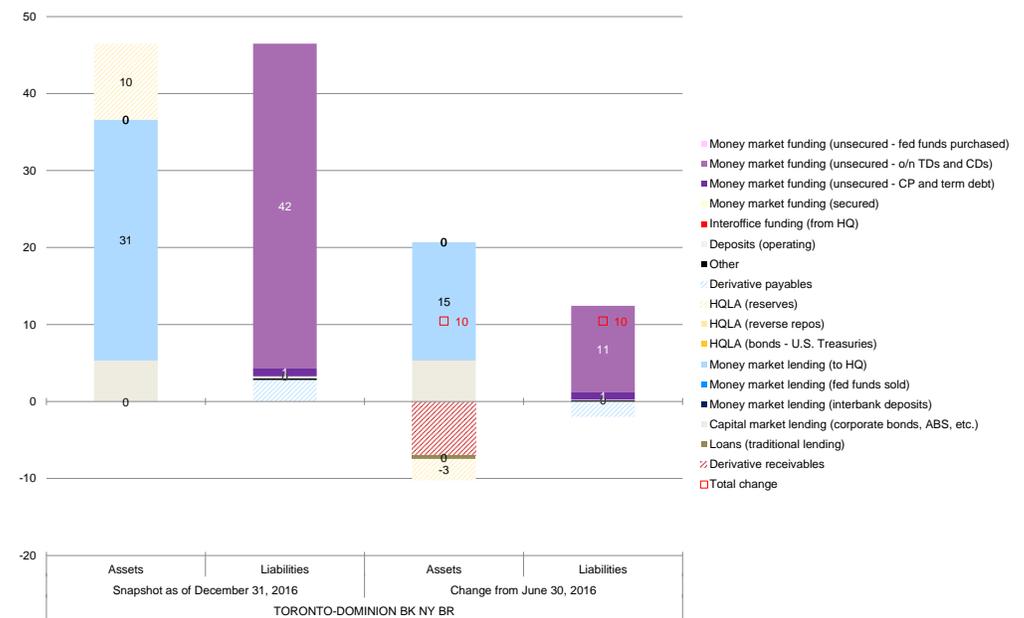
Figure A4-1: Canadian Arbitrageurs



Source: FFIEC002, Credit Suisse

Figure A4-2: Toronto Dominion Bank

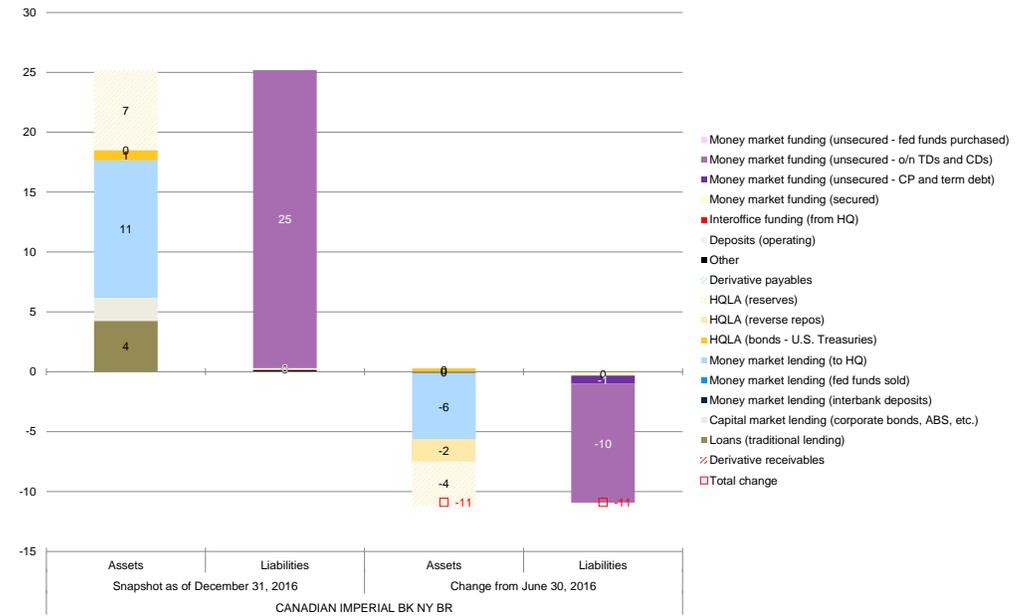
New York branch, \$ billion



Source: FFIEC002, Credit Suisse

Figure A4-3: CIBC

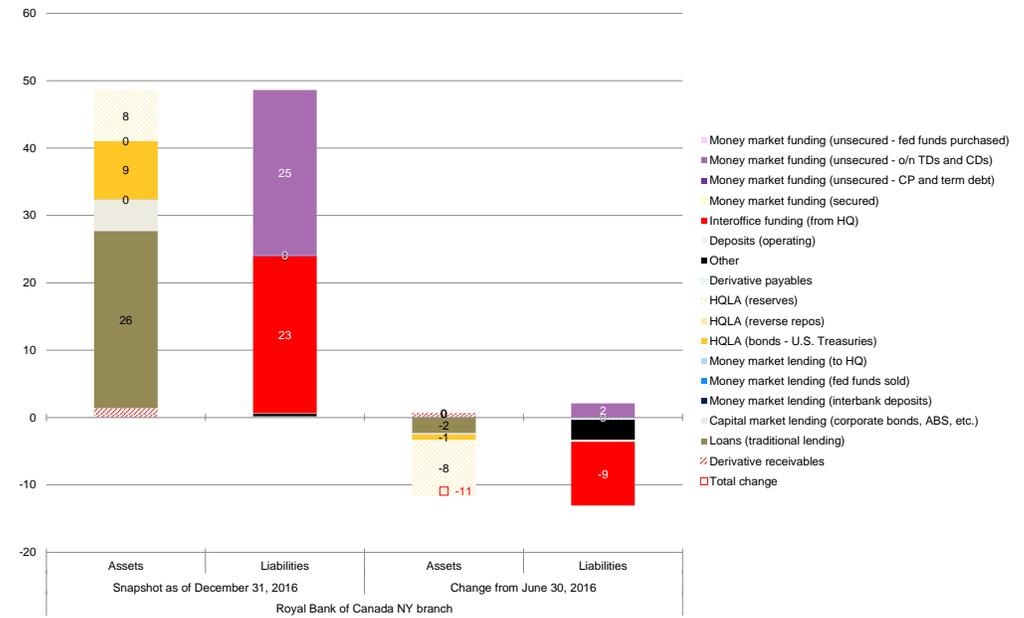
New York branch, \$ billion



Source: FFIEC002, Credit Suisse

