

# How do Global Banks Scramble for Liquidity? Evidence from the Asset-Backed Commercial Paper Freeze of 2007\*

by

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## Abstract

In the August of 2007, banks faced a freeze in funding liquidity from the asset-backed commercial paper (ABCP) market. We investigate how banks scrambled for liquidity in response to this freeze and its implications for the real economy. Commercial banks in the United States raised deposits and took advances from Federal Home Loan Banks (FHLBs). In contrast, foreign banks – with limited access to the deposit market and FHLB advances – lent less in the overnight interbank market and borrowed more from the Federal Reserve’s Term Auction Facility (TAF) auctions. Relative to before the ABCP freeze and relative to their non-US dollar lending, foreign banks with ABCP exposure charged higher interest rates on syndicated loan packages denominated in dollars. The results point to a funding risk in global banking, manifesting as currency shortages for banks engaged in maturity transformation in foreign countries.

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In August of 2007, significant maturity transformation undertaken by the global financial sector came to a screeching halt. The market dislocation began by affecting banks that borrowed short-term (typically with a maturity less than a week) in the asset-backed commercial paper (ABCP) market – via special purpose vehicles (ABCP “conduits”) guaranteed by these banks – and then invested in subprime mortgage-backed and other asset-backed securities. Within a few days after August 9<sup>th</sup>, 2007, ABCP spreads (relative to the federal funds target rate) rose by over 100 basis points, and the ability of bank-sponsored conduits to roll over ABCP fell significantly (see Acharya, Schnabl and Suarez (2009) for detailed evidence). This “freeze” in the ABCP market put severe funding stress on bank balance-sheets as in many cases sponsoring banks were required to take the conduit assets back on their balance-sheets.<sup>1</sup>

Interestingly, Acharya and Schnabl (2010) document that while much of the ABCP exposure was US dollar denominated, a substantial portion of this ABCP exposure was concentrated amongst foreign banks. In particular, they document that out of the total ABCP outstanding of \$1,235 billion, only \$489 billion was sponsored by banks of the United States origin, with banks from Germany and United Kingdom being significant underwriters too (about \$200 billion each), and large banks from a number of Western European economies participating in some measure (and often significantly so relative to the size of their balance-sheets and capitalization). Equally importantly, about 60% of the total ABCP outstanding of German, French and UK banks was in fact denominated in USD, rather than in Euros or pounds. Many of these foreign banks with large exposure to US ABCP did not have large US regulated banking operations. Of banks with

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<sup>1</sup> See also Acharya and Richardson (2009), Brunnermeier (2009), Diamond and Rajan (2009), Gorton (2009), Greenlaw et al. (2008), Kacperczyk and Schnabl (2009), and Krishnamurthy (2010) for summaries of how the financial crisis of 2007-08 unfolded, the liquidity and credit problems faced by banks in different markets, and the underlying causes behind banks being exposed in a substantial manner to these problems.

exposure to US ABCP, the ratio of total US regulated assets to exposure was 10.9x for US banks compared to only 6.0x for foreign banks.

How did these global banks scramble for US dollar liquidity in response to the ABCP freeze? What avenues did they explore in private markets and from public (government or central bank) sources to meet their USD funding needs? Were banks successful in muting the impact of the ABCP freeze; or, did the freeze immediately lead to some loss of intermediation by banks to the real sector? Were the responses different between US dollar and non US dollar loans, and between US and foreign banks given their differential access to the US dollar funding markets? These are some of the questions we attempt to answer in this paper.

Our main finding is that in the immediate aftermath of the ABCP freeze, banks headquartered in the United States were able to tap into alternative funding sources, especially in the deposit market and in the form of advances from the Federal Home Loan Banks (FHLBs) (as documented by Ashcraft, Bech and Frame (2008) and He, Khang and Krishnamurthy (2010));<sup>2</sup> in contrast, foreign banks which had engaged in significant maturity transformation denominated in US dollars were not able to access the deposit market in the United States in the same amounts as their US counterparts. Foreign banks scrambled for liquidity by trying to raise deposits reducing their lending in the interbank market, and much later by actively participating in the Term Auction Facilities (TAF) set up by the Federal Reserve.<sup>3</sup> This asymmetry highlights an important

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<sup>2</sup> Federal Home Loan Banks were set up in 1932 when Congress created twelve regional FHLBs owned by the savings and loans (S&L) institutions and some life insurance companies. As a creation of the federal government, the FHLB System can borrow funds in the capital markets at favorable rates, and individual FHLBs can lend these funds to their member-owners, who were the primary originators of mortgages at the time. In an important sense, the FHLB System was an early “government-sponsored enterprise” (although that term was not used until decades later).

<sup>3</sup> The TAF is a temporary program conducted by the Fed between December 17, 2007 and March 8, 2010 which provides term funding to depository institutions on a collateralized basis, at interest rates and amounts set by auction.

funding risk in global banking, manifesting as currency shortages for banks engaged in significant maturity transformation in foreign countries.

In addition to their role in ABCP, foreign banks play a large role in underwriting syndicated loans in the US. More than 63% of facilities in 2007 had at least one foreign bank in the underwriting syndicate and 35% had a foreign bank leading the syndicate. Despite this important role in underwriting US dollar loans, many foreign banks do not have large US regulated US subsidiaries. The ratio of total US regulated assets to underwritten revolvers outstanding as of August 2007 was 256x for US banks and only 7x for foreign banks.<sup>4</sup>

We examine the importance of the funding asymmetry to the transmission of bank-level funding risk to corporations. In particular, relative before the ABCP freeze and relative to non-US dollar loans, foreign banks with ABCP exposure charged higher spreads on syndicated loans denominated in US dollars. This difference-in-differences approach helps control for variation in some inherent characteristics across banks, differences in banks between before and after the shock, and between US dollar and Euro-denominated syndicated loan, for a given bank. At the same time, the approach allows us to exploit the variation among banks due to funding shock (ABCP exposed versus not) and due to differential access to funding in the US dollar markets (foreign versus US banks). The differences are statistically significant, and economically within the relevant range for cost of credit lines and their substitutes such as cash holdings. For instance, in the three months following the ABCP funding shock a foreign bank with US ABCP exposure increased spreads on its US dollar loans on average by 10 basis points. This is 3 basis points more than on its other loans (41%).

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<sup>4</sup> Assumes that share of underwriter is proportional to the number of underwriters.

Consider the sources of immediate funding available to banks. We divide them into two types: *private* and *government*. In private sources, we include federal funds in the unsecured overnight interbank market, sale and repurchase agreements (“repos”) which are collateralized and can be considered close substitutes to ABCP and deposit markets (demand deposits as well as time deposits). In government sources, we include Discount Window borrowing, and FHLB advances. In order to understand if there was residual funding demand, we examine access to TAF auction repos with the Federal Reserve, although that liquidity was not immediately available after the ABCP freeze (that is, not until December 2007).

These liquidity sources differ in terms of their ease of access and in the case of private sources also in terms of associated funding risk. For instance, while interbank and repo markets are relatively arm’s length and easier to access in normal times on a day-to-day basis, they are far more fragile particularly relative to insured deposits in terms of the risk of a “run” (such as the ABCP freeze). FHLB advances against most kinds of mortgage assets are relatively easily obtained, however they are available only to commercial banks who are FHLB members, that is, many foreign banks do not have access to these funds.<sup>5</sup> Discount Window funding can be readily accessed by solvent banks with pledgeable US assets, but banks may be reluctant to access these funds due to the “stigma” attached to Discount Window lending. Finally, while there was substantial demand from foreign institutions at the TAF auctions, which allowed greater access to Federal Reserve funding without the stigma associated with the Discount Window, these auctions were not in place until mid-December 2007.<sup>6</sup> While we cannot measure the extent to

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<sup>5</sup> See Ashcraft, Bech and Frame (2008) for documentation of the substantial role played by FHLB advances in early phase of the crisis starting August 2007 and on the differential access and tradeoffs faced by US and foreign commercial banks in FHLB system and Discount Window.

<sup>6</sup>Armantier, Ghysels, Sarkar and Shrader (2010) provide compelling evidence of a “stigma” attached to borrowing (effectively, of a lack of sufficient borrowing) from the Discount Window during the financial crisis of 2007-08. The TAF facility had several features designed to remove this stigma: i) an auction format requiring simultaneous

which foreign banks accessed local deposits and swapped them into US dollars, we focus on the time period before December 11<sup>th</sup>, 2007 when the Federal Reserve instituted swap lines with most foreign central banks in an attempt to alleviate US dollar funding pressure.<sup>7</sup>

We find that these differences mattered. The US banks grew their government funding substantially relative to the foreign banks, especially through FHLB advances; they also grew significantly their overall US dollar deposits, but importantly through time deposits. In contrast, foreign banks grew their net repo borrowing and were not able to increase their borrowing at their US subsidiaries in the interbank market as much as US banks did. In part this reflects the fact that deposits at this time grow in proportion to US assets, and foreign banks have less US assets.

Overall, while US banks were able to access more stable government and longer-term sources of funding, foreign banks did not increase funding by as much and their funding remained relatively short-term or demandable. We hypothesize that this differential access in terms of funding following the scramble for liquidity in the fall of 2007 meant that foreign banks, particularly ABCP-exposed foreign banks, were exposed to a greater dollar liquidity crunch. We expect that foreign banks became less willing to take on US dollar funding risk on their asset side and through extension of commitments on the liability side, or in other words, do so but demand a greater compensation in return by charging higher spreads to borrowers.

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bidding, ii) a market-based interest rate rather than a penalty premium set by the Fed, iii) a cap on the bid amount to allow for the wide allocation of funds and to reduce the likelihood of individual identification, iv) settlement of funds with a three day lag to signal that participation was not driven by pressing needs for funds. See Armantier, Krieger and McAndrews (2008) for an overview of the design and creation of TAF. See also <http://www.federalreserve.gov/monetarypolicy/taffaq.htm> for additional information on the TAF auctions.

<sup>7</sup> See [http://www.federalreserve.gov/monetarypolicy/bst\\_liquidityswaps.htm](http://www.federalreserve.gov/monetarypolicy/bst_liquidityswaps.htm) for information on the dollar liquidity swap lines.

To test this hypothesis, we exploit the idea that funding should have a direct effect on commercial banks' lending, focusing on syndicated loans made in US dollars.<sup>8</sup> In particular, we examine bank participation in syndicated loans, recorded at time of their origination in the Loan Pricing Corporation's DealScan dataset. We design a difference-in-differences test to study the terms (spread, maturity and amount) of syndicated loans denominated in US dollars and loans that are denominated in Euros or Pounds (we will refer to these loans as European loans for simplicity). We exploit several types of differences-in-differences, the first difference being between US dollar and Euro-denominated loans, the second between foreign banks and US banks, and the third difference being between after and before August of 2007 (in order to exploit within-firm variation). Finally, we also employ a quadruple-difference test where we study the impact of exposure to ABCP.

We find that the contractual feature of bank credit that is affected in our difference-in-differences test is mainly the spread. Compare, for example, Bank of America, BNP Paribas and West LB. All three banks were exposed to the US ABCP market, with ABCP outstanding of \$45 billion (34.5% of equity), 5 billion (8.6% of equity) and 30 billion (368.3% of equity), respectively. Comparing the pre and post period, Paribas and West LB grew the average spread on its US dollar loans by 16 basis points and 15 basis points respectively, while the average spread on Bank of America's US dollar loans fell by 22 basis points. In contrast, in their European loans,

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<sup>8</sup> Kashyap, Rajan and Stein (2002) argue that as long as deposits raised by banks are not too correlated with corporate demand for immediate credit, banks can act as liquidity providers on both sides of their balance-sheets. Acharya, Almeida and Campello (2009) provide rationale for why in times of aggregate risk, banks reduce provision of lines of credit in the aggregate (as their ability to smooth liquidity shocks reduces), and that banks more exposed to aggregate risk experience greater reduction. Gatev and Strahan (2006) and Gatev, Schuermann and Strahan (2009) document that banks benefit from deposit inflows when commercial paper spreads widen and this enables them to meet loan commitment drawdowns; Pennachi (2006) shows that this effect was non-existent prior to the formation of the FDIC in 1934; and, Acharya and Mora (2011) document using deposit rates and flows data that during the 2007-September 2008 period (and in earlier periods of stress) banks in fact struggled to raise deposits, especially weaker banks, which had to offer substantially higher deposit rates (a cost that we expect would be passed on in the form of costlier loans and credit lines).

