Application in banking: securitization and global banking

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DOI: https://doi.org/10.1016/B978-0-12-815859-3.00023-8

Other titles: Chapter 23

Panel Data Econometrics Volume 2: Empirical Applications
Application in Banking: Securitization and Global Banking
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Abstract

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Keywords: Bank Lending Channel, Fixed Effects, Global Banking, Monetary Transmission, Panel Estimation, Securitisation

☆Degryse acknowledges financial support from Fund for Scientific Research Flanders under FWO G.0857.16. Ongena acknowledges financial support from ERC ADG 2016 - GA 740272 lending.

This chapter reviews the econometric techniques and findings regarding two recent developments in the banking literature – securitization and global banking. The banking industry has become more complex in its business models and in its geographic structure. First of all, banks have become more complex in scope. Securitization for example has allowed banks to diversify their traditional credit business, by selling the original loans to outside investors, and to create more complex financial products. At the same time, most banks are no longer local entities, lending to local firms and sensitive only to local shocks. Indeed banks have become global in many aspects. This new geographical structure is studied by the global banking literature.

The benefits of securitization and global banking are driven by the same forces: diversification and risk-sharing. The costs arise due to potential market failures such as asymmetric information. Furthermore, the private costs may differ from the social costs stemming from contagion among the users of these innovations, which can be substantial as witnessed during the financial crisis.

Below, we review recent empirical contributions that have relied on comprehensive data and panel data econometrics to study the effect that these two innovations have had on the traditional credit market. The first part of this chapter deals with securitization, which is then followed by global banking. Each section includes a review of the econometric methodologies employed and a discussion of selected contributions. Before this, however, the following section provides an overview of the main sources of data employed in this literature.

1. Data Sources

Most of the datasets used in this literature have a panel structure, with a time and a cross-section dimension, typically across countries, banks, firms or loans. More granular data leads to better identification.

Studies at *bank level* typically rely on bank financial information, extracted from balance sheets and income statements. This is available either through regulatory reports (for example, the Federal Reserve's Report of Condition and Income or "call reports"), or from private data providers (such as Orbis Bank Focus or SNL). Indicators for the intensity of securitization can be obtained from private data provider Dealogic, who reports banks' involvement in different types of securitized assets (mortgages, corporate loans, covered bonds), or from rating agencies, such as Moody's. Trading

data involving asset-backed securities, including commercial paper or bonds, can be found either in trade repositories, such as the Depository Trust and Clearing Corporation (DTCC), or by approaching the dealer banks who make markets for these products.

In many empirical analyses, bank data is supplemented with *firm level* financial information, generally available either from Compustat (worldwide) or Bureau van Dijk and Moody's Analytics (European), and financial market indicators.

For *loan level* analyses, the source of data depends on the type of credit product concerned. Most of the empirical research on mortgage lending has focused on the US market, where data is available either from the Home Mortgage Disclosure Act (HMDA) or the First American CoreLogic LoanPerformance databases. Detailed information is available, including mortgage rates, loan size, maturity, year of origination, contract types (hybrid, fixed-rate, adjustable-rate), default information, as well as borrower characteristics (credit scores, debt to income ratios) and loan application status (denied, approved, originated). Data aggregated at ZIP-code level is also available from Equifax, another data provider that maintains consumer credit history and related data on US households. Equifax provide annual aggregated data for outstanding credit and defaults, broken down by type of loan: mortgages, home equity lines, credit card debt, auto loans, student loans and consumer loans.

Loan level data on corporate credit has come from a variety of sources. The most widely used cross-country data source is Thomson Reuters' Dealscan database on syndicated loans, although information on securitized loans is also available from other providers such as Creditex. In many countries, loan level data is available through credit registries or bureaus, often organized at national central banks. Typically, they include all bank-firm lending above a certain threshold (e.g., Djankov et al. (2007)). As in the case of mortgages, these datasets offer an array of characteristics on the loan itself (maturity, interest rate, performance), or on the borrower.

Global banking requires data *across countries*. For instance, the "perfect" dataset to test the international transmission of monetary policy through banks would be a multi-country credit registry, combined with detailed data on banks and firms, and potentially enhanced with loan applications.[1] This unfortunately does not exist yet,

[1]See Jiménez et al. (2012) for the use of loan application data in identifying the bank balance sheet channel of monetary policy transmission.

due to the confidential nature of credit registries.

As a result, the datasets most frequently used for country level studies are the Bank of International Settlements (BIS) Locational Banking Statistics (LBS) and, more recently, their Consolidated Banking Statistics (CBS). The LBS database contains data on the composition of banks' balance sheets by currency, and a geographical breakdown for their counterparties. The CBS database contains data on the worldwide consolidated country risk exposure of internationally active banks, with headquarters in countries which report to BIS. In addition, information on bank lending behaviour across countries is sometimes available from surveys (an example being the Bank Lending Survey, carried out by the Eurosystem). However, aggregation at country level (or even bank level) requires the strong assumption of homogeneous loan demand across banks. It is therefore crucial to control for borrower characteristics to avoid having to make this assumption.

Thus, a tension between internal and external validity is present in the global banking literature, even at the level of data comprehensiveness. To include the additional dimension of borrower information, the global banking literature has had to sacrifice coverage. For example, Morais et al. (forthcoming) make good use of the Mexican credit registry in order to identify the international credit channel of monetary policy. The data is rich enough to allow them to employ time-varying bank and firm effects, which benefits identification. Further, the granularity of the data allows the authors to test for heterogeneous real effects at firm level. The ability to measure real effects is important, as the transmission of monetary policy or other economic shocks only matters if there are real effects. All this consolidates the internal validity of their study. However, the use of this data confines the analysis to a single country, which limits its external validity.

Syndicated loan datasets resolve this issue as they contain bank-firm data covering multiple countries. However, they have a different weakness. Although the data is sufficiently granular, syndicated loans tend to be large loans given to large firms. Using this data can hide credit supply effects on small and medium sized firms. Further, a key requirement for monetary policy to have real effects is imperfect substitutability between bank lending and other financing sources. Large firms are likely to have better access to outside financing. Thus, an analysis using this data is likely to underestimate the real effects of the bank lending channel.[2]

[2]Aggregated bank or country level data also suffers from this vulnerability, as lending to large

Recent contributions have found other ways to combine these datasets in ways that alleviate the tension between external and internal validity. Although not a multicountry credit registry, Ongena et al. (2015) employ granular data across countries and currency areas, combining multiple datasets[3] to obtain bank-firm data on SMEs, across 13 countries. This allows for the identification of the international bank lending channel and the analysis of its real effects, across a heterogeneous sample of firms. Popov & Ongena (2011) use the Business Environment and Enterprise Performance Survey (BEEPS), to create a synthetic panel dataset that can be merged with interbank market rates from the Global Financial database. This level of granularity in a panel structure allows modelling the effects of financial integration on firms' access to bank credit (borrowing constraints) and the cost of bank credit (loan rates).

2. Securitization and Lending

While securitization dates back to the 17th and 18th century in Holland (Goetzmann & Rouwenhorst, 2008), its massive usage is a relatively recent development in credit markets. Securitization implies that financial intermediaries that grant illiquid loans, subsequently pool them together, diversifying risks, and convert them into liquid assets or asset-backed securities (ABSs). These assets are then sold to outside investors, in exchange for wholesale funding. While the largest share of ABSs cover home mortgage loans, other types of loans have also been securitized, including automobile credit, student loans or corporate loans.

