The Anatomy of a Credit Supply Shock: Evidence from an Internal Credit Market

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ABSTRACT

We examine how lending channel effects are transmitted by tracing the anatomy of a credit supply shock for small and medium sized business-lending in emerging markets. Using a novel data set that captures both lending relationships and a bank-wide shock for a multinational bank, we examine how lending channel effects vary by firm and loan contract characteristics. Borrowers with better ratings, borrowers that pledge firm non-specific collateral such as cash and property, and borrowers that yield higher non-lending revenues experience lower cuts in lending when there is a bank-wide credit supply shock. We show that the results are not explained by credit demand or borrowers with multiple relationships shifting borrowing away from the bank. Our results highlight the important role that collateral plays in financial contracts, not only at loan origination but also on an ongoing basis. In addition to increasing financing capacity through mitigating ex-ante and ex-post contracting problems, pledging collateral insulates firms from supply-side lending channel frictions which are unrelated to firm risk. The results also suggest that loan contracting, and in particular non-specific collateral, is a channel through which borrowers can mitigate bank-specific lending channel effects without turning to alternate lenders in the credit market.

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Bank liquidity or credit shocks were at the center of the recent financial crisis. Facing shocks to liquidity, banks passed on the fluctuations to borrowing firms even when there was no change in the borrrowers' credit worthiness or demand for credit. These lending channel shocks can have large real effects if firms are unable to withstand fluctuations in credit supply. While the literature has examined aggregate lending channel effects (e.g., Kashyap et. al., 1993; Peek and Rosengren, 1997; Kashyap and Stein, 2000; Paravisini, 2007), very little is understood about the anatomy of these effects and the lending margins that determine the transmission of credit shocks.

In this paper, we examine the anatomy of a bank-specific credit supply shock using a novel cross-country data set containing small and medium-sized business loans issued by a multinational bank to private firms in six emerging markets. This setting offers a unique opportunity to study how lending channel effects impact firms; the financing constraints that face firms; and in turn how certain borrowers are better insulated from lending channel effects. Faced with a liquidity shock that shifts the supply curve inward we should observe a decrease in lending and an increase in the marginal price that banks charge lenders. The increase in marginal price may incorporate one of or a combination of a decrease in risk or an increase in lending income. In particular, cross-sectionally we study the role that risk, such as credit rating, firm size, and collateral, and income, such as interest rate spread and non-lending revenues, play in the transmission of the credit supply shock.

The bank-specific credit supply shock we study provides a natural experiment to trace the impact of lending channel effects. Our data come from the small and medium-sized firm lending division of a large multinational bank ("the Bank") that operates in emerging economies. The bank's lending portfolio totals $2.46 billion at the start of 2004. In the first quarter of 2004, headquarters, which approves and allocates overall lending limits for each country, implemented an *unanticipated* worldwide 20% reduction in the approved amount of funds for all

small and medium-sized business lending programs. Since the shock was unanticipated and implemented uniformly across all countries it is unlikely that it was linked to specific credit conditions in each country. Further, there is no evidence that the small and medium-sized business lending programs were underperforming prior to the shock, or that other multinational banks experienced similar cuts in lending activity. Thus, we treat the shock as a liquidity shock that is unrelated to demand for credit.

We begin our analysis by documenting the effect of the shock on the internal margin. Using firm fixed effects, we compare how a firm's loan growth changes in the period of the shock relative to the same firm's loan growth in other periods. We find that, on average, debt growth decreases by approximately 10% in the period of the shock. This reduction in lending is less than the 20% reduction in the approved amount of funds because country-level lending divisions operate with lending slack both at the firm level and at the aggregate level. Next, we ask if the effect of the shock varies across default risk. Using the Bank's internal risk classification we find that borrowers with high default risk exhibit a decrease in debt growth of around 20%, twice that of borrowers with low default risk. Similarly, we find that the smallest borrowers are associated with a greater decline in borrowing in the period of the shock. We also show that the borrowers with more banking relationships are associated with a smaller, not larger, decline in lending by the Bank. Further, the borrowers that experience the largest decline in borrowing are precisely the same firms that should be less likely to have multiple banking relationships, such as small firms or firms with poor credit ratings. Therefore, it seems that the borrowers that experience the largest decline in borrowing from the Bank are precisely the same borrowers that would find it hardest to find substitute funds. Consequently, these borrowers would likely face the greatest financing constraints post the credit shock.

Bank lending contracts commonly feature collateral pledged by the borrower. Barro (1976), Stiglitz and Weiss (1981) and Hart and Moore (1994) point out that pledging collateral en-

hances a firms debt capacity by compensating for ex-ante information asymmetry. Providing outside investors with the option to liquidate pledged assets ex post acts as a strong disciplining device on borrowers. This, in turn, eases financing ex ante. Alternatively, a second set of theories argue that collateral is used to to resolve ex-post frictions such as moral hazard in riskier firms (see Boot, Thakor and Udell 1991; Boot and Thakor 1994, Aghion and Bolton 1997, Holmstrom and Tirole 1997). Both sets of theories predict that collateral eases financing constraints and that asset liquidation values thus play a key role in the determination of a firms financing capacity. Consequently, we might expect that the lending channel effects vary with firm collateral.

The availability of detailed borrower-level data allows us to explore the role that collateral plays in insulating borrowers from lending channel effects. For each loan we observe the collateral type and value pledged by the borrower. We measure collateralization rate as the ratio of the collateral value to loan outstanding. Further, we classify collateral as being either non-specific or firm-specific. On average, 83.0% of borrowers pledge at least some collateral. The average collateralization rate is 70.2%, which is split across non-specific (30.9%) and firm-specific (39.4%) assets. Non-specific assets pledged as collateral include cash, liquid securities, land and property, while firm-specific collateral includes firm-specific assets, inventory and accounts receivable. The value of firm-specific collateral is likely to be more susceptible to concerns regarding a borrower's agency risk, and thus be less attractive to lenders.

We first show that collateralized lending exhibits the smallest decreases in response to the shock; while uncollateralized lending bears the brunt of the shock. Next, we decompose the collateralization rate into non-specific or firm-specific collateralization rates. We find that the effect of the shock is dampened by pledging a higher ratio of collateral to loan value, and that this effect is driven almost entirely by pledging non-specific assets as collateral. The results

on default risk and collateral show that the Bank cuts lending at the risk margin for borrowers, consistent with moral hazard as a cause of credit constraints.

Next, we examine how loan pricing plays a role in the lending channel. For each borrower, we measure the total financing charge, interest rate spread above the base rate, and non-lending revenue associated with cross-sell activities such as advisory services. For each type of income, we find no relation between debt growth and income level in response to the credit shock for the full sample of firms. However, when we focus on the high default borrowers we find that borrowers that yield higher income for the Bank exhibit a lower decrease in lending than other high default firms.

In light of the results showing how the margins along which Bank makes the decision to cut lending, we also examine how the credit supply shock affects the cost of borrowing. If the Bank faces an increase in the shadow cost of lending, and passes this onto borrowers, then we should expect to observe an increase in the cost of borrowing. As such the cost of borrowing will increase for all borrowers in the period post the credit shock, where the cost of borrowing might be the rate and type of collateralization, the financing charge, or both. Tracking the same borrower, we find that the Bank demands a higher level of collateral per dollar loan post shock, and that the effect is most pronounced for non-specific collateral such as cash and real estate. Further, we show that the increase in the collateral cost of borrowing is strongest in countries where there are weak creditor rights, precisely where collateral, and non-specific collateral in particular, is most valuable.

We also examine if the bank-specific shock impacts the extensive margin by forcing the Bank to stop lending to firms altogether? We estimate if a firm exits from the Bank in response to the shock. We find that the probability of a firm exiting increases and new lending decreases in the period of the shock relative to other periods. Further, comparing lending to exiting firms and new firms we find that these marginal firms have greater collateralization rates and higher

lending income after the shock. This shows that the shock likely had a permanent effect on the lending behavior of the Bank.

In robustness checks, we confirm that the results are not driven by credit demand shocks. We estimate Granger causality tests and show that the decrease in lending does not predict the shock. Additionally, we collect aggregate lending data for multinational banks into the countries included in our sample from the Bank for International Settlements. Using the aggregate quarterly growth in lending, we show that the credit supply shock was specific to the Bank in our study and further that aggregate lending increased in the period of the shock. We also rule out the concern that our results are driven by unobserved determinants of collateral rather than collateral itself. If the Bank demands collateral in response to institutional, market, and firm characteristics then it is possible that the lending channel effects we document are driven by these.

This paper contributes to the empirical literature on the bank lending channel and the emerging empirical literature on collateral. Empirical literature on the bank lending channel initially utilized time series correlations between changes in liquidity and changes in loans (or output) to argue that liquidity shocks have real consequences (Bernanke and Blinder, 1992; Bernanke, 1983; and Bernanke and James, 1991). The next wave of research examined exogenous aggregate-level shocks to liquidity to show that shocks to the financial system affect the supply of credit (Gertler and Gilchrist (1994), Kashyap et. al. (1994), Kashyap and Stein (2000), and Ashcraft (2006) plus others. Paravisini builds on this work by exploring how variation in bank health affects lending channel effects. De Haas and Van Horen (2012, Forthcoming) use the collapse of Lehman Brothers to examine how lending channel effects vary with heterogeneity in banks international exposure. A few recent papers examine how lending channel effects vary across firms. Khawja and Mian (2008) examine an exogenous shock that results in cross-sectional variation in liquidity supply across banks combined with multi

firm-bank relationships to separate credit supply and credit demand. They show that, at least for large firms, alternative borrowing provides a hedge against bank-specific shocks. However, multiple banking relationships are uncommon for many small and medium-sized firms, and especially so for private firms and those in emerging markets. Yet these firms are also most likely to rely on bank financing and contribute significantly to economic growth. Chava and Purnanandam (2010) exploit a global banking crisis to show that lending channel effects are concentrated in bank dependent firms. None of these studies focus on the anatomy of the shock, or have detailed loan contract data on collateral or interest rates.

Our paper is also closely related to recent work that highlights the role of collateral in financial contracts. Benmelech, Garmaise and Moskowitz (2005) document that more liquid pledgeable assets are financed with loans of longer maturities and durations. Benmelech and Bergman (2008) documents how U.S. airline companies are able to take advantage of lower collateral value to renegotiate ex post their lease obligation downward. Benmelech and Bergman (2009) construct industry-specific measures of redeployability and show that more redeployable collateral leads to lower credit spreads, higher credit ratings, and higher loan-to-value ratios. Finally, Chaney, Sraer and Thesmar (2011) show that investment is sensitive to collateral value by examining US real estate pledged as collateral.

The results in this paper highlight the important role that collateral plays in financial contracts, not only at loan origination but also on an ongoing basis. In addition to increasing financing capacity through mitigating ex-ante and ex-post contracting problems, we show that pledging collateral insulates firms from supply-side lending channel frictions which are unrelated to firm risk. The finding that collateral has a role to play beyond loan origination is also instrumental in the recent study by Benmelech and Bergman (2011). They propose that a firms bankruptcy reduces collateral values of other industry participants, thereby increasing

the cost of external debt finance industry wide. Similar to our results, pledging more liquid non-specific collateral eases financing constraints.

Our paper compliments the work by Khawja and Mian (2008). They show that large and connected firms hedge lending channel effects by borrowing more from liquid banks, but that small firms are entirely unable to hedge and face large drops in borrowing. We build on their results by studying the effects of a liquidity shock using loan contract data for small and medium-sized private firms. These firms, which are entirely unable to hedge liquidity shocks, can insulate themselves from lending channel effects through pledging collateral in the loan contract.

The remainder of the paper is organized as follows. In Section I we describe the empirical setting and data. In Section II we present our main results. In Section III we present robustness checks. In Section IV we conclude.

I. Data and Empirical Setting

A. The Bank and Collateralized-Based Lending Programs

Our data come from the small and medium-sized firm lending division of a large multinational bank that operates in emerging economies. The small and medium-sized lending division is headquartered in New York, with individual lending divisions located within each country. Headquarters approves and allocates overall lending limits for each country but each country-based lending division has complete discretion to implement, execute and monitor the lending program locally. Credit process, procedures and delinquency management are managed by each division at the local-country level. Each country is responsible to make loans at the local country level.