Paribas and West LB lowered spread by 41 and 48 basis points on average, respectively, and Bank of America lowered similarly spreads by 41 basis points. While this example does not control for differences in the characteristics of the loans made, we find that even after controlling for observables, US dollar loans by foreign exposed banks after the ABCP shock had higher spreads by 10 basis points, controlling for bank fixed effects and borrower and loan characteristics.

Besides documenting an important dollar funding risk for foreign banks engaged in maturity transformation in the United States, our results suggest that the transmission channel of the ABCP freeze when studied just for the US banks may understate the true underlying strength of the channel. Since most US banks had access to FHLB advances and could also employ their deposit franchises to raise US dollar funding, their response in terms of transmitting the ABCP freeze to the real sector is already muted by prevailing government interventions and market structures. In this sense, studying the transmission channel of foreign banks facing US dollar funding risk on to US dollar borrowers provides for a cleaner identification.<sup>9</sup> The rest of the paper is organized as follows. Section 1 discusses the related literature. Section 2 documents the information available on foreign banks and their funding in the US. Section 3 examines how banks scrambled for liquidity following the ABCP freeze, via private and government sources of funding. Section 4 investigates the transmission of bank funding risk – and realized funding – to the real sector. Section 5 presents concluding remarks.

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<sup>9</sup> While these results suggest that access to deposits and government funding – stable liabilities – can help stabilize the banking sector and the transmission channel in a crisis, their ex-post efficacy must be weighed against any ex-ante moral hazard they induce.



## **1. Related Literature**

Our paper is related to papers by Bord and Santos (2011) and Irani (2011) that also analyze the effect of the ABCP freeze. Bord and Santos (2011) find that US banks that increased their use of funding from the Federal Home Loan Bank system or the Fed's Discount Window following the ABCP freeze charged higher fees to grant new lines of credit to corporations, the increase being driven by credit lines that pose more liquidity risk to banks and affecting predominantly bank dependent borrowers. Similarly, Irani (2011) finds that the deterioration of contract terms into 2009 from exposed banks is concentrated among speculative grade borrowers, long-term credit lines, and borrowers with weak banking relationships or without access to the commercial paper market. He further finds that relative to other syndicate members, exposed banks are more likely to exit relationships with borrowers, that investment grade borrowers are more likely to exit relationships with exposed banks, and that such exit is typically associated with worsening of contract terms, except for investment grade borrowers. These papers do not exploit the differentiation between US-based and foreign banks, which is the focus of our paper. The economic magnitude of our findings on the impact of ABCP exposure of a bank on the cost of its credit lines appears an order smaller than in these other papers. This is likely due to the fact that we are looking at the differential response between US-based and foreign banks, as well as between their US-based and foreign borrowers, which controls more conservatively for differences in the macroeconomic environment and the degree of pure (dollar) funding shock.

Our paper is also related to the recent literature on how funding shocks are transmitted across borders through operations of global banks. Cetorelli and Goldberg (2010) examine the global transmission of shocks emanating from the financial crisis of 2007-08 and find that regions with higher aggregate exposure to dollar funding shocks lent less following the shock to emerging

markets countries. Giannetti and Laeven (2012) show that there is a rebalancing of banks loan portfolios back to home markets (that is, in countries where banks are domiciled) in the 2008 financial crisis. Schnabl (2011) investigates the liquidity shock of the Russian default, and finds that it was transmitted by global banks to borrowers in Peru.

In another related set of papers, banks reliant on core deposit funding have been shown to be able to insulate access to finance even in the face of shocks to their lenders (Ivashina and Scharfstein (2010); Cornett, McNutt, Strahan and Tehranian (2010) and Gozzi and Goetz (2010)). However, these papers do not study the effect of the funding source (private versus government) and of the differential access to these sources on foreign bank lending. Liu (2011) analyzes the effect of financial crises over the past 20 years globally on banks operating with branches in crisis-affected and non-crisis countries. She finds that banks with deposit exposure cut back lending significantly in branches outside the crisis country (funding shock); and the magnitude of this effect is twice as large as that stemming from non-depository asset exposure only (capital shock).<sup>10</sup> Duchin et al (2010) exploit cash holdings of businesses to separate effects due to fall in demand at the onset of the crisis in 2007 and show that loan supply effects were important in the first year of the crisis. Carvalho et al (2011) find in the financial crisis of 2007-08 that client stock returns are associated with negative shocks to banks.

Our analysis is complementary to both of these sets of papers in that we are focused on the effect of *lending in the crisis-affected country from foreign banks* whose limited access to funding in the crisis country (relative to domestic banks) helps us isolate the supply effect of bank lending terms on credit lines to the real sector.

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<sup>10</sup> In similar spirit, Aiyar (2010) provides evidence that the external funding shock for banks in the United Kingdom translated into greater reduction in lending in the UK by foreign subsidiaries and branches compared to banks that were domestically-owned (in the UK).

## **2. Foreign Banks**

### **2.1. Institutional Background**

In the aftermath of the collapse of the ABCP market in 2007, banks with exposure to conduits financed with ABCP needed short term liquidity to finance their assets (see Acharya, Schnabl and Suarez (2009) for detailed evidence). In a nutshell, global commercial banks funded long-term assets such as mortgage- and asset-backed securities (MBS and ABS), credit card receivables, through overnight wholesale funding in the ABCP market. The “conduits” through which the ABCP was issued had little equity capital of their own, other than the guarantees provided by sponsoring banks (which found it attractive to do so due to the favorable treatment of such guarantees in the regulatory capital requirements). When the underlying assets, especially MBS and ABS, experienced a drying up of liquidity following the housing-market collapses in various parts of the world, the ABCP investors “ran” on the conduits, that is, reduced the overnight rollovers and charged higher spreads for doing so. Specifically, the run began on the 9<sup>th</sup> of August 2007, following the announcement by hedge funds of BNP Paribas on the 8<sup>th</sup> of August 2007 that their sub-prime MBS investments could no longer be marked to market due to evaporation of liquidity in market for these securities.

Being exposed to this run through the guarantees, the sponsoring banks had to either take over the conduit assets “on balance-sheet”, which resulted in greater capital requirements, or generate overnight funding against the assets through alternative sources to the ABCP. Acharya, Schnabl and Suarez (2009) document that this ABCP run – effectively on the global commercial banks – was very large, with the market collapsing from its peak of over \$1,200 billion in beginning of August 2007 to just over \$600 billion by the end of 2008. Throughout the paper we label this, the “freeze” in ABCP or the ABCP “shock.” We are particularly interested in understanding

differences in access to liquidity between exposed US and foreign banks, and thus we first outline sources of short term liquidity available to US and foreign banks.

Foreign banks can access US dollar liquidity in the short run in many ways. In terms of private sources of immediate funding, they may have US cash on hand, in the form of reserves or interest bearing balances with other banks. They can borrow from other banks on an unsecured basis in the fed funds or Eurodollar market or on a secured basis in the repo market. They can also borrow from US depositors and money market funds or issue dollar denominated commercial paper. In addition, foreign banks can borrow from home country depositors or issue local currency commercial paper and swap that into US dollars in foreign exchange markets. Finally, they can sell liquid assets.

US branches and agencies of foreign banks that hold reserves can also access liquidity from US government sources, including the Discount Window. An alternative source of government funding is advances from FHLBs, but these funds are available only to foreign banks with US commercial bank subsidiaries. While many programs were ultimately designed to alleviate US dollar and liquidity shortages including swap lines with many foreign central banks (e.g. the Term Auction Facility (TAF) auction and the Term Asset-Backed Securities Loan Facility (TALF)), we restrict the analysis in our paper to the period before December 11<sup>th</sup>, 2007, when the first of these programs was instituted so as to better isolate the liquidity shock.

Foreign banks engage in US banking through six principal types of organizations: representative offices, branches, agencies, banks, Edge Act and Agreement international banking corporations, and international banking facilities (IBFs). Reporting requirements vary depending on organizational structure. *Representative offices* are subject to minimal regulation and file no

reports with the FFIEC, OCC or Federal Reserve. These offices engage in representational and administrative functions but do not conduct bank activities. *Branches and agencies of foreign banks (FBOs)* file FFIEC 002 (Report of Assets and Liabilities of US Branches and Agencies of Foreign Banks). The activities of a branch of an FBO are similar to those conducted by a branch of a US bank, including wholesale and foreign deposit acceptance as well as other credit fiduciary activities. However, the FDIC does not insure the deposits of foreign bank branches and branches of FBOs are not required to join the Federal Reserve System. Foreign banks can establish *subsidiary US banks or bank holding companies*, which file the Call Report (FFIEC 0031) or Y-9C.<sup>11</sup> These subsidiary banks have the same legal and regulatory restrictions and reporting requirements as domestic banks. Foreign banks can also create separate *Edge Act subsidiaries* to engage in international banking activities. No regulatory data on these exist in either the Call Report, Y9-C or 002 filings except for a breakdown of interest income accruing from Edge and Agreement subsidiaries. Finally, foreign banks may create an *international banking facility (IBF)* as an extension of the previous five structures. These facilities are used to book deposits unrestricted by US reserve requirements or other deposit insurance premiums. The activities of the IBF are consolidated in the 002 filing for branches and agencies of foreign banks. In addition, FBOs can own other structures including savings associations, industrial LLCs, and other securities LLC companies for which no Federal Reserve regulatory filings are available. Finally, no regulatory information is available for foreign banks' holding of dollar-denominated assets or dollar funding at non-US subsidiaries.

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<sup>11</sup> After the enactment of the Foreign Bank Supervision Enhancement Act of 1991, foreign banks accepting insured deposits must establish a US subsidiary bank. The difference between branches and agencies is that the agency primarily makes commercial and corporate loans, but does not have deposit-taking authority.

We review the availability of these data for foreign banks, and aggregate the various filings into a picture of foreign banks' change in US funding at this time. Unfortunately, comprehensive data are not available for all possible liquidity sources on a daily bank-by-bank basis, and we are forced to examine funding mostly by looking at changes in quarterly figures. In order to get some estimates at a higher frequency, we also take advantage of information from the Federal Reserve's weekly survey of banks (approximately 815 domestic and 60 foreign-related institutions in 2007). Data items are a subset of call report items that are aggregated and released publicly. However, participation in this panel is voluntary and not all banks file in all weeks.

### **3. Bank Funding of ABCP Exposed Banks in 2007**

#### **3.1. Data**

We use Moody's data to identify 53 banks that are exposed to US dollar denominated ABCP and thus exposed to a liquidity shock in August 2007 (see Acharya, Schnabl and Suarez (2009) for a detailed discussion of these data). On average, exposed banks have \$13.2 billion of US dollar denominated ABCP assets. The average exposure is very high relative to Tier 1 equity – a mean of 53x. In order to have a comparison set of banks, we add information on US bank holding companies (BHCs) and foreign banks that file US regulatory reports. We limit US banks to the 427 bank holding companies with more than \$500 million in assets, since banks with ABCP tend to be larger,<sup>12</sup> and include all 82 foreign banks with any US regulatory filings, since they are likely to be similar to foreign banks with a US presence. The resulting dataset includes 567 banks, of which 22% are foreign. Of banks with ABCP exposure, 75% are foreign. We use Bankscope to gather information on foreign banks' total assets and Tier 1 equity. The average

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<sup>12</sup> The smallest US ABCP-exposed domestic bank holding company (BHC) has \$100.7 billion in assets while the mean of all non-ABCP-exposed domestic BHCs is only \$9.9 billion.

