Abstract

We study the relationship between the cross-border funding activities of global banks and the international transmission of business cycles. In particular, we focus on the effect of regulatory changes on the global banks’ ability to transform local deposits into international loans. First, using a novel data set compiled by the Federal Reserve Board, we examine the cyclical behavior of the net positions between U.S.-based branches of European banks and their parent banks. We also document the pattern of lending by U.S.-based subsidiaries of foreign banks to large and small U.S. firms. Second, we study the role of international bank funding in a two-country real business cycle model, with each economy consisting of: (1) One representative household that provides bank deposits. (2) A continuum of monopolistically-competitive firms that are heterogeneous in labor productivity and borrow working capital from banks. (3) Two types of banks: a “local” and a “global” bank. The global bank, in addition to its domestic operations, also collects deposits from abroad and issues loans to foreign firms. For firms, borrowing from the global banks has the advantages of a lower interest rate and access to international funding, but requires a per-period fixed cost. In this framework, we study the cyclical behavior of firm borrowing from local vs. global banks and its implications for the macroeconomic interdependence between the two economies.

Keywords: International banks, bank branches, intra-bank lending, firm borrowing, extensive margin, international business cycles

JEL codes: F41, F44, G21
1 Introduction

Starting in the summer of 2007, the Federal Reserve and other central banks implemented non-traditional policies to mitigate the effect of disruptions in their local credit and derivatives markets. For example, one trigger of the crisis was the run on the liabilities of certain financial entities (“special purpose vehicles”) that financed their holdings of long term assets with commercial paper (Arteta et al., 2009). Most of the riskier entities were sponsored by large European banks, which provided them with backup liquidity facilities. As these entities became unable to roll over their outstanding commercial paper (largely denominated in U.S. dollars) in August 2007, they tapped into the backup lines of credit provided by their sponsors. In turn, the sponsoring banks had to seek additional funding in the interbank and other money markets. European banks with U.S. branches accessed the U.S. money markets to satisfy their loan commitments, disrupting these markets. In response, by the end of 2007, the Federal Reserve had announced the Term Auction Facility (TAF) to provide liquidity directly to banks, and had arranged liquidity swap lines with other major central banks, as the U.S. interbank market was still under stress.

These events motivate our focus on a group of financial institutions actively involved in the interbank market during the crisis: foreign-owned bank branches. In particular, we study the link between cross-border intrabank transactions (i.e. lending between parent banks and their foreign branches) and the international transmission of business cycles, using a two-country dynamic stochastic general equilibrium (DSGE) model with a local and a global bank in each country. The local bank raises domestic deposits and issues loans to domestic firms; the global bank, in addition to its domestic operations, also raises deposits from the foreign household and issues loans to the foreign firms, maintaining the ability to fund domestic loans with foreign deposits. In this context, we examine the effect of current regulatory proposals that would implement liquidity standards for financial institutions to limit their ability of transforming local deposits into foreign loans, thus affecting the operations of foreign branches of international banks (Basel Committee on Banking Supervision, 2009).

Why do we focus our study on foreign bank branches? At the end of September 2008, the month
when Lehman Brothers collapsed, the U.S.-based branches of foreign banks held $2.1 trillion in assets, equivalent to almost one-fifth of the assets held by all insured commercial banks in the United States. These institutions obtain their funding in the wholesale deposit market and the interbank market, as they do not participate in the FDIC’s deposit insurance scheme, and therefore, do not attract retail deposits. The amount of federal funds borrowed and securities sold under repurchase agreements by U.S. branches of foreign banks reached almost $230 billion at end-September 2008, equivalent to more than one-fourth of similar transactions done by U.S. insured commercial banks. These statistics highlight the importance of foreign branches in the execution of monetary policy and the design of bank regulation.

Our study is both empirical and theoretical. Empirically, we document the cyclical fluctuations of intrabank transactions between parent banks and their foreign branches using a novel data set compiled by the Federal Reserve Board from the Federal Financial Institutions Examination Council’s (FFIEC) 002 report. These reporting forms are used to collect information on the balance sheet position of the U.S.-based branches of foreign banks (FFIEC 002) every quarter, for the interval between 1980:Q1 and 2009:Q4. In particular, the reports provide information on the assets and liabilities of these branches with respect to their related offices, including the head office. In addition, we use data on the lending by U.S.-based commercial banks—including subsidiaries of foreign banks—to small and large U.S. firms, reported in the FFIEC 031 report.

Using these data, our study documents a set of stylized facts that we rationalize in the two-country DSGE model developed in the theoretical section of the paper. First, the "net due to" position of U.S. branches of European banks (a measure which reflects the net outstanding loans issued by European banks to their U.S.-based branches) is positively correlated with the GDP growth differential between the U.S. and the European Union-16, as illustrated in Figure 1. Second, small U.S. firms borrow mostly from U.S. banks rather than from foreign banks operating in the United States. As seen in Figure 2, small U.S. firms receive about 75 percent of the number of outstanding loans issued by U.S. banks; in contrast, they receive only 60 percent of the number of loans issued by FDIC-insured foreign banks that operate in the United States. Third, the share of loans granted by foreign banks to small
U.S. firms (in the number of outstanding loans) is procyclical with the U.S. economy, suggesting that foreign banks in the United States reduce their lending especially to small U.S. firms during economic downturns. As shown in Figure 2, the share of small U.S. firms in the number of outstanding loans of foreign banks declined during the U.S. recession in 2001, increased during the subsequent recovery, and declined again as the U.S. economy slowed in the late 2000s. Fourth, Figure 3 shows that the loans to small U.S. firms represent a relatively small share of the value of outstanding loans of either U.S. or foreign banks (i.e. 20 and 10 percent respectively), despite their larger shares in the total number of outstanding loans. The share of small U.S. firms in the total value of outstanding loans issued by foreign banks in the U.S. displays a similar procyclical pattern as their share in the total number of loans, although the pattern is less pronounced.

In the theoretical section, we study the relationship between the cross-border funding activities of global banks and the international transmission of business cycles. In particular, we focus on the effect of regulatory changes on global banks’ ability to transform local deposits into international loans. We study the role of international bank lending in a two-country DSGE framework. In each economy, there is one representative household and a continuum of monopolistically-competitive firms that are heterogeneous in labor productivity. Every period, firms borrow working capital from banks. There are two types of banks in each country—a local and a global bank—that attract deposits from the local household and give loans to the local firms. In addition to its domestic operations, the global bank collects foreign deposits through its foreign branch and issues loans to foreign firms. The global bank is relatively more productive than the local bank in its ability to transform deposits into loans, and therefore issues loans at a lower interest rate. Each firm can either borrow locally (from the local bank) or take a syndicated loan provided by the two global banks. Borrowing from the global banks has the advantages of a lower interest rate and access to international funding, but requires a per-period fixed cost paid by the firm. In this framework, we study the behavior of firm borrowing from local vs. global banks and its implications for the macroeconomic interdependence between the two economies.

The dynamics in our model are driven by (i) aggregate productivity shocks that affect the firms’ demand for bank loans; and (ii) regulatory provisions for the branches’ loan-to-deposit ratio. First,
following an aggregate productivity increase in the home country, foreign banks find it increasingly profitable to convert foreign deposits into loans for the more productive home firms, which generates a pro-cyclical “net due to” position of the foreign branch in Home relative to its parent bank, as in the data. Second, regulatory provisions that reduce the ability of the foreign global bank to transform foreign deposits into home loans should dampen the response of domestic real activity to local or foreign shocks.