Figure A4-4: Royal Bank of Canada

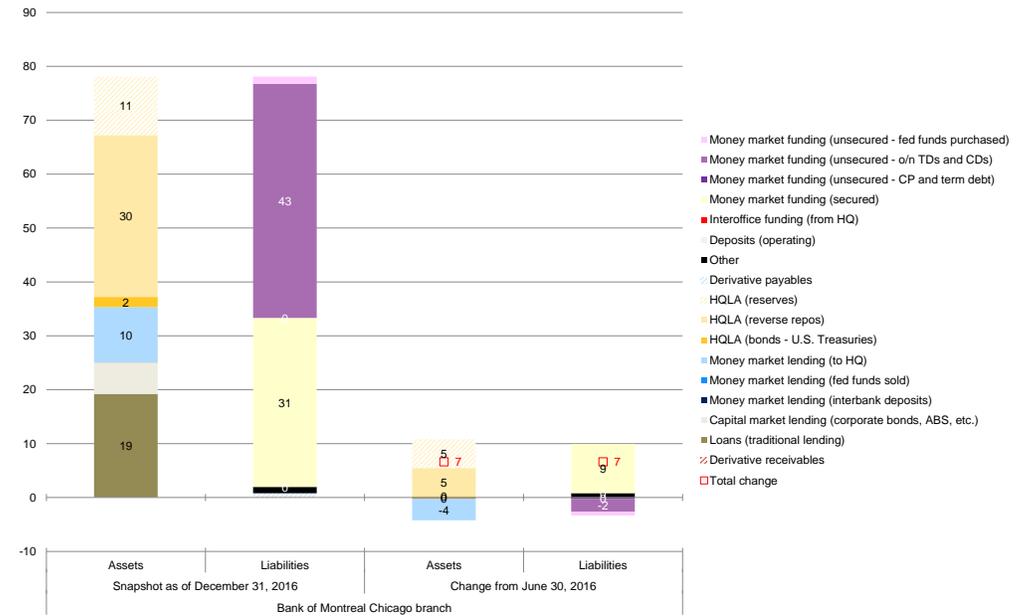
New York branch, \$ billion



Source: FFIEC002, Credit Suisse

Figure A4-5: Bank of Montreal

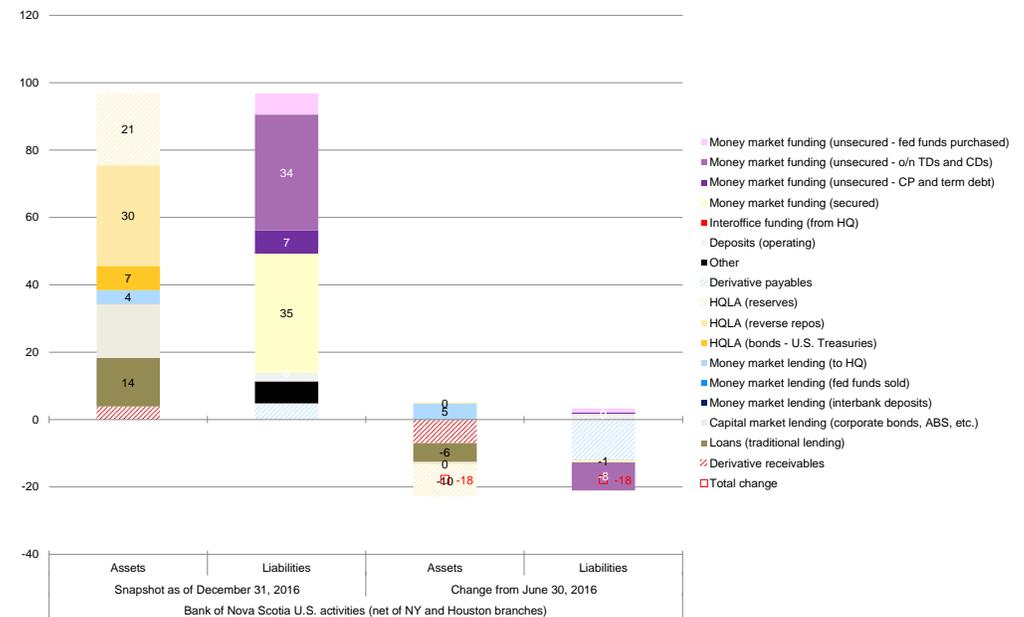
Chicago branch, \$ billion



Source: FFIEC002, Credit Suisse

Figure A4-6: Bank of Nova Scotia

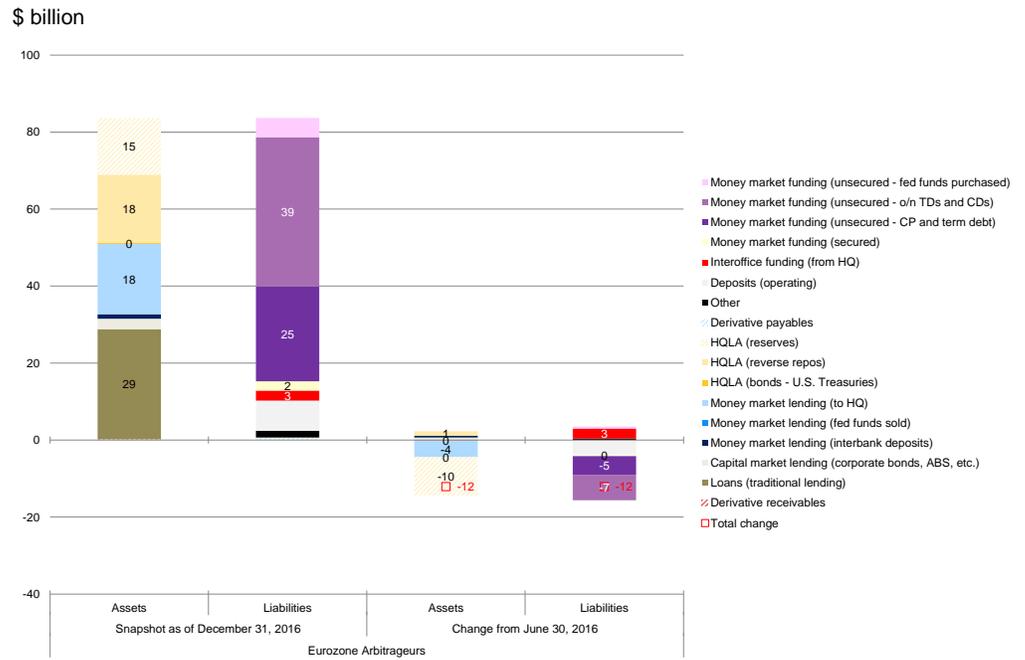
New York agency and Houston branch, \$ billion