ABCP-exposed foreign bank is larger than other foreign banks with US branches and offices, with mean total assets of \$784 billion, compared to the mean assets of non-ABCP-exposed foreign banks of \$176 billion. Summary statistics for these banks are presented in Table 1.

For information on foreign banks' funding we aggregate several different US regulatory reports (Call Report (FFIEC 031), FFIEC 002, FR Y-9C) filed by foreign banks' offices (FBOs), and other subsidiaries supervised by the Federal Reserve.<sup>13</sup> Of the foreign exposed banks, approximately 63% file a US regulatory report of some kind. The remaining seventeen exposed banks file no US regulatory reports, and thus are assumed to have no US deposits.<sup>14</sup> Since the regulatory report data are available on a quarterly basis, we compare funding as of the quarter immediately before (June 30, 2007) and after (September 30, 2007) the ABCP market shock on August 9, 2007.

In Figure 1, we outline the availability of US regulatory filings for foreign banks in the sample.

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<sup>13</sup> Foreign banking organizations report some consolidated regulatory capital information quarterly on the FR Y-7Q; however balance sheet line items are not available in this reporting form. We effectively assume that all funding and loans reported in US regulatory filings are dollar denominated. However, domestic BHCs may have foreign deposits and loans included in these numbers. Similarly, foreign banks may hold dollar denominated assets or liabilities at non-US entities which will not be included in their US regulatory filings.

<sup>14</sup> The banks in the sample that file no regulatory reports are as follow: KBC Groep NV, Credit Agricole SA, Dresdner Bank AG, Landesbank Hessen-Thuringen Girozentrale, Bayerische Hypo-und Vereinsbank AG, WestLB AG, Bayerische Landesbank, Natixis, Danske Bank A/S, Norddeutsche Landesbank Girozentrale, Eurohypo AG, ING Groep NV, Hypo Real Estate Holding AG, Sachsen Bank KG, Nomura Holdings Inc, LBB Holding AG, and Nationwide Building Society.

**Figure 1: Availability of US Regulatory Reports for Foreign Banks**

US Regulatory filings	ABCP Exposure	
	No ABCP	ABCP
<b>Y9-C Filer</b>		
Y9-C and 002 Filers	13	11
<b>No Y9-C Filer</b>		
CALL Filer(s) Only	6	0
CALL and 002 Filers	5	2
002 Filers Only	60	14
<b>No Regulatory Report Filers</b>		
No Y9-C, CALL or 002	3	13
<b>TOTAL:</b>	87	40
<b>H8 (FR 2644)</b>	35	20
In reporting panel	265	31

### 3.2. Private Funding

We begin by looking at the change in funding for all banks in the sample between the second and third quarter of 2007. We examine the following liability items: Total US Deposits, Net Repo, Net Fed Funds, Fed Funds Sold, and Other Borrowed Money (less FHLB advances). We also measure changes in Cash and Balances and Available for Sale Securities, asset categories which may serve as sources of short term liquidity. Exact definitions of the variables can be found in Appendix A.

On average, banks in the sample increase short term liquidity in the third quarter of 2007, both by increasing short term liabilities and by decreasing short term assets. The last two columns of Table 2, Panel A present summary statistics separately for the ABCP-exposed banks. Between the second and third quarters of 2007, as shown in Table 2, Panel A, banks increase deposits and dramatically increase borrowing from government sources. There are large differences between



banks with and without exposure – on average, banks increase deposits by \$435 million, while ABCP-exposed banks increase deposits by more than \$2.5 billion.

Within the sum of US deposits we also examine changes in the following subcategories of deposits: Demand Deposits, Core Deposits, Time Deposits (<100k), Time Deposits (>100k), and Other Deposits. On average, as banks search for liquidity at the end of 2007, they grow time deposits and other deposits, but not demand and core deposits. Net repo and fed funds are falling as well, and banks, particularly exposed banks are reducing their cash balances.

We aggregate funding variables into the total *Private Funding Change* – the sum of the change in Net Fed Funds, Total US Deposits, Net Repo, Cash and Balances, Available for Sale Securities, and Other Borrowed Money (less FHLB advances). ABCP exposed banks increase funding by more than six times as much as non-exposed banks at this time.

Differences between exposed and non-exposed banks are not the only differences we see at this time. In Panel B of Table 2, we separate the sample between domestic and foreign banks and find dramatic differences between foreign and US banks' access to liquidity. For example, while on average banks exposed to ABCP grow deposits more than do non-ABCP-exposed banks; the difference is driven by the US banks. In fact, foreign banks with ABCP exposure grow deposits by three times less than do exposed US banks. This seems to suggest that foreign exposed banks were not able to switch to more stable sources of funding as US banks did. Within types of deposits, exposed US banks grow their time deposits and other deposits, while foreign banks grow their more flighty large time deposits only. US exposed banks also raise other debt financing, increasing other borrowed money, selling available for sale securities and shrinking

cash balances, while foreign exposed banks pay back other borrowed money, and grow cash balances.

Panel B of Table 2 also separates foreign banks between those with and without ABCP exposure. We do see that foreign banks with exposure to ABCP are growing funding by more than their non-exposed peers, although perhaps not by as much more as we would have expected. Foreign banks with ABCP grow deposits by three times as much as their non-exposed peers. They also increase repo by more, but shrink other borrowed money.

Of course, this analysis is univariate in nature. In Table 3, we present the results of a number of specifications in which the change in funding (the difference between balances as of 3Q 2007 and 2Q 2007) is the dependent variable. As explanatory variables, we include bivariate controls for whether the bank is foreign and for whether the bank is exposed to US dollar ABCP. In addition, we add a control for the log of the bank's total assets as well as its US regulated assets. In the fall of 2007, we see that the increase in total US deposits is associated with the amount of total assets – for each additional 10% in US assets, banks increase total US deposits by [\$34 million]. Looking across the six regression specifications, each with a dependent variable measuring a source of short term funding, we do not find any statistically significant relationship between the interaction of US ABCP exposure and foreign banks. In short, banks increase deposits proportionately to their US regulated assets, but exposed foreign banks do not increase funding in any area by more than do similarly exposed US banks. In fact, when we examine different types of deposits in columns 7 through 9, all exposed banks seem to be losing core deposits at this time, but US banks seem to be making up the difference with time deposits and other wholesale deposits.

In summary, US banks with ABCP exposure grew private funding by more than six times as much as their foreign exposed peers. And while their funding needs were likely much higher than those of other foreign banks, ABCP exposed foreign banks grew funding by only 1.7x as much as did their foreign peers without ABCP exposure.

### **3.3. Weekly funding**

Since funding conditions may be affected in the shorter term, but perhaps may be resolved within one quarter's time, we also examine in the bottom half of Panel B of Table 2 the subset of 276 banks (27 ABCP-exposed banks) in our sample that file weekly reports. We look at changes in balances between August 1<sup>st</sup>, 2007 and August 15<sup>th</sup>, 2007. Because these filings have different line items we can also look at transfers between foreign bank subsidiaries, which would approximate liquidity raised outside of the US and swapped into dollars.<sup>15</sup> We examine both the change in Net Due from (to) Related Institutions and the change in Borrowing from US Commercial Banks at this interval. The former is a measure of intrabank liquidity flowing to US regulated entities from their non-US corporate parents and affiliates, while the latter measures interbank lending within the US.

Looking within the two-week time period around the ABCP funding shock, foreign exposed banks raise substantial amounts of liquidity from their affiliates, growing the net amount due to foreign parents by more than \$2 billion between August 1<sup>st</sup> and August 15<sup>th</sup> of 2007, on average, and \$4 billion from quarter-end June to quarter-end September. This is in contrast to the behavior of other foreign banks at this time, and is consistent with the transfers documented in Cetorelli and Goldberg (2012).

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<sup>15</sup> While this information includes transfers among foreign commercial banks and their US offices, it represents a lower bound on access to dollars, since it measures only funds sent to US regulated subsidiaries.

While exposed foreign banks are raising money from their affiliates, they are losing liquidity from US banks over the quarter -- foreign exposed banks return almost \$126 million borrowed from US commercial banks in the two weeks around the shock (almost \$300 million from quarter to quarter), while their exposed US peers borrow an additional \$3 billion more.

### **3.4. Government Funding**

We next compare funding from government sources, specifically the Discount Window and advances from Federal Home Loan Banks (FHLBs). We calculate the change in funding from the Discount Window primary credit program by summing the borrowing amount of primary credit at the Discount Window for the months (September, October, November, December) and subtracting the amount for the months (April, May, June, July). These data come from the proprietary Federal Reserve database and exclude borrowing done through secondary credit and seasonal credit lending programs. While not all banks access the Discount Window, we have complete information for all banks that borrow. Although the aggregate borrowing level was low, US banks borrowers increase Discount Window borrowing by three times as much as their exposed foreign peers.

We also measure the quarterly change in Federal Home Loan Bank advances over all maturities reported on the Call Report. As shown in Panel A of Table 4, in aggregate, ABCP exposed banks borrow more than 10 times as much from the FHLB as do their non-exposed peers. In fact, only 27 of the 128 foreign banks in the sample even had access to FHLB advances. Going back to our earlier example, Bank of America borrowed more than \$16 billion from FHLBs in this time period, while Paribas borrowed only \$345 million and West LB did not take out any FHLB advances during this time period. Adding up both sources of government funding, we obtain

*Government Funding Change* and again we find that the US banks expand funding much more than do foreign exposed banks. Examining borrowing from the discount window and the FHLB, and adding linear controls for bank size, we see the same strong result in Panel B of Table 4 – funding is significantly associated with US regulated assets, but not with total assets. And foreign exposed banks access dramatically less liquidity than do their US peers.

The last line in Panel A of Table 4 sums up the total amount of funding that banks add in the third quarter of 2007, before the TAF facility is instituted. It is the sum of private and government funding in our previous analysis, *Total pre-TAF Funding Change*. By this measure we see the funding gap clearly illuminated. In aggregate, ABCP exposed banks increase their funding from private and government sources by dramatically more than do their non-exposed peers. But foreign banks with ABCP exposure grow their funding dramatically less than US banks with ABCP exposure do (approximately 1/8<sup>th</sup> as much). In fact they only grow their funding by as much as do non-ABCP-exposed foreign banks, on average.

### **3.5. Residual Funding Demand**

As a measure of the unmet demand for US dollar liquidity, we next examine borrowing from the Term Auction Facility (TAF), which was instituted in December 2007, and calculate the sum of the amount borrowed in the TAF auctions held on December 17<sup>th</sup> and 20<sup>th</sup> of 2007.<sup>16</sup>

On average, foreign ABCP exposed banks borrow more from the TAF than do any other category of bank, although not all banks bid at the TAF auctions. In Panel B of Table 4 we run

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<sup>16</sup> On December 17, 2007, the Federal Reserve conducted a 28-day TAF auction of \$20 billion at a stop-out rate of 4.65 percent. The awarded loans settled on December 20, 2007, and matured on January 17, 2008. On December 20, 2007, the Federal Reserve held another TAF auction of \$20 billion in 35-day credit at 4.67 percent stop-out rate. Loans settled on December 27, 2007, and matured on January 31, 2008. TAF transaction data is publicly available through [http://www.federalreserve.gov/newsevents/reform\\_taf.htm](http://www.federalreserve.gov/newsevents/reform_taf.htm)

simple OLS regressions to understand if our results are driven by bank scale. We control for the size of banks' total assets, as well as banks' US assets held through Federal Reserve regulated subsidiaries, because US assets may determine access to deposits. We find that foreign banks in general are disproportionately likely to access the TAF. While exposed banks borrow more from the TAF on average, there is no statistically significant difference between foreign and US exposed banks. Adding together the TAF and FHLB funding, we see a dramatic difference in access to US government funding – foreign exposed banks access much less government funding than do US exposed banks.

