Banking Globalization and Monetary Transmission

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Abstract

Globalization of banking raises questions about banks' liquidity management, their response to liquidity shocks, and the potential for international shock propagation. We conjecture that global banks manage liquidity on a global scale, actively using cross-border internal funding in response to local shocks. Having global operations insulates banks from changes in monetary policy, while banks without global operations are more affected by monetary policy than previously found. We provide direct evidence that internal capital markets are active in global banks and contribute to the international propagation of shocks. This feature was at play during the financial crisis of 2007 to 2009.

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As financial markets have become increasingly globalized, banks have expanded their global operations, developing growing networks of physical branches and subsidiaries in foreign countries. We refer to such entities as "global" banks.

This changing orientation in banking activity raises important questions about how banks manage their liquidity, how they react to liquidity shocks and how these shocks may be transmitted across borders. We conjecture that global banks can respond to a domestic liquidity shock by activating a cross-border, internal capital market between the head office and its foreign offices, thus reallocating funds on the basis of relative needs. Because of this potential access to internal capital markets with foreign offices, lending by global banks is likely to be more insulated from domestic liquidity shocks. However, this does not mean necessarily that a domestic liquidity shock has a diminished impact in the presence of global banks: if global banks respond through an internal reallocation of funds, their foreign lending may be affected. Hence, banks managing liquidity globally may increase the *international* propagation of domestic liquidity shocks.

We test our conjectures by analyzing the response of U.S. banks to changes in monetary policy. Using more than twenty years of quarterly data we find evidence that corroborates our conjectures regarding liquidity management in global banks. Global operations and global liquidity management are traits that can make loan supply effectively insulated from domestic monetary policy. The activation of internal funding within the bank and across international locations is key to such insulation, and it is also a main channel of transmission of domestic shocks into foreign lending markets. This channel is symmetrically used in response to positive and negative liquidity disturbances.

This study makes direct contributions to the literature on the lending channel for monetary policy effectiveness.[1] By emphasizing the changing orientation of banking activity we propose a substantial re-examination of the mechanics of the lending channel. A liquidity shock no longer starts and ends on the balance sheet of a given bank: it now extends and links together balance sheets of the same organization across borders. In fact, we empirically show that once we take into account this modification in the lending channel mechanism, the overall effectiveness of liquidity shocks triggered by monetary policy is much larger, both in size and scope. Indeed, we find that broader segments of the population of U.S. banks are affected by

monetary policy than previously assessed. And once we factor in the effects on lending by the foreign offices of global banks, the effectiveness of the lending channel proves to be even stronger. Evidence focusing only on effects on domestic soil is bound to produce systematic underestimation of the lending channel.

Our evidence thus advances our understanding of the effectiveness of monetary policy, but its relevance is much broader. Indeed, our arguments apply to any liquidity shocks banks may experience, as underscored by activity during the financial crisis of 2007 to 2009. As we document, the onset of the crisis, determined by severe funding shortages, did in fact trigger sizeable and widespread inflows of internal funding in support of the head offices' balance sheet. We also document a subsequent related contraction in (external) lending by the foreign offices that provided funds, corroborating the international propagation mechanism. Previous evidence on an international transmission channel through banking is associated with the work, for example, of Peek and Rosengren (1997, 2000). However, and to the best of our knowledge, we are the first to document a systematic relationship between bank globalization and monetary policy effectiveness.

The paper also makes contributions to the literature on internal capital markets in financial firms. That banks – as other business organizations – have active internal capital markets is not new, and evidence has been reported, among others, in Houston, James and Marcus (1997), Campello (2002), Ashcraft (2006, 2008), and Ashcraft and Campello (2007). Importantly, we are the first to provide *direct* evidence of cross-border internal capital markets: we use data that U.S. banks are required to file quarterly, reporting the value of the net liabilities (or claims) between the head office and its foreign offices. These data thus provide an unusual opportunity for a direct test of the existence of an internal capital market, since data on borrowing and lending *within* an organization, between its different components, is hardly ever available.[2] Accordingly, we directly test whether cross-border, internal flows of funds within a banking organization are systematically associated with changes in U.S. monetary policy and we confirm that this is the case.

Overall, the mechanisms we identify have broad consequences. The themes we emphasize are directly relevant in the current policy debate regarding the reshaping of bank regulation and the role for international coordination of regulatory activity. Liquidity

management of global banks is at the forefront of the current policy debate in the aftermath of the financial crisis. Possible restrictions to the ability of financial firms to manage liquidity at a global level (arguments for "ring fencing", "local liquidity pools") are within the core of bank reform proposals from many national regulatory authorities (see, e.g. BIS Committee on the Global Financial System, (2010a, 2010b)). While global banking has strong benefits (Goldberg (2009)), banks are nonetheless operating in a potentially deeply integrated international environment, with exposures to markets that are sometimes beyond the direct purview of regulators. These interlinkages are important for the supervision and risk assessments of globally active banks. The crisis period also demonstrates that these issues may have bearing on the division of lender of last resort responsibilities across national borders.

On the macroeconomic level, the operations of global or multinational banks can serve as a stabilizing mechanism, especially in emerging markets, in response to local shocks.[3] Cetorelli and Goldberg (2011) show transmission of the financial crisis through the lending channel by a cross section of industrialized countries to a broad panel of emerging markets. Micro-economic data exercises documenting shock transmission to emerging markets are provided by Khwaja and Mian (2008) for Pakistan and by Schnabl (forthcoming) for Peru. For industrialized countries, there is a well established literature on international shock transmission and business cycle comovement. While cross-border correlations are well documented, for example as in Frankel et al. (2004), Obstfeld et al. (2005) and Neumeyer and Perri (2005), the direct evidence on the actual mechanisms for international transmission of shocks and policy is more limited. Thus our analysis serves to identify one such mechanism that arises through global bank funding practices.

In the next section we outline our empirical identification approach. We then provide information on the data and follow with the presentation of the results. After making our case focusing on monetary policy as a funding shock, we conclude with a case study of the mechanism at work during the 2007 to 2009 financial crisis.

I. Identification strategies

We test our conjectures on the importance of global banks and internal capital markets with a set of alternative and complementary empirical strategies. We begin by re-examining the existing evidence on the bank lending channel, introducing a distinction among banks based on the global

orientation of their balance sheets. We then proceed by directly looking for evidence on the existence of the internal capital market channel. Next, we follow with specific evidence of the propagation of the shocks to the balance sheet of the foreign offices of global banks. We conclude by documenting evidence specific to the events of the 2007 to 2009 financial crisis. Since the funding shock that jump started the crisis was not directly related to monetary policy, we analyze the latter crisis events as a separate case study.

A. Revisiting the Lending Channel

The basic description of the bank lending channel is the following: banks experience a funding shock. If they cannot substitute liabilities with other external funding sources, such as by issuing certificates of deposit or attracting money market funds, the shock is transmitted to the asset side of their balance sheets.[4] Absent a sufficiently large buffer of liquid assets, the original shock is then absorbed by lending activity, thus completing the transmission of the shock to the real economy.

Our argument instead suggests that the head office of a global bank can accommodate the original shock by effectively involving the balance sheets of its foreign affiliates, activating an internal funding transfer (an increase in *internal* liabilities by the head office and a corresponding increase in *internal* assets by its' foreign offices). The head office asset side is insulated, but the asset side of the foreign offices may now be affected and their *external* lending may have to adjust in response to the change in internal lending.

This argument speaks to previous empirical contributions that incorporate the main insights on the existence and economic importance of the lending channel. The influential work by Kashyap and Stein (2000) has shown that, in practice, the lending channel works only through the balance sheet of small banks. By contrast, large banks have unencumbered access to external capital markets so that any funding shock is absorbed with a liability substitution. Campello (2002) goes further and shows that, in fact, even among small banks the ones that are most affected are stand-alone entities: the benefits of insulation from shocks achieved by the large banks are extended to those small banks that are affiliated with such large banks as parts of the same bank holding company.

The natural starting point for us is to build on these results to provide the first batch of evidence on the consequences of global banking. We begin by observing that global banks are likely to be large banks, as the establishment of foreign offices presumably requires a pre-existing large scale of operation. If all that matters is size, large banks should be insulated from monetary policy shocks irrespective of whether they have global operations or not. Hence, our empirical analysis begins by re-examining the bank lending channel for large banks, but now sorting these banks according to whether they had or did not have global operations.[5]

In order to test our conjecture and isolate the role of globalness, we take the exact same two-step empirical methodology adopted in Kashyap and Stein (2000) and Campello (2002), the only innovation being that we break down the population of banks along the global versus domestic dimensions.[6] The first step of this empirical strategy entails running separate cross-sectional regressions for each data quarter for banks indexed by *i* and within each of the two subsets of banks: the large global banks and the large, non-global, banks. The general stage 1 specification is:

$$\Delta \log(Y_{i,t}) = \sum_{j=1}^{4} a_{tj} \Delta \log(Y_{i,t-j}) + \beta_t X_{i,t-1} + \text{Controls} + \varepsilon_{i,t} \qquad (1)$$

where $Y_{i,t}$ is either total lending or commercial and industrialized (C&I) lending.[7] $X_{i,t-1}$ is a measure of a bank's overall balance sheet liquidity and is defined as the logarithm of the ratio of a bank's liquid assets to total assets. A bank's capitalization ratio, its asset size, and the value of its nonperforming loans are included as bank-specific controls. These balance sheet measures are lagged one quarter to avoid econometric issues arising due to simultaneity. The vector of controls also includes indicator variables for the state where the bank's headquarters is located and whether or not the bank's headquarters is in a metropolitan statistical area (MSA). The inclusion of the state and MSA indicator variables allows for different macroeconomic conditions in each period for each geographical area and is intended to capture unobserved variability of loan demand.

The key variable of interest in (1) is the estimated coefficient on X_{it-1}, denoted by β_t. Each regression is run for each quarter, thus generating a separate time series of estimated β_t coefficients for each class of banks under consideration. The second step of this empirical

strategy uses each of the β_t series estimated in the first step as dependent variables in order to determine how lending sensitivity to bank balance sheet liquidity varies with monetary policy:

$$\beta_t = \eta + \sum_{j=1}^{n} \phi_j MP_{t-j} + \delta \text{Controls} + \mu_t \qquad (2)$$

where MP_{t-j} is an indicator of monetary policy. In our analysis we use three alternative indicators of monetary policy: the Bernanke-Mihov indicator of liquidity conditions, the nominal Federal Funds rate, and the real Federal Funds rate.[8] These indicators of monetary policy are defined in our analysis so that they increase in times of liquidity tightening and decrease in times of looser liquidity conditions. As in Campello (2002), the number of policy lags *n*, in the summation term is equal to eight, to capture what could be a relatively slow adjustment of lending aggregates to changes in liquidity conditions. The basic control vector in each specification (2) includes a time trend, three quarterly indicator variables to capture seasonality, and the growth rate in real GDP and its lags to capture business cycle effects. Also following Campello and given the time series nature of specification (2), we correct standard errors using the Newey-West variance estimator to consider possible autocorrelations of up to an 8 quarters lag.