The rationale of these programs is to offer a small and mid-market segment of borrowers almost all credit and non-credit products available to large corporate borrowers. The strategy of these programs is designed to achieve a robust and consistent growth in the small and medium-sized borrower segment targeting well-managed companies with typically entrepreneurial management style, growth prospects and leveraging cross-selling opportunities. The attractiveness of this segment lies in its large and well-established base, which is typically the engine of growth for developing economies, revenue characteristics, high cross-sell opportunities, and capacity for self-funding through marketing of liability products. Generally, this segment, although competitively banked, provides an untapped market for traditional products offered to large-sized borrowers.

Product offerings are similar across countries. Products are all short-term, collateralized-structured and generally linked to cash management and trade finance. These products include working capital facilities, term loans, trade services, trade financing, overdraft and cash management products. Since these are all collateralized asset-based programs, collateral is used to secure most of the loans. Collateral may be in the form of cash, account receivables, guarantees, inventory, letters of credit, equipment, vehicles or real estate. Pricing is driven by market conditions in each country tough lending terms and requirements are standardized and consisted across countries.

The world-wide total banks lending portfolio in this segment of the market totals $2.46 billion at the start of 2004, with the greatest single-country exposure of $403 million in India. The program is on average well-diversified across 39 internal industry classifications, although certain countries may be more heavily skewed towards a particular industry.[1]

[1]The full list of industries, and the number of firms belonging to each industry, is reported in Appendix 1. There are a large number of high quality borrowers, belonging to industries where the number of good players is not large enough to provide with a critical mass to justify exposure to an industry. These borrowers are include in the Miscellaneous category.

The small and medium-sized firm lending division provides a useful setting to study the anatomy of a bank supply shock for three reasons. First, it is difficult for small and medium sized firms to costlessly switch banks. Therefore, it is not straightforward to substitute borrowing from one of the lenders.[2] Second, most loans are secured with a type of collateral that cannot simultaneously be pledged to a second lender. Finally, each country asset-based program cannot supplement lending from other sources such as local deposits and thus is constrained by the allocation of headquarters.

B. The Shock

In the first quarter of 2004, headquarters implemented an unanticipated worldwide 20% reduction in the approved amount of funds for small and medium-sized lending programs across all the 18 emerging economies where these programs were originally launched. These programs were at the core of an embedded bank strategy that the Bank had in emerging markets during the early 2000s.[3]

The rationale for the shock was the following: The Bank believed that the increase in exposure to the borrowers under the umbrella of the asset-based programs had evolved at a quicker pace than expected. Since headquarters gave full discretion to each country to implement and monitor the programs, headquarters wanted to test the performance of these programs. As

[2]Petersen and Rajan (1994) show that US small firms tend to concentrate their borrowing from one source, though this concentration decreases as firm size increases. Khawja and Mian (2008) show that small firms both have fewer banking relationships and are less able to develop new relationships when their original lenders face a liquidity shock.

[3]The 2001 Annual Report of the Bank highlighted the concept of an embedded bank strategy: Our goal is to grow our market share over the next five years through our embedded bank strategy. By embedded bank we mean a bank that has roots in the country as deep as local as any local indigenous bank, building a broad customer base, offering diverse products, actively participating in the community and recruiting staff and senior management from the local population. Our long history in these regions positions us as a genuinely local bank.

part of their portfolio stress-testing activities, headquarters implemented a reduction in the approved amount of funds to all asset-based programs in emerging markets.

Throughout, we consider the shock as a pure credit supply shock that was unanticipated by borrowers and was also unrelated to borrower credit quality or credit demand. Since the shock was implemented uniformly across all countries it is unlikely that it was linked to specific credit conditions in each country. Further, there is no evidence that the small and medium-sized business lending programs were underperforming prior to the shock. In Figure 1 we plot aggregate total loan outstanding, the percentage of firms with a high default risk rating (assigned by the Bank), and the percentage of firms in default for which the Bank was creating loss reserves or writing off the loan for the twelve months prior to and including the shock. We center the time clock on the period of the shock such that Clock = 0 is Q1 of 2004.

The aggregate total loan outstanding was approximately level in the twelve months prior to the shock, which suggests that there was neither changes in credit supply or demand prior to the shock. In the period of the shock the total loan outstanding exhibits a decrease of approximately twenty three percent, and then remains level post shock. Further, examining the average default risk and losses, there is no evidence that the programs were under financial stress or that the portfolio quality was deteriorating in the 4 quarters before the shock. However, the (unobserved) decision to implement the reduction in credit supply was not assigned randomly and therefore cannot be considered completely exogenous. Accordingly, we are careful in our empirical design to rule out alternative explanations.

It is worth emphasizing that a 20% reduction in the approved amount of funds at the country level may not result in a direct 20% reduction in the approved lending or loans outstanding at the firm level. It is likely that all country-level lending divisions operate with lending slack both at the firm level and at the aggregate level. Therefore, firm-level approved lending may be greater than firm-level loan outstanding, and the country-level approved amount of funds

may be greater than aggregate firm-level approved lending. As such, we do not expect to see a precise 20% reduction in loans outstanding when the 20% reduction in the approved amount of funds is implemented.

C. Data

The Bank internal lending data contain every loan issued by the Bank and follows each loan over a two-year period from 2002 through to the third quarter of 2004, with information updated every three months. While the lending program operates in 18 countries, we are left with a cross-sectional sample of loans in 6 countries after applying several screening rules that address incomplete data. First, we drop firms in Argentina, Brazil, Hong Kong, Korea, Malaysia, Romania, Sri Lanka and Thailand because data is not available both pre and post the shock. Next, we drop firms in South Africa and Taiwan because the data is incomplete with regards to collateral. Finally, we retain only those countries where we observe borrowers that participate in the lending program twelve months prior to the shock. This ensures that we can track individual borrowers at the intensive margin through time from twelve months prior to the shock and addresses the concern that the composition of firms varies significantly through time. In this final step we lose Hungary and Pakistan. This results in a sample of 1,528 firms in the six countries Chile, Czech Republic, India, Singapore, Slovakia, and Turkey.

Table I presents the number of firm observations by country and by quarter. The table presents the number of lending observations by quarter from Q1 of 2003 to Q3 of 2004. We center the time clock on the period of the shock such that Clock = 0 is Q1 of 2004 and follow lending for twelve months prior to shock and six months post the shock. The data includes

1,528 borrowers that remain in the lending program throughout the sample window, conditional on participating in the lending program twelve months prior to the shock.[4]

In Table I we present the 10,696 quarterly observations for the intensive margin of the 1,528 borrowers that participate in the lending program twelve months prior to the shock and continue to borrow from the Bank. The number of borrowers is not uniform across countries, varying from 415 in Chile to 73 in Singapore. To address the concerns that results may be driven by a single country we employ a research design that absorbs both country and compositional effects. We describe the research design in Section II.A.

For every loan we observe the borrower's identity, industry, and country. We also observe the total approved loan, loan outstanding, loan default status, the firm's size and risk as determined by the Bank, the loan income to the Bank, both the type and value of the collateral used to secure the loan, and the number of alternate active bank relationships. Table II provides summary statistics for all the variables in our data set for the sample of 1,528 borrowers presented in Table I with non-zero loan outstanding.[5] The mean (median) total loan outstanding is $565,277 ($200,00), with a standard deviation of $925,519. Our main variable of interest is the growth in total loan outstanding (debt growth) at the quarterly level. For each firm we estimate debt growth in the current quarter by comparing the current total loan outstanding with the total loan outstanding in the prior quarter. The mean (median) debt growth is 0.49% (0.00%) per quarter, with a standard deviation of 36.54%.

We examine how the impact of the credit supply shock varies by firm size. The Bank asses firm size based on annual total net sales as reported in the last available audited financial statement. Firm Size is the internal classification indicator variable that captures the size of

[4] In further analysis we also examine the 935 borrowers that enter the Bank lending program over the sample period.

[5] The sample of 10,696 borrower-quarters is conditional on non-missing growth in total loan outstanding. This is less than the 10,392 borrower-quarters presented in Table I for *Debt Growth* because we lose 334 borrower observations where the total loan outstanding was reduced to zero in the prior period.

the firm. Indicators 3, 2, 1, and 0 are for firms with net sales ¿$25 million, ¡$25 million and ¿$5 million, ¡$5 million and ¿$1 million and ¡$1 million, respectively. The median firm has sales between $1 million and $5 million, and approximately ten percent of firms have sales greater than $25 million. We classify firms as small if they are in the lowest size category, which comprises 43% of the firm-quarters in the sample.

We also examine how debt growth is affected by the credit supply shock and also how this affect varies across firm type. We classify firms based on default risk and collateral. The Bank assesses borrower default risk on an ongoing basis and assigns a risk rating of one through five, with one being the least risky and five being default. The Bank bases the rating on both the riskiness of the borrower at the time of loan origination and any new information relating to the borrower. The risk grade is based upon two sets of information. The first includes objective measures of firm performance based on firm and industry fundamentals such as profitability, sales growth, and past credit history. The second set includes subjective measures of firm performance such as assessment of the quality and reliance of information, management interviews, and site visits. The majority of borrowers receive a risk rating of one. We classify firm risk based on whether the firm has a rating equal to one (low default risk) or greater than 1 (high default risk). On average, 7.81% of borrowers are classified as high default risk.

For each loan we have information on both collateral amount and collateral type pledged by the borrower. On average, 83.0% of borrowers pledge collateral. For each loan, the Bank records both the market value of collateral. The market value reflects the current market value, assuming the lender receives full ownership of the collateral. We divide the market value of collateral by the total loan outstanding to construct the collateralization rate for a loan. The mean (median) collateralization rate is 70.20% (100.0%) with a standard deviation of 46.20%.

The mean collaterization rate is similar to rates presented in studies that similarly study asset backed lending (e.g. Liberti and Mian, 2008, and Djankov, Hart, McLiesh and Shleifer, 2008).

In addition to the value of collateral, our data also include the type of asset pledged as collateral. Collateral types are classified according to the assets pledged as collateral. Asset types correspond to two categories and six sub-categories. The two categories are: Non-Specific Assets and Firm-Specific Assets. The two sub-categories for Non-Specific Assets are: (i.) Land and Property, including buildings, plants and commercial real estate; (ii) Liquid Assets, including cash or liquid securities held by the firm such as bonds and shares. The four sub-categories for Firm-Specific Assets are: (i.) Firm Inventory/Machinery including firm inventory, machinery and equipment; (ii.) Account Receivables, including receivables, contract order and post-dated checks; (iii.) Guarantees, including any type of third-party guarantee, or other bank guarantee or promissory note; (iv.) Letters of Credit, stand-by letter of credit, import and export letter of credit. Table II shows the composition of collateral by summarizing the collateralization rates by collateral type categories. For example, while firm machinery and inventory are highly specific to the state of a firm, real estate and liquid assets are not. We find that collateral is split fairly evenly between non-specific and firm-specific assets. Land & property are the most common types of collateral, followed by firm inventory and machinery. The type of collateral varies significantly in its specificity to the firm's operation and performance. Liberti and Mian (2008), Berger, Frame, and Ioannidou (2012), and Liberti and Sturgess (2012) study how collateral type affects lending.

We also classify firms on the income that they generate for the Bank. The mean (median) total financing charge is 14.50% (12.80%). For each loan there are two income channels. Lending income describes the interest earned on the loan outstanding and any fees earned on the approved loan amount such as a commitment fee. The lending income typically comprises an interest rate that includes a spread and the component equal to the cost of funds. The

interest rate spread represents the net income to the Bank. The mean (median) interest rate spread is 7.80% (6.70%). Cross-sell income describes non-lending income earned from cross-sell activities. Cross-sell activities are commonly used by banks and include transactional activities such as corporate finance advisory, asset management, and cash management. The mean (median) cross-sell income is 3.10% (1.90%), measured as ratio of cross-sell income to loan outstanding (in the beginning of the sample period). Additionally, we measure the percentage of income derived from non-lending activities as the ratio of cross-sell income to sum of lending income and non lending income. The mean (median) percentage of income derived from non lending activities is 19.10% with a standard deviation of 15.4%.

