Crises and Rescues:
Monetary Policy Transmission Through International Banks

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Abstract

We study the effects of the U.S. Federal Reserve's Term Auction Facility (TAF) on globally active banks. We exploit a unique dataset with information on all foreign activities of German banks' affiliates both, in- and outside the US. All German parent banks with US affiliates tapped TAF liquidity, which mitigates self-selection concerns. This setting allows testing whether foreign affiliate activity *outside* the US has evolved differently for banks with and without access to TAF. Our results provide evidence for monetary policy transmission through internationally active banks. After controlling for parent-, affiliate-, and host-country characteristics, TAF had a positive impact on assets and liabilities of foreign affiliates of German parent banks outside the US. The response to TAF differs across banks and regions though. Government-owned and large banks drive the positive TAF effect. The effect is strongest for assets held in financial centers and in the European Monetary Union (EMU).

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1 Motivation

During the global financial crisis, banks have adjusted their international positions and cross-border bank lending has contracted. Relative to pre-crisis levels, cross-border assets of European banks fell to 75%, those of German banks to 63% by the end of 2012.[1] International banking markets have become increasingly fragmented (Giannetti and Laeven 2012, Hildebrand et al. 2012, Rose and Wieladek 2012). This is a reflection of adverse liquidity and asset price shocks. To prevent a further meltdown and disintegration of markets, central banks have intervened massively by means of concerted actions or standby measures. In December 2007, the Fed announced "measures designed to address elevated pressures in short-term funding markets".[2] The Federal Reserve's Term Auction Facility (TAF) is one channel through which US monetary policy has been transmitted to other countries (Shin 2011).

In this paper, we analyze the effects of this specific monetary policy measure – the Term Auction Facility (TAF). We use detailed data on the access of German banks' US-based foreign affiliates to TAF and subsequent changes in the activities of German banks' foreign affiliates *outside* the US. Hence, we analyze whether affiliates *other* than those directly supported by TAF liquidity have changed their foreign asset holdings. Our main finding is that liquidity shocks are transmitted across countries through foreign affiliate networks of global banks. All other things equal, access to TAF eased banks' liquidity constraints, and non-US affiliates of parents that accessed TAF report higher asset holdings during the crisis.

Our identification scheme rests on three features of the data. First, only foreign banks with US-based affiliates could bid for TAF liquidity. Yet, the affiliate network was predetermined when the housing bubble burst in 2007: out of 92 German parent banks in our dataset, 12 banks operated US-based affiliates, which all bid for TAF liquidity without exception. These affiliates had been established well before the crisis. Hence, we can rule out any active sorting of banks into eligibility for TAF support. Second, with the TAF program, the Fed explicitly addressed foreign, non-US chartered banks for the first time in order to relieve the dollar funding pressure. From the foreign banks' perspective, this kind of unprecedented support could hardly be anticipated. Third, it is unlikely that the liquidity needs of a specific foreign affiliate – which is our unit of analysis – were *causal for* the decision of banks to bid for TAF support. Thus, the TAF liquidity shock can be considered exogenous for the network of German banks' foreign affiliates located outside the US.

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[1] These numbers gauge the nominal decline in cross border assets of banks between December 2008 and December 2007. They are based on the Consolidated Banking Statistics of the Bank for International Settlements, Table 9b. Data have been downloaded on February 2, 2013. Data for 2012 relate to the end of September.

[2] See press release dated December 12, 2007: http://www.federalreserve.gov/newsevents/press/monetary/20071212a.htm.

The parent bank- and affiliate-level information is taken from a supervisory dataset with detailed information on the internationalization of German banks.[3] The "External Position Report" provided by the *Deutsche Bundesbank* yields monthly, country-by-country time series on various kinds of asset classes submitted by each parent bank and foreign affiliate. This data design allows switching off any direct channels of shock propagation. Our sample covers the pre- and the post-crisis episode and ranges from March 2002 to October 2012. Compared to similar datasets from other countries, the German data are unique in that they capture details on the international activities of foreign affiliates by host and destination country.

Our analysis contributes to a growing literature on the role of international banks during financial crises and the transmission of monetary policy. This research follows the seminal work by Peek and Rosengren (1997, 2000) documenting the transmission of shocks originating in Japan to the US. Cetorelli and Goldberg (2011) use bilateral country-level data and find a negative impact of the crisis on lending to emerging markets. They exploit the fact that banks have been hit differently by the drying up of the market for dollar funding due to the crisis. Cetorelli and Goldberg (2012) analyze the role of banks' internal capital markets. They find that lower internal funds available for foreign banks' affiliates in the US led to a decline in lending by these affiliates. Our work differs because we look at the impact of US monetary policy on the activities of German banks' foreign affiliates worldwide.

Another strand of research compares the lending behavior of foreign and domestic banks during the financial crisis. This literature shows that access to a stable funding base of (local) deposits and the strength of the capital buffer of the (foreign) parent bank can affect the stability of local lending. Foreign banks remained more committed to those countries hosting an affiliated subsidiary, that are geographically close, and that have built up relationships with local banks (De Haas and van Horen 2011); domestic banks showed more stable lending patterns than multinational banks (Claessens and van Horen 2012, De Haas and van Lelyveld 2011); and financial distress of the parent bank was transmitted to local financing of SMEs in Central and Eastern European countries (Popov and Udell 2010). Giannetti and Laeven (2012) attribute the collapse of the global syndicated loan market to a flight-home effect with lenders attempting to rebalance their loan portfolios. Our paper complements this literature, but it exclusively deals with global banks that maintain a network of foreign affiliates. We find that liquidity access during the crisis had a stabilizing impact.

[3] Similar data have been used by Düwel et al. (2011) who find that rising risk aversion of a German parent bank has a negative impact on cross-border lending activities of the corporate banking group, even more so during the financial crisis. Using these data, it has also been shown that foreign activities of German banks are related to the size and productivity of banks (Buch et al. 2011) and that international banking activities have a relatively limited impact on banks' risk-return trade off (Buch et al. 2013).

A growing strand of literature discusses the effectiveness of central banks' emergency programs. McAndrews et al. (2008) argue that scarce liquidity was the dominant problem when interbank markets froze between 2007 and 2008. They find that the TAF program was effective in the sense of relaxing liquidity constraints. In contrast, Taylor and Williams (2009) put forward that counterparty risk instead of liquidity scarcity was the major problem in financial markets. Therefore, they argue that the TAF did not affect interest rate spreads. In a similar vein, Wu (2011) finds that the TAF has mitigated pressure in the money market, but exercised little effect on counterparty risk premia. Benmelech (2012) stresses that the Fed allocated 58% of TAF loans to foreign banks, which provided a higher proportion of asset-backed securities as collateral than domestic banks. Acharya et al. (2013) also find that foreign banks in the US with substantial exposure to the asset-backed commercial paper market requested more liquidity from the Fed's TAF program. Overall, these papers suggest that the TAF program has mitigated liquidity and counterparty risk.