We note that our analysis has some limitations. We have no comprehensive information on US dollars or dollar denominated assets of non-US entities, and we lack information on US dollar commercial paper issuance of foreign banks.<sup>17</sup> This lack of information itself is symptomatic of a mismatch between bank exposure to US assets and incomplete information on banks that are headquartered outside of the US. It is worth noting that while exposed US banks accessed dramatically more funding, in terms of amounts relative to Tier 1 Capital, foreign banks actually had 2.5% more US ABCP exposure than did US banks, on average.

## **4. Real Market Response**

### **4.1. Syndicated Loans**

Having documented differential access of domestic and foreign banks to US dollar funding sources, we turn to the syndicated loan market to understand if the ABCP funding shock had real

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<sup>17</sup> Comprehensive data on CP issuance has been made available only since August 2008. While some of this information is on Bloomberg, the fields are not well populated.

effects on corporate credit and differentially so between US and foreign banks, and for USD versus foreign currency denominated loans.

We use the Loan Pricing Company's (LPC) Dealscan database to analyze the terms of syndicated loans arranged in 2007. LPC data have been extensively described in previous literature (see, for example, Ivashina (2009)). We link (by hand) banks from our sample to LPC using bank names and RSSD information from the National Information Center hierarchy to assign a match when the LPC lender name matches to any of the bank's subsidiaries. These banks comprise 20% of unique LPC lender names, and matched banks participate in 92% of the loans made in 2007.<sup>18</sup> We are able to find matches for 312 of the 567 sample banks (117 foreign banks). We limit the analysis to observations with sales data from LPC so as to better control for borrower quality. Of the 312 banks, only 159 of these underwrote syndicated loan facilities with available data in our sample period of January 1<sup>st</sup>, 2007 to December 11<sup>th</sup>, 2007 (154 underwrote USD-denominated loans, 69 underwrote Euro-denominated loans, 64 underwrote both USD- and Euro-denominated loans, and 149 underwrote revolving credit lines). The remaining banks did not underwrite syndicated loans reported to LPC in this time period. In addition to information on the lending syndicate, we use this database for information on each loan facility, including all-in-drawn spread, maturity, amount, purpose and the sales and industry of the borrower.

It is notable that just as we see a mismatch between foreign banks' US ABCP exposure and their US regulated assets, we see a mismatch between foreign banks that underwrite US dollar denominated syndicated loans and their US regulated assets. Table 5 presents summary statistics on the underwriting of US dollar syndicated loans by foreign and US banks. Adding up all loans

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<sup>18</sup> LPC lender names and IDs are not unique by bank. Large banks such as JP Morgan may have as many as 22 lender IDs in LPC. In 2007, there were 9,489 syndicated loans made excluding Bond and Note loan types. The banks in our sample were lenders in the syndicate for 92% of the loans (98% of the total facility amount outstanding) and a lead arranger in 89% of the loans (95% of the total facility amount outstanding).

likely to be outstanding as of August 9<sup>th</sup> 2007, defined as facilities with a start date before and maturity after August 9, 2007 (162,555 facilities), and assuming that each member of the underwriting syndicate underwrites an equal amount of each facility, the numbers are striking – Exposed US and foreign banks underwrite roughly the same amount of syndicated loans. These underwriting commitments are approximately 30% of banks’ total assets, but 4.5 times foreign banks’ US regulated assets.

Of course, many of these loans are underwritten but sold off. To be more conservative, we assume that banks keep only their portion of the revolver, and retain no exposure to the term loans. Even under this assumption, we find that foreign exposed banks’ revolving credit line commitments are 1.8 times as large as their regulated US assets. To be even more conservative, if we assume that banks keep only 25% of their underwritten share of the revolver and 5% of the term loans, ABCP-exposed foreign banks still have an exposure to US dollar denominated loans that approached 60% of their regulated US assets (the comparable number for US banks is 8%). In part this reflects that fact that large syndicated loan underwriters such as Deutsche Bank and Credit Suisse have relatively small assets in the US, relative to their total assets. For example, Bank of America has 7.2% of underwritten loans relative to US assets, while the same ratio for BNP Paribas is 32.7%. While this small asset base relative to total assets would not be relevant if US dollars could be raised at will and in a frictionless manner, aggregate dollar shortages as well as frictions in raising market funding (due to moral hazard and adverse selection concerns) render such a small asset base as a significant exposure to future dollar funding risk.

Do US dollar funding frictions affect the terms of loans that foreign exposed banks grant? We use information on 4,634 syndicated loan facilities from the period before the ABCP crisis and 1,754 in the post period (August 9<sup>th</sup>, 2007 to December 11<sup>th</sup>, 2007), a total of 14,701 lender-



facility observations. In the pre-period, 9,758 are denominated in US dollars, and 596 in Euros or Pounds; of the facilities in the post-period, 4,088 are denominated in US dollars, and 259 in Euros or Pounds.<sup>19</sup> We also use information about the Moody's loan ratings from the Dealscan database. If the Moody's loan rating is not available, we use the first available of the following ratings: S&P Loan Rating equivalent, Moody's Senior Debt, S&P Senior Debt, Moody's Senior Implied, and Fitch Short Term.

We begin by comparing loans arranged before and after the shock to ABCP funding markets in US dollars and in Euro or Pounds (GBP). We first tabulate the average terms of loans made before and after the shock in Table 6. On average, after the ABCP market shock spreads fall by three times as much in the Euro/GBP market as they do in US dollar denominated loans. However, these results do not control for systematic differences in the types of banks, borrowers and loans granted.

We also see differences in the terms of the USD and Euro/GBP denominated loans between exposed US and foreign banks. In the beginning of 2007, on average, ABCP-exposed banks seem to be making similar USD loans, with mean loan spreads around 150 basis points. In Europe, relative to USD loans, both exposed US and foreign banks seem to be making riskier loans, with mean spreads around 200 basis points. US banks seem to be participating in larger loan facilities in the European market, with an average loan size greater than \$1 billion. Euro/GBP loan packages also appear to be of slightly longer maturity, on average. After the ABCP market shock, US and foreign banks still seem to be making riskier loans in the European market, US banks appear to participate in larger loan facilities in Europe and on average Euro/GBP denominated loans seem to be of similar or slightly longer maturity than USD loans.

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<sup>19</sup> See Carey and Nini (2007) for a discussion of the US versus European syndicated loan data.

These univariate differences point out the importance of controlling for bank and currency fixed effects.

## 4.2. Empirical Methodology

In order to control for important differences in the type of loans that banks make and for differences in different loan markets, we employ a differences-in-differences strategy, where we estimate the terms of loan facilities extended before and after the ABCP shock, in US dollars and in other currencies, by foreign and domestic banks and by ABCP and non-ABCP-exposed banks. We can thus estimate how loan terms changed in the following segments: i) after the ABCP shock, ii) in US dollar loans vs. non US dollar loans, iii) for foreign banks after the ABCP shock, and iv) for foreign banks with ABCP exposure after the ABCP shock, while controlling for bank fixed effects, borrower characteristics and loan characteristics. Specifically, we estimate the following equation:

$$LPC Term_{b,l,f} = \alpha + \gamma_0(USD) + \Lambda\Psi(Post) + \Gamma\Psi(Post)(USD) + \tau(X_b) + \varphi(Y_l) + \omega(Z_f)$$

where  $b$  indexes banks,  $l$  indexes loan facilities and  $f$  indexes borrower firms;  $\Lambda = [\lambda_i]$  and  $\Gamma = [\gamma_i]$ , for  $i=1,..,4$ , are row vectors of coefficients; and  $\Psi$  is a column vector of variables of interest defined as:

$$\Psi = [1, (Foreign), (US ABCP Exposure), (Foreign)(US ABCP Exposure)]^T.$$

The dependent variable is a term from the loan package, either spread, amount or maturity. We include fixed effect controls for each bank ( $X_b$ ). In addition, we add  $Y_l$  a vector of controls for loan characteristics associated with terms of syndicated loans, including loan security, and fixed effects controls for the loan purpose. We also include  $Z_f$  controls for borrower firm

characteristics including sales divided by package amount and fixed effects for the borrower industry, and rating. In our sample, approximately 29% of loans are rated. In some of the spread specifications we include controls for other co-determined loan characteristics such as maturity and amount. Standard errors are clustered at the loan package level. Detailed variable definitions are available in Appendix A.

Our variables of interest are the following: *Post*, which is defined as a dummy variable equal to 1 on or after August 9<sup>th</sup>, 2007; *US ABCP Exposure*, an indicator variable equal to 1 if a bank has US dollar ABCP exposure; *Foreign*, a dummy variable equal to 1 if the bank's ultimate parent is headquartered outside of the US; and *USD*, a dummy variable equal to 1 if the currency of the loan is US dollars.

We thus can estimate differences in loan terms after controlling for observable loan characteristics, borrower characteristics and for any fixed differences among currencies and banks. Results emerge from differences in the differences in bank terms between currencies before and after the ABCP shock. Of course, there are limitations to any analysis of syndicated loan data. First, loans are priced in a syndicate, and therefore terms are jointly determined. This would bias us against finding any results, since a withdrawal of credit by foreign banks might be mitigated by additional credit provision by other syndicate members. Second, syndicated loans are underwritten by the syndicate banks, but they may originate the loan to sell-off some of or the entire loan package. Third, we can only analyze the prices of the loans that are actually made after the liquidity shock (the intensive margin). In Section 4.5, we attempt to understand the extent to which the extensive margin changes, although we are limited by the lack of data on loan demand.

### **4.3. Loan Pricing after the ABCP Funding Shock**

We hypothesize that banks exposed to the ABCP shock have suffered more of a liquidity shock than have banks without ABCP exposure. This liquidity shock is denominated in US dollars, and since we find evidence that US banks have differential access to US dollar liquidity in Section 3 (by raising deposits and accessing FHLB financing), we expect there to be differential impacts in the US lending market relative to other currencies, assuming that there are frictions in liquidity across currencies for foreign banks. Thus in order to estimate the impact of a negative liquidity shock to lending, we look to see if foreign exposed banks offer different terms than do US exposed banks, or foreign or domestic non-exposed banks.

We begin in Table 7 by looking at the pricing of loans before and after the ABCP shock, starting with specifications that include loan level and rating controls and lender fixed effects. While not statistically significant before adding controls for bank type, after controlling for bank fixed effects, prices on US dollar loans increase more in the post-shock period, as do prices for loans made by exposed banks (see first specification of Table 7).

Significant differences emerge, however, when we allow the effect of ABCP exposure to vary by loan currency. Foreign banks with exposure to ABCP raise interest rates on US dollar loans after the ABCP funding shock, particularly when compared to US exposed banks or to non exposed foreign banks. The effect is statistically and economically significant, even after controlling for loan maturity, size and loan rating (specification 2). Adding up the coefficients, exposed foreign banks are raising prices after the US ABCP shock. The average effect is an additional 10 basis points on US dollar loans – almost 45 percent larger than the increase in the post period on their non-USD loans. In addition to the large effect estimated within banks, when we look at the cross

section without controlling for lender fixed effects we also find that exposed foreign banks are charging higher prices on their US dollar loans after the shock (not shown).

In theory, a liquidity shock might be expected to have the strongest effects on the terms of the liquidity that banks provide to their customers through revolving lines of credit. Looking at US banks and only US loans in the same time period, Bord and Santos (2011) find that banks that accessed the liquidity facilities of the Federal Reserve raised prices on the undrawn fees for revolving credit lines to their customers. Surprisingly, in our analysis the effect is relatively limited when we restrict the sample to revolvers (not shown). However, we are estimating our results on all-in spread, rather than on undrawn spread because we have very few observations with information on undrawn spreads for non us dollar revolvers.

Finally, since loan facilities are typically part of a larger loan package, we want to make sure that the pricing differences we find are present in aggregate loan packages. Therefore, we aggregate facilities of a single borrower into a loan package and calculate a weighted average spread on all facilities. The results are of similar magnitude and economic significance.

#### **4.4. Other Loan Terms**

The remaining six columns of Table 7 provide an analysis of important loan terms such as facility amount, maturity and rating. As with spread, we look at each loan term with and without lender fixed effects to better understand how loan terms are affected both overall and within banks. Since loan terms may be jointly determined, we include controls for other loan terms such as spread, amount or maturity. Beginning with loan amounts, we do not find statistically significant difference in the post-shock period. US dollar denominated loan amounts decline slightly relative to other loans, although the effect is not statically significant.

