Collateral Heterogeneity and Monetary Policy Transmission: Evidence from Loans to SMEs and Large Firms*

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

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Abstract

We study the role of heterogeneous financial frictions in the transmission of monetary policy, using firm-bank matched administrative data for the U.S. We find that collateral heterogeneity in loan contracts shapes both the pricing and the quantity of credit in response to monetary policy shocks. Small and risky (leveraged) firms pledge mostly accounts receivable, inventory, and blanket liens as collateral, tying their borrowing capacity to procyclical earnings. Loan spreads on these collateralized facilities respond less to monetary policy shocks than spreads on unsecured loans. At the same time, because the value of this collateral itself moves procyclically, these firms' debt capacity expands during monetary easings and contracts during tightenings, so their borrowing and investment rise more during easings and fall more during tightenings than for other firms. Our micro estimates of this collateral-based debt-capacity channel are economically significant and can explain 77 percent of aggregate credit expansions and contractions.

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†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 policy influences the real economy by altering the availability and cost of external finance (Bernanke and Gertler, 1989). Yet firms exposed to the same monetary policy shock frequently experience strikingly different changes in borrowing outcomes. Following an episode of monetary easing, some firms expand credit rapidly while others exhibit little response, despite operating under the same aggregate financial conditions. These differences matter because access to external finance ultimately shapes firms' investment, working-capital management, and production decisions. Explaining why otherwise similar firms experience markedly different borrowing and investment responses has therefore become a central question in the literature on monetary transmission.

Existing research has largely offered two explanations for heterogeneous monetary transmission to firms. The first literature emphasizes borrower balance sheets as the primary determinant of borrowing capacity. Beginning with the financial accelerator framework of Bernanke, Gertler, and Gilchrist (1999), this literature argues that firms with weaker balance sheets should respond more strongly to monetary policy because external finance becomes relatively more expensive. While early empirical evidence broadly supports this view (Gertler and Gilchrist, 1994), more recent work has produced mixed conclusions. Ottonello and Winberry (2020) show that highly leveraged public firms respond less to monetary policy shocks, consistent with higher default risk increasing the cost of external finance. Notice that both lines of works associate high leverage and weak balance sheets with higher risk, where higher risk increasing external finance premia leading to more responsive investment on the one hand and with higher default risk leading to less responsive investment on the other hand. Without focusing on monetary policy changes, Crouzet and Mehrotra (2020) find that although smaller and riskier firms exhibit greater cyclical sensitivity, these differences do not appear to arise primarily from balance sheet strength or weakness.

A second literature emphasizes collateral as the determinant of borrowing capacity (Kiyotaki and Moore, 1997). Because external finance depends critically on pledgeable assets, collateral expands firms' access to credit and relaxes financing constraints by reducing external finance premia. However, this literature has largely emphasized whether assets are pledgeable, rather than whether different forms of collateral can generate different borrowing capacity connected to different external financing costs that change with monetary policy.

This paper bridges these literatures by arguing that understanding heterogeneous monetary transmission requires moving beyond the quantity of collateral toward its composition and its impact on the cost of borrowing, put differently, marginal cost of funds. Improved financial conditions via easy monetary policy alone do not generate more borrowing and investment. Firms borrow when they possess assets capable of supporting additional debt at lower cost. As a result, they can increase their leverage as long as their external finance premia does not go up. Operating collateral—including accounts receivable, inventory, and blanket liens—is directly linked to firms' current production and cash flows, whereas fixed assets and real estate collateral derive much of their lending value from liquidation or resale. Because monetary policy affects firms' operating activity and liquidation value of fixed assets differentially, these different forms of collateral need not transmit monetary policy equally. The composition of pledgeable assets therefore becomes a fundamental determinant of firms' effective debt capacity.

Testing this hypothesis requires observing not only firms' borrowing and investment responses to monetary policy but also the contractual features underlying that borrowing. Existing empirical work typically relies on balance-sheet proxies for borrowing capacity—such as firm size, age, leverage, or net worth—or focuses on samples consisting primarily of either very large public firms or very small businesses. While these measures capture important dimensions of financial constraints, they do not reveal the specific assets securing individual loans or the contractual terms such as loan interest rates through which monetary policy affects the marginal cost of external finance. Different samples of firms might also capture different financial contracts, limiting the representativeness.

We overcome these limitations using confidential supervisory data, FR Y-14Q, linking firms, banks, and individual loan facilities over 2012Q3–2024Q4. The data are supervisory reports collected by the Federal Reserve as part of the CCAR process.[1] The data identify the collateral pledged on each loan together with contractual interest rates, borrowing quantities, and borrower-lender relationships. The reporting banks account for approximately 70 percent of U.S. commercial and industrial lending, while the firms in our sample, public and private, account for roughly 65 percent of total corporate debt and 75 percent of U.S. gross output.[2] This combination allows us to observe not only whether firms borrow or repay debt following monetary policy shocks but also whether those responses depend on the composition of pledged collateral and price of loans secured with that collateral.

Our analysis yields three main findings.

First, collateral composition is a central determinant of heterogeneous monetary trans-

[1]The data cover large bank holding companies and U.S. intermediate holding companies of foreign banking organizations. The asset threshold changed in 2019 from $50 billion to $100 billion, and reporting adjustments occurred around 2020. We retain only loans outstanding as of 2020Q1 to maintain consistency.

[2]Shares are computed using FR Y-14, Call Reports, Z.1 Financial Accounts, and BEA Gross Output data; see Appendix A.

mission. Private firms rely disproportionately on operating collateral, whereas public firms frequently borrow unsecured. Exploiting variation across facilities within the same firm-bank-quarter relationship, we show that borrowing secured by operating collateral exhibits different quantity and pricing responses to monetary policy than borrowing secured by fixed assets and real estate, both relative to unsecured borrowing. These differences imply that collateral composition governs how firms' borrowing capacity responds to monetary policy.