At the end of 2007, the US securitized mortgage loan market reached $6.42 trillion.[4] A liquid market for securitized assets has recognized benefits for the banking industry, such as improving risk sharing and reducing banks' cost of capital (Pennacchi, 1988). Credit to both households and firms should grow as a result. However, the global financial crisis of 2007-09 uncovered ways in which securitization could also hurt lending. It is well understood that the crisis started in the securitized subprime mortgage market, which collapsed after having accumulated unmanageable amounts of risks. This prompted both researchers in finance and policy makers to

firms drives aggregate loan volumes.

[3]They combine the Bank-ownership database compiled by Claessens & van Horen (2014), bank funding data using Dealogic, bank balance sheet information from Bankscope, firm balance sheet information from Amadeus, and bank-firm connection information from Kompass.

[4]See Loutskina (2011).

seek a better understanding of the benefits and the vulnerabilities of the markets for asset-backed securities. Below, we offer a non-exhaustive review of the recent empirical literature addressing this need.

2.1. Methodology

The empirical literature investigating the relationships between securitization and bank lending uses extensively panel data econometrics. In general, the research design seeks to establish causality between securitization and the functioning of credit markets.

One way to take a stab at establishing causality is to exploit *cross-sectional* heterogeneity between subjects along theoretical priors. At the country level, for example, Maddaloni & Peydró (2011) investigate whether monetary policy has a larger impact on lending standards in countries with a higher intensity of securitization. Or, at the bank level, Loutskina (2011) studies whether banks with a higher share of loans that can be securitized have lower holdings of liquid assets. Acharya et al. (2013) investigate whether banks with lower levels of regulated capital engage more intensely in securitization. At the loan level, Benmelech et al. (2012) and Albertazzi et al. (2016) argue that securitization does not negatively impact all credit markets, by showing that securitized corporate loans perform similarly to non-securitized ones. Other studies rely on the *time* pattern of correlations to suggest causality. Gorton & Metrick (2012), for example, use a panel where the cross-sectional dimension is given by several prime and subprime financial markets. They exploit its time dimension, showing the subprime market led the prime one in the run-up to the financial crisis. The panel structure of the data allows the researchers to include controls at subject-time level, but also fixed effects along each of the two dimensions.

However, while many times a powerful tool, such correlational evidence can still be vulnerable to endogeneity. In the cross-sectional dimension, banks able to use securitization might be different from banks that are not, or securitized loans might be different from non-securitized ones, along characteristics that are unobservable to the econometrician. In the time series dimension, there might be macroeconomic factors and policies with a heterogeneous impact on lending, which might correlate with the intensity of securitization. For example, increasing house prices or extending government guarantees might lead to the securitization of riskier loans. Finally, observed loan volumes and spreads are the equilibrium result of transactions between banks and borrowers and, as such, they are subject to simultaneity between supply

and demand.

The literature has addressed each of these issues in several ways. The recent availability of banking microdata allowed researchers to construct increasingly homogeneous samples, thereby comparing individuals with similar characteristics, within the same product or geographical market segment (Demyanyk & Hemert, 2009; Mian & Sufi, 2009; Benmelech et al., 2012; Albertazzi et al., 2016). Other studies relied on established empirical technics that specifically tackle endogeneity, such as difference-in-differences or regression discontinuity designs (Purnanandam, 2010; Keys et al., 2010). And, even when detailed microdata was not available, simultaneous estimation helped disentangle supply and demand (Carbo-Valverde et al. (2015)).

Below, we review some of these contributions in more detail.

2.2. Securitization and Bank Business Models

The possibility to engage in loan securitization has changed the way banks do business. The impact has been both direct, by altering bank management decisions, and indirect, as securitization affected the transmission of monetary policy or bank regulation. In this section, we review selected empirical contributions that have documented these changes.

The direct benefits of securitization are put to the test in Loutskina (2011). The author uses bank balance sheets and income statements extracted from the Federal Reserve's call reports to study how securitization changes bank liquidity and funding management. Relying on panel data analysis conducted over 30 years (1976 to 2007), this study documents that securitization reduces banks' needs for liquid assets. In turn, this increases banks' ability to extend credit. The reason is clear: loans that are long-term and illiquid can now be sold in the market, in exchange for new liquidity. Banks, thus, adapt their business from holding loans on balance sheet up to maturity to selling them to outside investors.

To capture this effect empirically, Loutskina (2011) constructs an index of potential liquidity for each bank's portfolio. More precisely, this is a weighted average of a bank's potential to securitize its own loans, based on the shares of loans of the same type already securitized on the market. She then finds that the index is inversely correlated with banks' holdings of liquid assets, measured as the share of marketable assets and the federal funds sold, to total assets. Further tests conducted

around regulatory changes affecting liquidity for securitized assets, confirm that a liquid ABS market offers a substitute to bank on-balance sheet liquidity.

But securitization can also have indirect effects on the banking market. One stems from its interaction with monetary policy. Expansionary monetary policy stimulates credit, but it can also increase risk-taking by banks. This is known in the banking literature as the "risk-taking channel of monetary policy". Agency problems in banking - due to bailouts and liquidity assistance - , mean that low interest rates may induce banks to soften their lending standards by improving banks' liquidity (Allen & Gale, 2007) and net worth (Adrian & Shin, 2010). Moreover, low interest rates make riskless assets less attractive and may lead financial intermediaries to search for yield (Rajan, 2006).

Above, we discussed how the possibility to securitize loans improves bank liquidity. But, this additional liquidity could be excessive during a monetary expansion. Furthermore, loan securitization is also one way of creating assets that yield attractive returns for investors, but that are risky. As a result, while expansionary monetary policy alone could lead to softer lending standards, securitization might further amplify this phenomenon. To investigate the impact of securitization on the risk-taking channel of monetary policy, Maddaloni & Peydró (2011) use data from the Eurosystem's Bank Lending Survey (BLS).[5] The authors assemble survey data from 12 countries which are in the European Monetary Union between 2002:Q4 to 2008:Q3.[6]

Directly assessing the effects of monetary policy on bank lending standards can lead to biased estimates, because both tend to be endogenously determined, together with local economic conditions. However, the authors argue, this is less concerning in the Euro-area. Here, monetary policy rates are set by the Governing Council of the European Central Bank (ECB) and are identical across countries, while significant national differences in terms of GDP and inflation persist. Based on this observation, the authors devise an identification strategy which exploits cross-country variation in monetary policy conditions and the intensity of securitization, across Euro-area countries.

[5] Jiménez et al. (2014) and Ioannidou et al. (2015) provide loan-level empirical evidence for the existence of the risk-taking channel of monetary policy.

[6] The 12 countries are: Austria, Belgium, France, Finland, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, and Spain.