Our paper differs from these studies in that we study the effect of the TAF program on foreign assets of non-US affiliates of German banks. We identify a channel of transmission of monetary policy shocks through the global banking network. In terms of the expected effect of the TAF program, both, lower liquidity risk and lower counterparty risk should have a positive impact of banks' foreign assets. Given that an internal market for capital exists within globally active banks, relaxing liquidity constraints for one part of the network should also relax liquidity constraints in other parts. Hence, the expected effect of the TAF program on foreign assets of non-US based affiliates is positive. Because the additional funds need to be channeled through the intra-bank market, we also expect to see a corresponding increase in the affiliate's liabilities.

In Section two, we present our model, describe our data, and provide descriptive statistics. Section three shows the regression results. We conclude in Section four.

2 Empirical Model and Data

2.1 Testing Equation

Our goal is to explain how German banks' foreign affiliates outside the US have reacted on TAF liquidity claimed by the US-based affiliate of the parent bank. We model foreign assets (expressed in logs) of German banks' foreign affiliates (*FA*) as a function of parent characteristics (j = 1, …, 92), affiliate characteristics (i = 1, …, 519), host country characteristics (k = 1, …, 63), and TAF liquidity support:

$$FA_{ijkt} = \alpha_0 + \alpha_1 TAF_{jt} + \alpha_2 X_{jt} + \alpha_3 Y_{ijt} + u_{ky} + S_{kt} + B_{ijt} + \varepsilon_{ijkt} \qquad (1)$$

X_{jt} and Y_{ijt} are vectors of monthly (t = 1, …, 127) parent-level and affiliate-level variables. We also estimate the same model for foreign affiliates' foreign liabilities (*FL*). Further, u_{ky}

are host-year fixed effects for host countries k and year (y = 2002, …, 2012) to absorb annual macroeconomic variation – such as differences in monetary policy or crises periods – specific to that host country. In our baseline specification, we also include a stock market index S_{kt} as a variable absorbing monthly macroeconomic variation at the host level k. B_{ijt} indicates whether the affiliate operates as a branch rather than as a subsidiary.[4] TAF_{jt} captures whether the US-based affiliate of the same bank holding company j bid for TAF liquidity support. To counter endogeneity concerns, we exclude the US-based affiliates and positions reported vis-à-vis the US. Because ignoring the clustering structure of standard errors can lead to wrong inferences, we use two-way clustered standard errors at the bank holding company (j) and time-level (t) to take serial and cross-sectional correlation at the level of the bank holding company into account (Cameron et al. 2011, Petersen 2009).

All regressions are estimated including a full set of parent-bank fixed effects to control for unobserved heterogeneity. Macroeconomic shocks that vary across countries and years are captured through country- and year-fixed effects. The host country's stock market index captures time-varying country-specific macroeconomic variation. These variables absorb all remaining country-level variation in the data due to, for instance, government rescue measures in particular host countries, including monetary policy measures by central banks other than the Fed.

The key econometric issue that we need to address is whether German banks self-select into eligibility for TAF support. We want to assess the impact on related foreign affiliates if the US-based affiliate bids for TAF liquidity. Our results would be biased if parent banks had adjusted their global activities in order to become eligible for the TAF program. The following three features of the data and of the TAF program design allow identifying the effects of the TAF program.

First, only those German parent banks with US-based affiliates could bid for TAF liquidity. Out of 92 included parent banks, 12 parent banks operate US-based affiliates which all bid for TAF liquidity without exception. All of these US affiliates had been set up prior to 2003. For this reason, we can safely assume that these parent banks did not self-select into eligibility for TAF support once the program was initiated in 2007.

Second, in order to relieve the US-dollar funding pressure, the Fed used the TAF program to explicitly address foreign, non-US chartered banks for the first time. Thus, neither German parent banks nor their US-based affiliates could anticipate these unconventional support measures of the Federal Reserve.

Third, we exclude positions vis-à-vis the US reported by foreign affiliates located outside the US. Hence, the liquidity needs of the global network of foreign affiliates are unlikely to be

[4] In some rare cases, affiliates are sold to a new parent bank, the time t and parent j indices trace these switches.

causal for the bidding of US-based affiliates for TAF support. In sum, we consider the TAF liquidity to be exogenous for the network of German banks' foreign affiliates located outside the US.

Figure 2 illustrates the setup of our policy experiment. Out of all foreign affiliates that existed when the TAF program started in 2007, affiliates related to 12 German parent banks were located in the US. When the Fed decided to launch the TAF program, only those parent banks with US representation could indirectly bid for TAF funding via their US-based affiliate. In order to alleviate endogeneity concerns, we do not look at the subsequent lending patterns of these banks or any of their affiliates in the US or in Germany. Rather, we study the effects on affiliate activities in other countries worldwide. To shut down any immediate channel of liquidity proliferation in our empirical analysis, we drop US-located affiliates and any positions vis-à-vis the US from our sample.

In the following, we describe the underlying data that can identify the effects of the TAF program on foreign affiliates of German banks. We briefly describe the TAF program itself before we introduce the data structure as well as bank-level information on parent and affiliate characteristics.

2.2 Term Auction Facility

In August 2007, strains on international funding markets sent an early warning of the crisis yet to come. Central banks responded through concerted actions and the provision of short-term liquidity assistance. The US Fed's TAF has been one of the largest programs, providing short-term liquidity to 416 participating banks and auctioned a total of USD 3.81 trillion. The TAF program provides a unique opportunity to study the international transmission of monetary policy shocks. Comprehensive information on the TAF program and on the participating banks is available online.[5]

Our baseline specification uses a 0/1-dummy that indicates the period of outstanding TAF loan(s) to an individual US-based affiliate at time *t*. Overall, affiliates of 12 German banks have received liquidity support under the TAF program between December 2007 and March 2010. However, affiliates bid for loans at different points in time, some more and some less frequently. To proxy the intensity of TAF support, we use the volume of outstanding TAF loans or the number of parallel loans as *independent* variables.

The first order effect of access to TAF on the global affiliate network of banks outside the US is positive. Borrowing under the TAF program allowed eligible banks to receive liquidity support without potential negative signaling effects of borrowing at the Fed's discount window (Shin 2011). *Ceteris paribus*, a particular bank holding company got access to

[5] See http://www.federalreserve.gov/newsevents/reform_taf.htm.

funding that was cheaper than any alternative sources during these turbulent times. Hence, banks can be expected to expand their global operations. But, in the context of the 2007/2008 crisis, the ceteris paribus assumption is unlikely to hold. Instead, the TAF refinancing window was opened in response to negative funding and asset valuation shocks. To capture the effects of these shocks and to isolate the effects of the TAF program, we include a comprehensive vector of parent- and affiliate-level characteristics capturing exposures to these shocks. Sections 2.4 and 2.5 provide more details.