Second, collateral composition and borrower balance sheets jointly determine firms' debt capacity. Highly leveraged firms rely more heavily on operating collateral, and these firms' greater debt capacity backed by operating collateral allow them to exhibit stronger borrowing responses to monetary policy. Thus, leverage alone is not sufficient to characterize firms' borrowing capacity. Highly leveraged firms whose debt is backed by operating collateral can expand debt capacity during monetary easings because those assets support additional borrowing at a lower marginal cost. These firms' debt capacity contracts during tightenings, confirming symmetric stronger responses to monetary policy relative to non-leveraged and/or larger unsecured public firms. The intuition goes back to the financial accelerator channel. Operating collateral mutes the price response to monetary policy, that is loan spreads move less when loans backed by operating collateral. The loan-level regressions with firm-bank-time fixed effects pick up relative changes in loan quantities, which can be noisy if total loan volumes move in the same direction. We show that this is the case once we move from loan-level regressions to firm-bank level regressions, where total commitments, debt capacity and investment all move consistently with each other.

Third, these financing differences propagate beyond credit markets. Monetary policy affects not only debt and investment but also firms' management of working capital. The same operating assets that expand borrowing capacity also become the inventory and receivables financed by that borrowing, linking the composition of collateral directly to firms' real operating decisions.

Our empirical strategy exploits two complementary sources of variation. At the loan-level, we interact high-frequency monetary policy surprises with predetermined collateral types, while comparing facilities extended by the same bank to the same borrower within the same quarter. Firm-bank-quarter fixed effects absorb all borrower demand, lender-specific credit supply, and relationship characteristics common to contemporaneous borrowing. Therefore, identification comes from differences in collateral composition across otherwise comparable loan facilities. Because we focus on existing credit relationships, collateral is predetermined with respect to contemporaneous monetary policy shocks, allowing us to isolate how the composition of pledged assets governs the transmission of monetary policy to loan quantities and borrowing costs.

We then aggregate from loan contracts to firms by constructing measures of debt capacity based on firms' collateral composition and leverage. This allows us to examine whether the heterogeneity identified at the loan-level propagates to firm-level borrowing, investment, and working-capital decisions. Finally, we aggregate the predicted firm-level borrowing responses to quantify the importance of debt-capacity heterogeneity for aggregate credit dynamics. Aggregating the estimated firm-level responses reveals that debt-capacity heterogeneity accounts for approximately 77 percent of the aggregate response of credit growth to monetary policy easing during our sample period.

Our paper refines classic interpretations of financial constraints by combining the insights of Bernanke and Gertler (1989) and Kiyotaki and Moore (1997). Much of the subsequent literature has emphasized either borrower balance sheets or collateral as the primary determinant of borrowing capacity. In one view, small and risky firms are more sensitive to monetary policy because they are "not well collateralized" and therefore face tighter financing constraints. In another, highly leveraged firms are risky and may respond less because greater default risk raises the marginal cost of external finance. We show that these perspectives are not competing explanations. Small and risky firms are often secured borrowers, as they will not be able to borrow otherwise, and the collateral backing their debt differs systematically from that of larger firms. They rely predominantly on working-capital-based collateral rather than hard assets, implying that the composition of collateral—not simply its presence—governs how debt capacity and the marginal cost of external finance respond to monetary policy. The fact that these small and risky firms pledge collateral while large firms often borrow unsecured[3] implies a tight mapping between firm size and financing structures as also argued by the earlier literature (Gertler and Gilchrist, 1994).

We proceed as follows. Section 2 reviews the related literature. Section 3 describes the data. Section 4 presents the main results. Section 5 shows investment outcomes and additional robustness analysis. Section 6 concludes.

2 Related Literature

Our paper relates to the literature studying how firm financial heterogeneity shapes investment during monetary policy cycles. Ottonello and Winberry (2020) propose a model that

[3] Public firms borrowing unsecured is well documented. For example, Benmelech, Kumar, and Rajan (2020) show that unsecured borrowing among large publicly listed firms has become more prevalent over time.

the responsiveness of investment depends on firms' default risk. Empirically, low-default-risk public firms respond more strongly to monetary shocks than highly indebted firms or firms closer to default. Related work organizes heterogeneity using other borrower characteristics. Jeenas (2019) emphasizes firms' balance-sheet liquidity, debt issuance, and investment responses, while Cloyne, Ferreira, Froemel, and Surico (2022) finds that young, non-dividend-paying firms exhibit the largest investment responses, even after conditioning on size, leverage, and liquidity. All of these studies infer differences in financing conditions from firm balance sheets and real outcomes, predominantly for publicly traded firms. We instead observe the contractual structure underlying external finance's price and quantity both for public and private firms. Loan-level collateral and interest rates allow us to measure directly how monetary policy changes the terms of borrowing and whether those changes depend on the assets pledged to support the debt.

We relate to the literature on firm size and cyclicality. Gertler and Gilchrist (1994) show that small manufacturing firms' sales decline more sharply following monetary tightenings and that these firms account for a disproportionate share of the contraction in inventory demand. They interpret these findings as evidence that credit-market imperfections amplify the response of small firms. More recently, Crouzet and Mehrotra (2020) confirm that smaller firms adjust real activity more strongly over the cycle, but find that traditional balance-sheet measures of financial constraints do not fully account for this pattern. Our evidence provides a contractual perspective on these results. Small and private firms are frequently secured borrowers, but the assets supporting their debt differ systematically from those of large firms. They rely predominantly on accounts receivable, inventory, and blanket liens rather than on hard fixed assets or unsecured borrowing. Firm size may therefore organize heterogeneous transmission not simply because it proxies for the level of financial constraints, but because it maps into different sources of collateral backing the debt capacity.