If lending by banks is affected by monetary policy, the testing approach maintains that bank lending becomes more dependent on balance sheet liquidity in times of policy tightening and less dependent in times of monetary policy loosening. Hence, the sum of the coefficients of the monetary policy indicators ϕ_j in the second-step regression would be positive and significant for the bank lending channel for either the global bank or the domestic bank specifications.

In implementing the specification based on equations (1)-(2), a concern is that the Kashyap and Stein identification strategy may be exposed to possible issues of endogeneity bias among the right hand side variables, since banks may change their liquidity holdings in response to macroeconomic conditions. Moreover, since global banks may be systematically different from non-global large banks, it is possible that whatever bias arises may apply differently across the two subgroups. We address directly the potential endogeneity of the measure of liquidity in stage (1) by running the stage-1 regressions with the liquidity-to-asset ratio instrumented by the residual of a regression of the liquidity-to-asset ratio on the ratio of C&I lending to total lending

and the ratio of non-performing loans to total loans, where both regressors should capture a cyclicality component in the measure of liquidity.[9]

B. Direct Tests of Internal Funding Activity

Our argument presupposes that global banks activate an internal capital market, moving resources between parent and foreign offices in response to domestic monetary policy changes. Conceptually, the literature justifying internal capital market transfers within an organization rationalizes such flows as leading to a more efficient allocation of resources (see, e.g., Stein (1997), Gertner, Scharfstein, and Stein (1994), Stein (2002)), or as a managerial tool to mediate agency frictions existing within a firm, across separate divisions, (e.g., Rajan, Servaes, and Zingales (2000), Scharfstein and Stein (2000)).[10] We do not take a stance on alternative theoretical justifications in international banking. Our documentation that global banks have very active internal capital markets is consistent with both theoretical perspectives, and most importantly, it is instrumental to our main objective of redefining the scope of the lending channel mechanism and understanding international transmission of disturbances.

We test this *directly* by analyzing whether cross-border, internal flows of funds within a banking organization are systematically associated with changes in U.S. monetary policy.[11] Normally, data on internal transactions within an organization are unavailable in any systematic format. However, U.S. banks are required to report quarterly the aggregate value of internal transactions between the head office and foreign offices ("Net Due To or From Own Related Offices in Other Countries").[12] We construct bank-specific quarterly changes of net internal positions for each bank. A positive value means the head office has increased its debtor position with its foreign offices, hence indicating an inflow of funds, and vice versa. It is important to recognize that this entry truly reflects internal funds reallocation within the banking organization, and it is totally distinct from reporting of other balance sheet activity, such as bank investments in foreign or local assets.

If global banks are insulated from domestic liquidity shocks just because of their size, and therefore for their innate ability to access external sources of funds, we should not expect to observe any abnormal behavior in the patterns of cross-border, internal capital markets between

parent banks and their foreign offices around times of changes in monetary policy. We test this conjecture using the time-series panel specification (3) over the full group of global banks:

$$\Delta Net\ Due_{i,t} = \alpha + \sum_{j=1}^{4} \varphi_j \Delta Net\ Due_{i,t-j} + \sum_{j=0}^{4} \theta_j \Delta MP_{t-j} + \sum_{j=0}^{4} \gamma_j \Delta GDP_{t-j} + \mu_{i,t} \qquad (3)$$

where $\Delta Net\ Due_{i,t}$, the quarterly change in real Net Due funds for bank *i* at time *t*, is regressed on its own four lags, on the change in the indicator of monetary policy and its four lags. Real Net Due is constructed by deflating nominal Net Due by the CPI, with 2005 as the CPI base year taking a value of 1. The regression includes the growth rates in real GDP and its four lags to control for general economic conditions. Some specifications also introduce controls for foreign monetary policy changes.

If the internal capital market is in operation within a global banking organization and is used to offset the local effects of domestic monetary policy shocks, this would appear as an increase in the inflow of funds to the domestic bank from (or a decline in outflows of funds to) its foreign operations in times of domestic monetary policy tightening, and the other way around when policy is looser. Evidence of the internal capital markets response between the parent and foreign affiliates would be reflected in a positive and significant sum of coefficients θ_j on the monetary policy variables.

C. Tests of International Transmission

Next, we focus on the methodologies for testing the last piece of our conjecture, that the internal funding activity of global banks is a direct channel for international propagation of liquidity shocks. First, and continuing in the spirit of analyses by Kashyap and Stein (2000) and Campello (2002), we test whether lending of the foreign offices is more or less dependent on the balance sheet strength of the head office as monetary policy conditions vary. In times of U.S. monetary policy contraction, for instance, lending by *foreign* offices would be expected to rely less on the overall balance sheet strength of the head office. For this test we again rely on the two-step procedure described in equations (1) and (2). In this case, however, the dependent variable in the first step is a measure of the lending activity of the foreign offices of bank *i* at

time *t*. The lending measures used are, alternatively, the growth in total lending of the foreign offices or the growth in C&I lending of the foreign offices. The main regressor of interest is the sum of coefficients ϕ_j from the second stage regressions liquidity measure of the reporting parent bank.

The final set of tests of international transmission look for a direct, empirical relationship between changes in internal funding flows and changes in lending by foreign offices of U.S. banks. Foreign offices may provide internal lending to the parent organization in times of domestic monetary policy contraction, but it is still not necessarily the case that the external lending of the foreign offices should be negatively affected by Net Due transfers: there may be margins of adjustments in the balance sheet that could potentially insulate the foreign offices' lending books. The crux of the conjecture is that substitution among uses of funds (external loans versus "internal" loans to the head office), and therefore effective international propagation, is most likely to occur if the bank has a constrained balance sheet. Hence, we test the relationship between changes in foreign office lending and changes in Net Due flows for those banks with low levels of liquid assets – which is a potential cushion that could mitigate the need for changes in loan supply – in times of contractionary or expansionary U.S. monetary policy. The model specification is the following

$$\Delta Y_{i,t} = \alpha + \sum_{j=1}^{4} \Delta NetDue_{i,t-j} \cdot \begin{pmatrix} \beta_j + \gamma_j \cdot \Delta MP_{t-j} + \delta_j \cdot LowLiquidity_{i,t-j} \\ +\eta_j \cdot \Delta MP_{t-j} \cdot LowLiquidity_{i,t-j} \end{pmatrix} + Controls + \varepsilon_{i,t} \qquad (4)$$

where $Y_{i,t}$ is a measure of total loans or C&I loans of the foreign offices of bank *i* at time *t.* The coefficients $\beta_j, \gamma_j, \delta_j,$ and η_j capture the effect of a change in internal lending, and the δ's and η's capture the partial effect of Net Due on liquidity constrained banks. $LowLiquidity_{i,t}$ is a dummy variable equal to one if bank *i* at time *t* has a liquid asset ratio below the median of global banks at date *t*, and is zero otherwise. The vector of *Controls* in this specification includes *all* partial terms of interactions (with the same lag structure) and individual variables (and lags), as well as GDP growth (and lags) and the foreign monetary policy variable in some specifications (and its lags).

II. Bank Characteristics and Balance Sheets

The core of our analysis utilizes data on bank balance sheets that is available quarterly for every chartered U.S. bank and is collected as part of bank supervision conducted in the United States.[13] Our sample of "Call Report" data consists of nearly 1.2 million bank-quarters over the period from 1980Q1 through 2005Q4. In section IV we discuss additional data used in analysis of the later financial crisis period.

Two broad distinctions prove useful for our empirical methods: between large versus small banks, and between domestic versus global banks. As in Kashyap and Stein (2000) and Campello (2002), we define a *large* bank as any bank that is in the 95th percentile or higher of banks sorted by asset size, with this categorization of banks performed in every quarter of the sample period. As in Campello (2002), a small bank is defined as any bank that is in the 90th percentile of size or lower: leaving out the intermediate group of banks between the 90th and 95th percentile is justified in order to achieve a clean separation between small and large banks.

We define a bank as *global* in each period if it has foreign assets greater than zero.[14] As said earlier, this definition identifies banks that have actual offices in foreign countries. The implication is that a bank that exclusively accesses foreign market customers through cross-border lending or borrowing is not considered a global bank for our purposes.

Table I provides balance sheet details for all banks in the United States and for some subsets of banks: large domestic banks, large global banks, small banks affiliated with a large global bank via common ownership under the same bank holding company (BHC) organization, and small banks in BHCs that contain large but non-global banks. The table rows present the numbers of bank-quarter observations in the sample, and the median values for bank size, loan to asset ratios, commercial & industrialized (C&I) lending as a share of assets, bank liquidity, capitalization, and nonperforming loan shares. Data is shown for three reference dates (1985, 1995, and 2005), providing snapshots of characteristics of banks in the respective decades covered by our dataset.

[Table I about here]

In part the result of banking sector consolidation, median bank size has grown substantially over time, with the most pronounced growth for banks that have global operations.

While there are only about a third as many global banks than domestic banks in the large bank category, the global bank share in total banking system assets rose from 56 percent in 1985 and 1995 to 68 percent in 2005. There are broad distributions of size across both the large domestic and large global bank categories, although many comparably sized banks are in the categories of large domestic and large global banks. Small banks affiliated with large banks account for less than 1 percent of banking system assets by 2005. The median sizes of these banks are similar regardless of whether they are affiliated with large domestic or large global banks through a BHC.

All categories of banks have a broadly similar focus on lending, as reflected in the share of total loans to assets. Differences across banks appear in the composition of loans extended and in financing. Among the large banks, the global banks focus substantially more on C&I lending.[15] Non-performing loan shares for the median banks are similar. The global banks tend to have less liquid assets and lower capitalization. Both categories of affiliated small banks are similar to the large domestic banks in the composition of lending. Smaller banks tend to have higher capitalization ratios compared with larger banks.[16]

For global banks, regulatory data also includes information on "foreign loans,"[17] which are loans extended directly by offices in the countries where the offices are physically located. Table II provides descriptive statistics on these loans at the three reference dates. Most global banks (more than 85 % by count) had foreign loans under 10 % of total bank assets. For the remaining global banks, the foreign loan share generally was under 30 % of the size of total bank assets. The largest global banks account for the majority of total foreign loans extended (not shown). These foreign loans are one of two main categories of lending to foreign counterparties: the second category is cross-border lending, which is done by the parent bank in the United States. As shown in Figure 1, global banks engage both in cross-border lending and foreign lending. While domestic banks conduct some cross-border lending, this activity is small in aggregate.