A first empirical specification confirms the effect of an expansionary monetary policy on lending standards:

$$LS_{t,i} = \alpha_i + \nu_t + \beta STrate_{t-1,i} + \gamma LTrate_{t-1,i} + \delta Controls_{t-1,i} + \epsilon_{t,i} \quad (1)$$

where $LS_{t,i}$ is the net percentage of banks that report having tightened credit standards in quarter t and country i. $STrate_{t-1,i}$ captures the local effect of monetary policy conditions, proxied by country-specific residuals, from regressing the EONIA rate[7] on local GDP growth and inflation. A positive (negative) residual indicates contractionary (expansionary) monetary policy. Therefore, if an expansionary monetary policy led to softer lending standards, then the β coefficient should be positive. The specification includes controls for long-term interest rates, GDP, inflation, as well as time and country fixed effects.

A second specification measures whether the effect of an expansionary monetary policy is amplified when securitization intensifies, by interacting the short-term rates with indicators for securitization. Maddaloni & Peydró (2011) measure securitization activity using the ratio between all issuances of asset-backed and mortgage-backed securities in each quarter and country (as reported by Dealogic), and GDP.

$$\begin{aligned} LS_{t,i} =& \alpha_i + \nu_t + \beta STrate_{t-1,i} + \zeta Securitization_{t-1,i} + \\ &+ \theta(STrate * Securitization)_{t-1,i} + \gamma LTrate_{t-1,i} + \delta Controls_{t-1,i} + \epsilon_{t,i} \end{aligned} \quad (2)$$

The results confirm that low monetary policy rates soften lending standards for both firms and households. And, crucially, this softening is amplified by intense securitization activity, especially in the case of mortgages (the θ coefficient on the interaction term is positive and statistically significant).

Aside from its interaction with monetary policy, securitization may also dilute banking regulation. Acharya et al. (2013) argue that, prior to the financial crisis, commercial banks relied on securitization in order to circumvent regulatory capital constraints.

[7] The EONIA rate is the Euro OverNight Index Average, the short-term rate on the interbank market, targeted by ECB's monetary policy.

Banks can reduce capital requirements by securitizing and offloading loans.[8] Focusing on the asset-backed commercial paper (ABCP) market prior to 2007, Acharya et al. (2013) show that some banks use heavily this product to cut required capital, without adequately transferring the underlying risk of the loan exposures. As a result, these banks are more vulnerable when the crisis starts. Below, we first describe the most relevant institutional features of the ABCP market and then we review the empirical methods and findings of this study.

In the run-up to the financial crisis, banks set up conduits to purchase their loans. The conduits securitize the loans, and finance them by issuing short-term ABCP to investors. But conduits are subject to "rollover risk": if the value of the assets in their portfolio deteriorates, they might not raise enough cash to refinance maturing commercial paper. However, many of the investors in ABCP at the time are money market funds, who prefer safe assets. To attract these investors, banks insure the new assets with explicit guarantees, structured such that investors get paid off even if the conduits' cash flow falls below the level of their claims. Crucially, even with such comprehensive guarantees, this type of securitization through conduits reduces significantly banks' capital requirements, to at most a tenth of the capital required to back on-balance sheet loans.

As a result, banks retain most of the credit risk even after securitizing the loans. When the financial crisis brings a sharp drop in the value of conduits,[9] losses to outside investors are small. The impact on banks, however, is negative and large, because they hold the financial responsibility of the conduits and have committed to repaying maturing ABCPs to investors at par.

To document these events empirically, the paper uses comprehensive panel data. The main data source are ratings reports for all 938 conduits rated by Moody's Investors Service from January 2001 to December 2009, containing data on conduit sponsors, type, assets, and guarantees. This is enhanced with Moody's Weekly

[8] Capital regulation determines the level of capital that financial institutions have to hold against risk-weighted assets. Until 2013, this amount was set under the Basel II agreement at a minimum of 8% for banks.

[9] In July 2007, the ABCP outstanding amount to $ 1.3 trillion. On 9 August 2007, the French bank BNP Paribas halts withdrawals from three funds invested in mortgage-backed securities, on the back of losses from the underlying assets. This has a profound impact on the ABCP market, which experiences a strong loss of investor confidence, with outstanding volumes dropping to $833 billion by December 2007.

Announcement Reports of rating downgrades on conduits, from January 2007 to December 2008. In addition, the authors access a proprietary dataset on all US ABCP transactions between January 2007 and February 2008, collected by the Depository Trust and Clearing Corporation (DTCC). Finally, they include bank financials and share prices.

The analysis follows three steps. The authors first investigate whether capital-constrained commercial banks are more likely to sponsor conduits, prior to the financial crisis. They use panel regressions, and assess the relation between bank exposure to ABCP (measured as the ratio of ABCP relative to bank equity) and bank capital:

$$Exposure_{it} = \alpha_i + \delta_t + \beta CapitalRatio_{it} + \gamma X_{it} + \epsilon_{it} \tag{3}$$

where $Exposure_{it}$ measures the ABCP exposure of bank i at time t, $CapitalRatio_{it}$ is the capital ratio of bank i at time t, α_i are bank fixed effects, δ_t are time fixed effects and X_{it} are controls for time-varying bank characteristics (size, return on assets and short-term debt, deposits, loans, each weighted by assets). Bank capital is measured both as economic capital (book equity to assets) and regulatory capital (Tier 1 regulatory capital to risk-weighted assets). Economic capital is included because regulatory capital is vulnerable to reverse causality. If banks had already engaged in securitization in order to arrive at their existing capital ratios, then, in equilibrium, the econometrician would only observe relatively larger levels of regulated capital. In this case, economic capital might provide a better measure of capital constraints, as it is not monitored by bank supervisors.

A second specification looks into which conduits experience greater outflows, lower issuance and higher spreads, as investors start fleeing risky assets in 2007. This analysis exploits cross-sectional variation in the strength of the guarantees: while some guarantees cover completely credit and liquidity risks, others are weaker. The focus is on the period of four months before and after August 9, 2007, as follows:

$$y_{it} = \alpha + \beta_j Guarantee_{ij} + \gamma_j After_t Guarantee_{ij} + \delta After_t + \epsilon_{it} \tag{4}$$

where y_{it} is either the natural logarithm of the value of ABCP outstanding of conduit i in week t, or the overnight ABCP spread over the federal funds rate on new issues by conduit i on day t. $Guarantee_{ij}$ is an indicator variable for the guarantee of type j of conduit i and $After_t$ is an indicator variable that equals one after August 9, 2007. Additional specifications include time fixed effects, conduit fixed effects and sponsor-time fixed effects. Had the financial crisis worried investors about

conduit risks, then conduits with weaker guarantees should have a relatively lower performance and less ability to roll over maturing assets (γ_j should be large and significant for relatively weaker guarantees).

For conduits that are fully guaranteed, the argument continues, investors should suffer no loss. In exchange, the negative shock should be absorbed by the sponsoring banks. A final specification tests whether these banks experience lower stock returns, in an event study around August 9, 2007. The baseline specification is:

$$R_i = \alpha + \beta ConduitExposure_i + \gamma X_i + \epsilon_i \tag{5}$$

where R_i is the cumulative equity return of bank i, computed over the three-day period from August 8 to 10, 2007. $ConduitExposure_i$ is bank i's conduit exposure relative to equity in January 2007, and X_i are bank characteristics. Consistent with the hypothesis, we would expect a negative β.

The estimations show that, first, banks that are more capital constrained have indeed larger ABCP exposures. Second, when asset quality deteriorates at the beginning of the crisis, ABCPs with weaker guarantees experience larger investor outflows. And, third, banks highly exposed to conduits appear to be the main losers from their underperformance: an increase in conduit exposure from 0% to 100% of bank equity reduces the stock return during the three-day event window by 1.4 percentage points.