Source: FFIEC002, Credit Suisse

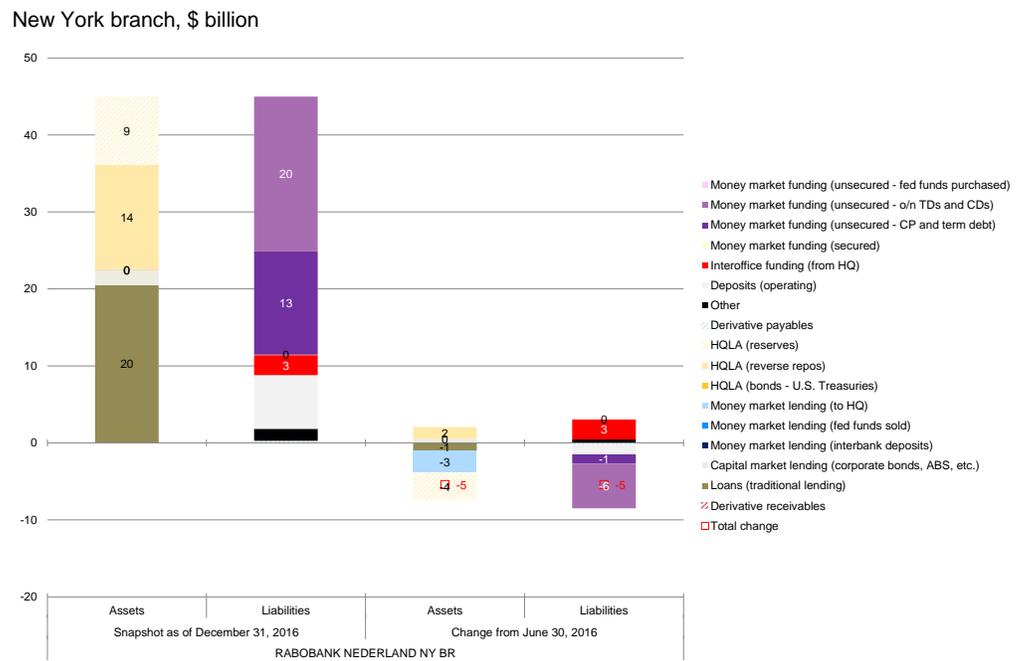
Appendix A5 – European Arbitrageurs and U.K. Banks