[Figure 1 about here]

For global banks we also capture data for the international internal funding transfers. These data are reported as "Net Due with foreign offices"[18] and reflect *direct* flows between a parent with its branches and subsidiaries abroad. Positive values ("net due to") mean the head

office has borrowed funds from its foreign offices, while negative values ("net due from") mean the head office has sent funds to affiliates outside of the United States. As shown in Table II, at each date the Net Due observations for global banks show some banks with "net due to" flows and others with "net due from" flows: the pattern of international transfers of dollars across individual banking organizations is not uni-directional. In 1995, for example, 103 of 170 global banks reported "net due to" observations, while the remaining 67 banks reported "net due from" observations.

[Table II about here]

When we argue that increases in net internal transfers to the U.S. parent within a banking organization can occur when liquidity conditions tighten in the United States, it is important to recognize that this can be achieved either though an increase in direct flows to the United States from affiliates, or via reduced support that U.S. parents provide to affiliates abroad.

III. Empirical Findings

For the empirical analysis, the data for bank observations are passed through standard screens to eliminate outliers.[19] While we present most results for total loans by banks, all tests were likewise performed on C&I loans. We present the results of the instrumental variables specifications, but all results were also generated using OLS specifications. All findings are robust to loan types and OLS versus IV specifications.

A. Evidence from Revisiting the Lending Channel

If we take the Kashyap and Stein (2000) methodology and divide the sample of large banks based on whether they have global operations, will their results hold? If globalness is irrelevant, banks in both groups, by virtue of size, should display similar insensitivity to monetary policy.

[Table III about here]

Table III presents results for estimated $\sum_{j=1}^{n} \phi_j$ from equation (2) regressions relating monetary policy variables and total loans. Recall that the dependent variable is the time series of estimated coefficients on the liquidity-to-asset ratio in quarterly, cross-sectional, instrumental

variable regressions based on equation (1) specifications. Each specification is run with or without GDP growth controls in the second stage, as indicated by column headings in the table. Results highlighted in bold are statistically significant at least at the 10 % level and indicate the existence of an active lending channel for monetary policy. All specifications are also run for C&I lending as dependent variables, with fully consistent empirical results (not reported).

The table shows that the pattern of statistical significance of the lending channel is different for the two subgroups of large banks. Large and global banks maintain the property of bank lending insulation from monetary policy that Kashyap and Stein (2000) had highlighted. The sums of coefficients for the regressions based on this category of banks are never significant at standard significance levels. The results for global banks are robust to whether or not specifications introduce controls for domestic GDP growth (column 1 and 3 compared with column 2 and 4). The results are consistent across all three metrics of U.S. monetary policy shown in the rows of the table. For global banks we also introduce a specification that contains, within stage 2 controls, a weighted average of foreign interest rates, with weights represented by U.S. global banks' exposures in different countries.[20] This variable may be important for internal capital market allocations of the global banks since it provides perspective on the relative opportunity cost of allocating resources internally or abroad. Presumably, if interest rates abroad move in correspondence with U.S. monetary conditions, the incentive of U.S. parent banks to reallocate funds between parents and foreign affiliates might be mitigated. The addition of this control, with the results provided in column 5, does not change the outcome of the regressions.

The results indicate that large, non-global banks are less insulated than expected based on the Kashyap and Stein (2000) findings. In five out of the six regressions in columns 1 and 2 the sums of coefficients are statistically significant and positive. While the basic result highlighted in Kashyap and Stein (2000) was that large U.S. banks were effectively insulated from monetary policy, our tests indicate that separating the cluster of large banks along the global dimension makes a difference. The assumed ability of large banks to substitute external market liabilities may in fact be less than perfect. Lacking the ability to activate cross-border internal funding, a liquidity shock is transmitted to the asset side of the large bank balance sheet.

How large are these effects? As in Kashyap and Stein (2000), we take the hypothetical case of a 100 basis points change in the Federal Funds rate and apply this to the median large,

non-global bank to gauge the overall economic impact. For instance, in the specification with GDP growth controls and total lending as dependent variable (column 2, first row) the estimated coefficient is 0.0008. To calculate the impact on lending growth, we evaluate the effect at the median point in the liquidity-to-asset ratio distribution across domestic large banks, which is equal to 0.2 (in logs equal to -1.6). Hence, the median bank loss in total lending growth is equal to 0.13 percentage points (0.0008 × -1.6) quarterly.[21] Thus, the 100 basis point change in monetary policy reduces the slope of the path of lending growth for large, domestic banks, leading to 0.13 percentage points less growth each quarter.[22]

These results provide indirect evidence that globalness may in fact be a factor in providing bank lending with insulation from monetary policy. This evidence is only suggestive at best, and for a number of reasons. First, global banks are significantly larger on average than non-global banks, even within the same top-five percentile cluster of the full population of banks, with the global banks over-populating the top 1 percentile. Yet, the original findings by Kashyap and Stein (2000) showed large bank lending insulation even in a sample excluding the top 1 percentile of banks. In any case, we perform robustness tests to further take into account the issue of bank size. Accordingly, in one additional set of regressions we curtail the dataset to banks within the 95th and the 99th percentile. This refinement, with results in the lower panel of Table III, columns 6 through 9, continues to show that large global banks (now excluding the very largest), have lending patterns that are insulated from monetary policy, while large, non-global banks within the same sub cluster continue to display a certain degree of lending sensitivity. In another robustness check, we ran weighted least squares regressions for global banks in the first stage, using as weights the size distribution of the large, non-global banks. This approach in essence statistically penalizes the largest of the global banks and over-emphasizes the contribution of the smallest global banks to the results. The results, in column 10, confirm the insensitivity of global banks, and are an additional piece of evidence that size per se does not appear to be the leading factor explaining the difference in results across the domestic and global large banks.

Another possible explanation of our results is that perhaps it is not globalness driving the differences across domestic and global banks, but rather some differences in the customer bases of these banks. Certainly, global banks cater to more internationally-oriented businesses, which

may have different loan demand responsiveness to changes in domestic macroeconomic conditions. In order to capture the impact of globalness on banks which are more likely to face a homogeneous demand schedule, we capitalize on the Campello (2002) findings that insulation of lending to monetary policy achieved in external capital markets by large institutions extends to their small bank affiliates within the United States. Small banks operate in similar lending markets, and face a more homogenous population of borrowers. If globalness of the large bank affiliates of the small banks is an irrelevant factor, we should expect to replicate Campello (2002)'s results for small banks affiliated with large banks, with results across these banks similar irrespective of whether the small banks are affiliated with large banks that are global or non-global. However, if globalness matters, those small banks affiliated with large, global banks should exhibit a higher degree of lending insulation than those affiliated with large but domestically-oriented banks.

The empirical specification used by Campello (2002) follows (1)-(2), but with a slightly different set of regressors. The main bank balance sheet variable of interest in this specification, $X_{i,t-1}$, is the ratio of income from operation to total loans. In the first stage, controls include the ratio of non-performing loans to total loans, the equity to asset ratio, the log of bank total assets, the log change in bank liquid assets, and state and MSA dummies. We add as additional control variables the total log of assets of the entire BHC to which the small bank belongs and its squared value. As in Campello (2002), the log change in liquid assets is instrumented by its lag.[23]

[Table IV about here]

The first set of columns in Table IV refer to estimated coefficients from the regressions run on the subset of small banks affiliated with large, domestic banks, while the second set of columns refer to regressions run on the subset of small banks affiliated with large, global banks. The second set of columns shows that small banks affiliated with large, global banks appear to have lending that is insulated from liquidity shocks: in all specifications, regardless of the indicator of monetary policy, the choice of total lending or C&I lending, and including or excluding GDP controls, the estimated $\sum_{j=1}^{n}\phi_j$ are never positive and significant. In fact, they are actually negative and significant in three of the regressions that have total loans as the first stage dependent variable.

The results for small banks affiliated with large, domestic banks are markedly different. In eleven of the twelve alternative specifications the sums of coefficients from the second stage regressions are positive and statistically significant, indicating that these small banks need to rely more on their own balance sheets in times of liquidity shortage. The implication is that the small banks affiliated with domestic-only BHCs appear to remain exposed to changes in U.S. liquidity conditions. This result is an indication that the large banks in their organizations may not be sufficiently shielded to be able to activate a meaningful reallocation of resources to their small affiliates through the organization's internal capital market.[24]

The combined results of Tables III and IV indirectly suggest that the global dimension of banks matters for the transmission mechanism of monetary policy. However, the results are more broadly relevant. They highlight a form of more complex dynamics in banks' response to liquidity shocks. Additionally, they indicate that the domestic scope of the lending channel is bigger than previously thought since large, non-global banks are not as insulated from policy and, by extension, small banks affiliated with them are also less insulated.

B. Internal Capital Markets of Global Banks

The next set of tests, using specification (3), examines directly whether the conjectured internal capital market channel between head offices and foreign offices is active and used to respond to changes in U.S. monetary policy. In all regressions the dependent variable is the change in Net Due flows between a bank's domestic headquarters and its foreign offices, with the Net Due flows expressed in constant 2005q4 dollars. By construction, an *increase* in Net Due means that the domestic offices are receiving more funds from their foreign offices or sending fewer resources abroad to their affiliates. Specifications differ based on which monetary variable is used and on whether a foreign interest rate control is included.

[Table V about here]

The results summarized in the first column, upper panel of Table V, show a pattern of funds flow internal to the banking organization which is both statistically significant and consistent with the expected direction of results. Column 1 shows that Net Due flows from foreign affiliates to the head office in the United States increase significantly (or outflows

decline significantly) when liquidity conditions tighten in the United States, and vice versa. This finding is robust across all three indicators of U.S. liquidity and monetary policy.

How important are these effects? From Table V, the response by a median global bank to an increase of the Federal Funds rate by 100 basis points would have been an increase in internal borrowing by $74.3 million (in 2005q4 dollars) over four quarters. This number per se is not small, considering that over the same period the median change – up or down – over four consecutive quarters would have been $179.5 million (median = $44.9×4 quarters). What matters, however, is an assessment of the hypothetical Net Due response magnitude in relation to the potential balance sheet impact on the median bank of the original liquidity shock. In the absence of this cross-border, internal capital market, our argument is that global banks would have exhibited lending growth sensitivity to monetary policy presumably similar to that of large, domestic banks. Hence, we run a counterfactual exercise, calculating the potential loss in loan growth for large, domestic banks, and then applying that loss to the global banks. We then assess whether the estimated increase in internal lending is comparable to the fictional loss that otherwise would have occurred from the liquidity shock. If the orders of magnitude of these terms are comparable, we take this as an indication that the internal capital market channel is a significant component of global banks' overall balance sheet management.