2.3. Types of Securitization and Asymmetric Information

The increased risk-taking observed prior to 2007 and associated with securitization may stem from a shift in the distribution of new borrowers, when supply increases sufficiently to satisfy a credit demand of lower quality. Securitization, however, can also increase informational frictions in the credit market.

In their traditional role as financial intermediaries, banks should reduce information asymmetries between lenders and borrowers. When the originator of a loan holds it to maturity, they have incentives to select the loans that perform best. This is done by both ex-ante screening borrowers and by monitoring them ex-post (Petersen & Rajan, 1994; Gorton & Pennacchi, 1995; Holmstrom & Tirole, 1997; Parlour & Plantin, 2008; Pennacchi, 1988). But, securitization changes the traditional lending market from an "originate-to-hold" to an "originate-to-distribute" model (Purnanandam, 2010). As banks offload loans shortly after origination, by securitizing them, their screening efforts might be reduced. In fact, if screening is costly and loans can

be easily securitized, banks might only screen borrowers for hard information. This is information that can easily be observed by outside investors and contracted upon. Any soft information that could predict the future performance of a loan, but that is costly to process and unobservable to outsiders, risks being overlooked.

The empirical evidence suggests that securization did increase informational asymmetries, but this effect was limited to the subprime mortgage market. Researchers have sought to explain the increased risk taking in this market segment by looking for causal evidence of, first, an increase in bank credit supply, and second, of a simultaneous reduction in screening efforts. Below, we review this evidence. Then, we review studies involving corporate credit, showing that these markets are more resilient to informational frictions.

2.3.1. Subprime Mortgage Lending

Among the first studies exploring the reasons behind the weakness of the securitized mortgage market in the run up to the financial crisis are Demyanyk & Hemert (2009) and Mian & Sufi (2009).

Demyanyk & Hemert (2009) use loan-level data on subprime mortgages from LoanPerformance and document a decrease in loan quality in this market segment, between 2001 to 2007. They employ proportional odds duration models, estimating the probability of first-time delinquency on a subprime mortgage loan as a function of loan characteristics, borrower characteristics, macroeconomic conditions and origination year effects. The evidence is consistent with a sustained increase in risk-taking in the market. Conditional on observables, loan quality deteriorates monotonically between 2001 and 2007, but it is masked by the simultaneous appreciation in house prices. As house prices start to decline in 2006, poor loan quality materializes into realized defaults in 2006 and 2007.

But what is the driver behind this increased risk-taking in mortgage lending? Is it demand or supply driven? And how is it linked to securitization? These questions are hard to address in the context of Demyanyk & Hemert (2009), as their study lacks a control group. Other lending segments might have behaved similarly. Mian & Sufi (2009) take the investigation further and show that the increased underperformance was supply-driven and specific to the securitized subprime mortgage sector. They employ data on lending activity at the level of US ZIP codes, by combining Equifax information on outstanding credit and defaults, with new mortgage lending from the

HMDA dataset.

Moreover, their work sheds light onto how microdata is necessary to choose between competing theoretical explanations. The expansion in subprime mortgage credit since 2000, they argue, could have been caused by two factors. It could have been demand-based, if the income prospects of subprime borrowers had improved over the same period. Or, lenders could have increased their supply of credit to riskier borrowers, expecting to immediately offload the risk by securitizing the loans. The analysis starts at county level. County level trends are consistent with the demand-based hypothesis: income growth is stronger in counties with a higher share of subprime consumers during 2002 to 2005. But, if this growth in incomes concentrated among the prime segments of the population, the correlation could be spurious. And, indeed, zooming at ZIP code level supports the alternative hypothesis: during the same period, subprime borrowers experience negative income growth. This supports the hypothesis of increasing credit supply to the riskier subprime sector.

So far, the causal interpretation is still weak. Subsequent contributions tackle causality and investigate further the underlying economic mechanisms linking securitization and deteriorating lending standards.

Keys et al. (2010) employ a regression discontinuity design to establish causality between securitization and decreased loan performance, due to reduced screening incentives. They use individual data on subprime mortgages from LoanPerformance, from January 2001 to December 2006.

The discontinuity is at a specific threshold in mortgage borrowers' credit scores, inducing exogenous variation in the probability that their loan is securitized. This threshold is based on governmental guidelines advising against lending to borrowers with a credit score below this level.[10] While the rule targeted lenders, investors purchasing asset-backed securities also adhered to it. As a result, loans made to borrowers with a credit score just above this threshold had a higher unconditional likelihood of being securitized than loans made to borrowers just below the threshold.

The premise is that the discontinuity in the likelihood of securitization induces

[10]Government-sponsored enterprises, Fannie Mae and Freddie Mac all recommended not to lend to borrowers with credit scores lower than 620.

a discontinuity in banks' screening incentives. To test this hypothesis, Keys et al. (2010) use a two-step approach. First, they look for a discontinuity in the number of loans securitized above and below the threshold:

$$Y_i = \alpha + \beta T_i + \theta f(CreditScore_i) + \delta T_i f(CreditScore_i) + \epsilon_i \tag{6}$$

where Y_i is the number of loans for each credit score i, T_i is an indicator that takes value 1 if the credit score is larger than the threshold and 0 otherwise, and ϵ_i is a zero-mean error term. $f(CreditScore)$ and $Tf(CreditScore)$ are flexible polynomials, aimed to fit the empirical distribution of the data. β represents the size of the discontinuity and is estimated by the difference in these two smoothed functions, at the cut-off.

Second, the authors evaluate the performance of the loans by examining realized defaults, up to 15 months after origination. If lenders screened with the same intensity loans around the threshold -which should be similar in terms of hard information - then the two groups of loans should have equal performance. They estimate a second specification, similar to (6), where the variable Y_i becomes the share of loans in default within ten to fifteen months of origination. Here, β measures the change in the default rate, at the threshold.

The first set of estimations show that loans just above the threshold have more than double chances of being securitized than loans just below the threshold. And, secondly, doubling the securitization volume on otherwise similar loans is associated with a 10%-25% increase in defaults, which the authors link to weaker bank screening.

Purnanandam (2010) complements these findings by showing that the weaker screening was not confined to a narrow segment of borrower FICO scores, but that banks highly involved in securitization did not actively screen entire loan portfolios. The author combines banking characteristics from call reports with loan-level information from the HDMA database. For identification, he exploits the liquidity shock that affected the secondary mortgage market in 2007, forcing banks to keep on balance sheets loans that were previously intended for sale. Purnanandam (2010) then compares observed defaults on mortgage loans granted by banks highly exposed to securitization versus lowly-exposed banks, in a difference-in-differences setup:

$$\begin{aligned} default_{it} =& \mu_i + \beta_1 after_t + \beta_2 after_t presec_i + \beta_3 after_t premortgage_i + \\ &+ X_{it} + \epsilon_{it} \end{aligned} \tag{7}$$

where the dependent variable measures the default rate of the mortgage portfolio of bank i in quarter t, μ_i are bank fixed effects and X_{it} are time-varying bank characteristics. The coefficient on the $after_t$ variable captures the change in the time trend of the default rate after the mortgage crisis. β_2 measures the change in default rate for banks that originated loans primarily to sell them to third parties, relative to the corresponding change for banks that originated loans primarily to retain them to maturity. The second interaction term controls for time-varying bank involvement in mortgage lending, to isolate the coefficient β_2 from changes in the overall lending portfolios of banks.