Figure A5-1: Eurozone Arbitrageurs



Source: FFIEC002, Credit Suisse

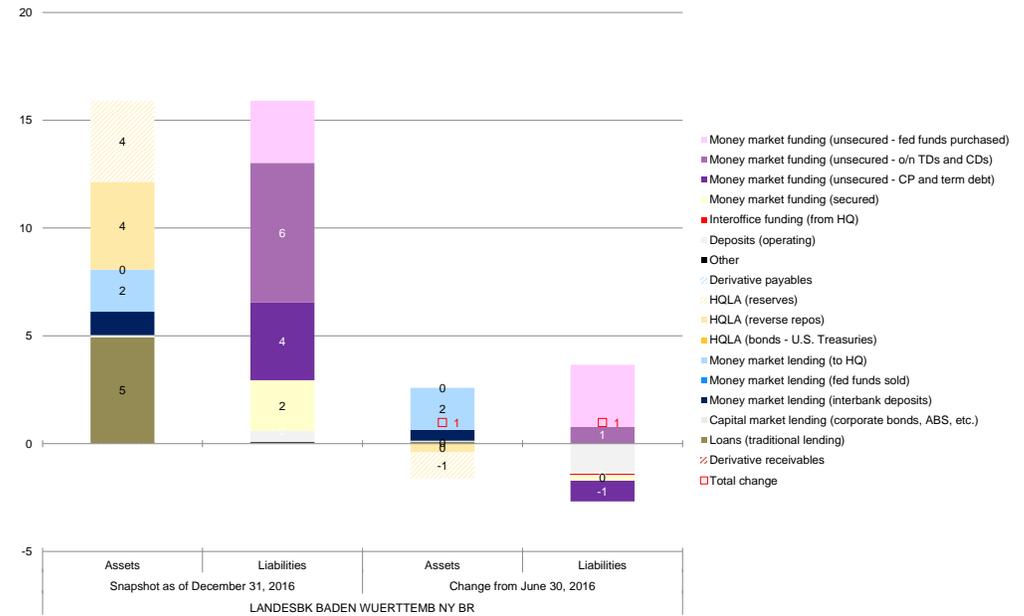
Figure A5-2: Rabobank



Source: FFIEC002, Credit Suisse

Figure A5-3: Landesbank Baden-Württemberg

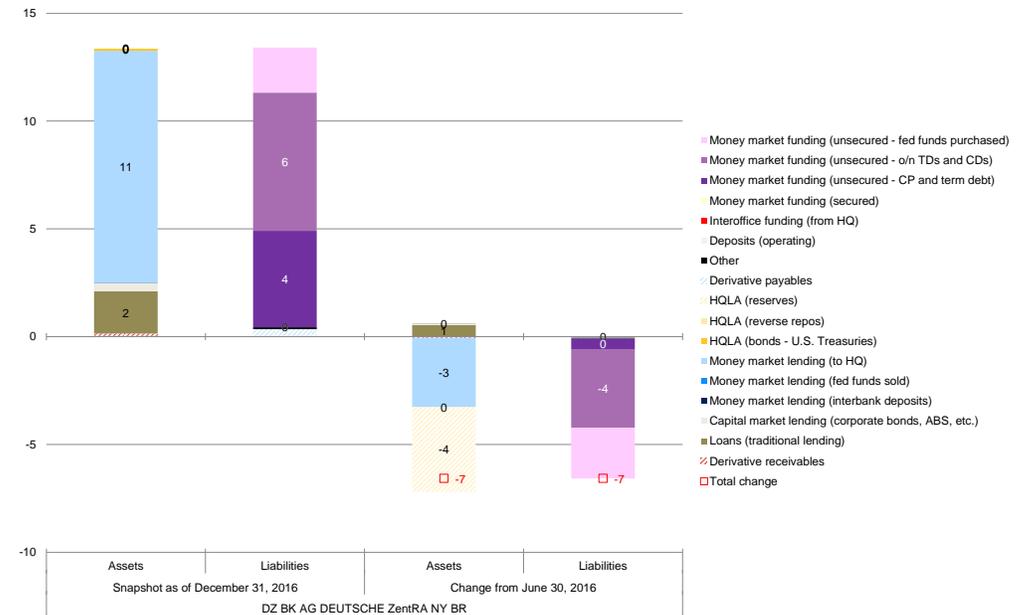
New York branch, \$ billion



Source: FFIEC002, Credit Suisse

Figure A5-4: DZ Bank

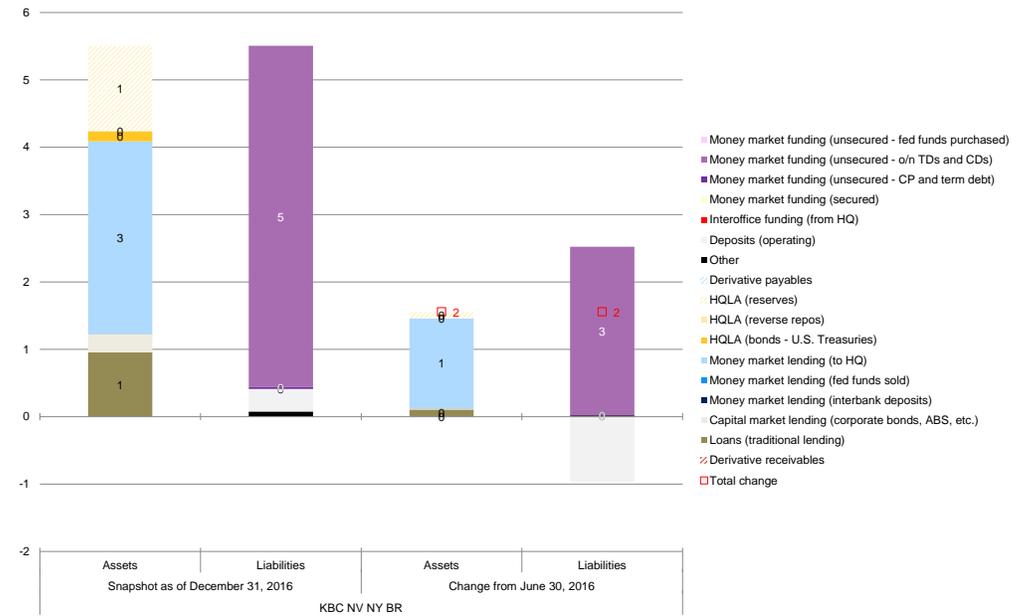
New York branch, \$ billion



Source: FFIEC002, Credit Suisse