The counterfactual uses the same 100 basis point change in federal funds rate and then looks for the strongest estimated impact on large, domestic banks. This approach embeds a type of worst-case scenario and the most adverse to test our conjecture. From the bottom panel of Table III, the largest estimated coefficient is obtained from the specification with GDP controls and excluding the largest, top 1 percentile domestic banks. This coefficient is 0.0016. To calculate the impact on lending growth, we evaluate the effect at the median point in the liquidity-to-asset ratio distribution, which is equal to 0.2 (in logs equal to -1.6). Hence, the median loss in total lending growth would be equal to 0.25 percentage points (0.0015×-1.6) quarterly. Thus, the 100 basis point change in monetary policy reduces the slope of the path in lending growth for large, domestic banks, leading to 0.25 percentage points less growth each quarter.[25] We now apply this estimate of the loss in potential lending growth to the global banks, and see if the internal inflow of funds from affiliates is sufficiently large to "fill the gap".

Over the whole sample period, at the average bank/quarter point, a global bank had loans for approximately $8.3 billion (in 2005q4 dollars). Because the response in internal funding is expected over four consecutive quarters, we calculate the hypothetical loss in lending growth from this average point over four consecutive quarters as: $8.3 billion×0.0025×4, which is approximately equal to $83 million. Hence, the estimated inflow of funds over the same time period for the median global bank observation seems to be quite exactly able to fill the funding gap and therefore maintain the balance sheet insulation of the global banks.

For robustness, we add to the basic specification the composite foreign interest rate with the same lag structure as the monetary policy variables and observe in column 2 that the inclusion of this control does not alter the basic result. Additional robustness checks in columns 3 and 4 include tests for asymmetry in the internal capital market response to U.S. liquidity condition tightening or loosening. The transmission of U.S. liquidity conditions onto Net Due flows occurs in response to both directions of liquidity change. Funds flow into the parent bank at a faster pace (or flow out from the parent at a slower pace) when domestic monetary policy is tighter (column 3), and funds flow out to the affiliates (or into the parent from the affiliate at a slower pace) when domestic monetary policy is more expansionary (column 4). Tests performed for equality across the asymmetric coefficients (not reported) show that none of the specifications yield a statistically significant difference between estimated size of Net Due response to tightening versus loosening of credit conditions. The empirics reject the notion that the response of internal capital markets between U.S. banks and their foreign affiliates is active only in one direction.

A potential critique of the internal capital market conjecture is that the movement of funds picked up by the regressions on Net Due flows may not reflect internal funding needs, but may instead be the result of chasing higher relative return opportunities across markets. If this were the case, however, foreign offices would simply increase their own positions in domestic assets on their balance sheet (e.g., through purchases of U.S. government securities). In other words, international portfolio reallocations could be done directly without the affiliate engaging in internal transactions with the head office. Nonetheless, we test the validity of this objection by running an alternative model specification. We test for a differential response in Net Due flows between banks with high versus low capitalization ratios. If the Net Due flows are just the result

of portfolio considerations and not due to internal funding needs, we would expect to see no difference in response between banks with higher and lower capital to asset ratio. On the contrary, under the presumption that, all-else-equal, banks with lower capitalization may have more difficulty accessing traditional external markets, we would expect to see a higher internal flow response exactly from this subgroup of banks. To implement this set of robustness checks, we construct for each quarter a dummy variable equal to one if a global bank has a lower than median capital-to-asset ratio relative to other global banks. We then run specification (3) separately for banks with lower or higher capital-to-asset ratios. The results, in Table V columns 5 and 6, corroborate the prior that global banks with lower capitalization ratios use the Net Dues channel more aggressively in response to liquidity conditions. We also run the specification for banks that are above or below median size each period. Columns 7 and 8 show that, as would be expected, the magnitude of the Net Due response scales up significantly for the larger global banks.

C. International Transmission through Global Banks

The fact that global banks activate internal capital markets with their foreign offices in response to changes in domestic liquidity conditions has direct implication for a potential international propagation mechanism. We provide two types of evidence on the consequences for the foreign offices. First, and as described in section II, we test whether foreign lending is more or less dependent on the strength of the balance sheet of the parent office as conditions of U.S. monetary policy vary.

[Table VI about here]

The regression specifications reported in Table VI cover growth in total lending of foreign offices, shown in the first set of columns, and growth in C&I lending of foreign offices, shown in the second set of columns. As in Table III, the reported results are the summed effects across quarters of a change in U.S. monetary variables, with the cells of the table drawn from regression specifications that are inclusive or exclusive of controls for real GDP growth and with the instrumented liquidity-to-asset ratio. The results are highly consistent across specifications. The estimated sums of coefficients are always negative and are significant in ten out of twelve regressions. The implication is that foreign lending activity of U.S. bank affiliates abroad relies

less on the overall strength of the home office in times of tighter monetary conditions in the United States, and relies more on the U.S. parent balance sheet in times of looser U.S. liquidity.

Second, we present direct evidence on the possible substitution between internal and external lending by foreign offices of global banks. This evidence more cleanly indicates the existence of an effective international propagation of domestic liquidity shocks via the internal capital market channel we have conjectured. Substitution between internal and external lending is expected to be stronger for those banks with a constrained balance sheet.

[Table VII about here]

We estimated equation specification (4), reporting in Table VII the sum of coefficients only for those terms needed to evaluate the total impact on foreign lending by low liquidity banks. Each column of Table VII reflects results of specifications utilizing different monetary policy variables.

Changes in Net Due *per se* have a small impact on lending by foreign offices. Indeed, changes in Net Due in times of U.S. monetary policy tightening are actually associated with a positive impact on foreign lending. This effect is likely capturing an increase in foreign investment that occurs during the periods when domestic macroeconomic conditions generate the need for policy tightening. A global bank with a relatively unconstrained balance sheet can receive support from its foreign operations while simultaneously increasing foreign office lending activity. However, the table also shows that liquidity-constrained banks instead substitute foreign external lending with cross-border internal lending, which is a direct indication that the internal capital market of global banks with their foreign offices represents an effective and potent channel of international propagation of domestic bank shocks to foreign markets. This substitution is observed in lower liquidity banks, but not those with higher liquidity.

To calculate the size of the international propagation channel, we use the results from Table VII to gauge the direct relationship between changes in internal lending and corresponding changes in external foreign lending. Take again the experiment of a 100 basis points change in the Federal Funds rate. The total effect of a change in internal lending due to such change in monetary policy for liquidity constrained banks is equal to a coefficient of – 0.065. To assess the economic impact, we turn this number into an elasticity, evaluating the effect at the mean of the distribution. The mean quarterly change in total foreign lending, up or down, for liquidity-

constrained global banks over the sample period was about $75 million. The corresponding mean quarterly change in Net Due was about $332 million. Hence the corresponding elasticity of foreign lending to Net Due in response to a 100 basis points change in the Federal Funds rate is equal approximately to 29 percent (0.065x(332/75)). For each dollar of extra internal lending that a liquidity-constrained global bank receives from its foreign offices, foreign external lending declines by 29 cents. Hence, even the magnitude of the international propagation channel seems very significant.[26]

IV. The Crisis Period

Our analysis has covered the period through the end of 2005 to purposefully maintain a separation from the events associated with the global financial crisis of 2007 to 2009. An in-depth analysis of the crisis is beyond the scope of this paper; however this more recent period still represents an opportunity to verify, in a very different scenario, the importance of the internal market funding channel that we have established.

As is well known, this period of time is characterized by a sequence of market events and an unprecedented battery of policy actions, by number and intensity.[27] For this reason, the end-of-quarter balance sheet data used in the previous part of the analysis may be unsuitable for capturing internal funding dynamics of banks. Given the high frequency of events and policy responses, for this specific exercise we utilize a different data source, the weekly series on aggregate Assets and Liabilities of Commercial Banks in the United States (the H.8 Statistical Release), published by the Board of Governors. The H.8 releases offer an important trade off: the data is aggregated over reporting banks, so we lose the bank-level dimension of Call Report data. On the other hand, the weekly frequency has the significant advantage that we are able to pin point a number of key event dates, corresponding to which we can conjecture and verify subsequent changes in the direction of the internal funding flows.

Another advantage of this data is that Net Due balances are presented not only for U.S. chartered banks (the population we have followed so far) but also for branches of foreign banks operating on U.S. soil (that are not required to file the standard Call Report form). Since the events of 2007 to 2009 did not just affect U.S. banks but also banks in other countries – especially those from developed Europe – this specific data offers ideal circumstances to contrast

internal capital market transfers across types of banks in light of U.S. versus foreign market pressures and responses.

The onset of the crisis is characterized by a severe funding shock to bank balance sheets. Banks, especially those in developed countries, had been accumulating substantial dollar denominated assets, mainly long-term securities derived from real estate activity, and they had funded such positions mainly through short-term dollar liabilities. Events in the summer of 2007 contributed to a substantial deterioration in quality of such asset portfolios, thus triggering a global shortage in short-term dollar supply right after the BNP Paribas announcement, on August 9th, of its inability to value assets in some of its investment funds. The response by the Federal Reserve was to facilitate access to the discount window. However, this form of borrowing remained very limited. As stresses mounted, in late December, the Federal Reserve introduced auction-based funding allocation with the institution of the bi-weekly Term Auction Facility (TAF) and dollar swap lines with the European Central Bank and the Swiss National Bank.[28] Through the swap lines, the U.S central bank could effectively provide some limited quantities of dollar liquidity to European banks through European central banks. During the first half of 2008, Bear Stern exited via its acquisition by JP Morgan Chase, first announced on March 17. While this event contributed in the subsequent weeks to increased market turmoil, the apex of the crisis was not reached until the bankruptcy filing of Lehman Brothers, on September 15. The following weeks were ones of extreme financial market stress, dollar funding shortages, and a range of policy measures. The first part of 2009 is characterized by still elevated uncertainty over banks' health (banks "stress tests" in the U.S. were announced and conducted between February and May) and a steep contraction in global demand. Signs of normalization in dollar funding markets are seen in mid 2009, after which and the Federal Reserve began the winding down of the emergency facilities.

We analyze separately the internal funding dynamics of U.S.-chartered banks and of U.S.-based branches of foreign banks in the upper and lower panels of Figure 2.

