Liquidity management of U.S. global banks: Internal capital markets in the great recession

Nicola Cetorelli
Federal Reserve Bank of New York

Linda S. Goldberg
Federal Reserve Bank of New York and NBER

March 2, 2012

Abstract

The recent crisis highlighted the importance of globally active banks in linking markets. One channel for this linkage is through how these banks manage liquidity across their entire banking organization. We document that funds regularly flow between parent banks and their affiliates in diverse foreign markets. We show that parent banks, when hit by a funding shock, reallocate liquidity in the organization according to a locational pecking order. Affiliate locations that are important for the parent bank revenue streams are relatively protected from liquidity reallocations in the organization, while traditional funding locations are more extensively used to buffer shocks to the parent bank balance sheets.

Keywords: Bank, global, liquidity, transmission, capital markets, crisis, contagion

JEL Classification: E44, F36, G32

The views expressed in this paper are those of the individual authors and do not necessarily reflect the position of the Federal Reserve Bank of New York or the Federal Reserve System. This paper was initially prepared for the NBER-Sloan Conference on Global Financial Crisis. The initial version of this paper appeared as NBER working paper 17355 (August 2011). We appreciate the thoughtful comments of Kristin Forbes, Jeffrey Frankel, Patrick McGuire, Phillip Schnabl, Beatrice Weder, participants at the NBER Sloan conference at Bretton Woods, and three anonymous referees. Address correspondences to Linda S. Goldberg, Federal Reserve Bank of NY, Research Department, 33 Liberty St, New York, N.Y. 10045. email: Linda.Goldberg@ny.frb.org or Nicola.Cetorelli@ny.frb.org . We thank Leslie Shen, Benjamin Mandel, and Lindsay Mollineaux for excellent research assistance.

I. Introduction.

The role of global banks as vehicle of international shock transmission has been clearly highlighted during the Great Recession. A crisis that started affecting a specific subset of banks, all from predominantly developed countries, spread across the globe in good part as a result of significant cross-border balance sheet adjustments of such banks (e.g., Acharya and Schnabl 2010, Cetorelli and Goldberg 2011, Shin 2011).

That global banks can contribute to international shock transmission is *per se* not a new notion. Basic evidence attesting their role goes back at least as far as Peek and Rosengren (1997, 2000). However, there have been at least two important developments since those contributions. The first is that the scale and scope of the consequences of global banking activity is an order of magnitude greater today than it was in the 1990s. As Figure 1 shows, the international claims of global banks from BIS reporting countries (highly representative of the universe) have grown ten-fold over the last twenty years, peaking at about $25 Trillion in 2007.

Second, we have developed a better understanding of the specific mechanics of international transmission associated with global banking. In other words, not only do we know that global banks contribute to international shock transmission, but we know better *how* that happens. Traditional channels of transmission through cross border lending are well-documented. Yet, recent decades have increasingly been characterized by banks setting up and serving clients through branches and subsidiaries established in foreign locations (Claessens and van Horen 2012). Applying basic corporate finance principles, it has been conjectured that global banks can respond to a funding shock by activating capital markets *internal* to the organization, reallocating funds across locations in response to their relative needs. Cetorelli and Goldberg (Forthcoming) have documented such dynamics, providing evidence of actual cross border, *intra*-bank funding flows between global banks' head offices and their foreign operations in response to domestic shocks. This internal funding reallocation can lead to adjustments in the *external* investments (e.g. lending and securities holdings) of their foreign operations, thus establishing another specific channel of international transmission. Importantly, this feature of internal funding allocation has been shown to be a common characteristic of global banks' conduct, observable in "normal" times and not just in times of crisis.

Hence, global banks manage liquidity on a global scale, and this liquidity management aspect is at the heart of the contribution of global banks to international shock transmission. But

how is this done exactly? What are the main drivers behind the choice of internal funding reallocation? And does it make a difference when we think of the global implications associated with global banking? In this paper we dig deeper on the subject of global banks liquidity management by exploring alternative conjectures regarding the decision rules driving cross-locations, and internal funding dynamics. We argue that an understanding of the liquidity management of global banks is of first order importance for refining our predictions on the consequences of global banking.

We explore two conjectures regarding the mode of operation of global banks' internal capital markets. The first conjecture reflects a common assertion about the underlying dynamics governing global banks' cross border flows: namely, that such flows generate "destabilizing … floods and droughts" (IMF, 2010, p. 4), where global banks move funds in and out of foreign markets in "ebb and flow" (Pontines and Siregar, 2012, p. 25), with fund surges and reversals cutting across destination countries and/or regions of the world. These types of broad patterns of "capital bonanzas" and "sudden stops" are documented in Reinhart and Rogoff (2009) and Forbes and Warnock (2011). A common argument is that this tendency in global banking flows is less related to specific foreign market conditions and more driven by the centralized decisions and needs of the industrialized countries. Within banking, the head offices of banks would be the source of such flows. This intuition is central, for instance, in the models of global banking in Bruno and Shin (2011) and Devereux and Yetman (2010), where international flows are driven mainly by head office balance sheet management considerations.

This view has a direct implication regarding global banks' liquidity management strategies: in the event of an adverse shock to the balance sheet of the head office, we should expect, on average, a common pattern of internal fund outflows from foreign locations to support the head office, irrespective of foreign location-specific considerations. Put differently, this conjecture implies that the domestic operations of a global bank are at the top of an *organizational pecking order,* with a priority in parent bank balance sheet support vis-à-vis the bank's foreign operations.[1]

[1] Embedded in this view is the existence of an underlying "home bias" in global banking activity. Giannetti and Laeven (2012, Forthcoming) have documented a "flight home" tendency by global banks during the 2007-2008 crisis, which implied a shrinking across the board of their foreign balance sheet in support of their domestic activities. Rose and Wieladek (2011) argue that non-British banks disproportionately contracted lending in the United Kingdom and increased interest rates in the Great Recession.

A second alternative conjecture is possible. This second conjecture posits that global banks operate instead following a *locational pecking order* in determining funding allocations internationally. In other words, there is no obvious unconditional organizational preference in determining global banks' liquidity management strategies, which instead are motivated by banks' overall global portfolio considerations. This second conjecture implies that liquidity management is driven by each bank's assessment of the marginal conditions of each foreign location along both funding and investment dimensions. A global bank is expected to draw more support from locations that normally attract local funds – reflecting an advantage in external market access - while also shielding locations that the bank considers important for lending activity – thus indicating better returns on investments. Such locations may even be net receivers of funding support from the head office. Hence, this second conjecture implies that banks manage their liquidity allocations taking into overall consideration the relative costs and benefits of the marginal dollar at each location in which it operates.[2]

Testing which conjecture may better reflect the data is important for refining our understanding of global banks' behavior and for formulating predictions about the impact of global banking. For instance, if global banks pull funds across foreign locations when hit by a domestic shock, then global banking activity can be expected to contribute to *directional* swings in gross international capital flows.[3] This consideration is relevant for macro-economic stability and for policy decisions of host country regulators, for whom the presence of global banks in operation on their territory could be seen as a potential source of local market volatility. The concerns are reflected in some recent efforts by host country regulators to restrict global banks in their ability to manage liquidity globally, pushing instead for a model centered around so-called "local funding pools" or some "ring-fencing" of activity (see, e.g., Bank for International Settlements, CGFS 2010 and ICB 2011).

The predictions for international capital flows and host markets are quite different if global banks' liquidity management is driven instead by more nuanced criteria associated with bank-specific funding and investment priorities. In this case, the decision rule governing liquidity management strategies is likely to be *heterogeneous* across otherwise similar global banks.

[2] Claessens and van Horen (2012) find that foreign banks enhance the stability of credit creation in markets where they have majority market share.

[3] In the event of a shock common across developed-country banks, we would expect large gross flows between developed and developing markets.

While aggregate gross flows can be very large, there may not be an immediately obvious direction associated with the global bank's funding disruption across affiliate locations. Moreover, a host country may be a funding source for a given foreign bank but operate as an investment sink for others.

In order to test these conjectures, we analyze confidential regulatory data filed by all U.S. global banks. This data allows the tracing of internal capital flows between parent banks and their affiliates across the globe. To our knowledge, this data have never been explored for research purposes. We provide evidence of a locational pecking order in global banks' liquidity management. Cross-location internal flows very much depend on bank-specific considerations of local funding and investment priorities. Some foreign markets are, for particular parent banks, "core investment markets" that remain destinations for funding. Other foreign locations serve instead as "core funding markets" that would send even larger net flows to parent banks in times of parent balance sheet disturbances. We show that this channel is economically important to both the parent banks and the foreign markets in which their affiliates are located.

Overall, our analysis provides a richer understanding of the role of banks in international transmission, building on insights from early studies by Peek and Rosengren (1997, 2000) and van Rijckeghem and Weder (2003). Other more recent insights pertain to transmission through syndicated and other forms of cross-border lending,[4] as well as through internal capital market flows between affiliated banks[5]. What we show in the present paper is that there are important nuances to the way these internal capital markets are used by banks. Global banks play significant roles in host markets, spreading out the consequences of positive and negative shocks to the balance sheets of the head office. The type of transmission that occurs through internal capital markets has a strong bank-specific and location-specific component. Consequences for aggregate flows vis-à-vis specific host markets depend on the local affiliates' positions in the locational pecking orders of their own banking organizations and on the balance sheet properties of those organizations.

[4] For example, see Chui, Domanski, Kugler and Shek (2010), Giannetti and Laeven (2012), and De Haas and van Horen (2012). A more extensive literature uses data on cross-border and local lending activity.

[5] Indirect evidence is provided by de Haas and Lleyveld (2009) and Cetorelli and Goldberg (2011), while direct evidence is provided by Cetorelli and Goldberg (forthcoming) and Cetorelli and Goldberg (2012).

II. U.S. global banks

Internationally active banks in the United States are required to file the Federal Financial Institutions Examinations Council (FFIEC) Country Exposure Report (FFIEC 009).[6] The 009 is filed on a quarterly basis, with banks required to provide details for each country in the world. While the report is strictly confidential and therefore micro details cannot be made public, information aggregated across banks is available.[7] However, the detailed information, by bank and by foreign country, is precisely the type of data needed to further our understanding of liquidity management strategies of globally active banks. To the best of our knowledge this dataset has never been used before for such research purposes.

The report contains information on three components of interest to our analysis:[8] 1) a bank's total claims vis-à-vis counterparties in a given country. Claims in turn are broken down by types as cross-border, i.e. originated by the bank from some location other than the destination market, or local, i.e. originated by its offices operating in a given country;[9] 2) local liabilities, which captures any external borrowing on the balance sheet of its offices in operation in that country; 3) the net internal position (credit or debit) of these foreign offices vis-à-vis the rest of the banking organization. By convention, the report asks banks to report this position as a net liability, which we refer to as the $NetDueTo_{ijt}$ position of the foreign offices of bank i in country j in quarter t. Hence, this position can be reported as a negative number in case the foreign offices are net lenders to the rest of their banking organization.

Since our analytical focus is on liquidity management across the global bank and through internal capital markets, we apply screens to the full dataset to restrict the sample of banks to those that actually have foreign offices. By bank and by its foreign location, we look for the existence of either positive local liabilities (for example, this would reflect local deposits taken at the affiliate location) or positive internal borrowing or lending with the rest of the organization. Starting with 2006Q1 and continuing through 2010Q1, this set of screens identifies more than 50

[6] This report must be filed by every U.S. chartered, insured, commercial bank in the United States, including the District of Columbia, Puerto Rico, and US territories and possessions, or it's holding company, provided that the bank (or holding company) has, on a fully consolidated bank basis, total outstanding claims on residents of foreign countries exceeding $30 million in aggregate. The reporters can be U.S. owned banks or foreign bank subsidiaries in the United States.

[7] The FFIEC releases quarterly summary tables within the E.16 report "Country Exposure Lending Survey."

[8] The form also requires banks to provide detail on off-balance sheet positions in each country, but this information is outside the scope of our analysis.

[9] Claims include bank loans, lease financing, and other investments. Details are available at www.ffiec.gov/pdf/FFIEC_forms/FFIEC009_201103_i.pdf

unique banks over the full interval, although closer to 42 at any single date (Table 1). As Table 1 shows, this group of banks is split between U.S.-owned and those that are U.S. chartered subsidiaries of foreign organizations.[10]

In every quarter, at least 30 of the unique banks have affiliates in at least two foreign countries.[11] The foreign affiliates are broadly dispersed around the globe and span a total of 121 countries. Many foreign owned banks report an affiliate in their parent country. Visualizations of the geographic distribution of the foreign affiliates of U.S. banks[12] are provided in Figures 2 and 3. Figure 2 shows counts of how many U.S. banks had affiliates in any foreign country at 2007Q2 (the raw data is in Appendix Table 1). A large number of U.S. banks have affiliates in Canada, Hong Kong, Ireland, Taiwan, and the United Kingdom, in addition to the Cayman Islands.[13] A large number of countries, fully half of the sample, have affiliates of only two or three of the U.S. banks. Figure 3 shows the relative dollar value of total U.S. bank positions in these countries, with the value capturing the sum of the total of affiliated bank local liabilities (in both local and foreign currency) plus net inflows from the parent organization (without adjustment if there are net outflows). There is a wide variance in the total value of the U.S. bank liabilities with each of these countries, with the median country having about $5 billion in U.S. bank liabilities and the largest countries at over $100 billion.