The regression is estimated on a matched sample of banks that differ in their securitization activities, but that have otherwise granted mortgages to observationally equivalent borrowers, in similar geographical areas, and at similar rates. A statistically and economically significant positive β_2 suggests that loans made by banks active in securitization were of inferior quality, with disproportionately higher borrower defaults. The matched sample of banks mitigates concerns that the effect might be due to observable differences in the quality of the loans, suggesting it is rather consistent with diluted screening incentives.

2.3.2. Corporate Lending

While most loan-level empirical evidence points to weaker lending standards and excessive risk in subprime mortgage loans, caused by bank securitization activities, corporate lending offers a different picture.

Benmelech et al. (2012) show that securitization was not associated with riskier lending in the US corporate loan market, prior to the financial crisis. They assemble loan-level information on syndicated loans from Dealscan and Creditflux, matched with firm financials from Compustat, over 1997 to 2007. Because syndicated loans are large ($ 522 million, on average), only parts of them are typically securitized.

The authors identify partially-securitized loans by looking at the identity of the lenders in the syndicate. In addition, they construct a control sample of unsecuritized loans. The research question is similar to Keys et al. (2010): do banks expend less effort in screening for soft information loans that they securitize? Because soft information is unobservable, the authors use as a proxy the ex-post performance on the loans, controlling for observables at the time of origination. Several measures of

performance are used.[11] The detail of the data allows estimation at loan-level, with fixed effects for the leader bank in the syndicate. This removes a possible source of sample selection bias, which could arise if unsecuritized loans were originated by banks with relatively weaker screening capabilities. A dummy on the securitized loans measures the marginal effect of securitization on loan performance, within the loans originated by a given bank.

Benmelech et al. (2012) find that securitized syndicated loans did not underperform syndicated, but unsecuritized loans. They offer a possible explanation specific to the syndicated loan market. Since there are several lenders in a syndicate, if the remaining lenders were able to compensate for weak screening and monitoring from the party engaged in securitization, then loan quality might remain high.

However, the better performance of securitized business loans is not restricted to the syndicated credit market. Using different data and a new empirical approach, Albertazzi et al. (2016) find only a limited role of asymmetric information in the securitization of SME loans. Here, the authors separate adverse selection from moral hazard, by adapting the methodology introduced by Chiappori & Salanie (2000), of testing for asymmetric information in insurance contracts. Applied to securitized loans, this implies jointly estimating a model for the probability of a loan being securitized and one for the probability that the loan quality deteriorates. The analysis uses loan-level data from the Bank of Italy Credit Register and Supervisory Records, covering all firms borrowing from Italian banks over 2002-07. The data includes information on the performance of both securitized and non-securitized loans until 2011, as well as bank and firm financials.

Albertazzi et al. (2016) argue that securitization increases information asymmetries if, accounting for characteristics observable to investors, there is positive correlation between the securitization of loans and the probability that these loans deteriorate into non-performing. Specifically, the probability of securitization and underperformance of a loan granted to firm f by bank b at time t can be assumed to depend on observable characteristics, θ, representing the information set of the investors in ABS:

$$Prob(Securitization_{fbt} = 1|\theta_{fbt}) = F_S(\eta\theta_{fbt} + \epsilon_{fbt})$$

[11] These include: secondary market loan prices, credit ratings, spreads on credit default swaps, implied probabilities of default based on accounting information, as well as violations of loan covenants.

$$Prob(Deterioration_{fbt} = 1|\theta_{fbt}) = F_D(\eta'\theta_{fbt} + \epsilon'_{fbt})$$

where the functions F can be linear probability models, logit or probit, and ϵ_{fbt} and ϵ'_{fbt} are the error terms. The correlation between the error terms provides a test for the presence of information asymmetries.

$$H_0(1) : Corr(\epsilon_{fbt}, \epsilon'_{fbt}) > 0 \tag{8}$$

Firms with multiple bank relationships help distinguish between adverse selection and moral hazard. Under the premise that adverse selection affects all financiers alike, ex-ante, a weak firm is equally likely to default on all exposures, not only on the securitized exposure. However, the incidence of moral hazard due to lack of monitoring should have a larger negative effect on the lender's own exposure. To disentangle the two effects, the authors decompose the error terms, ϵ_{fbt} and ϵ'_{fbt}, into two components: firm-time fixed effects (α_{ft} and α'_{ft}) and the remaining errors, μ_{fbt} and μ'_{fbt}.

Testing for adverse selection comes down to assessing whether there is positive correlation between the coefficients of the *firm-time* fixed effects:

$$H_0(2) : Corr(\alpha_{ft}, \alpha'_{ft}) > 0 \tag{9}$$

And, the behaviour of the remaining bank-firm residuals provides a test for moral hazard:

$$H_0(3) : Corr(\mu_{fbt}, \mu'_{fbt}) > 0 \tag{10}$$

The authors find supporting evidence for $H_0(1)$, consistent with the presence of information asymmetries. Decomposing this effect further, they confirm that $H_0(2)$ holds, while $H_0(3)$ is rejected, implying that these asymmetries of information result from adverse selection, and not from moral hazard. However, the negative effect of adverse selection is dominated by positive selection on observables, at the time of securitizing the loans. As a result, overall, securitized SME loans perform better than the unsecuritized ones.

2.4. Securitization and Financial Stability

Because securitized markets have developed in close connection to the banking system, another important question is whether these markets are susceptible to the main vulnerability of banks: the risk of an inefficient run (Diamond & Dybvig, 1983;

Diamond & Rajan, 2005). Runs are sometimes caused by contagion, from a "bad" to a "good" market. In fact, Gorton & Metrick (2012) document a run in the sale and repurchase (“repo”) market), where banks exchange securitised assets for funding from outside investors.[12]

Financial distress starts in the securitized subprime mortgage market, the authors argue, and spreads to the less risky, non-subprime securitized assets, through the repo market. Up to 2007, some repo agreements are backed by subprime housing assets. The deterioration in this sector increases uncertainty about bank solvency and counterparty risk in the repo market. This leads to a generalised withdrawal of repo funding, affecting also non-subprime assets.

To test this hypothesis, the authors assemble different datasets. The main dataset has information on 392 securitised bonds, from dealer banks, covering non-subprime credit products such as credit cards, student loans, auto loans and commercial mortgage-based securities. It contains spreads on the bonds, as well as repo rates and haircuts. To proxy for fundamentals in subprime market, the authors use the ABX index, a synthetic tradable index that references 20 equally weighted subprime mortgage-backed securities. Finally, bank counterparty risk is captured by the 3-month LIBOR-OIS, which is the spread between the rate charged for unsecured interbank borrowing (LIBOR) and the rate on an overnight interest swap (OIS), exchanging a floating Fed fund rate for a fixed rate, both with a maturity of three months.