[Figure 2 about here]

Pre-crisis, the aggregate Net Due To balances for U.S.-chartered banks were roughly around $350 billion. As the figure shows, Net Due balances started increasing (more funds flowing in) *right after* the August 9th BNP announcement. The pace of increase was fairly steady

and reached a first peak of $500 billion in the third week of January. By then, the TAF had conducted the first three auctions, allocating increasing but still limited amounts of dollars to eligible banks. As U.S. head offices consolidated the direct funding support from TAF, we should observe less demand for internal funding inflows. Indeed, Net Due balances decrease in the subsequent weeks. After the Bear Stern event, internal funding of U.S. banks by foreign offices picks up again before reaching a trough of $415 billion just around the Lehman event (data point of September 24, 2008). The largest changes are observed in the subsequent weeks, with a new peak of $600 billion by January 2009. Balances return to pre-Lehman levels only by March 2009. Despite continued volatility, the trend is decreasing throughout the first half of 2010, where it reaches levels similar to those recorded in pre-crisis weeks. The internal funding dynamics for U.S. banks during the crisis period thus seem to fit quite closely with our conjectures about their responses to liquidity conditions in U.S. markets.

The internal funding dynamics for the branches of foreign banks located in the U.S. provide perspective on how the foreign head offices managed liquidity internally given the conditions outside of the United States. Our conjectures suggest a different time line in their internal funding dynamics: the initial funding shock was in fact a shock that affected the head offices in foreign countries. In the time between mid August 2007 and mid December 2007, while the foreign banks' head offices may have been actively engaged in "repatriating" funds internally from *a range of* foreign offices, it is not obvious one would observe a significant contribution coming from their U.S. offices, especially given the impaired liquidity conditions observed in U.S. financial markets overall. However, with the introduction of the TAF, the U.S. offices of foreign banks gained direct access to a low cost source of dollar funding. Hence, for this set of bank entities, our conjectures would imply observing a spike in their internal *lending* out to their own organizations only in the weeks *after* the start of TAF auctions.

The Net Due series in the lower panel of Figure 2 show the relatively flat dynamics between mid August and mid December, with outstanding balances averaging about $380 billion. A substantial upward trend occurs right after the start of the TAF auctions and continues throughout the first half of 2008. The trend stops right before the Lehman event, with a peak at September 9 of $600 billion in outstanding balances vis-à-vis their own foreign organizations (hence an increase of almost 60 percent over just nine months). Post-Lehman, the chart shows a

sudden drop in internal transfers abroad for these foreign entities. While taken in isolation this pattern would seem puzzling, in September 2008 foreign draws on the central bank dollar swap facilities accelerated. The uncapping of available dollars through this facility broadened the central bank dollar swap lines balances from about $100 billion to about $600 billion over the subsequent period, a similar order of magnitude change as the drop in internal bank transfers. The direct dollar funding provision by the Federal Reserve to foreign central banks essentially allowed direct funding support by foreign central banks to the head offices of their own affected banking organizations. Hence, once their own central banks were able to provide significant dollar funding through their own auction-based system, the need for internal borrowing from their U.S.-based offices subsided. The pattern throughout the rest of 2009 is similar to that observed for U.S. chartered banks. In particular, both sets of banks denote a pattern of decreasing net due balances going back to pre-crisis level.

Regarding the impact on foreign lending, the crisis embeds an additional challenge, due to the fact that investment demand slows down on a global scale. Hence, it is hard to highlight changes in lending *supply* by the foreign offices of U.S. banks in a period of concomitant important changes in lending demand as well. Suggestive evidence on the effects of internal capital market transfers comes from examination of bank-level changes in foreign lending from average levels before the middle of 2007 and afterwards.[29] We perform an exercise (not reported) similar in spirit to the exercise reported in Table VII, wherein we expect more severe lending contractions for banks with ex ante pre-crisis ratios of liquid assets to total assets below median, with this difference-in-difference approach being one method of controlling for simultaneous changes in loan demand across banks.

[Figure 3 about here]

The data, although limited in power by the relatively limited number of observations, show that there was a negative relationship for low liquidity banks (an increase in net dues, i.e. more internal lending, corresponds to lower external lending) and a non-existent or opposite relationship for high liquidity banks.

V. Conclusions

The results provided in this paper support the conjecture that globalization of banking has a deep and pervasive impact on the consequences of domestic and international liquidity shocks. First, we find that having global operations insulates banks from changes in monetary policy while banks without global operations are more affected by monetary policy than previously suggested in the literature. Second, using data on actual internal funding between banks' head offices and their foreign offices, we provide direct evidence for the conjectured internal capital market activity of global banks. Third, we show that these internal capital market flows of global banks directly contribute to the international propagation of domestic liquidity shocks into the lending done by their foreign affiliates. These internal capital market transfers in global banks were also an important feature of bank liquidity management during the financial crisis of 2007 through 2009.

The consequences are statistically and economically significant. The mechanisms we identify imply that, under increasing banking globalization, the impact of monetary policy on domestic bank lending and on the U.S. economy as a whole is more attenuated, while at the same time the domestic shock is transmitted more broadly to foreign markets through affiliated banks. A continuing process of increasing banking globalization suggests that the lending channel within the United States could be declining in strength, with international transmission rising for policy and shocks originating in the United States.[30]

As the period of the financial crisis demonstrated, understanding the dynamics of international, intra-bank funding is important for effective policy making. With financial globalization and the broader international propagations of shocks, the international community responded with an unprecedented degree of policy coordination and cooperation. Looking forward, there could be enhanced efforts to understand the funding models of banks and the forms of interlinkages in global organizations that support the efficient allocation of liquidity internationally.

In conclusion, geographic national boundaries are increasingly losing importance in evaluating the effects of domestic shocks, and the rise of global banking is an effective vehicle of transmission across borders. Central bankers and regulators in general are then confronted with a diminishing effectiveness of their standard policy tools and with a renewed and expanded need for broader international coordination.

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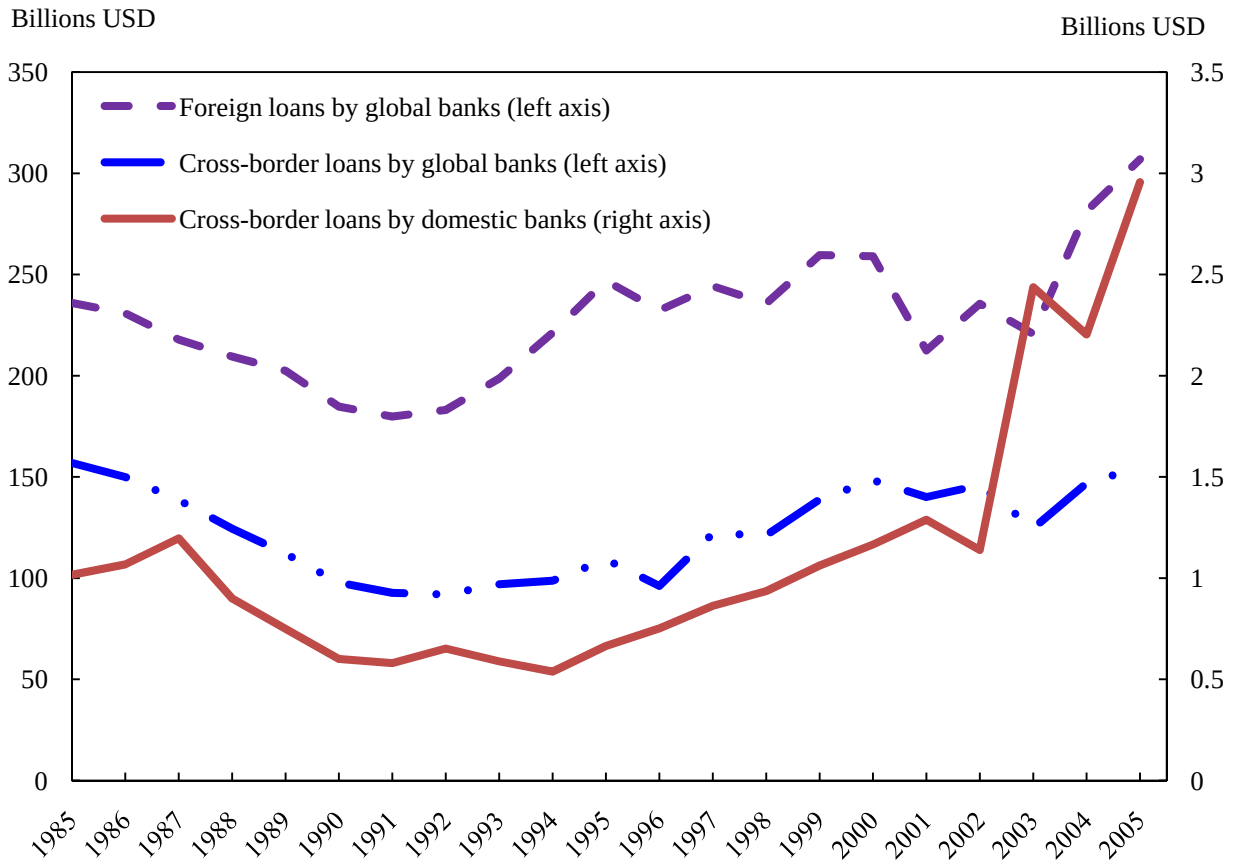
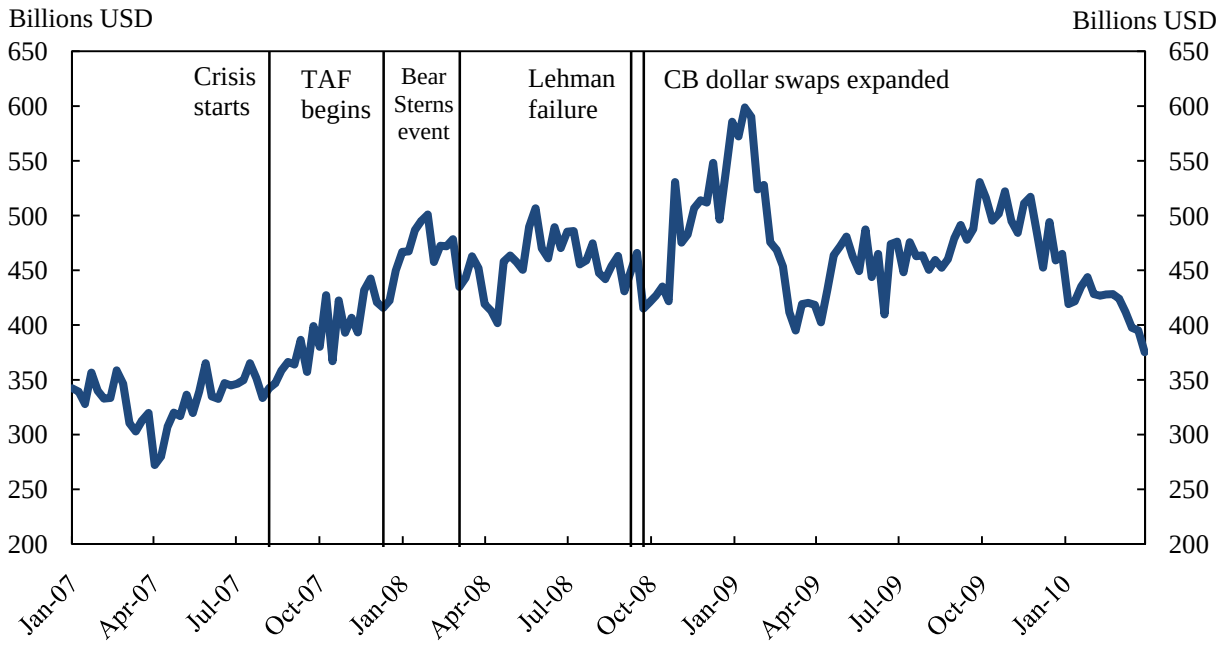
Figure 1 International Lending by U.S. Banks