What are some of the characteristics of these global banks? For this information we access a broader set of regulatory reports filed by the individual banks or their bank holding companies.[14] The type of information we consider covers parent bank size (total assets),

[10] For the purpose of this table and the econometric analysis which follows, we exclude the large institutions that became banks or had a change in entity status late in 2008Q4 and in 2009Q1/Q2. Examples of such excluded banks are Goldman, Morgan, GMAC, CIT, and American Express.

[11] The choice of a specific mode of entry depends on a number of factors, including taxes, regulatory restrictions on entry and branching, preferences for retail operations, and economic and political risks, as well as growth rates and investment opportunities, as established by Focarelli and Pozzolo (2005). Cerutti, Dell'Ariccia, and Martinez Peria (2007) provided econometric analysis of such choices for entry into Latin America and Eastern Europe. From the vantage point of countries choosing an optimal structure of foreign entry in their own markets, Fiechter et al. (2011) argues that there is no one-size-fits-all conclusion. Claessens and van Horen (2008) show that foreign entry is associated with common language, similar legal systems and banking regulations, and geographic proximity.

[12] "U.S. banks" refer to all legal entities in the United States as indicated in Table 1, regardless of whether these are U.S. owned or foreign owned.

[13] The Cayman Islands are an offshore financial center frequently used by U.S. banks. According to the International Monetary Fund, there are 46 countries that meet the definition of offshore financial center. See Zerome (2007) for a discussion of alternative approaches to identifying OFCs.

[14] From the Federal Financial Institutions Examinations Council (FFIEC) 031 report and the Y9-C, we used the following variables: total assets (RCFD2170), total loans (RCFD2122), total foreign loans (RCFN2122), equity (RCFD3210), and liquid assets constructed as the sum of securities, trading assets, and (RCFD1754+RCFD3545+RCFD1350). From the FFIEC 009, we have for the bank (or holding company), on a

solvency, liquidity, and aggregate foreign lending. Summary statistics for the U.S. banks, are presented in the upper panel of Table 2. We show this information for a pre-crisis interval, as well as 2009Q2 and 2010Q2.

Pre-crisis (2006Q1 – 2007Q2), the median global bank is moderately sized, at over $50 billion in assets. However, the size distribution is very broad across all banks. The mean asset size is about $200 billion, reflecting the presence of some very large banks in the sample. Across all banks, liquid asset shares are typically under 3 percent of total assets, although some banks had liquidity over 5 percent prior. Bank equity or solvency ratios were generally close to 9 to 10 percent of bank total assets. Foreign lending (to unrelated entities) typically ranged from 2.5 to 5 percent of total bank assets.

International *intra*-bank flows are captured by bank reports of their "total net due from," which is total net internal lending (if positive) or borrowing (if negative) vis-a-vis all its foreign offices. The pre-crisis internal capital market balances (in absolute value) were typically in the range of 2 to 8 percent of assets. Some parent banks were net lenders to their foreign affiliates, while others were net borrowers. Indeed, a stark illustration of the absolute scale of internal capital flows for these banks is provided in Figure 4, which shows gross intra-bank flows on the same axes as gross *interbank* flows, which reflect bank borrowing and lending internationally with unaffiliated banks. These flows are of a similar order of magnitude. Similar observations on scale can be made on the basis of Treasury International Capital System data, which show that over half of total U.S. bank claims and liabilities internationally are vis-à-vis their own affiliates.[15]

As the crisis progressed and then abated, some of the balance sheet characteristics of these banks evolved substantially. The data columns for 2009Q2 and 2010Q2 show a noteworthy contraction in the foreign loan share, an observation consistent with a more inward focus of lending activity and also observed for banks from other countries. Also, the use of internal

---

fully consolidated bank basis, the following variables: total cross border claims constructed as the sum of cross border claims by banks, public, and other (C915+C916+C917), total foreign office claims on local residents in non-local and local currency constructed as the sum of foreign office claims by banks, public, and other, and foreign office claims in local currency (C918+C919+C920+C922), net due to (or due from) own related offices in other countries (8595), and foreign office liabilities constructed as the sum of foreign office liabilities in non-local currency and in local currency (C938+C939).

[15] Thanks to Gian Maria Milesi-Ferretti for the relevant computations based on TIC bank claims and liabilities. These data are not exactly comparable to our underlying data. The bank flows that are captured are vis-à-vis all affiliates in foreign markets, not just bank affiliates.

capital markets by banks changed over time. Some banks reduced their reliance on this channel, while others expanded intra-bank flows.

The lower panel of Table 2 provides details on the offices of the U.S. reporting banks in foreign countries. There are approximately 550 bank-affiliate country observations during each quarter.[16] There is a bi-modal distribution of affiliates per bank. Some banks have affiliates only in one or two foreign countries; many other U.S. global banks have affiliates in over twenty countries, with some in excess of 50 countries.

The funding models of these affiliated banks also appear bi-modal. Some bank affiliates raise about 75 percent of their financing locally. Other affiliate locations raise very little local funding. There is also a broad distribution of importance of affiliate markets in the international lending activity of each parent bank. The median location has about 6 percent of parent international lending, which encompasses both cross-border loans and the claims extended by the local affiliates. These totals are not always primarily driven by local lending by affiliates. Indeed, one interesting observation is that about 40 percent of bank-affiliate locations had no local lending. For these affiliates, funds collected domestically are used either for affiliate cross-border lending activity or as funding flows to parent banks that may not necessarily return as cross-border investments from the rest of the organization. Additionally, across countries there is a broad distribution of loan maturities. The long term share is typically close to 15 percent for the median bank while the mean level across banks is closer to 30 percent of all loans.

The information presented emphasizes dimensions along which each affiliate market might be assessed as "core" or "periphery" from the vantage point of the parent organization. We highlight two dimensions: the funding of the affiliates, and their relative importance in the total foreign lending of the parent organization. These respectively are viewed as indicative of the degree to which a specific affiliate market, from the vantage point of a parent bank, is a core or periphery location from the vantage point of sourcing funding or directing resources for investment activity. Given our conjectures about organizational pecking order and locational pecking order, our empirical strategy uses this information in hypothesis testing.

[16] The units of observation are total within country affiliates of individual banks, instead of individual branches or subsidiaries.

III. Analysis

An essential prerequisite to perform an analysis of how global banks manage liquidity across the organization is the identification of a source of change in parent bank funding needs that can be considered as reasonably exogenous from the perspective of the unit of observation. In our analysis, this unit will be the internal capital market flows of each foreign location of each bank with its parent organization. Lacking an identified shock, observed changes in local internal funding patterns, either inflows or outflows, could just be driven by variations in local market conditions. For instance, fund inflows to or outflows from a given location could just be incidental to a change in local investment opportunities or change in access to local borrowing sources, without being informative of an underlying liquidity management of the whole banking organization. We provide the identification strategy before turning to the econometric specification.

III.1. Identifying the funding shocks timing and incidence

The crisis of 2007-2008 offers special opportunities to run quasi-natural experiments on the internal funding dimension of global banks. We propose two separate "shock" events that can be considered as drivers of subsequent funding dynamics within banks and that can be considered as exogenous from the perspective of U.S. global banks foreign locations. Both shocks specifically impact the operations of the head offices of the banks and can be reasonably assumed to be orthogonal to both the pre-existing choice of operation in any given foreign country by each bank and exogenous to specific events occurring in any of these locations.

First shock. As it has been widely described, the initial stage of the financial crisis materialized in the second half of 2007 in the form of a broad shortage of U.S. dollar funding.[17] Banks and other financial institutions, both in the U.S. and abroad, had been accumulating substantial dollar denominated assets, mainly long-term securities derived from real estate activity and had funded such positions mainly through short-term dollar liabilities. Commercial paper had grown to be the largest instrument in total U.S. short-term funding, with the asset-backed commercial paper

[17] For example, these issues are discussed at length in the IMF's *Global Financial Stability Report* (October 2010).

(ABCP) component representing the lion share for many institutions.[18] While ABCP is issued by entities (conduits) that are distinct from the financial institutions in our sample, some of those entities operate with the direct backing of such institutions, through the existence of liquidity or credit enhancements. Indeed, large commercial banks, mainly U.S. and European, were among the largest providers of such enhancements. Many ABCP entities were unable to continue issuing new paper in the second half of 2007 after investors became concerned about the overall quality of the assets backing commercial paper issuance. The off-balance sheet commitments by banks led to massive absorption of the assets of the conduits they had sponsored. Thus, the *ex-ante* large off-balance sheet exposures to the ABCP market materialized as a severe funding shock to the balance sheets of many banks.

We use the pre-crisis level of exposure to the ABCP market of each bank in our sample relative to bank equity capital as a metric capturing the funding shock after August 2007. This exposure seems reasonably unrelated to market conditions in the many foreign locations where the same global banks also have operations. This identification approach follows the treatment in other recent studies, including Acharya, Schnabl and Suarez (forthcoming), Acharya and Schnabl (2010), and Cetorelli and Goldberg (2012). As in those studies, bank *i* specific balance sheet shocks to funding are constructed as: $Shock_i$ = (Total ABCP exposure / total equity)$_i$ calculated at end of December 2006 to proxy each bank *i*'s funding shock experienced in August 2007. [19]

Second shock. At the end of December 2007, recognizing the exceptional severity of the crisis the Federal Reserve introduced an emergency facility, the Term Auction Facility (TAF), aimed specifically at providing funding to banking institutions that had experienced funding disruptions. The establishment of the TAF was unprecedented and very significant in size.[20] Hence, we consider the introduction of the TAF as a *positive funding shock* to the parent, and

[18] Excellent discussions and details are available in Acharya and Schnabl (2010) and Acharya, Schnabl and Suarez (forthcoming). Corroborating the severity of the balance sheet disruption, Acharya, Schnabl and Suarez (2009) documented a significant impact on market valuation for those banks with larger exposure as a share of equity capital in subsequent months.

[19] We thank Viral Acharya and Philipp Schnabl for sharing this data. The conduit group comes from Moody's Investor Service reports. Acharya and Schnabl match conduits to sponsoring organizations and then match the sponsor to the consolidated financial company. We match these consolidated financial companies to the U.S filers of regulatory report FFIEC 009. If there are U.S. filers without Moody's rated conduits, we treat the ABCP value as zero.

[20] See Armentier, Krieger, and McAndrews (2008) for details on the facility.

posit that the same banks with higher *ex ante* ABCP exposure were the ones to have the stress similarly relieved through this facility.

The identification of a second funding shock, especially one of opposite sign, provides multiple benefits to the analysis. First, it enriches the study by documenting the detailed dynamics in global banking flows during an extraordinary historical period. Second, by having two separate events we reduce the likelihood that the results we document are driven by confounding factors and/or determined by conditions violating the exogeneity assumption regarding the foreign markets where banks operate.

We have purposefully chosen a period for our analysis that excludes what is arguably the most extreme episode of the crisis and which is associated with the bankruptcy announcement of Lehman Brothers in mid September 2008. The crisis dramatically broadened and deepened. The policy responses also were broad-based, with the adoption or the significant expansion of policies of support to bank balance sheets in at least 34 countries besides the United States, spanning Europe, Asia and Latin America (Levy and Shich, 2010, Table 1). Moreover, there was enhanced coordination of policy across countries, as in the expansion of dollar swap lines of the Federal Reserve with 14 central banks (Goldberg, Kennedy and Miu, 2011) and the Vienna Initiative within Europe to provide funding to banks with operations in Eastern European countries. While the post-Lehman bankruptcy period was characterized by extreme swings in internal capital market flows between banks and their affiliates, from an econometric perspective it does not fit the conditions required to satisfy our methodological approach. In particular, it seems hard to impose a condition of exogeneity of the shock event from the perspective of the foreign markets where banks operate. Nonetheless, since the *aggregate* flow of internal funds is an order of magnitude larger for a period of time after Lehman compared with before, in the results section we provide a description of those internal funding dynamics and comment on the fit with our working conjectures.

