Risk-Taking and Monetary Policy Transmission: Evidence from Loans to SMEs and Large Firms *

Cecilia Caglio† R. Matthew Darst‡ Şebnem Kalemli-Özcan§

July 2022

Abstract

Using administrative data, we document new facts on the importance of heterogeneity in firms' financing conditions for credit growth in the U.S., and show that such heterogeneity is central to monetary policy transmission. Most of the private firms are small-medium-size-enterprises (SMEs), whose entire balance sheet debt comes from banks and collateralized by their earnings and intangibles, that is their enterprise value. Relative to publicly listed firms, monetary expansions increase highly levered SMEs' risk-taking by expanding their borrowing capacity and credit demand as the value of their earnings-based collateral rise and their continuation value together with their ability to repay debt improves. Our results imply that the effectiveness of monetary policy depends on both the firm-size distribution and the type of collateral pledged.

Keywords: low interest rates, firm size, private firms, earnings-based collateral.

*We would like to thank our discussants Olivier Darmouni, Mariassunta Giannetti, Luc Laeven, Yueran Ma, and David Thesmar. We thank Boragan Aruoba, Thomas Dreschel, Mark Gertler, Sasha Indarte, Chen Lian, Peter Karadi, Amir Kermani, Nobu Kiyotaki, Guillermo Ordonez, Pablo Ottonello, Pascal Paul, Jose-Luis Peydro, Adriano Rampini, John Shea, Joseph Stiglitz, Ludwig Straub, Thomas Winberry, participants at seminars at Berkeley, Columbia, Duke, MIT, AEA, ECB/CEPR-WEAREIN, NBER EFG, NBER ME and other conference and seminar attendees for useful suggestions. We thank Jacob Faber, Jacob Fahringer, Alvaro Silva, and Adam Tucker for their invaluable research assistance. Kalemli-Özcan thanks NSF Grant 2018623 for support. The views in this paper are solely those of the authors and do not reflect the views of the Federal Reserve Board of Governors, or anyone in the Federal Reserve System

†Federal Reserve Board of Governors: cecilia.r.caglio@frb.gov.

‡Federal Reserve Board of Governors: matt.darst@frb.gov.

§University of Maryland, NBER, and CEPR: kalemli@umd.edu

1 Introduction

Monetary expansions aimed at stimulating the economy in the short run might lead to low productivity coupled with high financial risks in the medium run. Low interest rates impact both the level of credit and its allocation across heterogeneous firms (e.g Borio and Zhu, 2012; Adrian and Shin, 2009; Acharya and Naqvi, 2012; Gopinath, Kalemli-Ozcan, Karabarbounis, and Villegas-Sanchez, 2017; Asriyan, Laeven, Martin, Van der Ghote, and Vanasco, 2021). For example, accommodative monetary policy can cause banks to extend loans to high default risk and/or low productivity firms. Or, easy monetary policy may relax financial constraints for less credit-worthy firms. Therefore, monetary expansions can increase credit growth, investment, and output today at the expense of corporate debt overhang, greater possibility of a financial crisis, and lower growth in the future. Understanding how heterogeneous firms and banks respond to monetary policy is central to understanding these trade-offs.

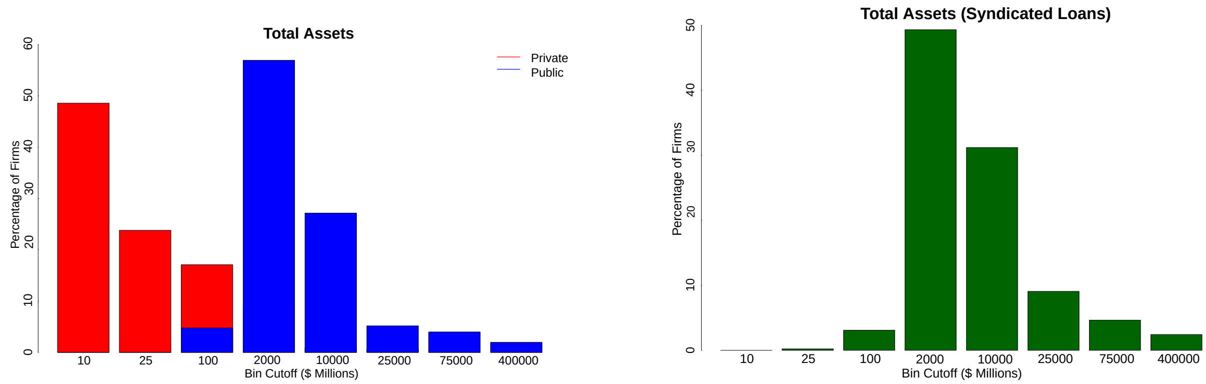
There is an extensive theoretical literature studying monetary policy transmission in heterogeneous agents macro models focusing on household heterogeneity for consumption channel (e.g McKay, Nakamura, and Steinsson, 2016; Kaplan, Moll, and Violante, 2018; Auclert, 2019; Wong, 2019) and firm heterogeneity for investment channel (e.g Ottonello and Winberry, 2020). However, there is no systematic empirical investigation of monetary policy transmission in the U.S. based on a truly representative sample of heterogeneous firms and banks. Our paper fills this gap.

We use an administrative firm-bank matched data set, at the firm-bank-loan-quarter level, containing a more representative set of U.S. firms than all the existing U.S. firm-level data sets that report firm financing sources.[1] This is shown below in Figure 1 that plots the firm size distribution. Panel (a) shows the private firms in red bars and public firms in blue bars. Panel (b) shows firms in green bars who borrow in syndicated loan markets.[2] Most private borrowers in our data are SMEs with assets less than $10 million. The selection issues in large firms samples are clear. The firm size distribution of firms who borrow in syndicated loan market is almost identical to the size distribution of public companies. This shows that the two popular data sources for syndicated loan research, LCD Dealscan and the Shared National Credit Registry (SNC) with covenant information, may not contain a representative set of U.S. corporate borrowers. To be included in our data, a firm must be borrowing more than 1 million USD, whereas to be included in SNC, firms need to borrow a minimum of 20 million USD from at least 3 banks.

[1] Dinlersoz, Kalemli-Ozcan, Hyatt, and Penciakova (2018) document the selection issues in existing firm-level data sets such as Census-QFR, Kaufman, SBFS and others based on matching these data to Longitudinal Business Dataset (LBD) of the U.S. Census that represents the universe of U.S. firms.

[2] Only 0.008 percent of the firms in our sample borrow in syndicated loan markets.

Figure 1: Firm Size Distribution: Private vs. Public Firms and Syndicated Loan Borrowers



Note: The figure shows firm size distribution based on assets, for all private firms (red bars) and public firms (blue bars), in Panel (a), and for firms in our data who also borrow in syndicated loan markets, Panel (b).

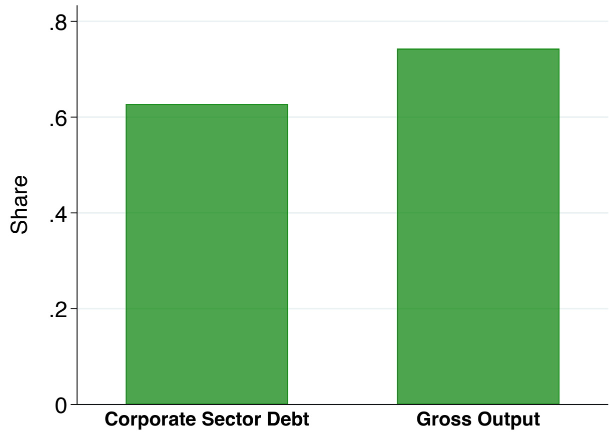
As our data comes from the quarterly Capital Assessments and Stress Testing Report (FR Y-14Q Report)— which is collected by the Federal Reserve as part of the Comprehensive Capital Analysis and Review (CCAR) process for bank holding companies, and U.S. Intermediate Holding Companies of foreign banking organizations—it only covers systemically important banks, defined as all financial institutions with $50 billion or more in total consolidated assets.[3] As a result, the data covers 70 percent of total Corporate and Industrial (C&I) loans made to U.S. firms from Q3:2012 to Q4:2019, instead of the universe of loans. Still, our Y-14 firms cover a large part of the U.S. corporate sector debt and U.S. gross output. Figure 2 plots the aggregate total dollar value of liabilities in the FR Y-14 data (from firms' balance sheets including bonds and loans) as a share of the aggregate dollar value of non-financial business debt liabilities from the Financial Accounts of the United States, showing 60 percent coverage during the sample period (first green bar). The second bar shows the share of Y-14 firms in U.S. output. We do the same exercise using total gross output from the Bureau of Economic Analysis output tables and show that Y-14 firms represent almost 80 percent of the U.S. economy.[4]

It is also important to note that, SMEs, which constitute most of the Y-14 firms, borrow entirely from banks with almost no presence in the bond markets. This fact is missed in the official aggregate data. Figure 3 plots financing sources for the non-financial business sector from the Financial Accounts of the United States. Panel (a) shows the debt share

[3]The asset threshold has changed to $100 billion end of 2019. The appendix provides the list of the reporting financial institutions.

[4]The publicly listed firms in Y-14 data account for 31 percent of the U.S. corporate debt. Not all publicly listed firms borrow from banks and hence not covered in Y-14 data. The share of U.S. corporate debt attributable to the universe of publicly listed firms is 48 percent. In terms of domestic U.S. gross output, publicly listed firms only account for 44 percent, once the foreign output is cleaned from the data. See Dinlersoz, Kalemli-Ozcan, Hyatt, and Penciakova (2018).

Figure 2: Coverage of Y-14 Data: Aggregate U.S. Corporate Debt and Output



Note: The first bar is corporate sector debt in Y-14 data as a share of total non-financial business debt liabilities from the U.S. Financial Accounts. The second bar shows gross output in Y14 as a share of BEA U.S. gross output.

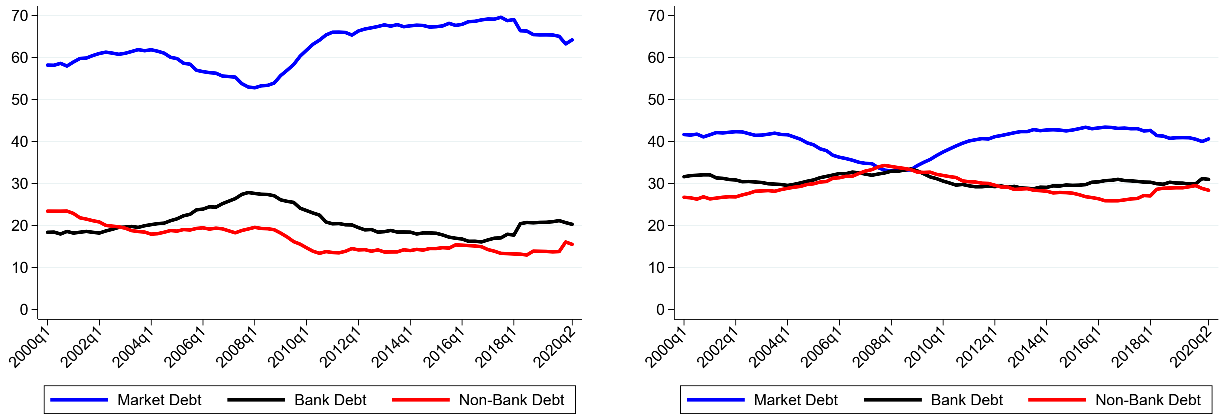
for publicly listed and large private firms (such as C and S corporations), known as "non-financial corporate businesses," an aggregate that is extensively used by researchers. The share of bank finance, shown by the line "Bank Debt" is small for these companies–around 20 percent on average. Panel (b) plots the "non-financial businesses" aggregate which includes other small private firms.[5] The figure shows that the bank-finance share goes up to 30 percent. In addition, the share of market debt declines sharply. Although bank financing overall plays a small role in the aggregate data, the difference between the two panels hints at the importance of bank financing for SMEs.

FR Y-14Q data paints a drastically different picture. Figure 4 plots the share of bank debt on firm balance sheets in the Y-14, only for private firms, to highlight the stark difference from the aggregate data that is dominated by listed firms. For large private firms, defined as firms in the upper quartile of the asset distribution, the Y-14 data matches the narrative of the aggregate data in Figure 3 (a); bank lending accounts for only 20 percent of their financing. However, financing for the remaining private firms–small and medium size categories–is almost exclusively bank-based. Private firms below the 75th percentile of the asset distribution have assets less than \$43 million and revenue less than \$86 million. The median firm has \$12 million in assets and \$28 million in sales, that is an SME.[6]

[5]The private firms included in the "non-financial non corporate" series (L.104 in the Financial Accounts of the U.S.) comprise partnerships, limited liability companies and sole-proprietorships. In the Financial Accounts of the United States, detailed liabilities for private firms, in both non-financial non-corporate and non-financial corporate categories, are not built from the bottom up using firm-level tax records. Total liabilities are based on aggregates from Statistics of Income (SOI) from IRS. Share of each liability type is estimated using other data sources (for example, Call Report for the total of bank deposits) reported by lenders.

[6]In U.S., SMEs are defined as firms with less than 500 employees. There is not a well-established asset

Figure 3: Non-financial Firms' Financing in the Financial Accounts of the United States

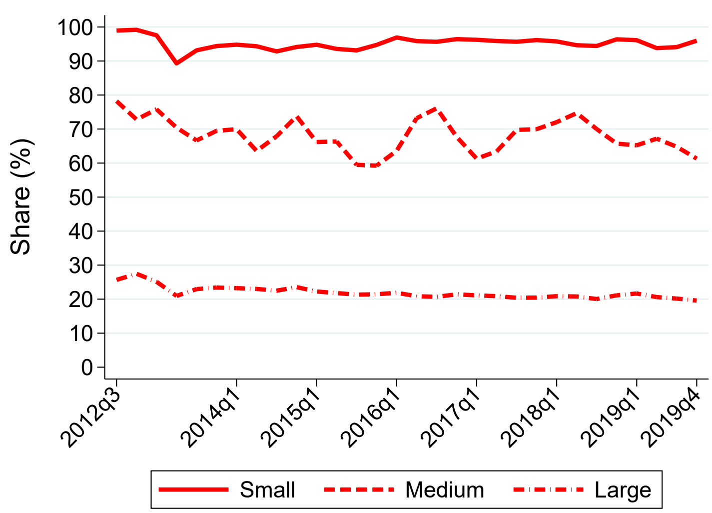


(a) Non-financial Corporate Businesses

(b) Non-financial Businesses

Note: The panel (a) represents the debt share for the "non-financial corporate businesses" in the U.S. The panel (b) represents the debt share for all "non-financial businesses" in the U.S. The "Bank Debt" include Corporate and Industrial (C&I) loans and non-residential mortgages held by banks. "Non-bank Debt" includes, among others, syndicated loans held by non-banks, non-residential mortgages held by non-banks, and finance company loans. "Market Debt" comprises corporate bonds, commercial paper, and industrial revenue bonds. Source: Financial Accounts of the United States.

Figure 4: Share of Bank Debt in Non-financial Private Firms' Financing in FR Y-14



Note: The figure plots the median loan *utilization* as share of total balance sheet debt (loans and bonds) for various points in the asset-size distribution among private borrowers. See Figure 19 for median loan *commitment*. Source: FR-Y14Q H.1

---

and/or revenue cut-off to define SMEs in the U.S. for all the industries. Since Y-14 data does not cover employment, we follow the OECD definition of SMEs as firms with assets less than $10 million, and/or revenue less than $50 million.

Understanding the borrowing patterns and loan terms of bank-financed SMEs are instrumental in understanding monetary policy transmission in the U.S. SMEs account for 99.8 percent of all U.S. firms, 52 percent of private sector employment and 48 percent of private sector gross output.[7] Using our data set, we ask the following questions about how monetary policy transmits through heterogeneous firms: Are the effects of monetary expansions on the cost of and demand for credit the same for SMEs and large firms and for private versus publicly listed firms? What are the respective roles that credit demand and supply play in determining equilibrium credit outcomes during monetary expansions? Does the response to expansionary monetary policy differ between firms and banks conditional on default risk and/or net worth? Does monetary policy interact with the type of collateral pledged in determining the cost of credit and demand for loans during expansions?

We regress two main credit outcome variables—cost and amount of credit—on measures of firm, bank, and loan heterogeneity interacted with high frequency monetary policy surprises as measured by Gürkaynak, Sack, and Swanson (2005) (GSS). The regressions assess the impact of a monetary policy surprise in quarter q on the credit outcomes for different firms and banks from quarter q to $q+1$. We separate firms and banks into treatment and control groups based on their characteristics observed before the monetary policy shock happens. We include bank×quarter and firm×quarter fixed effects separately to pin down the relative importance of credit demand versus supply. Regressions with bank×quarter fixed effects use cross-firm variation in firm credit demand from a single bank. Regressions with firm×quarter fixed effects use variation in credit supply from multiple banks lending to the same firm. Finally, to ease concerns of non-random matching between firms and banks, we use variation from multiple loans between a given firm-bank pair by employing firm×bank×quarter fixed effects–*within-firm-bank* variation–where credit outcomes are driven simultaneously by changes in loan demand and supply for a given relationship.

Heterogeneous financial frictions can be important for understanding monetary policy transmission. Gertler and Karadi (2015) argue that monetary policy can change the cost of credit through movements in risk spreads. Therefore, monetary policy may impact loan terms for firms with high default risk differently than firms with low default risk. Ottonello and Winberry (2020) show that, although expansionary monetary policy lowers the cost of credit, firms with high default risk (high leverage firms) might respond less than low default risk firms to monetary expansions due to increasing marginal costs. Alternatively, monetary expansions improve the borrowing capacity for small and low net worth borrowers (e.g. Bernanke and Gertler, 1989) with aggregate consequences (e.g. Bernanke, Gertler, and Gilchrist, 1996). The loan-level pricing and pledged collateral information provided in Y-14

[7] See www.census.gov.

allow us to zoom in on the financial friction that expansionary monetary policy relaxes: lower default risk, higher net worth, or both.[8]

We show that SMEs with higher "ex-ante" leverage (before the expansion) borrow more at a higher cost during monetary expansions. This is a result driven by their higher demand for credit and not by their high default risk. The mechanism depends on the type of collateral SMEs pledge: SMEs mostly borrow against collateral whose value is inextricably tied to firm operations, intangibles, and hence enterprise continuation values and not against collateral whose value is market or re-sale based such as fixed assets and real estate. SMEs that pledge earnings and operations based collateral access more credit at lower rates during normal times, and this access to credit effect is amplified during monetary expansions. Expansionary monetary policy stimulates aggregate demand and firms' earnings, which reduces highly levered SME default risk by reducing the spreads on loans backed by collateral tied to earnings and operations. As a result, the higher cost of borrowing these leveraged SMEs pay relative to others is a result of their higher credit demand, as their default risk goes down with higher valued earnings and operations based collateral thanks to the monetary expansion. These results are consistent with the expansion of borrowing capacity when earnings based constraints are dominant form of collateral as shown recently for publicly listed firms in the U.S. (e.g Lian and Ma, 2020; Drechsel, 2019), and for the universe of firms in Peru and Spain (Ivashina, Laeven, and Moral-Benito, 2020). Our granular data on pledged collateral shows that earnings based constraints are even more important for SMEs and central to monetary policy transmission in the U.S.

All our results are driven by SMEs. For large publicly listed firms, we find the opposite result. Highly levered public firms, regardless of the type of collateral they pledge, obtain less credit and pay higher spreads when pledging collateral, responding less to monetary expansions. These results are consistent with Ottonello and Winberry (2020), who also uses publicly listed firms. We also do not find any evidence of risk-taking by banks. Our results suggest the opposite; highly levered banks *lend less* to risky private firms and SMEs during monetary policy expansions. Overall, our results show that credit growth under low interest rates depends crucially on earnings and operations based collateral SMEs use to borrow.

We proceed as follows. Section 2 summarizes the literature. Section 3 describes the data. Section 4 presents the empirical analysis. Section 5 presents a primer on a potential theoretical mechanism, and Section 6 concludes.

[8]It is very rare to observe both the loan-level interest rates and loan-level collateral in credit registries. The only other credit registry with this information, to the best of our knowledge is from an emerging market, Turkey, see di Giovanni, Kalemli-Ozcan, Ulu, and Baskaya (2019).

2 Literature

Our paper contributes to several strands of literature. First, we contribute to the literature that studies the impact of monetary policy with a focus on financial frictions, both from the borrower and lender sides. Bernanke and Gertler (1989) and Bernanke, Gertler, and Gilchrist (1996) focus on the financial accelerator channel in representative agent new Keynesian models. Expansionary monetary policy improves net worth and reduces agency frictions, which allows low net worth (risky) borrowers to increase their access to finance. Alternatively, low interest rates reduce funding costs and the incentive to produce risky projects, which may result in less credit rationing across borrowers (e.g Stiglitz and Weiss, 1981). Low interest rates can also induce "search-for-yield" behavior and reallocate capital toward risky borrowers (e.g Rajan, 2005). Dell'Ariccia, Laeven, and Suarez (2017) find that *high capital-low leverage* bank portfolios become more risky–higher share of risky loans–when interest rates fall. Moreover, these banks charge lower spreads on syndicated loans during expansionary policy (e.g Paligorova and Santos, 2017). Other papers find the opposite result: *low capital-high leverage* banks lend to "riskier" borrowers who have defaulted before (e.g Jiménez, Ongena, Peydró, and Saurina, 2014; Ioannidou, Ongena, and Peydró, 2014). Our contribution to this literature is to investigate risk-taking from both sides, borrowers and lenders, focusing on heterogeneous financial frictions. We show that credit growth is driven by the borrower side during expansions, where these borrowers are risky since they are smaller firms and have high leverage that implies higher default risk. We also show why risky firms borrow more: monetary expansions relax their earnings and operations based constraints, increasing their borrowing capacity and lowering their default risk.