A related literature identifies the bank lending channel of monetary policy. Kashyap and Stein (2000) show that lending by less-liquid banks responds more strongly to monetary policy, while Jiménez, Ongena, Peydró, and Saurina (2012) use loan applications to isolate changes in bank credit supply from changes in borrower demand. Our mechanism is complementary. Bank×quarter fixed effects in our firm-level credit specifications mean that we are conditioning on these papers' channels by absorbing them together with all bank-wide, time-varying supply shocks. Our estimates compare heterogeneous borrowers exposed to the same bank-level lending conditions even they change over time. More stringently, our collateral specifications include firm×bank×quarter fixed effects and therefore compare facilities within the same borrower–lender relationship and quarter. Identification comes from facilities that differ in the collateral pledged, holding constant all contemporaneous firm, bank, and relationship conditions common to those loans and conditioning on time-varying firm-credit-demand and bank-credit-supply conditions.

This distinction also connects our analysis to Kashyap, Lamont, and Stein (1994), who argue the importance of distinguishing between inward shifts in loan supply and collateral-based tightening of borrower constraints. They show that inventory investment at firms without access to public bond markets is especially sensitive to liquidity during tight-credit episodes. We examine the contractual mechanism that can generate such working-capital heterogeneity. Relative to unsecured debt, loans backed by operating collateral exhibit a narrower range of spread movements: their spreads rise less during monetary tightening and fall less during easing. Thus, operating collateral partially insulates borrowers from fluctuations in the marginal cost of external finance. At the same time, the quantity of borrowing supported by operating collateral responds strongly to monetary policy. The joint price and quantity evidence points to changes in borrower debt capacity, rather than to bank-wide movements in credit supply alone.

Finally, our analysis contributes to the literature on the form of corporate borrowing constraints. In the canonical collateral framework of Kiyotaki and Moore (1997), borrowing capacity depends on the resale value of durable assets. More recent work emphasizes borrowing tied to revenues and earnings (Lian and Ma, 2020; Drechsel, 2022; Kiyotaki, Moore, and Zhang, 2021). We observe all types of pledged collateral in the data covering both these literatures inclusive of durable assets and earnings. Our contribution is to identify a contractual bridge between these two mechanisms. Accounts receivable and inventory are legally pledged assets, but their value is generated by firms' current sales and production; blanket liens similarly provide claims on operating assets and continuation value. We show that these forms of operating collateral are especially important for small and private firms and that they govern how collateral values, loan quantities, and borrowing costs respond to monetary policy.

3 Data

We use the Federal Reserve's supervisory (CCAR) FR Y-14Q Corporate Loan data, which provide facility-level information on loan commitments, loan pricing, borrower balance sheets, and pledged collateral.[4] Our sample spans 2012Q3 through 2024Q4 and includes the COVID-

[4] Additional institutional details are provided in Appendix A.

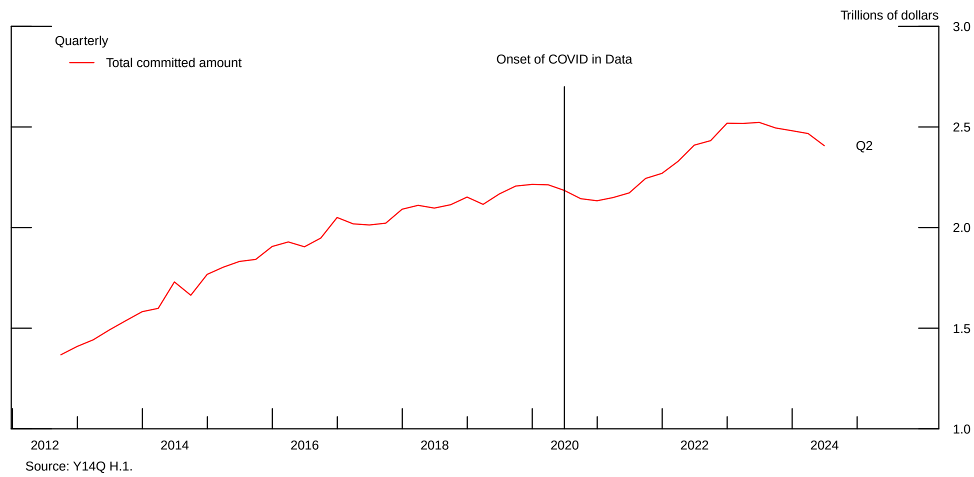


Figure 1.— Total Non-financial, C&I Loan Commitments. Notes: The figure plots the total dollar value of commercial and industrial loans issued to non-financial corporations by reporting banks.

19 pandemic, which represents a structural break in credit markets. Figure 1 shows a temporary decline in total loan commitments at the onset of the pandemic, followed by a recovery as policy support measures were implemented. This period reflects a combination of precautionary behavior, government lending programs, and emergency policy interventions that are not directly comparable to standard monetary transmission episodes. To isolate conventional policy effects, we include a COVID-period indicator from 2020Q2-2022Q2 in our baseline specifications.

3.1 Coverage and Representation

The U.S. Census Bureau defines SMEs as firms with less than 500 employees. Based on this employment definition, the Small Business Administration (SBA) reports that SMEs account for 99.6 percent of all U.S. firms, 52 percent of private sector employment and 50 percent of private sector gross output in the U.S. There is not a well-established asset and/or revenue cut-off to define SMEs in the U.S. across all the industries. Since FR Y-14Q 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. As shown in Panel (a) of Figure 2, most of the private firms (red bars) in our data are SMEs with assets less than \$10 million, while there are almost no SMEs among public firms (blue bars).