Turning to facility maturity (specifications (5) and (6)), we find that exposed foreign banks seem to be shortening maturities on all loans after the shock: we estimate negative coefficients on *Foreign \* US ABCP Exposure \* Post*, even after including controls for bank fixed effects and loan ratings. In contrast to our expectations, foreign exposed banks actually seem to be extending maturities on their USD loans relative to their loans in other currencies (positive statistically significant coefficient on *USD\* Foreign \* US ABCP Exposure \* Post*, although when adding up all the marginal effects, we see that relative to the pre-shock period, exposed US banks are extending maturities on their US loans and shortening maturities on their Euro loans (3.19 US vs. -28 Euro), while exposed foreign banks are doing the same but less dramatically (3.64 US vs. -9.39 Euro).

Finally we look at the riskiness of loans. In these specifications, we are simply trying to understand if the average rating of loans done in the post-shock period has changed. Therefore we do not include controls for loan characteristics such as sales, or other loan terms. Generally, foreign banks seem to be making less risky USD loans in the post-shock period (negative coefficient on *USD \*Foreign\*post* in specifications 7 and 8), and exposed banks are making less risky USD loans (negative coefficient on *USD \*Foreign\*post*) although exposed foreign banks are not reducing the riskiness of their loans by quite as much (insignificant positive coefficient on *USD\*exposure \*Foreign\*post*). In summary, the impact of differential funding access of domestic and foreign banks to US dollar funding seems predominantly on the cost (spreads) of syndicated loans, rather than on their maturity, size or risk.

#### **4.5. Extensive margin**

It is plausible that the real effect of a liquidity shock is in the loans that do not get made at all. While we cannot identify all borrowers that would have liked to borrow in the syndicated loan market (the full extensive margin), we can examine borrowers that previously accessed this market to see if they are able to refinance their existing loans. For this purpose we use the set of syndicated loans outstanding at the time of the ABCP shock, and test if US dollar borrowers with foreign exposed banks in their syndicate are less likely to refinance their loans.

In Table 8, we present a Cox proportional hazard analysis of refinancing. We regress a dummy variable indicating if the borrower received a new syndicated loan package between August 9, 2007 and December 11, 2007 on our set of lender characteristics, controlling for features of the loan being refinanced that we expect to be associated with the probability of refinancing. As before, our main variables of interest are *US ABCP Exposure* and *Foreign* and the interaction of the two variables. Since we only look at loan refinancing after August 9th, we no longer need a dummy variable for the post-ABCP shock time period.

While the previous analysis considered only loans issued in 2007, for this analysis, we want to begin with a sample of loans that were outstanding at the time of the ABCP shock. For this reason, we look backward for a period of five years and begin with the 8,768 loan packages outstanding as of August 9, 2007 underwritten by sample banks (45,968 loan package – lender observations). In this analysis, we focus on the loan package as our unit of observation, because we are interested in understanding how the crisis affects borrowers' access to loans, not the refinancing of any particular facility. Since bank liquidity shocks might disproportionately affect revolving credit lines we also look at the subsample of 37,897 revolver – lender observations that were arranged in the five years prior to the shock and outstanding as of August 9, 2007.

In order to isolate the effect of the loan underwriter on refinancing, we include controls for characteristics of the initial loan that might affect the probability of refinancing including the time to maturity of the original loan as of August 9, 2007, the price of risk at the time of the original loan, loan rating, loan purpose, and the industry of the borrower. Detailed definitions of the control variables are provided in Appendix A. We also include a *Must Refinance* dummy variable to allow for a nonlinear effect for loans maturing between August 9 and December 11, 2007. The controls generally have the expected sign, with loans of longer time to maturity being less likely to be refinanced.

We estimate each specification with and without lender fixed effects. The specifications without bank fixed effects (specifications (1), (3), (5) and (7)) allow us to understand how bank characteristics affect the likelihood of refinancing. Including controls for bank fixed effects (specifications (2), (4), (6) and (8)) allows us to estimate differences in the likelihood of refinancing loans in US dollars versus other currencies for the same bank.

We find that foreign exposed banks are less likely to refinance USD dollar revolving loans in the months following the ABCP shock. The effect is economically large, although the estimated coefficients (-0.217 in specification (5) and -0.432 in specification (6)) are not statistically significant. This also highlights the importance of controlling for risk in the spread regressions of the previous sections, since it is likely that the risk of loans extended by foreign exposed banks in US dollars is falling at this time relative to their other currency loans.

## **5. Concluding Remarks**

Our primary finding in this paper is that foreign banks borrowing in the ABCP market and operating in the United States, in particular, had to scramble for liquidity when the ABCP market



froze. Their limited access to deposit and government funding sources suggests that they relied mainly on the relatively more fragile wholesale markets for funding. In turn, they passed on the cost of this fragility to their US dollar borrowers in the form of greater costs for provision of syndicated loan packages.

It is interesting to consider a few issues concerning other sources of funding for the foreign banks. Clearly, as the US banks relied on their own deposit markets and government funding, foreign banks may have also had access to such funding in their home countries. However, what these banks were scrambling for were primarily US dollars. Eventually, US dollars were made available through swap lines set up by the Federal Reserve with other central banks. However, this did not happen until December 11<sup>th</sup> 2007 (see McGuire and Goetz (2009), for example), giving us at least a quarter of data starting with the ABCP funding shock in August 2007, from which we can identify the lending channel operating through foreign bank dollar shortages. That the TAF auctions conducted by the Federal Reserve starting in December 2007 had significant take-up by foreign banks, and that the dollar swap lines provided to foreign central banks were heavily used appear to suggest that foreign banks' US dollar needs were not fully met at least until December 2007.

Another source of US dollar funding for foreign banks considered in the work of Cetorelli and Goldberg (2011) is that of management of liquidity across an entire banking organization, with funds flowing across international affiliates and within geographically diverse banks. They find that faced with a shock to the parent in the ABCP market, global banks activated internal capital markets shuffling funds in and out of specific locations based on the relative importance of such locations as local funding pools. While we do not analyze how such management of liquidity contributes to – or affects – our results, if such liquidity management were relatively costless,

then it should have only made it harder for us to find a differential effect between foreign and domestic banks operating in the US.

Finally, there are two policy issues that are relevant for discussion in the context of our results. First, we find evidence that suggests that dollar funding shortages can affect not only the stability of foreign banks, but also induce spillover onto the US real economy, especially to corporations borrowing from foreign banks. For instance, the recent 10% contraction in short-term paper extended by money market funds to European banks may also potentially be associated with such a spillover and may be fruitful ground for further inquiry.<sup>20</sup> A robust conclusion is that ensuring prudential regulation of domestic banks in a country may not be sufficient for guarding against financial fragility if the economy is a large center of global banking activities.

Second, while we can draw conclusions about the changes in loan pricing after August 2007 we cannot say whether spreads on syndicated loans made by foreign banks were too low pre-August 2007 or whether the spreads rose excessively so post-August 2007 (or both). Our empirical analysis, which is based on difference in differences, cannot rule in favor of one thesis or the other. Acharya and Richardson (2009) argue that bank risk-taking in the pre-crisis period was driven by regulatory arbitrage motive. Acharya, Schnabl and Suarez (2009) show convincingly that the reliance on ABCP by commercial banks was primarily the result of advantageous capital treatment accorded to issuance of such paper (and guarantees to it) by most national regulators. Shin (2011) calls the resulting provision of intermediation a “global banking glut,” arguing that it led to the under-pricing of dollar-denominated maturity mismatch and in particular to compressed loan premiums. Our results are supportive of these conclusions, but also potentially

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<sup>20</sup> The foreign bank presence in borrowing from the money-market funds in fact dates back to pre-crisis periods, as documented by Baba, McCauley and Ramaswamy (2009).

consistent with an ex-post credit crunch (too high spreads relative to efficient ones) due to transmission by foreign banks of their adverse funding conditions to corporations. Investigating this issue further presents a significant but worthy challenge.

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## Appendix A: Variable Definitions

Variable	Definition
<b>Changes in Funding Variables (calculated as level change between 2007:Q2 and 2007:Q2)</b>	
<i>US Deposits</i>	Total noninterest-bearing (including total demand deposits and noninterest-bearing time and savings deposits) and interest-bearing deposits (FR Y9C: bhdm6631, bhdm6636, bhfn6631, bhfn6636; FFIEC 031: rcon6631, rcon6636, rcfn6631, rcfn6636; FFIEC 002: rcfd2205)
<i>Repo, Net</i>	The amount of securities sold under agreements to repurchase less securities bought under agreements to repurchase (FR Y9C: bhckb995, -bhckb989; FFIC 031: rcfdb995, -rcfdb989; FFIEC 002: rcfdc422, rcfdc423, -rcfdc414, -rcfdc415)
<i>Fed Fund, Net</i>	Net fed funds from regulatory filings (FR Y9C: bhdm993, -bhdm987; FFIEC 031: rcon993, -rcon987; FFIEC 002: rcfdc420, rcfdc421, -rcfdc412, -rcfdf856, -rcfdc413)
<i>Fed Funds Sold</i>	Amount of fed funds purchased (FR Y9C: bhdm987, FFIEC 031: rcon987, FFIEC 002: rcfdc412, rcfdf856, rcfdc413)
<i>Other Borrowed Money (less FHLB advances)</i>	Other borrowed money from nonrelated commercial banks and others less FHLB advances ( <i>Other borrowed money</i> defined as FFIEC031: rcfdf055, rcfdf056, rcfdf057, rcfdf058)
<i>Cash and Balances</i>	Cash and balances due from depository institutions (FR Y9C: bhck0081, bhck0395, bhck0397; FFIEC 031/ FFIEC 002: rcfd0010)
<i>Available for Sale Securities</i>	Securities that are available for sale (FR Y9C: bhck1773; FFICE 031/ FFIEC 002: rcfd1773)
<i>Demand Deposits</i>	Demand deposits (FR Y9-C: bhcb2210; FFIEC 031/ FFIEC 002: rcon2210)
<i>Core Deposits</i>	The sum of deposits under \$100,000 plus all transactions deposits
<i>Time Deposits (&lt;100k)</i>	Total time deposits of less than \$100,000 (FR Y9-C: bhcb6648, bhod6648; FFIEC 031/ FFIEC 002: rcon6648)
<i>Time Deposits (&gt;100k)</i>	Total time deposits of more than \$100,000 (FR Y9-C: bhcb2604, bhod2604; FFIEC 031/ FFIEC 002: rcon2604)
<i>Other Deposits</i>	NOW, ATS and other transaction accounts, money market deposit accounts and other savings accounts not classified as demand deposits or time deposits
<i>Total Private Funding</i>	the sum of the changes in <i>Fed Funds Net</i> , <i>Total US Deposits</i> , <i>Repo Net</i> , <i>Cash and Balances</i> , <i>Available for Sale Securities</i> , and <i>Other Borrowed Money (less FHLB advances)</i>
<b>Changes in Funding Variables (calculated as level change between 1<sup>st</sup>, 2007 and August 15<sup>th</sup>, 2007)</b>	
<i>Net Due from (to) Related Institutions Change</i>	The amount which is sent to (received from) related institutions that are not US banks. (FR 2644: walb2154, -walb2944; FR 2069: wrss2163, -wrss2941)