Gorton & Metrick (2012) prove contagion to the non-subprime sector, by showing that their measure of counterparty risk, the LIBOR-OIS spread, increases following subprime distress, subsequently leading the spreads of non-subprime securitized assets, which are also used as collateral in the repo market. They run the following specification, separately on credit card, auto loans, student loans, and commercial mortgage-backed securities:

[12] In the repo market, agreements are established between banks looking for funds and institutional investors. The transactions are frequently backed by securitised bonds: the investors buy the asset as collateral from the bank and, at the same time, the bank agrees to repurchase the asset at some later time, for a set price. The difference between the sale price and the repurchase price is the repo rate. Typically, the value of the collateral contracted upon is lower than the value of the securitised assets, with the difference being the “haircut”. If the bank defaults on the promise to repurchase the asset, then the investor has the right to terminate the agreement and keep the collateral.

$$\Delta Y_{i,t} = a_1 + b_1 \Delta LibOis_t + b_2 \Delta ABX_t + b_3 \Delta X_t + \epsilon_{i,t} \tag{11}$$

where the $Y_{i,t}$ is, in turn, the weekly spread, the repo rate and the repo haircut on bond i at time t. $LibOis_t$ is a vector of the last four observations of the LIBOR-OIS spread, ABX_t is a vector of the last four observations of the ABX spread, and X_{it} is a vector of financial controls, including the ten-year Treasury rate, the retuns on the S&P index, the VIX index, the slope of the yield curve and the overnight swap spread.

The results from the main specification consistently show that the LIB-OIS variables are jointly significant when explaining spreads, repo rates and haircuts across the four classes of non-subprime bonds. This supports the hypothesis of contagion, suggesting that runs remain a threat to the functioning of modern banking markets.

3. Global Banking

In addition to becoming wider in scope, banks have also become wider in geography. The degree to which the global banking system is integrated has important consequences for the transmission of monetary policy and economic shocks between monetary areas. Further, it has implications for the stability of the global financial system, firms' access to finance and potentially the real economy of countries, other than the country where the shocks originate (host countries). It is important for policy makers to have an understanding of these effects, so that they are better able to design policy that has its desired impact. Further, these policies may "spill over" across borders, potentially implying a need for international coordination in local prudential policy making.

The literature studying the link between foreign markets and bank lending is relatively new. Some of the earlier papers found evidence that shocks to the Japanese financial system were transmitted to the US bank lending market (Peek & Rosengren, 1997), and this had an impact on the real economy in the US (Peek & Rosengren, 2000). However, the literature only truly developed following the financial crisis. Its aim has been to understand the implications of global banking for cross-border economic shock transmission, including monetary policy (Bräuning & Ivashina, 2017), and other economic shocks (Cetorelli & Goldberg, 2012b). From a regulatory viewpoint, the concept of "cross-border lending" was not mentioned in regulatory guidelines until 2006 (Aiyar et al., 2014).

Global banking models have evolved from relatively straightforward exporting of local impulses (Peek & Rosengren, 1997) to more complex models involving global loan portfolios and liquidity management (Cetorelli & Goldberg (2012a), Giannetti & Laeven (2012)). They borrow heavily from the bank lending channel (BLC) literature (Kashyap & Stein, 2000), and have only recently begun to incorporate foreign exchange, through FX Swaps (Bräuning & Ivashina, 2017), or to study real effects (Ongena et al., 2015).

3.1. Methodology

In terms of econometric methodology, this literature uses a range of panel data econometric techniques to aid in uncovering the transmission channels. These techniques, along with what makes them useful in a global banking context, are discussed below.

As in the BLC literature, if researchers want to be able to say anything about a shock transmission through banks, they need to disentangle loan demand from loan supply. This is because we view an equilibrium outcome. Initial work on the BLC literature (Kashyap & Stein (2000)) relied on proxies for time-varying loan demand, such as GDP growth, and on the assumption that all banks face homogeneous loan demand. Recent literature on the BLC and on global banking have employed more sophisticated approaches, such as using time-varying country/firm effects (Altunbas et al. (2010), Bräuning & Ivashina (2017)) or explicitly modelling firm heterogeneity (Ongena et al., 2015).

The interaction of time and country fixed effects (e.g. country-year fixed effects) is used to control for country level loan demand and other time varying country level effects (omitted variables). This fixed effects specification absorbs factors such as the demand for bank debt in a particular country, at a particular time. By including these country level effects, researchers are able to make statements about effects at bank level, i.e. how changes in the supply of bank loans vary by banks' characteristics. Put differently, the inclusion of these fixed effects allows researchers to analyse within-country variation.

Another fixed effect specification is the use of both bank-year fixed effects and firm-year fixed effects. The former controls for bank factors that vary with time, such as the shock to Japanese banks documented in Peek & Rosengren (1997), causing an overall contraction in lending by these banks at that particular time. The latter

controls for loan demand factors at borrower level.[13] Bräuning & Ivashina (2017) are able to use this fixed effect specification because they employ data from the syndicated loan market in which loans involve multiple banks and where banks lend to multiple firms, i.e. bank-firm level data. As a result, the authors are able to make statements about bank-firm level factors (e.g., the probability of firm i obtaining a loan from bank j in time t), while controlling for time-varying bank and firm specific effects.

However, the use of fixed effects does not come without its disadvantages, as Khwaja & Mian (2008) make clear. With loan-level (bank-firm-level) data, the use of firm-level fixed effects can effectively exclude parts of the sample and potentially diminish external validity. This occurs as many firms, especially SMEs, have a relationship with only one bank (Degryse et al., 2009). A solution is to control for observable key firm characteristics. Khwaja & Mian (2008) show that after controlling for firm characteristics, including firm-level fixed effects has little impact on the estimated coefficient. In Ongena et al. (2015), this problem is particularly relevant as their dataset contains mainly SMEs, and the inclusion of firm-level fixed effects would have excluded two-thirds of their sample. They resolve this issue by following the solution of Khwaja & Mian (2008), while employing higher-level fixed effects (country and industry).

In addition, the literature often makes use of lags of the dependent variable. The number of lags used varies and depends on the frequency of the data (4 lags for quarterly; 12 lags for monthly). Such dynamic panel data models are constructed to allow for dynamics in changes of the loan supply. They reflect the fact that changes in monetary policy takes time to percolate into the banking system. However, the inclusion of dynamics in what is often a fixed effects regression causes inconsistency in the parameter estimates (Nickell, 1981).

Once demand and supply have been disentangled, the traditional BLC literature explains heterogeneous changes to banks' loan supply by differences in banks' characteristics, such as size (Kashyap & Stein, 2000). This raises a potential issue of simultaneity bias as a bank's loan growth affects its size. To resolve this issue, the traditional literature uses bank size in the previous period, as it is unlikely to be determined by its growth in loans in the current period. As a precaution, the literature

[13] The use of this fixed effect specification, in the global banking literature, often includes the use country-time effects, or explicit controls for macro effects at country level, e.g. GDP growth rates.

tends to lag all bank characteristics, whether the potential for simultaneity bias is clear or not. The global banking literature has used the same approach (Cetorelli & Goldberg, 2012a).

The potential for independent variables to be endogenous and the problem of Nickell bias in these dynamic panel data models has led the BLC literature to adopt estimation techniques that specifically address these issues, such as the Generalized Method of Moments (GMM) estimators developed by Arellano & Bond (1991) and extended by Arellano & Bover (1995) and Blundell & Bond (1998).[14] Once again, the global banking literature has borrowed from the traditional BLC literature and has begun using these estimation techniques (Wu et al. (2011) and Cerutti (2015)).