Finally, we observe the number of total active borrowing relationships for each borrower. Ongena and Smith (2000) and Diamond (2004) argue that multi-bank borrowing is typical in emerging markets. Berger, Saunders, Scalise and Udell (1998) and Detragiache, Garella, and Guiso (2000) both present evidence that suggest multi-bank borrowing provides an insurance mechanism against liquidity shocks of banks. The mean (median) number of total active borrowing relationships is 5.63 (6.00). Only 91 of the 1,528 borrowers maintain no alternate borrowing relationship.

II. Empirical Analysis

A. Empirical Design

The perfect empirical design would allow us to observe both the supply and demand for lending. Then, we could examine the anatomy of a credit supply shock controlling for changes in demand for credit. While our data allow us to directly track borrowers through time, we observe equilibrium lending and the incidence of a supply shock. Hence we are concerned that the effect of the shock stems from a change in economic conditions, and specifically a

demand shock. If firms experience a demand shock then this may explain both a decline in loan outstanding and the decision by the Bank to reduce total approved lending. To ensure that results are not explained by a demand shock or additional identification concerns we do three things.

First, in our main tests we examine the intensive margin by tracking only those firms that both were borrowers twelve months before the shock and continued to borrow from the Bank through the sample period. This step allows us to examine the effect of the credit shock while holding the composition of borrowers constant. In later tests we confirm that our main findings are supported at the extensive margin. Second, we confirm our results are robust to conditioning on borrower characteristics such as risk rating, and collateral, twelve months prior to the shock to rule out endogeneity between firm characteristic and lending growth. For example, if a borrower has only recently been rated as low risk or posted additional collateral, perhaps based on new information regarding future performance, then a contemporaneous or lagged classification may introduce an endogenous link between lending and firm future performance. Conditioning on the borrower twelve months prior to the shock alleviates the concern that any results are driven by such demand side considerations. This ensures both that our results are not an artifact of borrower composition or a change in economic conditions that might affect aggregate demand for credit and aggregate loan outstanding

Third, we are careful to avoid incorrectly attributing a change in borrowers, data availability, or economic conditions to the effect of the shock on loan growth. To ensure that the results are not an artifact of the borrower make-up we include firm fixed effects when we examine the intensive margin. The inclusion of firm fixed effects allows us to identify the effect of the shock on debt growth by comparing the growth in total loan outstanding growth in the period of the shock with other periods within the same firm. Further, in additional tests the inclusion

of country-seasonal and country-industry-time effects means we control for common effects in borrowing within firm and also within country-industry groups in the same quarter.

Further, in Section III we examine trends in borrowing behavior and the riskiness of the lending program, and exploit lending data from other unaffected banks. Both sets of tests offer evidence that the supply shock was uncorrelated with changes in demand by examining how lending growth and lending losses varied pre and post the shock for the Bank and in the quarter of the shock for other unaffected banks.

We implement the empirical analysis by estimating the growth in loan outstanding at the firm level through time in a borrower fixed effects framework:

$$y_{i,t} = \alpha_i + \beta_1 \text{Shock} + \beta_2 \text{Shock} * \mathbf{X}_{i,t} + \beta_3 \mathbf{X}_{i,t} + \epsilon_{i,t} \tag{1}$$

where $y_{i,t}$ is debt growth for borrower i in period t, measured as the growth in total loan outstanding, $Shock$ is a dummy variable equal to one in the quarter of the credit supply shock and zero otherwise, α_i are borrower fixed effects, and $X_{i,t}$ represents the loan or borrower characteristic we are investigating. For example, $X_{i,t}$ can be the collateralization rate or a dummy variable equal to one if the firm has a high default risk. We also estimate similar regressions at the borrower-level with country-seasonal and country-industry-time effects. Since the liquidity shock is implemented at the country-level, changes in loans from the same bank division may be correlated. Following Angrist and Pischke (2008), since we have only six countries, all our loan level regressions cluster errors at the country-industry level.

This empirical design allows us to examine the average effect of the shock, as well as by borrower characteristic such as collateralization rate or default risk. The coefficient β_1 represents the one-time effect of the credit supply shock on loan growth for all firms. The differential impact across characteristic $X_{i,t}$ is given by β_2, which measures how the effect

of the shock is amplified, or dampened, for borrowers with characteristic $X_{i,t}$. Where we conditioning on borrower characteristics such as default risk, and collateral, twelve months prior to the shock the effect of the firm characteristic β_3 is consumed in the borrower fixed effect α_i.

B. What is the effect of the credit supply shock on debt growth?

We start by investigating changes in the Bank's lending decisions after the credit supply shock by examining debt growth for *all* firms at the intensive margin. We compute debt growth for each firm and examine how this changes in the period of the shock compared with other periods in our sample. In Figure 2 we plot median debt growth for all firms through time from Q1 2003 to Q3 2004. Time is centered on the period of the shock such that $t = 0$ responds to Q1 2004. The plot clearly shows that debt growth fluctuates around zero but there is a large decrease in lending in the period of the shock. The plot illustrates that the shock was predominantly a one-time event, with no subsequent reversal and therefore had a permanent effect in lending.

We also plot the fraction of firms that experienced a decline in loan outstanding in each period in Figure 2. The fraction of firms with negative debt growth is approximately 50% for the sample period, but peaks at 75% in the quarter of the shock. Figure 2 suggests that the Bank reduced lending by approximately 5% in response to the unanticipated worldwide 20% reduction in approved lending. Further, the decline in lending affected around 75% of borrowers. However, both of these measures underestimate the true effect of the credit shock because they examine the intensive margin only and ignore borrowers that may have left the lending program because of the shock.

In Figure 3 we repeat the plots presented in Figure 2 but also include borrowers that enter and exit the lending program at the extensive margin. Once again, we observe a steep decline in debt growth in the period of the shock, but the decline is amplified to -16.9% by the inclusion of the exiting firms. In Figure 2 we present more evidence on the extensive margin. In each period we measure entry as the number of new borrowers to enter the program and exit as the number of new borrowers that leave the program entirely. In the periods prior to the shock the average exit rate is 7.7% per quarter and the average exit rate is 6.6% per quarter. The net entry rate is approximately zero, on average. However, in the period of the shock the entry rate decreases to 3.4%, the exit rate increases to 27.81%, and the net entry rate decreases to -24.3%. Therefore in the period of the shock not only did lending decline at the intensive margin, but also the number of borrowers declined by around one-quarter. In summary, the credit shock has important consequences for both the intensive and extensive margin.

C. How does the effect of the credit supply shock vary with firm risk?

How do bank lending programs implement a credit supply shock? In this section we investigate if borrower characteristics such as default risk and alternate borrowing relationship play a role. Borrower risk may explain the anatomy of the shock if they are systematically associated with higher risk and lower margins on a risk adjusted basis. For example, firms with a high default rating may receive larger cuts if they contribute less (per dollar lent) to profits or if they are more likely to realize default losses for the Bank. We use the Bank's internal risk classification to rate firm risk. The internal classification allocates a rating of one to firms in good health and a rating ranging from two to five for firms with higher risk. We classify borrowers with an internal risk rating equal to or greater than one as high default risk.

We present the results of estimating debt growth at the firm level in Table III. In column (1) of Table III we present the base results of estimating equation (1) with firm fixed effects and country-seasonal fixed effects for *Shock* only. We find that β_1 is negative and significant (-0.095). This result reveals that the Bank reduced lending by 9.5% in the period of the shock relative to debt growth for the same firm. The combination of fixed effects also ensures that comparisons are made within a country and average differences in lending practices across countries due to institutional and macro factors are factored out. Country-seasonal and seasonal effects factor out calendar trends that are common within and across countries. Additionally, the specification helps alleviates concerns that any results are driven by compositional changes in the data.

We examine the role that firm risk plays in column (2) of Table III. We find that borrowers assessed as high default risk experience a reduction in lending around seventy-five percent greater than low default risk firms. This can be observed by noting that β_2 is negative and significant and approximately three-quarters the size of β_1. Combining β_1 and β_2 in column (2) shows that high default risk firms experience a decrease in lending of 15.4%. Once again the results presented compare the effect of the shock on lending growth within the same firm and also controlling for country-seasonal effects.

It is possible that results in columns (1) and (2) might be driven by a specific subset of firms that also happen to be high risk firms. For example, firms within a particular country-industry might experience a decline in lending in the period of the shock that is otherwise unrelated to the credit supply shock. To rule this potential alternative explanation out we include country-industry-time fixed effects in addition to firm fixed effects in an attempt to completely absorb factors influencing the demand for credit. In column (3) we estimate β_2 relative to debt growth within the same firm and to other firms in the same country and same industry at the time of

shock. The negative and significant coefficient on β_2 of 10.0% confirms the result that lending falls more for high default risk firms than other firms.[6]

As described in Section II.A, we condition on borrower characteristics such as risk rating, and collateral, twelve months prior to the shock to rule out endogeneity between firm characteristic and lending growth. In columns (4) and (5) we repeat the estimations presented in columns (2) and (3) for default risk, but instead measure default risk twelve months prior to the shock. The result that borrowers with high default risk exhibit a greater decline in lending continue to obtain.[7]

In columns (6) and (8) we provide further evidence that high risk firms experience an additional decrease in lending in response to the credit shock. As an alternative to default risk, we use borrower size as a proxy for firm risk. Using the internal size classification we those in the lowest tier as small firms. It is important to note that all firms in the sample are small or medium sized enterprises and thus share any risk associated with being small. Nonetheless, the smallest firms may pose a greater risk to lenders. In columns (6) and (7) we present evidence that smaller borrower firms are affected more by the shock. Once again, we also include the estimation with country-industry-time fixed effects in addition to firm fixed effects in column (8). As before, even after controlling for common country-industry effects at the time of the shock we find that the riskier borrowers experience a decline in lending relative to prior quarters.

In columns (9) and (10) we present evidence on how the effect of the credit shock varies by the number of alternate borrowing relationships the Banks' borrowers have. It is unclear how the number of lending relationships might affect the anatomy of the shock. On the one hand, those borrowers that have multiple relationships should be better insulated against bank-

[6]Obviously, the inclusion of country-industry-time effects results in β_1 not being estimated.

[7]In all further tests, we use borrower characteristics estimated twelve months prior to the shock. The results are robust to using lagged characteristics

specific credit shocks because they can move lending to alternate borrowers. Therefore, if the results we observe are due to borrowers voluntarily leaving the Bank we might expect debt growth to decline more for borrowers with multiple relationships in the period of the shock. Alternatively, if the Bank knows that these borrowers have multiple relationships, then the Bank may chose not to cut these same borrowers because of the threat of losing these customers.[8] Put differently, while it is clear that having multiple relationships provides insulation from bank-specific credit shocks in aggregate, it may also provide insulation against cuts in lending by the bank experiencing the bank-specific credit shock. We show that the negative effect of the shock on debt growth is declining in the number of banking relationships the borrower has. The coefficient on $Shock\ x\ Ln(BankRel.)$ of 5.0% illustrates that moving from the twenty-fifth percentile of two relationships to the seventy-fifth percentile of six relationships is associated with a decline in lending of approximately seven percentage points smaller in the period of the shock.

In this section we present evidence that the credit supply shock affected all firms, but not equally. In particular, firms classified as riskier experienced a decrease in lending approximately twice as large as those firms in good health. Further, the results on alternate banking relationships suggests that lending channel effects that we document are due to the Bank cutting borrowing rather than borrowers voluntarily leaving the Bank. Therefore, the results offer evidence on the margins that Banks operate and the financing constraints that borrowers face. Finally, we show that the results are unlikely to be driven by firms clustered in countries or industries, or a decline in firm risk.

[8] Additionally, multiple bank relationships might be an indicator of borrower quality.

D. How does the effect of the credit supply shock vary with the level of collateral?

Bank lending contracts commonly feature collateral posted by the borrower as a mechanism to reduce overall risk to the the lender. Consequently, if the Bank implements the credit supply shock in an objective manner - especially along the dimension of risk as shown in Section D - we might expect collateral to influence the allocation of lending cuts. In this section, we investigate if the effect of the credit supply shock is influenced by collateral.