III.2. Identifying bank-specific core funding and core investment markets

The underlying hypothesis is that banks that were *ex ante* more exposed to ABCP conduits are the one that experienced the largest funding shocks after August 2007. Recall that our goal is to inform which of the two conjectures characterize liquidity management across the global bank. The first conjecture, that global banks manage liquidity according to an *organizational* pecking

order, thus subordinating foreign operations to the needs of the head office, predicts a repatriation of funds across locations irrespective of local markets considerations.[21] The second conjecture instead suggests that liquidity management takes into account the role of each local market along the two fundamental dimensions of funding and investment. Specifically, a bank faced with an adverse shock should be drawing more funds from locations that are especially advantaged at accessing local funding, while it should protect locations that are important investment choices. In addition, global banks are likely to differ among one another both in terms of their overall reliance on foreign market liabilities and in terms of intensity in their foreign investments. We exploit all of these differences in our econometric analysis.

We propose the following definitions: 1) a *core funding* market *j* for bank *i* is a market where the local foreign offices in *j* fund their operations largely through local borrowing; 2) a *core investment* market *j* for bank *i* is a market that represents a large share of overall foreign investments (claims) of bank *i.* Operationally, we construct the two variables as:

$$CoreFunding_{ijt} = (Local\ liabilities_{ijt} / Total\ liabilities_{ijt}) \text{ and}$$

$$Core\ Investment_{ijt} = (Total\ claims_{ijt} / Total\ claims_{it}).$$

III.3. Econometric specifications

The main variable of interest in our analysis is the net internal funding position of the foreign offices of a bank *i* located in country *j*. This position $NetDueTo_{ijt}$, is reported as a positive number in a given quarter *t* if foreign offices in country *j* have a net debit position (i.e. they are net internal borrowers) with the rest of the banking organization, and negative if they have instead a net credit position (they are net internal lenders).

Exploiting the identification of the two shock events, we define three separate sub-periods: a *pre-crisis* period, including quarters beginning in 2006Q1 through 2007Q2; an intermediate period for quarters 2007Q3-2007Q4; and a third period for quarters 2008Q1-2008Q2. We compute the first difference of $NetDueTo_{ijt}$ over each of two consecutive sub-periods, calculated as averages in the respective "post" periods minus averages in the "pre" period. This gives us two separate first difference variables,

[21] In the context of this paper, *local* always refers to the location of the foreign affiliates of a U.S. parent bank. Hence, local is synonymous with foreign country.

$$\Delta NetDueTo^{1}_{ijt} = NetDueTo_{ijt|average(2007Q3-2007Q4)} - NetDueTo_{ijt|average(2006Q1-2007Q2)} \text{ and}$$

$$\Delta NetDueTo^{2}_{ijt} = NetDueTo_{ijt|average(2008Q1-2008Q2)} - NetDueTo_{ijt|average(2007Q3-2007Q4)} .$$

Each first difference variable tells us whether a given location *j* experienced a net inflow or outflow of funds vis-à-vis the rest of the organization in the immediate period subsequent each of the two identified shock events. $\Delta NetDueTo_{ijt} > 0 \Delta$ means offices in location *j* are on net *taking in* more funds than during the previous period, while $\Delta NetDueTo_{ijt} < 0$ means they are on net *sending out* more funds to the rest of the organization.[22]

The basic econometric specification, which nests the two conjectures, takes the form:

$$\Delta NetDueTo^{p}_{ij} = \beta_0 + \beta_1 \cdot Shock_i + \beta_2 \cdot X_{it} + \beta_3 \cdot X_j + \beta_4 \cdot X_{ijt} + \varepsilon_{ijt} \qquad (1)$$

where $$\beta_1 = \gamma_0 + \gamma_1 \cdot X_{it} + \gamma_2 \cdot X_j + \gamma_3 \cdot X_{ijt}$$

The dependent variable is defined with the superscript *p* indicating either the first or the second sub-periods. $Shock_i$ is the ABCP exposure to equity ratio of bank *i* at end of 2006. X_{it}, X_j and X_{ijt} are, respectively, vectors of bank *i* characteristics, country *j* characteristics, and indicators associated specifically with foreign offices of bank *i* in market *j*. These vectors act as controls to soak up variability in the dependent variable and are defined in section IV. Note that the core funding and investment variables are contained in the vector X_{ijt}. The X_{it} and X_{ijt} variables are calculated as *ex ante* with respect to the time difference for each respective left hand side variable. So, for instance, for $p = 1$ the vectors are constructed as averages over the quarters 2006Q1-2007Q2, and for $p = 2$ as averages over the quarters 2007Q3-2007Q4.

In order to better understand the economic specification, consider the specification as first applied to the $p = 1$ data. Consider the underlying hypothesis that banks with higher *ex ante* exposure to ABCP conduits were the ones that experienced the largest initial funding shocks. What does this imply for internal funding dynamics? The first conjecture, that global banks manage liquidity according to an organizational pecking order, thus subordinating foreign operations to the needs of the head office, predicts a repatriation of funds across locations ($\Delta NetDueTo^{1}_{ij} < 0$) irrespective of local markets considerations. Hence, this implies a negative

[22] There are two ways $\Delta NetDueTo_{ijt} > 0$ can be achieved. This can occur when an office in location *j* is receiving more support from the parent organization than had previously been the case. Alternatively, this office can be sending smaller amounts of funds to the parent than had previously occurred.

sign on the γ_0 estimated coefficient of the $Shock_i$ variable and zero values for the γ_3 estimated coefficients for the interactions of $Shock_i$ with the core funding and core investment variables contained in the vector X_{ijt}.

The second conjecture instead predicts heterogeneous internal funding dynamics across foreign locations of the same bank along the funding and investment dimensions. Hence, the γ_3 estimated interaction of $Shock_i$ with $CoreFunding_{ijt}$ should be negatively signed while the interaction of $Shock_i$ with $CoreInvestment_{ijt}$ should be positively signed, with both statistically different from zero.

For $p = 2$ instead we expect a reversal in the direction of the funding flows to contribute to restore the pre-crisis cross-market allocations. Again, according to the first conjecture the funding relief should be reflected in an across the board inflow of funding to foreign offices. Hence, the γ_0 coefficient of $Shock_i$ should be positive and significant but the γ_3 terms of interaction with $CoreFunding_{ijt}$ and $CoreInvestment_{ijt}$ should be zero. Conversely, the second conjecture signs these interactions as positive and negative, respectively.

IV. Results

Overall, the empirical strategy seeks identification by comparing the change in net internal funding positions of banks' foreign offices when the parent banks are differentiated according to their ex ante vulnerability to the funding disruption. We differentiate further across each bank's foreign offices along the funding and investment dimensions. This difference approach allows us to achieve econometric identification while at the same time controlling for other factors that may explain internal funding dynamics but are not directly related to the working conjectures about bank liquidity management across affiliates. The specification is flexible enough to accommodate the inclusion of bank- or country- indicator variables, or both. In this section we present results across a range of different specifications applied to each shock episode.

Among the controls we include for each bank *i* are: total asset size, asset liquidity (the ratio of liquid assets to total assets), and capitalization (the total ratio of total equity to total asset) and a measure of concentration of the bank's foreign claims across countries. The size, liquidity, and capitalization controls should account for the differential abilities of banks in absorbing the original funding shock within the head office's overall balance sheet. Larger, more liquid, and

better capitalized banks are generally viewed as having better access to strategies that can help offset some exogenous shocks, as argued by Kashyap and Stein (2000) among others. The variable constructed to reflect concentration of foreign claims captures some ex ante variability across banks in their global business model. A more "dispersed" distribution of claims may indicate a model where many locations are similarly important for the bottom line of the banking organization, and this may affect overall liquidity management strategies.

Among the country controls are a measure of physical distance of a destination country from the U.S. (from Rose and Spiegel (2009), the exchange rate regime, whether pegged or unpegged with the U.S. dollar (Ilzetski, Reinhart and Rogoff 2009, 2011), and the Chinn and Ito (2008) measure of capital account openness. These variables should capture different frictions in moving funds in and out of a given location as already explored in other studies of international capital flows, such as Portes and Rey (2005) and Buch (2005). If global penetration is based on a geographical distance model, more physically distant locations may be considered more peripheral to the overall business of U.S. global banks and be more prone to funding flow changes vis-à-vis the head offices. We also include an indicator of whether a country is an off-shore financial center (OFC), according to the IMF classification.

Finally, among the controls for each bank's foreign office in each bank-specific location, we include – in addition to the core funding and core investment variables – a measure of the total size of the foreign affiliates, as proxied by their total reported liabilities. We also include a measure of the proportion of claims in a given location that have maturity shorter than a year. The idea is that for given size of claims in a location, shorter term claims should be an indication of a lesser level of investment commitment than long term ones.

For all three sets of controls, the regression specifications also include their interactions with the $Shock_i$ variable, thus allowing not only for a direct effect from these controls, but also for a differential effect of the underlying exposure variable across the control variable dimensions. For instance, while a bank with larger ex ante ABCP exposure is presumed to suffer more from the funding disruption, the balance sheet impact is permitted to be different for larger than for smaller banks.

IV.1. First shock regressions

We begin presenting the empirical results from the first shock specifications, on the changes in net internal funding experienced by banks in the immediate aftermath of the August 2007 crisis and prior to the institution of the TAF. Table 3 summarizes our findings.

As discussed, the regression coefficients of interest are on the bank-specific variable $Shock_i$ (the ratio of pre-crisis ABCP exposure to equity of each bank *i*) and its interactions with $CoreFunding_{ijt}$ and with $CoreInvestment_{ijt}$. For expositional convenience, Table 3 reports only the estimated coefficients for these three regressors and contains only qualitative information about the inclusion or exclusion in the various regressions of the vectors of controls.[23]

Column (a) reports the estimates from the basic specification of equation (1). All controls, in levels and interactions, are included. The results of this first regression show that banks whose head offices were more exposed to the funding shock are the one to mobilize, on average and across locations, larger funding outflows from their foreign offices (the estimated coefficient of the $Shock_i$ variable is negative and statistically significant). The estimates also indicate substantial heterogeneity *within* bank and *across* foreign office locations. In particular, conditional on the funding shock, funding changes to support the organization are larger from core funding locations. By contrast, parent banks provide relative protection to those locations that are considered as core from an investment perspective.[24] The results support the conjecture that global banks' liquidity management is not exclusively the result of some basic organizational pecking order, with foreign operations subordinated to head office positions. Instead, the liquidity reallocation is the result of *each bank's* specific mode of engagement in each different foreign market. Changes in internal funding flows are not characterized by a common, aggregate "direction", all pointing toward the home country.

It is reasonable to consider whether this first specification provides unbiased estimates of the parameters of interest. There is an underlying assumption of exogeneity of the funding shock $Shock_i$ with respect to dynamics in the foreign markets where banks operate. Yet, if the funding disruption experienced after August 2007 was the result of events that were broader and more global in scope than presumed, the observed common reallocation of funds away from the

[23] The full set of quantitative results is available as an on-line appendix.

[24] Note that because we are measuring differential changes in position, a positive coefficient does not necessarily mean a net inflow of funds to core investment locations, but it could just mean that such locations contribute relatively less with respect to the bank's "periphery" investment locations.

foreign locations could result from changes in the balance sheet prospects at those locations rather than from balance sheet disruptions experienced by banks' head offices. In this case, the estimated coefficient on $Shock_i$ would overstate the basic claim that funds are allocated in response to head office funding needs. Another source of bias could arise if banks with different ex ante levels of ABCP exposures systematically entered countries with fundamentals that make internal capital market reallocations more difficult to achieve. In this case, the estimated coefficient on $Shock_i$ would understate the true extent of liquidity management. [25] Hence, scale and direction of a potential bias on the estimate of $Shock_i$ may be uncertain a priori.

We assess the potential bias of the results in column (a) by comparing them with results from an alternative, fixed effect specification in which a vector of country indicator variables are included. In this specification, identification on the $Shock_i$ coefficient is obtained by comparing the differential response of two banks, both with operations in the same locations, but with different levels of shock exposure. Any funding dynamic driven by a country-specific shock reaction would be absorbed by the indicator variables. This fixed effect alternative specification is conceptually similar to that presented in Khwaja and Mian (2008). Column (b) shows the results from this regression.[26] The estimated coefficient of $Shock_i$ is larger (more negative) than in column (a), suggesting that the exogeneity presumption seems reasonable and that the scale of the funding adjustments is even more conspicuous than what the raw data would suggest. The coefficients on the interaction terms are not very different from those in column (a) and remain highly significant.[27]

Another concern about specification (a) is that perhaps off-shore financial centers are fundamentally different as U.S. bank affiliates and these are included in our full sample of affiliate locations. Such locations could bias the results toward supporting the conjecture of an existing organizational pecking order, with the off-shore locations more likely to be subordinated

[25] Note that this argument should not affect the interpretation of the terms of interaction with core funding and investment, since identification here is obtained *within* a bank, across its locations, and because any given location can be different for any two banks along the funding and investment dimensions.