2 Empirical Evidence

This section provides empirical evidence of the activities of international banks in the United States. We focus on U.S.-based branches of foreign banks, in particular on branches with parent banks headquartered in Europe.

Over the last three decades, U.S. branches of foreign banks have been increasingly active in the U.S. wholesale credit and money markets. Low costs of entering the U.S. market through branches, as opposed to subsidiaries, makes it attractive to foreign banks that want to access U.S. capital markets without a need of tapping retail customers. During the recent financial crisis, these branches played an important role while serving as conduits for foreign banks to the U.S. money markets.

In the rest of this section, we describe a dataset with information on the activities of U.S. branches of foreign banks. This will be useful for our theoretical model, which explicitly addresses the question of linkages between two economies through the banking sector, in particular, through intrabank lending. Thus, we test for factors that determine the financial linkages of these branches vis-a-vis their parents through time. Lastly, we describe other stylized facts that are incorporated in the model.

2.1 Data

The Federal Financial Institutions Examination Council (FFIEC) requires all U.S. branches of foreign banks to report balance sheet and off-balance sheet information every quarter in the "Report of Assets and Liabilities of U.S. Branches and Agencies of Foreign Banks" (FFIEC 002). Table 1 shows
the aggregate balance sheet of branches of U.S. banks as of the end of June and December 2007, and December 2008 and 2009. Before the financial crisis, U.S. branches of European banks had $1.4 trillion in assets. This number went up to $1.5 trillion as of December of 2007 and then decreased to $1.3 trillion as of end-2009. The composition of the balance sheet also changed in this period. Although claims on non-related parties remained at about 65 percent of total assets (with the exception of the quarter when Lehman Brothers collapsed), more cash holdings, securities and loans compensated for a decrease in transactions in the repo market. On the liabilities side, access to the Federal Reserve’s various lending programs and later, an increase in deposits compensated for the same reduction in transactions in the repo market.

To analyze the transmission of shocks between countries, we focus on intrabank transactions. Financial flows between branches and parent banks can take the form of loans or repatriation of profits. In Table 1, the **Net Due From** position of U.S. branches of European banks is listed on the assets side, while the **Net Due To** position is part of the liabilities. The table shows that, on aggregate, these branches have a positive Net Due From position with their parents (or a negative Net Due To position). It means that parents owe to their branches more than what branches owe to their parents. Through the crisis we observe that the net position of the branches with related institutions changed somewhat, fluctuating from a total Net Due From position of 28 percent relative to assets after the collapse in the Asset Back Commercial Paper (ABCP) market to 25 percent after Lehman’s bankruptcy. These changes were influenced by developments in the money markets as well as interventions by various governments.

This evidence shows the important role that branches played during the crisis. However, the model outlined in the next section focuses on changes in intrabank activity starting from a steady state equilibrium. Thus, we also need to determine the long run features of intrabank transactions and their role as conduits between different economies. Figure 1 shows the Net Due To position of U.S. branches of European banks as a share of assets from 1980 to 2009. We observe that intrabank positions are positively related to the GDP growth differential between the United States and Europe. In periods when the U.S. economy is growing at a faster pace than Europe, global banks have an
incentive to lend more to U.S. borrowers. Thus, the Net Due To position of their branches in the
United States should increase. The opposite is true if growth opportunities in Europe are more
attractive than in the United States.

2.2 Determinants of Intrabank Transactions

Above, we provided some evidence on the fluctuations of intrabank transactions through time. In this
section, we formally test for the determinants of these flows of resources between parent banks and
their branches. In Table 2 we estimate the following equation:

\[
\frac{NDT_{ijt}}{TA_{ijt}} = \alpha + \beta_1 USGDP_t + \beta_2 ForeignGDP_t + \beta_3 USFedFundsRate_t + \beta_4 \log{Assets_{ijt}} + \theta_{ij} + \epsilon_{ijt} \tag{1}
\]

Where NDT is the Net Due To (or Gross Due To or Gross Due From) position of foreign branches
in the United States and TA is total assets; branches are indexed by i, countries by j and time by
t; USGDP and ForeignGDP are the growth rates of U.S. GDP and the branch home country’s GDP,
respectively; USFedFundsRate is the effective real federal funds rate; LogAssets is the log value of
claims on non-related parties, a measure of the branch’s size; and \( \theta_{ij} \) is a branch specific fixed effect.

We show the results of this estimation in Table 2. The main finding is that the Net Due To position
of foreign branches are positively related to U.S. GDP growth. Branches lend less to their parents
when the U.S. economy is growing faster, as shown by the negative coefficient on U.S. GDP growth
in column (3). Tighter monetary policy decreases both the Gross Due To position and the Gross Due
From position having no effect on the net position.

In Table 3 we estimate the same equation, but break down the sample between large and small
branches. We find that intrabank transactions for large branches not only depend on U.S. GDP
growth by also on U.S. monetary policy. An increase in the real effective federal funds rate decrease
the amount the branches lend to their parents. As liquidity is tighter in the United States, parents
decrease the amount of funds that they demand from U.S. investors through their branches.

Lastly, Table 4 provides some evidence on the role that branches played during the recent finan-
cial crisis. We estimate a difference-in-difference equation to assess if European banks tapped their branches after the collapse of the U.S. ABCP market in the third quarter of 2007. The control group for this estimations are the branches of non-European banks. As the crisis unfolded, some European banks needed dollar funding to finance assets purchased through off-balance conduits. At the same time, U.S. money markets were experiencing significant problems. European banks used their branches to access dollar funding.

The coefficient of interest in the estimation is the interaction between Dummy Crisis and Dummy Europe. The later equals 1 for four quarters staring the third quarter of 2007 and the former equals 1 for European banks. The table shows that branches of European banks had larger Gross Due From positions and smaller Gross Due To positions after the ABCP market collapse. This results is evidence that branches worked as liquidity conduits after the shock to the ABCP market.

3 The Model

We consider a two-country (Home and Foreign) real business cycle model with international banks. In each economy, there is one representative household and a continuum of monopolistically-competitive firms that are heterogeneous in labor productivity. There are also two types of banks, a local and a global bank, that attract deposits from the local households and give loans to the local firms. In addition to its local operations, the global bank also collects wholesale deposits in the foreign interbank market and issues loans to foreign firms through a branch established abroad. The global bank is relatively more productive than the local bank in its ability to transform deposits into loans, and therefore issues loans at a lower interest rate. Every period, firms borrow working capital from banks. For this purpose, each firm can either take a loan from the local bank or a syndicated loan from the global banks from Home and Foreign.\footnote{For instance, the home firms have the option to either borrow from the local bank, or borrow from a consortium that includes the home global bank and the domestic branch of the foreign global bank.} Borrowing from the global banks has the advantage of a lower interest rate, but requires a per-period fixed cost paid by the firm. As a result, only the more productive firms can afford to borrow from the global banks, whereas the less productive firms borrow...
locally.

### 3.1 Households

In what follows we describe the model from the perspective of the home economy. Since the model is symmetric, the setup for the foreign economy is identical. Variables from the foreign economy are market with a star superscript.