Figure A5-5: KBC

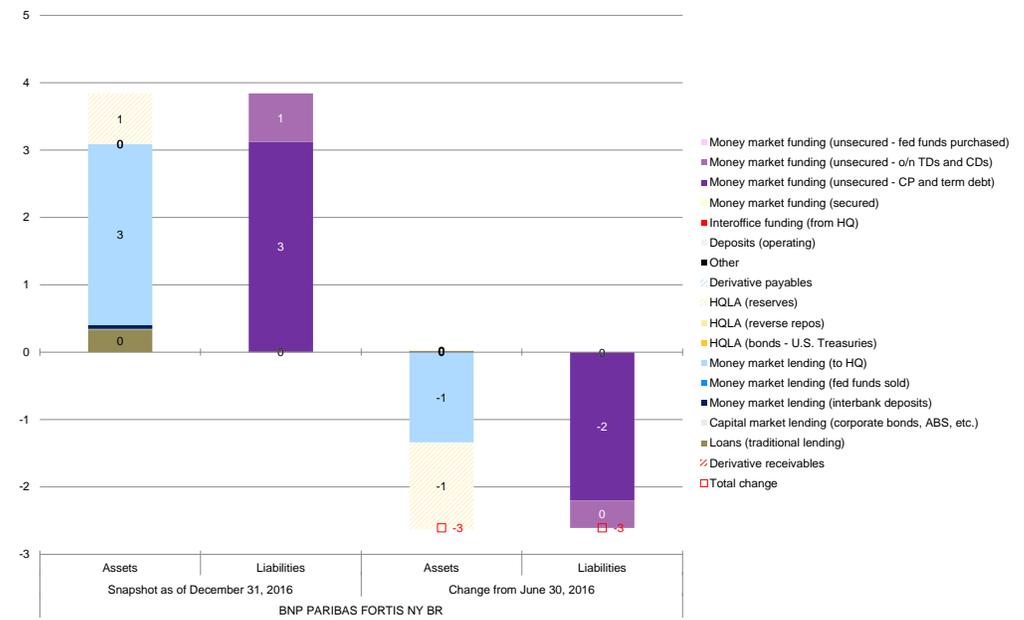
New York branch, \$ billion



Source: FFIEC002, Credit Suisse

Figure A5-6: BNP Paribas Fortis

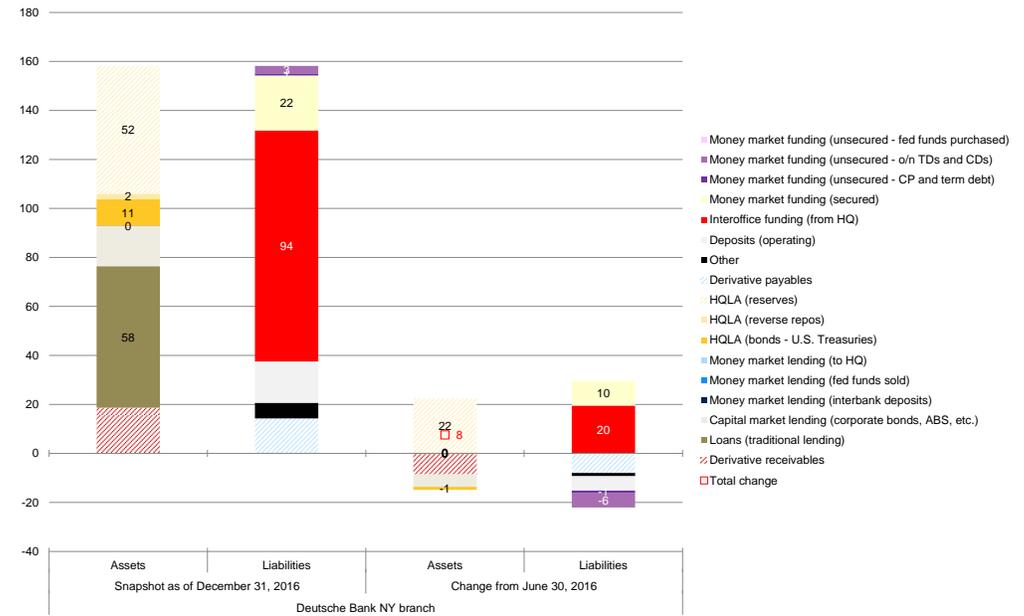
New York branch, \$ billion



Source: FFIEC002, Credit Suisse

Figure A5-7: Deutsche Bank

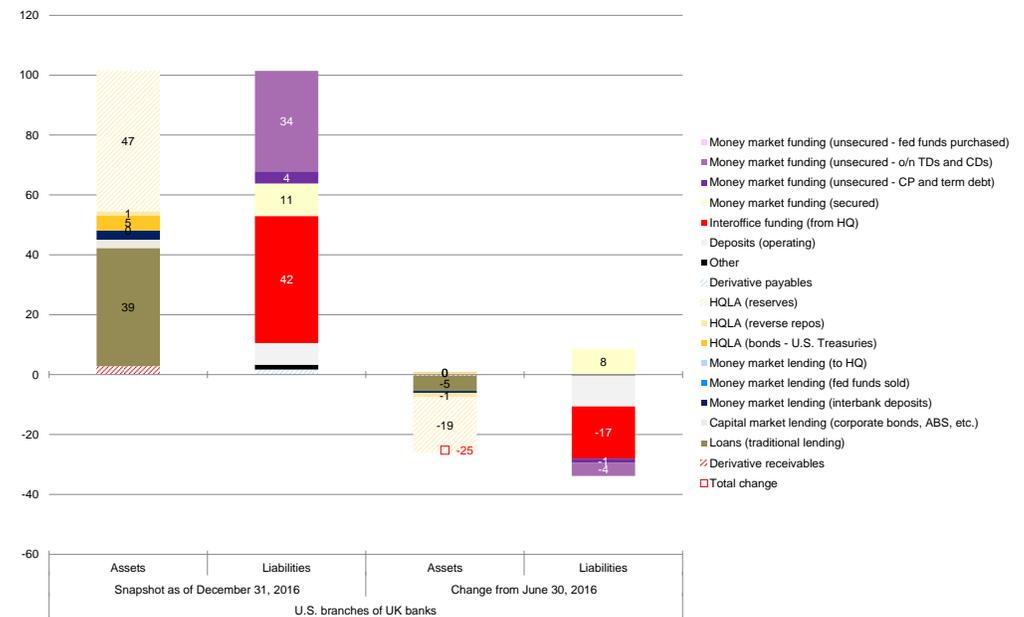
New York branch, \$ billion



Source: FFIEC002, Credit Suisse

Figure A5-8: New York Branches of U.K. Banks