Second, our paper relates to the literature studying how firm heterogeneity, in terms of firm size, age and leverage, affects monetary policy transmission (e.g Gertler and Gilchrist, 1994; Jeenas, 2019; Cloyne, Ferreira, Froemel, and Surico, 2018; Ottonello and Winberry, 2020). The empirical results from this literature are mixed as they are based on different U.S. firm samples. Our representative sample of U.S. firms allows us to pin down the firm heterogeneity that matters for the policy transmission and document the mapping from firm heterogeneity, in terms of size, age, leverage, to firm-level financial frictions. Our results are fully consistent both with Gertler and Gilchrist (1994) and Ottonello and Winberry (2020). The former study shows the importance of small firms for policy transmission and the latter shows, although theoretically ambiguous, empirically, high leverage public firms respond less to monetary policy shocks. We find similar results for highly leveraged public firms (see Appendix Table 19), but highly levered private firms and SMEs both respond more to monetary policy shocks, making smaller firms important for the transmission as argued by

Gertler and Gilchrist (1994). We provide an interpretation of our results from the lens of the model of Ottonello and Winberry (2020) in our last section.

Third, our paper contributes to the literature highlighting the importance of financial contracts in transmitting shocks to the aggregate economy. In the models developed by Kiyotaki and Moore (1997) and Kiyotaki, Moore, and Zhang (2021), entrepreneurs borrow against fixed assets and real estate (trees). If a firm uses these assets as collateral and defaults, then lenders confiscate the assets and sell them to other buyers. Hence, the market or liquidation value of the asset determines its collateral value to lenders. In these models, entrepreneurs use collateral to generate output (fruit) but cannot borrow against future output. However, in our data, SME loans are most frequently secured by accounts receivable and inventory (AR&I) collateral and blanket liens: Firms pledge *current* fruit whose value derives from firm operations. This is because sales that firms generate combine ideas, intangible capital, marketing of products, etc. and get embedded into the value of the fruit they produce and become capitalized on the balance sheet and pledgeable as AR&I and blanket lien. We find that monetary policy not only changes the relative price of fixed assets as in traditional models, it also impacts firms' ability to produce its own assets that are used as collateral (fruit). The framework of Benmelech and Bergman (2012) can rationalize our findings. They argue that monetary policy, through the general equilibrium impact on aggregate demand, increases firm sales (and accounts receivable), which increases borrowing capacity.

Our results are consistent with the new literature that draws a distinction between debt secured by assets (asset based loans) and debt tied to firm cash-flows and earnings (earnings-based or going concern debt) (e.g Lian and Ma, 2020; Kermani and Ma, 2021). Our contribution here is to draw on brand-new granular data on pledged collateral, which allows us to show that the firm itself *creates* its own collateral value through production rather than purchasing it as it does with land or machines. We show that the inability to separate the liquidation value of AR&I from going-concern value embedded in blanket liens is particularly important for SMEs who do not have large amounts of tangible fixed assets to pledge. We call AR&I and blanket lien collateral, 'earnings and operations based' collateral. Our results on monetary policy transmission show that these two types of collateral, AR&I and blanket liens, work in the same way in the data because their values derive from firm operations and continuation values.

Fourth, we contribute to the literature arguing that monetary policy can be less effective or less powerful during recessions and/or during a low interest rate environment (e.g Tenreyro and Thwaites (2016), Kiyotaki, Moore, and Zhang (2021).) Our contribution shows that the power of monetary policy depends on heterogeneity in terms of firm size and the type of collateral used to secure loans, especially during monetary expansions and low interest rate periods.

3 Data

We present a brief description of our data in this section and provide additional details in the Data Appendix.

3.1 What is a private firm and a public firm?

For each quarter, we define private firms in FR Y-14Q data as those that cannot be matched to COMPUSTAT either via 6-digit CUSIP or via tax ID (EIN). The number of private firms that become public during our sample period is almost nil. Large public firms generally report consolidated financial statements to banks. To avoid double counting of financial variables, we match our data to the Bloomberg Corporate Structure Database with EIN, when possible, or name matching. We roll up loans to subsidiaries to their parent company when banks report parent company rather than subsidiary financial information. In these cases, treating subsidiaries as separate "firms" would introduce errors in firm size and other distributional cuts of the data.[9] The final data has 3,798,946 loan-level observations for 155,589 U.S. corporations. Importantly, the data contain nearly 153,000 unique private firms and cover all sectors of the U.S. economy.

3.2 Descriptive Statistics

3.2.1 Banks

Table 1 shows descriptive statistics for the 39 banks subject to CCAR. Total (0.882) and short-term (0.727) bank leverage during our sample period are lower than before the financial crises due to various post-crisis regulatory reforms. The last two rows report bank charge offs, which are non-performing loan losses on banks' balance sheets. The average bank charge-off is about about $22 million and represents on average 6 percent of a given loan, again showing that non-performing loan issues were not big during this period.

[9] Relying on the tax ID without the full corporate structure to identify unique firms in the data is also problematic because banks frequently report identical tax ids for both parent companies and their subsidiaries. This results in different balance sheet information for the same tax id because the balance sheet information is attributed to two distinct firms. For robustness in all of our regressions, we remove the loan amounts to identified subsidiaries and find that the results are qualitatively the same.

3.2.2 Firm and Loan Level Outcomes

Tables 2, 3, and 4 provide summary statistics for a number of firm balance sheet variables and loan-level information on pricing, collateral and maturity. These summary statistics suggest that financial constraints are tighter for private than public firms.

Table 2 shows that the average private firm has $137 million in assets compared to $10 billion for the average public firm. The average private borrower is more levered in terms of short term debt leverage and has higher sales growth and investment than the average public firm. The average private firm does not access other financing sources than banks. They have almost no outstanding bonds, nor any other form of security outstanding–for example, commercial paper, privately placed or expired bond. By contrast, a large part of publicly listed firms have current bonds outstanding (34 percent) and almost all have issued some form of security (99 percent).

Table 3 compares firms along the size distribution and leverage dimensions. The Table shows that SMEs have average assets of $18.5 million compared to the average large firm–defined by the upper quartile of the asset distribution–with $1.8 billion, and have slightly higher sales growth. Large firms are more leveraged than SMEs. In general, sales growth and investment are similar among high and low leveraged firms, for all firms and for SMEs.

Finally, Table 4 shows that private borrowers pay higher interest rates on their loans than public borrowers, despite almost always collateralizing loans. Accounts receivable and inventory and blanket liens are the most common forms of collateral used by private firms.

Table 1: Summary Statistics – Bank Level

	(1) 1st Qu.	(2) Median	(3) Mean	(4) 3rd Qu	(5) SD
Liabilities-to-Assets	0.868	0.884	0.882	0.897	0.024
Short-Term-Debt-to-Assets	0.690	0.769	0.727	0.808	0.14
Charge-off$_b$ (millions)	0	10.415	22.618	29.295	38.887
Charge-off/Loan$_b$	0	2.645	5.857	7.347	10.351

Note: This table reports bank level statistics for the 39 banks that report loan and borrower information on the FR Y-14Q used in the analysis. Liabilities-to-assets use total liabilities and the short-term-debt-to-assets ratio uses only financial debt liabilities due within one year. Charge-off is the cumulative dollar value of all net charge-offs across all outstanding loans on a bank's balance sheet. Charge-off/loan is the ratio of the cumulative charge off associated with a given loan over the remaining committed value of the loan. Source Y9C and FR Y-14Q H.1.

Table 2: Summary Statistics – Firm Level

	(1) All Firms	(2) Private Firms	(3) Public Firms
Levels (millions $)			
Fixed Assets	169.575	38.673	6298.168
Capital Expenditures	650.642	20.965	19611.266
Total Assets	419.795	137.144	10012.128
EBITDA	60.842	17.764	1518.326
Ratios			
Liabilities-to-Assets	0.626	0.627	0.582
Account Receivable-to-Sales	0.117	0.092	0.957
Inventory-to-Sales	0.112	0.102	0.433
Short-Term-Debt-to-Assets	0.140	0.144	0.014
Δ Fixed Assets/Fixed Assets	0.133	0.134	0.093
Sales Growth	0.017	0.350	0.313
Share of firms issuing bond	0.012	0.006	0.337
Share of firms issuing securities	0.060	0.040	0.990

Note: This table reports mean of firm balance sheet and income statement variables by firm type. The sample includes 155,600 U.S. firms for the period 2013-2019, excluding financial and government owned firms such as utilities, and 2,043,008 firm-quarter pairs. All dollar amounts in the table are expressed in millions. Liabilities-to-Assets is defined as total liabilities over total assets while short-term-debt-to-assets is defined as total short-term financial debt over total assets. Δ fixed assets is defined as the annual change in fixed assets. Sales growth is defined at the annual percentage change in total sales. Private firm accounting and income statement data come from the FR Y-14 H.1 Schedule and are winsorized at 4 percent; public firm data are from the S&P Compustat database and are winsorized at 1 percent. Refer to Table A.1 in the Appendix for additional variable definitions.

4 Empirical Analysis

In this section, we map monetary policy surprise shocks to firm-bank and loan-level credit outcomes to understand the role that firm, bank, and collateral heterogeneity play in monetary policy transmission.

4.1 Measuring Monetary Policy Surprises

We estimate monetary policy surprises, denoted with 'MP', following the high frequency methodology of Gürkaynak, Sack, and Swanson (2005). In particular, we compute the surprise component of a policy announcement at the monthly level as:

$$MP_t^m = \gamma_t \times \left(\text{ffr}_t^m - \text{ffr}_{t-\Delta t}^m\right); \gamma_t \equiv \frac{\tau^n}{\tau^n - \tau^d} \tag{1}$$

where m denotes the month, ffr_t is the implied Fed Funds Rate from a Federal Funds future contract at time t, and the adjustment factor, γ_t, controls for the timing of the announcement

Table 3: Summary Statistics by Firm Size and Leverage – Firm Level

			All Firms		SME	
	(1) All SME	(2) Large	(3) High Leverage	(4) Low Leverage	(5) High Leverage	(6) Low Leverage
Levels (millions $)						
Fixed Assets	6.647	449.472	147.622	168.480	7.404	5.922
Capital Expenditures	2.693	496.268	153.077	209.865	1.919	2.832
Total Assets	18.527	1086.888	357.883	426.988	17.711	17.990
EBITDA	2.543	157.381	56.009	65.165	2.437	2.354
Ratios						
Liabilities-to-Assets	0.614	0.643	0.784	0.492	0.794	0.474
Account Receivable-to-Sales	0.100	0.147	0.087	0.125	0.072	0.115
Inventory-to-Sales	0.105	0.125	0.120	0.100	0.114	0.094
Short-Term-Debt-to-Assets	0.136	0.144	0.247	0.045	0.241	0.049
Δ Fixed Assets/Fixed Assets	0.141	0.102	0.108	0.123	0.097	0.132
Sales Growth	0.363	0.318	0.361	0.371	0.373	0.373
Observations						
Firms	116157	55843	88882	105325	62936	78350
Firm-Quarter	1267683	766629	884048	1080736	526547	691637

Note: This table reports mean of firm balance sheet and income statement variables by firm size. See Table 2 for the definition of variables. 'SME' are firms with sales less than 50 million on average throughout the sample. 'High Leverage' firms those with leverage greater than the median leverage in the sample on average. Refer to Table A.1 in the Appendix for additional variable definitions.

Table 4: Summary Statistics – Loan Level

	(1) All Firms	(2) Private Firms	(3) Public Firms
Interest Rate (Percent)	2.80	3.00	1.90
Collateral: Fixed assets and real estate	0.243	0.266	0.14
Collateral: Cash and marketable sec	0.024	0.022	0.034
Collateral: Act. receiv. and inventory	0.284	0.308	0.172
Collateral: Blanket lien and other	0.304	0.322	0.224
Collateralized	0.854	0.916	0.567
Maturity (in years)	3.079	3.1	2.994

Note: This table reports loan-level mean of each variable. The collateral categories are the fraction of total loans collateralized by each respective category. For example, among all firms, 24 percent of all loans are collateralized by fixed assets and real estate. Collateralized is the fraction off all loans that are collateralized by any collateral category. For example, among all firms, 85.4 percent of loans are collateralized.

within the month. τ^n is the number of days in the month of the FOMC meeting, and τ^d is the day of the FOMC meeting.[10] It is common to use a combination of current month, 3-month ahead and 6-month ahead futures. Our data begin in 2012Q4 when policy rates were

[10]Note that the multiplier becomes quite large for FOMC events at the end of the month. This could magnify measurement errors. When the adjustment factor is greater than 4, we follow Gürkaynak, Sack, and Swanson (2005) and replace the adjustment factor with the rate change in the following month federal futures contract without a multiplier.

operating at the zero-lower bound (ZLB). Thus, the size of the raw surprises from 1 month or 3 month futures are small, and insufficient to identify the impact of monetary policy on credit outcomes. To address this issue, we use the 6-month ahead and 9-month ahead futures contract following the work by Miranda-Agrippino and Rey (2020) and Kalemli-Ozcan (2019), who both study international spillovers of U.S. monetary policy during the ZLB.[11] To extract the surprise component, we measure price changes of the futures 15 minutes before and 45 minutes after the FOMC.

We follow Ottonello and Winberry (2020) and convert the surprise series to a quarterly variable using a weighted moving average of the surprises based on the number of days in the quarter after the surprise has occurred. We plot these in Figure 5 below. This ensures that the surprises are weighted according to the amount of time banks and firms have to react to the changes.

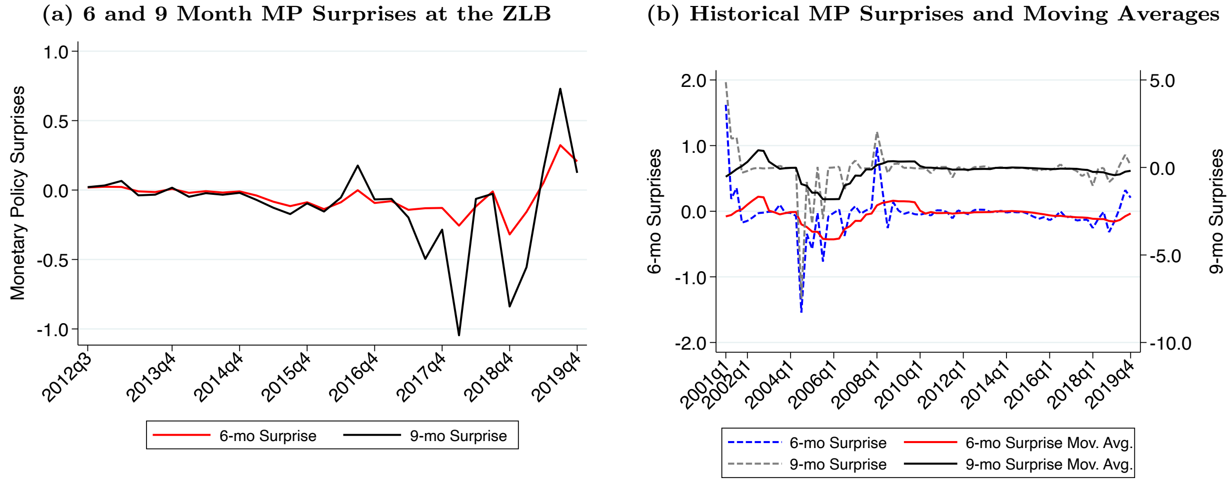
When we analyse the dynamic impulse responses of credit outcomes to policy surprises via local projections, we use these quarterly surprises shown in Figure 5 directly. For the OLS regressions that deliver average effects, we construct 4 and 8-quarter moving averages of the quarterly surprises. The moving average representation allows for monetary policy to have delayed and persistent effects. For example, Romer and Romer (2004) find that monetary policy transmits to real variables and prices with a several quarters' delay and has persistent effects over twenty quarters in the future. Hence, a moving average representation of the quarterly surprises links the surprises to the intermediate-term stance of the monetary policy. Both the surprises and the policy stance were largely expansionary during our sample period.

4.2 Measuring Leverage

We measure firm leverage as in Ottonello and Winberry (2020) since these authors show that firm leverage is a good proxy for firm default risk, which is informative for borrowing capacity and credit costs. Since these authors show this only for public firms, below we replicate their results for public firms and extend them to our private firms. As shown below, firm leverage predicts default, both unconditionally and conditional on having non-performing loans, for both set of firms. These results go through regardless how we measure firm leverage: based on short-term debt to total assets or total debt total assets. For the default risk predictability regressions, we measure firm leverage every quarter but for our main monetary policy transmission regressions we use firm and bank leverage "ex-ante" that

[11] If we use price changes in 2-year treasuries, we obtain similar results. These results are available upon request.

Figure 5: Quarterly Monetary Policy Surprises



Note: This figure plots monetary policy surprises in percentage points following the quarterly aggregation of Ottonello and Winberry (2020). Panel (a) plots the surprise component of the 6-mo and 9-mo feds funds future during our period and panel (b) plots the historical-moving average of the same shocks to compare the size of the shocks during the ZLB period vs before.

is we measure pre-leverage in the first quarter before monetary policy shocks take place.

Table 5: Firm Leverage and Default

	Default Probability								
	All Firms			*Private Firms*			*Public Firms*		
Firm Leverage$_{q-1}$	0.0448***		0.0496***	0.0412***		0.0367***	0.1044***		0.1266***
	(0.0028)		(0.0074)	(0.0027)		(0.0063)	(0.0214)		(0.0327)
Non-Performing Loan$_{q-1}$		0.0181***	0.0175**		0.0525***	0.0519***		0.0002	-0.0007
		(0.0049)	(0.0048)		(0.0115)	(0.0114)		(0.0038)	(0.0038)
Observations	1656049	535836	535836	1454694	415830	415830	201355	120006	120006
Adjusted R^2	0.601	0.810	0.811	0.601	0.822	0.822	0.576	0.663	0.673
Firm F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: This table reports the results of regressing firms i's loan-weighted default probability in quarter q on its lagged leverage ratio and a non-performing loan dummy. The loan-weighted default probability is the each bank's one-year ahead default probability for firm i weighted by the loan commitment amount for each bank. The non-performing loan dummy is equal to 1 if a firm has any non-performing loans in the prior period. The results are reported for all firms in the sample, and for the private and public firm samples. All regressions contain firm and time fixed effects.

4.3 Firm-Bank Level Regressions

We start with aggregating all loans between a firm and a bank to the pair level. The two dependent variables are the credit amount borrowed and interest rates paid by firm f and bank b. We run the below regressions to understand differential transmission of monetary policy by high and low leverage firms.