The representative household in Home maximizes the expected lifetime utility subject to its budget constraint:

\[
\max_{\{D_{t+1}, x_{t+1}\}} \left[ E_t \sum_{s=t}^{\infty} \beta^{s-t} \frac{C_t^{1-\gamma}}{1-\gamma} \right],
\]

where \( \beta \in (0,1) \) is the subjective discount factor, \( C_t \) is aggregate consumption, and \( \gamma > 0 \) is the inverse of the inter-temporal elasticity of substitution. The budget constraint is:

\[
(\bar{v}_t + \bar{\pi}_t) N_t x_t + (1 + r_t) D_t + w_t L \geq \bar{v}_t(N_t + N_{E,t}) x_{t+1} + D_{t+1} + \frac{\xi}{2} \left( D_{t+1} \right)^2 + C_t.
\]

The representative household starts every period with share holdings \( x_t \) in a mutual fund of \( N_t \) firms whose average market value is \( \bar{v}_t \), and also with deposits \( D_t \) allocated across the local bank, the global bank and the foreign branch that operate in Home. It receives dividends equal to the average firm profit \( \bar{\pi}_t \) in proportion with the number of operating firms \( N_t \) and its share holdings \( x_t \). It also receives interest \( r_t D_t \) on bank deposits, and the real wage \( w_t \) for the amount of labor \( L \equiv 1 \) supplied inelastically.

Every period, the household purchases \( x_{t+1} \) shares in a mutual fund of firms that includes: (i) \( N_t \) firms that already produce at time \( t \), and (ii) \( N_{E,t} \) new firms that enter the market in period \( t \). Each share is worth its market value \( \bar{v}_t \), equal to the net present value of the expected stream of future profits of the average firm. The household also places new bank deposits \( D_{t+1} \). In addition, the household purchases the consumption basket \( C_t \):

\[
C_t = \left[ \int_{\omega \in \Omega} y_t(\omega)^{\frac{\theta-1}{\theta}} d\omega \right]^{\frac{\theta}{\theta-1}},
\]

which includes all varieties in the set \( \Omega \) available in the home market at period \( t \); parameter \( \theta > 1 \) is the
symmetric elasticity of substitution across varieties. We define the home consumption basket $C_t$ as the numeraire good, so that the price index in Home is normalized to unit, $P_t = \left[ \int_{\omega \in \Omega} p_t(\omega)^{1-\theta} d\omega \right]^{1 \over 1-\theta} = 1$.

Under monopolistic competition, the demand for each variety is $y_t(\omega) = \left[ {p_t(\omega) \over P_t} \right]^{-\theta} C_t = p_t(\omega)^{-\theta} C_t$.

Using $\kappa_t$ to denote the Lagrangian multiplier associated with the budget constraint, the first order conditions with respect to $C_t$ and $D_{t+1}$ imply:

$$C_t^{-\gamma} = \kappa_t$$

$$-\kappa_t (1 + \xi D_{t+1}) + \beta (1 + r_{t+1}) E_t \kappa_{t+1} = 0$$

Substituting $\kappa_t$ gives the Euler equation for bank deposits:

$$1 + \xi D_{t+1} = \beta (1 + r_{t+1}) E_t \left[ \left( {C_{t+1} \over C_t} \right)^{-\gamma} \right]. \quad (4)$$

Given the law of motion for the number of firms in the presence of firm entry, $N_{t+1} = (1 - \delta) (N_t + N_{E,t})$, which will be described later, the first order condition for $x_{t+1}$ gives the following Euler equation for stocks:

$$\ddot{v}_t = \beta (1 - \delta) E_t \left( {C_{t+1} \over C_t} \right)^{-\gamma} (\ddot{v}_{t+1} + \ddot{\pi}_{t+1}), \quad (5)$$

where $\delta$ is the exogenous rate of firm exit every period.

### 3.2 Firms

#### 3.2.1 Firm Entry and Exit

Firm entry takes place every period as in Ghironi and Melitz (2005). In the home market, firm entry requires a sunk entry cost equal to $f_E$ units of home effective labor. After paying the sunk entry cost, each firm is randomly assigned an idiosyncratic labor productivity factor $z$ that is drawn independently from a common distribution $G(z)$ with support over the interval $[z_{min}, \infty)$, and which the firm keeps for the entire duration of its life.

The $N_{E,t}$ firms entering at time $t$ do not produce until period $t+1$. Irrespective of their idiosyncratic...

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2 The sunk entry cost is equivalent to $f_E w_t / Z_t$ units of the home consumption basket.
productivity, all firms – including the new entrants – are subject to a random exit shock that occurs with probability $\delta$ at the end of every period. Thus, the law of motion for the number of producing firms is $N_{t+1} = (1 - \delta)(N_t + N_{E,t})$.

The potential entrant firms anticipate their expected post-entry value $\tilde{v}_t$, which depends on the expected stream of future profits $\tilde{\pi}_t$, the stochastic discount factor, and the exogenous probability $\delta$ of exit every period. The forward iteration of the Euler equation for stocks (5) generates the following expression for the expected post-entry value of the average firm:

$$v_t = E_t \left\{ \sum_{s=t+1}^{\infty} [\beta(1 - \delta)]^{s-t} \left( \frac{C_s}{C_t} \right)^{-\gamma} \tilde{\pi}_s \right\}. \quad (6)$$

Thus, every period, the unbounded pool of potential entrant firms faces a trade-off between the sunk entry cost and the expected stream of future monopolistic profits. In equilibrium, firm entry takes place until the expected value of the average firm is equal to the sunk entry cost expressed in units of the home consumption basket: $\tilde{v}_t = f_E \frac{w_t}{Z_t}$.

### 3.2.2 Production

Each firm produces a different variety of goods. The firm with idiosyncratic labor productivity $z$ obtains output $y_t(z) = Z_t z n_t(z)$, which is a function of the aggregate productivity $Z_t$, the firm-specific labor productivity $z$, and domestic labor $n_t(z)$. Given that one unit of labor produces $Z_t z$, and given that $w_t$ is the real wage, the unit cost of production is $\frac{w_t}{Z_t z}$.

Each firm must borrow working capital in order to pay a fraction $\phi$ of its labor costs at the beginning of each period, before it produces and sells its output. To this end, firms must choose one of two possible borrowing strategies: (1) Borrow from the local bank for a relatively higher interest rate, as described later. (2) Use a syndicated loan from the global banks, i.e. the home global bank and the local branch of the foreign global bank. Working with the global banks has the advantage of a lower interest rate, but requires a per-period fixed cost. The next two sections illustrate the mechanisms of borrowing from either local or global banks as alternative choices for each firm.
3.2.3 Profits with local loans

The firm that chooses to borrow from the local bank maximizes its per-period profit:

\[
\pi_{L,t}(z) = p_{L,t}(z)y_t(z) - w_t n_t(z) - r_{L,t} l_t(z)
\]

subject to the demand for its variety \(y_t(z)\), and the requirement that firms must borrow working capital \(l_t(z)\) in order to pay a fraction \(\phi\) of its labor cost \(w_t n_t(z)\) at the beginning of each period:

\[
y_t(z) = p_{L,t}(z) - \theta C_t,
\]

\[
l_t(z) \geq \phi w_t n_t(z).
\]

Substituting the constraints into the profit function, the profit-maximization problem implies the following equilibrium price:

\[
p_{L,t}(z) = \frac{\theta}{\theta - 1} \frac{w_t}{Z_t z} (1 + r_{L,t}). \tag{7}
\]

The corresponding profit expressed in units of the aggregate consumption basket \(C_t\) is:

\[
\pi_{L,t}(z) = \frac{1}{\theta} p_{L,t}(z)^{1-\theta} C_t. \tag{8}
\]