We begin our analysis of the effects of collateral on the lending channel by examining how debt growth varies with the value of collateral pledged by the borrower. Our dataset allows us to examine the value of the level of collateral in addition to the composition of collateral for each loan. We measure the collaterization rate as the percentage of loan that is secured with collateral. Collateral can be of many types, ranging from firm-specific assets such as accounts receivables, and assets such as inventory and machinery to non-specific assets such as cash and real estate. Since the value of firm-specific assets is more susceptible to concerns regarding borrower's agency risk, the composition of collateral may also influence lending channel effects.

For each loan we observe the market values of assets pledged as collateral for the following categories: firm-specific assets, accounts receivables, cash and liquid securities, leases, third party guarantees, promissory notes and real estate. We collapse the collateral types in two categories, non-specific collateral and firm-specific collateral. Non-specific collateral includes real estate and cash and liquid securities, while firm-specific collateral includes firm assets such as inventory, plant and machinery, and accounts receivable. Third party guarantees and promissory notes may be firm-specific or non-specific but are not marketable in the same way that cash or real estate is. Therefore we include guarantees and promissory notes in firm-specific assets. We then decompose the collateralization rate into non-specific and firm-

specific components. Thus, the original collateralization rate variable is the sum of these two components. As reported in Table II the mean collateralization rate in our sample is 70.2%. A breakdown of the collateralization rate shows that 30.9% are from non-specific collateral and the remaining 39.4% are from firm-specific collateral.

In Table IV we estimate equation (1) with collateral. Once again to mitigate identification concerns, we estimate collateralization rates twelve months prior to the shock. In columns (1) we estimate the effects of collateralization rate on debt growth, by examining the collaterization rate. Throughout, we control for default risk by including the variable of interest in Table III, High Default Risk. The results in show that pledging collateral helps mitigate adverse credit supply shock effects. Firms that pledge collateral with a collateralization rate of one hundred percent exhibit a decrease in debt growth approximately fifty percent lower than firms that do not pledge collateral.

Columns (2), (3) and (4) test whether the effects of collateral varies by collateral type. In column (2) we include the non-specific collateral rate and in column (3) we include the firm-specific collateral rate. There is a stark difference between the coefficients in columns (2) and (3). The effects of collateral are driven solely by non-specific collateral. In column (2) the coefficient on *Shock* $\times$ *Non-Specific Collateralization Rate* of 0.074 reveals that firms that secure lending with non-specific collateral exhibit much lower decreases in lending in response to the liquidity shock. In column (3), we find no such dampening of the credit shock effect for firm-specific collateral. Firm-specific collateral appears to offer little insulation against lending channel effects. In column (4) we include both non-specific and firm-specific collateralization rates and find similar results. Thus, the dampening effects of collateral on the lending channel are primarily driven by firm-specific collateral.

Finally, we confirm our results are robust to the inclusion of country-industry-time fixed effects in addition to firm fixed effects. The supply of collateral may, among other things, be a

determinant of industry asset composition and country factors such as financial development. Therefore, we include country-industry-time fixed effects to control for common factors that might explain both collateralization rate and type and credit supply or demand beyond the credit shock that we examine. The results in column (5) show that our results are robust to such concerns.

The findings in this section illustrate the importance of collateral, and in particular non-specific collateral, as a channel through which small and medium-sized borrowers can mitigate bank-specific lending channel effects in emerging markets. These firms are almost certainly unable to hedge lending channel effects through the firm borrowing channel in the same way that large firms or those with business or political ties can, as described by Kwaja and Mian (2008).

E. How does the effect of the credit supply shock vary with pricing margin?

The results in Sections II.C and II.D show that the Bank implements the shock conditioning on borrower risk, both in terms of default risk and collateral level and type. Alternatively, the Bank may implement the shock based on pricing margin or income. We study the effect of the shock and examine three types of income: total financing charge; interest rate spread, the spread over the cost of funds that the Bank charges its borrowers; and cross-sell income, the income in dollars earned from non-lending revenue normalized by total exposure. Since the shock is implemented by each country lending program, we are specifically interested in whether high or low levels of income margin relative to other borrowers in the same country influences the anatomy of the credit shock. Therefore, for all three income measures, we classify income as *high* if the value is in the top quartile of the distribution within country-

time. The results are robust to alternative methods such as measuring income relative to the country-industry-time and using the median as the cutoff.

The results are presented in Table V. In column (1) we present results for total financing charge, and in column (2) for total financing charge and default risk. We find that the credit shock is not implemented based on total financing charge. In columns (3) and (4) we switch attention to interest rate spread. Once again, we find that the credit shock is not implemented based on income. However, conditioning on default risk the results in column (5) shows that borrowers with high default risk and high interest rate spread experience a smaller shock to lending than other borrowers with high default risk. Further, when we examine the results for cross-sell income in columns (5) and (6), we find a similar trend. For example, in column (6), we find that the average effect of the shock on debt growth is -8.6%, that this is higher for borrowers with high default risk (the coefficient is -0.098), but that the marginal effect on default risk is more than compensated for by the cross-sell ratio for borrowers with high default risk and high cross-sell ratio (the coefficient is 0.227).

Thus, it appears that lenders trade-off risk and income margin when passing on a credit supply shock to borrowers. Borrower risk such as default risk or low collateral directly impacts the anatomy of the shock for all firms. Income margin has no effect in the cross-section of borrowers, but lenders trade-of margin and risk for those firms deemed to be high risk, which ultimately bear the brunt of the shock. These results for income margin are similar in spirit to Petersen and Rajan (1994) and Kwaja and Mian (2008) who find that quantity rather than price is the more relevant margin in bank-firm relationships.

F. The effects of the credit supply shock on borrowing cost

The results in Section II.D show that the Bank considers the collateralization of lending when cutting borrowers. If the Bank faces an increase in the shadow cost of lending, and passes this onto borrowers, then we should expect to observe an increase in the cost of borrowing. As such the cost of borrowing will increase for all borrowers in the period post the credit shock, where the cost of borrowing might be the rate and type of collateralization, the financing charge, or both. In this section we examine if the cost of borrowing increases in response to the credit shock for the borrowers that existed prior to the shock. In doing so, we provide direct evidence on the constraints that face borrowers.

We investigate if the the cost of borrowing changed by by estimating the cost of borrowing, such as collateralization rate or total financing charge, at the firm level through time in a borrower fixed effects framework:

$$y_{i,t} = \alpha_i + \beta_1 \text{Post Shock} + \beta_2 \text{Post Shock} * \text{X}_i + \epsilon_{i,t} \tag{2}$$

where $y_{i,t}$ is the cost of borrowing, such as collateralization rate or total financing charge, for borrower i in period t, measured as the growth in total loan outstanding, $PostShock$ is a dummy variable equal to one in the quarters of, and following, the credit supply shock and zero otherwise, α_i are borrower fixed effects, and $X_{i,t}$ represents a borrower characteristic that might affect the cost of borrowing, such as default risk. Additionally, we include country-time fixed effects in all estimations. Once again, following Angrist and Pischke (2008), all our loan level regressions cluster errors at the country-industry level.

F.1. Does the Bank demand better collateral?

In Table VI we present evidence for whether the Bank increases the cost of borrowing through the collateral channel. We start by asking if the collateralization rate increases post shock, compared with the collateralization rate for the same firm in the period prior to the shock. The results in column (1) shows that this is the case. The collateralization rate is 2.8% higher in the period post credit shock. In column (2) we examine if the increase in the cost of borrowing is shared equally by all firms by conditioning on default risk. We find no significant effect. In column (3) we examine if increase in collateralization rate varies by creditor rights at the country-level. Liberti and Mian (2010) show that demand for collateral is greatest in countries with less financial development or weaker creditor rights. Consequently, we might expect that a greater increase in the collateral cost of borrowing for borrowers in countries with weak creditor rights. Creditor Rights is the natural logarithm of the creditor rights index defined in Djankov, McLiesh and Shleifer (2007), which takes a value of 4 (strongest) to 1 (weakest). The results in column (3) indeed show that as creditor rights increase the increase in the collateral cost of borrowing post credit shock is dampened.

In columns (4) - (9) we examine if the collateral cost of borrowing results presented in columns (1) - (3) apply to collateral type as well as collateral level. In columns (4) - (6) we focus on the non-specific collateralization rate and in columns (7) - (10) we investigate the firm-specific collateralization rate. If the collateral cost of borrowing increases post credit shock, then ceteris paribus, we should expect the Bank to demand more non-specific collateral than firm-specific collateral. The results in columns (4) - (6) show this to be the case. The increase in the collateral cost of borrowing is approximately twice as large for non-specific collateral than for firm-specific collateral, as illustrated by the coefficients on *Post Shock* of 0.020 in column (4) and 0.011 in column (7). The difference in the collateral cost of borrowing

across collateral type is especially pronounced for high default risk borrowers. Further, the variation in the collateral cost of borrowing with creditor rights exists only for non-specific collateral. Moving from high to low creditor rights, there is an increase in the collateral cost of borrowing which requests borrowers to post not only more collateral but specifically more non-specific collateral.

F.2. Does the Bank demand higher prices?

In Table VII we present evidence for whether the Bank increases the cost of borrowing through the financing charge. We examine total financing charge, interest rate spread, and cross-sell income. The interest rate spread reflects the cost of borrowing over and above the Bank's cost of funds and is directly related to the risk of the loan. As such, we might not expect the interest rate spread to change. However, non lending revenue is originated through cross-sell activities which are not related to loan risk. Therefore we might expect the Bank to increase efforts to generate non lending revenue.

We start by asking if the total financing charge increases post shock, compared with the total financing charge for the same firm in the period prior to the shock. The results in columns (1) and (2) shows that this is the case. The total financing charge is 0.4% higher in the period post credit shock. In columns (3) and (4) we examine if the increase in the total financing charge is because an increase in the interest rate spread. We find that the interest rate spread is unchanged.

In columns (5) and (6) we examine if the increase in total financing charge is due to an increase in cross-sell income. The cross-sell income is approximately 0.2% higher post-shock compared with pre-shock, and more so for borrowers with high default risk. The results in

Table VII show that the cost of borrowing increases post shock, and that non-lending revenue provides a channel for Banks to increase the cost of borrowing.[9]

G. The effects of the credit supply shock on extensive margin

So far we have examined lending channel effects of a bank-specific shock on the intensive margin. Do bank-specific shocks also impact the extensive margin of banks' lending behavior by forcing them to stop lending to firms altogether? Figure 4 shows that the entrance of new borrowers is dampened and the exit of existing borrowers is accelerated in response to the shock. In this section we test if the extensive margin varies with collateral level and type. In Sections II.F we show that the credit shock raises the shadow cost of lending, which is passed on to borrowers. Consequently, we might expect that new entrants to the lending program post credit shock face greater borrowing costs compared with new entrants prior credit shock.

The data allows us to identify whether a given borrower is new to the lending program. Using this information we restrict the sample to the 1,528 borrowers who were either existing borrowers from the Bank (the intensive margin) and the 935 new entrants to the Bank's lending program. We investigate if the the cost of borrowing at the extensive margin by estimating the cost of borrowing, such as collateralization rate or total financing charge, at the firm level through time:

$$y_{i,t} = \alpha_i + \beta_1 \text{Post Shock} + \beta_2 \text{Entry}_i + \beta_3 \text{Post Shock} * \text{Entry}_i + \beta_4 \mathbf{X}_{i,t} \epsilon_{i,t} \quad (3)$$

[9] There is an alternative explanation to the results in this section. If the Bank decreases the amount of total loan outstanding, as shown in earlier results, but firms continue to hold collateral and non-lending revenue constant in dollar terms, then the result that borrowers pledge more collateral and pay more non-lending revenue compared to the level of loan outstanding may be, at least partially, due to a mechanical adjustment. However, since collateral is costly (the firm could pledge it elsewhere), then it seems unlikely that collateralization rates would increase in this manner. Instead, the results might be explained by the Bank cutting lending and requesting that the firm maintain the dollar level of collateral, thereby forcing the borrower to increase the collateralization rate. The differential results across non-specific and firm-specific collateral is consistent with this explanation, but not the mechanical adjustment explanation.

where $y_{i,t}$ is the cost of borrowing, such as collateralization rate or total financing charge, for borrower i in period t, measured as the growth in total loan outstanding, $PostShock$ is a dummy variable equal to one in the quarters of, and following, the credit supply shock and zero otherwise, α_i are borrower fixed effects, $Entry_i$ is an indicator variable equal to one if the borrower is a new entrant to the lending program, and $X_{i,t}$ represent a borrower characteristics that might affect the cost of borrowing, such as default risk, firm size or loan size.