<b>Variable</b>	<b>Definition</b>
<i>Borrowing from US Commercial Bank Change</i>	The change in the amount borrowed in aggregate from other US banks (FR 2644: walba286; FR 2069: wrssa286)
<b><i>Dealscan Variables</i></b>	
<i>Spread</i>	All-in-drawn spread (in basis points) corresponding to the total cost (interest rate and fees) paid over LIBOR for each dollar drawn down under the loan facility
<i>Amount</i>	Logarithm of the total loan facility in millions
<i>Maturity</i>	Maturity of the facility in months
<i>Unsecured</i>	Dummy equal to 1 if the loan is not secured
<i>Number of lenders</i>	Number of lenders in the syndicate
<i>Borrower Industry</i>	Dummy variable for the 2-digit SIC industry code of the borrower
<i>Deal purpose</i>	Dummy for the loan purpose (aggregated to business purposes, transaction related, project financing or other (CP backup, IPO Related Finance, Pre-Export, and Securities Purchase))
<i>Leverage</i>	Sales divided by package amount
<i>Rating</i>	Dummy variable for Moody's loan rating (26 dummies). If the Moody's loan rating is not available, we use the first available of the following ratings: S&P Loan Rating equivalent, Moody's Senior Debt, S&P Senior Debt, Moody's Senior Implied, and Fitch Short Term.
<i>No loan rating</i>	Dummy equal to 1 if the loan and borrower is not rated.
<b><i>Refinancing Variables</i></b>	
<i>Time to Maturity</i>	the distance between August 9 <sup>th</sup> , 2007 and the maturity of the original loan
<i>Risk Price</i>	Spread of Moody's seasoned Baa corporate bond yield over the 20 year Treasury less the Moody's seasoned Aaa corporate bond yield over the 20 year Treasury at the issuance date of the original loan



**Appendix B: Availability of Information on Sources of Funding Liquidity**

Source of ST liquidity	Data	Not captured
<i>Private</i>		
Cash	Quarterly (includes non-dollar denominated currency and coin, and cash in interest-bearing balances offshore)	US dollars held outside of US (at FBO headquarters etc.)
AFS Securities	Quarterly	AFS securities at FBO headquarters, disaggregated AFS holdings at the domestic branch and offices of foreign banks (002 filers)
Net Fed Funds / Eurodollar	Daily estimates (extracted from payments data), Quarterly at US regulated subsidiary only	May include correspondent banking, term fed funds, Eurodollar loans and tri-party repo. May miss activity not settled in Fedwire and loans with unusually high or low rates compared to the daily effective fed funds rate
Repo	Quarterly	Repo of assets at foreign headquarters
US Deposits (including Demand deposits, time deposits, and other deposits)	Quarterly	US dollar deposits held at FBO level (the y-7q reports figures at the FBO level but does not detail deposit figures)
Local currency funding swapped into US dollars	Weekly information on transfers from headquarters for subset of banks	Banks which are not included in H8 (voluntary) panel, US dollar funding not sent through regulated subsidiary
Commercial Paper	Quarterly for BHCs (Data tracked in Y-9C but not CALL or 002.)	Commercial banks not part of a BHC and 002 filers (available CP data from DTCC begins August 29, 2008; CP facility data from Bloomberg not populated)
<i>Government</i>		
Discount window	Daily (access only for US branches and agencies of foreign banks that hold reserves)	None
TAF	Daily (access for US depository institutions and US branches and agencies of foreign institutions in good standing and maintaining deposits subject to reserve requirements)	None
FHLB advances	Quarterly (access only for member US commercial banks and BHCs)	None

**Table 1, Panel A: Summary Statistics**

	units	Full Sample				ABCP Exposed			
		n	Mean	Std. Dev	p(50)	n	Mean	Std. Dev	p(50)
<i>Firm Characteristics</i>									
Foreign Lender dummy	--	567	0.2	0.4	0.0	53	0.8	0.4	1.0
US ABCP Outstanding	\$million	567	1237.3	6208.0	0.0	53	13236.7	16050.0	6724.0
US ABCP Exposure	%	567	4.9	27.8	0.0	53	52.6	76.3	30.1
Total Assets, 2006q4	\$billion	567	103.9	299.3	2.6	53	739.2	563.3	543.7
Total US Assets, 2006q4	\$billion	567	22.9	129.5	1.5	53	166.8	383.3	12.0
US Tier 1 Capital/US Assets, 2006q4	%	534	9.4	9.5	8.3	47	7.6	24.8	3.6

**Table 1, Panel B: Summary Statistics by Bank Type**

	Sample	Exposed	Banks with ABCP			Foreign Banks		
			Foreign	US	Difference, For - US	No ABCP	ABCP	Difference, ABCP-No ABCP
<b>Summary Statistics (\$B)</b>								
Number of banks	567	53	40	13		87	40	
US ABCP Outstanding	1237.3 (6,208.0)	13236.7 (16,050.0)	10,919.3 (10,562.3)	20,367.4 (26,090.5)	-9,448.1	0.0 (0.0)	10,919.3 (10,562.3)	-10,919.3
US ABCP Exposure	4.9 (27.8)	52.6 (76.3)	53.3 (84.6)	50.5 (44.4)	2.8	0.0 (0.0)	53.3 (84.6)	-53.3
Total Assets, 2006q4	103.9 (299.3)	739.2 (563.3)	783.8 (554.7)	602.0 (590.1)	181.8	175.7 (289.3)	783.8 (554.7)	-608.1
Total US Assets, 2006q4	(22.9) (129.5)	(166.8) (383.3)	72.5 (144.0)	457.0 (669.6)	-384.5	6.3 (12.4)	72.5 (144.0)	-66.2
US Tier 1 Capital/US Assets, 2006q4	9.4 (9.5)	7.6 (24.8)	7.8 (27.7)	7.0 (1.4)	0.8	7.1 (8.5)	7.8 (27.7)	-0.7

Panel A of Table 1 displays summary statistics of bank characteristics. Panel B of Table 1 displays summary statistics for banks with ABCP separately for foreign and domestic banks and for foreign banks with and without ABCP. The sample consists of 567 banks (53 with US ABCP exposure). Characteristics include: *US ABCP Outstanding* (the amount of US dollar ABCP outstanding in millions); *US ABCP Exposure* (the percentage of US ABCP as of 1/1/2007 relative to bank equity), which comes from Moody's Investor Service and Bankscope as detailed in Acharya and Schnabl (2011); *Total Assets, 2006q4* is the total assets of the consolidated bank and comes from Bankscope; and *Total US Assets, 2006q4* is the assets of the bank in the US and comes from regulatory reports. *Tier 1 Capital/Assets, 2006q4* is the Tier 1 regulatory capital over total assets for 2006q4.

**Table 2, Panel A: Change in Funding (\$ millions)**

	units	Full Sample						ABCP Exposed		
		n	Mean	Std. Dev	p(25)	p(50)	p(75)	n	Mean	Std. Dev
<i>Sources of Funds</i>										
<u>PRIVATE</u>										
Fed Funds Net Change	\$million	567	-40.4	923.0	-16.2	0.0	22.8	53	-213.7	2,556.4
Fed Funds Sold Change	\$million	567	-8.8	381.1	-10.7	0.0	5.4	53	3.5	429.3
Cash and Balances Change	\$million	567	-17.1	880.2	-8.5	-0.6	3.7	53	-202.5	2,825.5
Repo Net (Sold-Purchased) Change	\$million	567	-50.6	2,253.6	0.0	0.0	6.4	53	-500.5	7,282.2
Total US Deposits Change	\$million	567	434.8	3,370.4	-23.2	3.1	33.5	53	2,571.8	9,166.4
Demand Deposits Change	\$million	567	-58.4	326.6	-19.3	-1.8	0.9	53	-231.8	619.9
Core Deposits Change	\$million	567	-25.4	340.7	-25.0	-1.9	6.9	53	-189.1	489.5
Time Deposits(<100k) Change	\$million	567	36.1	324.5	-4.2	0.0	5.3	53	97.1	497.3
Time Deposits(>100k) Change	\$million	567	275.5	2,383.6	-6.9	1.4	14.4	53	1,850.1	6,715.0
Other Deposits Change	\$million	567	184.7	2,001.8	-8.6	0.7	26.2	53	910.8	5,649.3
Other Borrowed Money (less FHLB advances)	\$million	567	154.9	2,874.8	0.0	0.0	0.9	53	1,646.3	9,250.3
<i>H.8 FR 2644 Sub-sample (change from June 27, 2007 to Sept 26, 2007)</i>										
Net due from Related Institutions Change	\$million	276	56.3	3,582.2	0.0	0.0	0.0	27	-2,032.6	7,285.9
Net due to Related Institutions Change	\$million	276	96.2	1,281.2	0.0	0.0	0.0	27	950.2	3,686.9
Net due to less from Change	\$million	276	39.9	3,667.9	0.0	0.0	0.0	27	2,982.8	8,098.0
Borrowing from US Commercial Bank Change	\$million	276	106.7	1,728.0	0.0	-0.3	0.0	27	496.9	4,583.8
<i>H.8 FR 2644 Sub-sample (change from August 1, 2007 to August 15, 2007)</i>										
Net due from Related Institutions Change	\$million	281	25.3	2,499.9	0.0	0.0	0.0	29	-800.4	5,192.8
Net due to Related Institutions Change	\$million	281	85.6	1,110.1	0.0	0.0	0.0	29	680.0	2,986.9
Net due to less from Change	\$million	281	60.3	2,760.5	0.0	0.0	0.0	29	1,480.5	6,214.3
Borrowing from US Commercial Bank Change	\$million	281	137.9	1,476.0	-3.1	0.0	14.5	29	517.4	3,761.4
<u>GOVERNMENT</u>										
Primary Discount Window Change	\$million	567	22.6	246.1	0.0	0.0	0.0	53	124.3	467.1
FHLB Advances Change	\$million	567	137.4	1,037.3	0.0	0.0	10.0	53	750.8	466.7
Term Auction Facility (TAF) Change	\$million	567	39.8	236.6	0.0	0.0	0.0	53	181.9	2,859.4
<u>TOTALS</u>										
Total Funding Change	\$million	567	678.2	5,600.1	-11.2	13.1	81.5	53	4,190.8	16,454.3
Total Government Funding Change	\$million	567	160.0	1,156.1	0.0	0.0	13.9	53	875.1	3,097.1
Total Private Funding Change	\$million	567	518.2	5,076.7	-18.2	10.6	72.7	53	3,315.6	14,824.4

**Table 2, Panel B: Change in Funding, by Bank Type**

	Banks with ABCP			Foreign Banks		
	Foreign	US	Difference, For - US	ABCP	No ABCP	Difference, ABCP - No ABCP
<b>Mean Quarterly Changes (2007Q3 - 2007Q2) (changes in \$millions)</b>						
US Assets	3,955.1 (17,279.3)	18,861.7 (38,868.1)	-14,906.6	3,955.1 (17,279.3)	421.0 (3,233.1)	3,534.0
<i>Funding (Private)</i>						
<i>Liabilities</i>						
Total US Deposits	1,649.8 (7,260.1)	5,408.6 (13,462.6)	-3,758.8	1,649.8 (7,260.1)	828.7 (3,821.7)	821.1
Repo Net	520.8 (4,286.3)	-3,642.8 (12,486.5)	4,163.6	520.8 (4,286.3)	-104.2 (857.5)	625.0
Fed Funds Net	-356.8 (2,614.4)	226.5 (2,414.0)	-583.4	-356.8 (2,614.4)	-164.7 (1,003.0)	-192.1
Fed Funds Sold	-31.8 (584.7)	-447.1 (1,126.6)	415.3	-31.8 (584.7)	-4.5 (602.3)	-27.3
Other Borrowed Money (less FHLB advances)	-812.6 (4,367.5)	9,212.1 (15,054.4)	-10,024.7	-812.6 (4,367.5)	11.8 (555.8)	-824.4
<i>Assets</i>						
Cash	271.3 (1,923.9)	-1,660.5 (4,417.4)	1,931.8	271.3 (1,923.9)	-31.6 (330.5)	303.0
Available for Sale Securities	183.1 (1,850.5)	-505.0 (5,524.3)	688.1	183.1 (1,850.5)	317.2 (1,720.1)	-134.1
<b>Total Private Funding</b>	<b>1,455.6</b> <b>(11,355.1)</b>	<b>9,038.9</b> <b>(22,051.0)</b>	<b>-7,583.3</b>	<b>1,455.6</b> <b>(11,355.1)</b>	<b>857.1</b> <b>(4,868.9)</b>	<b>598.4</b>
<i>Quarterly Changes in US Deposits</i>						
Demand Deposits	-112.7 (387.0)	-598.4 (992.7)	485.7	-112.7 (387.0)	-20.0 (95.0)	-92.7
Core Deposits	-141.2 (454.7)	-336.5 (579.1)	195.3	-141.2 (454.7)	-21.7 (101.7)	-119.5
Time Deposits (<\$100k)	-4.7 (59.4)	410.4 (958.8)	-415.0	-4.7 (59.4)	-1.2 (10.6)	-3.5
Time Deposits(>\$100k)	1,612.1 (7,291.5)	2,582.2 (4,673.2)	-970.1	1,612.1 (7,291.5)	660.8 (2,766.7)	951.3
Other Deposits	178.8 (1,418.6)	3,162.9 (11,156.9)	-2,984.0	178.8 (1,418.6)	189.6 (1,751.7)	-10.7
Total US Deposits	1,649.8 (7,260.1)	5,408.6 (13,462.6)	-3,758.8	1,649.8 (7,260.1)	828.7 (3,821.7)	821.1