[26] Note that technically the fixed effect regression does not use information from those markets where there is only one bank in operation. For this reason, Khwaja and Mian (2008) removes such observations from the sample when running regressions with fixed effects. Running the regression on the whole sample does not affect the point estimate, although the difference in sample size will have an impact on the calculation of the standard errors. In practice, in our analysis this is really a marginal issue, since only a handful of observations are dropped. We have run the specifications both ways and the impact on the standard errors is indeed second order. For this reason, in the table we report the fixed effect regressions on the full sample.

[27] Also, because of the country fixed effects we had to drop the country controls.

to the head office needs. At the same time, off-shore centers may have little to do with local funding and local investment considerations, as Lane and Milesi-Ferretti (2010) emphasize in discussing the pure intermediary roles of many such locations, and could weaken the interpretation of the core funding and core investment terms of interaction. Both specifications in column (a) and (b) already contained a dummy variable for off-shore centers and its interaction with $Shock_i$. However, as a further robustness check we report in column (c) an alternative specification where we drop the records for the most prevalent off-shore center in our sample, which is The Cayman Islands.[28] We provide the results of the specification without country fixed effects, but the results are qualitatively the same to those obtained using the specification with country fixed effects. The estimated coefficients remain significant and maintain the same sign and size pattern as previously, indicating that the patterns in internal funding dynamics described by our business model variables are not driven by patterns particular to this location.

Another possibility is that specification (a) does not exhaustively control for *bank*-specific characteristics, so that we are attributing the observed funding dynamics to specific liquidity management strategies, when instead those patterns may be driven by certain omitted bank variables. To address this potential concern we include specification (d) which contains bank indicator variables. By such inclusion, the specification omits the basic $Shock_i$ variable (and all other variables in the vector of bank controls), rendering this specification as a robustness check specific to the core funding and core investment interaction terms.[29] As shown in column (d), the coefficients maintain sign and significance and remain of comparable size.

As a final test of robustness, we sought to exclude from the sample the records of those U.S. chartered banking institutions that are subsidiaries of foreign entities (e.g., Banco Santander or HSBC). This exclusion allows for the possibility that the foreign-owned banks are different in that they could have access to a broader group of affiliates and internal capital market transfers that are beyond the scope of U.S. regulatory reporting requirements. All else equal, we might expect stronger results on the U.S.-owned reporters for which we can observe the entire network of foreign banking affiliates. Moreover, it is clear from examination of the percent allocations of the largest U.S. money market funds that the shocks to bank funding during this period were

[28] We also ran an alternative specification where we dropped *all* off-shore center records and even in this case the results remained qualitatively similar.

[29] A similar note to the one related to the inclusion of country fixed effect is in order. The identification with bank fixed effects is only obtained from records for those banks that are active in at least two countries. Again, there is no impact on the point estimates and the impact on the standard errors is marginal.

especially pronounced among U.S. banks.[30] For brevity, we present the results of this alternative specification based on the benchmark of column (a). The results confirm the column (a) findings and actually show somewhat larger estimated coefficients, consistent with our priors.

What is the economic significance of the differences arising from the core funding and core investment variables? Using column (a) results, and starting with the $CoreFunding_{ijt}$ coefficient, we calculate the additional change in internal borrowing/lending for a bank at the 75th percentile of the ABCP exposure distribution (a high ex-ante ABCP exposure bank), between a location at the 75th percentile and at the 25th percentile of the $CoreFunding_{ijt}$ distribution. The average $NetDueTo_{ijt}$ value prior to the crisis for banks of high ex-ante exposure, in relatively important core funding locations, was -$1,094 million. In other words, the average high core-funding location for such banks would be a $1 billion net creditor vis-à-vis the rest of its banking organization. Performing the above mentioned exercise, this location expands its net internal flow to the parent organization by $586 million more compared with a location at the 25th percentile of the funding distribution. Given the pre-crisis average position for such locations, relatively important local funding locations expanded their support to the rest of the organization by about 53 percent.

Likewise, we calculate the differential change in internal capital market flows for locations at the 75th percentile of the $CoreInvestment_{ijt}$ distribution relative to locations at the 25th percentile. The average $NetDueTo_{ijt}$ value prior to the crisis for banks of high ex-ante ABCP exposure and in important core investment locations +$1,902 million, thus indicating that such locations would normally be a destination of internal funding flows from (or carry a net liability position vis-à-vis) the rest of their organization. The computation indicates that during the first phase of the crisis, a core investment location contributed about $236 million less to the internal funding reallocation toward the rest of the organization -- about 12 percent of their pre-crisis position --compared with a more peripheral investment location. As noted earlier, the positive sign for the loan share interaction may not imply an actual increase in internal *borrowing* for the core locations in response to the shock to the parent, but rather a smaller decline in support from parents at these locations.

Hence, these econometric results show that global banks clearly consider the roles played by the foreign locations where they have operations along both the funding and the investment

[30] We thank an anonymous referee for making this point and providing documentation.

dimensions. Importantly, a funding shock hitting many global banks at the same time does not necessarily imply a common tendency across these banks in the aggregate direction of international funding flows vis-à-vis affiliates. Indeed, it may not even imply a common pattern for funds in or out of a particular location. To illustrate this point, Figure 5 shows the pattern of predicted internal funding flows in and out of each country where the banks in our sample have operations, as a result of this first shock. More precisely, the figure shows aggregate predicted values of the dependent variable ($\Delta NetDueTo^1_{ij}$) from the benchmark regression results in Table 3 column (a). The predicted values are aggregated by country across all banks into two separate subsets: the sum across all banks displaying predicted net inflows to that country, and the sum across all banks with predicted net outflows from that country. Both numbers are then scaled by the total predicted gross flow for that same country (the sum of the absolute values of the two components). For each country, the stacked lines (blue for aggregate net inflows, red for aggregate net outflows from a location) indicate the relative contributions to the total gross and therefore sum to 100 percent. The figure provides an interesting illustration of the business models at work in liquidity reallocation by global banks. There are some countries where funds either exclusively flow out (the left tail of the chart) or exclusively flow in (the right tale). Yet, in most countries there are some banks that are net recipients of funding from their organizations, while other banks are net providers of funds.

While Figure 5 shows the prediction based on the full model in specification (a), we also examined just the contribution of $CoreFunding_{ijt}$ and $CoreInvestment_{ijt}$ (not shown). These two variables contribute very significantly to the overall funding dynamics, both across banks and across locations.

IV.2. Second shock regressions

We perform a similar range of tests using the data for the second shock episode. Recall that this second episode treats the introduction of the TAF as a *positive* funding shock and we posit that those same banks with high pre-crisis ABCP exposure, those that had been hit the most post August 2007, would be the ones with strongest balance-sheet relief from this innovation. Consequently, we expect at least some reversal of internal liquidity flows, in the direction of restoring the pre-crisis net positions across foreign affiliate locations. We find that, as in the results from the first shock event during the crisis, U.S. global banks continued to adopt a

strategy in liquidity management that accounted for the characteristics of each location of operation along both the funding and the investment dimensions. The related internal funding reallocations continued to be large as a proportion of the average initial internal balances carried across foreign offices.

Table 4 presents the results. The structure of the table is the same as the previous one, but now the dependent variable $\Delta NetDueTo_{ijt}^{2}$ captures the changes internal funding positions between 2008Q1-Q2 and 2007Q3-Q4, and all the regressors are constructed as ex ante averages over the 2007Q3-Q4 period.

The results in column (a) remain consistent with the locational pecking order conjecture. In this case – with a positive funding shock – we observe on average larger net *inflows* of internal funds from the high $Shock_i$ banks (a positive and significant coefficient γ_0 on $Shock_i$) and continuing heterogeneity along the funding and investment dimensions with the expected *reversed* signs compared to the results of Table 3. The results are consistent across specifications. For instance, column (b) with country fixed effects included reports a larger coefficient for $Shock_i$, evidence of a certain downward bias in the benchmark OLS specification of column (a). Hence, the second shock event also seems to be reasonably exogenous. Despite some higher imprecision in the estimate of the coefficient for the $CoreInvestment_{ijt}$ variable in the column (c) specification that drops Cayman Islands observations, this second set of results corroborates the main findings and strengthens our understanding of global banks' liquidity management strategies.

The computed economic significance for this second shock event are a comparable order of magnitude to what observed for the first shock event, but opposite in direction. Using column (a) results we calculate that the location at the 75th percentile of $CoreFunding_{ijt}$ "received" about $1,148 million more internal funds than a location at the 25th percentile. The average $NetDueTo_{ijt}$ position in the second half of 2007 (the *pre* period in this exercise) for banks of high ex-ante exposure, in relatively important core funding locations, was $2,534 million. Hence, the net flow back to these affiliates corresponded to a significant 45 percent of their total internal position.

Likewise, we calculate the differential change in internal capital market flows for locations at the 75th percentile of the $CoreInvestment_{ijt}$ distribution relative to locations at the 25th percentile. This differential effect amounted to about $154 million. The average $NetDueTo_{ijt}$ position in the second half of 2007 for banks of high ex-ante exposure and in important core

investment locations was $4,731 million. Hence, the net change corresponded to about 3 percent of their previous position.

IV.3. The Lehman event

While the Lehman bankruptcy event was associated with the largest disruptions of the 2007-2009 crisis, perhaps exactly because of the broad resonance it does not lend itself naturally to provide identification power to our methodology. It is more difficult to defend the presumption of exogeneity of the shock event. Moreover, the severity and the complexity of the crisis as well as the number and variety of policy countermeasures announced and implemented, suggest that the patterns observed in the data may not lend themselves to a description of global bank liquidity management strategies.

Nonetheless, at least for descriptive purposes we repeat our analysis defining a third shock period with much weaker priors on the key variables explored for the first two shock episodes. We compare the change in internal funding between 2008Q1-Q2 and 2008Q3-Q4, and run the same set of regressions as presented in Tables 3 and 4.[31] Across specifications and as expected, we do not find any significant effects from the terms of interaction of $Shock_i$ and both $CoreFunding_{ijt}$ and $CoreInvestment_{ijt}$. The coefficient on $Shock_i$ resulted as positive and significant, consistent with internal funding flows toward the parent organization. However, and interestingly, the fixed effect specification generates coefficients *smaller* in magnitude than with the basic OLS (and the estimate also loses statistical significance). These results are supportive of the baseline specifications generating biased coefficients, which as we expected, indicates that part of what is observed in the data arises due to concomitant changes occurring in the foreign markets. This corroborates our expectation that, over this particular and dramatic period, it is harder to defend the exogeneity presumption. Even setting aside this consideration, the regression results indicate that the coefficient on $Shock_i$ is not very robust across specifications.

A possible additional reason for this finding is that in the aftermath of the Lehman event the stresses affecting all the banks in our sample were not well described by their pre-crisis exposure to the ABCP market. For additional insight into the episode, we also ran a stripped-down model specification which excluded the $Shock_i$ variable and all its interactions from the regression. In this case, we only look for basic correlations in the data, reflecting the relationship

[31] Results are available as Appendix Tables 3 and 4.

between internal funding flows and the various bank, country, and foreign office variables included in our other specifications. The results of this exercise suggest very little explanatory power from such variables over this period, other than perhaps from the indicator variable of the offshore financial centers. These results can be interpreted as showing that much of the internal funding movements immediately post-Lehman were driven less by economic fundamentals and more by the emergency nature of the period. Alternatively, it could be that quarterly data -- such as that collected for regulatory purposes and used in our study – are inadequate for capturing the models at work in the immediate aftermath of the Lehman bankruptcy and surrounding the multitude of policy interventions that were implemented in that period.

V. Conclusions

The recent crisis highlighted the importance of globally active banks in linking markets. One channel for this linkage is through how these banks manage liquidity across their entire banking organization. We document that funds regularly flow between parent banks and their affiliates in diverse foreign markets. We show that parent banks, when hit by a funding shock, reallocate liquidity in the organization according to a locational pecking order. Affiliate locations that are important for the parent bank revenue streams are relatively protected from liquidity reallocations in the organization, while traditional funding locations are more extensively used to buffer shocks to the parent bank balance sheets.

These findings contribute to refining our understanding of global banking and its role on shock international transmission, and it informs the policy debate around the regulation of global banks. From "host country" perspective, i.e. a country that allows foreign banking activity, macroeconomic transmission from foreign banks may be less a function of its overall *openness* and more related to the particular distribution of foreign banks engaged in their economy, the balance sheets of those foreign banks, and the mode of operations within the country.