The baseline regression is the following:

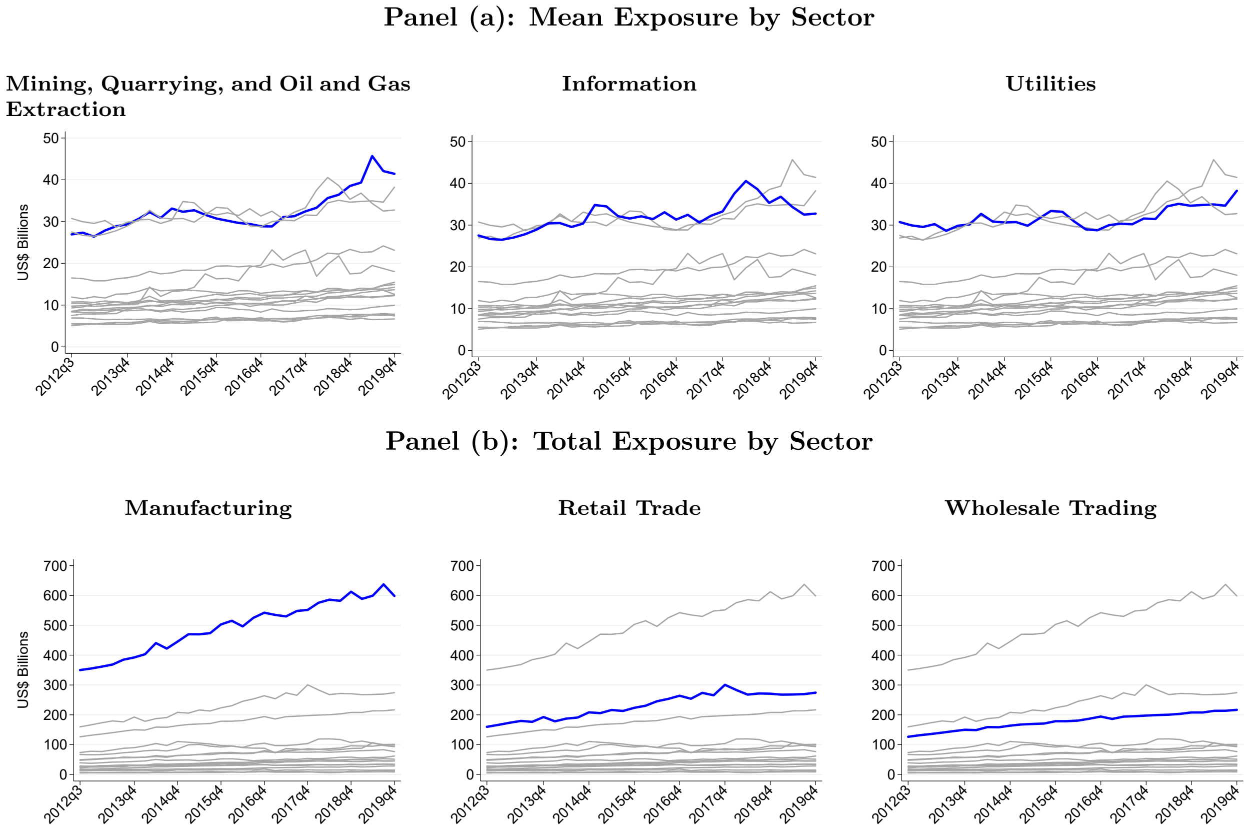
$$\log \sum_{l \in \mathcal{L}(f,b,q)} Y_{f,b,q}(l) = \alpha_{f,b} + \alpha_{b,q} + \alpha_{s,q} + \kappa \left(\textbf{High Leverage Firm}_f \times \frac{1}{N} \sum_{k=0}^{N} \text{MP}_{q-k} \right) + \vartheta_{f,b,q} \tag{2}$$

where $\log \sum_{l \in \mathcal{L}(f,b,q)} Y_{f,b,q}(l)$, is either the total loan amount, $\mathcal{L}$, or weighted average of one plus the loan interest rate, $(1 + i_{f,b,q})$ for a given bank-firm pair, (b, f) and quarter (q). Loan interest rates between pairs are computed as a weighted average based on the dollar value of the loan because different loans may have different rates for a given bank-firm pair. $\alpha_{f,b}$ is the firm×bank fixed effect and $\alpha_{b,q}$ is the bank×quarter fixed effect, which soak up the cross-sectional variation in banking relationships and time variation in differential bank credit supply. N captures either a 4 or 8-quarter moving average, indexed by k. On the left-hand side, we consider the log of total loans to allow expansionary monetary policy to create new firm entry into the credit market. A Δ log formulation (credit growth for a given firm) restricts the analysis to existing firms throughout the sample, which misses an important monetary policy objective. The interest rate contains a risk-free rate, which is LIBOR over 80 percent of the loans, plus an idiosyncratic credit spread. Time fixed effects absorb the common risk-free rate, and direct effect of monetary policy and hence all variation comes from the idiosyncratic risk spread in the interest rate variable.

We use sector× year fixed effects given by $\alpha_{s,q}$. This is important given the large differences in loan outcomes across sectors. Figure 6 shows the average and total dollar amounts committed to each two-digit NAICS sector in Panels (a) and (b) respectively. The Figure shows that, on average, the largest loans are committed to firms in the utilities; information; and mining, quarrying, and oil and gas extraction sectors. By contrast, aggregate commitments are largest for firms in the manufacturing and wholesale and retail trade sectors, indicating that there are many small loans to a large number of businesses in these sectors.

Why should monetary policy affect high and low leverage firms differentially? As in Ottonello and Winberry (2020), we show above that firm leverage is a good proxy for firm default risk, which is informative for borrowing capacity and credit costs. We have also shown above that high and low leverage firms have similar sales and investment growth, hence the impact of monetary policy on these firms' credit demand should also be similar unless monetary policy changes the borrowing costs and hence borrowing capacity differentially for high and low leverage firms. The leverage variable is time-invariant to ensure that leverage is measured ex-ante before the monetary policy surprise shock. Specifically, 'High Leverage Firm' is a dummy equal to one for firms with leverage in the first quarter of the sample (or

Figure 6: Loan Commitments by Sector



Note: Panel (a) plots the mean dollar value of loan commitments made by CCAR banks to firms by the borrower's primary 2-digit NAICS industry. Panel (b) plots the total dollar value of committed loans made by CCAR banks to firms by the borrower's primary 2-digit NAICS industry. Source: FR-Y14Q H.1.

average leverage) higher than the median leverage, and zero otherwise. Moreover, we use two leverage measures: short term debt to total assets and total debt to total assets, yielding similar results.

4.4 Results: Firm Leverage and Firm Size

Table 6 shows the baseline credit demand results for quantity (columns (1)-(3)) and price (columns (4)-(6)). Top row uses MP surprises based on 6 month futures and bottom row uses the surprises based on 9 month futures. Columns (1) and (4) show that a surprise monetary expansion leads more levered firms to borrow more at higher spreads, consistent with improved borrowing capacity and increased credit demand.[12] The interpretation that

[12]Similar results are obtained using total loan utilization rather than commitments; the coefficient is -0.7852 and a std. deviation of 0.175 on the interaction term of high leverage and MP surprises-6mo in all U.S. firms sample.

the effects are demand driven is supported by two observations. First, prices and quantities move in the same rather than opposite direction. Second, including bank×time fixed effects absorbs supply side variation and allows variation in demand to drive the results. The interpretation that the relatively higher cost of credit (higher spreads) for high leverage firms as purely a credit demand driven effect is under the assumption that monetary expansions reduce spreads of all firms. The higher cost of credit of high leverage firms can also simply reflect the higher default risk of these firms. Or expansionary policy reduces spreads more for low leverage firms. Our collateral results in Section 4.5 will help sort out the exact mechanism underlying these results.

The aggregate results in columns (1) and (4) are entirely driven by private rather than public borrowers. Columns (3) and (6) show that credit demand among public firms does not respond differently to monetary policy surprises based on their leverage, though highly levered public firms borrow at lower cost, opposite of the private firm result when we use 6 month surprises. This is is not a robust result though, as for the 9 month surprises this effect goes away statistically, where the sign remains positive. If these public firms respond less to monetary expansions due to their higher default risk, as shown by Ottonello and Winberry (2020), then it is not surprising that they borrow at lower cost driven by their lower demand for credit. Note that without loan-level data and the use of firm×time and bank×time fixed effects, one cannot differentiate between credit demand vs. credit supply driven effects.

Table 6: Monetary Policy and Credit Outcomes: The Role of Firm Leverage

	Quantity: Log(Loan)			**Price: Log(1+i)**		
	(1) All	(2) Private	(3) Public	(4) All	(5) Private	(6) Public
High Leverage Firm × MP Surprise-6mo$_q$	-0.4212***	-0.8478***	-0.0498	-0.0262***	-0.0395***	0.0156**
	(0.0772)	(0.1221)	(0.2075)	(0.0027)	(0.0035)	(0.0046)
Observations	2460475	2140482	319985	2472261	2150197	322056
Adjusted R^2	0.945	0.939	0.837	0.768	0.768	0.676
High Leverage Firm × MP Surprise-9mo$_q$	-0.5212***	-0.6175***	-0.0198	-0.0262***	-0.0495***	0.0056
	(0.0672)	(0.0632)	(0.2075)	(0.0017)	(0.0030)	(0.0046)
Observations	2460475	2140482	319985	2472261	2150197	322056
Adjusted R^2	0.925	0.919	0.817	0.728	0.668	0.656
Bank × Firm F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Bank × Time F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Firm × Time F.E.	No	No	No	No	No	No

Note: $^{+}$ $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. This table presents OLS estimates of (5) at the bank-firm level at a quarterly frequency. Interest rates are weighted by the loan shares for a given firm-bank. Double-clustered standard errors by firm and time are reported in parentheses.

To confirm the results are driven by highly leveraged SMEs rather than unobserved differences between private and public firms, we run the regression equation (5) on the full sample of Y-14 firms and cut the sample on size and leverage to show their importance. Specifically, we define a time-invariant SME dummy equal to one if the average firm's revenue over the sample is less than $50 million. The high leverage dummy is defined as before. The specification also includes the triple interaction term of high leverage, SME, and the monetary policy surprise. We use surprises based on 6 month futures.

Table 7 shows the results. The last row in the table shows that our baseline result is indeed driven by leveraged SMEs. Expansionary monetary policy raises SME borrowing capacity and credit demand. In particular, the significance of the interaction of leverage and monetary policy almost disappears moving from column (1) to (3). Column (6) shows that leveraged SMEs pay even higher spreads than leveraged large firms during monetary expansions, indicative of higher SME credit demand. Interestingly, the coefficient of the interaction between the SME dummy and monetary policy surprise indicates that SMEs borrow and pay less than large firms as a result of monetary policy easing, which suggests SMEs face tighter borrowing constraints and demand less credit in equilibrium than large firms.

Overall, the results show that expansionary monetary policy has a particular effect on the borrowing capacity and credit demand of leveraged SMEs that is not *ex-ante* obvious. In Section 4.5, we dig deeper on the exact form of financial friction to explain the channel on why leveraged SMEs credit demand and borrowing capacity expands in spite of their higher default risk.

4.5 Results: Earnings & Operations Based Collateral

The results so far show that expansionary monetary policy surprises increase the borrowing capacity of leveraged SMEs, in spite of their higher default risk. Following Kiyotaki and Moore (1997), many papers show that financial frictions, in the form of collateral constraints, impact monetary policy transmission and can amplify business cycle fluctuations. In this class of models, firm borrowing is collateralized by a fraction of the resale value of the capital stock in the next period, because of their default risk. Hence the risk does not show up in borrowing costs as spreads in these models but rather in the use of collateral. Monetary policy changes asset values and hence the resale value, expanding and shrinking firm borrowing capacity.

The collateral information reported in the FR Y-14 data allows us to test the impact of monetary policy on credit growth and pricing via *relaxation/tightening* of collateral con-

Table 7: Monetary Policy and Credit Outcomes: The Role of Leverage and Size

	Quantity			*Prices*		
	(1) Log(Loan)	(2) Log(Loan)	(3) Log(Loan)	(4) Log(1+i)	(5) Log(1+i)	(6) Log(1+i)
High Leverage Firm × MP Surprise$_q$	-0.4212***		-0.1503^{+}	-0.0262***		-0.0189***
	(0.0772)		(0.0856)	(0.0027)		(0.0026)
SME × MP Surprise$_q$		0.5530***	1.0737***		0.0140***	0.0288***
		(0.1012)	(0.1984)		(0.0014)	(0.0028)
High Leverage Firm × SME × MP Surprise$_q$			-0.7368***			-0.0199***
			(0.1633)			(0.0032)
Observations	2460475	2460475	2460475	2472261	2472261	2472261
Adjusted R^2	0.945	0.945	0.945	0.768	0.767	0.768
Bank× Firm F.E	Yes	Yes	Yes	Yes	Yes	Yes
Bank× Time F.E	Yes	Yes	Yes	Yes	Yes	Yes

Note: $^{+}$ $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. This table presents results for the OLS regressions for bank-firm pairs using quarterly data for the all sample. The dependent variable in columns (1)-(3) is the natural logarithm of the total committed loan amount for a bank-firm pair; the dependent variable in columns (4)-(6) is the natural logarithm of one plus the nominal interest rate weighted for loan shares for a given bank-firm pair. *SME* is a dummy indicating whether a firm is a SME (less than 50 millions in net sales) or non-SME. Double-clustered standard errors by firm and time are reported in parentheses.

straints based on the different types of collateral pledged to obtain a loan. We start by showing descriptive statistics on collateral that form the basis of the new facts we document in this paper on U.S. credit markets.

4.5.1 Descriptive Statistics on Pledged Collateral

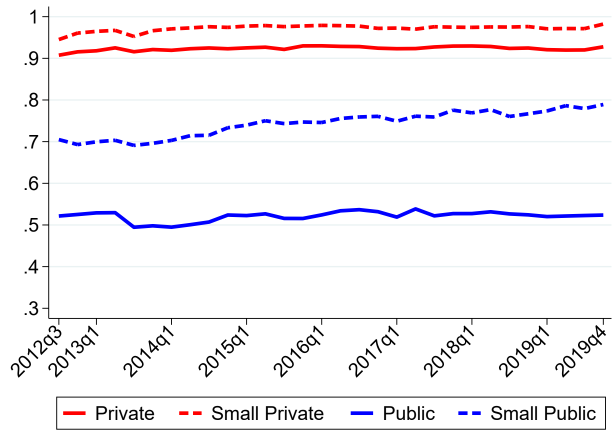
Figure 7 plots the share of loans secured by some form of collateral. 90 percent of all private loans are collateralized (red solid line), compared to roughly 50 percent for public borrowers (blue solid line). Remarkably, 95 percent of all loans to smaller private firms are collateralized (red dotted line), while small public firms collaterize up to 70 percent of the loans (blue dotted line). Hence pledging collateral can be mapped one to one to firm size indicating small firms are more financially constrained than large firms.[13]

The FR-Y14Q data also contains granular information about the type of collateral used to secure a loan. Specifically, the banks report six collateral categories: real estate; fixed assets; cash and marketable securities; accounts receivable and inventory (AR&I); blanket liens, and other. Figure 8 shows loan shares (by value) secured by the different collateral types.[14] There are several remarkable features to highlight. First, real estate collateral (in red) is important only for the smallest private borrowers and virtually absent among public borrowers. Second, fixed assets (light green) as a fraction of all collateralized loans is not

[13] Gopinath, Kalemli-Ozcan, Karabarbounis, and Villegas-Sanchez (2017) show evidence for similar size dependent collateral constraints for European firms.

[14] Appendix Figure 21 shows the same figure based on number of loans instead of value.

Figure 7: Share of Loans that are Collateralized: Public vs. Private



Note: The figure reports the share of loans that are collateralized, for private (red) and public (blue) borrowers. The solid line is the share of total loans collateralized for the private and public firm samples. The dashed line represents the share of total loans that are collateralized for firms in the 25th percentile of the asset distribution (small), for both the private and public firm sample. Source: FR Y-14Q H.1

an important source of collateral and may only reflect leases (Eisfeldt and Rampini, 2008). Third, AR&I (dark green) and blanket liens (light blue) are equally important collateral sources across the firm size distribution except for the medium and large public companies. In fact AR&I and blanket lien collateral are the most important collateral for all private firms and the smallest public firms. Finally, unsecured borrowing (dark blue) increases monotonically across firm size and dominates the borrowing pattern of large public firms. Appendix Figure 20 zooms in on SMEs and shows the same collateral break down. As expected, the figure mimics the pledged collateral by small private and medium private firms, and shows that the most important form of collateral used to borrow by financially constrained SMEs are AR&I and blanket liens.

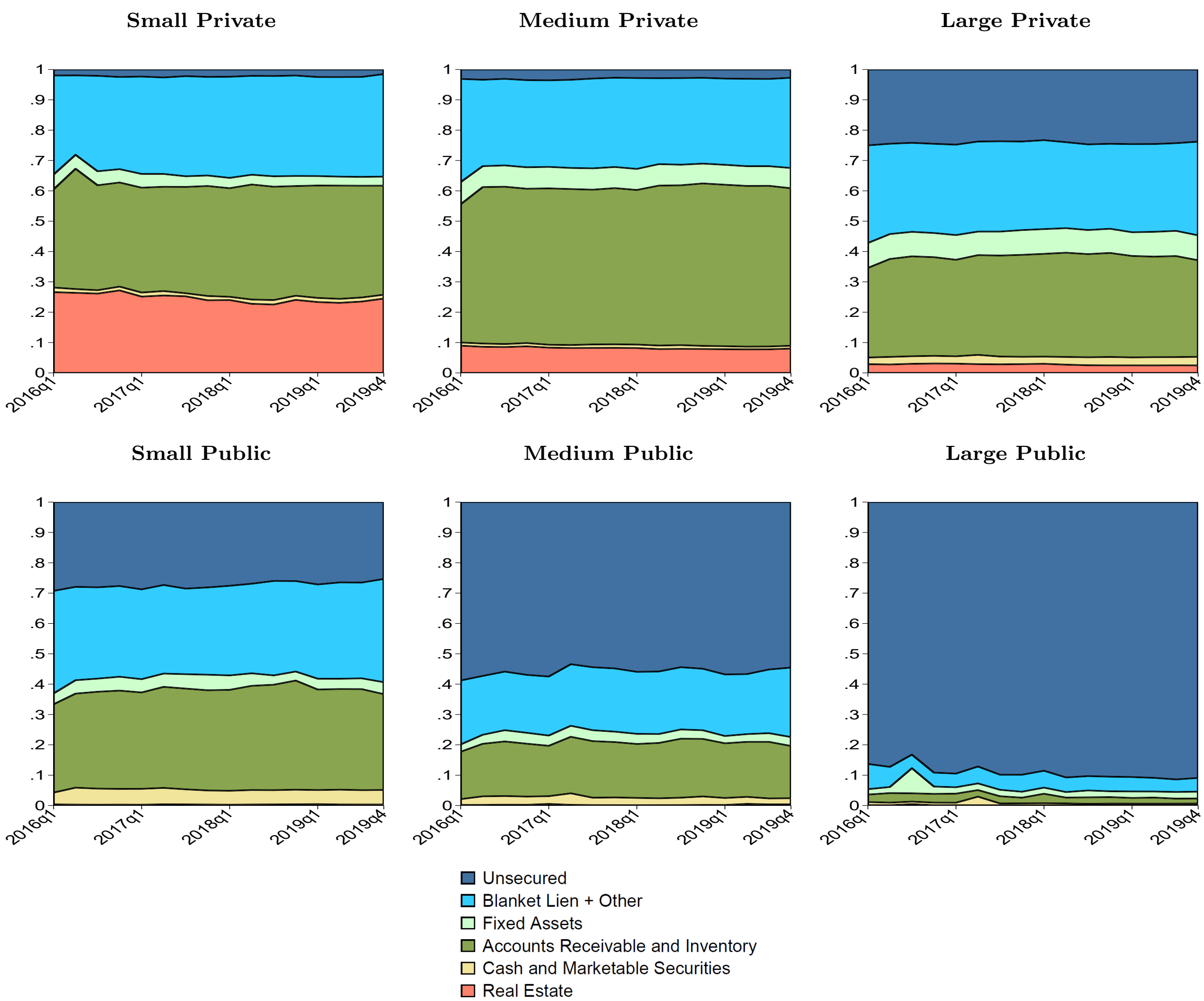
4.5.2 Regression Results: Collateralization

To investigate the role of loan-specific collateral, we start by running an extensive margin regression:

$$\log \mathrm{Y}_{l,f,b,q} = \alpha_{f,b,q} + \alpha_{s,q} + \beta \textbf{Collateralized Dummy}_l + \lambda(\textbf{Collateralized Dummy}_l \times \mathrm{MP}_q) + \vartheta_{l,f,b,q} \tag{3}$$

where we use loan-level quantities and interest rates, as dependent variables, without aggregating to the firm-bank pair level. The decision to collaterize or not (given by a dummy of 1 in the collateralized dummy variable) in a given period is not exogenous and will depend

Figure 8: Collateral Types Across Firm Size Distribution by Public and Private Firms



Note: The figure plots the value share of loans secured by different collateral types over time. The different types of collateral are cash and marketable securities (yellow); accounts receivable, inventory (green); blanket liens (light blue); fixed assets (mint); real estate (salmon); and unsecured loans (dark blue). The top three panels from left to right show loan values secured by the different collateral types and unsecured for private borrowers in the bottom quartile of assets (small), between the bottom and top quartile of assets (medium), and above the top quartile of assets (large). As an example, we add up the value of all loans for firms below the bottom quartile (Total Loan Value$_t$). We then add up the value of all loans for firms within each quartile and loan category (Total Loan Value$_{ct}$). The graph shows at each point in time the share of loan value accounted for each category Share$_{ct}$ = Total Loan Value$_{ct}$/Total Loan Value$_t$. The bottom three panels present the same information for public borrowers. Source: FR Y14-Q H.1.

on both firm and bank factors as the decision to lever-up. Hence, we use the same strategy in our leverage regressions and define a time-invarying collateralization dummy as of first quarter of the sample. The loan contract specifies the collateral in the first quarter and then MP surprises take place during the sample period. We identify from loans during the sample period drawn based on the initial collateral. Since there are new loan originations with new collateral during our sample period, we also use average collateral. Furthermore in addition to firm×quarter and bank×quarter fixed effects, we can also use firm×bank×quarter fixed effects, $\alpha_{f,b,q}$, in these loan-level regressions. These effects strengthen the identification as it controls all time varying firm and bank factors that collateralization decision is endogenous too. Though this strategy requires multiple loans over time for a given firm-bank pair. Over 50 percent of our firms have multiple loans from their banks.

We begin by running the regression equation (4) using a collateral dummy variable equal to one if the loan is collateralized and zero otherwise, regardless of the *type* of collateral pledged. The results highlight a stark difference in the way that pledging collateral interacts with access to and pricing of credit across firm types. Tables 8 and 9 show that for private borrowers, collateralizing a loan is associated with improved access to credit and lower prices. The opposite is true for public borrowers: collateralization is associated with lower loan amounts and higher prices. The first row in each table captures the effect of collateralizing a loan during normal times, using different sets of fixed effects. The results show that the positive (negative) association between collateral and loan quantity (price) holds regardless of which fixed effects are included. Hence, the results are robust to variation coming from demand or supply side.