When analyzing the effects of the TAF program, we look at the impact of tapping TAF funds by US-based affiliates of German banks on the activities of foreign affiliates in *other* countries worldwide. We do so because US liquidity support to a German affiliate in the US is independent from the financial position of affiliates located elsewhere *outside* the US. Thus, TAF represents an exogenous friction regarding the impact on international assets of foreign affiliates located in countries other than the US. Our highly detailed supervisory dataset allows shutting off any direct linkages between non-US and US-based affiliates of the same parent as well as linkages between the non-US affiliates and the German parent bank. Figure 2 illustrates this procedure. Hence, we exclude the direct effects of intra-bank lending under the roof of the same parent bank. In short, we limit our focus on assets of foreign affiliates *outside* the US vis-à-vis foreign counterparties across all asset classes.

2.3 External Position Report

The "External Position Report" of the *Deutsche Bundesbank* provides information on the asset and liability structure of German banks' foreign affiliates, both within and outside the US (Fiorentino et al. 2010). The *Bundesbank* collects detailed mandatory reports on cross-border positions as well as reports on positions of German banks' foreign affiliates. These data serve, inter alia, as inputs to the bilateral banking statistics provided by the *Bank for International Settlements*. Data are available on a monthly basis; reporting thresholds have been abandoned in January 2002. The data can be used only for research purposes on the premises of the *Deutsche Bundesbank*.

From the "External Position Report", we retrieve information on foreign assets and liabilities of all German banks' affiliates (branches plus subsidiaries) located in 63 host countries. We aggregate the data across the most prominent 51 destinations countries, except for the US.[6] Our sample accounts for about 85% of German banks' international activities and for virtually all activities of foreign affiliates. Our empirical analysis looks at the adjustment along the intensive margin, through the assets and liabilities of German banks' foreign affiliates.

Figure 2 shows the structure of our data. Foreign assets of an affiliate *X* residing in country *A* are its assets aggregated across all foreign destination countries outside the US. Assets in the

[6] A list of host countries is provided in the Data Appendix.

host country are included; assets vis-à-vis Germany are excluded. In a symmetric fashion, foreign liabilities are liabilities aggregated across all foreign destination countries outside the US. The host country is included; Germany is excluded. Both, foreign assets and liabilities include foreign positions vis-à-vis other foreign affiliates of the same parent bank but not the German parent bank itself.

Hence, there are two channels through which additional liquidity through the TAF program can reach affiliate *X*: The first is a direct channel – non-US foreign affiliate *X* can borrow from a US affiliate with access to TAF. This is a channel of transmission, which we switch off because we do not consider liabilities vis-à-vis affiliates in the US.

The second, indirect channel runs through the internal capital market. If an affiliate increases its liabilities vis-à-vis the parent, (foreign) liabilities are not affected. If it borrows more on any host or destination market, foreign liabilities increase. Here, the effects differ depending on whether the funds are intermediated through the German parent or through another foreign affiliate (Figure 2). If the counterparty on the internal capital market is another foreign affiliate *Y* that intermediates the TAF funds, the foreign assets of affiliate *Y* increases. Other foreign affiliates might, for instance, be located in financial centers that perform a hub function. Liabilities of affiliate *Y* are unaffected because we exclude the liabilities vis-à-vis the US. The affiliate *X*, which borrows from *Y*, would exhibit an increase of foreign liabilities. If, as a response to increased access to liquidity, a foreign affiliate increases its activities, foreign assets would increase – unless these assets are held in Germany or in the US.

Figure 1a plots aggregate foreign assets (blue) and aggregate foreign liabilities (red) of the global network of all German banks' foreign affiliates over time. It ignores US-based affiliates and positions reported vis-à-vis the US. Both time series peak in the middle of 2007 and move almost in parallel over time. Strong, persistent growth between 2004 and 2007 has been stalled by financial market turmoil in 2007 and 2008 and lead to a contraction of assets and liabilities ever since. Furthermore, Figure 1a illustrates the overall contraction of foreign affiliates during the TAF period. To some extent, this decline has been driven by valuation effects, but results in Düwel et al. (2011) show similar trends when accounting for valuation changes. As we exclude positions vis-à-vis Germany, the gap between assets and liabilities is due to the funding of affiliates from German parent banks.

The key question we want to address in this paper is whether banks with and without access to TAF have behaved differently. Figure 1b thus compares German banks with US-based affiliates (red) to German banks without any US representation (green). It traces the log of foreign assets of foreign affiliates. Generally, banks with US-based affiliates have higher foreign assets. Relative to the balance sheet total of the parent banks, their foreign assets stood at almost 50% at the beginning of our sample (2002), while the corresponding ratio was 10% for the banks without US affiliates and thus without access to TAF. This shows the importance to control for heterogeneity between both groups of banks and thus for factors that

determine the structural differences between bank groups. Subsequently, foreign assets for both groups of banks have declined, with a somewhat more moderate decline for the TAF than for the non-TAF banks.

2.4 Parent- and Affiliate-Level Controls

Bidding for TAF liquidity could be triggered by parent- and affiliate-level characteristics such as worsening access to wholesale funding. We thus include control variables that capture structural characteristics of parents and non-US foreign affiliates. The data come from supervisory balance sheets statistics of German banks ("Monatliche Bilanzstatistik "or "Bista") filed by banks with *Deutsche Bundesbank*.

We use three variables to control for the funding structure of parents and affiliates. The *capital ratio* is defined as a bank's equity over total assets (non risk-weighted assets). To account for the structure of liabilities, we include the share of *wholesale funding* as the share of securitized debt in total debt as well as *latent liabilities* relative to total assets. Latent liabilities capture irrevocable credit commitments and mezzanine finance. We further include the share of *liquid assets*, i.e. the ratio of cash and central bank deposits to total assets. For the parent bank, we account for *size* using log total assets. As a robustness check, we also control for the share of *non-performing loans* in total loans as well as for *return on equity*. However, both variables are only available at lower frequency for a subset of banks, which is why we do not specify them as part of the baseline vector of control variables.

Table 1 presents descriptive statistics on all foreign affiliates outside the US and their related parent banks. About 65% of the observations accrue to banks that have received TAF support. The reason is that those 12 parent banks associated with TAF support are the most prominent German banks, which operate the largest networks of foreign affiliates. Table 1 also compares key characteristics of TAF-recipient banks to non-recipient banks. It shows that the TAF banks tend to be more vulnerable to changing funding conditions than the non-TAF banks. These patterns are consistent with too-big-to-fail and too-connected-to-fail considerations. More specifically, *wholesale funding* and the share of *latent liabilities* are higher for the TAF than for non-TAF banks. Also, non-TAF parent banks have a slightly lower share of *liquid assets* than TAF parent banks. Further, non-TAF parent banks exhibit lower *capital ratios* than banks related to TAF support. Foreign affiliates with US-based affiliates, however, report a much lower *capital ratio* than foreign affiliates without US representations.