References:

Acharya, Viral and Philipp Schnabl. 2010. "Do Global Banks Spread Global Imbalances? The Case of Asset-Backed Commercial Paper During the Financial Crisis of 2007-09." *IMF Economic Review* vol. 58 (1) pp .37-73 (August).

Acharya, Viral, Philipp Schnabl, and Gustavo Suarez. Forthcoming. "Securitization without Risk Transfer" *Journal of Financial Economics*.

Armantier, Olivier, Sandy Krieger, and Jamie McAndrews, 2008. "The Federal Reserve's Term Auction Facility". Federal Reserve Bank of New York *Current Issues in Economics and Finance*, July vol.14 (5).

Bank for International Settlements, Committee on the Global Financial System, 2010. "The functioning and resilience of cross-border funding markets," CGFS Publications no. 37 (March).

Bruno, Valentina and Hyun Song Shin. 2011. "Capital Flows, Cross-Border Banking and Global Liquidity." working paper, Princeton University.

Buch, Claudia, 2005. "Distance and International Banking," *Review of International Economics*, vol. 13(4), pages 787-804, 09.

Cerutti, Eugenio, Giovanni Dell-Ariccia, and Maria Soledad Martinez Peria, 2007. "How Banks Go Abroad: Branches or Subsidiaries?" *Journal of Banking and Finance*, vol. 31(6), pages 1669-1692.

Cetorelli, Nicola and Linda Goldberg, "Banking Globalization, Monetary Transmission, and the Lending Channel," forthcoming in the *Journal of Finance*.

Cetorelli, Nicola and Linda Goldberg. 2012. "Follow the Money: Quantifying Domestic Effects of Foreign Bank Shocks in the Great Recession" *American Economic Review, Papers and Proceedings* vol. 102 (3) (March).

Cetorelli, Nicola and Linda Goldberg, 2011. "Global Banks and International Shock Transmission: Evidence from the Crisis," International Monetary Fund *Economic Review*, vol. 59, pages 41-76.

Chinn, Menzie and Hiro Ito, 2008. "A New Measure of Financial Openness," *Journal of Comparative Policy Analysis,* vol. 10(3), pages 307-320. Data: Chinn-Ito (2006) Financial Openness measure (data extending to 2008, updated July 2010).

Chui, Michael, Dietrich Domanski, Peter Kugler, and Jimmy Shek, 2010. "The Collapse of International Bank Finance During the Crisis: Evidence from Syndicated Loan Markets" Bank for International Settlements *Quarterly Review* (September).

Claessens, Stijn and Neeltje van Horen, 2008. "Location Decisions of Foreign Banks and Institutional Competitive Advantage," *DNB Working Papers* no. 172, Netherlands Central Bank.

Claessens, Stijn and Neeltje van Horen, 2012. "Foreign Banks: Trends, Impact and Financial Stability." International Monetary Fund Working Paper, WP/12/10 (January).

De Haas, Ralph and Iman Lelyveld, 2009. "Internal Capital Markets and Lending by Multinational Bank Subsidiaries," forthcoming in the *Journal of Financial Intermediations.*

Devereux, Michael and James Yetman. 2010. "Leverage constraints and the international transmission of shocks." *Journal of Money, Credit, and Banking* vol. 42 pages 71-105.

Fiechter, Jonathan, Inci Otker-Robe, Anna Ilyina, Michael Hsu, Andre Santos, and Jay Surti, 2011. "Subsidiaries or Branches: Does One Size Fit All?" IMF Staff Discussion Note SDN/11/04 (March).

Focarelli, Dario and Alberto Pozzolo, 2005. "Where Do Banks Expand Abroad? An Empirical Analysis," *Journal of Business*, vol. 78(6), pages 2435-2464.

Forbes, Kristin and Francis Warnock. 2011. "Capital Flow Waves: Surges, Stops, Flight, and Retrenchment." NBER working paper #17351.

Giannetti, Mariassunta and Luc Laeven, 2012. "The Flight Home Effect: Evidence from the Syndicated Loan Market during Financial Crises," forthcoming.

Goldberg, Linda, Craig Kennedy, and Jason Miu. 2011. Central Bank Dollar Swap Lines and Overseas Dollar Funding Costs" *Economic Policy Review* (May).

ICB Independent Commission on Banking. 2011. *Final Report Recommendations* (United Kingdom, September).

Ilzetski, Ethan, Carmen Reinhart, and Kenneth Rogoff (2009, 2011). "The country chronologies and background material to Exchange Rate Arrangements into the 21st Century: Will the Anchor Currency Hold?"

International Monetary Fund. 2010. *Global Financial Stability Report: Sovereigns, Funding, and Systemic Liquidity* (October).

Kamil, Herman and Kulwant Rai, 2010. "The Global Credit Crunch and Foreign Banks' Lending to Emerging Markets: Why Did Latin America Fare Better?" *IMF Working Paper* WP/10/102.

Kashyap, Anil and Jeremy Stein, 2000. "What Do A Million Observations on Banks Say About the Transmission of Monetary Policy?" *American Economic Review,* vol. 90(3), pages 407-428.

Khwaja, Asim and Atif Mian, 2008. "Tracing the Impact of Bank Liquidity Shocks: Evidence from an Emerging Market," *American Economic Review,* vol. 98(4), pages 1413-1442.

Lane, Philip and Gian Maria Milesi-Ferretti. 2010. "Cross-Border Investment in Small International Financial Centers" IMF Working Paper wp/10/38.

Levy, Aviram and Sebastian Schich, 2010, "The Design of Government Guarantees for Bank Bonds: Lessons from the Recent Financial Crisis", *OECD Journal: Financial Market Trends*, 3, 1, p. 35-66.

Peek, Joe and Eric Rosengren, 1997. "The International Transmission of Financial Shocks: The Case of Japan," *American Economic Review*, vol. 87(4), pages 495-505.

Peek, Joe and Eric Rosengren, 1997. "Collateral Damage: Effects of the Japanese Bank Crisis on Real Activity in the United States", *The American Economic Review*, March 2000, 30-45.

Pontines, Victor and Reza Siregar. 2012. "How Should We Bank with Foreigners? An Empirical Assessment of Lending Behaviour of International Banks to Six East Asian Countries" CAMA working papers 2012-04 (Australian National University)

Portes, Richard and Helene Rey. 2005. "The Determinants of Cross-Border Equity Flows," *Journal of International Economics*, vol. 65 pp.269-296.

Reinhart, Carmen and Kenneth Rogoff. 2009. *This Time is Different: A Panoramic View of Eight Centuries of Financial Crises*. Princeton, NJ: Princeton University Press.

Rose, Andrew and Mark Spiegel, 2009. "International Financial Remoteness and Macroeconomic Volatility," *Journal of Development Economics,* vol. 89(2), pages 250-257.

Rose, Andrew and Tomasz Wieladek. 2011. "Financial Protectionism". NBER working paper 17073.

Shin, Hyun Song. 2011. "Global Banking Glut and Loan Risk Premium" International Monetary Fund 2011 Mundell Fleming Lecture.

Van Rijckeghem, Caroline and Beatrice Weder, 2003. "Spillovers through Banking Centers: A Panel Data Analysis of Bank Flows," *Journal of International Money and Finance*, vol. 22(4), pages 483-509.

Zorome, Ahmed, 2007. "Concept of Offshore Financial Centers: In Search of an Operational Definition," *IMF Working Paper* WP/07/87.

Table 1 Counts of U.S. banks that have foreign affiliates

	2006q1	2007q1	2008q1	2009q1	2010q1
ALL banks					
Total	42	41	39	43	44
US-owned	27	26	26	25	25
foreign-owned	15	15	13	18	19

Source: Authors' computations based on FFIEC 009 reporting by quarter.

Table 2: Basic Balance Sheet Information of U.S. Banks with Foreign Affiliates

Statistics on U.S. Banking Organization	2006Q1-2007Q2 (Avg)		2009Q2		2010Q2	
	median	mean	median	mean	median	mean
Bank asset size (billions USD)[1]	53.4	198.5	64.6	253.9	66.2	262.5
Bank solvency ratio (%)[2]	8.8	10.0	9.4	10.5	9.9	11.0
Foreign loans / Assets (%)[3]	2.0	3.7	1.4	3.5	0.9	3.0
Bank liquid assets / Total assets (%)[4]	2.3	5.0	2.5	4.4	2.6	4.9
Absolute value of Total Net Due / Assets (%)[5]	2.3	7.3	1.3	9.9	1.4	6.8
Statistics computed by Bank, across Foreign Affiliates: Compared across all bank-affiliate observations						
Number of affiliates per parent bank	2	13	2	13	2	12
Affiliate Liabilities:						
Total (millions USD)	0.7	32.8	0.4	35.9	0.5	36.7
Locally raised / Total within country (%)[6]	81.2	63.3	68.2	56.7	74.5	60.1
Affiliate Assets:						
Local claims in country / Total local claims across all countries (%)[7]	0.06	4.9	0.05	4.9	0.05	5.5
Long-term total claims in country / All total claims in country (%)[8]	11.9	27.7	16.2	30.8	11.7	27.5
Affiliate destination total claims / All total claims across countries (%)	3.9	11.6	4.6	15.6	5.0	17.1
Absolute value of Total Net Due / Liabilities (%)	32.3	82.9	35.5	151.2	28.2	54.6
Number of parent banks or bank holding companies	44		43		44	
Number of bank-affiliate country observations	566		540		540	
ABCP exposure / Equity of parent	0.0	18.0				

Source: Quarterly Call Report forms, FR Y-9C, and FFIEC 009. Note: [1]Bank asset size from series RCFD2170 of the call reports and BHCK2170 of FRY-9C. [2]Solvency is ratio of equity (RCFD3210, BHDM3210) to bank asset. [3]Foreign loans are series RCFN2122 of the call reports. (Note that no equivalents series are available for BHCs, which make up approximately 35% of the sample.) [4]Liquid assets are sum of total held-to maturity securities (RCFD1754, BHCK1754), total trading asset (RCFD3545, BHCK3545), and federal funds sold and securities purchased under agreements to resell (RCFD1350, BHCK1350). [5]Net due are from Column 4 of FFIEC009 Schedule1a. [6]Local liabilities are sum of foreign-office liability in non-local currency and in local currency (Column 1 and 2 of FFIEC009 Schedule1a). Total liabilities are sum of local liabilities plus net due inflows (positive values of Column 4 of FFIEC009 Schedule1a). [7]All claims are on immediate counterparty basis. Local claims are the sum of foreign-office claims on local residents in non-local currency by sectors and in local currency (Columns 4, 5, 6, 8 of FFIEC009 Schedule1), and cross border claims are the sum of cross-border claims by sectors (Columns 1-3 of FFIEC009 Schedule1). [8]Long-term claims are computed as the difference of total local/cross-border claims and claims of remaining maturity up to and including 1 year (Column 7 of FFIEC009 Schedule1).