We compare the borrowing cost for new borrowers with existing borrowers by estimating β_2, and compare the borrowing cost for new borrowers post credit shock with new borrowers prior to the credit shock by estimating β_3. If the shock affects the margin at which the Bank lends we should observe different lending behavior, on average, across the two periods. We do not include firm fixed effects because we examine the borrowing costs across firms in the same period, and also across firms across the shock. Instead, we include country-industry-time fixed effects in all estimations to purge any common effects with a country-industry-quarter that might affect borrowing cost. The inclusion of country-industry-time fixed effects consumes the estimation of β_1. Once again, following Angrist and Pischke (2008), all our loan level regressions cluster errors at the country-industry level.

In table VIII we present results that examine how the borrowing cost changes at the extensive margin post the credit supply shock. We start by investigating whether the type of firm that the Bank lends to changes after the shock. Since we are unable to include firm fixed effects it is important to control for these changes in the composition of borrowers when we examine the borrowing cost. In columns (1), (2), and (3) we estimate firm size, loan size, and default risk. Firm Size is measured as the natural logarithm of the Bank's size classification; Loan Size is measured as the natural logarithm of the total loan outstanding; and High Default Risk is an indicator variable equal to one if the Bank classifies the borrower as having high default risk. In general, the results show that new borrowers are smaller, have smaller loan

outstanding, and are less likely to be classified as high default risk than the existing portfolio of borrowers. However, estimating the difference in new borrowers across the credit shock (β_3) shows that new borrowers are larger and receive larger loan outstanding, relative to new borrowers prior to the shock.

In column (4) we repeat the examination presented in Sections II.F.F.1 for the collateral cost of borrowing. As firm size, loan size, and default risk vary across new and existing borrowers in the results in columns (1) - (3) we include these as control variables. The positive and significant coefficients on $Entry$ of 0.038 and $Entry\ x\ Post\ Shock$ of 0.035 reveal that new borrowers pledge higher levels of collateral in general, and that the collateral cost of borrowing increases post credit shock. Controlling for country, industry, and quarter effects, the collateralization rate is three and half percentage points higher for new borrowers post shock, compared with new borrowers pre-shock. This mirrors the results on the collateral cost of borrowing presented in Table VI for the intensive margin.

In column (5) we re-examine if the total financing charge changes post credit shock. Once again, as firm size, loan size, and default risk vary across new and existing borrowers in the results in columns (1) - (3), and these likely affect the financing charge, we include these as control variables. The total financing charge is not significantly different either across new borrowers and existing borrowers, or across pre and post shock for new borrowers. Combined with the earlier results on the intensive margin, it seems that financing charge is less affected by the shock than other borrowing costs such as collateral.

There is an alternative interpretation of these results. In our discussion above, we assumed that the pool of borrowers that the Bank faces in any given period remains constant, i.e new borrowers are comparable through time. It is plausible that with the pool of borrowers that applies to the Bank slants towards better quality borrowers in the period post shock. However, the fact that the changes in lending are also present in the pool of existing borrowers (Sec-

tions II.B - II.E) gives us comfort that, at least part of these results are being driven by our interpretation.

III. Identification Concerns

A. Did the Bank respond to changes in borrowing demand?

The results in Table III might be explained by the Bank responding to a shock in borrowing demand. If this is true then debt growth might explain, rather than be explained by, the credit supply shock. Figure 1 gives us some comfort in this regard because we do not observe a decline in total loan outstanding prior to the shock. To formalize this, we re-estimate the effects of the shock on debt growth but test if there is a significant relation between debt growth and future shocks. In unreported results we repeat the estimation of debt growth from Table III but include $Shock_{t+1}$ to formally test if debt growth predicts the credit supply shock. The Granger causality results show that the credit shock led to the decrease in the lending and rules out that the decision to reduce lending limits was not a reaction to lower borrowing.

In addition to testing for Granger causality, we are also interested in understanding the nature of the shock. Specifically, was the shock a single period shock or a change in policy that led to effects post shock. If the shock was the start of a long-term decline in lending then the shock might be related to the expected future performance of the lending portfolio, for example. We formally test the nature of the shock by testing if lending decreased in the period following the shock in addition to the period of the shock itself by estimating debt growth including both $Shock_t$ and $Shock_{t-1}$. The coefficient on $Shock_t$ continues to be negative and significant while the coefficient on $Shock_{t-1}$ is insignificant. It appears that the credit supply shock was a one-time shock and not part of a longer term policy change.

B. Was the bank-specific credit shock really bank-specific?

We document the effect of a bank-specific credit supply shock on debt growth for a sample of borrowers. If the credit shock we document was part of a wider shock, and not specific to our lender, then it may be harder to argue that the shock was not a credit demand shock. Consequently, if we observe lending decreasing at the time of the shock for other lenders then we would be concerned that the credit supply shock, and our analysis, is mis-identified. To mitigate this concern we would ideally like to observe the internal credit market for an alternative multinational bank that did not implement a cut in lending. Clearly, this is not possible. Instead, we examine aggregate data for all multinational banks that lend into the countries we study.

We collect quarterly data on the total dollar value of loans outstanding made by foreign banks in each country of our study from the Bank for International Settlements. Next we estimate the growth in loans outstanding for each quarter of our study. The growth rate in loans outstanding is plotted in Figure 5. The solid blue line shows that aggregate multinational bank lending increased in the period of the shock. Further, plotting the difference in growth between the lending by the Bank in our study versus all multinational bank lending shows that the shock resulted in a relative decrease in lending by 21.3%. Based on this evidence, it does not appear that the bank-specific supply shock was driven by an economy-wide demand shock.

C. Are the results driven by the underlying determinants of collateral?

The literature shows that banks and firms set collateral level to alleviate financial frictions stemming from institutional details and firm characteristics such as financial development,

creditor protection, agency risk, and business risk. For example Mian and Liberti (2010) show that collateral varies by firm-risk and further collateral spread decreases with financial development.[10] If banks demand collateral in response to at least some of these characteristics, then it is possible that results on collateral level and type in Tables IV, VI, and VIII are driven by these same characteristics.

However, we do not believe this is a concern for three reasons. First, most of our results are within firm results. Since the supply of collateral is unlikely to change within firm, comparing the same firm post-shock and pre-shock should purge any effects of the supply of collateral. Second, in additional estimations, such as column (5) in Table IV we also include country-industry-time fixed effects. Any transient effects of the supply of collateral, not isolated by firm fixed effects, are most likely common across a country-industry-time as shocks that would affect the value of collateral would be common across these groups, for example. Third, as shown in Liberti and Mian (2010) the supply of collateral is negatively correlated with financial development and creditor rights. Therefore, the results on how the post shock increase in collateral borrowing cost is decreasing in the level of creditor rights in Table VI works against a collateral supply argument.

D. Do borrowers find substitute funds?

Throughout, our focus is on a credit supply shock for an individual lender. Therefore, we are not able to answer what happens to lending if *all* sources of financing dry up. Further, we do not have balance sheet data including total borrowing for customers of the Bank, or lending data for all banks. This raises two concerns. First, did borrowers that faced a reduction in

[10]Theory focusing on moral hazard argue that firms with greater default risk pledge more collateral (see Berger and Udell, 1990; Eisfeldt and Rampini, 2009; Rampani and Visnawathan, 2008; and Tirole, 2005). Empirical support is documented in Jimenez, Salas, and Saurina (2006) and Mian and Liberti (2010) plus others.

lending find alternate lending, maybe through multiple banking relationships? Second, if so, can these firms insulate themselves from credit supply shocks through banking relationships? The results in Table III show that the borrowers with more banking relationships are associated with a smaller, not larger, decline in lending by the Bank. Further, the borrowers that experience the largest decline in borrowing are precisely the same firms that should be less likely to have multiple banking relationships, such as small firms or firms with poor credit ratings. Therefore, it seems that the borrowers that experience the largest decline in borrowing from the Bank are precisely the same borrowers that would find it hardest to find substitute funds. Consequently, these borrowers would likely face the greatest financing constraints post the credit shock.

Finally, an alternative explanation of our results is consistent with adverse selection as a cause of credit constrains. For instance, good type firms secure more attractive lending through relationship banking, but also have a low elasticity of demand for funds with one particular lender because the alternative is to be pooled as a bad firm. Conversely, the bad type firms gain little from banking relationships and are able to switch lender with little cost. Consequently, bad type firms can find alternate lending. In general, our results are consistent with the adverse selection explanation of credit constraints. We show that the Bank raises the cost of borrowing in response to a greater shadow cost of lending; and that the borrowers with the highest elasticity of demand such as small borrowers, borrowers with low credit ratings, and borrowers with lower and firm-specific collateral experience larger declines in borrowing in response to the shock.

IV. Concluding Remarks

The aim of this study was to better understand the anatomy of a credit supply shock. While lending channel effects have been studied, especially in light of the recent financial crisis,

much less is know about the anatomy of these effects and precisely how banks pass on credit supply shocks to borrowers. Understanding the anatomy of a credit supply shock is important for understanding the financing constraints that firms face. We study a credit supply shock affecting the small and medium-sized firm lending division of a large multinational bank that operates in emerging economies. The unique feature of this data is that we can trace lending activity at the borrower-level pre- and post-shock, and have detailed data on borrower characteristics including size, credit rating, collateral, and lending income. The results illustrate how small and medium-sized private firms can insulate themselves from lending channel effects through the loan contract with a single bank. Understanding this is important precisely because these firms are least likely able to hedge lending channel effects through alternate borrowing or equity capital markets.

The results show that the Bank cuts lending along risk (credit rating and collateral) and income margins. Consequently, borrowers with low credit ratings, borrowers with less collateral, and the least profitable borrowers experience larger declines in borrowing in response to the shock. Given the importance of pledged collateral in loan contracts, especially with regards to loan availability, we focus on collateral as a channel of insulating against bank-specific liquidity shocks. We analyze the lending channel effects of a bank-specific liquidity shock by collateralization rate and collateral type. We show that borrowers that pledge firm non-specific collateral such as cash and property experience lower cuts in lending when there is a bank-wide credit supply shock. Our results suggest that collateral, and in particular non-specific collateral, is a channel through which borrowers can mitigate financing constraints and bank-specific lending channel effects without turning to alternate lenders in the credit market. In extensions to the main results we show that anatomy effects also hold at the extensive margin. In robustness tests, we show that bank-specific shock is unlikely to be driven by a

demand shock. Further, we show that our results are not driven by the underlying determinants of collateral.

Overall the results in this paper offer further evidence on financing constraints facing firms, the role of collateral in lending and the anatomy of a bank-specific credit supply shock. In particular the results offer new insights into how lending channel effects vary across firm and loan contract characteristics.