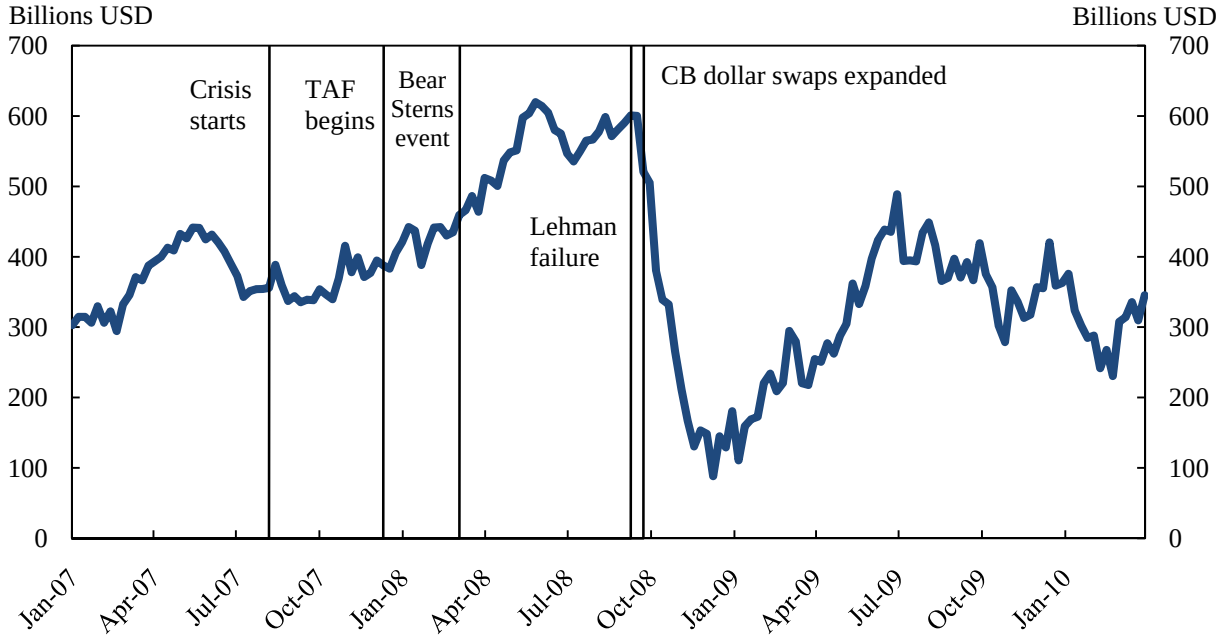
Source: Data on loans are from schedule RC-C of form FFIEC 031 of the Call Reports. Cross-border loans are computed as the sum of consolidated commercial and industrial loans to non-U.S. addressees (RCFD 1764), domestic offices loans to banks in foreign countries (RCON B535), consolidated loans to foreign governments and official institutions(including foreign central banks) (RCFD 2081), and consolidated lease financing receivables to non-U.S. addressees (RCFD 2183), sorted for every quarter and averaged annually. Foreign loans are computed as the difference between total loans and leases of consolidated banks (RCFD 2122) and total loans of their domestic offices (RCON 2122), sorted for every quarter and averaged annually. A bank is defined as global in a quarter if it reports positive foreign assets. A bank is defined as domestic if all its activity comes from offices located domestically.

Figure 2 Patterns of Internal Borrowing During the Crisis

Internal borrowing by large U.S. chartered banks from related foreign offices



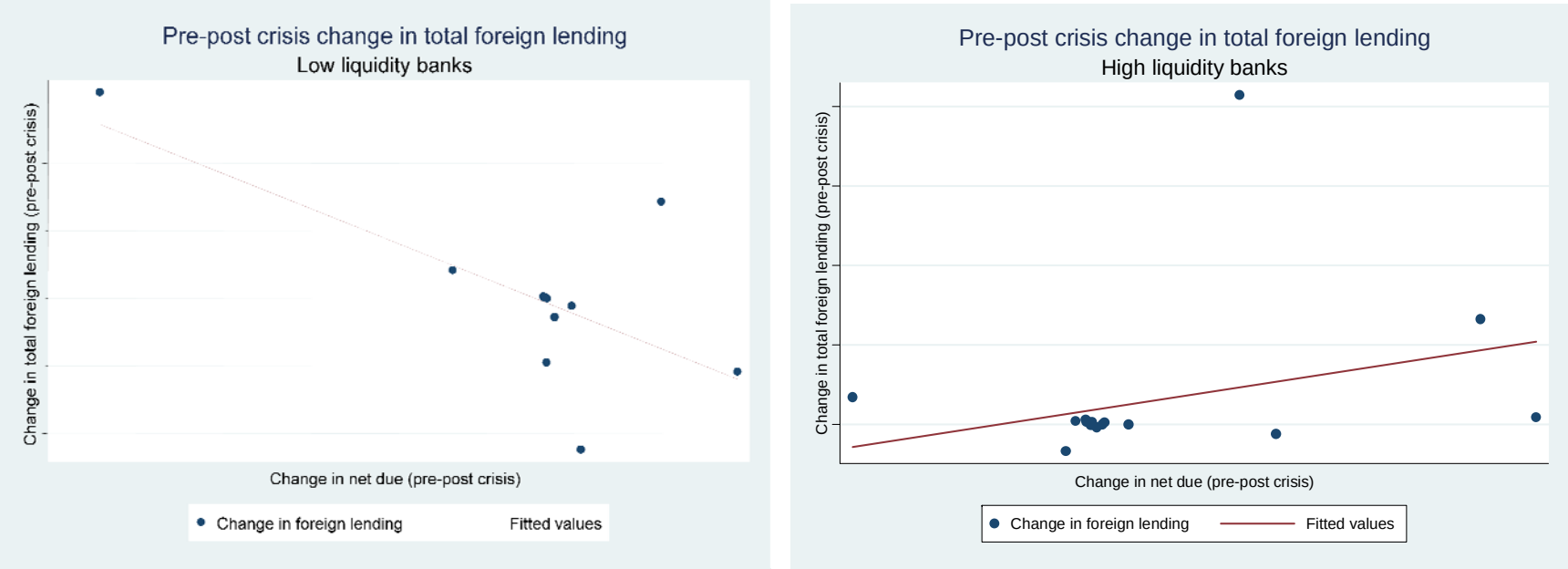
Internal lending by U.S.-based FBOs to affiliates abroad



Source: Weekly series on aggregate Assets and Liabilities of Commercial Banks in the United States (H.8 report). Data is reported from the perspective of the reporting institution located in the United States. Hence, the series shown *are internal borrowing by* large U.S. chartered commercial banks (net due to related foreign offices), and

internal lending of U.S.-based foreign banking organizations (FBOs) to their foreign affiliates (negative net due to foreign affiliates).

Figure 3 Foreign Lending During the Crisis



The charts display the relationship between change in total foreign lending and change in net due from pre-crisis levels (average levels in quarters up to 2007q2 compared to average levels afterwards), separately for large global banks with pre-crisis liquid asset levels below median (low liquidity banks) and above median (high liquidity banks). Low-liquidity banks display a negative relationship, consistent with the hypothesis that an increase in internal lending is associated with a decrease in external lending for banks with an ex-ante more constrained asset side of the balance sheet. There is no relationship between external and internal lending (if anything a slight positive relationship) for banks with an -ante less constrained balance sheet.

Table I: Basic Balance Sheet Information for U.S. Banks

	All banks	Large domestic banks	Large global banks	Small banks in domestic BHCs	Small banks in global BHCs
Total number of bank observations (1980Q1-2005Q4)	1,162,969	43,921	14,252	41,339	47,640
Median values for bank asset size (millions 2005USD)					
1985	62.3	997	5,123.7	93.9	103
1995	73.9	1,775.9	10,358.6	142.7	134.8
2005	105.2	2,236.5	22,300	213.3	213.2
Share of each bank group in total assets (%)					
1985	100.0	16.6	56.0	1.4	2.2
1995	100.0	22.6	56.1	1.0	0.9
2005	100.0	17.9	67.9	0.4	0.3
Median total loans / assets (%)	55.6	61.1	60.4	57.1	55.5
Median C&I loans / assets (%)	17.3	22.8	35.4	18.4	21.0
Median real estate loans / assets (%)	24.5	26.0	17.5	26.2	22.3
Median bank liquid assets / total assets (%)	24.1	19.8	16.6	27.3	26.3
Median capitalization ratio (%)	8.7	7.2	6.4	8.0	7.6
Value of nonperforming loans/ total loans (%)	1.0	1.0	1.1	1.6	0.8

Data is from quarterly Call Report forms for all banks from 1980Q1 to 2005Q4. A bank is defined as global in a quarter if it reports positive foreign assets. A bank is defined as domestic if it has no foreign assets. Large banks are those with total assets above the 95^{th} percentile of the total asset distribution in each quarter. Small banks are those with total assets below the 90^{th} percentile of the total asset distribution in each quarter. Small banks in domestic BHCs are small banks affiliated in BHCs with at least one large, domestic bank and no global banks. Small banks in global BHCs are small banks affiliated in BHCs with at least one large, global bank.