We also account for the fact that several German banks have received capital injections, credit lines, or guarantees by the German government (federal and state-level) between August 2007 and August 2008. With the United Kingdom, which provided liquidity and guarantees to Northern Rock between September 2007 and February 2008, and the United States, which provided emergency lending to Bear Stearns in March 2008, Germany has been among the

first industrialized countries to provide support to distressed banks. [7] We use information on the timing of capital injections and the issuance of government-guaranteed bonds, which has been kindly provided by Stephanie Stolz and Michael Wedow (Stolz and Wedow 2010). We use a combined indicator equal to one from the time the German parent has received *any* German support measure. Overall, 10 out of 92 parent banks have received government support in one form or another.

3 Regression Results

3.1 Baseline Regression Results

Table 2 shows results from estimating equation (1). In Columns (1)-(5), we present different models using log total assets of the affiliate as the dependent variable; in Column (6), we use total liabilities instead. A foreign affiliate's foreign liabilities may differ from foreign assets if the affiliate receives funding from Germany and thus, to a large extent, from its German parent. We aggregate activities across all destination countries of individual foreign affiliates of German banks in a given host-country. In our preferred specification (4), the explanatory power of the model is quite high with an R^2 of 0.65, which is largely due to the large set of fixed effects. An unreported model including parent-level controls only yields an R^2 of 0.14.

If TAF liquidity is channeled through the bank's internal capital market, we expect different effects depending on whether funds are intermediated by other foreign affiliates or by the German parent bank. A positive effect on the affiliate's foreign assets means that the funding is invested abroad. A positive effect on the affiliate's foreign liabilities means that funding is obtained from abroad.[8] If we find a positive effect on liabilities and an insignificant or even negative effect on foreign assets, we might infer that funds are obtained from another foreign affiliate but ultimately flow to Germany. Irrespective of the channel through which funds are intermediated internally, the use of TAF reduces the overall capital cost of the affiliate and enables it to finance local growth opportunities. Such a price effect in internal capital markets would then entail a positive TAF coefficient for total foreign assets.[9]

Our main result is that liquidity provided to US-based affiliates through the TAF program has indeed a positive and significant impact on both, the assets and liabilities of other German banks' affiliates worldwide. Yet, we find a stronger effect on foreign liabilities than on foreign assets, indicating that part of the funding ultimately flows to Germany or to the

[7] See BIS (2009), Fed (2010), Petrovic and Tutsch (2009), or Stolz and Wedow (2010) for surveys.

[8] Note that we have dropped positions of affiliate *X* vis-à-vis the US to shut down the third, direct channel through the internal capital market.

[9] We cannot test this hypothesis more formally due to lacking information on internal funding flows. See Cetorelli and Goldberg (2012) for more direct evidence on the presence of internal capital markets in globally active banks.

German parent bank. Foreign assets increase by about 0.13% if a related US-affiliate uses TAF liquidity support. The effect is even stronger for foreign liabilities (+0.36%). These results may point at the presence of an internal capital market. The positive effect on foreign liabilities indicates that TAF liquidity has been intermediated by foreign affiliates outside the US. Foreign affiliates located in financial centers are likely to have performed such a hub function. The positive coefficient on the TAF dummy is in line with Figure 1b which shows a moderated decline in foreign assets of banks with (indirect) access to TAF. But this effect is not homogeneous across types of banks and country groups, as we detail in Sections 3.2 and 3.3. below.

In terms of the bank- and affiliate-level determinants of foreign assets, the impact of *bank size* and the capitalization of the affiliates stand out. Larger banks report, not surprisingly, higher foreign assets. Better capitalized affiliates have lower assets. Increasing the *capital-asset ratio* of foreign affiliates by one percentage point, reduces their foreign assets by -0.05 percentage points. This may imply that banks are risk averse and fund (risky) assets with more equity capital. We do not have information on the riskiness of assets and we cannot test for the direction of causality. Hence, we refrain from further interpretation.[10] *Branches* have lower foreign assets than subsidiaries. This reflects different business models because branches are more geared towards retail activities while subsidiaries engage in wholesale activities. Foreign affiliates in countries with a booming *stock market* have higher foreign assets. This could reflect stronger aggregate, and hence credit demand, but also the fact that firms in booming markets have better collateral available.

The remaining parent- and affiliate-level characteristics are insignificant because most of the variation in the data is absorbed by the bank fixed effects and bank size. In Column (5), we additionally include the parent bank's *return on equity* and the share of *non-performing loans*. Both are insignificant, and the TAF indicator turns insignificant as well. Because the size of the sample shrinks from about 34,000 to 28,000 observations, we continue our robustness tests with the model abstracting from these additional variables.

3.2 Regional Sample Splits[11]

In principle, we have designed our empirical model such that reverse causality should not play a role. In particular, funding constraints of affiliates outside the US should not have induced the US-based affiliate to bid for TAF liquidity. US-based affiliates and positions vis-à-vis the US have been omitted from the data. But one may ask whether affiliates in Dublin or London that have performed a hub function affect our results. Affiliates located in these

[10] As a simple robustness check, we distinguished the effect of TAF measures on foreign asset holdings vis-à-vis banks and non-banks. The results for this crude asset category split did not differ significantly from each other.

[11] We do not report all of the following results. Unreported results are available upon request.

financial centers held structured financial products, and the liquidity needs arising during the crisis might have induced the banks to borrow under the TAF program.

In order to mitigate the concern that TAF liquidity might not have been exogenous for specific affiliates, we alter the set of host countries considered. We estimate the model separately for financial centers and drop them from the estimation sample; we differentiate between countries in the European Monetary Union (EMU) and those outside the EMU; and we exclude and focus on the UK, Ireland, and the crisis countries in the periphery of Europe (Greece, Ireland, Italy, Portugal, Spain).

Table 3 shows the results. The TAF indicator remains positive and significant in the specifications for financial centers, for EMU countries, and for the specifications excluding Ireland and the periphery countries. The latter two results are comforting because they suggest that endogenous liquidity needs in the crisis countries are not driving the results. By and large, the signs of the bank-level controls remain robust across the different specifications. The finding that the positive TAF effect is driven by countries hosting financial centers as well as EMU countries could be taken as evidence that it indeed reflects the operation of an internal capital market. The strength of intra-bank linkages is higher in these highly financially integrated regions. This result is in line with our finding that foreign liabilities increase in response to TAF, presumably because liquidity is channeled through other foreign affiliates in the US which assume hub functions.