To assess the impact of monetary policy on demand and supply of credit, we interact the collateral dummy variable with the policy surprises. The results are shown in the second row of Table 8 and 9. The negative coefficient of the interaction term in the first three columns of Table 8 implies that expansionary monetary policy strengthens the 'access to finance' effect of collateralizing loans for private firms. The negative coefficient on the interaction term for the last three columns indicates that effect of collateral in reducing prices is lower during monetary expansions. In other words, firms can pledge less collateral to lower spreads during expansions. The result should not be surprising because monetary policy narrowed spreads significantly during this period.

Table 9 shows that, for public firms, expansionary policy mitigates but does not reverse the negative relationship between collateral and credit. Moreover, expansionary monetary policy amplifies the positive relation between collateral and spreads. Public firms who pledge collateral borrow less and pay higher spreads in response to expansionary monetary policy surprises. The impact on credit spreads is stronger in the firm credit demand regression (column (4)). The interpretation is that distressed public firms pay higher spreads if their credit demand increases. Given that most public firms borrow unsecured, the higher cost of secured credit most likely reflects the monitoring costs associated with secured debt.

Table 8: Monetary Policy and Loan Level Outcomes: Private Firms

	Quantity			*Prices*		
	(1) Log (Loan)	(2) Log (Loan)	(3) Log (Loan)	(4) Log $(1+i)$	(5) Log $(1+i)$	(6) Log $(1+i)$
Collateralized	0.2888***	0.3467***	0.4181***	-0.0023***	-0.0045***	-0.0058***
	(0.0353)	(0.0523)	(0.0606)	(0.0005)	(0.0009)	(0.0012)
Collateralized × MP Surprise$_q$	-0.9698***	-2.1818***	-2.3107***	-0.0130***	-0.0190*	-0.0264*
	(0.1719)	(0.3730)	(0.4394)	(0.0033)	(0.0073)	(0.0105)
Observations	2984365	1563912	1371794	3128248	1564644	1377795
Adjusted R^2	0.724	0.454	0.282	0.634	0.428	0.357
Bank×Firm F.E	Yes	Yes	No	Yes	Yes	No
Bank×Time F.E	Yes	No	No	Yes	No	No
Firm×Time F.E	No	Yes	No	No	Yes	No
Bank×Firm×Time F.E	No	No	Yes	No	No	Yes

Note: $^+$ $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. This table presents the results of OLS regressions for the effect of collateral using loan level data at a quarterly frequency, for private firm sample. The dependent variable in columns (1) through (3) is the natural logarithm of the total committed loan amount; the dependent variable in columns (4) through (6) is the natural logarithm of the nominal real interest rates. $Collateralized_q$ is a dummy variable equal to one if the loan is collateralized, and zero otherwise. Double-clustered standard errors by firm and time are reported in parentheses.

Table 9: Monetary Policy and Loan Level Outcomes: Public Firms

	Quantity			*Prices*		
	(1) Log (Loan)	(2) Log (Loan)	(3) Log (Loan)	(4) Log $(1+i)$	(5) Log $(1+i)$	(6) Log $(1+i)$
Collateralized	-0.6190***	-0.6384***	-0.8910***	0.0074***	0.0081***	0.0108***
	(0.0481)	(0.0490)	(0.0770)	(0.0006)	(0.0006)	(0.0009)
Collateralized × MP Surprise$_q$	-0.6125*	-0.4756	-2.0066*	-0.0233***	-0.0157*	-0.0092
	(0.2575)	(0.3938)	(0.7709)	(0.0050)	(0.0069)	(0.0100)
Observations	644446	634710	485440	639445	629677	481327
Adjusted R^2	0.506	0.490	0.284	0.479	0.513	0.378
Bank×Firm F.E	Yes	Yes	No	Yes	Yes	No
Bank×Time F.E	Yes	No	No	Yes	No	No
Firm×Time F.E	No	Yes	No	No	Yes	No
Bank×Firm×Time F.E	No	No	Yes	No	No	Yes

Note: $^+$ $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. This table presents the results of OLS regressions of the effect of collateral using loan level data at a quarterly frequency, for the public firm sample. The dependent variable in columns (1) through (3) is the natural logarithm of the total committed loan amount ; the dependent variable in columns (4) through (6) is the natural logarithm of the nominal real interest rates. $Collateralized_q$ is a dummy variable equal to one if the loan is collateralized, and zero otherwise. Double-clustered standard errors by firm and time are reported in parentheses.

4.5.3 Regression Results: Collateral Types

The next set of results replace the single collateral dummy with dummies for different collateral categories. Hence we run:

$$\log \mathrm{Y}_{l,f,b,q} = \alpha_{f,b,q} + \alpha_{s,q} + \beta \textbf{Collateral Type Dummy}_l + \lambda(\textbf{Collateral Type Dummy}_l \times \mathrm{MP}_q) + \vartheta_{l,f,b,q} \tag{4}$$

Each dummy is equal to one when a loan is collateralized with that type of collateral and zero otherwise. To reduce the number of the categories, we combine fixed assets with real estate collateral because they represent physical assets. The 'unsecured' category remains omitted.

The results are reported in Table 10 for private firms and in Table 11 for public firms. For private firms, the result that collateralizing improves access to credit at a lower price is associated with three types of collateral, regardless of fixed effects: cash, AR&I, and blanket liens. We argue that the values of these three types of collateral are inextricably linked to firm earnings and operations. During monetary expansions, the access to finance effect comes from AR&I and blanket lien collateral, though fixed assets and real estate collateral also improve access to finance in the supply regression and when using within-loan variation. In terms of spreads, pledging AR&I collateral reduces loan spreads during monetary expansions, showing the importance of operations-based collateral.

For public firms, Table 11 shows that all collateral types signal distress—less credit and higher spreads—regardless of which fixed effects are included. During monetary policy expansions, pledging cash, AR&I, and blanket liens mitigates the negative impact on loan quantities–there is no effect coming from fixed assets and real estate. That said, the total effect shows that public firms borrow less when pledging all types of collateral during expansions (relative to unsecured). Finally, the effect on spreads is amplified when pledging blanket lien and AR&I collateral. In other words, public firms pay higher spreads during monetary expansions when they pledge these types of collateral. Pledging cash, fixed assets, and real estate during monetary expansions partially mitigates the negative distress effect.

The collateral-type results suggest "collateral pecking order". For both sets of firms, AR&I and blanket liens seem to be the most valuable collateral-types, and they work exactly the same way. Importantly, for private firms, these two types of collateral drive all the access to finance results. Why is this the case?

The values of AR&I and blanket lien collateral are both tied to firm earnings and operations in an important way that other fixed assets, such as real estate and machines, are

Table 10: The Role of Collateral: Private Firms

	Quantity			*Prices*		
	(1) Log (Loan)	(2) Log (Loan)	(3) Log (Loan)	(4) Log $(1+i)$	(5) Log $(1+i)$	(6) Log $(1+i)$
Fixed assets and real estate	0.0362	-0.0298	0.0332	0.0015**	0.0009	-0.0000
	(0.0324)	(0.0433)	(0.0494)	(0.0005)	(0.0009)	(0.0012)
Cash and marketable sec.	0.2225***	0.3331***	0.3270***	-0.0049***	-0.0070***	-0.0093***
	(0.0361)	(0.0536)	(0.0713)	(0.0006)	(0.0010)	(0.0013)
Act. receiv. and inventory	0.5424***	0.7790***	0.8924***	-0.0046***	-0.0082***	-0.0102***
	(0.0406)	(0.0509)	(0.0535)	(0.0006)	(0.0010)	(0.0013)
Blanket lien and other	0.3668***	0.4817***	0.5787***	-0.0024***	-0.0046***	-0.0053***
	(0.0332)	(0.0431)	(0.0514)	(0.0005)	(0.0008)	(0.0010)
Fixed assets and real estate × MP Surprise$_q$	-0.0606	-1.0468***	-1.1313**	-0.0008	-0.0107*	-0.0178*
	(0.0811)	(0.2082)	(0.2485)	(0.0017)	(0.0051)	(0.0072)
Cash and marketable sec. × MP Surprise$_q$	-0.1948	-0.9140**	-0.7354+	0.0009	-0.0040	-0.0054
	(0.1258)	(0.2931)	(0.4310)	(0.0026)	(0.0062)	(0.0093)
Act. receiv. and inventory × MP Surprise$_q$	-1.0223***	-2.1088***	-2.3031***	-0.0118***	-0.0135*	-0.0227**
	(0.1391)	(0.3011)	(0.3342)	(0.0026)	(0.0052)	(0.0077)
Blanket lien and other × MP Surprise$_q$	-0.5070***	-0.9747***	-0.6990*	-0.0018	-0.0105*	-0.0120+
	(0.1064)	(0.2348)	(0.3015)	(0.0018)	(0.0045)	(0.0065)
Observations	2650313	1362500	1192230	2781417	1365280	1199252
Adjusted R^2	0.734	0.472	0.307	0.647	0.442	0.376
Bank×Firm F.E	Yes	Yes	No	Yes	Yes	No
Bank×Time F.E	Yes	No	No	Yes	No	No
Firm×Time F.E	No	Yes	No	No	Yes	No
Bank×Firm×Time F.E	No	No	Yes	No	No	Yes

Note: $^+$ $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. This table presents the results of OLS regressions of the effect of collateral type using loan level data at a quarterly frequency, for the private firm sample. The dependent variable in columns (1) through (3) is the natural logarithm of the total committed loan amount ; the dependent variable in columns (4) through (6) is the natural logarithm of the nominal real interest rates. The dependent variables are dummy variables equal to one if the loan is collateralized by specific type of collateral, zero otherwise; we drop the category "Unsecured". The coefficients for the collateral types are calculated but not displayed. Double-clustered standard errors by firm and time are reported in parentheses.

not. In particular, the values of AR&I and blanket lien collateral are not derived from resale value or what lenders can recover in a spot market transaction, which is where the value of fixed assets and real estate lie.[15] Consider one-period debt as in (Kiyotaki and Moore, 1997) where the relationship between collateral value and borrowing is determined by the standard borrowing constraint $Rb_t \leq q_{t+1}k_{t+1}$, where Rb_t is the gross repayment amount on borrowing at time t and k_{t+1} and q_{t+1} are the holdings and price of capital in following period. The subtle but important distinction between tangible assets, such as real estate and machines, and AR&I embedded in the capital stock, k_{t+1}, is that the book value of AR&I collateral only exists because of the firm's ability to create sales that generate the receivables and inventory. In other words, the operations of the firm combine intellectual

[15] According to the standard industry dichotomy, loans secured by AR&I are technically asset-based loans because the advance rate on the loan is based on a fraction of the book value of receivables rather than the future value of receipts. The advance rate for accounts receivable is generally much higher (up to 85 percent of book value) than the advance rate for inventory (only up to 65 percent), which largely reflects differences in the liquidity of the assets. However, most AR&I loans are tied to the "AR" rather than the "I" (See the documentation in the OCC *Comptroller's Handbook on Asset-Based Lending*).

Table 11: The Role of Collateral: Public Firms

	Quantity			*Prices*		
	(1) Log (Loan)	(2) Log (Loan)	(3) Log (Loan)	(4) Log $(1+i)$	(5) Log $(1+i)$	(6) Log $(1+i)$
Fixed assets and real estate	-1.4410***	-1.4400***	-1.8022***	0.0178***	0.0174***	0.0219***
	(0.0609)	(0.0703)	(0.0757)	(0.0009)	(0.0009)	(0.0011)
Cash and marketable sec.	-0.5642***	-0.5283***	-0.7002***	0.0034**	0.0048***	0.0060**
	(0.0633)	(0.0697)	(0.1222)	(0.0011)	(0.0011)	(0.0020)
Act. receiv. and inventory	-0.1679*	-0.2192**	-0.2921*	0.0032***	0.0036***	0.0028*
	(0.0690)	(0.0756)	(0.1187)	(0.0007)	(0.0008)	(0.0013)
Blanket lien and other	-0.3759***	-0.3934***	-0.5355***	0.0045***	0.0052***	0.0073***
	(0.0483)	(0.0505)	(0.0913)	(0.0005)	(0.0005)	(0.0009)
Fixed assets and real estate × MP Surprise$_q$	1.0635*	0.9617$^+$	-0.3164	0.0139	0.0060	0.0275*
	(0.4006)	(0.5166)	(0.8001)	(0.0097)	(0.0105)	(0.0127)
Cash and marketable sec. × MP Surprise$_q$	-1.7177**	-1.6142*	-2.5546$^+$	0.0041	0.0216$^+$	0.0760**
	(0.5340)	(0.6360)	(1.4276)	(0.0102)	(0.0116)	(0.0246)
Act. receiv. and inventory × MP Surprise$_q$	-1.7494***	-2.8136***	-5.5757***	-0.0399***	-0.0287***	-0.0465**
	(0.3921)	(0.5887)	(1.1364)	(0.0055)	(0.0072)	(0.0134)
Blanket lien and other × MP Surprise$_q$	-0.7591*	-1.1205*	-2.2961*	-0.0333***	-0.0226**	-0.0203$^+$
	(0.3102)	(0.4592)	(0.9398)	(0.0047)	(0.0065)	(0.0116)
Observations	644446	634710	485440	639445	629677	481327
Adjusted R^2	0.538	0.523	0.339	0.491	0.525	0.398
Bank×Firm F.E	Yes	Yes	No	Yes	Yes	No
Bank×Time F.E	Yes	No	No	Yes	No	No
Firm×Time F.E	No	Yes	No	No	Yes	No
Bank×Firm×Time F.E	No	No	Yes	No	No	Yes

Note: $^+$ $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. This table presents the results of OLS regressions of the effect of collateral type using loan level data at a quarterly frequency, for the public firm sample. The dependent variable in columns (1) through (3) is the natural logarithm of the total committed loan amount ; the dependent variable in columns (4) through (6) is the natural logarithm of the nominal real interest rates. The dependent variables are dummy variables equal to one if the loan is collateralized by specific type of collateral, zero otherwise; we drop the category "Unsecured". The coefficients for the collateral types are calculated but not displayed. Double-clustered standard errors by firm and time are reported in parentheses.

property, managerial talent, marketing, etc. to generate sales and the receipts that serve as collateral. The firm does not purchase this collateral like machines or land, it creates it.

The inability to separate the liquidation value of AR&I from the going-concern value embedded in blanket liens is particularly important for small private borrowers who do not have large amounts of other tangible fixed assets to pledge. In these cases, blanket liens are thus close substitutes for AR&I that also give the lender additional security.[16] Using the trees/machines and fruit/engineers metaphor of Kiyotaki and Moore (1997), fixed assets and real estate are the trees or the machines that firms purchase from one another in the spot market and borrow against for production. Within the firm, managerial know-how and engineers' ability to use tools combines with the machines to generate output or fruit. Hence, AR&I and blanket lien collateral are different from trees/machines, and *are frequently* used as

[16]This intuition that blanket liens and AR&I collateral are substitutes is confirmed in an interview with the CFO of a medium-sized private company, with annual sales of nearly $70mn. They note that in their multiple loan facilities with a large bank, their working capital loans (a standard term for AR&I loans) are secured by a blanket lien on the firm assets, and not just the AR&I.

collateral. Thus, the tree's fruit is not bruised and unusable; it becomes compost providing additional nutrients to generate additional future fruit. In sum, it is not the recovery or liquidation value of AR&I that is important; it is the fact that the value cannot exist outside of firm production.[17]

4.5.4 Regression Results: Earnings and Operations Based vs. Asset Based Collateral

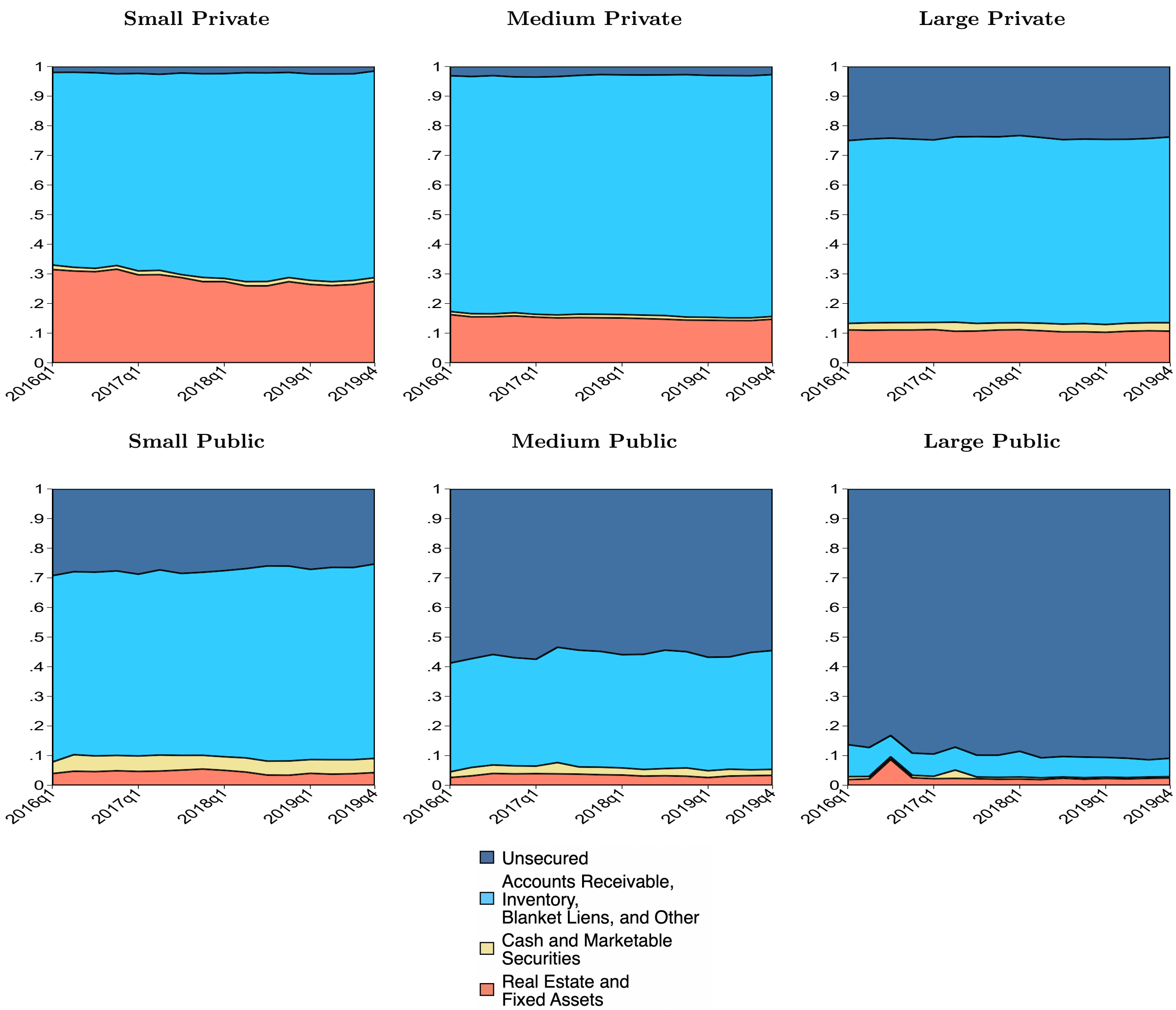
Based on our results shown in above tables, we group AR&I with blanket liens in Figure 9 as 'Earnings and Operations Based Collateral' in light blue. The figure makes clear that, for SMEs and private firms, earnings and operations based collateral dominates all others. The category depicted in orange is real estate and fixed assets. The unsecured category stays in dark blue and cash and marketable securities is in yellow. With this grouping, we create a new dummy variable for 'Earnings and Operations Based Collateral' and horse-race it against 'Asset Based Collateral' comprising of fixed assets and real estate. We rerun our regressions with these two categories, leaving 'unsecured' as the omitted category.

The results are shown in Tables 12 and 13 for private and public firms, respectively. The second row of Table 12 shows clearly that, among private firms, 'Earnings and Operations Based Collateral' drive the access to credit and pricing results. These results hold regardless of what fixed effects are included. The fourth row of the table shows that the expansionary monetary policy effects are driven by this collateral on the pricing side. 'Asset Based Collateral' also has an access to finance role for private firms during monetary expansions, as shown in columns (2) and (3), when bank credit supply variation is used. This is expected since these firms are financially constrained and any collateral will act as a tool for access to finance. However, the impact of 'Earnings and Operation Based Collateral' is stronger because smaller firms do not have sufficient quantities of fixed assets to fully relax their borrowing constraints.

The first two rows of Table 13 show that, for public firms, both types of collateral signal distress. Expansionary monetary policy ameliorates the distress problem, shown in the last row of Table 13, but does not completely reverse it and only for loan quantities when pledging 'Earnings and Operations Based Collateral'. In terms of spreads, both during normal times and monetary expansions, public firms who pledge collateral pay higher spreads than firms

[17] Based on our interviews with SME CEOs, we observe the following: Accounts receivable (AR) account for 20 percent of annual sales among firms with $50-100 million in annual sales. When obtaining working capital loans with "AR&I" collateral, they submit weekly AR and inventory reports to the bank. This means that if they obtain a $1 million revolver now and their AR continues to increase, then they will be eligible for a new revolver with a higher limit. Eligible AR collateral for loans is generally given 60 days in advance, which means that eligible AR collateral that is booked now must be paid within 60 days.