**Table 2, Panel B: Change in Funding, by Bank Type (cont'd)**

	Banks with ABCP			Foreign Banks		
	Foreign	US	Difference, For - US	ABCP	No ABCP	Difference, ABCP - No ABCP
<i>H.8 FR 2644 Sub-sample (change from June 27, 2007 to Sept 26, 2007)</i>						
Number of banks	21	6		21	28	
Net Due To Less From	4,176.0 (8,804.5)	-1,193.5 (2,003.7)	5,369.5	4,176.0 (8,804.5)	-2,349.2 (7,676.1)	6,525.2
Borr. from US comml bank	-295.8 (1,623.2)	3,271.7 (9,318.7)	-3,567.5	-295.8 (1,623.2)	226.8 (938.1)	-522.6
<i>H.8 FR 2644 Sub-sample (change from August 1, 2007 to August 15, 2007)</i>						
Number of banks	23	6		23	31	
Net Due To Less From	1,939.1 (6,926.5)	-277.6 (700.5)	2,216.7	1,939.1 (6,926.5)	-831.3 (5,680.3)	2,770.4
Borr. from US comml bank	-125.9 (1,131.9)	2,983.8 (8,024.3)	-3,109.7	-125.9 (1,131.9)	108.4 (1,121.2)	-234.3

Table 2, Panel A displays summary statistics of the change in funding. Table 2, Panel B displays summary statistics of the change in private funding separating foreign and domestic and ABCP exposed and non-exposed banks. Detailed definitions of variables are in Appendix A. The sample consists of 567 banks (53 banks have US ABCP exposure).

**Table 3: Determinants of the Change in Funding**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
							Deposits Detail		
Change in:	Net FF/Euro (Borrow- Lend)	FF/Euro Lending	Net Repo (Sold- Purchased)	Total US Deposits	Cash and Balances	AFS Securities	Time (<100k)	Core	Total Deposits - Core Deposits
US Exposure	183.4 (744.5)	-583.3* (333.3)	-3,716.9 (3,605.8)	4,920.9 (3,729.4)	-1,714.8 (1,270.9)	-338.7 (1,643.5)	283.7 (280.8)	-361.5** (179.4)	5,282.4 (3,738.3)
Foreign dummy	-224.3 (172.3)	-103.7 (75.5)	-195.4 (365.1)	754.2 (525.3)	-91.4 (155.7)	433.2 (315.0)	-79.6 (61.9)	-55.1 (61.1)	809.3 (527.4)
US Exposure*Foreign	-397.7 (772.9)	492.5 (323.4)	4,308.3 (3,500.1)	-4,245.7 (3,710.1)	1,992.7 (1,237.0)	275.5 (1,577.0)	-327.6 (260.3)	224.2 (168.0)	-4,470.0 (3,727.1)
US Assets (2006q4)	-41.1 (47.1)	-19.7 (12.9)	-53.1 (137.8)	337.3** (138.8)	-31.2 (51.4)	11.5 (59.9)	16.3* (8.8)	-27.5*** (7.8)	364.8** (141.5)
Total Assets (2006q4)	10.6 (40.4)	25.9 (17.1)	15.6 (92.4)	42.7 (116.9)	11.3 (40.2)	-28.5 (69.4)	15.2 (14.5)	8.2 (13.9)	34.4 (118.6)
Constant	233.5 (205.5)	-40.9 (104.1)	295.4 (452.4)	-2,741.5*** (753.6)	157.3 (147.9)	109.5 (498.7)	-199.1** (92.6)	137.4 (89.2)	-2,878.9*** (765.6)
Observations	567	567	567	567	567	567	567	567	567
Adjusted R-squared	0.01	0.03	0.06	0.12	0.09	0.00	0.06	0.05	0.14

Table 3 shows the changes in private funding of 567 banks in our panel. Dependent variables are quarterly change to 2007q3 from 2007q2 of: *Net FF Borrow/Lend*, the amount of Fed funds borrowed less the amount lent; *FF/Euro Lending*, the amount of Fed Funds lent; *Net Repo*, the amount of securities sold under agreements to repurchase less the securities bought under agreements to repurchase; *Total US Deposits*, total US Deposits; *Cash and Balances*, the cash and balances due from depository institutions; *AFS Securities*, the amount of available-for-sale securities; *Primary Discount Window*, the borrowing amount of primary credit at the discount window excluding all borrowing done through secondary credit and seasonal credit lending programs; *TAF*, the sum of the amount borrowed in the two 28-day Term Auction Facility auctions held on December 17<sup>th</sup> and 20<sup>th</sup> of 2007; *FHLB Advances*, the amount of Federal Home Loan Bank advances over all maturities; *Time Deposits (<100k)*, the total time deposits of less than \$100,000. *Time Deposits (>100k)* is the total time deposits of more than \$100,000; *Core Deposits*, the amount of transaction deposits and insured time deposits; *Total Deposits – Core Deposits*, the amount of total deposits less all core deposits. The independent variables: *US Exposure*, equal 1 if the high-holder bank has exposure to US ABCP; *Foreign dummy*, equal to 1 if the high-holder bank is foreign; *US Exposure\*Foreign*, is the interaction between US Exposure and Foreign dummy; *US Assets (2006q4)*, are the US assets of the bank as of 2006q4; *Total Assets (2006q4)*, are the total banking assets as of 2006q4. \*\*\*, \*\*, and \* indicate p-values of 1%, 5%, and 10%, respectively.

**Table 4, Panel A: Summary Statistics Change in Government Funding**

	Banks with ABCP			Foreign Banks		
	Foreign	US	Difference, For - US	ABCP	No ABCP	Difference, ABCP - No ABCP
<b>Mean Changes in Government Funding (changes in \$millions)</b>						
<i>Funding (Government)</i>						
Primary Discount Window	51.4 (341.9)	348.6 (702.3)	-297.2	51.4 (341.9)	13.9 (107.6)	37.5
FHLB Advance	27.9 (255.3)	2,975.2 (5,302.5)	-2,947.3	27.9 (255.3)	48.9 (276.9)	-21.0
<b>Total pre-TAF Govt Funding</b>	79.3 (402.6)	3,323.8 (5,695.0)	-3,244.5	79.3 (402.6)	62.8 (359.7)	16.5
TAF	240.2 (525.6)	2.7 (7.3)	237.5	240.2 (525.6)	133.1 (443.4)	107.1
<b>Total pre-TAF Total Funding</b>	1,534.9 (11,425.6)	12,362.8 (25,555.9)	-10,827.9	1,534.9 (11,425.6)	919.9 (4,879.2)	614.9

Table 4, Panel A displays summary statistics of the changes in government funding separating foreign and domestic and ABCP exposed and non-exposed banks. The sample consists of 567 banks (53 banks have US ABCP exposure).

**Table 4, Panel B: Change in Government Funding**

	(1)	(2)	(3)	(4)
<i>Dependent Variable</i>	FHLB Advances	Discount Window	TAF	TAF+FHLB Advances
Foreign Lender dummy	-89.2 (228.2)	-1.8 (59.2)	115.1*** (36.5)	25.9 (225.9)
US ABCP Exposure	2,665.9* (1,449.3)	304.5 (205.7)	-49.3 (52.0)	2,616.6* (1,437.1)
Foreign Lender* US ABCP Exposure	-2,781.9** (1,385.3)	-279.6 (191.9)	135.9 (84.5)	-2,646.0* (1,372.5)
US Total Assets, 2006q4	105.6** (50.7)	20.7** (8.5)	19.4*** (6.7)	125.0** (49.9)
Total Assets, 2006q4	32.8 (58.7)	4.1 (14.6)	7.2 (7.9)	40.1 (58.0)
Observations	567	567	567	567
Adjusted R <sup>2</sup>	0.24	0.08	0.14	0.26

Table 4, Panel B shows the results of regression specifications with the dependent variable of changes in government funding. The dependent variable in specification (1) is *FHLB Advances*, the sum of all *FHLB advances*, the specification (2) is *Primary Discount Window*, the borrowing amount of primary credit at the discount window excluding all borrowing done through secondary credit and seasonal credit lending programs, the specification (3) is *TAF Borrowing*, the amount borrowed from the borrowed in the Term Auction Facility auctions held on December 17th and 20th of 2007, and specification (4) is *TAF+FHLB* (the sum of *TAF borrowing* and the change in *FHLB Advances*). Detailed definitions of variables are in Appendix A. Other explanatory variables include: *Foreign Lender dummy* which equals 1 if the bank is headquartered outside of the US and *US ABCP Exposure*, which equals 1 for banks with US ABCP exposure, and the interaction of the *Foreign lender dummy* and *US ABCP Exposure*. Robust standard errors are in parentheses; \*, \*\*, and \*\*\* indicate significance at the 10%, 5%, and 1% level.



**Table 5: Mismatch between US Dollar Underwriting and US Regulated Assets**

<b>Sum</b>		<b>Means</b>	
Amount/n		% of total assets	% of US assets (from Fed filings)
Domestic, Exposed	3,085.1	33.3%	44.4%
Domestic, Nonexposed	1,007.3	44.0%	44.0%
Foreign, Exposed	3,474.1	26.5%	459.5%
Foreign, Nonexposed	725.6	8.4%	363.7%
<b>Sum</b>		<b>Means</b>	
Revolver Only		% of total assets	% of US assets (from Fed filings)
Domestic, Exposed	1,591.6	18.7%	27.7%
Domestic, Nonexposed	491.2	20.5%	20.5%
Foreign, Exposed	1,593.8	12.5%	178.2%
Foreign, Nonexposed	325.7	2.4%	88.4%
<b>Sum</b>		<b>Means</b>	
25%* Revolver + 5%*Term Loans		% of total assets	% of US assets (from Fed filings)
Domestic, Exposed	472.6	5.4%	7.8%
Domestic, Nonexposed	148.6	6.3%	6.3%
Foreign, Exposed	492.5	3.8%	58.6%
Foreign, Nonexposed	101.4	0.9%	35.9%

The sample includes all outstanding US Dollar currency denominated loans in LPC made by the 567 banks in our panel, defined as any facility with a start date before August 9, 2007 and an end date after August 9, 2007 (n=162, 555 facility-lenders). Revolvers with maturities of less and greater than one year are grouped as Revolvers; all other facilities loan types are grouped as Term Loans. *Domestic, Exposed* are domestic headquartered banks with exposure to US ABCP; *Domestic, Nonexposed* are domestic headquartered banks with no exposure to US ABCP; *Foreign, Exposed* are foreign headquartered banks with exposure to US ABCP; *Foreign, Nonexposed* are foreign headquartered banks with no exposure to US ABCP. The sum total of outstanding amounts, as well as mean outstanding amounts as a percentage of total bank assets and US bank assets.