The typical thresholds for being a "small" firm in the U.S. studies are based on firms with assets less than \$100 million in Compustat or QFR, corresponding to bottom 10-15th

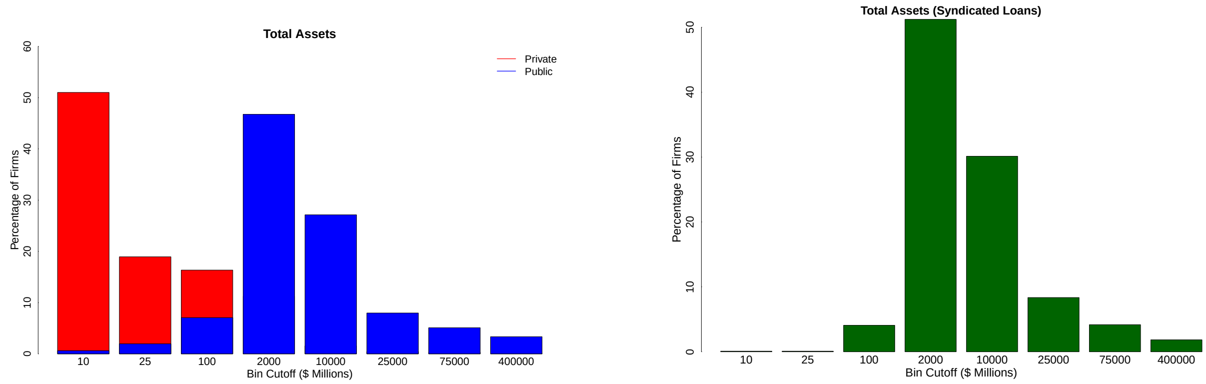


Figure 2.— Firm Size Distribution: Private vs. Public Firms and Syndicated Loan Borrowers. Notes: The figure shows firm size distribution based on assets, for all private firms (red bars) and public firms (blue bars), in Panel (a), and for firms who borrow in syndicated loan markets, Panel (b).

percentile, due to low coverage of truly small firms in those datasets. As shown in Table 1, our smallest firms have assets less than 1 million and sales less than 5 million. This is why our data captures a significant number of SMEs, and hence representative of U.S. Census Bureau Revenue enhanced Longitudinal Business Dynamics (RLBD) data that covers the true population of the U.S. firms via its universal coverage.[5]

To be clear, our data does not capture the universe of firms and hence universe of firm-borrowers. To be included in our data, a firm must borrow at least 1 million USD from banks subject to CCAR. However, this low threshold and extensive coverage of the banking sector makes our data the most representative firm-level dataset for the U.S. that connects firms' real and financial outcomes both through firm balance sheets, other types of debt and assets, and through credit transactions between firms and their banks. For example, a typical dataset used in this literature is on firms who borrows in the syndicated loan market. Panel (b) of Figure 2 shows the firm-size distribution for firms who borrow in syndicated loan markets. Only 0.8 percent of the firms in our sample borrow in syndicated loan markets, since most of our small firms cannot access these markets. Importantly, the green bars in Panel (b) mimic the blue bars in Panel (a) indicating that the firm-size distribution in the syndicated loan market is almost identical to the distribution of public companies. Hence, the popular data sources, LCD Dealscan and the Shared National Credit Registry (SNC), do not seem to contain a representative set of U.S. corporate borrowers.[6]

This of course begs the question whether the private firms in our data are important for

[5]The two-hump firm size distribution shown in Figure 1, Panel (a) is very similar to studies using RLBD data, although first hump is higher given many more small firms in the Census data; see for example Dinlersoz, Kalemli-Ozcan, Hyatt, and Penciakova (2018).

[6]This is not surprising since in order to be included in SNC, firms need to borrow a minimum of 20 million USD from at least 3 banks.

Table 1.— Firms Sales and Assets by Decile (millions)

Variable/Decile	1	2	3	4	5	6	7	8	9	10
Assets	1.239	3.500	6.233	10.223	16.801	29.622	63.784	210.982	1081.471	69431
Sales	5.938	13.997	23.861	38.630	63.394	108.453	209.839	472.919	1488.500	63404

Notes: The figure shows firm size distribution based on assets and sales (in millions, for the all sample of firms in the FR Y14Q data).

the U.S. corporate sector debt. The answer is yes. As noted in the introduction our data, FR Y-14Q, covers 65 percent of the aggregate U.S. corporate sector debt. The publicly listed firms in FR Y-14Q account less than half of this— 31 percent of the U.S. corporate debt. Even though, not all publicly listed firms borrow from banks and hence are not covered in FR Y-14Q data, we are not far from the true representation of public firms' share of U.S. corporate sector debt: The share of U.S. corporate debt attributable to the universe of publicly listed firms in Compustat is 48 percent. Hence, more than 50 percent of the U.S. corporate sector debt is born by private firms, which our data is representative of: 52 percent of the U.S. corporate sector debt is accounted by private firms both in our data and in true population.

3.2 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). We track for initial public offerings (IPOs) and leveraged buy-outs (LBOs). In particular, we match FR Y-14 data to COMPUSTAT quarter-by-quarter. Therefore, a private firm undertaking an IPO will move from private to public in that quarter. That said, the number of firms that move between samples during our time period is very small.

Large public firms generally report consolidated financial statements to banks. To avoid double counting of financial variables for the subsidiaries, 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.[7]

The final data contain 5,938,802 loan-level observations, for 195,850 unique U.S. corporations, of which 191,844 are private firms, covering all sectors of the U.S. economy.

[7]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.

(a) Non-financial Corporate Businesses

(b) Non-financial Businesses

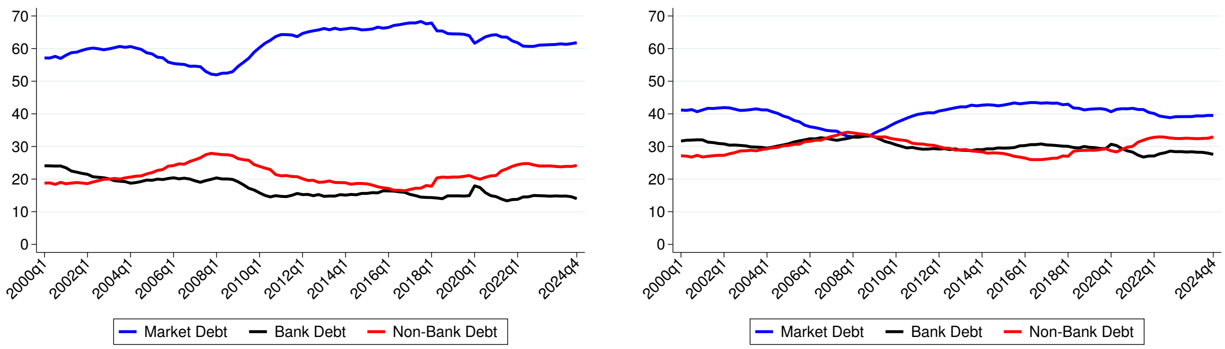


Figure 3.— Debt Shares from Different Lenders from Financial Accounts of the United States. Notes: The panel (a) represents the debt share from different lenders for the "non-financial corporate businesses" in the U.S. The panel (b) represents similar debt share for all "non-financial businesses" in 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.