Figure 9: Collateral Type: Public vs. Private (Based on Values)



Note: The figure plots the proportion of loans by value secured by different collateral types over time. The different types of collateral are real estate and fixed assets (in red); cash and marketable securities (in yellow); accounts receivable, inventory, and blanket liens (in light blue); and unsecured loans (in dark blue). The top three panels from left to right show the proportion of loans secured by the different collateral types and unsecured for private borrowers in the bottom quartile of assets (small), between the bottom and top quartile of assets (medium), and above the top quartile of assets (large). As an example, we add up the value of all loans for firms below the bottom quartile (Total Loan_t). We then add up the value of all loans for firms within each quartile and loan category (Total Loan_{ct}). The graph shows at each point in time the share of loan value accounted for each category $\text{Share}_{ct} = \text{Total Loan}_{ct}/\text{Total Loan}_t$. The bottom three panels present the same information for public borrowers. Source: FR Y14-Q H.1.

who borrow unsecured, signalling distress and the cost to monitor secured claims.

The fact that the relationship between pledging collateral and spreads is the opposite for private versus public firms strengthens our argument that collateral is a measure of access to finance for private firms and signals default risk for public firms.[18] Collateral signals

[18]Very small private firms who lack collateral cannot access credit as they are screened out of the market as in Darst, Refayet, and Vardoulakis (2020). Although we do not observe this extensive margin, as our data

Table 12: The Role of Collateral: Private Firms

	Quantity			*Prices*		
	(1) Log(Loan)	(2) Log(Loan)	(3) Log(Loan)	(4) Log(1+i)	(5) Log(1+i)	(6) Log(1+i)
Asset-based	0.0544^{+}	-0.0204	0.0278	0.0009^{+}	-0.0001	-0.0010
	(0.0301)	(0.0458)	(0.0546)	(0.0005)	(0.0009)	(0.0012)
Earnings & Operations-based	0.4106***	0.5765***	0.6912***	-0.0038***	-0.0067***	-0.0085***
	(0.0402)	(0.0545)	(0.0608)	(0.0005)	(0.0009)	(0.0012)
Asset-based × MP$_q$	-0.1172	-1.5071***	-1.5839***	-0.0021	-0.0165*	-0.0260*
	(0.1277)	(0.3319)	(0.4050)	(0.0031)	(0.0077)	(0.0107)
Earnings & Operations-based × MP$_q$	-1.4829***	-2.5766***	-2.5402***	-0.0173***	-0.0203*	-0.0293*
	(0.2144)	(0.4032)	(0.4689)	(0.0035)	(0.0074)	(0.0107)
Observations	2984365	1563912	1371794	3128248	1564644	1377795
Adjusted R^2	0.731	0.474	0.310	0.635	0.435	0.366
Bank × Firm F.E.	Yes	Yes	No	Yes	Yes	No
Bank × Time F.E.	Yes	No	No	Yes	No	No
Firm × Time F.E.	No	Yes	No	No	Yes	No
Bank × Firm × Time F.E.	No	No	Yes	No	No	Yes

Note: $^{+}$ $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. This table presents the results of OLS regressions of the effect of collateral type using loan level data at a quarterly frequency, for the private firm sample. The dependent variable in columns (1) through (3) is the natural logarithm of the total committed loan amount ; the dependent variable in columns (4) through (6) is the natural logarithm of the nominal real interest rates. The dependent variables are dummy variables equal to one if the loan is collateralized by specific type of collateral, zero otherwise. "Asset Based" is a dummy variable equal to one if the collateral pledge is either Real Estate, Fixed Assets or Cash and marketable securities; "Earning and Operation Based" is equal to one if the collateral pledged is either blanket lien, account receivable and inventory or other; we drop the category "Unsecured". The coefficients for the collateral types are calculated but not displayed. Double-clustered standard errors by firm and time are reported in parentheses.

default risk for public borrowers because, otherwise, they are not financially constrained, while small, private firms are. The existing empirical literature finds mixed results on the relation between collateral and spreads, which is due to using different samples of firms and banks. For example, Berger and Udell (1990) use bank-level data and show that collateralized loans have higher interest rates in the U.S. Berger, Frame, and Ioannidou (2016) show the same result in Bolivia. di Giovanni, Kalemli-Ozcan, Ulu, and Baskaya (2019) find the same negative relation as us using data on the universe of firms from Turkey. Luck and Santos (2019), also using FR Y-14 data, show that small firms who post collateral pay lower rates. Using publicly listed firms, Rauh and Sufi (2010) shows that there is a positive relation between posting collateral and being a low quality firm in distress.

4.6 Results: Collateral and Leverage

To recap our results: First, monetary expansions relax constraints for high leverage SMEs. Second, collateral constraints relax the most for 'Earnings and Operations Based Collateral'

is on firms who borrow, our results show that the same intuition works at the intensive margin.

Table 13: The Role of Collateral: Public Firms

	Quantity			*Prices*		
	(1)	(2)	(3)	(4)	(5)	(6)
	Log(Loan)	Log(Loan)	Log(Loan)	Log(1+i)	Log(1+i)	Log(1+i)
Asset-based	-1.2454***	-1.2489***	-1.6386***	0.0146***	0.0148***	0.0195***
	(0.0543)	(0.0607)	(0.0719)	(0.0008)	(0.0008)	(0.0010)
Earnings & Operations-based	-0.3105***	-0.3421***	-0.4388***	0.0041***	0.0048***	0.0054***
	(0.0516)	(0.0538)	(0.0949)	(0.0005)	(0.0006)	(0.0009)
Asset-based × MP_q	0.5611	0.5472	-0.3345	0.0116	0.0088	0.0305*
	(0.3421)	(0.4600)	(0.7612)	(0.0086)	(0.0094)	(0.0120)
Earnings & Operations-based ×MP_q	-1.3400***	-1.7572***	-4.0888***	-0.0364***	-0.0260***	-0.0300**
	(0.2895)	(0.4475)	(0.9127)	(0.0046)	(0.0064)	(0.0106)
Observations	644446	634710	485440	639445	629677	481327
Adjusted R^2	0.530	0.516	0.330	0.486	0.521	0.390
Bank × Firm F.E.	Yes	Yes	No	Yes	Yes	No
Bank × Time F.E.	Yes	No	No	Yes	No	No
Firm × Time F.E.	No	Yes	No	No	Yes	No
Bank × Firm × Time F.E.	No	No	Yes	No	No	Yes

Note: $^{+}$ $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. This table presents the results of OLS regressions of the effect of collateral type using loan level data at a quarterly frequency, for the public firm sample. The dependent variable in columns (1) through (3) is the natural logarithm of the total committed loan amount ; the dependent variable in columns (4) through (6) is the natural logarithm of the nominal real interest rates. The dependent variables are dummy variables equal to one if the loan is collateralized by specific type of collateral, zero otherwise. "Asset Based" is a dummy variable equal to one if the collateral pledge is either Real Estate, Fixed Assets or Cash and marketable securities; "Earning and Operation Based" is equal to one if the collateral pledged is either blanket lien, account receivable and inventory or other; we drop the category "Unsecured". The coefficients for the collateral types are calculated but not displayed. Double-clustered standard errors by firm and time are reported in parentheses.

despite higher default risk.

To show the strong connection between these two sets of results, we go back to our baseline regressions at the firm-bank level without restricting the credit demand or credit supply channels. That is, we do not use fixed effects except $\alpha_{f,b}$ that is bank×firm to take out average differences so we can keep identifying from time-series variation in MP surprises. SInce there are no time fixed effects in this regression, we enter the MP surprises directly. In particular, we run a horse-race regression:

The baseline regression is the following:

$$\log \sum_{l \in \mathcal{L}(f,b,q)} Y_{f,b,q}(l) = \alpha_{f,b} + \beta \frac{1}{N} \sum_{k=0}^{N} \text{MP}_{q-k} + \kappa \left(\textbf{High Leverage Firm}_f \times \frac{1}{N} \sum_{k=0}^{N} \text{MP}_{q-k} \right) \tag{5}$$

$$+ \omega \left(\textbf{High Earnings-Operations Collateral Firm}_f \times \frac{1}{N} \sum_{k=0}^{N} \text{MP}_{q-k} \right) + \vartheta_{f,b,q} \tag{6}$$

'High Earnings and Operations Collateral' equal to one for firms above the median in the distribution of the share of loans collateralized with earnings and operations based collateral, on average. 'High Leverage' dummy defined as before. The results in Table 14 column (1) clearly show that higher earnings and operations collateral firms borrow more relative to other firms during expansionary monetary policy. Column (2) shows the baseline result that high leverage firms borrow more during expansions. Finally, the horse race in column (3) shows that high leverage captures most of the earnings and operations collateral effect because leverage among these firms is tied to earnings and operations based collateral.

Table 14: The Role of Collateral and Leverage

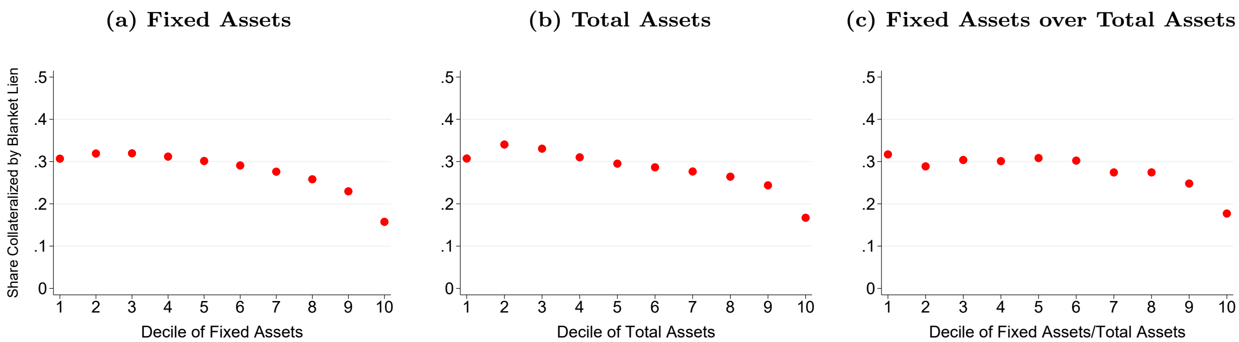
Dep. Var: Log(Loan)	(1)	(2)	(3)
High Earnings and Operations Collateral × MP_q	-0.2363**		-0.1758*
	(0.0843)		(0.0788)
High Leverage Firm × MP_q		-1.1746***	-1.1657***
		(0.1400)	(0.1376)
Observations	2140485	2140485	2140485
Adjusted R^2	0.937	0.937	0.937
Bank × Firm FE	Yes	Yes	Yes
Direct Effect of MP_q	Yes	Yes	Yes

Note: $^+$ $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. This table presents the results of OLS regressions for bank-firm level at a quarterly frequency. High Leverage Firm is a dummy equal to one if the firm leverage is above the sample median and is based on short-term debt. Double-clustered standard errors by firm and time are reported in parentheses.

Why is leverage against earnings and operations based collateral that is composed of AR&I and blanket lien? Technically, blanket liens are loans secured by all firm assets, which gives the lender a legal claim to all of a borrower's business assets in the event of default. A loan secured by a blanket lien will cover the entire firm and all unencumbered assets not already pledged as collateral. However, if a borrower previously pledged specific asset–such as real estate and fixed assets–to secure a loan, then a future loan with a blanket lien is secured only by the firm's remaining unencumbered assets. Accounts receivable and inventory are usually what remain after other fixed assets have been pledged.

Figure 10 shows that use of blanket liens by SMEs is due to a trade-off between lack of physical assets and a desire to borrow but being financially constrained. We plot the share of loans secured by blanket lien for each decile of the fixed assets distribution in panel (a), for each decile of total assets distribution in panel (b) and for each decile of fixed to total assets distribution in panel (c). If blanket lien collateral covers mostly fixed assets, then this relationship should be positive. The data shows that the relationship is negative; larger firms with more fixed assets use fewer blanket liens as collateral to secure funding. Table 15 shows, for the average private firm with existing collateralized loans, the share of subsequent loans secured by different collateral types. For example, the first row shows that, conditional on existing loans being collateralized by non-blanket lien, the share of new loans secured by blanket lien is 19.5 percent. More importantly, conditional on having already encumbered fixed assets and real estate, the share of additional loans secured by AR&I and AR&I and blanket liens 17.2 percent and 35 percent respectively. This evidence further indicates that blanket liens, like AR&I, secure additional loans and do not simply proxy for liens against fixed assets and real estate. This supports our narrative that SMEs lever-up using these type of collateral.

Figure 10: Relation Between Blanket Liens and Fixed Assets for Private Firms



Note: Each panel shows the share of loans secured by blanket liens across: (a) each decile of the fixed assets distribution, (b) each decile of the total assets distribution and (c) each decile of the ratio of fixed assets over total assets. The plots only consider private firms.

Table 15: Multiple Loans Secured by Different Types of Collateral for the Average Private Firm

Share of Additional Loans Collateralized by	
Blanket Lien (1)	0.1950
AR&I (2)	0.1725
AR&I and Blanket Lien (3)	0.3508

Note: (1) Firms with more than one loan and at least one non-blanket lien loan. (2) Firms with more than one loan and at least one fixed assets and real estate loan. (3) Consider firms with more than one loan and at least one fixed assets and real estate loan.

4.7 Aggregation

In this section, we explore the quantitative effects in relation to the lietrature that uses aggregate data.

We start by running the following regression and predict the credit growth:

$$\log \sum_{l \in \mathcal{L}(f,b,q)} Y_{f,b,q}(l) = \alpha_{f,b} + \kappa_0^{\text{Agg}} \text{MP}_q^{MA} + \vartheta_{f,b,q}$$
$$\Longrightarrow \widehat{\log Y_{f,b,q}} = \hat{\alpha}_{f,b} + \hat{\kappa}_0^{\text{Agg}} \text{MP}_q^{MA}$$

Taking difference with respect to $q-1$

$$d \log \widehat{Y_{f,b,q}} = \hat{\kappa}_0^{\text{Agg}} \Delta \text{MP}_q^{MA}$$

Multiplying each side by $\omega_{f,b,q-1}$ such that $\sum_{f,b} \omega_{f,b,q-1} = 1$ and adding across all bank-firm (b,q) pairs at time q

$$\omega_{f,b,q-1} \widehat{\log Y_{f,b,q}} = \omega_{f,b,q-1} \hat{\kappa}_0^{\text{Agg}} \Delta \text{MP}_q^{MA}$$
$$d\, \widehat{\log Y_q} = \hat{\kappa}_0^{\text{Agg}} \Delta \text{MP}_q^{MA}$$
$$\frac{\text{Average}\{d\, \widehat{\log Y_q}\}}{\text{Average}\{\text{Agg. Loan Growth}_q\}} = 0.03$$

The last equation uses series on the observed MP surprises during our sample and shows these surprises can explain 3 percent of the observed credit growth (used on the denominator). This is in the ballpark of the literature that uses 5 times the MP surprises we use on average (25 basis points versus 5 basis points) and explain 30 percent of the credit growth.

What is important for us is what fraction of that 3 percent is driven by high leverage firms? To estimate that number, we run:

$$\log \sum_{l \in \mathcal{L}(f,b,q)} Y_{f,b,q}(l) = \alpha_{f,b} + \kappa_0 \text{MP}_q^{MA} + \kappa_1 \times \textbf{High Leverage Firm}_f \times \text{MP}_q^{MA} + \vartheta_{f,b,q}$$
$$\Longrightarrow d \widehat{\log Y_{f,b,q}} = \hat{\kappa}_0 \Delta \text{MP}_q^{MA} + \hat{\kappa}_1 \times \textbf{High Leverage Firm}_f \times \Delta \text{MP}_q^{MA}$$

Multiplying each side by $\omega_{f,b,q-1}$ such that $\sum_{f,b} \omega_{f,b,q-1} = \omega_{q-1}^{HL} + \omega_{q-1}^{HL} = 1$ and adding over (f,b)

$$d \log \widehat{Y}_q = (1 - \omega_{q-1}^{HL}) \hat{\kappa}_0 \Delta \text{MP}_q^{MA} + \underbrace{\omega_{q-1}^{HL}}_{\text{Share of Total Loans by High Leverage Firms}} (\hat{\kappa}_0 + \hat{\kappa}_1) \Delta \text{MP}_q^{MA}$$

Hence, we can show that, 60 percent of the observed credit growth due to MP shocks are driven by high leverage firms.

$$\frac{\text{Avg}\left(\omega_{q-1}^{HL}(\hat{\kappa}_0+\hat{\kappa}_1)\Delta \text{MP}_q^{MA}\right)}{\text{Avg}\left(d\log \widehat{Y}_q\right)} = 0.6$$

4.8 Can Risk-Taking by Banks Explain the Results?

So far we have focused mostly on the impact of monetary policy on credit demand. Can our results be driven by the bank side? Next we investigate the role of banks' risk taking by running the standard regression in the literature, that is:

$$\log \sum_{l\in\mathcal{L}(f,b,q)} Y_{f,b,q}(l) = \alpha_{f,b} + \alpha_{f,q} + \omega\left(\textbf{High Leverage Bank}_b \times \frac{1}{N}\sum_{k=0}^{N}\text{MP}_{q-k}\right) + \vartheta_{f,b,q} \tag{7}$$

This is a much more restrictive specification that the one we used for firm leverage as identifying ω requires that firms borrow from multiple banks, where the κ we identify before simply requires that banks lend to multiple firms in each quarter, which is always the case. Hence, firms are not dropped and there is no concern about the representativeness of the sample in our previous regressions but in the above regression this can be a concern.

Equation (7) helps determine if our results so far were misinterpreted. For example, instead of expansionary monetary policy causing high leverage firms to increase borrowing, the additional borrowing could be due to high leverage firms switching to high leverage banks during monetary expansions if those banks extend more credit. Our results based on the regression specification in (7) suggest this is not the case. In addition, specification (7) also allows us to test for risk-taking behavior among banks.

Table 16 shows the results. During monetary policy expansions highly levered banks supply fewer loans at lower prices, though the price effects are weak. The results are mainly driven by private firms in columns (2) and (5). Hence, the supply results for private firms are the exact opposite of the firm credit-demand regressions. Moreover, the results are also inconsistent with the supply-side risk taking channel. Risk taking by banks should manifest as more lending to smaller and less transparent private borrowers, not less. This means that low leverage banks lend more to private borrowers, consistent with other papers using U.S. data.

The lack of risk-taking could reflect the time period of our data during which banks have

Table 16: Monetary Policy and Credit Outcomes: Firm-Bank Level — Bank Leverage

	Quantity: Log(Loan)			**Price: Log(1+i)**		
	(1) All	(2) Private	(3) Public	(4) All	(5) Private	(6) Public
High Leverage Bank × MP Surprise$_q$	0.4026***	0.5429***	0.1605	0.0069**	0.0066*	0.0059*
	(0.1130)	(0.1319)	(0.1559)	(0.0021)	(0.0027)	(0.0022)
Observations	656882	349527	307355	662254	352806	309448
Adjusted R^2	0.910	0.929	0.862	0.853	0.858	0.818
Bank × Firm F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Bank × Time F.E.	No	No	No	No	No	No
Firm × Time F.E.	Yes	Yes	Yes	Yes	Yes	Yes

Note: $^+$ $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. This table presents the results of OLS regressions for bank-firm level at a quarterly frequency. Interest rates are weighted by the loan shares for a given firm-bank. Bank Leverage is based on short-term debt and it is lagged and demeaned. Double-clustered standard errors by firm and time are reported in parentheses.

been highly regulated and well capitalized. Therefore, the impact of leverage differences may be minimal. Fortunately, the Y-14 data have other dimensions to identify bank risk-taking, as we turn next.

4.8.1 The Role of NPLs

Each bank reports the cumulative net charge-off (or loan loss) amount for each loan that it makes. Net charge-offs represent the dollar value of non-performing loans that banks determine they will not recover in default and will have to write-down. Net charge-offs have a distinct advantage over other common measures in the literature such as default probabilities or simple delinquency dummies. Charge-offs are net of collateral confiscation, meaning they take into account the fact that loan recovery rates are, on average, 80 percent of face value. Moreover, the losses associated with defaulted loans that are highly collateralized are generally much smaller than uncollateralized loans. Hence, net charge-offs capture this difference.

The cumulative net charge-offs are aggregated to bank-firm level and normalize by the total committed loan amount for each borrower. The charge-off ratio varies by bank-firm-quarter.

The charge-off results reported in Table 17 show a clear difference in the way that monetary policy easing impacts lending to private SMEs versus large public firms. The first column shows that private borrowers with higher charge-off rates on outstanding loans receive less credit when policy rates fall. Banks cut lending to risky private borrowers for whom they book past losses. By contrast, column (3) shows that there is no impact on credit among public firms.