3.3 Responses Across Banking Groups

Next, we shed light on the response of different banking groups. In Table 4, we estimate the model for different subsets of German banks. In addition to private banks, government-owned banks (savings banks and *Landesbanken*), and regional banks (small private, savings and cooperative banks), we show large banks (large private banks, *Landesbanken* and cooperative head institutions) separately.

The effect of TAF on total foreign assets of affiliates outside the US is positive and significant for government-owned and large banks only. Because the *Landesbanken* are included in both of these groups, they might actually drive the positive TAF effect. Large banks, at the same time, are also those being more strongly reliant on wholesale funding, hence they have also been affected most by the drying up of wholesale funding during the crisis. This interpretation finds support in the insignificant impact of TAF on the regional banks with a strong regional funding base. In short, we find that different institutional backgrounds matter for the effect of TAF support on foreign affiliates.

These effects are qualitatively confirmed by the estimations that split the response of total foreign liabilities by banking group (Table 5). Consistent with the result for the full sample in column (6) of Table 2, the effect of TAF is significant across all types of banks. These results lend support to two possible interpretations.

First, internal capital cost were reduced for all affiliates of all bank types, which is in line with the objective of the policy to alleviate funding pressure in the strained global banking system. But, instead of expanding foreign affiliate activities, these subsidized funds have been used by all but the large, government-owned banks in Germany to increase foreign funding and substitute away from parent bank funding. As such, the TAF program seems to have been successful in reducing global funding pressure. But it did not ignite global credit expansion across the board, which, most likely, was not the first order objective either.

Second, if foreign liabilities increase and foreign assets are less affected, the difference might be channeled to Germany. In this line of argument, the significant liability effect might suggest that other foreign affiliates outside the US intermediate the TAF funding that they in turn borrowed from the US-based affiliate. The ultimate recipient then invests into German assets or increases its claims vis-à-vis the German parent bank.

When drawing inference about the "success" of TAF, it is crucial to bear in mind that our study does not permit inference about the effects that TAF has had in the U.S. and/or the German credit market. Here, we limit ourselves to a fairly clear identification of effects on global banks outside the US (and Germany) via parent banks' and internal capital markets.

3.4 Intensity of the Treatment

So far, we have considered whether the US-based affiliate of a particular bank had access to the TAF program – i.e. *whether* it has been treated – but not the *intensity* of the treatment. As we do have details on the borrowed volume and the number of TAF loans outstanding in parallel, we can examine the treatment intensity as well. In unreported regressions, which are available upon request, we find a positive but statistically weak effect (at the 10%-level) of the volume of TAF loans on banks' foreign assets. The number of loans taken out has no significant impact.

4 Summary

We analyze how monetary policy shocks affect the activities of globally active banks through their internal capital market. Detailed supervisory data from the *Bundesbank*'s "External Position Report" provide us with information on both, German banks' US affiliates with access to the Federal Reserve's Term Auction Facility (TAF) and on the complete network of global affiliates of German banks. We focus on affiliates located outside the US to rule out self-selection into TAF eligibility. For these reasons, the TAF liquidity shock can be considered exogenous for the network of German banks' foreign affiliates located outside the US. Our analysis has three main findings:

First, our results provide evidence for monetary policy transmission through internationally active banks. We find stronger effects on foreign liabilities than on foreign assets. While,

during the crisis, foreign affiliates have lowered their foreign assets, this decline has been moderated by banks' access to the TAF program. Controlling for other bank-specific features, assets of German banks' foreign affiliates are higher for those banks that had access to the TAF program or used the Term Auction Facility more often. This finding can be taken as indirect evidence for the presence of an internal capital markets in globally active banks. Global banks used US funding to finance assets outside Germany or outside the US.

Second, the impact of TAF on foreign assets differed across regions and banks. Positive TAF effects are driven by financially more integrated regions, such as financial centers and EMU members. Whereas foreign liabilities increased for all banks, only large banks and government-owned banks expanded their foreign assets in response to TAF. This pattern may reflect the larger dependence on wholesale funding of these banks compared to retail-based regional banks. It also indicates that the TAF program helped to alleviate global funding pressure outside the US (and Germany), but it did not spark credit or other bank asset expansion across the entire global banking system.

Third, the most important bank-level determinant of banks' cross-border assets are size and the degree of capitalization: larger banks hold higher foreign assets, and better capitalized foreign affiliates are smaller.

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6 Data Appendix

External Position Report

Data on foreign assets of the affiliates of German banks are taken from the External Position report (*Auslandsstatus*) of the *Deutsche Bundesbank*. They are confidential and can be used on the premises of the *Bundesbank* only.

International assets: capturing loans and advances to banks, companies, governments, bonds and notes, foreign shares and other equity, participation abroad, denominated or converted into euro. Irrevocable credit commitments are included but no other off-balance sheet items. For a more detailed description of this data see Fiorentino et al. (2010).

Branches and subsidiaries: Foreign affiliates of German parent banks. Branches operate without independent legal status, are not subject to foreign bank regulation and are fully incorporated by the German parent. The Bundesbank receives a joint report of all branches of a German bank per host country. Subsidiaries have an independent legal status and are majority owned (50% plus one share) by the German parent. They submit individual reports which allow identifying several subsidiaries in each host country. We aggregate across all destination countries per report while dropping the US as host and destination country. For this reason, one observational unit is either a subsidiary of bank *X* located in country *Y*, or the composite report of all branches of bank *X* hosted by country *Y*.

Time: Monthly data from March 2002 to October 2012 (t =127)

Host Countries of all German banks' affiliates: Austria, Australia, Argentina, Belgium, Bulgaria, Brazil, Canada, Cayman Islands, Channel Islands, Chile, China, Croatia, Czech Republic, Denmark, Estonia, Finland, Former Parts of Yugoslavia, France, Greece, Hong Kong, Hungary, Iran, Ireland, India, Indonesia, Italy, Japan, Korea, Latvia, Liechtenstein Lithuania, Luxembourg, Malaysia, Malta, Mauritius, Mexico, Netherlands, Dutch Antilles, New Zealand, Norway, Pakistan, Panama, Philippines, Poland, Portugal, Romania, Russian Federation, Saudi Arabia, Singapore, Slovenia, Slovakia, Spain, Sri Lanka, South Africa, Sweden, Switzerland, Taiwan, Thailand, Turkey, Ukraine, United Arab Emirates, United Kingdom, United States, Vietnam.

Country groups:

- European Monetary Union EMU (as composed during the sample period): Austria, Belgium, Cyprus, Spain, Finland, France, Greece, Ireland, Italy, Luxembourg, Malta, Netherlands, Portugal, Slovenia, Slovakia
- European Crisis Countries (Periphery): Greece, Italy, Ireland, Portugal, Spain
- Financial Centers: Cayman Islands, Channel Islands, Hong Kong, Ireland Liechtenstein, Luxembourg, Singapore, Switzerland, United Kingdom

Term Auction Facility

Detailed data on the Federal Reserve's Term Auction Facility (TAF) can be downloaded from the Fed's webpage at http://www.federalreserve.gov/newsevents/reform_taf.htm#data (as of February 12, 2013).