\$ billion

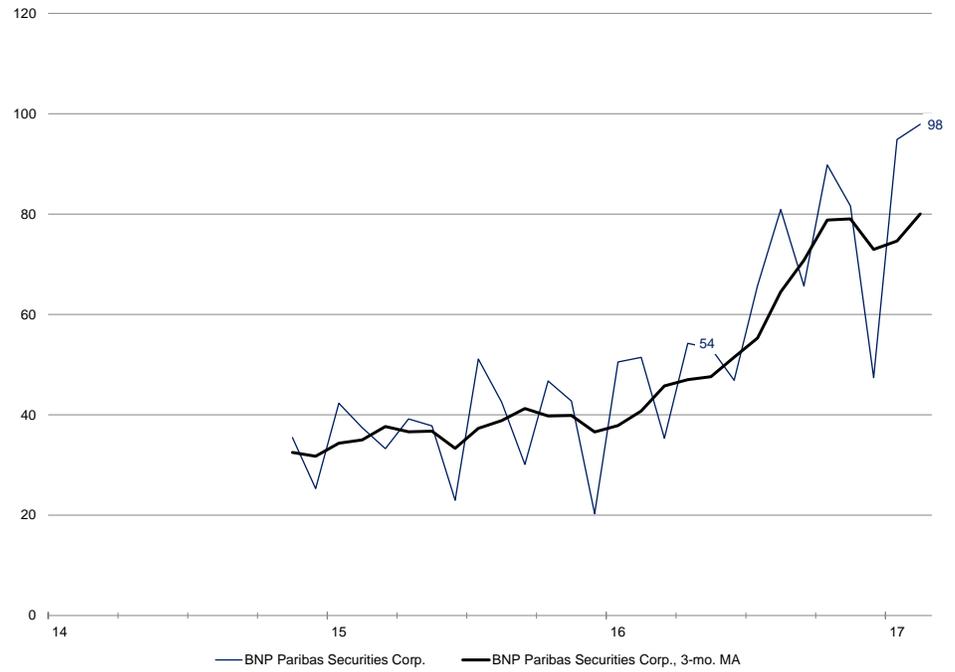


Source: FFIEC002, Credit Suisse

Appendix A6 – Primary Dealers

Figure A6-1: BNP Paribas

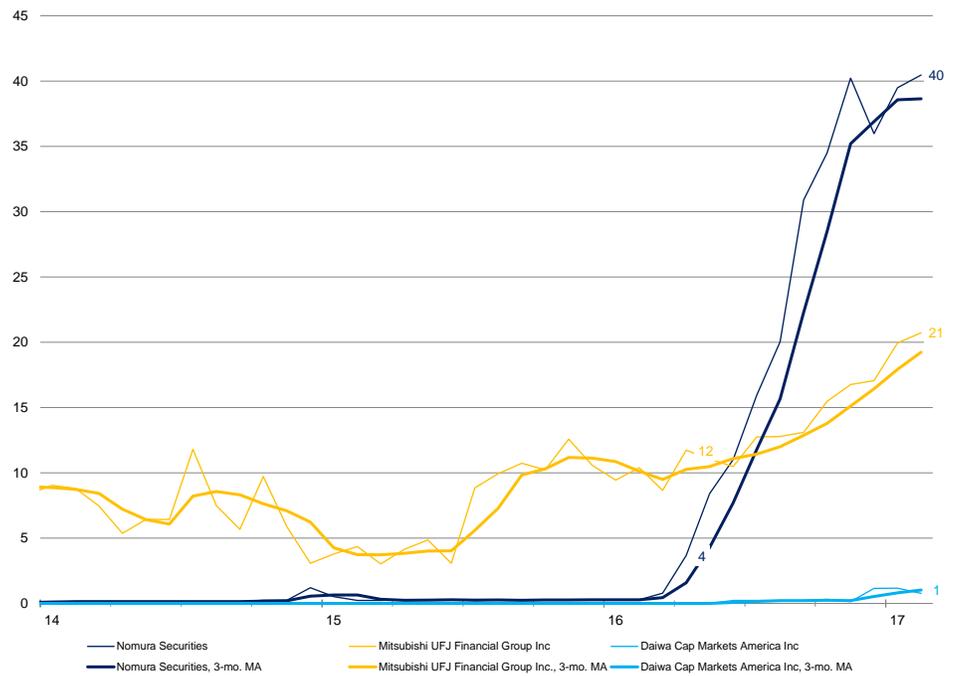
o/n tri-party repos backed by U.S. Treasury and MBS collateral, \$ billion



Source: OFR, Credit Suisse

Figure A6-2: Japanese Primary Dealers

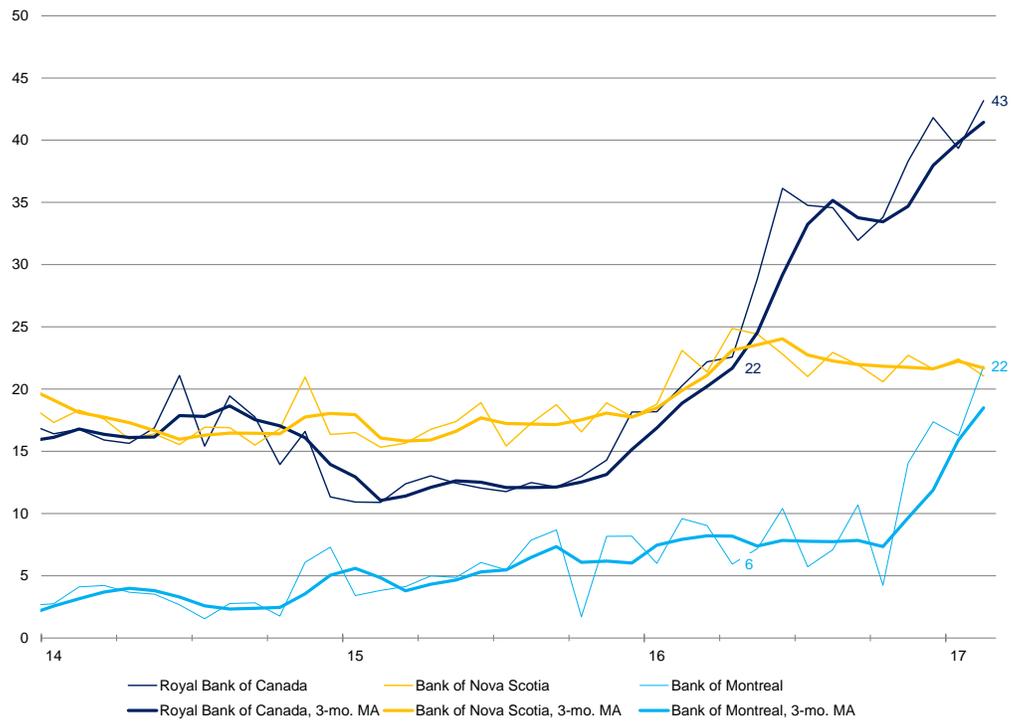
o/n tri-party repos backed by U.S. Treasury and MBS collateral, \$ billion