Finally, note that the charge-off results identify risk-taking from the same set of bank-firm pairs as the bank leverage results above. Taken together, the results show that high-risk banks (high leverage) cut lending more in the future to risky private borrowers based on past losses (charge-offs).

Table 17: Monetary Policy and Bank Risk-Taking via Loan Losses: Firm–Bank Level

	Private Firms		*Public Firms*	
	(1)	(2)	(3)	(4)
	Log (Loan)	Log $(1+i)$	Log (Loan)	Log $(1+i)$
$(\text{CCO/Loan})_{q-1}$	-0.0612	-0.0001	-0.2491	-0.0058
	(0.0553)	(0.0022)	(0.2025)	(0.0052)
$(\text{CCO/Loan})_{q-1} \times$ MP Surprise_q	2.8959**	0.0327	-1.4709	-0.0450
	(0.8349)	(0.0268)	(1.6931)	(0.0446)
Observations	310023	297044	285175	277986
Adjusted R^2	0.933	0.874	0.868	0.835
Bank×Firm F.E	Yes	Yes	Yes	Yes
Firm×Time F.E	Yes	Yes	Yes	Yes

Note: $^+$ $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. This table reports OLS estimates of alternative risk measures for banks at the bank-firm level for the private firm sample (Panel A) and the public firm sample (Panel B) using quarterly data. The dependent variable in columns (1)-(4) is the natural logarithm of the total committed loan amount for a bank-firm pair; the dependent variable in columns (5)-(8) is the natural logarithm of one plus the nominal interest rate weighted for loan shares for a given bank-firm pair. The measure of bank risk is the ratio of a bank-firm‘s total net charge off amount divided its committed loan amount for each firm, lagged one quarter. Each column sequentially adds different fixed effects. Standard errors are double clustered at the firm and quarter levels.

4.9 Financial Stability Risks

Overall, our results suggest that monetary policy transmission during a period of low interest rates mostly stimulates firm credit demand rather than bank credit supply. In particular, lower policy rates raise credit demand among smaller and more leveraged private companies, do not change bank credit supply, conditional on leverage, and do not increase lending to firms with prior defaults. Thus, we do not find any evidence of risk-taking behavior by banks. However, our findings do not imply there are no financial stability risks.

In this section we assess if highly levered firms that borrow more today are more likely to default in the future.

To address the question we use the same specification in Jiménez, Ongena, Peydró, and Saurina (2014). Specifically, we define a dummy variable equal to one if a firm has a non-performing loan with a given bank at any point in the future. A non-performing loan is one for which no payment has been made for at least 30 days and is delinquent. Thus, the variable indicates if loans to risky firms or loans by risky banks (risk captured by ex-ante time invariant leverage) are more likely to become non-performing at any point in the future. We run separate regressions for firm and bank leverage and interact leverage with the monetary policy surprise variable.

Table 18 contains the results for the different firm samples. Panel A is the full sample, panel B are only privately-owned firms and panel C are only publicly-owned firms. Overall, we do not find evidence of risk-taking by U.S. banks, contrary to the findings of Jiménez, Ongena, Peydró, and Saurina (2014) for Spanish banks. In fact, our results suggest that banks with less capital make *more prudent* loan decisions in response to expansionary monetary policy surprises. The first row in all three panels shows that the coefficients on the bank leverage and monetary surprise interaction terms are positive and statistically significant at 1 percent. These regressions include firm-time fixed effects to control for credit demand. The interpretation is that risky banks make loans that are less likely to be delinquent in the future than less risky banks. The second row reports the credit demand regressions that include bank-time fixed effects to control for supply factors. The coefficient on the interaction term of firm leverage and the monetary policy surprise is negative and statistically significant at 1 percent for private firms and 10 percent for public firms. Hence, we find that highly leveraged firms are more likely to be delinquent in the future when monetary policy is expansionary. This result suggests that low rates pose a hidden financial stability risk.

Additionally, we plot leverage growth among firms as a function of credit rating. The increase in leverage for public and private firms documented in Figure 11 suggests that future delinquencies are likely to rise not only for public firms, but also for the riskiest private borrowers.[19] Figure 11 breaks down public and private firm leverage ratios by credit rating bins to investigate evolution over time: investment grade firms (AAA-A and BBB) and high yield firms (BBB and below).[20] The ratios are normalized to 1 at the beginning of our sample period. The figure shows that after the Global Financial Crisis, most of the financial leverage increase among U.S. firms is due to rapid growth in investment grade public firms. On the contrary, for private firms, financial leverage has steadily increased only for the most risky segment–high-yield equivalent borrowers (BBB and below), raising potential financial stability concerns. These results are consistent with Coimbra and Rey (2017), suggesting a trade-off between stimulating the economy and increasing the financial stability risks.

[19] In separate analysis, we have also confirmed that leverage predicts default even conditional on non-performing loans for private firms. These results are available upon request.

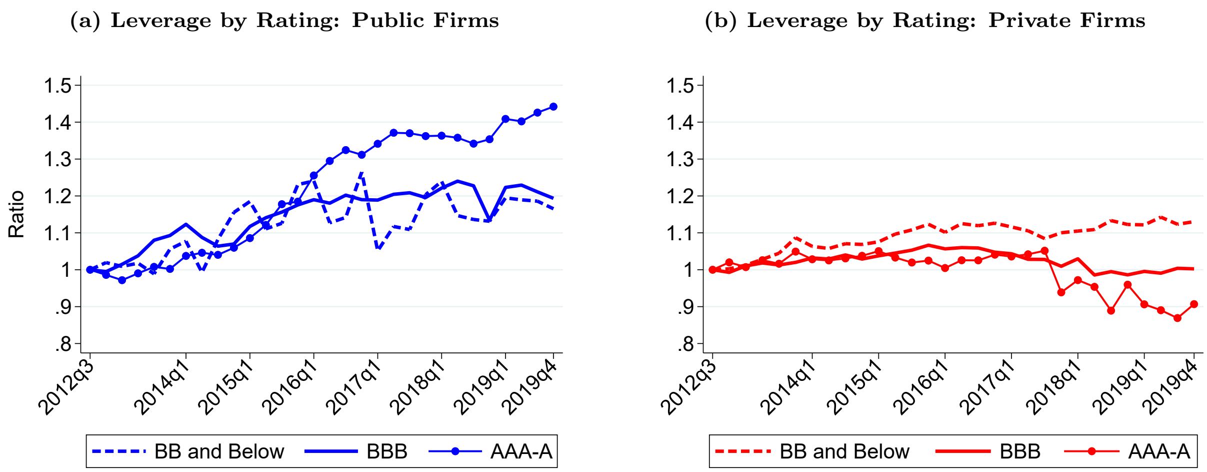
[20] We use the internal ratings that each BHC assigns to its borrowers in Schedule H1 of the FR Y-14 report. To compare ratings across reporting institutions, the internal rating is converted to a standardized rating scale going from AAA (very low risk of default) to D (in default).

Table 18: Monetary Policy and Future Delinquency, Bank-Firm Level

	Panel A: All Firms		*Panel B: Private Firms*		*Panel C: Public Firms*	
	(1) Non-performing	(2) Non-performing	(3) Non-performing	(4) Non-performing	(5) Non-performing	(6) Non-performing
High Leverage Bank × MP Surprise$_q$	0.1302***		0.1218**		0.2420***	
	(0.0275)		(0.0366)		(0.0417)	
High Leverage Firm × MP Surprise$_q$		-0.0498**		-0.0594**		-0.0705^{+}
		(0.0153)		(0.0164)		(0.0377)
Observations	647889	2469016	342990	2150032	304899	318976
Adjusted R^2	0.699	0.647	0.710	0.636	0.699	0.700
Bank×Firm f.e	Yes	Yes	Yes	Yes	Yes	Yes
Bank×Time f.e	No	Yes	No	Yes	No	Yes
Firm×Time f.e	Yes	No	Yes	No	Yes	No

Note: $^{+}$ $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. This table reports OLS estimates of the effect of MP shocks on the probability that loans become delinquent at any point in the future at the bank-firm level using quarterly data. Panel A uses all firms, panel B uses the private firm sample, and panel C uses the public firm sample. The dependent variable is an indicator variable that equals 1 if a firm has any loan outstanding that becomes delinquent for more than 30 days at any point in the future. *High leverage firm$_i$* is a dummy variable equal to one if the first quarter leverage of firm i is higher than the median leverage of the firms in the sample, and zero otherwise. *High leverage bank$_k$* is a dummy variable equal to one if the first quarter leverage of bank k is higher than the median leverage of the banks in the sample, and zero otherwise. Each column sequentially adds different fixed effects. Standard errors are double clustered at the firm and quarter levels.

Figure 11: Leverage Growth by Rating (Base 2012Q3)



Note: The figures plot leverage ratio–defined at the sum of short- and long-term debt over total assets– normalized to 1 the 2012Q3. The left (right) panel are the leverage ratios for public (private) borrowers. Each line is the median leverage ratio for borrowers with the specified bank provided risk-rating. Source: FR Y-14Q H.1

5 Additional Analysis and Robustness

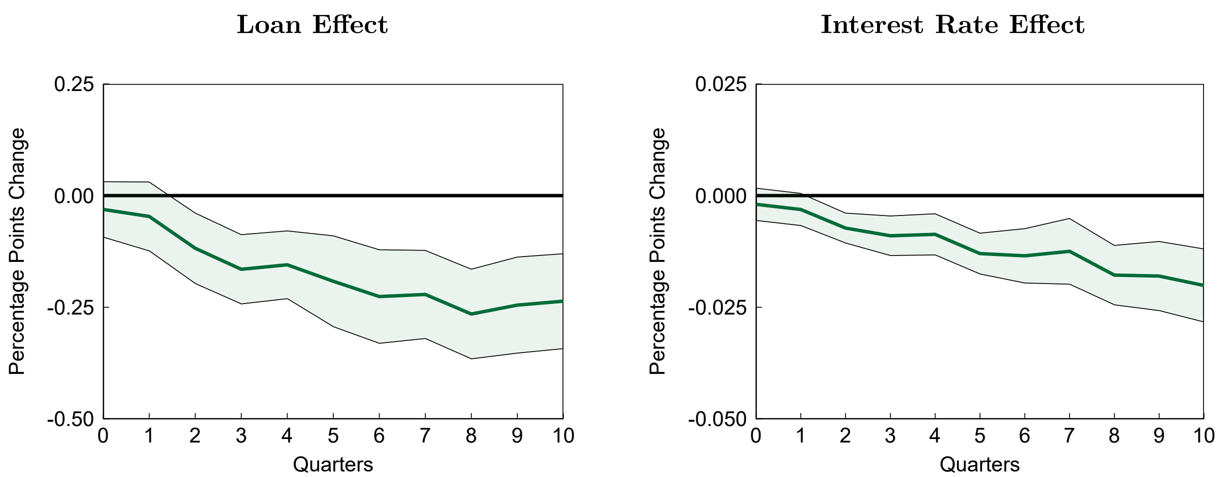
5.1 Dynamic Effects of Monetary Policy on Credit Outcomes

We estimate the dynamic response of credit outcomes to monetary policy surprises through the following local projections:

$$\log \sum_{l \in \mathcal{L}(f,b,q+h)} Y_{f,b,q+h}(l) = \alpha_{f,b} + \alpha_{b,q} + \kappa_h \left(\textbf{High Leverage Firm}_f \times \text{MP}_{q-k} \right) + \vartheta_{f,b,q+h} \quad (8)$$

Figure 12 shows the results for the full sample of firms. The expansionary effects of monetary policy on credit quantities and prices for leveraged firms are highly persistent, lasting 10 quarters. Figures 13 and 14 decompose these effects for private and public firms. The results clearly show that the overall effects are driven by private firms, both for loan quantities and prices. An expansionary (contraction) surprise leads to more (less) borrowing and higher (lower) spreads for leveraged private firms. The results for leveraged public firms are insignificant.

Figure 12: Dynamic Effects of Monetary Policy on High Leveraged Firms

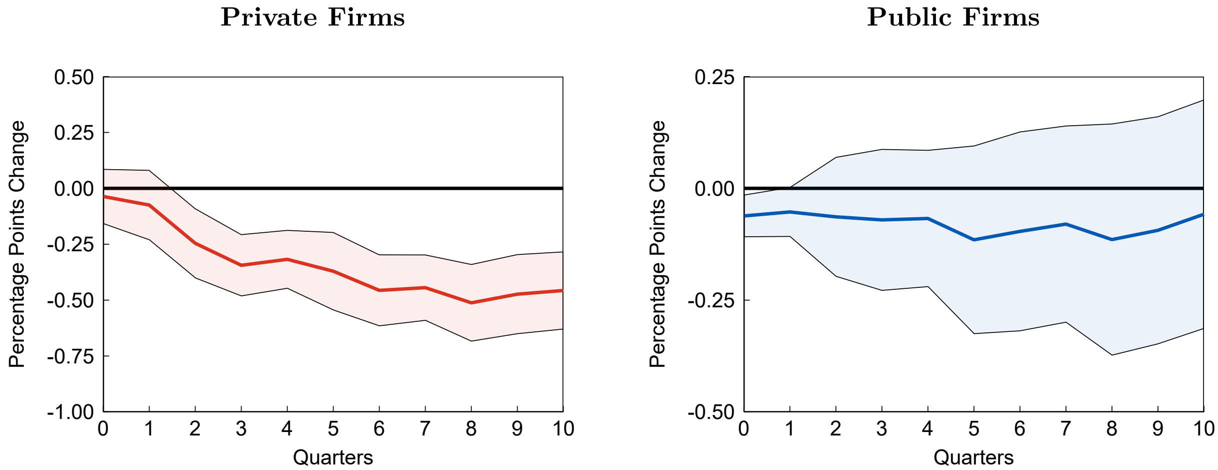


Note: The figure shows the dynamics of the interaction coefficient, κ_h, between firm leverage and monetary shocks over time, over quarter h from equation (8). Black lines report 95 percent error bands.

Figure 15 shows the dynamic triple interaction that include the leverage and SME dummy variables. The results are also persistent, especially on loan quantities. Highly leveraged SMEs borrow and pay more in response to expansionary monetary policy surprises over 10 quarters. In particular, a 1 basis point expansionary surprise causes high leveraged SMEs to borrow 0.4 percentage points (pp) more over 10 quarters relative to larger, safer firms. Credit spreads are 0.02 pp higher for highly levered SMEs relative to others over this period.

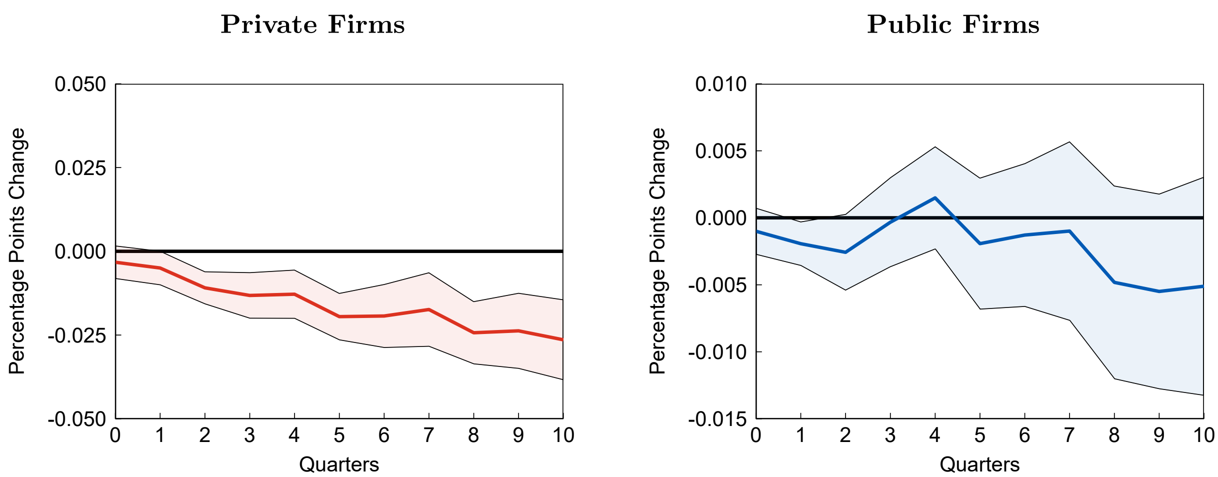
All these dynamic results are based on identified relative effects. If we want to know the aggregate time series patterns, we can simply plot the borrowing costs for different types of firms (credit growth has increased overall in this period). Figure 16 plots interest rates for the typical public and private borrower. Public firms borrow at lower interest rates, as shown by the blue line in the first chart on the left. The middle and right charts show median

Figure 13: Dynamic Effects of Monetary Policy on Loans to High Leveraged Firms by Firm Type



Note: The figure shows the dynamics of the interaction coefficient, κ_h, between firm leverage and monetary shocks over time, over quarter h from equation (8), for private and public firms. Black lines report 95 percent error bands.

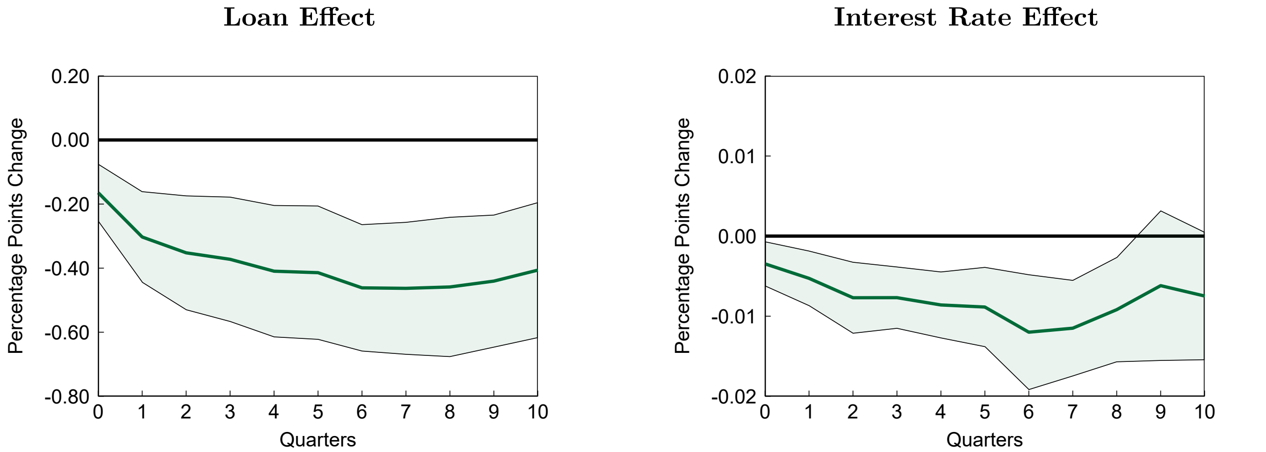
Figure 14: Dynamic Effects of Monetary Policy on Interest Rates of High Leveraged Firms by Firm Type



Note: The figure shows the dynamics of the interaction coefficient, κ_h, between firm leverage and monetary shocks over time, over quarter h from equation (8), for private and public firms. Black lines report 95 percent error bands.

interest rates by loan and rate type (fixed versus floating rate loans and credit lines versus term loans) for private and public firms. Floating rate loans (dashed lines) track monetary policy rates for both borrower types. By contrast, fixed-rate loans declined both for private firms (solid gold line) and for public borrowers (solid purple line) before increasing in 2017. Figure 17 focus on rates only for new loan originations and suggest that floating rate credit line prices rose faster during rate lift-off. This might have induced a compositional change as we show in Figure 22 in the Appendix: the share of term loans among all loans has increased

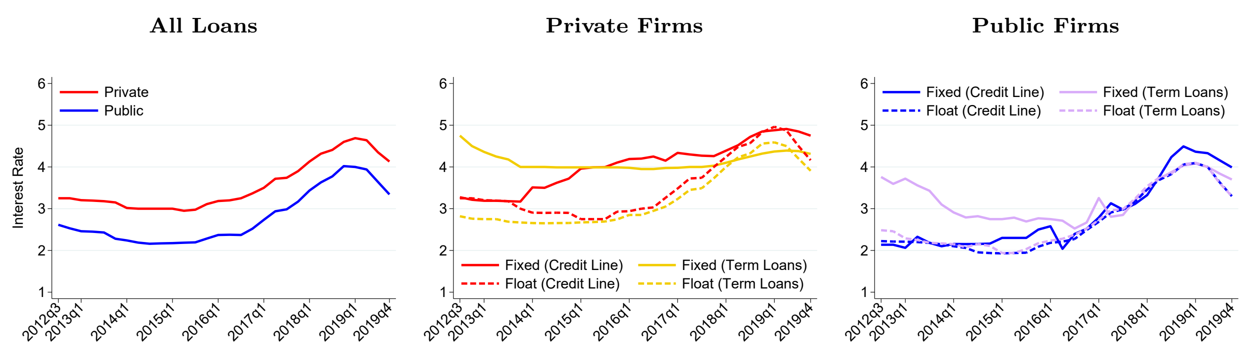
Figure 15: Dynamic Effects of Monetary Policy on High Leveraged SMEs



Note: The figure shows the dynamics of the interaction coefficient, κ_h, between firm leverage and monetary shocks over time, over quarter h from equation (8), for private and public firms. Black lines report 95 percent error bands.