While the majority of the literature does not explicitly model the degree of financial integration, Popov & Ongena (2011) do measure the degree of integration in the interbank market in a first-stage regression. Their measure is the co-integration (Engle & Granger, 1987) between the rates in the domestic interbank market and the rates in a benchmark market (Germany). By basing the relationship of interbank lending rates on an error-correction model, they are able to disentangle the long run co-movement of the interbank rates from the short-run adjustment towards the equilibrium. They then use the coefficient estimates from this first-stage regression as an explanatory variable in later regressions measuring the impact of interbank integration on borrowing constraints and loan rates.

Popov & Ongena (2011) make use of a three-stage Tobit scheme, following Heckman (1979), in order to account for a double-selection bias. This bias arises from the fact that loan rates are only observed conditional on firms not being credit constrained, and firm credit constraints are only observed when they have a positive credit demand. The correction has been used for similar purposes in studies on consumer debt, where this method is used to differentiate between desired and actual debt (Hayashi (1982), Cox & Jappelli (1993)).

In the section that follows, we review more in depth a handful papers and highlight the methodologies, data, and their findings.

[14] See Ehrmann et al. (2001) for an early use of these estimators in the traditional bank lending channel literature.

3.2. Global Banking and Credit

The main concept in this literature is that global banks have global balance sheets which can be affected by monetary policy changes (Cetorelli & Goldberg, 2012a) or other economic shocks (Cetorelli & Goldberg, 2012b), in their home countries or the host countries of their branches or subsidiaries. We can distinguish outward transmission, i.e., transmission of a home country shock to the host country, and inward transmission, i.e., transmission of a shock in the host country towards the home country. These shocks, in turn, affect the allocation of capital between the head office and subsidiaries, impacting loan supply in both home and host country.[15]

The altering of individual banks' home and host country loan portfolios impacts the proportion of loans granted by global banks, as a whole, in the host country. Thus, shocks in the home country have the potential to affect the credit cycle in host countries (Giannetti & Laeven, 2012). Lastly, the decision to re-adjust an international loan portfolio and liquidity management (central bank deposits) also takes into account the FX market and the cost of hedging (Bräuning & Ivashina, 2017).

In an alternative strand of the global banking literature, researchers have analysed the effects of cross-border prudential policy[16] spillovers as an additional source of impulse to local banking systems. These shocks occur when a change in home country macroprudential policies affects banks' behaviour in host countries (and viceversa). Buch & Goldberg (2017) conducted a meta-analysis of a multi-study initiative of the International Banking Research Network (IBRN). In the IBRN study, 15 central banks and 2 international organizations conducted country level analyses on the international spillovers of prudential policy for bank lending. Buch & Goldberg (2017) find that while these spillovers sometimes occur, they are not large on average. Further, the effects vary across prudential instruments, while bank-specific characteristics, such as business models or balance sheet conditions, impact the size and direction of the spillovers.

Cetorelli & Goldberg (2012a) conduct a two-step Kashyap & Stein (2000) style analysis to test for differences in the response of US banks to monetary policy, based on whether banks have foreign operations or not. This is done by first estimating:

[15] Ongena et al. (2015) depart from the concept of home/host but rather focuses on the transmission of international shocks to banks with more or less global balance sheets.

[16] Examples of such policies include limits on loan-to-value ratios, debt-to-income ratios, credit growth, as well as reserve and capital requirements.

$$\Delta log(Y_{i,t}) = \sum_{j=1}^{4} \alpha_{tj} \cdot \Delta log(Y_{i,t-j}) + \beta_t \cdot X_{i,t-1} + Controls + \epsilon_{i,t} \tag{12}$$

where $\Delta log(Y_{i,t})$ is the change in the total lending of bank i at time t. $X_{i,t-1}$ is the log of the bank's liquidity ratio. Control variables include banks' capitalization ratios, size, and non-performing loans, included following the BLC literature. The first lag of X_i and the controls are used in order to avoid simultaneity bias.[17] Further, state and metropolitan area fixed effects are included, to account for unobserved loan demand factors. Equation 12 is estimated for each quarter, resulting in a time series of β_t estimates, which are used in the next step.

The second step of the analysis uses the β_t's estimated above as dependant variable, to determine how the sensitivity of bank lending to bank balance sheet characteristics, in this case liquidity, varies with monetary policy changes. This is done as follows:

$$\hat{\beta}_t = \eta + \sum_{j=1}^{n} \phi_j \cdot MP_{t-j} + \delta \cdot Controls + u_t \tag{13}$$

where MP_{t-j} is an indicator of monetary policy, for which an increase corresponds to a tightening of monetary policy.[18] The authors select a lag, n, of 8 to capture a slow response of lending to monetary policy conditions. Controls include GDP growth, as well as its lags, to account for business cycle fluctuations. Time fixed effects are also included. Equation 13 is run for a sample of large domestic banks, and for large global banks. Further, the authors use Newey-West robust standard errors to account for autocorrelation in the standard errors (Newey & West, 1987).

The sign of the sum of the coefficients of MP_{t-j} is positive, as bank lending is expected to be more dependent on liquidity during tight monetary policy and less during expansionary monetary policy. By splitting the sample into global banks and domestic banks the authors are able to test if the ϕ_j's are significantly different from zero in each specification. Then they draw conclusions about the bank lending

[17] For example, banks may be large due to experiencing high loan growth.

[18] The choice of the monetary policy indicator is non-trivial, and it is not always simply the central bank's policy rate. The correct measure depends on the currency area. For example, the 3-month Euro Interbank Offered Rate (3m EURIBOR) or the Eonia rate are common choices in studies of Euro Zone countries, while the Bernanke & Mihov (1998) measure if often used for U.S studies.

channel's flow through global or domestic banks. Cetorelli & Goldberg (2012a) find, contrary to the traditional BLC literature (Kashyap & Stein, 2000), that large banks are sensitive to monetary policy if they are not global. Similarly, the authors find that small banks affiliated with large global banks are less sensitive to monetary policy shocks, than small banks affiliated with large domestic banks. They argue that this is due to large global banks being able to use foreign liquidity to insulate the loan supplies of their affiliates.

Bräuning & Ivashina (2017) focus on the hedging costs arising from currency mismatches between global banks' funding and investment activities. The authors argue that if currency flows are large enough, the cost of hedging will increase, which will decrease the return on lending in the foreign currency. They show that an increase in the monetary policy interest rate differential, between two currency areas, decreases foreign lending, leading to a redeployment of capital through the global balance sheet and an increase in local lending.

At the aggregate macro level, they show that there is a positive relationship between foreign bank reserve holdings and the difference between the overnight rate on excess reserves ($IOER_{US-HQ}$). Specifically, they find that an increase in the $IOER_{US-HQ}$ of 0.25% leads to a 6% increase in deposits with the US Federal Reserve (with the funds transferred from their foreign offices) and a 2.5% decrease in lending to US firms. They also document an increase in banks' FX swapping activity into high yield currencies, as well as an increase in the cost of hedging in response to a decrease in the monetary policy rate in the home country.

At bank level, they document a reallocation of loan volumes, as an increase in the $IOER_{US-HQ}$ leads to a 1% decrease in lending in the foreign currency. The effects are particularly strong for lowly-capitalised banks.