3.3 How much of SMEs balance sheet is bank debt?

Figure 3 plots financing sources for the non-financial business sector from the Financial Accounts of the United States (Flow of Funds). Panel (a) shows the debt share for publicly listed and large private firms (such as C and S corporations), known as "non-financial corporate businesses," an aggregate category 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.[8] In this panel, 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.

Figure 4 plots the share of bank debt on private firm balance sheets in the FR Y-14Q. The small firms within SMEs constitute most of the FR Y-14Q firms and borrow almost entirely from banks with almost no presence in the bond market (92.5% of balance sheet debt is bank loans). Medium sized firms are slightly less reliant on banks loans, but the majority of their debt is still within the banking system (63.3%). For large private firms, defined as firms in

[8] 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. The share of each liability type is estimated using lender data sources, for example, Call Reports for the total of bank deposits.

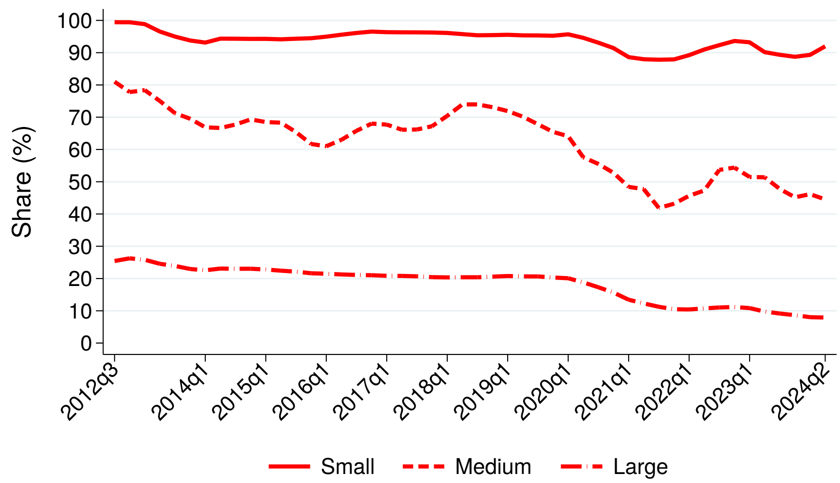


Figure 4.— Share of Bank Debt in Non-financial Private Firms' Financing. Notes: The figure plots bank debt (the median loan *utilization*) as share of total balance sheet debt (loans and bonds) for various points in the asset-size distribution among private borrowers. Figure 17 in the Online Appendix plots shares for median loan *commitment*.

the upper quartile of the asset distribution, the FR Y-14Q data matches the aggregate data in Figure 3 (a); bank lending accounts for only 22 percent of their financing.[9]

3.4 Descriptive Statistics

3.4.1 Banks under Regulation (CCAR)

Table 2 shows descriptive statistics for the 39 banks subject to administrative regulation (CCAR) during our sample period, which accounts for 85 percent of the U.S. banking industry in terms of assets. Average bank leverage measured from total liabilities (0.882) and short-term liabilities (0.727) 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 $24 million and represents on average 5 percent of a given loan.

3.4.2 Firm Balance Sheets, Collateral and Loan Outcomes

Tables 3, 4, and 5 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 and also for small rather than large firms.

[9]For reference, 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, making the typical private firm in the U.S. an SME.

Table 2.— Summary Statistics – Bank-Level

	1st Qu. (1)	Median (2)	Mean (3)	3rd Qu (4)	SD (5)
Liabilities-to-Assets	0.868	0.885	0.882	0.897	0.024
Short-Term-Debt-to-Assets	0.691	0.769	0.727	0.808	0.14
Charge-off$_b$ (millions)	0	11.438	24.833	34.289	44.61
Charge-off/Loan$_b$ (%)	0	2.30	4.80	6.70	7.70

Notes: 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 3.— Summary Statistics – Firm-Level

	All Firms (1)	Private Firms (2)	Public Firms (3)
Levels (millions \$)			
Fixed Assets	192.77	46.49	6958.62
Capital Expenditures	777.39	27.13	22951.99
Total Assets	515.65	175.13	11725.44
EBITDA	75.59	22.25	1827.68
Ratios			
Liabilities-to-Assets	0.613	0.614	0.590
Account Receivable-to-Sales	0.268	0.245	1.045
Inventory-to-Sales	0.268	0.263	0.451
Short-Term-Debt-to-Assets	0.130	0.133	0.012
Investment	0.134	0.135	0.092
Sales Growth	0.484	0.260	0.253
Share of firms issuing bond	0.012	0.006	0.337
Share of firms issuing securities	0.060	0.040	0.990

Notes: Sample includes 195,850 U.S. firms for the period 2012Q3–2024Q4, excluding financial and government-owned firms, and 5,938,802 loan-level observations. 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. Investment is defined as the annual change in tangible fixed assets. Sales growth is defined at the annual percentage change in total sales. Private firm balance sheet 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.