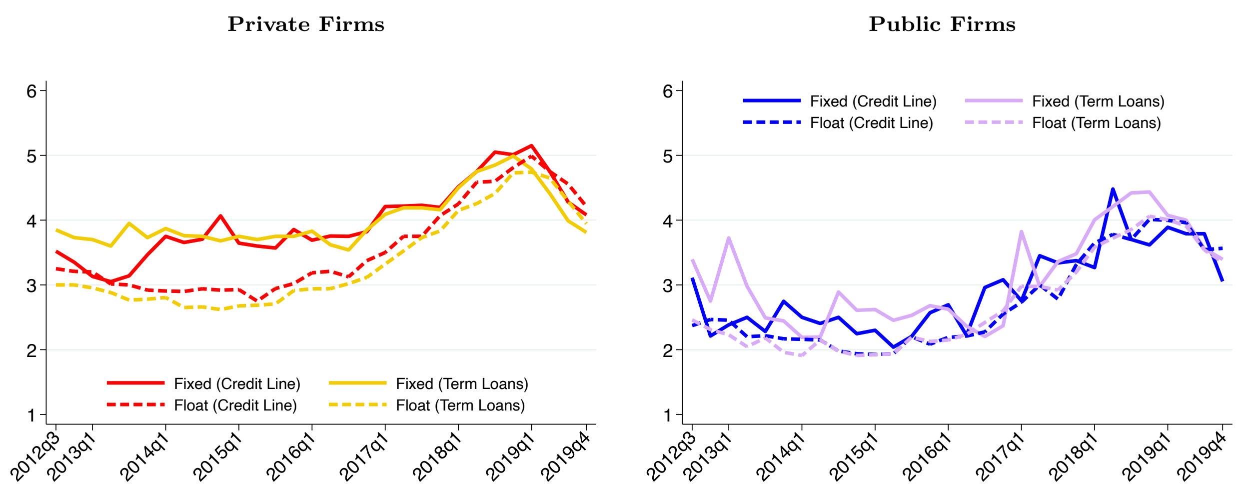
nearly 7 percent while the share of floating rate loans has fallen nearly 10 percent during our sample period. In order to shield our results from such compositional effects, we use all types of loans.

Figure 16: Interest rates: Fixed versus Floating



Note: The figure plots the median interest rates (in percent). The first chart plots interest rates for all loans for private borrowers in red and public borrowers in blue. The middle chart plots median interest rate for private borrowers for different loan types and rates. Solid lines plot rate on fixed rate loans (credit lines in red and term loans in gold). The dashed lines are rate on floating rate loans (credit lines in red and term loans in gold). The right chart plots median interest rate for public borrowers for different loan types and rates. Solid lines plot rate on fixed rate loans (credit lines in blue and term loans in purple). The dashed lines are rate on floating rate loans (credit lines in blue and term loans in purple). Source: FR Y-14Q H.1.

Figure 17: Interest rates on New Originations



Note: The figure plots the median interest rate (in percent) for new loan origination broken out by credit lines, term loans with fixed versus floating rates. The chart on the left plots the various loan rates for for private borrowers on the left and public borrowers on the right. The solid lines are fixed rate loans and the dashed lines are floating rate loans. Source: FR Y-14Q H.1. Source: FR Y-14Q H.1.

6 A Primer on the Mechanism

In this section we introduce a simple conceptual framework that can explain the new results presented in the paper. Recall that expansionary monetary policy works mostly via credit demand of private SMEs whose borrow against earnings and operations based collateral. We argue that expansionary policy increases the value of this type of collateral most among all collateral types. We show below how this type of collateral expands the borrowing capacity of risky firms by increasing net worth and lowering default risk.

Standard macroeconomic theory conceptualizes firm financial frictions in one of two ways. The first follows Bernanke and Gertler (1989) and Bernanke, Gertler, and Gilchrist (1996). These costly-state verification models do not feature collateral constraints but feature default. Monetary policy relaxes an agency friction by increasing net worth and lowering default risk. The second framework pioneered by Kiyotaki and Moore (1997) introduces a collateral constraint that specifies firms may borrow up to a fraction of their capital. However, all debt in this class of models is risk-free because collateral constraints bind and firms cannot borrow more than the value of what they can repay in the future. In the micro contracting literature, there is a clear relation between pledging collateral and default risk, where high default risk firms have to pledge collateral and their debt is limited by the liquidation value of this collateral; in a default event, the re-sale value of the collateral provides insurance to the lender. Darst and Refayet (2018) offer a simplified 2-period model that features both endogenous default and a restriction on the value of promises firms make today based on the value of what they can produce tomorrow. However, we are not aware of any full-fledged macro model that incorporates both collateral constraints with risky debt.

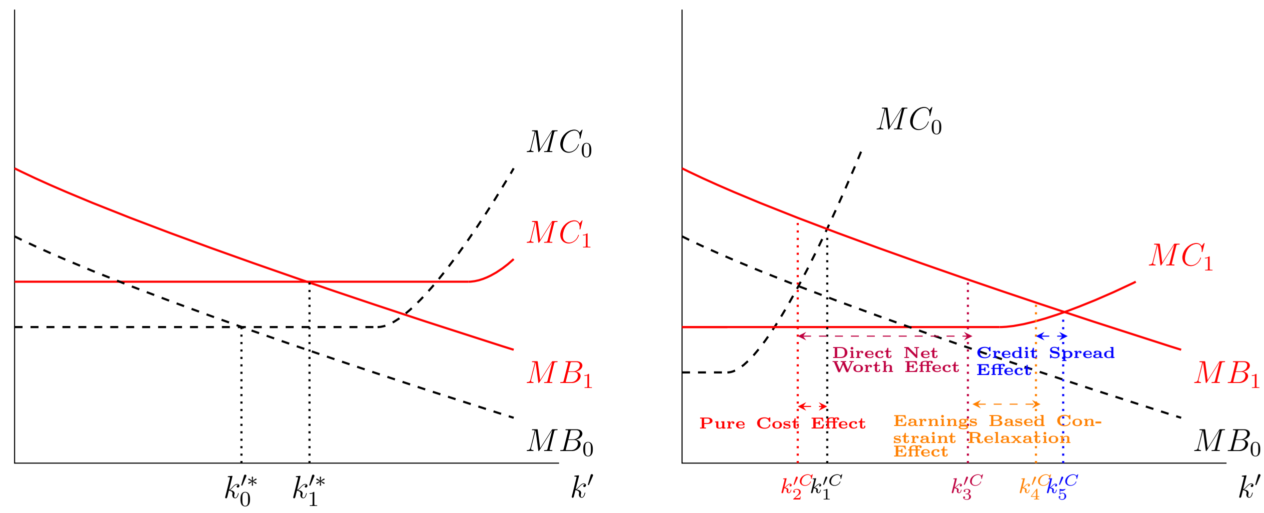
Our results embed both effects. A monetary expansion relaxes SMEs collateral constraint because the constraint is based on earnings, which also improves their ability to repay, leading to lower default risk. The recent heterogeneous firm new Keynesian framework of Ottonello and Winberry (2020) features default, but does not have a collateral constraint. Nevertheless, a simple modification of their framework is suitable to interpret our empirical results.

Panel (a) in Figure 18 is the same as Ottonello and Winberry (2020), which shows that a low leverage/default risk firm operates on the flat portion of the marginal cost for investment curve. Equilibrium investment is determined by the intersection of the marginal cost and benefit curves, $k_0^{\prime *}$. A monetary expansion, shown by the shifts to the red lines, raises both marginal cost and benefit curves. The new investment level is given by $k_1^{\prime *}$.

Risky/high leverage firms operate on the upward sloping part of the marginal cost curve shown in panel (b). Expansionary monetary policy increases the price of capital shifting the marginal cost curve up. The movement from $k_1^{\prime C}$ to $k_2^{\prime C}$ captures this pure cost increase. Additionally, expansionary policy extends the flat portion of marginal cost curve due to a higher net worth. Higher net worth implies that firms can repay debt over a larger state-space. Moreover, expansionary policy also flattens the marginal cost cure because it increases the value of the earnings-based collateral used to secure the loan. As shown in the figure, the use of earnings and operations based collateral can amplify this effect by significantly flattening the cost curve, leading larger relative changes in risky firm investment shown by $k_5^{\prime C}$. This simple modification captures the essence of our results.

Figure 18: Speculative Intuition

(a) Risk-Free Firm **(b) Risky Firm**



7 Conclusion

We use confidential supervisory data to explore how monetary policy transmits in an economy with heterogeneous firms and banks. We show that, compared to large public firms, SMEs are financially constrained, bank dependent, and post different forms of collateral to borrow. Guided by differences in financial constraints and collateral, we then show that monetary policy transmission during normal times operates by stimulating highly leveraged SMEs credit demand rather than credit supply among risky banks. We then use granular collateral data to document the importance of earnings and operations-based collateral for monetary policy transmission. Lower policy rates relax SME collateral constraints by increasing net worth, which is tied to their borrowing, and raising their ability to repay, lowering default risk. We find no similar effects for large publicly listed firms and show that leveraged private firms/SMEs drive the results for the full sample of U.S. firms. Furthermore, we do not find evidence that low interest rates lead to risk-taking among U.S. banks. In fact, we find that more risky banks extend less credit than safe banks and cut credit to risky private firms from whom banks recognize prior loan losses. Finally, we show that there is a trade-off between stimulating the economy in the short-run and future financial stability because lower policy rate increase firm leverage at the expense of higher future default risk.

Our results stress the importance of collateral to capture risk versus access to finance as function of firm size. The relation between collateral and risk is positive for large, listed firms but negative for private firms and SMEs. Hence, posting collateral for large firms, who typically borrow unsecured, is a sign of distress. By contrast, posting collateral for SMEs is associated with higher loan quantities and lower credit spreads. In addition, SMEs mostly rely on earnings based collateral rather than fixed assets and real estate. Expansionary monetary policy makes this collateral more valuable because it stimulates aggregate demand, which raises the value of SME operations and earnings enabling additional credit growth and borrowing. This mechanism shows that the effectiveness and power of monetary policy depend on the joint distribution of firm size and the type of collateral used to obtain credit.

A recent literature argues that general equilibrium effects of firm investment are critical to understanding monetary policy transmission (Auclert, Rognlie, and Straub, 2020). Our results suggests that the effectiveness of the firm general equilibrium channel may also depend on the firm size distribution and the different types of collateral used to obtain financing to maintain and expand operations.

References

Acharya, Viral, and Hassan Naqvi. 2012. "The Seeds of a Crisis: A Theory of Bank Liquidity and Risk Taking over the Business Cycle." *Journal of Financial Economics* 106 (2): 349 – 366. https://doi.org/10.1016/j.jfineco.2012.05.014.

Adrian, Tobias, and Hyun Song Shin. 2009. "Money, Liquidity, and Monetary Policy." *American Economic Review* 99 (2): 600–605. 10.1257/aer.99.2.600.

Asriyan, Vladimir, Luc Laeven, Alberto Martin, Alejandro Van der Ghote, and Victoria Vanasco. 2021. "Falling Interest Rates and Credit Misallocation: Lessons from General Equilibrium." Working Papers 1268, Barcelona Graduate School of Economics, https://ideas.repec.org/p/bge/wpaper/1268.html.

Auclert, Adrien. 2019. "Monetary Policy and the Redistribution Channel." *American Economic Review* 109 (6): 2333–67.

Auclert, Adrien, Matthew Rognlie, and Ludwig Straub. 2020. "Micro Jumps, Macro Humps: Monetary Policy and Business Cycles in an Estimated HANK Model "Secured Credit Spreads and the Issuance of Secured Debt." working paper, http://web.stanford.edu/~aauclert/mjmh.pdf.

Benmelech, Efraim, and Nittai K. Bergman. 2012. "Credit Traps." *American Economic Review* 102 (6): 3004–32. 10.1257/aer.102.6.3004.

Berger, Allen N., W. Scott Frame, and Vasso Ioannidou. 2016. "Reexamining the empirical relation between loan risk and collateral: The roles of collateral liquidity and types." *Journal of Financial Intermediation* 26 28 – 46. https://doi.org/10.1016/j.jfi.2015.11.002.

Berger, Allen N., and Gregory F. Udell. 1990. "Collateral, loan quality and bank risk." *Journal of Monetary Economics* 25 (1): 21–42. https://doi.org/10.1016/0304-3932(90)90042-3.

Bernanke, Ben, and Mark Gertler. 1989. "Agency Costs, Net Worth, and Business Fluctuations." *The American Economic Review* 79 (1): 14–31, http://www.jstor.org/stable/1804770.

Bernanke, Ben, Mark Gertler, and Simon Gilchrist. 1996. "The Financial Accelerator and the Flight to Quality." *The Review of Economics and Statistics* 78 (1): 1–15, http://www.jstor.org/stable/2109844.

Borio, Claudio, and Haibin Zhu. 2012. "Capital Regulation, Risk-taking and Monetary Policy: A Missing Link in the Transmission Mechanism?" *Journal of Financial Stability* 8 (4): 236 – 251. https://doi.org/10.1016/j.jfs.2011.12.003.

Cloyne, James, Clodomiro Ferreira, Maren Froemel, and Paolo Surico. 2018. "Monetary Policy, Corporate Finance and Investment."Technical report, National Bureau of Economic Research.

Coimbra, Nuno, and Hélène Rey. 2017. "Financial Cycles with Heterogeneous Intermediaries." Working Paper 23245, National Bureau of Economic Research. 10.3386/w23245.

Darst, Matthew, Ehraz Refayet, and Alexandros Vardoulakis. 2020. "Banks, Non-Banks, and Lending Standards." *Finance and Economics Discussion Series 2020-086: Washington: Board of Governors of the Federal Reserve System.* https://doi.org/10.17016/FEDS.2020.086.

Darst, R. Matthew, and Ehraz Refayet. 2018. "Credit Default Swaps in General Equilibrium: Endogenous Default and Credit-Spread Spillovers." *Journal of Money, Credit and Banking* 50 (8): 1901–1933. https://doi.org/10.1111/jmcb.12507.

Dell′Ariccia, Giovanni, Luc Laeven, and Gustavo A. Suarez. 2017. "Bank Leverage and Monetary Policy's Risk-Taking Channel: Evidence from the United States." *The Journal of Finance* 72 (2): 613–654. 10.1111/jofi.12467.

di Giovanni, Julian, Sebnem Kalemli-Ozcan, Mehmet Fatih Ulu, and Yusuf Soner Baskaya. 2019. "International Spillovers and Local Credit Cycles." forthcoming *Review of Economic Studies*.

Dinlersoz, Emin, Sebnem Kalemli-Ozcan, Henry Hyatt, and Veronika Penciakova. 2018. "Leverage over the Life Cycle and Implications for Firm Growth and Shock Responsiveness." nber working paper no. 25226.

Drechsel, Thomas. 2019. "Earnings-Based Borrowing Constraints and Macroeconomic Fluctuations."Technical report.

Eisfeldt, Andrea L., and Adriano A. Rampini. 2008. "Leasing, Ability to Repossess, and Debt Capacity." *The Review of Financial Studies* 22 (4): 1621–1657. 10.1093/rfs/hhn026.

Gertler, Mark, and Simon Gilchrist. 1994. "Monetary Policy, Business Cycles, and the Behavior of Small Manufacturing Firms." *The Quarterly Journal of Economics* 109 (2): 309–340.

Gertler, Mark, and Peter Karadi. 2015. "Monetary Policy Surprises, Credit Costs, and Economic Activity." *American Economic Journal: Macroeconomics* 7 (1): 44–76. 10.1257/mac.20130329.

Gopinath, Gita, Sebnem Kalemli-Ozcan, Loukas Karabarbounis, and Carolina Villegas-Sanchez. 2017. "Capital Allocation and Productivity in South Europe." *The Quarterly Journal of Economics* 132 (4): 1915–1967. 10.1093/qje/qjx024.

Gürkaynak, Refet S, Brian Sack, and Eric Swanson. 2005. "Do Actions Speak Louder Than Words? The Response of Asset Prices to Monetary Policy Actions and Statements." *International Journal of Central Banking* 1 (1): , `https://ideas.repec.org/a/ijc/ijcjou/y2005q2a2.html`.

Ioannidou, Vasso, Steven Ongena, and José-Luis Peydró. 2014. "Monetary Policy, Risk-Taking, and Pricing: Evidence from a Quasi-Natural Experiment." *Review of Finance* 19 (1): 95–144. 10.1093/rof/rfu035.

Ivashina, Victoria, Luc Laeven, and Enrique Moral-Benito. 2020. "Loan Types and the Bank Lending Channel." NBER Working Papers 27056, National Bureau of Economic Research, Inc, `https://ideas.repec.org/p/nbr/nberwo/27056.html`.

Jeenas, Priit. 2019. "Firm Balance Sheet Liquidity, Monetary Policy Shocks, and Investment Dynamics." *Working Paper*.

Jiménez, Gabriel, Steven Ongena, José-Luis Peydró, and Jesús Saurina. 2014. "Hazardous Times for Monetary Policy: What Do Twenty-Three Million Bank Loans Say about the Effects of Monetary Policy on Credit Risk-taking?" *Econometrica* 82 (2): 463–505, `http://www.jstor.org/stable/24029266`.

Kalemli-Ozcan, Sebnem. 2019. "U.S. Monetary Policy and International Risk Spillovers." working paper, Proceedings from Jackson Hole Symposium, `http://econweb.umd.edu/~kalemli/assets/publications/Ozcan_JH2019.pdf`.

Kaplan, Greg, Benjamin Moll, and Giovanni L. Violante. 2018. "Monetary Policy According to HANK." *American Economic Review* 108 (3): 697–743. 10.1257/aer.20160042.

Kermani, Amir, and Yueran Ma. 2021. "Two Tales of Debt." working paper, `https://cpb-us-w2.wpmucdn.com/voices.uchicago.edu/dist/7/1291/files/2017/01/TwoTalesOfDebt-v7.pdf`.

Kiyotaki, Nobuhiro, and John Moore. 1997. "Credit Cycles." *Journal of Political Economy* 105 (2): 211–248, `http://www.jstor.org/stable/10.1086/262072`.

Kiyotaki, Nobuhiro, John Moore, and Shengxing Zhang. 2021. "Credit Horizons." Working Paper 28742, National Bureau of Economic Research. 10.3386/w28742.

Lian, Chen, and Yueran Ma. 2020. "Anatomy of Corporate Borrowing Constraints*." *The Quarterly Journal of Economics* 136 (1): 229–291. 10.1093/qje/qjaa030.

Luck, Stephan, and Joao Santos. 2019. "The Value of Collateral in Loan Contracts." ssrn working paper, `http://dx.doi.org/10.2139/ssrn.3467316`.

McKay, Alisdair, Emi Nakamura, and Jón Steinsson. 2016. "The Power of Forward Guidance Revisited." *American Economic Review* 106 (10): 3133–58.

Miranda-Agrippino, Silvia, and Hélène Rey. 2020. "U.S. Monetary Policy and the Global Financial Cycle." *The Review of Economic Studies* 87 (6): 2754–2776. 10.1093/restud/rdaa019.

Ottonello, Pablo, and Thomas Winberry. 2020. "Financial Heterogeneity and the Investment Channel of Monetary Policy." *Econometrica* 88 (6): 2473–2502. https://doi.org/10.3982/ECTA15949.

Paligorova, Teodora, and Joao A.C. Santos. 2017. "Monetary Policy and Bank Risk-taking: Evidence from the Corporate Loan Market." *Journal of Financial Intermediation* 30 35 – 49. https://doi.org/10.1016/j.jfi.2016.11.003.

Rajan, Raghuram G. 2005. "Has Financial Development Made the World Riskier?" Working Paper 11728, National Bureau of Economic Research. 10.3386/w11728.

Rauh, Joshua D., and Amir Sufi. 2010. "Capital Structure and Debt Structure." *The Review of Financial Studies* 23 (12): 4242–4280. 10.1093/rfs/hhq095.

Romer, Christina D., and David H. Romer. 2004. "A New Measure of Monetary Shocks: Derivation and Implications." *American Economic Review* 94 (4): 1055–1084. 10.1257/0002828042002651.

Stiglitz, Joseph E., and Andrew Weiss. 1981. "Credit Rationing in Markets with Imperfect Information." *The American Economic Review* 71 (3): 393–410, http://www.jstor.org/stable/1802787.

Tenreyro, Silvana, and Gregory Thwaites. 2016. "Pushing on a String: US Monetary Policy is Less Powerful in Recessions." *American Economic Journal: Macroeconomics* 8 (4): 43–74.

Wong, Arnele. 2019. "Refinancing and The Transmission of Monetary Policy to Consumption." *Working Paper*. https://static1.squarespace.com/static/576576adbe659449f97e0d35/t/5ce1f9f23fdc1e00014f3d22/1558313459256/Paper_AERrevision_0519.pdf.