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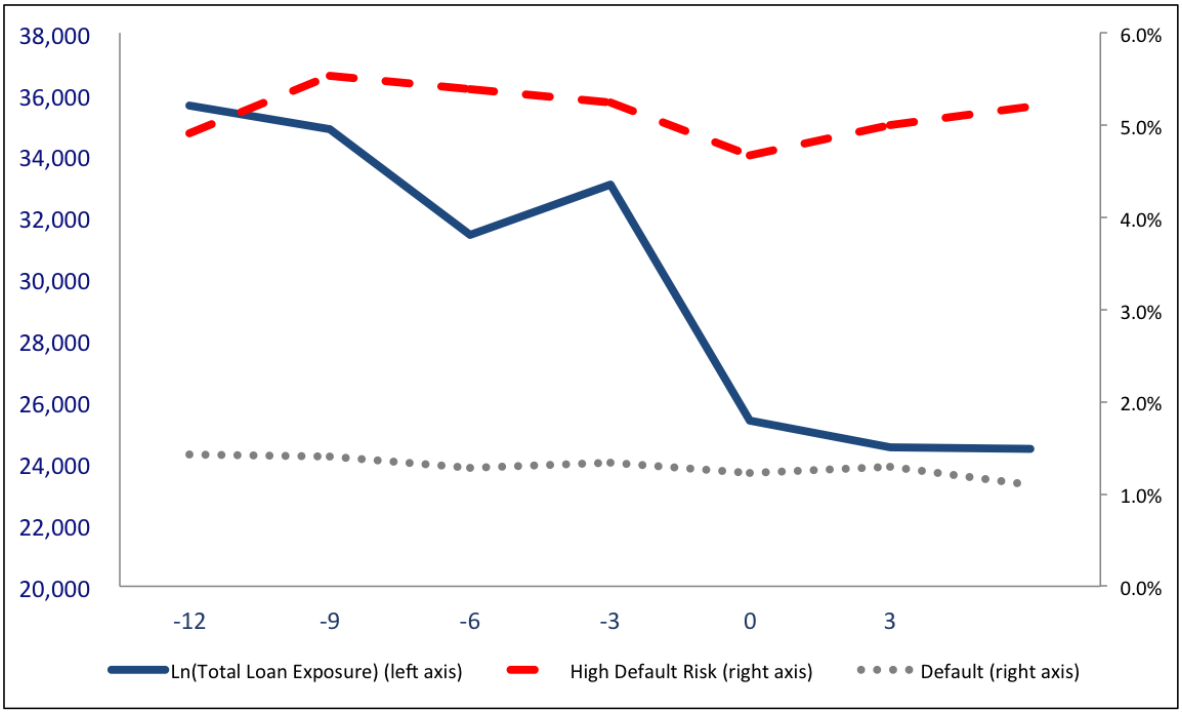
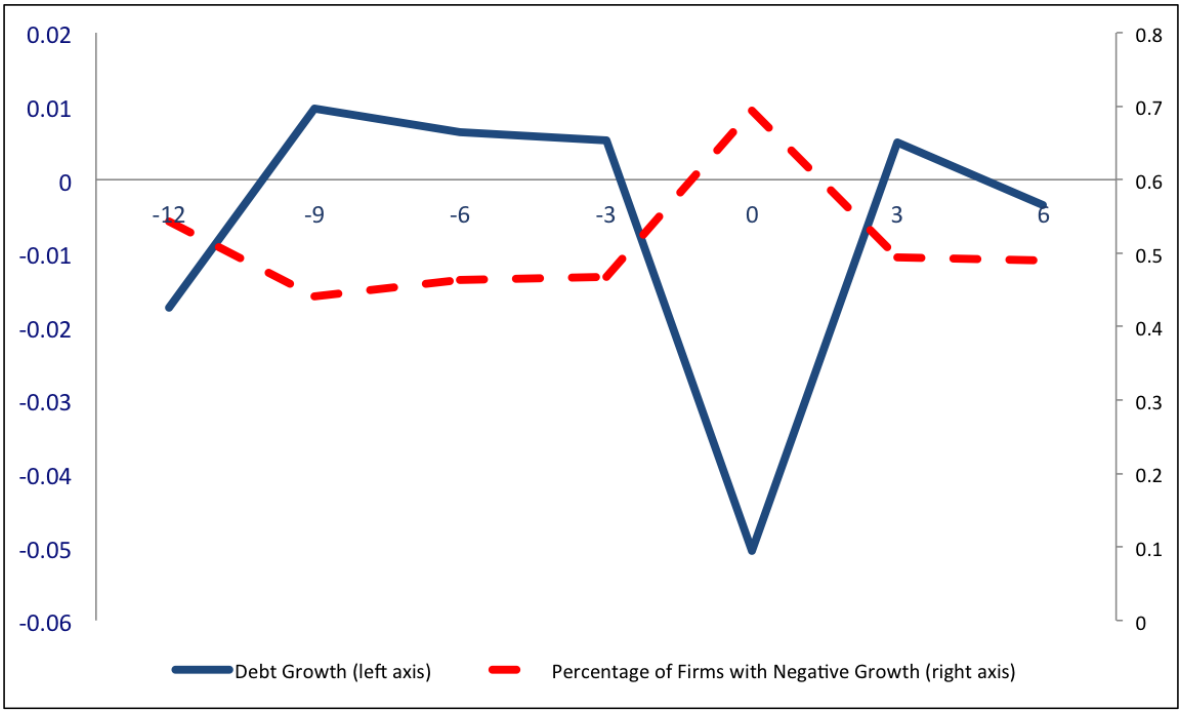
Figure 1. Lending Program Performance Prior to Shock



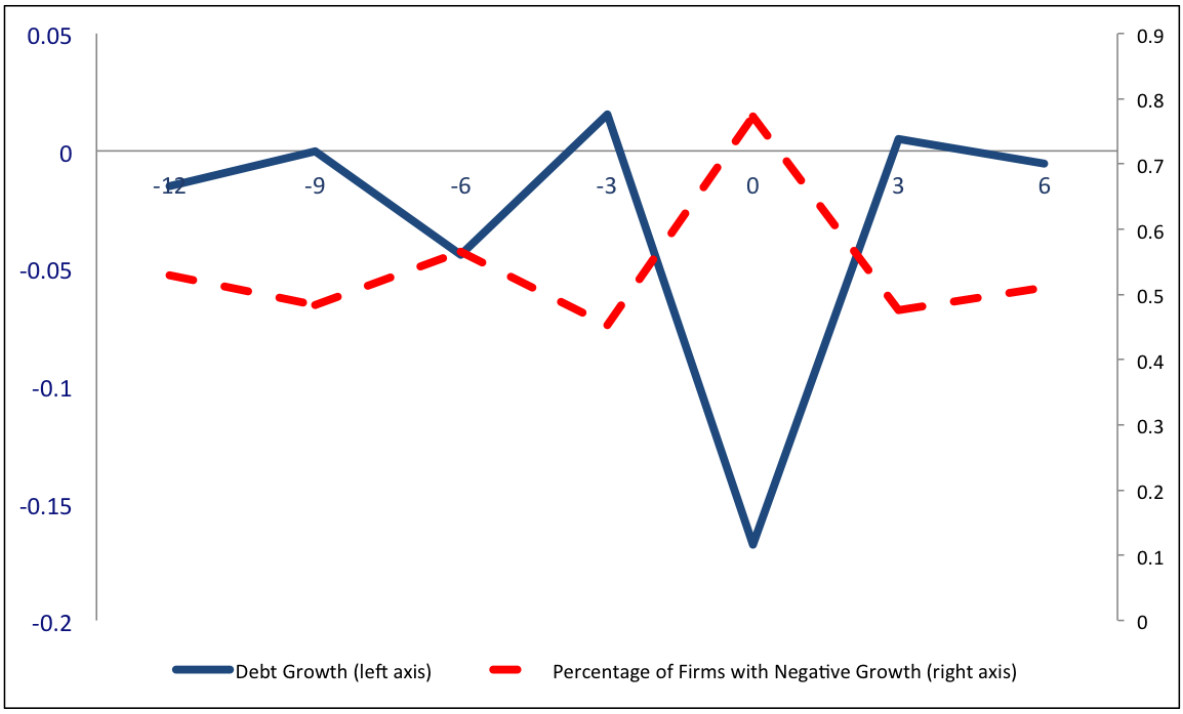
The figure shows lending program performance in the period prior to the shock. The log of total loan outstanding (dashed red line, right-axis) measures the aggregate loans made for all six lending programs. High Default Risk (solid blue line, left-axis) and Default (solid green line, left-axis) measure the percentage of borrowers with a high default risk rating and in default, respectively. The x-axis shows time in quarters with the quarter of the credit supply shock at clock=0.

Figure 2. Debt Growth: Intensive Margin Sample Borrowers



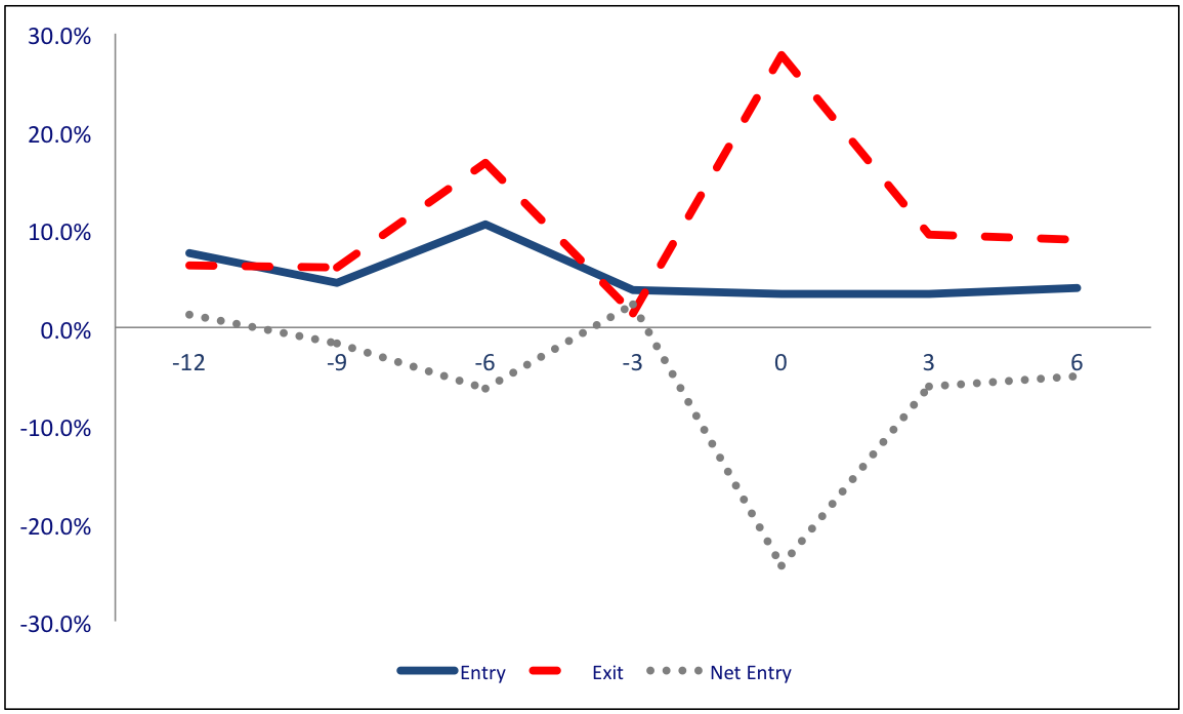
The figure shows the median quarterly debt growth (solid blue line, left-axis) and percentage of firms with negative debt growth (dashed red line, red-axis) for borrowers that participate in the lending program twelve months prior to the shock and continue to borrow from the Bank, presented in Table I. The x-axis shows time in quarters with the quarter of the credit supply shock at clock=0.