Table 3 shows that the average private firm has \$175 million in assets compared to \$12 billion for the average public firm. The average private borrower is more leveraged in terms of short term debt and has higher sales growth and investment than the average public firm. The average private firm does not have access to other financing sources aside from banks. They have almost no outstanding bonds, nor any other form of security outstanding–for example, commercial paper, privately placed or expired bonds. 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 4 compares firms along the size distribution and leverage dimensions. SMEs have average assets of \$21.7 million compared to the average large firm–defined by the upper quartile of the asset distribution–with \$1.25 billion, and have higher sales growth. Large

Table 4.— Summary Statistics by Firm Size and Leverage – Firm-Level

			All Firms		SME	
	All SME (1)	Large (2)	High Leverage (3)	Low Leverage (4)	High Leverage (5)	Low Leverage (6)
Levels (millions \$)						
Fixed Assets	6.957	479.195	191.681	174.819	8.131	5.964
Capital Expenditures	3.226	571.453	229.309	227.522	2.431	3.274
Total Assets	21.799	1252.819	507.318	478.123	20.730	21.103
EBITDA	2.651	184.207	78.961	74.975	2.590	2.506
Maturity	4.380	2.938	4.201	3.574	4.886	4.021
Ratios						
Total Debt-to-Assets	0.317	0.326	0.597	0.114	0.622	0.106
Account Receivable-to-Sales	0.101	0.150	0.892	0.125	0.071	0.114
Inventory-to-Sales	0.105	0.124	0.118	0.103	0.111	0.098
Short-Term-Debt-to-Assets	0.122	0.127	0.227	0.041	0.225	0.044
Investment	0.139	0.111	0.117	0.131	0.098	0.130
Sales Growth	0.275	0.226	0.291	0.293	0.299	0.294
Credit Lines	0.625	0.626	0.591	0.644	0.568	0.658
Observations						
Firms	147297	74728	113818	138274	80369	102404
Firm-Quarter	1884206	1266665	1323114	1705365	754457	1050855

Notes: See Table 3 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.

firms are slightly more leveraged than SMEs. In general, sales growth and investment are similar among high and low leveraged firms, for all firms and for SMEs. The difference in debt maturity across firm size is minimal. SME loans are on average 4.3 years compared to 2.9 years for large firms. Among SMEs, loan maturity for high versus low leverage firms is comparable, at 4.8 versus 4.0 years. Moreover, the type of loan–credit line versus term loan–does not vary across firm size. Both SME and large firm have 62% of loans in credit lines. Low leveraged firms have slightly more credit lines than high leverage firms.

Figure 5 plots the average leverage ratio among all, private, and public firms. The figure shows that leverage for private borrowers was quite stable around 34 percent until COVID and has leveled off at a lower level around 28 percent. Meanwhile, public firm leverage consistently grew from 27 percent to just over 31 percent before the public accounting rule change requiring operational loans and leases to be capitalized on balance-sheet. After the leverage spike during COVID, leverage has leveled off around 30 percent for public firms. Moreover, leverage for the average firm in the sample will be closely approximated by the average private firm.

Table 5 shows that private borrowers pay higher interest rates than public borrowers on their loans, despite almost always pledging collateral. Accounts receivable and inventory and blanket liens are the most common forms of collateral used by private firms. The shares of different collateral pledged by different firms do not sum to one because a firm may

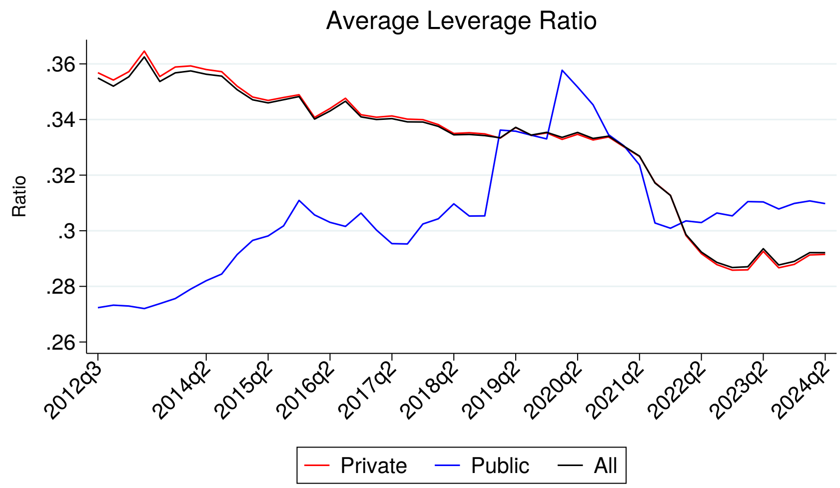


Figure 5.— Average Leverage Ratio Across Firms. Notes: The figure plots the mean total debt-to-asset ratio for all firms, private firms, and public firms.

Table 5.— Summary Statistics – loan-level

	All Firms (1)	Private Firms (2)	Public Firms (3)
Panel A: Loan Characteristics			
Interest Rate (Percent)	3.40	3.50	2.60
Collateral: Fixed assets and real estate	0.249	0.273	0.140
Collateral: Cash and marketable sec	0.023	0.021	0.033
Collateral: Act. receiv. and inventory	0.281	0.306	0.163
Collateral: Blanket lien and other	0.300	0.315	0.228
Collateralized	0.852	0.914	0.561
Maturity (in years)	3.692	3.734	3.510
Panel B: Facility Type			
Credit line	0.6595	0.6488	0.7252
Term loan	0.3261	0.3387	0.2498
Other	0.0091	0.0078	0.0173
Panel C: Interest Rate Type			
Fixed	0.2064	0.2119	0.4717
Floating	0.5931	0.6133	0.2578
Mixed	0.1445	0.1257	0.1734
Fee only	0.0237	0.0220	0.0419

Notes: The collateral categories are the fraction of total loans collateralized by each respective category. For example, among all firms, 25 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.