From this database, we extract the following information:

Loan date: Date on which the TAF was loan originated.

Maturity date: Date on which the TAF loan was scheduled to mature.

Term: Number of days for which the loan was extended.

Borrowers: According to the name of the borrower, the dataset lists the following affiliates of German parent banks: Bayerische Landesbank, Commerzbank, Deutsche Bank, Dresdner Bank, DZ Bank, Euro Hypo, Helaba, HSH Nordbank, LBBW, Nord LB and West LB.

Loan amount: Amount of TAF loan, in millions of US Dollars

Loan number: Number of outstanding TAF loans in parallel.

Bank- and affiliate-level variables

Banking groups: *Private* (big and small commercial banks, cooperative banks and their head institutions, mortgage banks); *Government* (savings banks and Landesbanks as their head institutions), *Large* (big commercial banks, head institutions of cooperative banks and Landesbanks), *Regional* (small commercial banks, savings banks and small cooperative banks).

Branch: dummy for foreign branches (0/1)

Capital: equity capital / total assets * 100

Latent liabilities: latent liabilities / total assets * 100 where latent liabilities consist of irrevocable credit commitments and mezzanine finance

Liquidity: cash and central bank deposits / total assets * 100

Non-performing loans: Impaired interbank and non-bank loans relative to non-bank loans

ROE: Return on equity of the parent bank.

Soffin: Indicator equal to one after (first) German intervention targeted at the German parent bank

Size: Log total assets of the parent bank.

Wholesale funding: Share of securitized funding of the parent or the affiliate in total liabilities in percent.

Table 1: Descriptive Statistics

This table compares key characteristics of parent banks and affiliates with and without TAF support. Details on the data definitions are given in the Data Appendix.

	Affiliates of banks not linked to TAF recipients (TAF = 0)		Affiliates linked to TAF recipients (TAF = 1)	
	Observations	Mean	Observations	Mean
Parent-level variables				
Capital ratio (%)	11,998	6.67	22,248	7.16
Liquidity ratio (%)	11,998	1.48	22,248	1.83
Latent liabilities (%)	11,998	15.73	22,248	48.26
Wholesale funding (%)	11,998	2.80	22,248	5.26
Non-performing loans (%)	9,618	3.79	18,927	1.70
Return on equity (%)	10,430	11.40	18,634	1.57
German support	11,998	0.05	22,248	0.12
Size (EUR bn)	11,998	25.9	22,248	304.2
Affiliate-level variables				
Total foreign assets (EUR mn)	11,998	838.3	22,248	5,274.8
Capital ratio (%)	11,998	6.76	22,248	4.44
Liquidity ratio (%)	11,998	1.10	22,248	0.94
Latent liabilities ratio (%)	11,998	9.13	22,248	12.41
Wholesale funding (%)	11,998	14.13	22,248	18.88
Stockmarket index	11,998	139.39	22,248	157.11
Branch indicator	11,998	0.64	22,248	0.55
Term Auction Facility (TAF)				
TAF indicator (0/1)	-	-	22,248	0.16
Sum of outstanding TAF loans by month (USD mn)	-	-	22,248	1,304.2
Number of TAF loans outstanding	-	-	22,248	0.54

Table 2: Baseline Regression Results

The dependent variable in columns (1)-(5) is the log of total foreign assets reported by individual foreign affiliates of German banks aggregated on their respective host-country level. In column (6), we replace total assets by total foreign liabilities. US-located affiliates and positions vis-à-vis the US are excluded. Parent- and affiliate-level ratios (capital, liquidity, latent liabilities and wholesale funding) are lagged by one month. Host country-year and parent fixed effects are included but not reported. Standard errors are two-way clustered at the bank holding company- and monthly time-level to account for serial and cross sectional correlation. The Data Appendix provides further definitions of the explanatory variables. Standard errors are reported in parentheses and ***, **, * denote significance at the 1%, 5%, 10%-level.

	(1) Foreign assets	(2) Foreign assets	(3) Foreign assets	(4) Foreign assets	(5) Foreign assets	(6) Foreign liabilities
TAF indicator (0/1)	0.194**	0.104	0.105	0.138*	0.110	0.356***
	(0.097)	(0.081)	(0.075)	(0.077)	(0.069)	(0.124)
Parent-level variables						
Capital	-0.004	0.011	0.010	0.014	0.024	-0.014
	(0.021)	(0.018)	(0.017)	(0.018)	(0.019)	(0.021)
Liquidity	-0.007	-0.016	-0.014	-0.015	-0.008	0.008
	(0.018)	(0.017)	(0.016)	(0.015)	(0.016)	(0.012)
Latent liabilities	0.009**	0.008*	0.006	0.005	0.003	-0.010
	(0.004)	(0.004)	(0.005)	(0.005)	(0.005)	(0.008)
Wholesale funding	-0.001	-0.006	-0.008	-0.008	-0.005	0.001
	(0.006)	(0.006)	(0.006)	(0.006)	(0.005)	(0.012)
Size	0.501***	0.433***	0.406***	0.401***	0.466***	0.270
	(0.120)	(0.131)	(0.130)	(0.136)	(0.153)	(0.200)
German support	-0.232	-0.121	-0.084	-0.039	0.001	-0.655***
	(0.195)	(0.200)	(0.188)	(0.200)	(0.212)	(0.238)
Affiliate-level variables						
Capital		-0.050***	-0.056***	-0.055***	-0.055***	-0.093***
		(0.005)	(0.004)	(0.005)	(0.005)	(0.005)
Liquidity		-0.009	-0.005	-0.002	-0.011	0.010
		(0.011)	(0.010)	(0.010)	(0.010)	(0.010)
Latent liabilities		-0.000	0.000	0.000	-0.000	0.000
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Wholesale funding		0.011*	0.009	0.008	0.011	0.002
		(0.006)	(0.006)	(0.006)	(0.008)	(0.009)
Branch indicator			-0.659**	-0.632**	-0.635**	-1.215***
			(0.265)	(0.264)	(0.311)	(0.231)
Stockmarket index				0.004***	0.005***	0.004***
				(0.001)	(0.001)	(0.001)
Return on equity					0.001	
					(0.001)	
Non-performing loans (ratio)					-0.007	
					(0.014)	
Constant	3.960*	5.223**	6.750***	6.497***	2.193	8.377**
	(2.193)	(2.438)	(2.294)	(2.389)	(2.056)	(3.645)
Observations	34,246	34,246	34,246	34,216	28,133	34,216
R^2	0.596	0.642	0.649	0.652	0.686	0.692

Table 3: Sample Splits by Host Countries of Foreign Affiliates

The dependent variable is the log of total foreign assets reported by individual foreign affiliates of German banks aggregated on their respective host-country level. US-located affiliates and positions vis-à-vis the US are excluded. Parent- and affiliate-level ratios (capital, liquidity, latent liabilities and wholesale) are lagged by one month. Host country-year and parent fixed effects are included but not reported. Standard errors are two-way clustered at the bank holding company- and monthly time-level to account for serial and cross sectional correlation. Periphery countries are Greece, Italy, Ireland, Portugal, and Spain. The Data Appendix provides further definitions of the explanatory variables and sets of host countries. Standard errors are reported in parentheses and ***, **, * denote significance at the 1%, 5%, 10%-level.