**Table 6: Summary Statistics Banks with US ABCP Exposure, Change in Syndicated Lending Terms, by bank type and currency**

	US \$ Loans								All US \$ Loans			
	Foreign				US							
	N	Mean	Std. Dev	Change in Mean	N	Mean	Std. Dev	Change in Mean	N	Mean	Std. Dev	Change in Mean
<b><i>Pre-Paribas</i></b>												
Loan amount (\$m)	3,182	959.1	324.4		3,836	772.8	260.4		9,751	753.30	1,196.06	
Spread (bps)	3,182	135.3	47.8		3,836	151.5	39.9		9,751	158.71	124.72	
Maturity (yrs)	3,182	4.9	0.6		3,836	5.1	0.3		9,751	5.02	1.49	
<b><i>Post-Paribas</i></b>												
Loan amount (\$m)	1,324	757.2	300.5	-201.9	1,545	824.5	326.6	51.7	4,088	762.48	1,124.79	9.19
Spread (bps)	1,324	129.8	77.0	-5.5	1,545	157.3	52.0	5.9	4,088	138.61	122.01	-20.10
Maturity (yrs)	1,324	4.8	1.0	-0.1	1,545	5.7	2.7	0.7	4,088	5.01	9.34	-0.01

  

	Euro/GBP Loans								All Euro/GDP Loans			
	Foreign				US							
	N	Mean	Std. Dev	Change in Mean	N	Mean	Std. Dev	Change in Mean	N	Mean	Std. Dev	Change in Mean
<b><i>Pre-Paribas</i></b>												
Loan amount (\$m)	365	988.5	576.5		74	825.3	594.1		604	956.44	1,465.54	
Spread (bps)	365	180.6	68.9		74	210.2	38.2		604	205.86	168.51	
Maturity (yrs)	365	5.6	1.4		74	5.8	1.1		604	5.93	2.58	
<b><i>Post-Paribas</i></b>												
Loan amount (\$m)	155	1,160.9	1118.5	172.4	33	1,987.4	1744.8	1,162.1	262	1,384.62	2,444.81	428.18
Spread (bps)	155	118.4	47.1	-62.2	33	159.0	161.0	-51.2	262	145.75	135.66	-60.10
Maturity (yrs)	155	5.3	1.2	-0.3	33	4.9	2.2	-1.0	262	5.67	1.97	-0.26

Table 6 shows lending summary statistics by banks with US ABCP Exposure (first two sections) and by all banks (rightmost section). The sample is the 14,705 underwritten between January 1 and December 11, 2007, before and after August 9, 2007 denominated in US dollars and in Euros or British Pounds made by the 567 banks in our panel. Statistics are presented for banks with exposure to US ABCP by US Dollar and Euro/GBP denominated loans, as well as for all US Dollar and Euro/GBP denominated loans in the right most columns. Loan amount is the amount of the loan facility in millions of US dollars. Euro loans are converted by LPC using the currency conversion rate at the facility start date. Spread is the all-in-drawn spread from LPC in basis points. Maturity is the maturity of the loan in years.

**Table 7: Spread, Amount, Maturity and Rating Before and After the ABCP Shock**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent Variable:	Spread		Amount		Maturity		Rating	
Post	-22.64 (22.0)	-97.78*** (35.4)	0.192 (0.31)	0.705 (0.54)	-8.157 (8.89)	-40.24* (21.2)	-3.325 (2.40)	-5.170 (4.03)
USD Dummy * Post	25.75 (22.3)	100.7*** (35.6)	-0.220 (0.31)	-0.696 (0.54)	6.608 (9.54)	40.44* (23.2)	3.441 (2.45)	5.222 (4.06)
US ABCP Exposure * Post	26.42 (16.5)	82.03*** (31.5)	-0.223 (0.23)	-0.0326 (0.45)	-4.354 (5.71)	12.24 (8.70)	1.107 (1.56)	-0.305 (3.35)
USD Dummy * US ABCP Exposure * Post	-18.29 (16.6)	-72.85** (31.8)	0.277 (0.23)	0.113 (0.45)	9.321 (7.53)	-9.253 (8.87)	-1.336 (1.57)	0.0524 (3.37)
Foreign * Post		95.27*** (35.3)		-0.713 (0.47)		39.58* (21.5)		3.124 (3.58)
Foreign * US ABCP Exposure * Post		-72.43** (35.0)		-0.128 (0.45)		-20.97 (13.0)		0.405 (4.08)
USD Dummy * Foreign * Post		-95.09*** (36.3)		0.573 (0.48)		-46.53* (26.3)		-3.031 (3.64)
USD Dummy * US ABCP Exposure * Foreign * Post		70.18* (36.0)		0.124 (0.46)		28.37* (16.3)		-0.258 (4.10)
<i>Controls:</i>								
USD Dummy * Foreign		24.60 (25.9)		-0.342 (0.31)		4.834 (5.75)		-2.153 (2.11)
USD Dummy * US ABCP Exposure		9.124 (22.4)		0.172 (0.29)		3.003 (7.79)		0.271 (2.29)
USD Dummy * Foreign * US ABCP Exposure		-16.76 (25.3)		-0.0538 (0.33)		-4.553 (6.47)		-1.888 (2.39)
USD Dummy	19.03 (14.9)	3.138 (23.8)	-0.583*** (0.17)	-0.407 (0.30)	3.849 (5.92)	0.357 (7.52)	-4.685*** (1.37)	-2.250 (1.90)
<i>Fixed Effects</i>								
Loan Level Controls (inc. rating)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Lender Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Other loan characteristic controls	Amt, Maturity	Amt, Maturity	Spread, Maturity	Spread, Maturity	Spread, Amount	Spread, Amount	No	No
<i>Marginal Effects – Exposed</i>								
Domestic Lender, USD Loan	11.24	12.10	0.03	0.09	3.42	3.19	-0.11	-0.20
Domestic Lender, Euro Loan	3.78	-15.75	-0.03	0.67	-12.51	-28.00	-2.22	-5.48
Foreign Lender, USD Loan	11.24	10.03	0.03	-0.05	3.42	3.64	-0.11	0.04
Foreign Lender, Euro Loan	3.78	7.09	-0.03	-0.17	-12.51	-9.39	-2.22	-1.95
<i>Marginal Effects – Not Exposed</i>								
Domestic Lender, USD Loan	3.11	2.92	-0.03	0.01	-1.55	0.20	0.12	0.05
Domestic Lender, Euro Loan	-22.64	-97.78	0.192	0.705	-8.157	-40.24	-3.325	-5.170
Foreign Lender, USD Loan	3.11	3.10	-0.03	-0.13	-1.55	-6.75	0.12	0.15
Foreign Lender, Euro Loan	-22.64	-2.51	0.192	-0.01	-8.157	-0.66	-3.325	-2.05
Observations	14,705	14,705	14,705	14,705	14,705	14,705	14,705	14,705
Adjusted R <sup>2</sup>	0.57	0.57	0.52	0.52	0.06	0.06	0.30	0.30

Table 7 shows the results of regressions for 14,705 syndicated loan facilities underwritten in 2007 with the following dependent variables: *Spread*, the all-in-drawn spread in basis points, *Amount*, the log of facility amount in millions, *Maturity*, the maturity of the facility in months, and *Rating*, the loan rating. Each specification includes the following loan level controls: A dummy variable if the loan is denominated in US dollars, sales divided by loan amount, unsecured dummy, number of lenders in the facility, number of facilities in the loan package, sales/ total loan amount), and fixed effects for 2-digit SIC code of borrower, deal purpose and loan type. In addition controls for *loan rating* (dummy variable) and *lender fixed effects* are included in all specifications. Detailed definitions of variables are provided in Appendix A. Explanatory variables include: *Post* is equal to one if the loan start date occurs after August 9, 2007. *Foreign* is equal to one if the bank is foreign. *US ABCP Exposure* is a dummy variable equal to 1 if the lender has any US ABCP exposure. Robust standard errors clustered on package are in parentheses; \*, \*\*, and \*\*\* indicate significance at the 10%, 5%, and 1% level.

**Table 8: Extensive Margin**

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable	Refinance Dummy					
Observation Level	Lender-Package			Lender-Facility		
Sample	Full	Revolver Only	Risky Loans	Full	Revolver Only	Risky Loans
Foreign	0.604 (0.433)	-0.072 (0.390)	0.833 (0.811)	0.562 (0.550)	-0.033 (0.396)	0.665 (0.863)
US ABCP Exposure	0.551 (0.393)	-0.135 (0.354)	0.699 (0.757)	0.509 (0.454)	-0.127 (0.350)	0.555 (0.703)
Foreign*US ABCP Exposure	-0.538 (0.398)	0.269 (0.400)	-0.634 (0.800)	-0.378 (0.486)	0.243 (0.386)	-0.275 (0.760)
Time to maturity (Orig Loan)	-0.000 (0.000)	0.000 (0.000)	0.000** (0.000)	-0.000 (0.000)	-0.000 (0.000)	0.000 (0.000)
Must Refinance Dummy	0.361 (0.246)	-0.466 (0.364)	0.818** (0.342)	0.441* (0.267)	-0.331 (0.375)	-0.117 (0.374)
BAA-AAA Spread (Original Loan)	-0.015*** (0.003)	-0.016*** (0.004)	-0.013*** (0.005)	-0.014*** (0.004)	-0.015*** (0.004)	-0.017*** (0.008)
Loan Rating (Original Loan)	-0.088*** (0.021)	-0.049* (0.025)	-0.025 (0.041)	-0.097*** (0.023)	-0.059** (0.024)	-0.020 (0.051)
Unrated Loan Dummy (Original Loan)	0.335 (0.339)	-0.041 (0.350)	0.158 (0.487)	0.758** (0.356)	0.027 (0.344)	0.318 (0.599)
USD Dummy	0.858* (0.464)	0.383 (0.502)	1.055 (0.767)	0.730 (0.557)	0.426 (0.514)	0.673 (0.842)
USD Dummy*Foreign	-0.737 (0.451)	-0.006 (0.405)	-0.645 (0.834)	-0.478 (0.571)	-0.039 (0.408)	-0.125 (0.902)
USD Dummy*US ABCP Exposure	-0.513 (0.389)	0.137 (0.355)	-0.687 (0.752)	-0.460 (0.453)	0.129 (0.350)	-0.544 (0.706)
USD Dummy*Foreign*US ABCP Exposure	0.475 (0.408)	-0.249 (0.423)	0.070 (0.795)	0.191 (0.502)	-0.217 (0.406)	-0.432 (0.777)
Fixed Effects						
Industry (2-digit SIC code)	Yes	Yes	Yes	Yes	Yes	Yes
Loan Level Controls						
Loan Rating	Yes	Yes	Yes	Yes	Yes	Yes
Deal Purpose	Yes	Yes	Yes	Yes	Yes	Yes
Loan Type	No	No	No	Yes	No	Yes
Lender Fixed Effects	No	No	No	No	No	No
Observations	65,662	47,537	37,847	136,595	52,375	92,138

Table 8 shows results from estimating a Cox proportional hazard regression on a binary dependent variable, *Refinancing*, equal to one if a loan is refinanced between August 9 and December 11, 2007. The sample is 136,595 loan facility-lender observations (52,375 revolvers) and 65,662 package-lender observations (47-537 revolvers) underwritten in the five years preceding the ABCP shock that were outstanding as of August 9, 2007.

Specifications (2) and (5) include only revolvers, and (3) and (6) include only risky loans defined as those loans with all-in-drawn spreads greater than 150 basis points. All specifications include fixed effects for 2-digit SIC code of borrower, deal purpose and loan type. *USD Dummy* is equal to one if the facility (package) is denominated in US dollars and 0 otherwise. *Foreign* is equal to one if the bank is foreign. *US ABCP Exposure* is a dummy variable equal to 1 if the lender has any US ABCP exposure. Specifications (5) and (6) include the binary variable, *Must Refinance*, which is equal to 1 if loans have a maturity date between August 9 and December 11, 2011 and its interactions with the variables of interest. Robust standard errors clustered by borrower are in parentheses; \*, \*\*, and \*\*\* indicate significance at the 10%, 5%, and 1% level.