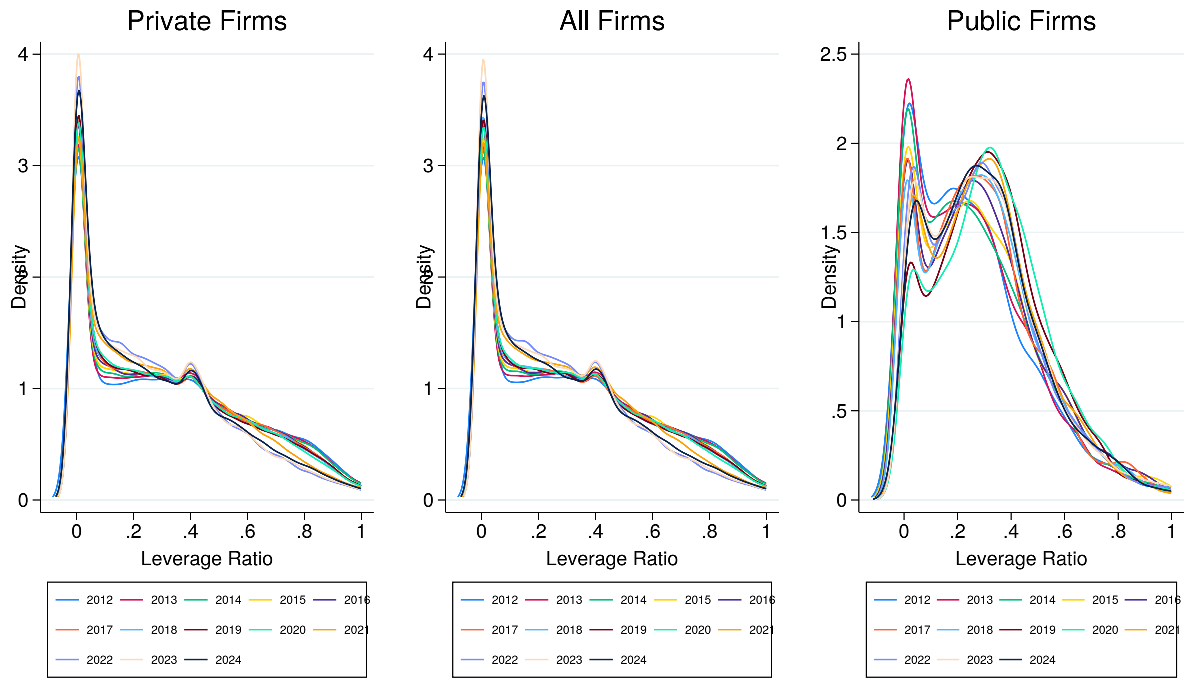


Figure 6.— Leverage Distribution by Firm Type. Notes: The figure plots the distribution of leverage in each year of our sample from 2012 through 2024. The left panel is the leverage distribution for private firms, the middle is the same distribution for public firms, and the right is the same distribution for all firms.

pledge multiple types of collateral across different facilities. The cross-sectional prevalence of collateral categories is broadly stable over time.

Finally, Figure 6 plots the kernel density for leverage among all, private, and public firms for each year in our sample. The full and private firm sample show very clearly that the overall distribution of leverage does not shift year to year. Hence, while individual firm leverage may fluctuate, the distribution of leverage remains constant. Leverage, on average, is time-invariant, which is important to document in order to interpret our regression results as being driven by monetary policy innovations rather than variation in leverage. Another thing to notice is that leverage distribution for all and private firms mimics firm-size distribution both in our data and also in the universe of firms of the Census. This finding further supports the high correlation between size and leverage.

4 Empirical Analysis

4.1 Measuring Monetary Policy Surprise Shocks

We estimate monetary policy surprises, denoted MP, using the high-frequency identification approach of Gertler and Karadi (2015). We compute the surprise component of a policy announcement at the monthly level as:

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

where m denotes the month, ffr_t^m is the implied federal funds rate from a federal funds futures contract, and γ_t adjusts for the timing of the FOMC announcement within the month. τ^n is the number of days in the meeting month and τ^d is the day of the meeting.[10]

Our baseline shock uses the 3-month-ahead federal funds futures contract. Using a horizon-ahead contract helps isolate unexpected policy news from high-frequency movements in the current-month contract around meetings. Results are robust to alternative horizons commonly used in the literature, including the current-month contract and other-horizon contracts such as the 4-month-ahead contract used in related work (e.g., Miranda-Agrippino and Rey (2020) and Kalemli-Ozcan (2019)). To extract the surprise component, we measure the change in futures-implied rates in a narrow window around the FOMC announcement.[11]

Following Ottonello and Winberry (2020), we convert monthly announcement surprises to a quarterly series using time weights based on the number of days remaining in the quarter after each announcement. For regressions that summarize average effects, we use an 8-quarter moving average of the quarterly surprises. This measure captures the intermediate-term monetary policy environment relevant for firms' credit and investment decisions and allows for delayed and persistent transmission. Accordingly, the coefficients in these regressions measure responses to a one-percentage-point increase in the eight-quarter moving average of monetary policy surprises, rather than to a single-meeting shock. It also allows for delayed and persistent transmission, consistent with evidence that monetary policy affects real activity with lags and persistence (e.g., Romer and Romer (2004)). For dynamic impulse responses (local projections), we instead use the quarterly surprise series directly without moving averaging. In all regressions, MP is expressed in percentage points (so a 100 bp surprise is coded as 1.0).

4.2 The Role of Collateral: What do Firms Pledge?

Following Kiyotaki and Moore (1997), many papers show that financial frictions via collateral constraints impact monetary policy transmission and can amplify business cycle fluctuations.

[10]The multiplier can become large for meetings late in the month, which may magnify measurement error. When $\gamma_t > 4$, we follow the literature and instead use the change in the following-month contract without applying the multiplier.