Table 3 Change in Affiliate Borrowing from Parents

Testing Organizational versus Locational Pecking Order – Shock 1

	(a)	(b)	(c)	(d)	(e)
Shock $_i$	-5427.2**	-7394.9**	-4681.8*		-9697.9***
	(2356.1)	(3398.1)	(2714.1)		(3599.7)
Shock $_i$ **CoreFunding* $_{ij}$	-884.6***	-948.1**	-875.6***	-755**	-1040.7**
	(312.1)	(373.9)	(312.6)	(297.8)	(510.1)
Shock $_i$ **CoreInvestment* $_{ij}$	14419.7***	13890.4***	13945.8***	13209.1***	18814*
	(4727.8)	(4679.9)	(4898)	(4789.8)	(11403.5)
Constant	-134.0	-846.8**	-261.6	-3475.8	-510.3
	(758.7)	(386)	(841.4)	(2904.5)	(1139.1)
Bank Controls	Yes	Yes	Yes	No	Yes
Country Controls	Yes	No	Yes	Yes	Yes
Foreign Office Controls	Yes	Yes	Yes	Yes	Yes
Country FE	No	Yes	No	No	No
Bank FE	No	No	No	Yes	No
Observations	500	500	474	500	423
R-squared	0.30	0.39	0.31	0.36	0.33

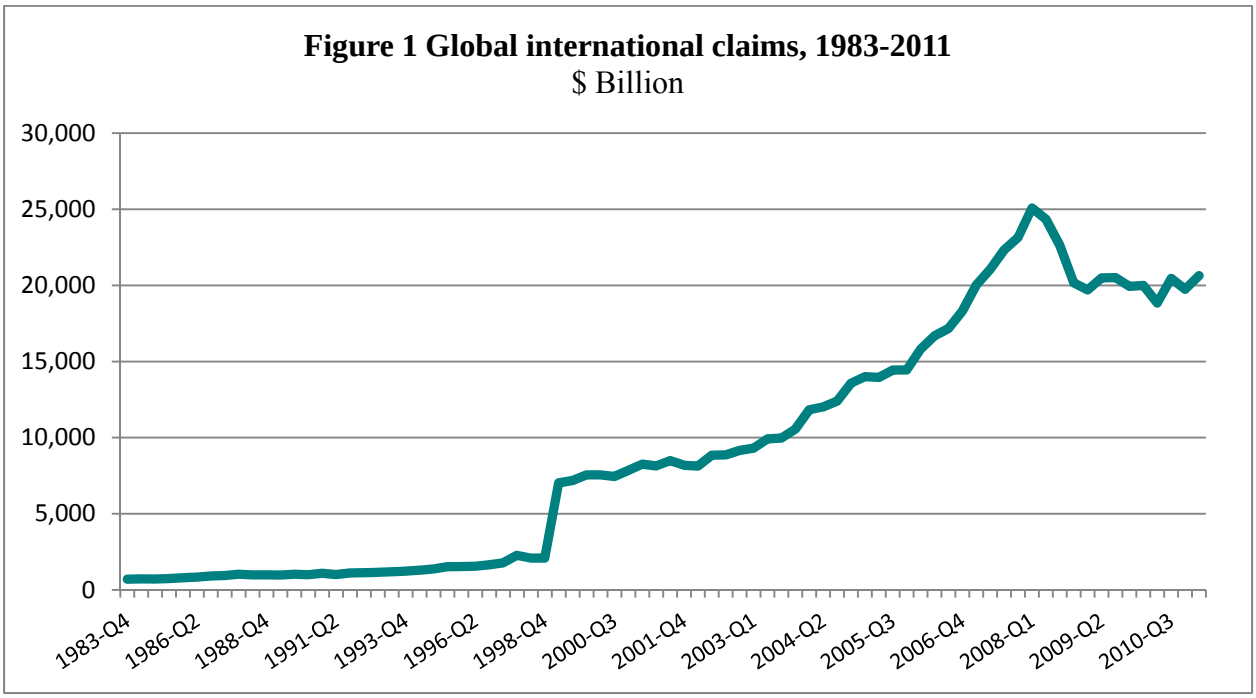
The dependent variable is the change in internal borrowing of foreign affiliates of bank i in country j between 2006q1-2007q2 and 2007q3-q4. $Shock_i$ reflects ABCP exposure, defined as the ratio of total ABCP outstanding of conduits sponsored by each bank i divided by total equity. Core Funding is the ratio of locally raised funds to total liabilities of affiliates of bank i in country j. Core Investment is the ratio of total claims of bank i in country j divided by total claims of bank i aggregated over all countries. Bank controls are total asset size, the ratio of liquid assets to total assets, the ratio of total equity to total assets, and a Herfindahl measure of the bank's foreign claims across countries. Country controls are the distance of the country from the United States, an exchange rate regime indicator, a measure of capital account openness, and the IMF offshore financial center indicator. Foreign office controls are total liabilities for each location, and the ratio of short-term claims to total claims. All controls are also interacted with the shock variable. Column (b) includes country fixed effects (hence country controls are excluded). Column (c) is the specification where we removed records where the affiliate was located in the Cayman Islands. Column (d) includes bank fixed effects (hence all bank controls are excluded). Column (e) excludes records for US-chartered banks with foreign parents. Standard errors are clustered by banks. ***, ** and * indicate significance at the 1%, 5%, and 10% level, respectively.

Table 4 Change in Affiliate Borrowing from Parents

Testing Organizational versus Locational Pecking Order – Shock 2

	(a)	(b)	(c)	(d)	(e)
Shock $_i$	5700.4***	6497.7***	3002.7		6218.4**
	(1700.9)	(2403.7)	(1842)		(2595.1)
*Shock $_i$ *CoreFunding $_{ij}$*	1673***	1679.3***	633.5***	1720.3***	2052.2***
	(381.4)	(405.4)	(148.8)	(408.7)	(476.9)
*Shock $_i$ *CoreInvestment $_{ij}$*	-9436.5***	-8993.9***	-2205.7	-9828***	-12930**
	(3216.3)	(3295.8)	(2471.4)	(3345)	(5443.8)
Constant	-785.3	398.0	-66.5	-784.1	-886.9
	(559)	(390.8)	(543.4)	(794.6)	(973.9)
Bank Controls	Yes	Yes	Yes	No	Yes
Country Controls	Yes	No	Yes	Yes	Yes
Foreign Office Controls	Yes	Yes	Yes	Yes	Yes
Country FE	No	Yes	No	No	No
Bank FE	No	No	No	Yes	No
Observations	513	513	485	513	438
R-squared	0.28	0.37	0.34	0.30	0.33

The dependent variable is the change in internal borrowing of foreign affiliates of bank i in country j between 2007q3-q4 and 2008q1-q2. Shock$_i$ reflects ABCP exposure, defined as the ratio of total ABCP outstanding of conduits sponsored by each bank i divided by total equity. Core Funding is the ratio of locally raised funds to total liabilities of affiliates of bank i in country j. Core Investment is the ratio of total claims of bank i in country j divided by total claims of bank i aggregated over all countries. Bank controls are total asset size, the ratio of liquid assets to total assets, the ratio of total equity to total assets, and a Herfindahl measure of the bank's foreign claims across countries. Country controls are the distance of the country from the United States, an exchange rate regime indicator, a measure of capital account openness, and the IMF offshore financial center indicator. Foreign office controls are total liabilities for each location, and the ratio of short-term claims to total claims. All controls are also interacted with the shock variable. Column (b) includes country fixed effects (hence country controls are excluded). Column (c) is the specification where we removed records where the affiliate was located in the Cayman Islands. Column (d) includes bank fixed effects (hence all bank controls are excluded). Column (e) excludes records for US-chartered banks with foreign parents. Standard errors are clustered by banks. ***, ** and * indicate significance at the 1%, 5%, and 10% level, respectively.



Note: Bank for International Settlements, International Banking Statistics

Figure 2: Number of U.S. Banks with Affiliates in Countries

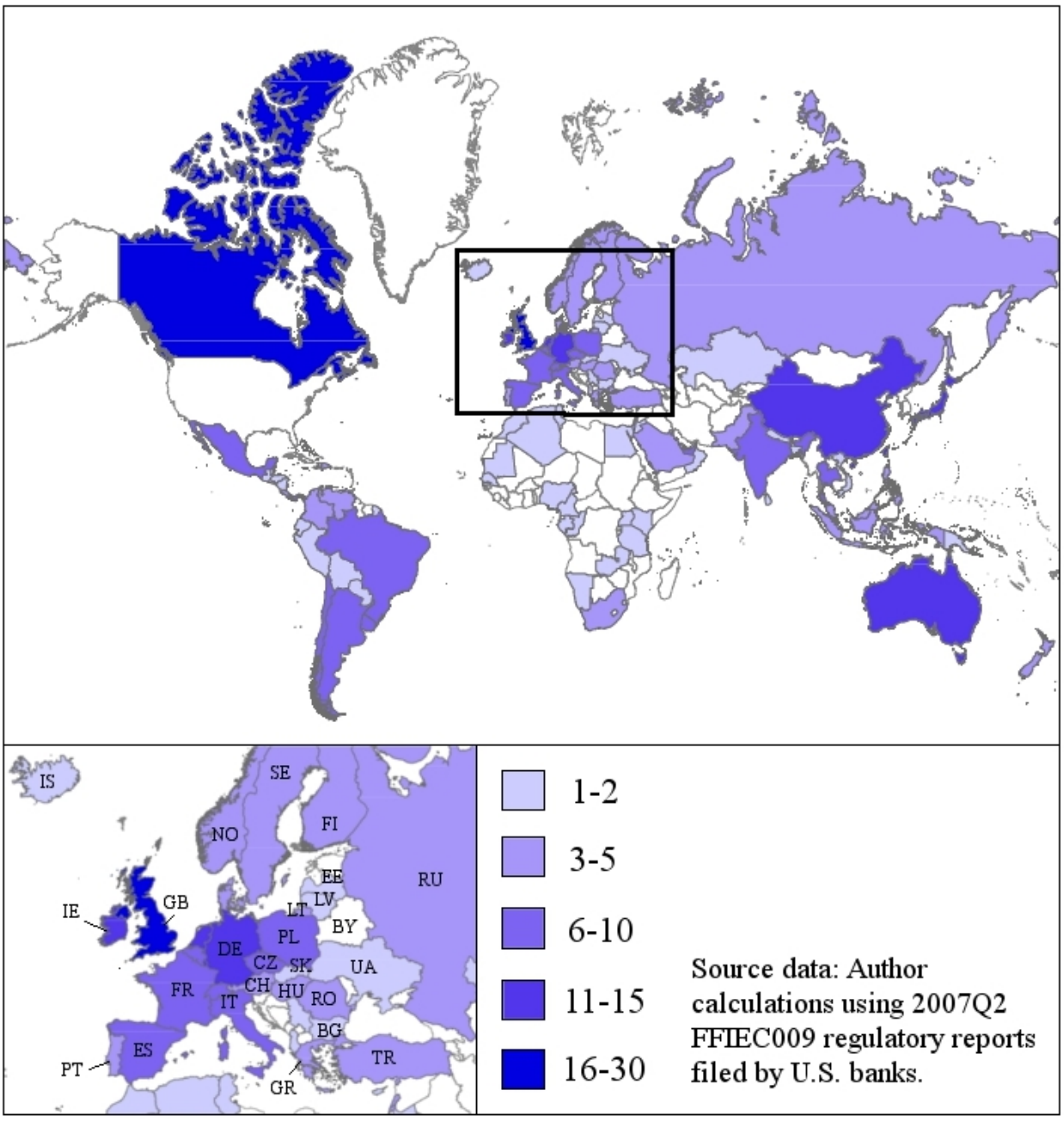


Figure 3: Value of U.S. Bank Affiliate Liabilities in Countries Worldwide (Million US $)