Table II: Net Due Flows and Foreign Loans
(Millions 2005 USD)

		1985q4	1995q4	2005q4
	Number of global banks	247	170	107
Loans of Foreign Offices				
Total loans	Median value across banks	$19.3	$0.027	$0
	Mean value across banks	$1,599.7	$1,978	$3,129.8
	Share of total bank lending	0.15	0.11	0.07
C&I loans	Median value across banks	$4.8	$0	$0
	Mean value across banks	$866.4	$942.2	$1,236.9
	Share of total C&I lending	0.08	0.05	0.03
Net Due flows				
Net Due To	Median	$62.3	$299.2	$657.3
	Mean	$304.3	$955.7	$3,856.1
	Number of observations	60	103	62
Net Due From	Median	$43.3	$3.9	$852
	Mean	$458.3	$332.5	$984
	Number of observations	187	67	45
(Net Due To – Net Due From)				
	Median absolute value	$47.3	$141.9	$74.4
	Mean absolute value	$420.9	$710.1	$2,648.2
	Number of observations	247	170	107

Net due to/from indicate the position of the domestic offices of a bank relative to all of the bank's Edge and Agreement subsidiaries, foreign branches, consolidated foreign subsidiaries, and branches in Puerto Rico and U.S. territories and possessions (schedule RC-H from form FFIEC 031 – Call Report). A positive net due *to* indicates that the head office owes funds to its foreign offices. A positive net due *from* indicates that the head office is owed funds from its foreign offices. Foreign loans are the total loans booked by the foreign offices of U.S. global banks.

Table III: Lending Channel for Large Domestic and Large Globally-Oriented Banks

	Domestic Banks		Global Banks		
	no gdp controls (1)	with gdp controls (2)	no gdp controls (3)	with gdp controls (4)	gdp and foreign rate controls (5)
Federal Funds Rate (nominal)	**0.0008** **[0.008]**	**0.0008** **[0.006]**	-0.0001 [0.915]	-0.0004 [0.659]	0.0007 [0.637]
Federal Funds Rate (real)	0.0004 [0.274]	**0.0008** **[0.036]**	0.0017 [0.109]	0.0011 [0.296]	0.0010 [0.519]
Bernanke-Mihov index (negative*100)	**0.0004** **[0.038]**	**0.0003** **[0.084]**	-0.0001 [0.902]	-0.0001 [0.831]	0.0001 [0.820]

Robustness

	Domestic Banks		Global Banks		
	No Top 1 %		No Top 1 %		WLS
	no gdp controls (6)	with gdp controls (7)	no gdp controls (8)	with gdp controls (9)	with gdp controls (10)
Federal Funds Rate (nominal)	**0.0016** **[0.000]**	**0.0016** **[0.000]**	-0.0030 [0.444]	-0.0029 [0.509]	0.0026 [0.587]
Federal Funds Rate (real)	**0.0010** **[0.077]**	**0.0014** **[0.007]**	-0.0012 [0.806]	0.0002 [0.963]	0.0057 [0.296]
Bernanke-Mihov index (negative*100)	**0.0005** **[0.052]**	0.0004 [0.130]	-0.0032 [0.264]	-0.0032 [0.334]	-0.0018 [0.589]

This table presents results from equation (2) using IV specifications for total bank loans. The dependent variable is the time series of estimated coefficients of the liquidity to asset ratio from quarterly cross-sectional regressions based on specification (1), where the dependent variable was growth in total bank loans. The reported figures in the columns are from the sum of the estimated coefficients on the eight lags of each respective monetary policy variables. The Bernanke-Mihov index has been modified from the original so that all three monetary policy indicators signal tightening when they increase. Reported in brackets is the probability that the sum of the coefficients is significantly different from zero. All reported specifications instrument the liquidity to asset ratio with the series of the residuals of a regression of such variable on the C&I to total lending ratio and the ratio of non performing to total loans. The first two columns reports results for the group of large, domestic banks, i.e. banks above the 95th percentile in asset size and reporting no foreign assets. The last three columns report results for the group of large, global banks, i.e. large banks with positive foreign assets. Columns 1 and 3 refer to second-stage specifications without GDP controls, while columns 2, 4 and 5 to specifications including GDP controls. Column 5 also includes foreign rate controls. In the lower panel, the first two columns report results for large, domestic banks, excluding banks in the top 1 % in asset size. Column 3 and 4 report equivalent results for large, global banks. The fifth column report results for large, global banks based on a WLS regression, with weights determined using the size distribution of large, domestic banks. Bold indicates statistical significance at least at the 10 % level. Sample period: 1980:Q1-2005:Q4. Standard errors are computed with an 8-lags Newey-West correction for autocorrelation and heteroskedasticity.

Table IV: Results for Small Affiliated with Large Domestic or Globally-Oriented Banks

	Total Bank Lending			
	Small in Domestic Banks		Small in Global Banks	
	no gdp controls (1)	with gdp controls (2)	no gdp controls (3)	with gdp controls (4)
Federal Funds Rate (nominal)	**0.2903** **[0.047]**	**0.5203** **[0.026]**	-1.1976 [0.131]	-0.3404 [0.471]
Fed Funds Rate (real)	**0.8440** **[0.000]**	**0.9411** **[0.001]**	**-1.5803** **[0.057]**	-1.8704 [0.142]
Bernanke-Mihov index (negative*100)	0.1278 [0.122]	**0.2495** **[0.016]**	**-0.6966** **[0.075]**	**-0.4937** **[0.042]**
	Total C&I Lending			
	Small in Domestic Banks		Small in Global Banks	
	no gdp controls (5)	with gdp controls (6)	no gdp controls (7)	with gdp controls (8)
Federal Funds Rate (nominal)	**1.4342** **[0.029]**	**1.0752** **[0.087]**	-0.1390 [0.764]	-0.0207 [0.970]
Fed Funds Rate (real)	**2.5029** **[0.050]**	**2.6469** **[0.027]**	-1.0854 [0.233]	-1.0579 [0.282]
Bernanke-Mihov index (negative*100)	**0.7712** **[0.035]**	**0.6619** **[0.057]**	-0.1084 [0.604]	-0.0145 [0.953]

This table presents results similar to those of Table III, but based on Campello (2002): the object of analysis are small banks (asset size below the 90th percentile) affiliated to either large, domestic banks or large, global banks as part of the same BHC. The dependent variable is the time series of estimated coefficients on the net income to loan ratio in quarterly cross-sectional regressions where the dependent variable was either growth in total bank loans or total C&I loans. The reported figures in the columns are from the sum of the estimated coefficients on the eight lags of each respective monetary policy variables. The Bernanke-Mihov index has been modified from the original so that all three monetary policy indicators signal tightening when they increase. Reported in brackets are the probabilities that the sum of the coefficients is significantly different from zero. The upper panel reports results from estimations where the dependent variable in the first-stage regressions was total lending growth. The lower panel reports results from estimations where the dependent variable in the first-stage regressions was total C&I lending growth. The first two columns reports results for the group of small banks members of BHCs where there is at least one large domestic bank and no global banks. The last two columns report results for the group of small banks members of BHCs where there is at least one large global bank and no other large, domestic bank. Odd columns refer to second-stage specifications without GDP controls, while even columns to specifications including GDP controls. Bold indicates statistical significance at least at the 10 % level. Due to sample size constraint, the sample period is 1980:Q1-1996:Q4. Standard errors are computed with an 8-lags Newey-West correction for autocorrelation and heteroskedasticity.

Table V: Internal Lending Between Parent Banks and Foreign Affiliates

Monetary variable	Baseline	Baseline with foreign rate controls	Baseline with Potential asymmetry of effects when	
			Tighter money	Looser money
	(1)	(2)	(3)	(4)
Federal Funds Rate (nominal)	**74,268** **[0.026]**	**80,162** **[0.020]**	**131,158** **[0.043]**	**82,441** **[0.000]**
Fed Funds Rate (real)	**75,715** **[0.044]**	**104,688** **[0.010]**	**82,266** **[0.024]**	**164,481** **[0.020]**
Bernanke-Mihov index (negative*100)	**14,633** **[0.083]**	**17,918** **[0.010]**	23,969 [0.230]	**24,231** **[0.043]**

Monetary variable	Capitalization rate		Bank Size	
	Lower	Higher	Below Median	Above Median
	(5)	(6)	(7)	(8)
Federal Funds Rate (nominal)	**157,352** **[0.008]**	-15,562 [0.489]	1,882 [0.698]	**152,704** **[0.023]**
Fed Funds Rate (real)	**163,302** **[0.017]**	-20,615 [0.288]	-2,025 [0.634]	**152,473** **[0.043]**
Bernanke-Mihov index (negative*100)	**28,300** **[0.078]**	2,598 [0.787]	3,039 [0.362]	**30,605** **[0.085]**

This table presents results from regressions where the dependent variable is the quarterly real change in net due flows from foreign affiliates to the head office. A positive change indicates a net inflow of funds from foreign operations. The dependent variable is in real 2005q4 dollars. The reported figures in the columns are from the sum of the estimated coefficients on the eight lags of each respective monetary policy variables. The Bernanke-Mihov index has been modified from the original so that all three monetary policy indicators signal tightening when they increase. In the upper panel, column 1 reports results from the baseline specification of equation (3). Column 2 reports results of the baseline specification where foreign rate controls were also included. Column 3 and 4 splits the sample in period of monetary tightening and monetary expansion, respectively. Tests of the equality of each pair of estimates from column 3-4 were run but they are not reported. In the lower panel, columns 1 and 2 split the sample between observations with a capital to asset ratio below and above the median, respectively. Column 3 and 4 instead split the sample in observations below and above the median in asset size. Reported in brackets are the probabilities that the sum of the coefficients is significantly different from zero. Bold indicates statistical significance at least at the 10 % level. Sample period: 1980:Q1-2005:Q4. Robust standard errors and clustered by bank id.

Table VI: Monetary Policy and Foreign Lending

Monetary variable	Total Foreign Lending		Total Foreign C&I Lending	
	Without gdp controls (1)	With gdp controls (2)	Without gdp controls (3)	With gdp controls (4)
Federal Funds Rate (nominal)	**-0.0104** **[0.008]**	**-0.0118** **[0.001]**	**-0.0159** **[0.004]**	**-0.0146** **[0.011]**
Fed Funds Rate (real)	**-0.0098** **[0.049]**	**-0.0124** **[0.002]**	**-0.0114** **[0.021]**	**-0.0118** **[0.025]**
Bernanke-Mihov index (negative*100)	**-0.0057** **[0.045]**	**-0.0063** **[0.016]**	-0.0026 [0.469]	-0.0012 [0.768]

This table presents results based on specification similar to those of Table III. Here the focus is on the activity of the foreign offices of global banks. The dependent variable is the time series of estimated coefficients of the liquidity-to-asset ratio from quarterly cross-sectional regressions where the dependent variable was either growth in total loans or total C&I loans of the foreign offices of global banks. The reported figures in the columns are from the sum of the estimated coefficients on the eight lags of each respective monetary policy variables. The Bernanke-Mihov index has been modified from the original so that all three monetary policy indicators signal tightening when they increase. Reported in brackets are the probabilities that the sum of the coefficients is significantly different from zero. The first two columns report results from estimations where the dependent variable in the first-stage regressions was total lending growth of foreign offices. The last two columns report results from estimations where the dependent variable in the first-stage regressions was total C&I lending growth of foreign offices. Odd columns refer to second-stage specifications without GDP controls, while even columns to specifications including GDP controls. All reported specifications instrument the liquidity to asset ratio with the series of the residuals of a regression of such variable on the C&I to total lending ratio and the ratio of non performing to total loans. Bold indicates statistical significance at least at the 10 % level. Sample period: 1980:Q1-2005:Q4. Standard errors are computed with an 8-lags Newey-West correction for autocorrelation and heteroskedasticity.