Source: OFR, Credit Suisse

Figure A6-3: Canadian Primary Dealers

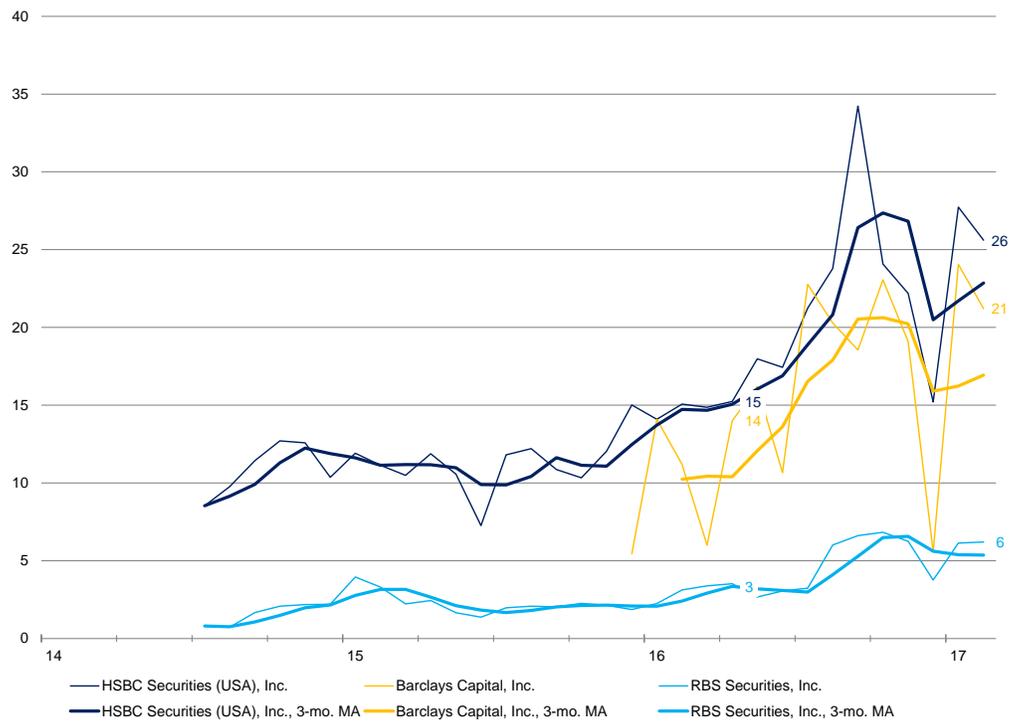
o/n tri-party repos backed by U.S. Treasury and MBS collateral, \$ billion



Source: OFR, Credit Suisse

Figure A6-4: U.K. Primary Dealers

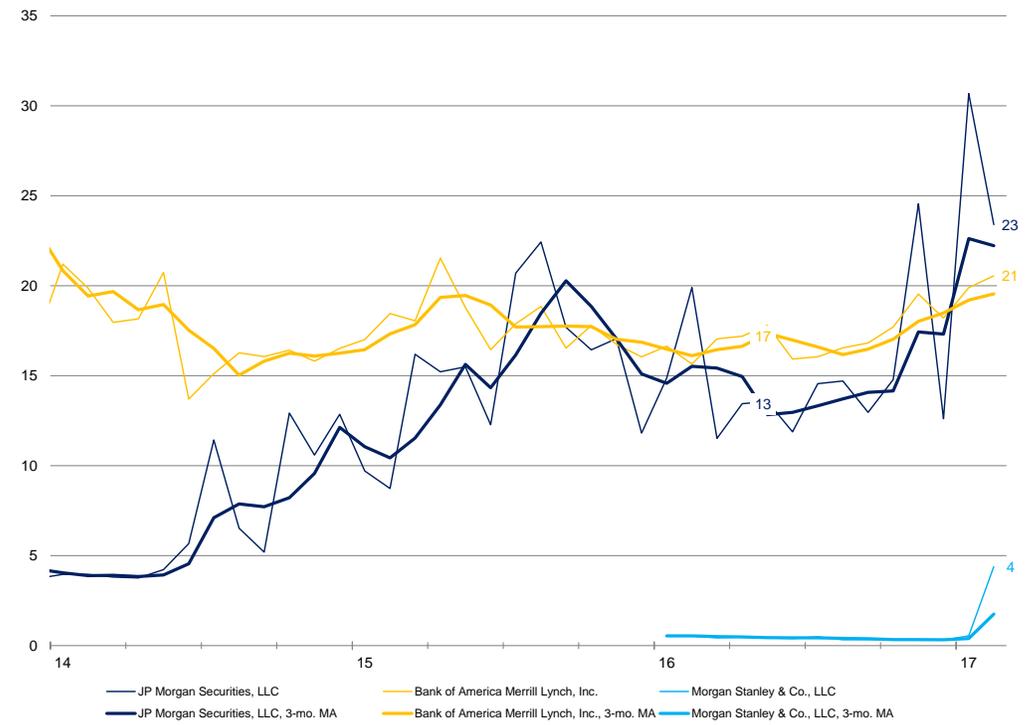
o/n tri-party repos backed by U.S. Treasury and MBS collateral, \$ billion



Source: OFR, Credit Suisse

Figure A6-5: U.S. Primary Dealers

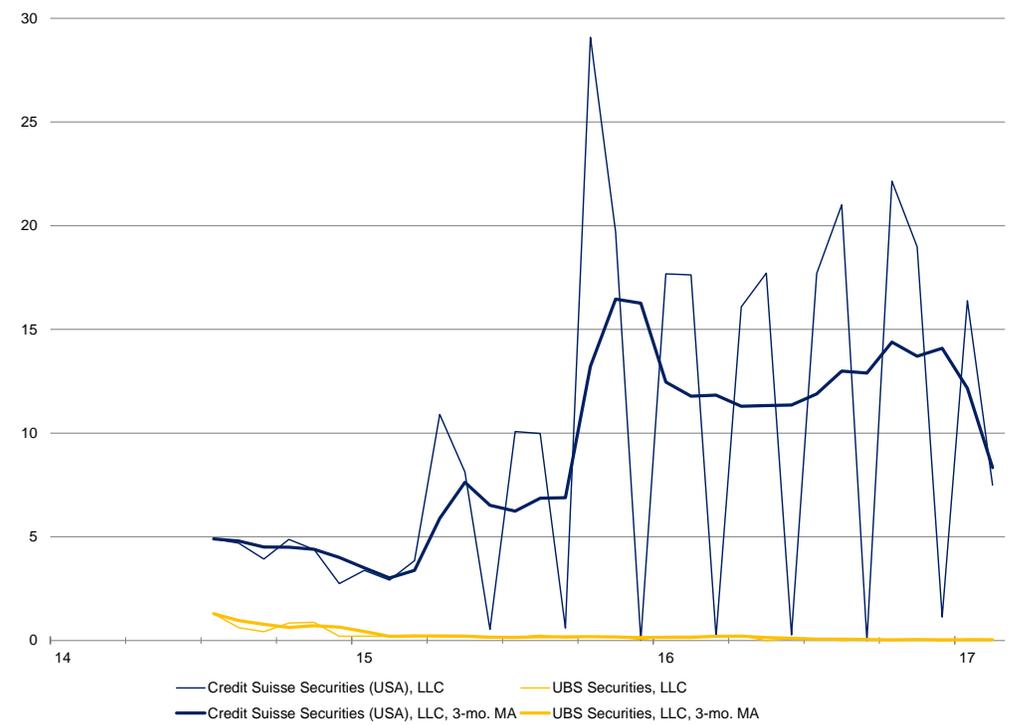
o/n tri-party repos backed by U.S. Treasury and MBS collateral, \$ billion