3.2.4 Profits with global loans

The firm that works with the global banks obtains a lower interest rate \(r_{G,t} < r_{L,t}\), as discussed later, but faces a fixed cost \(f_G \frac{w_t}{Z_t}\) every period. It maximizes the per-period profit:

\[
\pi_{G,t}(z) = p_t(z)y_t(z) - w_t n_t(z) - r_{G,t} l_t(z) - f_G \frac{w_t}{Z_t}.
\]

The maximization problem implies the following price and profit:

\[
p_{G,t}(z) = \frac{\theta}{\theta - 1} \frac{w_t}{Z_t z} (1 + r_{G,t}). \tag{9}
\]

\[
\pi_{G,t}(z) = \frac{1}{\theta} p_{G,t}(z)^{1-\theta} C_t - f_G \frac{w_t}{Z_t}. \tag{10}
\]
3.2.5 Endogenous productivity cutoff

When deciding upon the location of production every period, the firm with productivity \( z \) compares the profit that it would obtain if it borrows locally, \( \pi_{L,t}(z) \), with the profit associated with borrowing from the global banks, \( \pi_{G,t}(z) \). As a result, each firm chooses the borrowing strategy that maximizes its per-period profit. As a particular case, we define the productivity cutoff level \( z_{G,t} \) on the support interval \([z_{\text{min}}, \infty)\), so that the firm at the cutoff obtains equal profits if it borrows from the local or the global banks:

\[
\begin{align*}
z_{G,t} &= \{ z \mid \pi_{G,t}(z_{G,t}) = \pi_{L,t}(z_{G,t}) \}. \tag{11}
\end{align*}
\]

The model implies that only the relatively more productive firms find it profitable to work with the global banks. Despite the lower interest rate associated with borrowing from the global banks, only firms with idiosyncratic productivity above a certain cutoff \((z > z_{G,t})\) obtain profits that are large enough to cover the fixed cost \( f_G \frac{W_t}{Z_t} \).

In order to illustrate the endogenous determination of the productivity cutoff \( z_{G,t} \), we re-write the per-period profits from local and global borrowing as functions of \( z^{\theta-1} \):

\[
\begin{align*}
\pi_{L,t}(z) &= \frac{1}{\theta} \left[ \frac{\theta}{\theta - 1} \frac{u_t}{Z_t} (1 + \phi r_{L,t}) \right]^{1-\theta} C_t z^{\theta-1}; \\
\pi_{G,t}(z) &= \frac{1}{\theta} \left[ \frac{\theta}{\theta - 1} \frac{u_t}{Z_t} (1 + \phi r_{G,t}) \right]^{1-\theta} C_t z^{\theta-1} - f_G \frac{W_t}{Z_t}.
\end{align*}
\]

In Figure 4, we plot the two profits as functions of the idiosyncratic productivity parameter \( z^{\theta-1} \) over the support interval \([z_{\text{min}}, \infty)\). The vertical intercept for local borrowing is zero; the intercept is equal to the negative of the fixed cost required to borrow from the global banks \((-f_G \frac{W_t Q_t}{Z_t})\). The existence of the equilibrium productivity cutoff \( z_{G,t} \) requires that the profit function associated with borrowing from the global banks must be steeper than the profit from working with the local bank, i.e. \( \text{slope} \{ \pi_{G,t}(z) \} > \text{slope} \{ \pi_{L,t}(z) \} \). When this condition is met, borrowing from the global banks generates greater profits than borrowing from the local bank for the subset of firms with idiosyncratic
productivity $z$ along the upper range of the support interval ($z > z_{G,t}$). The more productive nature of the global banks allows them to issue a syndicated loan at a lower interest rate than the local bank, $r_{G,t} < r_{L,t}$. This property ensures that the slope inequality is satisfied.

### 3.2.6 Aggregation over heterogeneous firms

We define two average labor productivity levels for firms that borrow locally ($z_{L,t}$) and globally ($z_{G,t}$), illustrated in Figure 5, and thus solve the model in terms of two representative firms. Every period $t$, $z_{L,t}$ is the average productivity of the $N_{L,t}$ firms that borrow locally ($z < z_{C,t}$), and $z_{G,t}$ is the average productivity of the $N_{G,t}$ firms that borrow from the global banks ($z > z_{C,t}$).

Assuming that the firm-specific labor productivity $z$ is Pareto-distributed, with p.d.f. $g(z) = kz_{\min}^{-k+1}$ and c.d.f. $G(z) = 1 - (z_{\min}/z)^k$, we obtain the following expressions for the firm productivity averages, as shown in the Appendix:

\[
\bar{z}_{L,t} = \left[ \frac{1}{G(z_{C,t})} \int_{z_{\min}}^{z_{C,t}} z^{\theta-1} g(z) dz \right]^{-\frac{1}{\theta-1}} = \nu z_{\min} z_{C,t}^{-\frac{k-1}{k-1}}, \tag{12}
\]

\[
\bar{z}_{G,t} = \left[ \frac{1}{1 - G(z_{C,t})} \int_{z_{C,t}}^{\infty} z^{\theta-1} g(z) dz \right]^{-\frac{1}{\theta-1}} = \nu z_{C,t}. \tag{13}
\]

Using the firm productivity averages, we write the average prices of varieties produced by the local and global-borrowing firms as:

\[
\bar{p}_{L,t} = \frac{w_t}{\theta - 1} \frac{1}{Z_t z_{L,t}} (1 + \phi r_{L,t}), \tag{14}
\]

\[
\bar{p}_{G,t} = \frac{w_t}{\theta - 1} \frac{1}{Z_t z_{G,t}} (1 + \phi r_{G,t}). \tag{15}
\]

The corresponding average profits are:

\[
\bar{\pi}_{L,t} = \frac{1}{\theta} (\bar{p}_{L,t})^{1-\theta} C_t, \tag{16}
\]

\[
\bar{\pi}_{G,t} = \frac{1}{\theta} (\bar{p}_{G,t})^{1-\theta} C_t - f_G \frac{w_t}{Z_t}. \tag{17}
\]
The aggregate price indexes for Home and Foreign become:

\[ 1 = N_{L,t} (\tilde{p}_{L,t})^{1-\theta} + N_{G,t} (\tilde{p}_{G,t})^{1-\theta} \]  
\[ 1 = N_{L,t}^* (\tilde{p}_{L,t}^*)^{1-\theta} + N_{G,t}^* (\tilde{p}_{G,t}^*)^{1-\theta} \]  

The expressions for total profits in Home and Foreign are:

\[ N_t \tilde{\pi}_t = N_{L,t} \tilde{\pi}_{L,t} + N_{G,t} \tilde{\pi}_{G,t} \]  
\[ N_t^* \tilde{\pi}_t^* = N_{L,t}^* \tilde{\pi}_{L,t}^* + N_{G,t}^* \tilde{\pi}_{G,t}^* \]

### 3.3 The banking sector

There are two types of banks in each economy, a local and a global bank. Banks are competitive and earn zero profits. In Home, the local bank and the global bank attract deposits from the local households and issue loans to the local firms. In addition to its domestic operations, the home global bank runs a branch in Foreign in order to collect wholesale deposits from the foreign inter-bank market and issue loans to foreign firms.