Figure 3. Debt Growth: All Borrowers



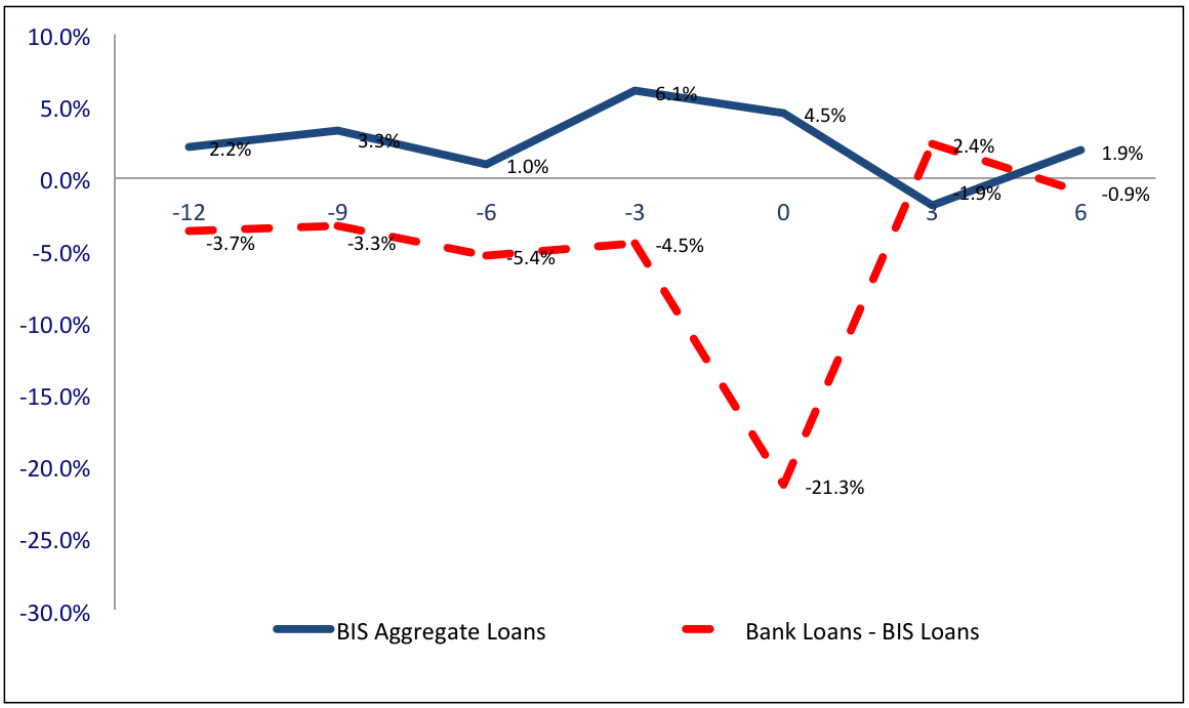
The figure shows the median quarterly debt growth (solid blue line, left-axis) and percentage of firms with negative debt growth (dashed red line, red-axis) for all borrowers. The x-axis shows time in quarters with the quarter of the credit supply shock at clock=0.

Figure 4. Extensive Margin: Borrower Entry and Exit



The figure the percentage of all borrowers that enter the lending program as new borrowers (solid blue line), exit the lending program (dashed red line), and net entry (dotted grey line). The x-axis shows time in quarters with the quarter of the credit supply shock at clock=0.

Figure 5. Debt Growth for all multinational bank lending versus. firms exposed to the bank-specific shock



The figure shows the quarterly debt growth in foreign lending by all multinational banks into countries in our sample (solid blue plot) and the difference between this and debt growth for firms exposed to the credit supply shock in our sample (broken red plot). Foreign lending by all multinational banks is from the Bank for International Settlements (BIS). The x-axis shows time in quarters with the quarter of the credit supply shock at clock=0.

Table I
Data Description by Country and Time

The table presents the distribution of data by country and time. The data comes from a sample of loans made to 1,528 small medium-sized borrowers in six countries by a multinational bank (the Bank) after applying several screening rules. Time is measured in quarters. The data is centered on the date of the credit supply shock, such that Time = 0 represents the quarter of the shock. Countries are reported in alphabetical order. Each number represents the number of firms present in a country at a specific quarter. The sample includes all borrowers for which we have complete lending data twelve months ($Time = -12$) prior to the shock. We are able to follow these same borrowers in each of the sub-sequent quarters (intensive margin). This sample is composed of 10,696 borrower-quarter observations.

	Time (months around credit supply shock)							
Country	-12	-9	-6	-3	0	3	6	Total
Chile	415	415	415	415	415	415	415	2,905
Czech Rep.	262	262	262	262	262	262	262	1,834
India	352	352	352	352	352	352	352	2,464
Singapore	76	76	76	76	76	76	76	532
Slovakia	73	73	73	73	73	73	73	511
Turkey	350	350	350	350	350	350	350	2,450
Total	1,528	1,528	1,528	1,528	1,528	1,528	1,528	10,696

Table II
Descriptive Statistics: Firm-level Loan Data

The table presents summary statistics of all the variables used in the empirical analysis for the intensive margin sample of 1,528 small medium-sized firms by the Bank. The number of borrower-quarter observations gets reduced from 10,696 to 10,362 since *Debt Growth* requires data in two consecutive periods and *Total Loan Outstanding* should be strictly positive. All other variables are measured at the borrower-quarter level. *Total Approved Facility* represents the total amount of credit facilities that a borrower has been approved by the Bank. At any point in time, the Bank may disburse loans up to the *Total Approved Facility*. *Total Loan Outstanding* is the total amount of credit disbursed to the borrower by the Bank. All amounts are reported in US Dollars. *Debt Growth* is the growth in total loan outstanding measured at the quarter level relative to the previous quarter. *Firm Size* is an indicator variable that captures the size of the firm in terms of the annual total net sales as reported in the last available audited financial statement. Indicators 3, 2, 1, and 0 are for firms with net sales >\$25 million, <\$25 million & >\$5 million, <\$5 million & >\$1 million and <\$1 million, respectively. Using this indicator we create a dummy variable (*Small*) that takes a value 1 if the indicator is 0 or 1, and 0 otherwise. There are five categories to indicate different degrees of credit risk and creditworthiness for any borrower determined by the Banks loan officer: Classification 1 (best) for sound credit exposure and Classifications 2 to 5 (worse) for adverse classifications indicating increasing degrees of potential risk of loss. These internal risk ratings are assigned on a monthly basis by loan officers to every borrower. *High Default Risk* is a dummy variable that takes a value of 1 if a borrower is classified above 1 and 0 otherwise. *Collateralization Rate* is the percentage of the total loan outstanding that is covered by the market value of the collateral in that quarter. Collateral types are classified according to the assets pledged as collateral. Asset types correspond to two categories and six sub-categories. The two categories are: *Non-Specific Assets* and *Firm-Specific Assets*. The two sub-categories for *Non-Specific Assets* are: (i.) *Land and Property*, including buildings, plants and commercial real estate and; (ii) *Liquid Assets (Cash)*, including cash or liquid securities held by the firm such as bonds and shares. The four sub-categories for *Firm-Specific Assets* are: (i.) *Firm Inventory/Machinery*, including firm inventory, machinery and equipment; (ii.) *Account Receivables*, including receivables, contract order and post-dated checks; (iii.) *Guarantees*, including any type of third-party guarantee, or other bank guarantee or promissory note and; (iv.) *Letters of Credit*, including stand-by letters of credit, import and export letters of credit. *Total Financing Charge* is calculated as the sum of all revenue generated from lending activities by a borrower (i.e., the revenue generated by the gross interest rate from all loans plus any commitment fees on the approved facility in a given quarter) over the total loan outstanding at the beginning of the quarter. *Interest Rate Spread* is the net spread generated from all lending activities by a borrower in a quarter. It is calculated as the gross interest rate charged minus the cost of funds. *Cross-Sell Income* is calculated as the ratio of all revenue generated from non-lending products and transactional services sold by the Bank to the borrower over the total amount outstanding at the beginning of the quarter. These products include cash management, corporate finance advisory, trade services, asset management and foreign exchange products, among others. *Cross-Selling Ratio* is the ratio of revenues generated from non-lending and transactional products over the total revenues generated by the borrower measured at the beginning of the quarter. *Number of Bank Relationships* represents the number of other banks each borrower operates with.

Variable	N	Mean	Median	Std Dev	Max	Min
Total Approved Facility (USD)	10,696	714,096	301,726	1,043,215	12,600,000	4,049
Total Loan Outstaning (USD)	10,696	565,277	200,000	925,519	9,821,975	0
Debt Growth	10,362	0.49%	0.00%	36.54%	100.00%	-100.00%
Firm Size	10,696	1.23	1.00	0.91	3.00	0
High Default Risk	10,696	7.81%	0.00%	26.83%	100.0%	0.00%
Collateralization Rate	10,696	70.2%	100.0%	46.2%	100.0%	0.0%
Non-Specific Assets	10,696	30.9%	0.0%	42.2%	100.0%	0.0%
Firm-Specific Assets	10,696	39.4%	1.0%	46.0%	100.0%	0.0%
Breakdown of Non-Specific Assets:						
Land and Property	10,696	24.2%	0.0%	39.6%	100.0%	0.0%
Liquid Assets (Cash)	10,696	6.7%	0.0%	22.8%	100.0%	0.0%
Breakdown of Firm-Specific Assets:						
Firm Inventory/Machinery	10,696	23.3%	0.0%	38.9%	100.0%	0.0%
Accounts Receivables	10,696	10.7%	0.0%	25.5%	100.0%	0.0%
Guarantees	10,696	5.4%	0.0%	21.1%	100.0%	0.0%
Letters of Credit	10,696	0.4%	0.0%	5.9%	100.0%	0.0%
Total Financing Charge	10,696	14.5%	12.8%	7.3%	38.0%	6.4%
Interest Rate Spread	10,696	7.8%	6.7%	4.4%	19.8%	2.0%
Cross-Sell Income	10,696	3.1%	1.9%	3.2%	14.0%	0.4%
Cross-Selling Ratio	10,696	19.1%	15.4%	12.8%	58.7%	4.9%
Number of Bank Relationships	10,696	5.63	6.00	2.66	12	1

Table III: The Effect of the Credit Supply Shock on Debt Growth

This table presents estimates of the average impact of the credit supply shock on debt growth of total loan outstanding at the borrower level in an OLS fixed effects framework using specification (1). The coefficient of interest (β_1) captures the one-time effect of the shock on Debt Growth for all firms in the intensive margin sample.

$$y_{i,t} = \alpha_i + \beta_1 \text{Shock} + \beta_2 \text{Shock} * \text{X}_{i,t} + \beta_3 \text{X}_{i,t} + \epsilon_{i,t}$$

The unit of observation is at the borrower-quarter level. The dependent variable ($y_{i,t}$) is Debt Growth for borrower i in time t. Shock is a dummy variable equal to 1 in the quarter of the shock (Q1 2004) and 0 otherwise. There are 1,528 Borrower fixed effects, 6 Country fixed effects and 18 Country-Seasonal fixed effects. All columns include Borrower fixed effects and Country-Seasonal fixed effects, except for Columns (3), (5), (8) and (10) which include Borrower and Country-Industry-Time fixed effects instead. $X_{i,t}$ are borrower characteristics: High Default Risk, Small and Number of Lending Relationships. All variable definitions are provided in Table II. Standard errors are reported in parenthesis and are heteroskedasticity-robust and computed after allowing for correlation across observations in a given country-industry. *, ** and *** statistical significance at the 10, 5 and 1 percent levels.

Dep. Var.: Debt Growth	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Shock	-0.095***	-0.088***		-0.091***		-0.078***	-0.072***		-0.169***	
	[0.013]	[0.014]		[0.014]		[0.015]	[0.015]		[0.030]	
Shock x High Default Risk$_{t-1}$		-0.066**	-0.100***							
		[0.029]	[0.034]							
Shock x High Default Risk				-0.075**	-0.104***		-0.084***	-0.110***	-0.092***	-0.122***
				[0.029]	[0.031]		[0.029]	[0.030]	[0.030]	[0.031]
Shock x Small						-0.053**	-0.058**	-0.059*		
						[0.024]	[0.024]	[0.031]		
Shock x Ln(Bank Rel.)									0.050***	0.058***
									[0.017]	[0.019]
High Default Risk$_{t-1}$		0.010	0.025							
		[0.023]	[0.027]							
Borrower FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country-Seasonal FE	Yes	Yes	No	Yes	No	Yes	Yes	No	Yes	No
Country-Industry-Time FE	No	No	Yes	No	Yes	No	No	Yes	No	Yes
No. Obs.	10,362	10,362	10,362	10,362	10,362	10,362	10,362	10,362	10,362	10,362
No. Firms	1528	1528	1528	1528	1528	1,523	1528	1528	1528	1528
Adj. R-sq.	0.048	0.049	0.068	0.049	0.067	0.049	0.050	0.068	0.050	0.068

Table IV
The Effect of Credit Supply on Debt Growth by Collateralization-Type Rates

This table presents estimates of the average impact of the credit supply shock on debt growth of total loan outstanding at the borrower level in an OLS fixed effects framework using specification (1) by different types of collateralization rates. The unit of observation is at the borrower-quarter level. The dependent variable ($y_{i,t}$) is Debt Growth for borrower i in time t. Shock is a dummy variable equal to 1 in the quarter of the shock (Q1 2004) and 0 otherwise. All columns include Borrower fixed effects. All columns include Country-Seasonal fixed effects except Column (5) which includes Country-Industry-Time fixed effects instead. All collateralization rates are measured twelve months prior to the shock ($Time = -12$). In Column (1) the right hand side variable of interest is the interaction between the Shock dummy and Collateralization Rate. In Columns (2) to (5) the collateralization rate is decomposed into Non-Specific and Specific Collateralization Rate. All variable definitions are provided in Table II. Standard errors are reported in parenthesis and are heteroskedasticity-robust and computed after allowing for correlation across observations in a given country-industry. *, ** and *** statistical significance at the 10, 5 and 1 percent levels.