	(1) Financial centers	(2) Non-financial centers	(3) European Monetary Union	(4) Non-EMU	(5) Excluding United Kingdom	(6) Excluding Ireland	(7) Excluding periphery countries
TAF indicator (0/1)	0.262**	0.079	0.205*	0.054	0.113	0.188**	0.155*
	(0.123)	(0.081)	(0.111)	(0.067)	(0.080)	(0.077)	(0.083)
Parent-level variables							
Capital	0.008	0.007	0.009	0.022	0.010	0.005	0.000
	(0.035)	(0.016)	(0.026)	(0.023)	(0.021)	(0.017)	(0.017)
Liquidity	-0.008	-0.017	0.012	-0.032	-0.018	-0.016	-0.019
	(0.022)	(0.017)	(0.013)	(0.022)	(0.016)	(0.015)	(0.018)
Latent liabilities	-0.010	0.008	0.012***	-0.015***	0.006	0.006	0.003
	(0.008)	(0.005)	(0.003)	(0.006)	(0.005)	(0.005)	(0.006)
Wholesale funding	-0.010	-0.010	-0.013*	-0.004	-0.008	-0.006	-0.004
	(0.011)	(0.006)	(0.007)	(0.006)	(0.006)	(0.005)	(0.005)
Size	-0.078	0.401***	0.539**	0.177	0.443***	0.360***	0.222*
	(0.193)	(0.137)	(0.253)	(0.127)	(0.161)	(0.123)	(0.118)
German support	-0.064	0.073	-0.317	0.057	-0.030	0.003	0.013
	(0.324)	(0.208)	(0.268)	(0.168)	(0.220)	(0.195)	(0.211)
Affiliate-level variables							
Capital	-0.065***	-0.051***	-0.044***	-0.057***	-0.056***	-0.054***	-0.053***
	(0.010)	(0.007)	(0.011)	(0.004)	(0.006)	(0.005)	(0.005)
Liquidity	0.007	-0.001	-0.038**	0.001	-0.003	-0.001	0.000
	(0.011)	(0.012)	(0.018)	(0.010)	(0.010)	(0.010)	(0.009)
Latent liabilities	-0.001***	0.000	-0.000	0.006***	0.000	0.000	0.000
	(0.000)	(0.001)	(0.000)	(0.002)	(0.000)	(0.000)	(0.001)
Wholesale funding	0.018	0.010**	0.006	0.009	0.007	0.012*	0.012**
	(0.012)	(0.004)	(0.009)	(0.006)	(0.007)	(0.006)	(0.006)
Branch indicator	-0.392	-0.692***	-1.026***	0.366	-0.718**	-0.534**	-0.468
	(0.517)	(0.203)	(0.306)	(0.272)	(0.339)	(0.254)	(0.292)
Stockmarket index	0.010***	0.002	0.006***	0.003**	0.003**	0.004***	0.003***
	(0.002)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)
Constant	17.461***	7.006***	5.013	8.403***	5.989**	7.116***	9.592***
	(3.786)	(2.404)	(4.573)	(2.340)	(2.775)	(2.198)	(2.205)
Observations	11,292	22,924	15,903	18,313	31,364	32,912	29,271
R^2	0.638	0.705	0.652	0.727	0.644	0.666	0.673

Table 4: Foreign Assets' Response to TAF by Type of Bank

The dependent variable is the log of total foreign assets reported by individual foreign affiliates of German banks aggregated on their respective host-country level. US-located affiliates and positions vis-à-vis the US are excluded. Parent- and affiliate-level ratios (capital, liquidity, latent liabilities and wholesale) are lagged by one month. Host country-year and parent fixed effects are included but not reported. Standard errors are two-way clustered at the bank holding company- and monthly time-level to account for serial and cross sectional correlation. The Data Appendix provides further definitions of the explanatory variables and banking groups. Standard errors are reported in parentheses and ***, **, * denote significance at the 1%, 5%, 10%-level.

	(1) All banks	(2) Private banks	(3) Government-owned banks	(4) Large banks	(5) Regional banks
TAF indicator (0/1)	0.138*	0.130	0.204*	0.151**	0.025
	(0.077)	(0.088)	(0.105)	(0.062)	(0.134)
Parent-level variables					
Capital	0.014	0.018	0.065	0.003	-0.018
	(0.018)	(0.021)	(0.041)	(0.014)	(0.027)
Liquidity	-0.015	-0.011	-0.066***	-0.010	-0.026
	(0.015)	(0.013)	(0.013)	(0.015)	(0.020)
Latent liabilities	0.005	0.007	-0.040***	-0.010***	0.014***
	(0.005)	(0.005)	(0.008)	(0.003)	(0.004)
Wholesale funding	-0.008	-0.012	0.009	-0.007	-0.015*
	(0.006)	(0.007)	(0.009)	(0.009)	(0.008)
Size	0.401***	0.621***	-0.478*	0.075	0.791**
	(0.136)	(0.169)	(0.262)	(0.093)	(0.336)
German support	-0.039	-0.227	0.207	-0.008	-0.389
	(0.200)	(0.244)	(0.265)	(0.164)	(0.367)
Affiliate-level variables					
Capital	-0.055***	-0.052***	-0.067***	-0.057***	-0.035***
	(0.005)	(0.005)	(0.008)	(0.007)	(0.006)
Liquidity	-0.002	0.003	-0.041	0.002	-0.005
	(0.010)	(0.010)	(0.029)	(0.012)	(0.015)
Latent liabilities	0.000	-0.000	0.006**	0.000	-0.003
	(0.000)	(0.000)	(0.003)	(0.000)	(0.002)
Wholesale funding	0.008	0.003	0.018	0.012*	-0.027***
	(0.006)	(0.007)	(0.014)	(0.007)	(0.006)
Branch indicator	-0.632**	-0.682**	-0.112	-0.406	-1.716***
	(0.264)	(0.310)	(0.648)	(0.301)	(0.463)
Stock market index	0.004***	0.004**	0.004***	0.004***	0.002
	(0.001)	(0.002)	(0.001)	(0.002)	(0.001)
Constant	6.497***	2.550	21.893***	10.348***	-0.819
	(2.389)	(2.892)	(4.670)	(2.079)	(6.087)
Observations	34,216	26,910	7,306	23,553	10,663
R^2	0.652	0.648	0.745	0.620	0.782