The global bank is relatively more productive than the local bank in its ability to transform deposits into loans, and therefore can issue loans at lower interest rates. Let \( c^j \geq 1 \), with \( j \in \{L,G\} \), be the cost parameter for the local and the global banks, respectively, that characterizes the technology used by each bank to transform deposits \( (D_t^j) \) into loans \( (L_t^j) \):

\[ L_t^j = \frac{D_t^j}{c^j}, \quad c^j \geq 1. \]

Following de Blas and Russ (2010), the cost parameter represents non-interest expenditures or institutional inefficiencies that prevent the bank from transforming a certain portion of deposits into loans. The portion of deposits not used to make loans increases with the cost parameter \( c^j \). Moreover, the cost introduces a wedge between the interest rate that banks pay on deposits and the rate they charge for loans; the wedge also increases with the cost parameter. Therefore, the assumption that
global banks are more productive than the local banks, \( c^G < c^L \), implies that the global bank can issue loans at a lower rate than the local bank.

### 3.3.1 The local bank

The local bank obtains the following per-period profit, which is equal to zero under perfect competition:

\[
\Omega^L_t = \underbrace{r_{L,t}(1-\delta)L^L_t}_{\text{interest received for good loans}} - \underbrace{\mu \delta L^L_t}_{\text{monitoring cost for non-performing loans}} - \underbrace{r_t D^L_t}_{\text{interest paid on deposits}},
\]

where \( r_{L,t} \) is the interest rate on loans, and \( L^L_t = \frac{D^L_t}{c^L} \) is the amount of loans issued by the local bank that obtains deposits \( D^L_t \). Given the mechanism of endogenous firm entry/exogenous exit, a fraction \( \delta \) of all firms exit every period without producing any output. We assume that firms receiving the exit shock also default on their bank loans, as in Russ and Valderrama (2010). In the event of default, banks must audit the exiting firms in order to liquidate the remaining assets, operation which involves a monitoring cost \( \mu \). Banks recover the borrowed funds, but with no interest and minus the monitoring cost. Therefore, \( r_{L,t}(1-\delta)L^L_t \) is the total interest income received by the bank for the good loans, and \( \mu \delta L^L_t \) is the monitoring cost that the banks must pay for the non-performing loans. Finally, \( r_t D^L_t \) represents the interest that the bank pays on deposits.

Substituting \( D^L_t = c^L L^L_t \) in the expression for bank profits \( \Omega^L_t \) gives the equilibrium interest rate that the local bank charges for loans granted to the less productive firms:

\[
r_{L,t} = \frac{c^L r_t}{1-\delta} + \frac{\mu \delta}{1-\delta}.
\]

### 3.3.2 The global bank

The profit of the home global bank is similar to that of the local bank, notwithstanding the fact that the global bank borrows and lends in both the home and the foreign markets:

\[
\Omega^G_t = r_{GB,t}(1-\delta)L^L_{H,t} + r_{GB,t}(1-\delta^*)L^L_{H,t}Q_t - \mu \delta L^L_{H,t} - \mu^* \delta^* L^L_{H,t}Q_t - r_t D^L_{H,t} - r^L_t D^L_{H,t}Q_t.
\]
The home global bank charges interest rate $r_{GB;t}$ for loans granted to the home firms ($L_{H,t}$) and to the foreign firms ($L_{H,t}^*$. Since the loans issued to foreign firms are expressed in units of the foreign consumption basket ($L_{H,t}^*$), we convert them into units of the home consumption basket using the real exchange rate $Q_t$. The bank must also pay the monitoring cost $\mu$ associated with non-performing loans issued in Home and $\mu^*$ for non-performing loans issued in Foreign. Finally, the global bank obtains deposits $D_{H,t}$ from home, for which it pays the interest rate $r_t$. It also receives wholesale deposits $D_{H,t}^*Q_t$ from the foreign inter-bank market, for which it pays the interest rate $r_t^*$ (the same as what the foreign banks pay for deposits to the foreign household).

The total amount of loans issued by the global bank in either home and foreign, $L_{H,t} + L_{H,t}^*Q_t$, is constrained by the bank’s technology to transform total deposits into total loans, $L_{H,t} + L_{H,t}^*Q_t = \frac{D_{H,t} + D_{H,t}^*Q_t}{c_G}$, $c_G \geq 1$, where $D_{H,t}$ and $D_{H,t}^*Q_t$ are the deposits received by the home bank at home and abroad, respectively (they will be defined later). Under symmetry $\mu = \mu^*$ and $\delta = \delta^*$, the expression for the lending rate of global banks is a weighted average of the costs associated with deposits obtained in Home and Foreign:

$$r_{GB,t} = \frac{D_{H,t}}{D_{H,t} + D_{H,t}^*Q_t} \left( \frac{c_G r_t + \mu \delta}{1 - \delta} \right) + \frac{D_{H,t}^*Q_t}{D_{H,t} + D_{H,t}^*Q_t} \left( \frac{c_G r_t^* + \mu^* \delta}{1 - \delta} \right).$$

### 3.3.3 Market clearing for loans

The market clearing condition for loans issued by the local bank is:

$$L_t^L = N_t^L \bar{t}_t^L,$$

where $N_t^L$ is the number of firms that borrow locally, $\bar{t}_t^L = \phi w_t (\bar{p}_{L,t})^{-\gamma} C_t$ is the average loan for the local borrowers, and $\bar{z}_{L,t}$ and $\bar{p}_{L,t}$ are the average productivity and price of local borrowers, which will be defined later.

The more productive home firms that work with global banks obtain an aggregate of loans issued by the home global bank ($L_{H,t}$) and by the foreign global bank ($L_{F,t}$), with elasticity of substitution
\( \epsilon > 1 \) and home bias \( 0 < \lambda < 1 \). Therefore, market clearing for global loans implies:

\[
L_t = \left[ \lambda^\frac{1}{\epsilon} L_{H,t}^{\frac{\epsilon}{1-\epsilon}} + (1 - \lambda)^{\frac{1}{\epsilon}} L_{F,t}^{\frac{\epsilon}{1-\epsilon}} \right]^{\frac{1}{\epsilon}} = N_t^G \tilde{t}^G,
\]

where \( N_t^G \) is the number of home firms that borrow from global banks (i.e. global borrowers), \( \tilde{t}^G = \phi w_t (\bar{p}_{GB,t} - \bar{c}_{GB}) \) is the average loan for the global borrowers, and \( \bar{z}_{G,t} \) and \( \bar{p}_{G,t} \) are the average productivity and price of global borrowers. The demand for each type of loan are:

\[
L_{H,t} = \lambda \left( r_{GB,t} \right)^{\epsilon} N_t^G \tilde{t}^G \quad \text{for home bank loans},
\]

\[
L_{F,t} = (1 - \lambda) \left( r_{GB,t}^* Q_t \right)^{\epsilon} N_t^G \tilde{t}^G \quad \text{for foreign bank loans}.
\]

### 3.3.4 The allocation of deposits

We assume that the financial intermediaries that operate in Home (i.e. the home local bank, the home global bank, and the local branch of the foreign global bank) obtain fixed fractions of the total deposits \( D_t \) made by the representative household each period, which we define as \( S_L, S_H \) and \( S_F \), respectively, so that \( S_L + S_H + S_F = 1 \). Thus, the home local and global banks receives deposits \( S_L D_t \) and \( S_H D_t \) in the home retail market every period. The local branch of the foreign global bank receives deposits \( S_F D_t \) in the home wholesale market every period.