Source: OFR, Credit Suisse

Figure A6-6: Swiss Primary Dealers

o/n tri-party repos backed by U.S. Treasury and MBS collateral, \$ billion



Source: OFR, Credit Suisse

GLOBAL FIXED INCOME AND ECONOMIC RESEARCH

James Sweeney, Managing Director
Head of Fixed Income and Economic Research
 +1 212 538 4648
james.sweeney@credit-suisse.com

Dr. Neal Soss, Managing Director
Vice Chairman, Fixed Income Research
 1 212 325 3335
neal.soss@credit-suisse.com

US / GLOBAL ECONOMICS AND STRATEGY

James Sweeney Chief Economist +1 212 538 4648 james.sweeney@credit-suisse.com	Xiao Cui +1 212 538 2511 xiao.cui@credit-suisse.com	Zoltan Pozsar +1 212 538 3779 zoltan.pozsar@credit-suisse.com	Jeremy Schwartz +1 212 538 6419 jeremy.schwartz@credit-suisse.com	Sarah Smith +1 212 325-1022 sarah.smith@credit-suisse.com	Wenzhe Zhao +1 212 325 1798 wenzhe.zhao@credit-suisse.com
Praveen Korapaty Head of Interest Rate Strategy 212 325 3427 praveen.korapaty@credit-suisse.com	Jonathan Cohn 212 325 4923 jonathan.cohn@credit-suisse.com	William Marshall 212 325 5584 william.marshall@credit-suisse.com			

EUROPEAN ECONOMICS AND STRATEGY

Neville Hill Head of European Economics & Strategy +44 20 7888 1334 neville.hill@credit-suisse.com	Anais Boussie +44 20 7883 9639 anais.boussie@credit-suisse.com	Peter Foley +44 20 7883 4349 peter.foley@credit-suisse.com	Sonali Punhani +44 20 7883 4297 sonali.punhani@credit-suisse.com	Veronika Roharova +44 20 7888 2403 veronika.roharova@credit-suisse.com	Giovanni Zanni +44 20 7888 6827 giovanni.zanni@credit-suisse.com
David Sneddon Head of Technical Analysis 44 20 7888 7173 david.sneddon@credit-suisse.com	Christopher Hine 212 538 5727 christopher.hine@credit-suisse.com				

GLOBAL FX / EM ECONOMICS AND STRATEGY

Shahab Jalinoos Head of Global FX Strategy 212 325 5412 shahab.jalinoos@credit-suisse.com	Honglin Jiang 44 20 7888 1501 honglin.jiang@credit-suisse.com	Trang Thuy Le +852 2101 7426 trangthuy.le@credit-suisse.com	Alvise Marino 212 325 5911 alvise.marino@credit-suisse.com	Bhaveer Shah 44 20 7883 1449 bhaveer.shah@credit-suisse.com
Kasper Bartholdy Head of Global EM Strategy +44 20 7883 4907 kasper.bartholdy@credit-suisse.com	Ashish Agrawal +65 6212 3405 ashish.agrawal@credit-suisse.com	Daniel Chodos +1 212 325 7708 daniel.chodos@credit-suisse.com	Nimrod Mevorach +44 20 7888 1257 nimrod.mevorach@credit-suisse.com	
Berna Bayazitoglu Head of EEMEA Economics +44 20 7883 3431 bema.bayazitoglu@credit-suisse.com	Alexey Pogorelov +44 20 7883 0396 alexey.pogorelov@credit-suisse.com	Carlos Teixeira +27 11 012 8054 carlos.teixeira@credit-suisse.com		
Alonso Cervera Head of Latin America Economics +52 55 5283 3845 alonso.cervera@credit-suisse.com	Juan Lorenzo Maldonado +1 212 325 4245 juanlorenzo.maldonado@credit-suisse.com	Casey Reckman +1 212 325 5570 casey.reckman@credit-suisse.com	Alberto Rojas +52 55 5283 8975 alberto.rojas@credit-suisse.com	
Nilson Teixeira Head of Brazil Economics +55 11 3701 6288 nilson.teixeira@credit-suisse.com	Paulo Coutinho +55 11 3701-6353 paulo.coutinho@credit-suisse.com	Iana Ferrao +55 11 3701 6345 iana.ferrao@credit-suisse.com	Leonardo Fonseca +55 11 3701 6348 leonardo.fonseca@credit-suisse.com	Lucas Vilela +55 11 3701-6352 lucas.vilela@credit-suisse.com

ASIA PACIFIC DIVISION

Ray Farris, Managing Director
Head of Fixed Income Research and Economics, Asia Pacific Division
 +65 6212 3412
ray.farris@credit-suisse.com

EMERGING ASIA ECONOMICS

Dr. Santitarn Sathirathai Head of Emerging Asia Economics +65 6212 5675 santitarn.sathirathai@credit-suisse.com	Vincent Chan Head of China Macro +852 2101 6568 vincent.chan@credit-suisse.com	Deepali Bhargava +65 6212 5699 deepali.bhargava@credit-suisse.com	Weishen Deng +852 2101 7162 weishen.deng@credit-suisse.com	Christiaan Tuntuno +852 2101 7409 christiaan.tuntuno@credit-suisse.com	Michael Wan +65 6212 3418 michael.wan@credit-suisse.com
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JAPAN ECONOMICS

Hiroichi Shirakawa Head of Japan Economics +81 3 4550 7117 hiromichi.shirakawa@credit-suisse.com	Takashi Shiono +81 3 4550 7189 takashi.shiono@credit-suisse.com
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When you purchase non-listed Japanese fixed income securities (Japanese government bonds, Japanese municipal bonds, Japanese government guaranteed bonds, Japanese corporate bonds) from CS as a seller, you will be requested to pay the purchase price only.