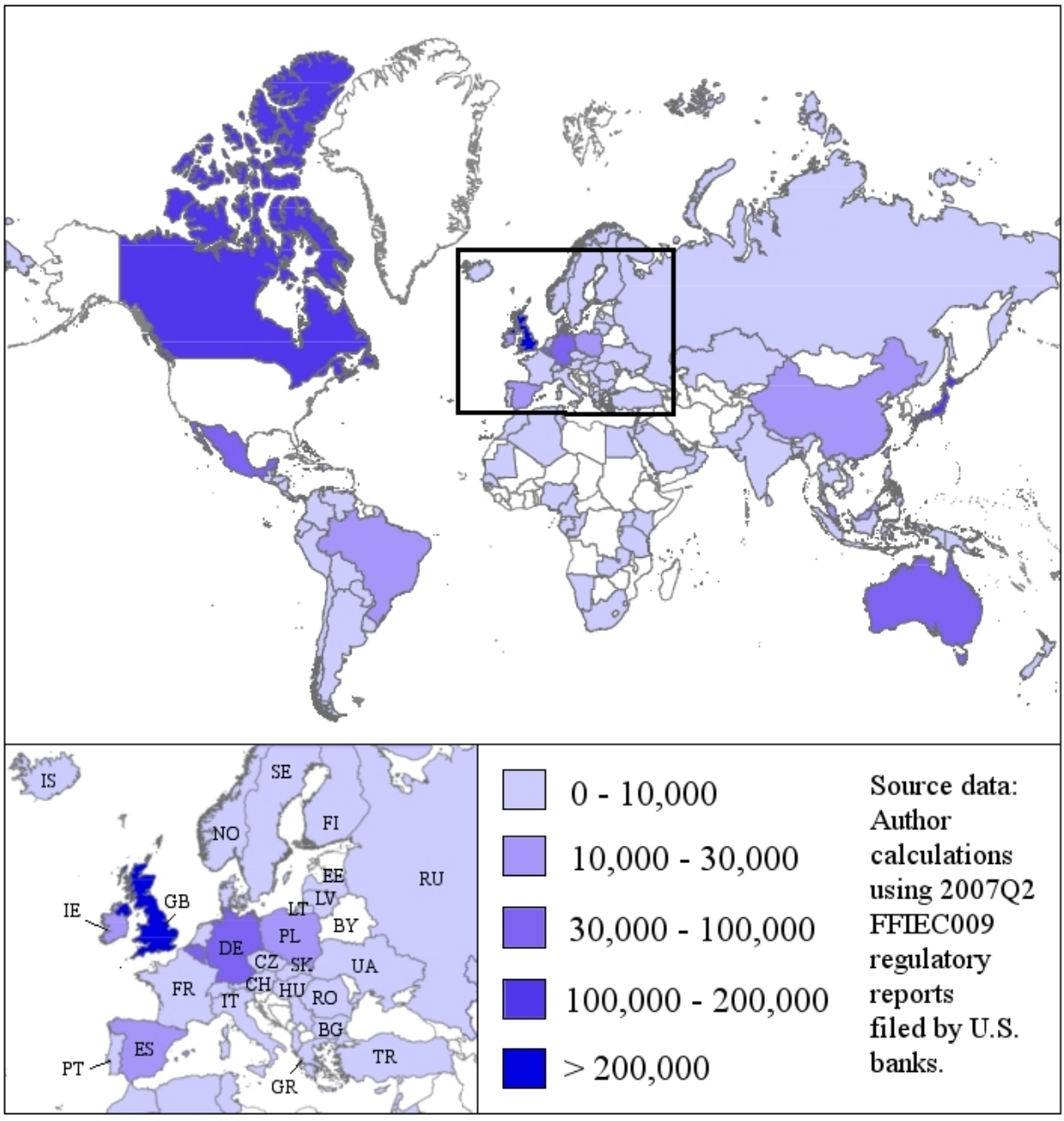
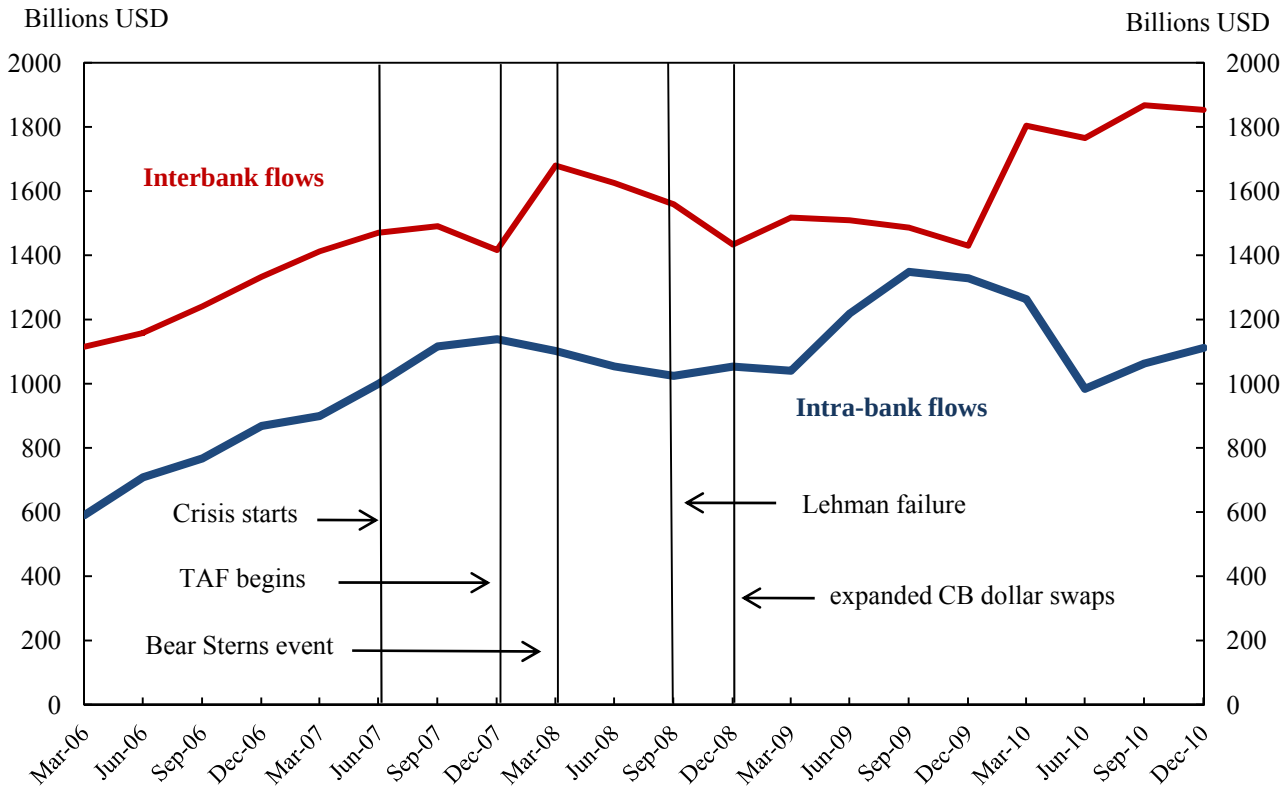
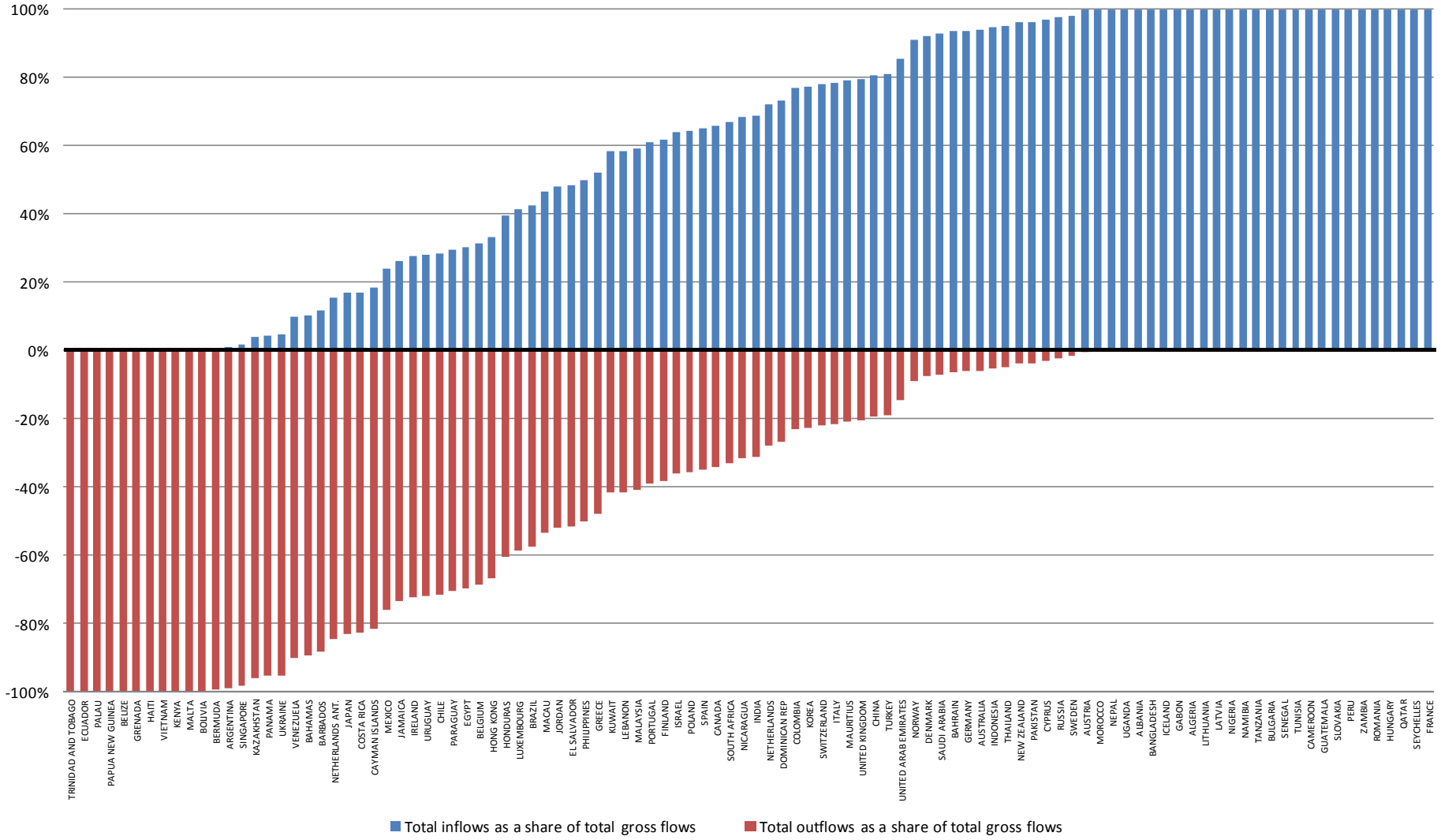


Figure 4 Intra-bank and Interbank Flows of U.S. Banks



Source: FFIEC 009 and BIS Consolidated Banking Statistics
Note: Intra-bank flows are computed as the sum of net due to (from) of affiliates (in absolute value), from FFIEC 009. Interbank flows are computed as the sum of foreign claims of the U.S. vis-a-vis rest of world and of rest of world vis-a-vis the U.S., from BIS.

Figure 5. Predicted inflows and outflows after first shock
By country, share of total gross flows



The figure shows the pattern of the predicted values of the dependent variable, the net due to flows, from the benchmark regression results in column (a), Table 3. The predicted values are aggregated by country across all banks in two separate subsets, the sum across all banks displaying predicted inflows to that country and the sum across all banks with predicted outflows from that country. Both numbers are then divided by the total predicted gross flow for the same country (the sum of the absolute values). Hence, for each country the stacked lines (blue for aggregate inflows, red for aggregate outflows) indicate relative contributions to the total gross, and therefore they sum to 100 percent.

Appendix Table 1 Countries (of 121) and Affiliates of U.S. Banks in Sample, By Country

Affiliate country	Counts (avg)	Affiliate country	Counts (avg)	Affiliate country	Counts (avg)
Albania	1	Grenada	1	Palau	1
Algeria	1	Guatemala	2	Panama	8
Argentina	9	Haiti	1	Papua New Guinea	1
Australia	11	Honduras	2	Paraguay	2
Austria	4	Hong Kong	14	Peru	2
British West Indies	8	Hungary	4	Philippines	5
Bahamas	11	Iceland	1	Poland	6
Bahrain	4	India	8	Portugal	4
Bangladesh	2	Indonesia	4	Qatar	2
Barbados	5	Ireland	12	Romania	3
Belgium	8	Israel	4	Russia	4
Belize	1	Italy	9	Saudi Arabia	4
Bermuda	9	Ivory Coast	1	Senegal	1
				Serbia And	
Bolivia	1	Jamaica	2	Montenegro	1
Bosnia And Herzegovina	1	Japan	11	Seychelles	1
Brazil	8	Jordan	2	Singapore	12
Brunei	1	Kazakhstan	2	Slovakia	2
Bulgaria	2	Kenya	1	South Africa	4
Cameroon	1	Korea	10	Spain	10
Canada	21	Kuwait	3	Sri Lanka	1
Cayman Islands	30	Latvia	1	Sweden	5
Channel Islands & Isle Of					
Man	8	Lebanon	3	Switzerland	7
Chile	7	Lithuania	1	Taiwan	10
China	11	Luxembourg	12	Tanzania	1
Colombia	5	Macau	2	Thailand	6
Congo, Democratic Rep.	1	Malaysia	5	Trinidad	2
Costa Rica	3	Malta	1	Trinidad And Tobago	3
Cyprus	2	Mauritania	1	Tunisia	1
Czech Republic	6	Mauritius	5	Turkey	5
Denmark	4	Mexico	10	Uganda	1
Dominican Republic	4	Monaco	2	Ukraine	2
Ecuador	2	Morocco	1	United Arab Emirates	6
Egypt	2	Namibia	1	United Kingdom	18
El Salvador	2	Nepal	1	Uruguay	8
Finland	4	Netherlands	11	Venezuela	4
		Netherlands			
France	1	Antilles	5	Vietnam	2
French Guiana	8	New Zealand	5	Zambia	1
French West Indies	1	Nicaragua	2		
Gabon	1	Nigeria	1		
Germany	12	Norway	5		
Gibraltar	2	Oman	1		
Greece	4	Pakistan	3		

Appendix Table 2 Country Features of Top 20 Countries By Total Claims Size in 2007Q2

Affiliate country	Total Claims[1] (Billions USD)	Log Physical distance from NYC[2]	Capital Account Openness[3]	Polity Index[4]	OFC[5]	$Peg[6]
United Kingdom	396.2	8.1	2.5	10	0	0
Japan	141.5	8.8	2.5	10	0	0
Canada	136.2	7.4	2.5	10	0	0
Germany	104.6	8.3	2.5	10	0	0
Mexico	89.8	7.6	1.1	8	0	0
Cayman Islands	83.5	7.8	2.5		1	1
Korea	78.9	8.8	-0.1	1	0	0
Netherlands	70.9	8.2	2.5	10	0	0
Australia	64.7	9.3	1.1	10	0	0
France	60.5	8.2	2.5	9	0	0
India	44.6	9.0	-1.1	9	0	1
Spain	39.8	8.2	2.5	10	0	0
Brazil	36.6	8.2	0.4	8	0	0
Italy	35.8	8.4	2.5	10	0	0
Singapore	35.4	9.2	2.5	-2	1	0
Ireland	34.1	8.0	2.5	10	1	0
Luxembourg	32.0	8.2	2.5		1	0
China	29.6	8.9	-1.1	-7	0	0
Hong Kong	25.6	9.0	2.5		1	1
Switzerland	23.8	8.3	2.5	10	0	0

Notes: [1] Total claims is the sum local claims and cross border claims, from authors' computations based on FFIEC 009 reporting by quarter.