### 3.3.5 Net due to position of bank branches

In our model, global banks receive fixed shares of the local deposits, but place variable shares of their total loans across countries according to the local demands for loans. In Home, the branch of the foreign global bank may issue more local loans than it receives deposits. We define the net due

\[
N_t^{L^* L^*} = L_t^{* L}.
\]

For the loans issued to foreign firms working with global financial intermediaries, the market clearing condition is:

\[
L_{t}^* = \left[ \lambda^\frac{1}{\epsilon} L_{F,t}^{\frac{\epsilon}{1-\epsilon}} + (1 - \lambda)^{\frac{1}{\epsilon}} L_{H,t}^{\frac{\epsilon}{1-\epsilon}} \right]^{\frac{1}{\epsilon}} = N_t^{* G} \tilde{t}^{* G}.
\]

The demand functions for each type of loans included in the aggregate are \( L_{F,t}^* = \lambda^* \left( r_{GB,t}^* \right)^{\epsilon} N_t^{* G} \bar{t}^{* G} \) for the foreign bank loans and \( L_{H,t}^* = (1 - \lambda^*) \left( r_{GB,t}^* Q_t \right)^{\epsilon} N_t^{* G} \bar{t}^{* G} \) for the home bank loans, expressed in units of the foreign consumption basket.

3Similarly, the credit market clearing condition for loans issued by the foreign local banks is:

\[
N_t^{* L^* L^*} = L_t^{* L}.
\]

For the loans issued to foreign firms working with global financial intermediaries, the market clearing condition is:

\[
L_{t}^* = \left[ \lambda^\frac{1}{\epsilon} L_{F,t}^{\frac{\epsilon}{1-\epsilon}} + (1 - \lambda)^{\frac{1}{\epsilon}} L_{H,t}^{\frac{\epsilon}{1-\epsilon}} \right]^{\frac{1}{\epsilon}} = N_t^{* G} \tilde{t}^{* G}.
\]

The demand functions for each type of loans included in the aggregate are:

\[
L_{F,t}^* = \lambda^* \left( r_{GB,t}^* \right)^{\epsilon} N_t^{* G} \bar{t}^{* G} \quad \text{for foreign bank loans},
\]

\[
L_{H,t}^* = (1 - \lambda^*) \left( r_{GB,t}^* Q_t \right)^{\epsilon} N_t^{* G} \bar{t}^{* G} \quad \text{for home bank loans}.
\]

4In Foreign, the local bank, the global bank, and the local branch of the home bank obtain fixed fractions of the total foreign deposits \( D_t^* \) made by the representative household in Foreign each period, defined as \( S_L^*, S_F^* \) and \( S_H^* \), respectively, so that \( S_L^* + S_F^* + S_H^* = 1 \).
position of the branch relative to its parent (i.e. the foreign global bank), expressed in units of the foreign consumption basket, as the difference between its total loans granted in Home and the amount of such loans covered by local deposits:

\[ NDTP_t^* = \frac{1}{Q_t} \left[ L_{F,t} - \frac{S_F D_t}{c^G} \right]. \]

Similarly, the net due position of the branch of the home global bank established in Foreign relative to its parent bank is:

\[ NDTP_t = Q_t \left[ L_{H,t}^* - \frac{S_H D_t^*}{c^G} \right] \]

### 3.3.6 Loan constraints for banks

The amount of loans issued by the home global bank (parent and branch), expressed in units of the home consumption basket, is constrained by the total amount of deposits received in both economies:

\[ L_{H,t} + L_{H,t}^* Q_t = S_H D_t + S_H D_t^* Q_t \]

Similarly, the loan constraint of the foreign global bank (parent and branch), in units of the foreign consumption basket, is:

\[ L_{F,t}^* + L_{F,t} / Q_t = \frac{S_F^* D_t^* + S_F D_t / Q_t}{c^G} \]

### 3.3.7 Balance of Payments

In the absence of trade in goods, the financial account must equal zero, \( NDTP_t = Q_t NDTP_t^* \). This implies:

\[ Q_t \left[ L_{H,t}^* - \frac{S_H D_t^*}{c^G} \right] = \left[ L_{F,t} - \frac{S_F D_t}{c^G} \right]. \]
4 Conclusions and Further Extensions

On the model side, our next step is to study the model dynamics in the presence of country-specific shocks. In particular, in response to a positive TFP shock in Home, the firms’ ability to access foreign funding through the global banks generates amplifies the expansion of output. The amplification effect is enhanced as more of the small firms gain access to international loans. In contrast, following a negative TFP shock in Home, the decline in international bank lending exacerbates the contraction.

In this framework, we aim to highlight the ability of proposed Basel III liquidity standards—that would decrease the amount of intrabank funding by limiting the banks’ ability to use deposits from one country to make loans in another—to reduce the volatility of economic activity in response to domestic and international shocks.

References


A Firm Averages

A.1 Average productivity levels

Firms borrowing from local banks  The average productivity of the firms that borrow from the local banks is:

\[
\tilde{z}_{L,t} = \left[ \frac{1}{G(z_{G,t})} \int_{z_{min}}^{z_{G,t}} z^{\theta-1} g(z) dz \right]^{\frac{1}{\theta-1}} = \left[ \frac{z_{V,t}^{k}}{z_{G,t}^{k} - z_{min}^{k}} \int_{z_{min}}^{z_{V,t}} z^{\theta-1} \frac{k_{min}^{k} \, z^{k+1} \, dz}{z^{k+1} \, dz} \right]^{\frac{1}{\theta-1}} = \\
= \left[ \frac{z_{G,t}^{k}}{z_{G,t}^{k} - z_{min}^{k}} \frac{k_{min}^{k} \, \left( z_{G,t}^{\theta-1-k} - z_{min}^{\theta-1-k} \right)}{(\theta - k - 1)} \right]^{\frac{1}{\theta-1}} = \\
= \nu \left[ z_{min}^{k} \, z_{V,t}^{k} \, \left( \frac{1}{z_{G,t}^{\theta-1-k}} - \frac{1}{z_{min}^{\theta-1-k}} \right) \right]^{\frac{1}{\theta-1}} = \\
= \nu z_{G,t} \left[ \frac{k - (\theta - 1) - z_{G,t}^{\theta-1-k}}{z_{G,t}^{\theta} - z_{min}^{\theta}} \right]^{\frac{1}{\theta-1}}. \tag{22}
\]

Firms borrowing from global banks  Under the assumption that the firm-specific productivity factors are Pareto-distributed, the average productivity of the firms that borrow from global banks is obtained by integrating over the upper range of the support interval \([z_{min}, \infty)\), above the productivity cutoff \(z_{G,t}\):

\[
\tilde{z}_{G,t} = \left[ \frac{1}{1 - G(z_{G,t})} \int_{z_{G,t}}^{\infty} z^{\theta-1} g(z) dz \right]^{\frac{1}{\theta-1}} = \left[ \frac{z_{G,t}^{k}}{z_{min}^{k}} \int_{z_{min}}^{z_{G,t}} z^{\theta-1} \frac{k_{min}^{k} \, z^{k+1} \, dz}{z^{k+1} \, dz} \right]^{\frac{1}{\theta-1}} = \\
= \left( \frac{z_{G,t}^{k}}{z_{min}^{k}} \frac{k_{min}^{k} \, z_{G,t}^{\theta-1-k}}{k - (\theta - 1) \, z_{G,t}^{\theta-1}} \right)^{\frac{1}{\theta-1}} = \\
= \nu z_{G,t} \left( \frac{k}{k - (\theta - 1)} \right)^{\frac{1}{\theta-1}}, \tag{23}
\]

where \(\nu \equiv \left( \frac{k}{k - (\theta - 1)} \right)^{\frac{1}{\theta-1}}\).
A.2 Average profits