Additionally, at firm level, Bräuning & Ivashina (2017) find that increasing the $IOER_{US-HQ}$ by 0.25% leads to a 1% lower probability of a particular bank lending to a particular firm in a given period (extensive margin), as well as an associated 3% decline in the lending volume (intensive margin). Lastly, they show that, at the aggregate domestic credit supply level, firms that had a larger share of foreign global banks in their syndicate, which subsequently experienced monetary easing in the country of their headquarters, faced a stronger contraction in credit. Specifically, a one standard deviation increase in the past share of foreign global banks in the syndicate leads to a 6.5% decrease in the probability of obtaining a loan and a 4%

drop in volume of granted loans, after an expansionary monetary policy in the home of the foreign bank.

Giannetti & Laeven (2012) find that global banks redistribute their loan portfolios based on their funding conditions at home. During good times (low funding costs), global banks tend to redistribute their loan portfolio in favour of foreign markets (flight abroad), and when funding conditions are poor, they tend to favour their home country (flight home). Furthermore, the authors show that the globalisation of banking activities affects the amplitude of credit cycles, and that banks export home-grown shocks to host markets.

Giannetti & Laeven (2012) test their first hypothesis that global banks redistribute their loan portfolio based on their funding conditions at home, by analysing the behaviour of the coefficient α_1 below:

$$Loan\ Share_{ijt} = \alpha_0 + \alpha_1 Funding\ Conditions_{i,t-1} + \Gamma X_{ijt} + \varepsilon_{ijt} \qquad (14)$$

where $Loan\ Share_{ijt}$ is the ratio of syndicated loans originated to borrowers in country j, by bank i, in year-month t to total loan supply. $Loan\ Share_{ijt}$ cannot be affected by overall loan supply shocks, because it captures the geographic distribution of new loans.

$Funding\ Conditions_{i,t-1}$ is measured by either the median ratio of market equity to book equity, or by the average spread in the interbank market over the overnight spread, in country i, during month-year t. Firms have a lower cost of issuing equity when market valuations are higher, which is captured by a higher market-to-book equity ratio (Pagano et al. (1998), Baker et al. (2009)). The interbank spread measures banks' short-term funding conditions. Because the study uses syndicated loan data, and multiple banks lend to multiple firms within the same country, identification relies on host country-year fixed effects, X_{ijt}. This controls for time-varying host-country variability, such as host country loan demand.

The authors find that one standard deviation increase in banks' market-to-book equity ratios (or one standard deviation decrease in interbank spreads) increases (decreases) the proportion of foreign loans by close to 5%. The authors stress that these findings are distinct from a flight to quality (a preference for lower risk assets in tighter funding conditions). They do so by including interactions between funding conditions and a variable measuring creditor rights in the host country. Then, they show that the flight abroad is stronger for countries with strong creditor rights (per-

ceived as safe), ruling out the flight to quality argument.

Gianetti & Laeven (2012) proceed by testing their second hypothesis that the degree of globalisation of banking activities in a host country affects the impact of home economic shocks on the credit cycles of the host country. Changes to bank funding conditions impact the degree of their home bias in issuing new loans, with an effect on the aggregate supply of credit in the host countries where they operate. The authors show that this home bias varies over time.

Adding the volatility of home bias to a host country's credit cycle should increase its overall volatility. This increase in volatility of the host country loan supply is determined by its exposure to foreign funded loans:

$$Vol(Loan\ Supply)_{jt} = \alpha_0 + \alpha_1 \frac{Loans\ from\ Foreign_{jt}}{Total\ Loans_{jt}} + \alpha_2 \frac{Loans\ to\ Foreign_{jt}}{Total\ Loans_{jt}} + \eta_{ijt} \tag{15}$$

where $Vol[LoanSupply_{jt}]$ is measured as the deviations of a country's real credit per capita from its trend. The use of real credit allows for a country's credit cycles to be disconnected from the dynamics of its GDP.

The authors find that the proportion of foreign loans in a host country explains between 20% and 40% of the volatility of credit, depending on the specification used. They conclude that countries dominated by foreign banks should have highly volatile business credit. Further, they argue that banks are more inclined to adjust their foreign loans when funding conditions change. As a result, home countries of international banks should experience less variation in their supply of loans.

Cetorelli & Goldberg (2012b) take the perspective of the foreign branch by employing US call report data on the activity of foreign banks in the US. The authors leverage a funding shock to the foreign parent bank to test for internal capital markets. This shock is measured as the degree to which the parent was exposed to Asset Back Commercial Paper conduits as a proportion of its equity capital, as of 31 December 2006. The authors find higher internal capital transfers for branches with parents subject to larger funding shocks, the largest effects being amongst the biggest branches. The median sized bank (total assets of $1B), with a parent ABCP exposure ratio equal to 1, would have experienced an internal fund withdrawal (transfer

to parent) of $343 million more than a parent bank without ABCP exposure. This is approximately 12% of the average level of internal balance at the branch, an economically significant effect.

Further, the authors document a positive and significant link between changes in net internal borrowing and branch credit supply. Specifically, they estimate that, for the median sized branch, a $1 decrease in internal funding would result in a $40c to $50c decrease in total domestic lending. This is again, an economically significant effect. Lastly, they show that the loan supply of larger branches is less sensitive to changes in internal funds. This might be due to increased access to alternative funding sources, which are not available to smaller branches.

Ongena et al. (2015) take a more traditional view of the bank as local entity, but determine its global operations in terms of its funding sources. They use a unique combination of databases and exploit the Lehman failure to test for the existence of the international bank lending channel. Then, the authors measure real effects at both firm and country level. They find supporting evidence for the existence of the international bank lending channel, where foreign-owned, or internationally-borrowing domestic banks contract their loan supply more than locally-funded domestic banks, after the shock.

When looking at firm-level effects, the authors find that credit-dependent firms, which borrow from foreign banks or internationally-borrowing domestic banks, experience negative financial and real effects. These effects are especially pronounced when a firm has a relationship with only one bank, is small, or it has limited tangible assets. As mentioned above, Ongena et al. (2015) do not include firm fixed effects in their specification as doing so would have effectively excluded two-thirds of their sample. They resolve this issue by following the solution of Khwaja & Mian (2008) and include key firm characteristics as control variables, with higher-level fixed effects.

Lastly, at country-level, Ongena et al. (2015) found that firms more reliant on foreign funding, from countries with slow contract enforcement and a low level of financial development, were especially affected.

4. Conclusion

We reviewed the data, econometric techniques and estimates with respect to two recent and salient developments in the banking industry, i.e., securitization and globalization. While our review established that access to ever more granular micro data has enabled researchers to arrive at estimates that are better identified and more reliable than ever before, much work remains to be done. Saturation with fixed effects for example is a welcome development that may warrant more applied methodological scrutiny however, whereby the eventually inevitable trade-off between internal and external validity may have to be made more explicit. Another area that may require more thought, at an almost science-philosophical level, is the optimal reliance on quasi-experimental regulatory and legal shocks to help identify banking phenomena of interest. To the extent that such shocks may be mostly present in times and places where re-active or erratic policy-making takes center stage, empirical work may itself gain internal validity but lose external validity. More research on making this trade-off better visible and manageable seems warranted.

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