[2] Log physical distance is the great circle distance of the affiliate country from New York City, from Rose and Spiegel (2009).

[3] Index ranges in value from −1.8 in the case of full control to 2.5 in the case of complete liberalization, from Chinn and Ito (2008).

[4] Country ratings on a scale ranging from strongly democratic (+10) to strongly autocratic (-10), from Center for Systemic Peace, Polity IV Project.

[5] Variable takes the value 1 if affiliate country is an offshore financial center, 0 otherwise, from International Monetary Fund.

[6] Variable takes the value 1 if currency of affiliate country is de facto dollar peg or crawl, 0 otherwise, from Ilzetski, Reinhart and Rogoff (2009).

Appendix Table 3

	(a)	(b)	(c)	(d)	(e)
$Shock_i$	-5427.2**	-7394.9**	-4681.8*		-9697.9***
	(2356.1)	(3398.1)	(2714.1)		(3599.7)
$Shock_i$*$CoreFunding_{ij}$	-884.6***	-948.1**	-875.6***	-755**	-1040.7**
	(312.1)	(373.9)	(312.6)	(297.8)	(510.1)
$Shock_i$*$CoreInvestment_{ij}$	14419.7***	13890.4***	13945.8***	13209.1***	18814*
	(4727.8)	(4679.9)	(4898)	(4789.8)	(11403.5)
Bank Controls					
$TotalAsset_i$	0.0	-0.2	0.1		0.1
	(0.2)	(0.2)	(0.1)		(0.2)
$Liquidity_i$	-3754.6*	-5071.3*	-3341.9		-7396.7**
	(2125.8)	(2824.9)	(2625.2)		(3309.5)
$Solvency_i$	-589.6	-992.1	251.5		-2764.9
	(1639)	(2383.9)	(1749.5)		(2820.1)
$Herfindahl_i$	233.0	202.9	-36.9		214.3
	(305.4)	(389.7)	(274.8)		(232.9)
Country Controls					
$kaopen_j$	2.2		-0.8	-1.2	20.1
	(49.6)		(47.1)	(52.5)	(70.8)
$ldistnyc_j$	27.7		34.4	49.3	94.6
	(76.9)		(85)	(73.1)	(115.3)
$exrate_j$	-65.9		-74.9	-166.3**	-136.9*
	(61.1)		(57.4)	(67.6)	(71)
OFC_j	-89.6		-88.0	-63.6	-93.4
	(98.2)		(101.5)	(80.8)	(107.5)
Foreign Office Controls					
$CoreFunding_{ij}$	-129.9	-22.1	-97.8	-222.5	-263.3
	(134.4)	(133.9)	(112.3)	(175.8)	(191.5)
$CoreInvestment_{ij}$	171.0	-147.4	363.4	723.5	153.5
	(736.3)	(756.8)	(796.1)	(895.6)	(942.9)
$TotalLocalLiabilities_{ij}$	-0.1	-0.1	-0.1	-0.1	0.0
	(0)	(0)	(0)	(0)	(0.1)
$ShortMaturityClaims_{ij}$	755.2	741.9	727.8	-95.0	1402.8
	(965)	(1336)	(1056.7)	(948.8)	(1491.1)
Interactions					
$Shock_i$*$TotalAsset_i$	0.0	-0.1	0.1		-0.3
	(0.3)	(0.4)	(0.3)		(1.3)
$Shock_i$*$Liquidity_i$	16221.8*	22746.5*	13343.0		31487.1**
	(8615.7)	(11894.4)	(10358.4)		(13462)
$Shock_i$*$Solvency_i$	35292.7**	51802.5**	26640.1		61000.6*
	(17654.6)	(24377.1)	(19816.6)		(32609.6)
$Shock_i$*$Herfindahl_i$	487.1	1417.0	1315.8		6048.1
	(1682.8)	(2638.3)	(2172.1)		(23126.1)
$Shock_i$*$kaopen_j$	7.4	35.4	10.0	-0.1	11.0
	(30.3)	(56.1)	(28.5)	(33.1)	(25.3)
$Shock_i$*$ldistnyc_j$	188*	211.7	182.3*	110.8	251.0
	(110.8)	(144.2)	(106)	(110.6)	(163.7)
$Shock_i$*$exrate_j$	-62.8	-24.9	-52.7	21.7	-62.1
	(152.7)	(200.9)	(149.5)	(129.5)	(193)
$Shock_i$*OFC_j	167.5***	158.1*	162.3***	161***	179.3*
	(60.8)	(84.9)	(59.6)	(62.4)	(101.1)
$Shock_i$*$TotalLocalLiabilities_{ij}$	0.1	0.1	0.1	0.1	0
	(0.0)	(0.0)	(0.0)	(0.1)	(0.1)
$Shock_i$*$ShortMaturityClaims_{ij}$	-10392.7*	-10301.7*	-10167.6	-8524.6	-16600.9
	(5870.9)	(6255.9)	(6187)	(5944.5)	(17821.1)
Constant	-134.0	-846.8**	-261.6	-3475.8	-510.3
	(758.7)	(386)	(841.4)	(2904.5)	(1139.1)
Country FE	No	Yes	No	No	No
Bank FE	No	No	No	Yes	No
Observations	500	500	474	500	423
R-squared	0.30	0.39	0.31	0.36	0.33

The dependent variable is the change in internal borrowing of foreign affiliates of bank i in country j between 2006q1-2007q2 and 2007q3-q4. $Shock_i$ reflects ABCP exposure, defined as the ratio of total ABCP outstanding of conduits sponsored by each bank i divided by total equity. Core Funding is the ratio of locally raised funds to total liabilities of affiliates of bank i in country j. Core Investment is the ratio of total claims of bank i in country j divided by total claims of bank i aggregated over all countries. Bank controls are total asset size, the ratio of liquid assets to total assets, the ratio of total equity to total assets, and a Herfindahl measure of the bank's foreign claims across countries. Country controls are the distance of the country from the United States, an exchange rate regime indicator, a measure of capital account openness, and the IMF offshore financial center indicator. Foreign office controls are total liabilities for each location, and the ratio of short-term claims to total claims. All controls are also interacted with the shock variable. Column (b) includes country fixed effects (hence country controls are excluded). Column (c) is the specification where we removed records where the affiliate was located in the Cayman Islands. Column (d) includes bank fixed effects (hence all bank controls are excluded). Column (e) excludes records for US-chartered banks with foreign parents. Standard errors are clustered by banks. ***, ** and * indicate significance at the 1%, 5%, and 10% level, respectively.

Appendix Table 4

	(a)	(b)	(c)	(d)	(e)
$Shock_i$	5700.4***	6497.7***	3002.7		6218.4**
	(1700.9)	(2403.7)	(1842)		(2595.1)
$Shock_i * CoreFunding_{ij}$	1673***	1679.3***	633.5***	1720.3***	2052.2***
	(381.4)	(405.4)	(148.8)	(408.7)	(476.9)
$Shock_i * CoreInvestment_{ij}$	-9436.5***	-8993.9***	-2205.7	-9828***	-12930**
	(3216.3)	(3295.8)	(2471.4)	(3345)	(5443.8)
Bank Controls					
$TotalAsset_i$	0.3*	0.5**	0.1		0.3**
	(0.2)	(0.3)	(0.1)		(0.2)
$Liquidity_i$	42.9	-192.8	149.7		-981.4
	(929.8)	(1250)	(558.5)		(1223.6)
$Solvency_i$	734.3	-832.7	30.3		1652
	(985)	(1980.1)	(705.1)		(1528.8)
$Herfindahl_i$	32.2	122.3	-148		25.7
	(239.5)	(317.3)	(217)		(273.3)
Country Controls					
$kaopen_j$	-9.3		-21.2	-11.2	-20.9
	(23.7)		(23.4)	(26.5)	(30.8)
$ldistnyc_j$	76.8		7.8	89.7	77.9
	(69.8)		(62.2)	(86.1)	(112.2)
$exrate_j$	-130.8		-80.6	-135	-163.6
	(126.5)		(87.4)	(144.8)	(152)
OFC_j	89.1		119.8	114.7	181.2
	(114.3)		(104.7)	(126.3)	(134.9)
Foreign Office Controls					
$CoreFunding_{ij}$	-214.1	-250.8	-91.4	-230.4	-233.6
	(200.8)	(215.7)	(110.8)	(218.5)	(262.2)
$CoreInvestment_{ij}$	1171	1148.1	489.9	1467.7	1831.1
	(953.5)	(970.5)	(828.1)	(1266)	(1184.9)
$TotalLocalLiabilities_{ij}$	0.1	0.0	0.1***	0.1	0.1
	(0.1)	(0.1)	(0.0)	(0.1)	(0.1)
$ShortMaturityClaims_{ij}$	199.4	-40	50.6	-45.4	-646.8
	(1146.8)	(1504.4)	(1124.8)	(1647.9)	(2002)
Interactions					
$Shock_i * TotalAsset_i$	-0.6***	-0.9***	-0.1		-0.8*
	(0.2)	(0.2)	(0.1)		(0.5)
$Shock_i * Liquidity_i$	-566	-1370.4	-636.4		4231.7
	(4903.2)	(6692.7)	(2779)		(4820.1)
$Shock_i * Solvency_i$	5097.3	3705.2	1295.5		12985.1
	(10214.7)	(14353.6)	(5192.8)		(12473.8)
$Shock_i * Herfindahl_i$	458.7	-885.8	-545.7		1403.2
	(1481)	(1938.1)	(1371)		(6234.1)
$Shock_i * kaopen_j$	-78.2	-113.2	-96.8	-82	-109.8**
	(52.5)	(80.9)	(63.7)	(54.6)	(49.6)
$Shock_i * ldistnyc_j$	-703.1***	-730.2***	-323.8*	-732.5***	-902.9***
	(192.2)	(215.7)	(194.8)	(218.5)	(245.8)
$Shock_i * exrate_j$	328.4*	412.3	-125.1	339.9*	391.9**
	(168.8)	(298.7)	(128.4)	(174.6)	(172.4)
$Shock_i * OFC_j$	109.4	96.3	64.2	95.2	71.7
	(263.6)	(288.8)	(219.4)	(268.5)	(341.2)
$Shock_i * TotalLocalLiabilities_{ij}$	-0.1	-0.1	-0.2***	-0.1	-0.1
	(0.1)	(0.1)	(0.0)	(0.1)	(0.1)
$Shock_i * ShortMaturityClaims_{ij}$	6509.9	4125.9	66.9	7187.6	14207.8
	(4373)	(4738.4)	(4053.6)	(5085.5)	(11679.3)
Constant	-785.3	398	-66.5	-784.1	-886.9
	(559)	(390.8)	(543.4)	(794.6)	(973.9)
Country FE	No	Yes	No	No	No
Bank FE	No	No	No	Yes	No
Observations	513	513	485	513	438
R-squared	0.28	0.37	0.34	0.30	0.33

The dependent variable is the change in internal borrowing of foreign affiliates of bank i in country j between 2007q3-q4 and 2008q1-q2. $Shock_i$ reflects ABCP exposure, defined as the ratio of total ABCP outstanding of conduits sponsored by each bank i divided by total equity. Core Funding is the ratio of locally raised funds to total liabilities of affiliates of bank i in country j. Core Investment is the ratio of total claims of bank i in country j divided by total claims of bank i aggregated over all countries. Bank controls are total asset size, the ratio of liquid assets to total assets, the ratio of total equity to total assets, and a Herfindahl measure of the bank's foreign claims across countries. Country controls are the distance of the country from the United States, an exchange rate regime indicator, a measure of capital account openness, and the IMF offshore financial center indicator. Foreign office controls are total liabilities for each location, and the ratio of short-term claims to total claims. All controls are also interacted with the shock variable. Column (b) includes country fixed effects (hence country controls are excluded). Column (c) is the specification where we removed records where the affiliate was located in the Cayman Islands. Column (d) includes bank fixed effects (hence all bank controls are excluded). Column (e) excludes records for US-chartered banks with foreign parents. Standard errors are clustered by banks. ***, ** and * indicate significance at the 1%, 5%, and 10% level, respectively.