Appendices

A Variable Definitions

Variable	Definition
Bank leverage	It is calculated both as short-term debt as a fraction of total assets and as total liabilities as a fraction of total assets.
Firm leverage	It is calculated both as short-term debt as a fraction of total assets and as total liabilities as a fraction of total assets.
Collateral type	Real estate Fixed assets Cash and marketable securities Accounts receivable and inventory Blanket lien and others Unsecured
Probability of future default	It is dummy equal to one if the firm defaults at any point in time in the future.
Charge-offs$_b$	It is calculated as the maximum cumulative net charge-offs by bank weighted by the bank's commitments.
Charge-offs$_f$	It is calculated as the total cumulative net charge-offs by firm.
Charge-offs$_l$	It is calculated as the average cumulative net charge-offs by loan.

B Data Details

B.1 FR Y-14Q Schedule H.1

The FR Y-14Q report collects detailed information on bank holding companies' (BHCs), savings and loan holding companies' (SLHCs), and U.S. intermediate holding companies' (IHCs) of foreign bank organizations (FBOs) on a quarterly basis. The data are collected as part of the Federal Reserve's Comprehensive Capital Analysis and Review (CCAR) for BHCs, SLHCs and IHCs with at least \$50 billion (\$100 billion starting from 2019) in total assets.[21] The banks that submit FR Y-14Q data since 2012 comprise over 85 percent of the total assets in the U.S. banking sector.

For our study, we use the Wholesale Risk Schedule, or H.1. Schedule, which collects loan level data on corporate loans and leases together with corporates' balance sheets. The H.1 Schedule has two sections: (1) Loan and Obligor Description section, which collects information related to the firm and the loan itself; and (2) Obligor Financial Data section, which collects data related to the financial health (balance sheet and income statement) of the firm. Hence we also have time varying information on bank and firm balance sheets.

[21]The assessment is conducted annually and consists of two related programs: Comprehensive Capital Analysis and Review and Dodd-Frank Act stress testing (DFAST).

Banks report details on corporate loans and leases that are either held-for-investment (HFI) or held-for-sale (HFS) in the loan book at each quarter end. Loans and leases with HFI designation are those that the bank has the "intent and ability to hold until the foreseeable future or until maturity or payoff." Loans and leases that are HFS are those that the bank intends or expects to sell at some indefinite date in the future. Both HFI and HFS loans and leases are categorically distinct from those that are reported as trading assets. Trading assets of banks are not reported on FR Y-14 Schedule H.1 and are instead reported on Schedule B (Securities Schedule). The vast majority of loans in the FR Y-14 data (on average 98 percent by dollar amount) are designated as HFI.

The population of loans is reported at the credit facility level (loan level) and is limited to commercial and industrial loans with a committed balance greater than or equal to $1 million.[22] Each facility is reported separately when borrowers have multiple facilities from the same bank. The facility level information includes total committed and utilized amounts, pricing and spread information, origination and maturity dates, and information on the value and type of underlying collateral. We use facility and loan interchangeably throughout the paper.

The total committed value of the loans reported on the H.1 Schedule as of 2019Q4 is nearly $3.3 trillion.[23] To get a sense for what fraction of total U.S. C&I lending our data comprise, we compare it to what is reported by the universe of BHCs, in the aggregate form, on the FR Y-9C (schedules HC-C and HC-L). BHCs commitments in the FR Y-9C total nearly $4.6 trillion. Thus, our data from the FR Y-14Q accounts for nearly 70 percent of all C&I equivalent lending in the U.S.[24]

The FR Y-14Q information on the financial health of the borrowers (firm balance sheet and income statement variables) is an invaluable source of information for private firms in the U.S. as this information does not exist anywhere else.[25] The data also contains borrower

[22] A credit facility is defined as a credit extension to a legal entity under a specific credit agreement, basically a loan contract.

[23] We keep loans identified on the FR Y-9C as C&I loans domiciled in the U.S. (item 4(a)), loans to finance agricultural production (item 3), loans secured by owner-occupied real estate domiciled in the U.S. (item 1(e)(1)), and other leases (item 10(b)).

[24] The comparisons between FR Y-14Q and FR Y-9C are not one-to-one and are complicated by at least three factors: 1) HC-C only reports utilized exposures; 2) the committed exposures reported on HC-L are aggregated differently and include loans that are not necessarily U.S. C&I loans. For example, HC-L reports total committed exposure for all C&I loans (Y-9C item 4), which includes loans to foreign addresses (item 4(b) in addition to those those domiciled in the U.S (item 4(a)). In addition, the HC-L reports the total committed amount of loans secured by real-estate (item 1), which includes various types of loans secured by real estate in addition to loans secured by owner-occupied real estate domiciled in the U.S. (item 1(e)(1)). 3) FR Y-14Q data only includes loans over $1mn. Therefore, FR Y-14Q comparisons of the total committed loans amounts to FR Y9-C represent lower bounds of the overall amount of C&I lending done in the U.S.

[25] Few commercial data providers, such as, Moody's ORBIS and D&B provide some of this data but for a select set of private firms that volunteer the information. Other sources such as FED's small business finance

identifiers such as tax identification numbers, CUSIPS, and company names and addresses. These firm identifiers allow us to match the data with other data sources to cross-check information and determine the relative importance of different sets of borrowers *e.g.* public versus private companies, SMEs versus large firms, and syndicated versus non-syndicated loans.

Bank Holding Companies subject to CCAR. The bank holding companies included in the sample are: beginning in Q3:2011 Ally Financial, Bank of America Corporation, BB&T Corporation, Bank of New York Mellon Corporation, Citigroup Incorporated, Capital One Financial Corporation, Fifth Third Bancorp, Goldman Sachs Group Incorporated, JPMorgan Chase & Co., Keycorp, Morgan Stanley, PNC Financial Services Group Incorporate, Regions Financial Corporation, Suntrust Banks Incorporated, State Street Corporation, U.S. Bancorp, Wells Fargo & Company. Beginning in Q3:2012 Comerica Incorporated, Huntington Bancshares Incorporated, HSBC North America Holdings Incorporated, M&T Bank Corporation, Northern Trust Corporation, RBC USA Holdco Corporation, Santander Holdings USA Incorporated, UnionBanCal Corporation (renamed to MUFG Americas Holding Corporation in Q3:2014), Zions Bancorporation. Beginning in Q2:2014 Discover Financial Services. Beginning in Q4:2014 BNP Paribas.

HFI, HFS, and Trading Assets. HFS loans and leases are also distinct from loans held on the trading book for market making purposes and subject to different different regulatory capital requirements. Specifically, loans and leases in the trading book are reported on a separate schedule (other than Schedule H1) and typically meet the following trading activities: a) regularly under-writing or dealing in securities; interest rate, foreign exchange rate, commodity, equity, and credit derivative contracts; other financial instruments; and other assets for resale, (b) acquiring or taking positions in such items principally for the purpose of selling in the near term or otherwise with the intent to resell in order to profit from short-term price movements, and (c) acquiring or taking positions in such items as an accommodation to customers or for other trading purposes.

Data Cleaning and Sample Construction. This section describes the intensive data cleaning process needed to use the FR Y14 data for our purposes.

---

survey and U.S. Census Bureau's QFR data sets are also for select set of firms and not representative of the U.S. economy. See Dinlersoz, Kalemli-Ozcan, Hyatt, and Penciakova (2018) that goes details of the selection problems in the financial data for private firms in the U.S. and how to use U.S. Census Bureau LBD data to correct for this selection.

1. Remove from the raw loan-level data loans issued to "Individuals" and loans to foreign addresses.

2. Remove any loans to financial firms (NAICS 52); real estate REITS (NAICS 513); educational servies (NAICS 611); religious, grantmaking, and civil and professional organizations (NAICS 813); and private household (NAICS 814).

3. Drop all observations for which there is no financial data reported and when total firm assets are missing or equal to 0.

4. Drop all facilities where the total value of commitments is less than $1 million (probable errors given reporting threshold).

5. To consistently identify firms across banks with missing or different tax ids, we first apply a name cleaning algorithm to make a consistent names for firms that are the same based on string matches, zipcode, and city. For example Firm A LLC, 20002 Washington D.C, Firm A Limited Liability Corporation 20002 Washington D.C., and Firm a LLC, 20002 Washington D.C. are all treated as the same firm, etc.

6. Once we have a clean and uniform set of firm names, we can fill in missing tax ids. For observations loans where firm tax id is missing, we fill in missing observations if the bank reports a consistent tax id through any portion of the loan; for multi-bank borrowers for which one bank does not report the tax id, we use a consistent tax id reported by other banks.

7. To ensure that firm income statement and balance sheet variables are reasonable and reported in consistent units, we apply a cleaning algorithm that searches for large reporting discrepancies within and across banks over time for the same firm. We set threshold for potential misreported to be a difference in a variable either by the same bank or across different banks of either 10^3, 10^6, 10^9 since these are most common unit differences reported in the data. We also note that when there is miss reporting, all variables appear to be consistently miss reported in the same way, so financial ratios are correct.

Internal Consistency of Balance Sheet Information. We follow Gopinath, Kalemli-Ozcan, Karabarbounis, and Villegas-Sanchez (2017) to check the sensibility of our cleaning procedure by comparing the sum of variables belonging to some aggregate of their respective category:

1. The sum of tangible fixed assets, intangible fixed assets, and other fixed assets as a ratio of total fixed assets.

2. The sum of fixed assets and current assets as a ratio of total assets

3. The sum of long-term debt and other non-current liabilities as a ratio of total non-current liabilities

4. The sum of cash and securities, inventory, and accounts receivable as a ratio of current assets

5. The sum of current assets and tangible assets as a ratio of total assets

6. The sum of accounts payable, short-term debt, and current maturity long-term debt as a ratio of current liabilities

7. The sum of current liabilities, long-term debt and minority interest as a ratio of total liabilities

8. The sum of total liabilities, retained earnings, and capital expenditure as a ratio of total assets.

Information on credit facilities and reporting thresholds in FR Y-14. A credit facility is defined as any legally binding credit extension to a legal entity under a specific credit agreement. A credit facility may be secured or unsecured, term or revolving, drawn or undrawn (excluding informal advised lines). There is no materiality threshold for securities reporting at the individual obligor level. BHCs must report their securities holdings if the entire portfolio is greater than either $5 billion or five percent of Tier 1 capital on average for the four quarters preceding the reporting quarter.

Note on Total Liabilities: Flow of Funds. Total non financial corporate liabilities reported by the Flow of Funds in the National Accounts of the U.S. (Table B.3, Series i.d. FL104190005.Q) is computed as

$$Liabilities_{total} = taxes + debtsecurities + loans + miscellaneous + FDI.$$

The following source the total liability components:

- Tax data come from Internal Revenue Service, Statement Of Income – This item is smallest line item in the total;

- Debt securities are bond data is from Mergent Fixed Income Securities Database;
- Loan data are pulled from bank call reports – These data are all U.S. chartered bank depository institutions plus foreign bank offices in the U.S. These data also include credit unions;
- Miscellaneous is a catchall category and is the largest single component. This data is the sum of private pension fund contributions from the Department of Labor, and an unidentified category, which is the largest component of miscellaneous. The unidentified category is computed as a residual category from the IRS SOI and flow of founds:

  $$unidentified = total_{assets} - equity - liabilities,$$

  where *liabilities* are the individual liability sub-components in the Flow of Funds;
- FDI comes from BEA

C Robustness Appendix

C.1 Tables

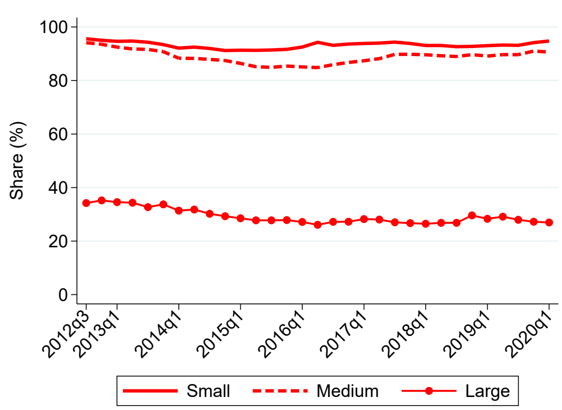
Table 19: Total Leverage: Public Firms

	Quantity: Log(Loan)	Price: Log(1+i)
	(1)	(2)
High Total Leverage Firm × MP Suprise$_q$	0.6014**	-0.0006
	(0.2078)	(0.0042)
Observations	322055	213531
Adjusted R^2	0.837	0.747
Bank × Firm F.E.	Yes	Yes
Bank × Time F.E.	Yes	Yes
Firm × Time F.E.	No	No

Note: $^+$ $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. This table presents the results of OLS regressions for bank-firm pairs at a quarterly frequency for the public firms sample. The dependent variable in column (1) is the natural logarithm of the total committed loan amount for a bank-firm pair; the dependent variable in columns (2) is the natural logarithm of one plus the nominal interest rate weighted for loan shares for a given bank-firm pair. Total Firm Leverage is based on short-term and long-term debt and it is 1 when the firm is above the median total leverage of the sample and it is zero otherwise. Double-clustered standard errors by firm and time are reported in parentheses.

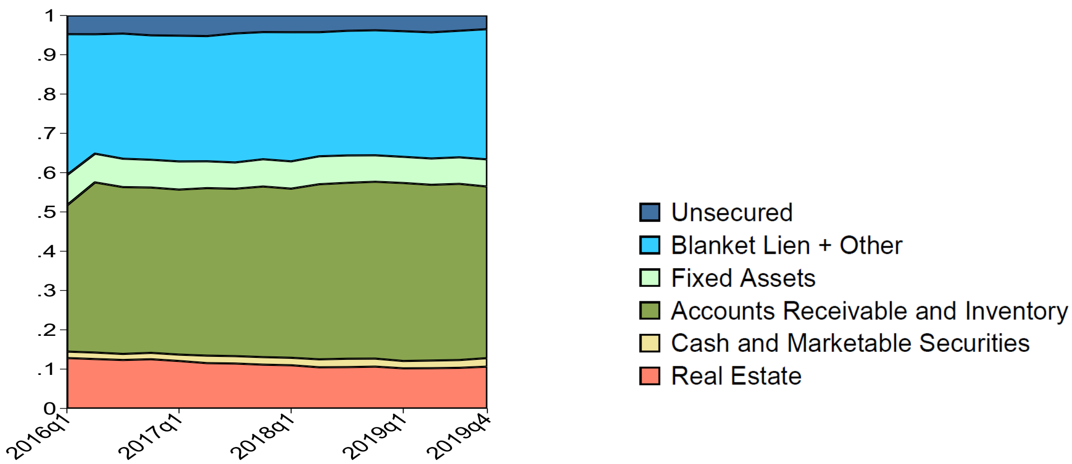
C.2 Figures

Figure 19: Share of Bank Debt in Non-Financial Private Firms' Financing in FR Y-14



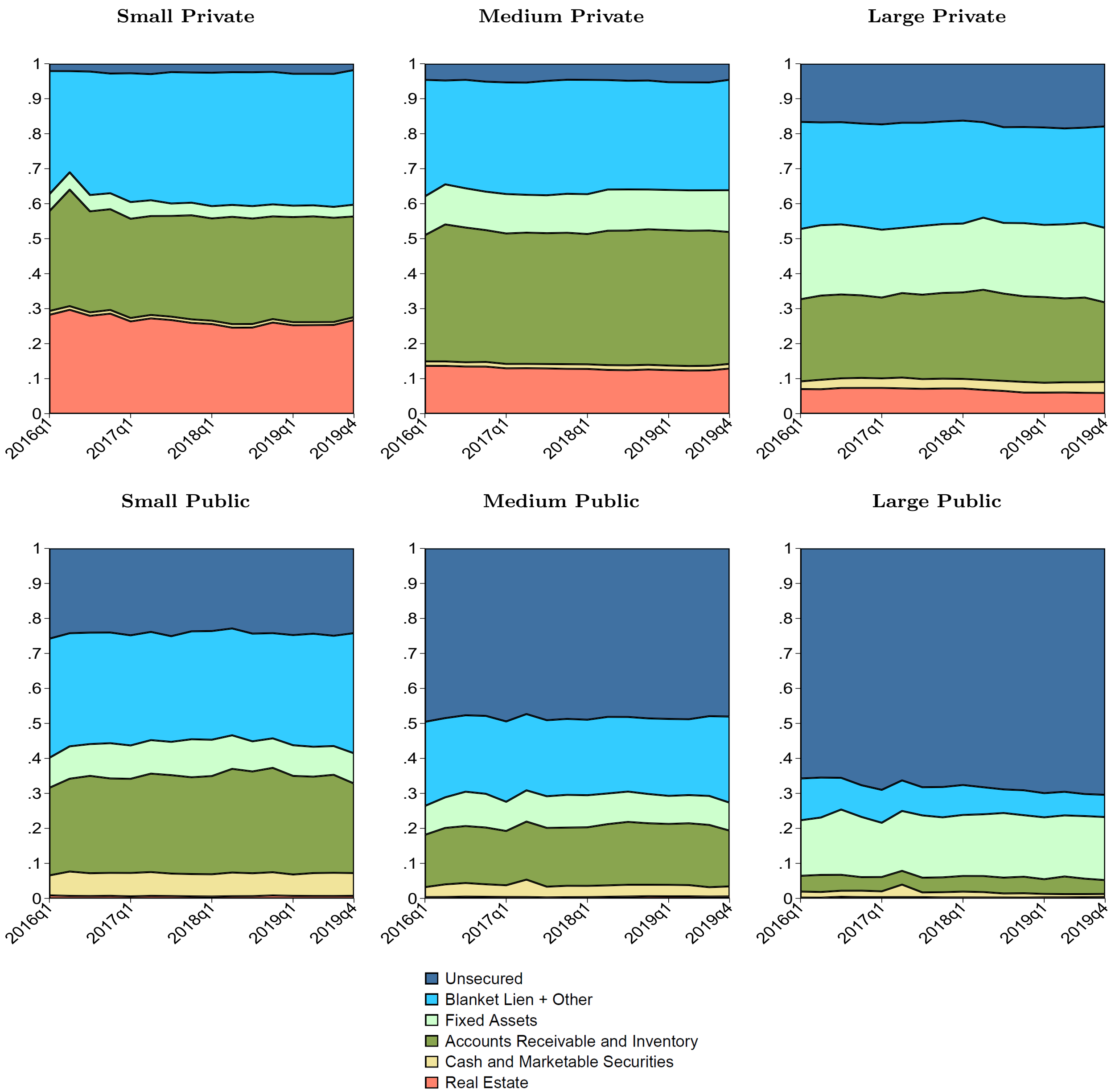
Note: The figures plots the median loan commitment as share of total balance sheet debt for various points in the asset-size distribution among private borrowers. Source: FR-Y14Q H.1

Figure 20: Collateral Types among SMEs



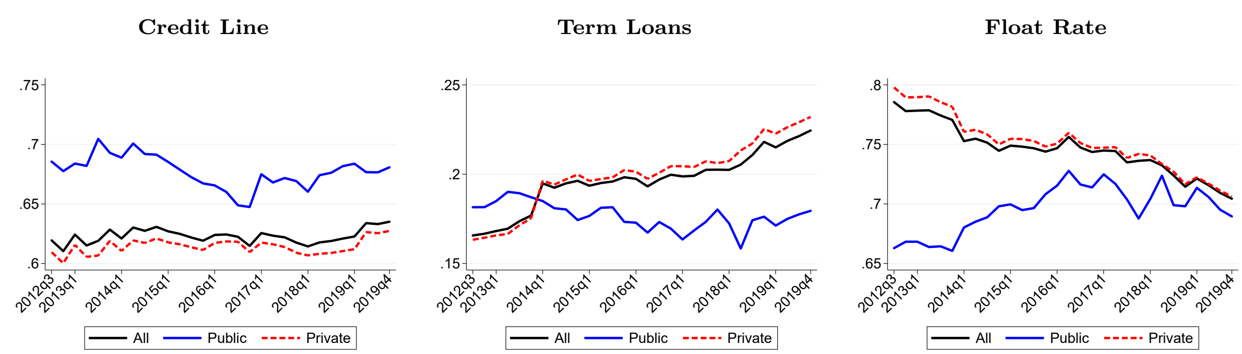
Note: The figure plots loan values secured by different collateral types over time for SME borrowers. SMEs are defined as firms with annual sales less than \$50mn. The different types of collateral are real estate collateral (salmon); cash and marketable securities (yellow); accounts receivable, inventory (green); fixed assets (mint); blanket liens and other (light blue); and unsecured (dark blue). Source: FR Y14-Q H.1.

Figure 21: Collateral Type: Public vs. Private (Based on Number of Loans)



Note: The figure plots the proportion of loans secured by different collateral types over time. The different types of collateral are cash and marketable securities (in yellow); accounts receivable, inventory (in dark green); blanket liens (in light blue); fixed assets (in light green); real estate (in orange); and unsecured loans (in dark blue). The top three panels from left to right show the proportion of loans secured by the different collateral types and unsecured for private borrowers in the bottom quartile of assets (small), between the bottom and top quartile of assets (medium), and above the top quartile of assets (large). The bottom three panels present the same information for public borrowers. Source: FR Y14-Q H.1.

Figure 22: Loan shares: Credit Lines/Term loans and Floating/Fixed Rates



Note: The share of credit lines among all loan types in the left panel. The middle panel plots the term loans shares. The right panel plots the share of loans with floating interest rates. Source: FR Y-14Q H.1. Source: FR Y-14Q H.1.