The average profit of the local borrowers is:

\[
\tilde{\pi}_{L,t} = \pi_{L,t}(z_{L,t}) = \frac{1}{\theta} \left[ \frac{\theta}{\theta - 1} \frac{w_t}{Z_t z_{L,t}} (1 + \phi r_{L,t}) \right]^{1-\theta} C_t =
\]

\[
= \frac{1}{\theta} \left[ \frac{\theta}{\theta - 1} \frac{w_t}{Z_t} (1 + \phi r_{L,t}) \right]^{1-\theta} C_t z_{L,t}^{\theta - 1} =
\]

\[
= \left\{ \frac{1}{\theta} \left[ \frac{\theta}{\theta - 1} \frac{w_t}{Z_t z_{G,t}} (1 + \phi r_{L,t}) \right]^{1-\theta} C_t \left( \nu z_{\min} z_{G,t} \right)^{\theta - 1} \right\} =
\]

\[
= \pi_{L,t}(z_{G,t}) (\nu z_{\min})^{\theta - 1} \left\{ \frac{z_{G,t}^{k - (\theta - 1)} - z_{\min}^{k - (\theta - 1)}}{z_{G,t}^{k} - z_{\min}^{k}} \right\}.
\]

The average profit of the firms that borrow from global banks is:

\[
\tilde{\pi}_{G,t} = \pi_{G,t}(z_{G,t}) = \frac{1}{\theta} \left[ \frac{\theta}{\theta - 1} \frac{w_t}{Z_t z_{G,t}} (1 + \phi r_{G,t}) \right]^{1-\theta} C_t - f_G \frac{w_t}{Z_t} =
\]

\[
= \frac{1}{\theta} \left[ \frac{\theta}{\theta - 1} \frac{w_t}{Z_t} (1 + \phi r_{G,t}) \right]^{1-\theta} C_t z_{G,t}^{\theta - 1} - f_G \frac{w_t}{Z_t} =
\]

\[
= \pi_{G,t}(z_{G,t}) \nu^{\theta - 1} + \left\{ \frac{\theta - 1}{k - (\theta - 1)} f_G \frac{w_t}{Z_t} \right\}^{\nu^{\theta - 1} - 1} f_G \frac{w_t}{Z_t} =
\]

\[
= \pi_{G,t}(z_{G,t}) \nu^{\theta - 1} + \frac{\theta - 1}{k - (\theta - 1)} f_G \frac{w_t}{Z_t}.
\]

A.3 Indifference condition for the marginal firm

The firm with productivity equal to the cutoff \(z_{G,t}\) is indifferent between borrowing from local or global banks. Using the profit indifference condition \(\pi_{L,t}(z_{G,t}) = \pi_{G,t}(z_{G,t})\) and equations (24) and (25), we
write the link between the average profits of the local and global borrowers. Starting with (25),

\[
\tilde{\pi}_{G,t} = \pi_{G,t}(z_{G,t}) \nu^{\theta-1} + \frac{\theta - 1}{k - (\theta - 1)} f_G \frac{w_t}{Z_t} = \\
= \pi_{L,t}(z_{G,t}) \nu^{\theta-1} + \frac{\theta - 1}{k - (\theta - 1)} f_G \frac{w_t}{Z_t} = \\
= \left( \frac{1}{\nu z_{\min}} \right)^{\theta-1} \left[ \frac{z_{G,t}^{k-(\theta-1)} - z_{\min}^{k-(\theta-1)}}{z_{G,t}^{k} - z_{\min}^{k}} \right]^{-1} \tilde{\pi}_{L,t} \nu^{\theta-1} + \frac{\theta - 1}{k - (\theta - 1)} f_G \frac{w_t}{Z_t} = \\
= z_{\min}^{1-\theta} \left[ \frac{z_{G,t}^{k-(\theta-1)} - z_{\min}^{k-(\theta-1)}}{z_{G,t}^{k} - z_{\min}^{k}} \right]^{-1} \tilde{\pi}_{L,t} + \frac{\theta - 1}{k - (\theta - 1)} f_G \frac{w_t}{Z_t} = \\
= \left( \frac{k}{k - (\theta - 1)} \right)^{\theta-1} \tilde{\pi}_{L,t} + \frac{\theta - 1}{k - (\theta - 1)} f_G \frac{w_t}{Z_t}. \\
\text{from eq. (22)}
\]
Table 1. Aggregate balance sheet of U.S. branches and agencies of European banks in the United States

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Cash</td>
<td>3%</td>
<td>2%</td>
<td>11%</td>
<td>15%</td>
<td>Deposits</td>
<td>53%</td>
<td>57%</td>
<td>52%</td>
<td>63%</td>
</tr>
<tr>
<td>Fed Funds Sold</td>
<td>1%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>Fed Funds Purchased</td>
<td>7%</td>
<td>3%</td>
<td>1%</td>
<td>1%</td>
</tr>
<tr>
<td>Resale Agreements</td>
<td>13%</td>
<td>12%</td>
<td>3%</td>
<td>4%</td>
<td>Repurchase Agreements</td>
<td>9%</td>
<td>8%</td>
<td>3%</td>
<td>3%</td>
</tr>
<tr>
<td>U.S. Gov. Securities</td>
<td>2%</td>
<td>2%</td>
<td>2%</td>
<td>4%</td>
<td>Trading Liabilities</td>
<td>6%</td>
<td>7%</td>
<td>9%</td>
<td>6%</td>
</tr>
<tr>
<td>Other Securities</td>
<td>22%</td>
<td>21%</td>
<td>25%</td>
<td>16%</td>
<td>Other Liabilities</td>
<td>17%</td>
<td>18%</td>
<td>30%</td>
<td>19%</td>
</tr>
<tr>
<td>Loans</td>
<td>23%</td>
<td>24%</td>
<td>27%</td>
<td>24%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other Assets</td>
<td>3%</td>
<td>2%</td>
<td>2%</td>
<td>2%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total Claims on Non-Related Parties</strong></td>
<td>66%</td>
<td>65%</td>
<td>70%</td>
<td>65%</td>
<td><strong>Total Liabilities to Non-Related Parties</strong></td>
<td>92%</td>
<td>93%</td>
<td>95%</td>
<td>92%</td>
</tr>
<tr>
<td>Net Due from Related Depository Institutions</td>
<td>34%</td>
<td>35%</td>
<td>30%</td>
<td>35%</td>
<td>Net Due to Related Depository Institutions</td>
<td>8%</td>
<td>7%</td>
<td>5%</td>
<td>8%</td>
</tr>
<tr>
<td><strong>Total Assets</strong></td>
<td>1,400,870</td>
<td>1,517,953</td>
<td>1,402,416</td>
<td>1,262,655</td>
<td><strong>Total Liabilities</strong></td>
<td>1,400,870</td>
<td>1,517,953</td>
<td>1,402,416</td>
<td>1,262,655</td>
</tr>
</tbody>
</table>

**of which:**

- Gross Due from Related Depository Institutions: 78% 77% 79% 92%
- Gross Due to Related Depository Institutions: -52% -50% -55% -65%