Table 5: Foreign Liabilities' Response to TAF by Type of Bank

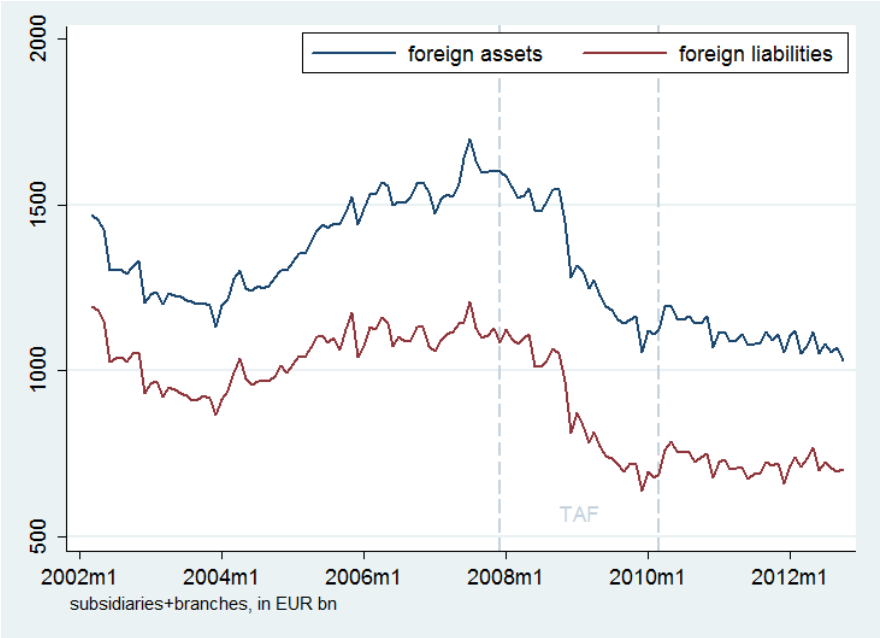
The dependent variable is the log of total foreign liabilities reported by individual foreign affiliates of German banks aggregated on their respective host-country level. US-located affiliates and positions vis-à-vis the US are excluded. Parent- and affiliate-level ratios (capital, liquidity, latent liabilities and wholesale) are lagged by one month. Host country-year and parent fixed effects are included but not reported. Standard errors are two-way clustered at the bank holding company- and monthly time-level to account for serial and cross sectional correlation. The Data Appendix provides further definitions of the explanatory variables and banking groups. Standard errors are reported in parentheses and ***, **, * denote significance at the 1%, 5%, 10%-level.

	(1) All banks	(2) Private banks	(3) Government-owned banks	(5) Large banks	(6) Regional banks
TAFindicator (0/1)	0.356***	0.415***	0.317**	0.315***	0.385*
	(0.124)	(0.141)	(0.154)	(0.063)	(0.211)
Parent-level variables					
Capital	-0.014	-0.006	0.014	-0.015	-0.019
	(0.021)	(0.026)	(0.040)	(0.013)	(0.034)
Liquidity	0.008	-0.000	-0.007	-0.007	-0.019
	(0.012)	(0.012)	(0.009)	(0.006)	(0.024)
Latent liabilities	-0.010	-0.012**	-0.033***	-0.024***	-0.006
	(0.008)	(0.006)	(0.010)	(0.004)	(0.012)
Wholesale funding	0.001	0.003	-0.015	-0.018	0.003
	(0.012)	(0.012)	(0.011)	(0.012)	(0.013)
Size	0.270	0.479*	-0.335	-0.104	0.673*
	(0.200)	(0.266)	(0.230)	(0.070)	(0.365)
German support	-0.655***	-1.045**	0.027	-0.527***	-1.695*
	(0.238)	(0.436)	(0.222)	(0.160)	(0.886)
Affiliate-level variables					
Capital	-0.093***	-0.091***	-0.103***	-0.096***	-0.068***
	(0.005)	(0.005)	(0.005)	(0.005)	(0.011)
Liquidity	0.010	0.017*	-0.048***	0.010	-0.005
	(0.010)	(0.010)	(0.018)	(0.013)	(0.015)
Latent liabilities	0.000	0.000	0.008***	0.000	0.004
	(0.000)	(0.000)	(0.003)	(0.000)	(0.003)
Wholesale funding	0.002	-0.005	0.008	0.000	-0.023
	(0.009)	(0.010)	(0.018)	(0.008)	(0.018)
Branch indicator	-1.215***	-1.130***	-1.443*	-0.931***	-2.082***
	(0.231)	(0.246)	(0.818)	(0.255)	(0.437)
Stock market index	0.004***	0.004**	0.005***	0.003**	0.005**
	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)
Constant	8.377**	4.060	20.524***	15.048***	-1.430
	(3.645)	(4.808)	(3.958)	(1.596)	(6.718)
Observations	34,216	26,910	7,306	23,553	10,663
R^2	0.692	0.702	0.748	0.644	0.703

Figure 1: Foreign Assets and Liabilities of German Banks' Foreign Affiliates

Graph (a) shows foreign aggregate assets (blue) and liabilities (red) reported by all German banks' foreign affiliates over time. The gap between assets and liabilities is due to funding of affiliates' from German parent banks. Graph (b) shows how the log of foreign affiliates' assets to the total assets of the related German bank holding company evolves over time. Graph (b) differentiates between banks whose US-based affiliates have claimed TAF liquidity from the Federal Reserve (supported, red) and banks that did not (non-supported, green). Solid red and green lines in Graph (b) refer to period-specific fitted regression lines before, during and after the TAF programme. Both graphs use dashed vertical lines to indicate the period from December 2007 to March 2010 during which the Federal Reserve auctioned TAF loans. Positions vis-a-vis the US and positions reported by the US-affiliates vis-a-vis any country are excluded.

(a) Aggregate Foreign Assets and Liabilities



(b) Foreign assets of banks with and without access to TAF

Figure 2: Transmission of Liquidity Shocks

This graph illustrates how German banks' US-based affiliates transmit the liquidity shock triggered by the Fed's Term Auction Facility (TAF) to a foreign country A. Due to the fact that each German bank with US-based affiliates has claimed TAF support, we distinguish between German parent banks with (Parent 1) and without (Parent 2) affiliates in the United States. Imagine that both German parent banks have affiliates in country A. The TAF liquidity shock may either run **directly** from the US-based affiliate of bank 1 to the Country A-located affiliate of bank 1 (the solid line) or **indirectly** via the German parent bank 1 (the dotted line). Our empirical analysis draws on assets of all foreign affiliates (like country A) while excluding positions vis-à-vis the US and dropping US-based affiliates.