Table VII: Net Due Effects on Foreign Lending in Response to Monetary Policy

Regression coefficients	Total Foreign Lending		
	Federal Funds Rate (nominal)	Fed Funds Rate (real)	Bernanke-Mihov index (negative*100)
Net Due	-0.0232 [0.168]	0.0058 [0.734]	**-0.0533** **[0.002]**
Net Due x Monetary policy	**0.2984** **[0.000]**	**0.2711** **[0.000]**	**0.1243** **[0.000]**
Net Due x Low Liquidity	**-0.0854** **[0.001]**	**-0.1165** **[0.000]**	**-0.0520** **[0.044]**
Net Due x Mon policy x Low Liquidity	**-0.2781** **[0.000]**	**-0.2156** **[0.000]**	**-0.1137** **[0.000]**

	Total Foreign C&I Lending		
	Federal Funds Rate (nominal)	Fed Funds Rate (real)	Bernanke-Mihov index (negative*100)
Net Due	0.0097 [0.241]	**0.0166** **[0.047]**	**-0.0179** **[0.037]**
Net Due x Monetary policy	**0.2161** **[0.000]**	**0.1436** **[0.000]**	**0.0969** **[0.000]**
Net Due x Low Liquidity	**-0.0352** **[0.015]**	**-0.0423** **[0.003]**	-0.0080 [0.574]
Net Due x Mon policy x Low Liquidity	**-0.1866** **[0.000]**	**-0.1022** **[0.000]**	**-0.0734** **[0.000]**

This table presents results from regressions of equation specification (4). They capture the direct effect on lending of foreign offices of a change in net due in response to a change in monetary policy. We report only a partial list of coefficients, to focus on the effect on low liquidity banks. The dependent variable is either the quarterly change in foreign total lending or foreign C&I lending. Each column is a separate regression for each of the three measures of monetary policy. The reported numbers are from each respective sum of estimated coefficients, as indicated by each row legend. Net Due is in real 2005q4 dollars. Low liquidity is a dummy equal to one if a global bank has a value of liquidity to asset ratio below the median in a quarter. Reported in brackets are the probabilities that the sum of the coefficients is significantly different from zero. Sample period: 1980:Q1-2005:Q4.

[1] For basic references on the lending channel see, e.g., Bernanke and Blinder (1988), Bernanke and Gertler (1995), and Kashyap and Stein (1994, 1995, 2000).

[2] For this reason, evidence on the existence of internal capital markets is typically derived indirectly by looking at the *performance* of one side of an organization in response to a shock to the other side. De Haas and Lelyveld (2010) and Barba Navaretti, Calzolari, Pozzolo, and Levi (2010) are recent applications using multinational bank data.

[3] Goldberg (2009) surveys the range of evidence on foreign bank consequences for lending overall and for lending to small and medium sized enterprises.

[4] See Stein (1998) for specific modeling of the informational frictions on banks' liability side.

[5] Note that while it is the case that global banks (again, defined in this paper as banks with actual foreign offices) are large banks, a large bank does not need to be "global" to engage in international lending. Large, but non-global U.S. banks can engage in "cross-border" lending activity, defined as lending by a domestic bank to clients residing abroad.

[6] For the sake of comparability with the existing results from Kashyap and Stein (2000) and Campello (2002), and in order to maintain a "ceteris paribus" condition, we follow closely their model specification while focusing our attention on the globalness aspect. One consideration raised is the desirability of the two-step procedure, instead of a nested single step procedure. The main advantage of the two-step procedure is in allowing for a more flexible parametric specification. For example, the effects of both local macroeconomic conditions and lags in the dependent variable can be allowed to be time-variant in the two-step procedure. While alternative modeling approaches could be worth investigating, presenting refinements of this kind would be narrow in focus and would take us away from the main goals we want to achieve. We nonetheless run a large battery of robustness tests of the basic model specification, described at length in the results section.

[7] As mentioned in Kashyap and Stein (2000), C&I lending may offer a more direct insight in the potential impact on real economic activity, but it is also the case that the loan portfolio across banks varies widely, as we show in Table I. For that reason focusing on total lending may be more inclusive and less exposed to potential sample biases.

[8] Bernanke and Mihov (1998) applied a flexible VAR model which nested specific assumptions about central bank operating procedures, such as whether it is based on federal funds rate or non-borrowed reserves targeting. Ilian Mihov kindly updated and revised this measure in December 2006 using data through the end of 2005. The Kashyap and Stein (2000) study uses a narrative measure of monetary policy, the Boschen-Mills index, the Federal Funds rates, and the Bernanke and Mihov measure. Kashyap and Stein (2000) do not use a real Federal Funds rate.

[9] A similar approach was also taken by Kashyap and Stein (2000). In addition, we have run equivalent OLS specifications, which yielded qualitatively similar results.

[10] See, e.g., Stein (2003) for a comprehensive survey.

[11] A recent paper, Cremer, Huang and Sautner (forthcoming), tests theories of internal capital markets using confidential data on internal funding activity between headquarter and member banks of a single banking group for the 2005 to 2007 period.

[12] Further details on this data are provided in section II.

[13] The specific details on the FFIEC 031 Consolidated Reports of Condition and Income for a Bank with Domestic and Foreign Offices and FFIEC 041 Consolidated Reports of Condition and Income for a Bank with Domestic Offices Only are available at http://www.ffiec.gov/forms031.htm and http://www.ffiec.gov/forms041.htm.

[14] The qualitative results presented are supported using larger thresholds for foreign asset shares.

[15] While both categories of large banks increased substantially the share of real estate lending in the decade ending 2005, this type of lending was a larger share of the loan portfolio for the more domestically-oriented large banks (not shown).

[16] Berger et al. (2005) explore differences in portfolios across banks distinguished by size. Bank size is correlated with the bank business model: larger banks tend to lend at a greater distance, interact more at arms-length with their borrowers, and have shorter and less exclusive relationships with these borrowers.

[17] These data are from schedule RC-C of the Call Reports filed by banks: item RCFN 2122 for total loans and RCFN 1763+1764 for C&I loans.

[18] We construct these as the difference between schedule RC-H Net due *to* own foreign offices, Edge and Agreement subsidiaries, and IBFs and Net due *from* own foreign offices, Edge and Agreement subsidiaries, and IBFs (RC-H 2941-2163).

[19] These screens follow closely those of Kashyap and Stein (2000) and Campello (2002). We drop bank quarters in which mergers or changes in "high holder" within a BHC occur. We drop bank quarters where asset growth was above 100 percent and total loan growth was above +50 percent or below –50 percent. In regressions where we focus on C&I lending, we remove similar outliers in the C&I lending growth distribution. Finally, for regressions

analyzing the lending of foreign offices we dropped outliers at the 1st and 99th percentile of either the series of growth in total and C&I lending of foreign offices.

[20] Given reliable data availability on such interest rates, we focus on the top 20 countries by exposure, which account anyway for the vast majority of total system exposure.

[21] This exercise is similar to those in Kashyap and Stein (2000).

[22] Their median growth in total lending over the whole period was 2.2 percent, hence the loss would amount to about 5 percent of such median value.

[23] However, the sample size of these sub groups of small banks implies a constraint in this empirical exercise: Because of the underlying process of industry consolidation occurring over the sample period, by the time we are in the mid 1990s the two sub-samples become relatively small. After 1996Q4, for instance, the sub group of small in BHCs with a large, global bank shrinks below 100 observations. Given the number of regressors in the first-stage estimation (balance sheet variables, quarterly dummies and state dummies), we decided to truncate the sample size at 1996Q4 for the analysis on the small banks. Since this exercise only has the specific task of addressing the issue of demand heterogeneity, and not of providing a full fledge analysis on small banks' funding patterns, we feel that this constraint is acceptable. We ran further tests on the sub group of small banks in BHCs with large, domestic-only banks, which has relatively more observations than the other sub group. Truncating their sample at 2000Q4, the quarter after which this sample size goes below 100, the results are consistent with those reported.

[24] The same quantitative exercise ran before shows a very large impact on the lending activity of this category of banks: the estimated coefficient of the specification with GDP growth controls and total lending as dependent variable was equal to 0.52 (second column, first row of Table V). The median liquidity to asset ratio for small banks affiliated with large, domestic banks is about 17 percent (in log equal to -1.77). Hence a 100 basis points change in the Federal Funds rate would reduce their total lending by about 0.91 percentage points.

[25] Their median growth in total lending was 2.2 percent, hence the loss would amount to about 10 percent of such median value. While it could be argued that this effect is relatively small in economic magnitude, the scale is not surprising: these are still relatively very large banks with better than average access to financial markets external to the banking organization. Despite access to such external markets, insulation of large bank lending to U.S. monetary policy is not complete without international operations.

[26] Since banks often follow their large multinational customers abroad, it is possible that when the foreign production is destined for the United States and liquidity tightens in the United States, demand for loans falls regardless of internal capital market transfers by banks. However, our examination of data on the composition of customers of foreign offices does not support this force as a driver of our results. For our population of global banks, the large majority of banks report that most of the C&I lending of their foreign offices is with *non*-U.S. borrowers. The median ratio of foreign offices' C&I lending to *non*-U.S. borrowers to their total C&I lending is never below 93 percent.

[27] For a summary of events and corresponding policy responses, see, e.g. Brave and Genay (2010).

[28] For in-depth overviews of facilities, see, e.g., Armantier, Krieger, and McAndrews (2008) on the TAF and Goldberg, Kennedy and Miu (2011) on the central bank dollar swap lines.

[29] For this part of the event study we felt it would not make much sense to perform finer subdivisions of the sample period as lending dynamics are known to be slow and certainly spanning over multiple quarters.

[30] This work is closely related to others that have also suggested a reduced potency for monetary policy as a result of evolution of the banking industry, e.g., Morgan, Rime and Strahan (2004), Ashcraft (2006) and Loutskina and Strahan, (2009).