Dependent Variable: Debt Growth	(1)	(2)	(3)	(4)	(5)
Shock	-0.114***	-0.096***	-0.073***	-0.115***	
	[0.021]	[0.013]	[0.016]	[0.021]	
Shock x Collateralization Rate	0.057**				
	[0.023]				
Shock x Non-Specific		0.074***		0.091***	0.061**
Collateralization Rate		[0.022]		[0.027]	[0.027]
Shock x Specific			-0.004	0.034	0.014
Collateralization Rate			[0.021]	[0.024]	[0.026]
Shock x High Default Risk	-0.080***	-0.090***	-0.068**	-0.092***	-0.092***
	[0.029]	[0.030]	[0.028]	[0.030]	[0.031]
Borrower FE	Yes	Yes	Yes	Yes	Yes
Country-Seasonal FE	Yes	Yes	Yes	Yes	No
Country-Industry-Time FE	No	No	No	No	Yes
No. Obs.	10,362	10,362	10,362	10,362	10362
No. Firms	1,528	1,528	1,528	1,528	1,528
Adj. R-sq.	0.034	0.034	0.033	0.034	0.062

Table V: The Effect of the Credit Supply Shock on Debt Growth by Pricing Margin

This table presents estimates of the average impact of the credit supply shock on debt growth of total loan outstanding at the borrower level in an OLS fixed effects framework using specification (1) by borrowers pricing margin. The unit of observation is at the borrower-quarter level. The dependent variable ($y_{i,t}$) is Debt Growth for borrower i in time t. Shock is a dummy variable equal to 1 in the quarter of the shock (Q1 2004) and 0 otherwise. All columns include Borrower fixed effects and Country-Seasonal fixed effects. The independent variable *High Income* is defined differently across the specifications: *Total Financing Charge* (Columns (1) and (2)), *Interest Rate Spread* (Columns (3) and (4)) and *Cross-Sell Income* (Columns (5) and (6)). All variable definitions are provided in Table II. Standard errors are reported in parenthesis and are heteroskedasticity-robust and computed after allowing for correlation across observations in a given country-industry. *, ** and *** statistical significance at the 10, 5 and 1 percent levels.

Dep. Var.: Debt Growth	Firm Income Characteristic					
	Income = Total Financing Charge		Income = Interest Rate Spread		Income = Cross-Sell Income	
	(1)	(2)	(3)	(4)	(5)	(6)
Shock	-0.089***	-0.085***	-0.099***	-0.100***	-0.092***	-0.086***
	[0.014]	[0.014]	[0.014]	[0.014]	[0.013]	[0.014]
Shock x High Income	-0.031	-0.031	0.019	0.011	-0.025	-0.036
	[0.026]	[0.027]	[0.026]	[0.027]	[0.025]	[0.025]
Shock x High Default Risk		-0.074**		-0.094***		-0.098***
		[0.031]		[0.032]		[0.031]
Shock x High Income		-0.005		0.167***		0.227**
x High Default Risk		[0.095]		[0.059]		[0.094]
Borrower FE	Yes	Yes	Yes	Yes	Yes	Yes
Country-Seasonal FE	Yes	Yes	Yes	Yes	Yes	Yes
No. Obs.	10,362	10,362	10,362	10,362	10,362	10,362
No. Firms	1,528	1,528	1,528	1,528	1,528	1,528
Adj. R-sq.	0.049	0.049	0.049	0.049	0.049	0.049

Table VI: The Effect of the Credit Supply Shock on Collateralization Rates

This table presents estimates of the average impact on collateralization rates after the credit supply shock at the borrower level in an OLS fixed effects framework using specification (2) in the intensive margin sample.

$$y_{i,t} = \alpha_i + \beta_1 \text{Post Shock} + \beta_2 \text{Post Shock} * \text{X}_i + \epsilon_{i,t}$$

The unit of observation is at the borrower-quarter level. The dependent variables ($y_{i,t}$) are: Collateralization Rate (Columns (1) to (3)), Non-Specific Collateralization Rate (Columns (4) to (6)) and Specific Collateralization Rate (Columns (7) to (9)) for borrower i in time t. $Post\ Shock$ is a dummy variable that equals to 1 in the quarter of, and following, the shock, and 0 otherwise. Creditor Rights is the natural logarithm of the creditor rights index defined in Djankov, McLiesh and Shleifer (2007), which takes a value of 4 (strongest) to 1 (weakest). All columns include Borrower fixed effects and Country-Seasonal fixed effects. All variable definitions are provided in Table II. Standard errors are reported in parenthesis and are heteroskedasticity-robust and computed after allowing for correlation across observations in a given country-industry. *, ** and *** statistical significance at the 10, 5 and 1 percent levels.

Dep. Var.:	Collaterization Rate			Non-Specific Collaterization Rate			Specific Collaterization Rate		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Post Shock	0.028***	0.027***	0.072*	0.020***	0.018***	0.093***	0.011**	0.010**	0.022
	[0.008]	[0.009]	[0.039]	[0.004]	[0.004]	[0.020]	[0.005]	[0.005]	[0.025]
Post Shock x High Default Risk		0.008			0.042***			0.004	
		[0.016]			[0.012]			[0.023]	
Post Shock x Creditor Rights			-0.018*			-0.030***			-0.005
			[0.009]			[0.008]			[0.009]
Borrower FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country-Seasonal FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No. Obs.	10,362	10,362	10,362	10,362	10,362	10,362	10,362	10,362	10,362
No. Firms	1528	1528	1528	1528	1528	1528	1528	1528	1528
Adj. R-sq	0.814	0.814	0.814	0.917	0.917	0.917	0.897	0.897	0.897

Table VII: The Effect of the Credit Supply Shock on Pricing Margin

This table presents estimates of the average impact on the pricing margin after the credit supply shock at the borrower level in an OLS fixed effects framework using specification (2) in the intensive margin sample. The unit of observation is at the borrower-quarter level. The dependent variables are: *Total Financing Charge* (Columns (1) and (2)), *Interest Rate Spread* (Columns (3) and (4)) and *Cross-Sell Income* (Columns (5) and (6)). All columns include Borrower fixed effects and Country-Seasonal fixed effects. *Post Shock* is a dummy variable that equals to 1 in the quarter of, and following, the shock, and 0 otherwise. All variable definitions are provided in Table II. Standard errors are reported in parenthesis and are heteroskedasticity-robust and computed after allowing for correlation across observations in a given country-industry. *, ** and *** statistical significance at the 10, 5 and 1 percent levels.

Dep. Var.:	Income = Total Financing Charge		Income = Interest Rate Spread		Income = Cross-Sell Income	
	(1)	(2)	(3)	(4)	(5)	(6)
Post Shock	0.004**	0.004*	-0.001	-0.001	0.002***	0.001***
	[0.001]	[0.001]	[0.001]	[0.001]	[0.000]	[0.000]
Post Shock x High Default Risk		0.003		-0.001		0.004***
		[0.005]		[0.003]		[0.001]
Borrower FE	Yes	Yes	Yes	Yes	Yes	Yes
Country-Seasonal FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	10,362	10,362	10,362	10,362	10,362	10,362
No. Firms	1528	1528	1528	1528	1528	1528
Adj. R-sq.	0.380	0.380	0.351	0.351	0.709	0.709

Table VIII
The Effect of the Credit Supply Shock on Extensive Margin: Entry

This table presents estimates of the average impact on the cost of borrowing at the extensive margin after the credit supply shock at the borrower level in an OLS fixed effects framework using specification (3):

$$y_{i,t} = \alpha_i + \beta_1 \text{Post Shock} + \beta_2 \text{Entry}_i + \beta_3 \text{Post Shock} * \text{Entry}_i + \beta_4 \text{X}_{i,t} \epsilon_{i,t}$$

The sample is composed by 1,528 old borrowers (intensive margin) plus 935 new entrants to the Banks lending program.The unit of observation is at the borrower-quarter level. *Entry* is a dummy variable that takes a value of 1 if the borrower is new to the lending program. *Post Shock* is a dummy variable that equals to 1 in the quarter of, and following, the shock, and 0 otherwise. The right-hand side variables of interest are $beta_2 2$ and $beta_3$: $beta_2$ captures the average cost for new borrowers relative the borrowing cost for existing borrowers, and $beta_3$ captures the borrowing cost for new borrowers post credit shock relative to new borrowers prior to the credit shock. $X_{i,t}$ are independent time-varying borrowing characteristics: *High Default Risk*, *ln(Firm Size)* and *Loan Size = ln(1 + Total Loan Outstanding)*. The dependent variables in Columns (1) to (5) are: *ln(Firm Size)*, *Loan Size = ln(1 + Total Loan Outstanding)*, *High Default Risk*, *Collateralization Rate* and *Total Financing Charge*, respectively. All columns include Country-Industry-Time fixed effects. All variable definitions are provided in Table II. Standard errors are reported in parenthesis and are heteroskedasticity-robust and computed after allowing for correlation across observations in a given country-industry. *, ** and *** statistical significance at the 10, 5 and 1 percent levels.

	(1)	(2)	(3)	(4)	(5)
Dep. Var.:	Ln(Firm Size)	Loan Size	High Default Risk	Collateralization Rate	Total Financing Charge
Entry	-0.211***	-1.043***	-0.068***	0.038***	0.001
	[0.025]	[0.159]	[0.008]	[0.014]	[0.003]
Entry x Post Shock	0.132***	0.594***	0.005	0.035**	-0.005
	[0.037]	[0.167]	[0.011]	[0.017]	[0.004]
Ln(Firm Size)				-0.010	-0.046***
				[0.013]	[0.004]
Loan Size				0.015***	-0.004***
				[0.004]	[0.000]
High Default Risk				0.116***	-0.006**
				[0.031]	[0.003]
Constant	0.709***	11.852***	0.081***	0.662***	0.223***
	[0.005]	[0.033]	[0.002]	[0.049]	[0.005]
Country-Industry-Time FE	Yes	Yes	Yes	Yes	Yes
No. Obs.	13,891	13,891	13,891	13,891	13,891
Adj. R-sq.	0.265	0.104	0.0392	0.440	0.188

Appendix A Table A.I. Industry Classification

The table presents the distribution of data by industry. The data comes from a sample of loans made to 1,528 small medium-sized firms in six countries by the Bank. Industries are reported in alphabetical order.

Industry Name	Freq.	Percent
Agriculture & Food Preparation	807	7.79
Airlines	6	0.06
Apparel/Footwear	608	5.87
Autos	417	4.02
Banks: Personal & Commercial	1	0.01
Business Services	511	4.93
Chemicals	757	7.31
Construction	596	5.75
Entertainment Group	209	2.02
Forest Products	247	2.38
Freight Transportation	437	4.22
Global Information Technology	523	5.05
Government	4	0.04
Government: Central Banks	1	0.01
Health Care	148	1.43
Home Goods	172	1.66
Industrial Machinery & Equipment	1,238	11.95
Insurance	1	0.01
Investment Banks	1	0.01
Metals	170	1.64
Miscellaneous	2,124	20.5
Natural Gas Distribution	1	0.01
Other Financial Institutions	6	0.06
Personal Care	134	1.29
Personal Services	97	0.94
Petroleum	80	0.77
Pharmaceutical Group	144	1.39
Real Estate	46	0.44
Retail	421	4.06
Telephone & Cable	33	0.32
Textiles	341	3.29
Tourism Group	69	0.67
Utilities	10	0.1
Total	10,362	100