Source: Federal Reserve Board

23
Table 2. Baseline results: determinants of intrabank lending

<table>
<thead>
<tr>
<th>Dependent variable:</th>
<th>Net due to / Assets</th>
<th>Gross due to / Assets</th>
<th>Gross due from / Assets</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
</tr>
<tr>
<td><strong>Real Effective Funds Rate</strong></td>
<td>-0.007</td>
<td>-0.958***</td>
<td>-0.952**</td>
</tr>
<tr>
<td></td>
<td>[0.630]</td>
<td>[0.332]</td>
<td>[0.391]</td>
</tr>
<tr>
<td><strong>U.S. GDP Growth</strong></td>
<td>0.507**</td>
<td>-0.014</td>
<td>-0.522***</td>
</tr>
<tr>
<td></td>
<td>[0.238]</td>
<td>[0.147]</td>
<td>[0.164]</td>
</tr>
<tr>
<td><strong>Foreign GDP Growth</strong></td>
<td>0.006</td>
<td>0.003</td>
<td>-0.003</td>
</tr>
<tr>
<td></td>
<td>[0.114]</td>
<td>[0.066]</td>
<td>[0.077]</td>
</tr>
<tr>
<td><strong>Log of Claims on Nonrelated Parties</strong></td>
<td>0.477</td>
<td>-1.559</td>
<td>-2.036*</td>
</tr>
<tr>
<td></td>
<td>[1.928]</td>
<td>[1.236]</td>
<td>[1.095]</td>
</tr>
<tr>
<td><strong>Constant</strong></td>
<td>-8.168</td>
<td>42.120***</td>
<td>50.288***</td>
</tr>
<tr>
<td></td>
<td>[15.233]</td>
<td>[9.822]</td>
<td>[8.592]</td>
</tr>
</tbody>
</table>

| Branch Fixed Effects                     | Yes                 | Yes                   | Yes                     |
| Quarterly Fixed Effects                  | Yes                 | Yes                   | Yes                     |

| Observations                             | 4,627               | 4,627                 | 4,627                   |
| Number of Branches                       | 142                 | 142                   | 142                     |

Robust standard errors in brackets
*** p<0.01, ** p<0.05, * p<0.1
Table 3. Determinants of intrabank lending for small vs. large branches

<table>
<thead>
<tr>
<th>Dependent variable:</th>
<th>Net due to / Assets</th>
<th>Gross due to / Assets</th>
<th>Gross due from / Assets</th>
<th>Net due to / Assets</th>
<th>Gross due to / Assets</th>
<th>Gross due from / Assets</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
<td>(4)</td>
<td>(5)</td>
<td>(6)</td>
</tr>
<tr>
<td>Real Effective Funds Rate</td>
<td>1.305**</td>
<td>-0.294</td>
<td>-1.598**</td>
<td>-0.511</td>
<td>-1.178***</td>
<td>-0.667</td>
</tr>
<tr>
<td></td>
<td>[0.628]</td>
<td>[0.325]</td>
<td>[0.610]</td>
<td>[0.772]</td>
<td>[0.404]</td>
<td>[0.471]</td>
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<td>U.S. GDP Growth</td>
<td>0.771**</td>
<td>-0.066</td>
<td>0.838***</td>
<td>0.459</td>
<td>0.03</td>
<td>-0.429**</td>
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<td>[0.316]</td>
<td>[0.207]</td>
<td>[0.271]</td>
<td>[0.295]</td>
<td>[0.176]</td>
<td>[0.190]</td>
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<td>0.026</td>
<td>0.084</td>
<td>0.061</td>
<td>0.029</td>
<td>-0.032</td>
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<td>[0.134]</td>
<td>[0.072]</td>
<td>[0.148]</td>
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<td>4.268**</td>
<td>-4.401</td>
<td>-0.957</td>
<td>-2.574*</td>
<td>-1.616</td>
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<td>[4.243]</td>
<td>[1.718]</td>
<td>[3.476]</td>
<td>[2.106]</td>
<td>[1.399]</td>
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<td>97.607**</td>
<td>-13.378</td>
<td>84.229**</td>
<td>5.209</td>
<td>49.066***</td>
<td>43.857***</td>
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<td>[41.959]</td>
<td>[17.127]</td>
<td>[34.302]</td>
<td>[15.389]</td>
<td>[10.365]</td>
<td>[7.501]</td>
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<td>Large</td>
<td>Large</td>
<td>Small</td>
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<tr>
<td>Branch Fixed Effects</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
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<tr>
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<td>1,042</td>
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Robust standard errors in brackets
*** p<0.01, ** p<0.05, * p<0.1
Table 4. Intrabank funding during the August 2007 ABCP market shock

<table>
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<tr>
<th>Dependent variable:</th>
<th>Net due to / Assets</th>
<th>Gross due to / Assets</th>
<th>Gross due from / Assets</th>
<th>Net due to / Assets</th>
<th>Gross due to / Assets</th>
<th>Gross due from / Assets</th>
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<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
<td>(4)</td>
<td>(5)</td>
<td>(6)</td>
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<td>Dummy Crisis</td>
<td>3.086</td>
<td>4.072*</td>
<td>0.986</td>
<td>3.692**</td>
<td>4.366***</td>
<td>0.674</td>
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<tr>
<td></td>
<td>[2.574]</td>
<td>[2.367]</td>
<td>[1.313]</td>
<td>[1.489]</td>
<td>[1.474]</td>
<td>[0.663]</td>
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<td>Dummy Europe</td>
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<td>14.067***</td>
<td>9.231***</td>
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<td></td>
<td>[2.760]</td>
<td>[2.423]</td>
<td>[1.402]</td>
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<td>[3.902]</td>
<td>[3.456]</td>
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<td>[2.694]</td>
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<td>39.855***</td>
<td>13.810***</td>
<td>17.265***</td>
<td>34.621***</td>
<td>17.355***</td>
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<td>[0.616]</td>
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<td>[0.332]</td>
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<td>No</td>
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<tr>
<td>R-squared</td>
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<td>0.06</td>
<td>0.09</td>
<td>0.03</td>
<td>0.03</td>
<td>0.04</td>
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</table>

Robust standard errors in brackets
*** p<0.01, ** p<0.05, * p<0.1
Figure 1. Aggregate net due to positions of U.S. branches of European banks
(% of assets)

Source: Federal Reserve Board (net due to positions), Haver Analytics (U.S. GDP in billions of chained 2005 dollars, annual)
Figure 2. Mean share of small business loans in the total number of outstanding loans
(by domestic vs. foreign banks in the U.S.)

Sources: Federal Reserve Board (for commercial and industrial loans to U.S. entities issued by FDIC-insured commercial banks in the U.S. with at least US$ 300 million in assets); Haver Analytics (for U.S. GDP in billions of chained 2005 dollars, annual).

Note: The number of small business loans (i.e. less than US$ 100,000) is expressed as a fraction of the total number of outstanding loans for each bank, measured at the end of the second quarter of each year; we average the resulting shares over domestic vs. foreign banks.
Figure 3. Mean share of small business loans in the total value of outstanding loans
(by domestic vs. foreign banks in the U.S.)

Sources: Federal Reserve Board (for commercial and industrial loans to U.S. entities issued by FDIC-insured commercial banks in the U.S. with at least US$ 300 million in assets); Haver Analytics (for U.S. GDP in billions of chained 2005 dollars, annual).

Note: The number of small business loans (i.e. less than US$ 100,000) is expressed as a fraction of the total number of outstanding loans for each bank, measured at the end of the second quarter of each year; we average the resulting shares over domestic vs. foreign banks.
Figure 4. Firm profits with local vs. global borrowing as functions of idiosyncratic productivity

![Graph showing firm profits with local vs. global borrowing as functions of idiosyncratic productivity.](image)

Figure 5. Average labor productivity for firms working with local banks ($\tilde{z}_{L,t}$) and global banks ($\tilde{z}_{G,t}$)

![Graph showing average labor productivity for firms working with local and global banks.](image)