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

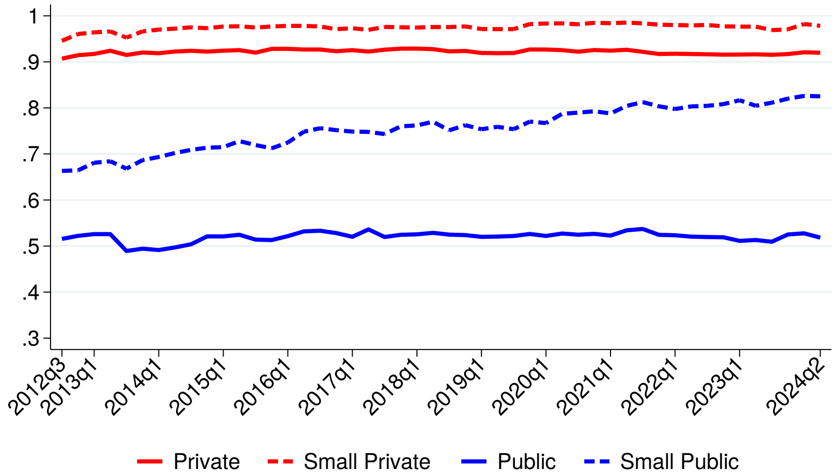


Figure 7.— Share of Loans that are Collateralized: Public vs. Private. Notes: The dashed line represents the share of total loans that are collateralized for firms in the 25th percentile of the asset distribution (small).

In this class of models there is no default risk, but due to latent default risk, firm borrowing is collateralized. Hence firms cannot borrow without pledging a fraction of the resale value of the capital stock. Monetary policy changes the resale value of assets that generates changes in firms borrowing capacity. The collateral information in the FR Y-14 allows us not only to see what types of collateral are actually pledged, but allows us to examine whether monetary policy transmission differs systematically across observed collateral types and whether these differences are consistent with a collateral-based transmission mechanism.

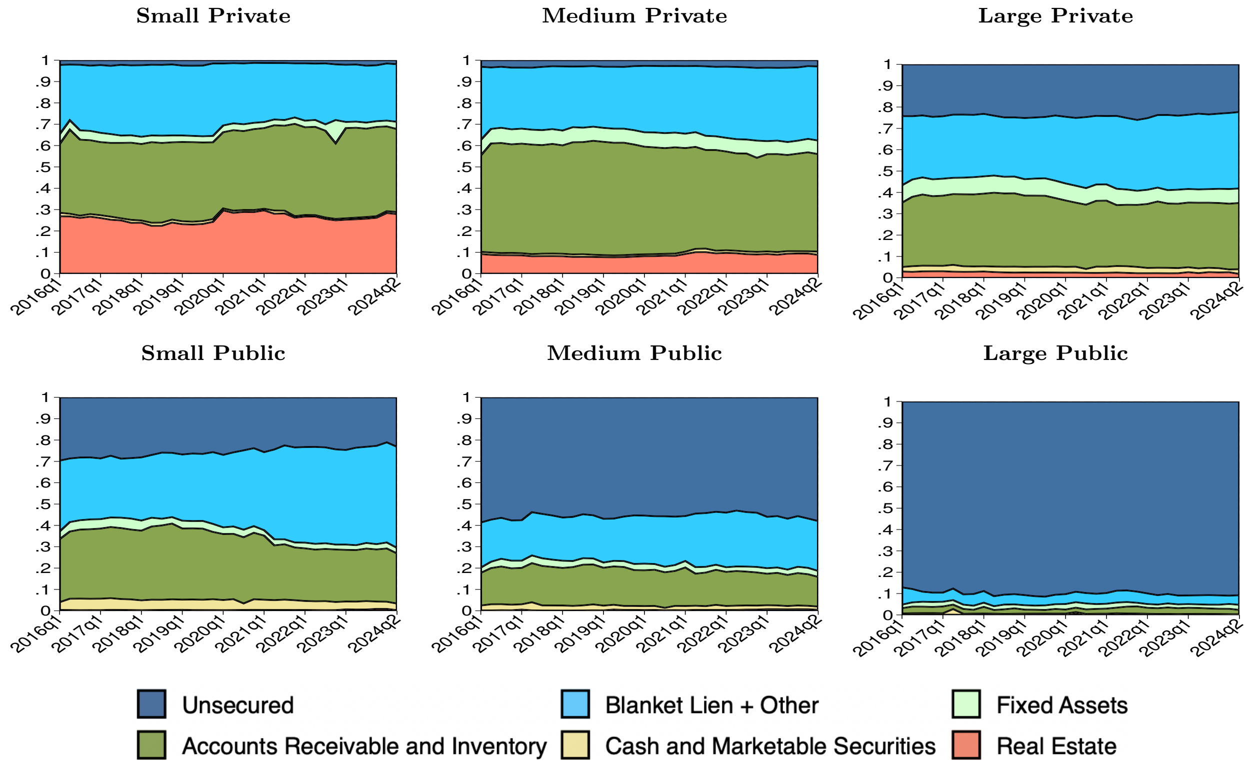
Figure 7 plots the share of loans secured by some form of collateral broken out by private and public borrowers. Slightly more than 90 percent of all private loans are collateralized (red solid line), compared to roughly 50 percent for public borrowers (blue solid line). Remarkably, 95 percent of all loans to smaller private firms are collateralized (red dotted line), while small public firms collateralize up to 70 percent of the loans (blue dotted line). Collateral use is therefore strongly associated with firm size, with smaller firms substantially more likely to borrow on a secured basis.

The FR-Y14Q data 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.[12].

There are four important facts that are documented first time in our paper for the U.S. corporate borrowers. First, real estate collateral (in red) is important only for the smallest private borrowers and virtually absent among public borrowers. Second, fixed assets (light

[12]The Online Appendix Figure 19 shows the same figure based on number of loans instead of value.

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



Notes: The figure plots the value share of loans secured by different collateral types over time. The top three panels from left to right show loan shares secured by the different collateral types 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 repeats the same exercise for public firms.

green) as a fraction of all collateralized loans is less frequently used. 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.[13] Finally, unsecured borrowing (dark blue) increases monotonically across firm size and dominates the borrowing pattern of large public firms. Figure 20 in the Online Appendix shows that SMEs collateral use mimics the pledged collateral by small private and medium private firms above, and that the most important form of collateral used to borrow by financially constrained SMEs are AR&I and blanket liens. These descriptive patterns suggest that the contractual structure of collateral differs systematically across firms. More importantly, they imply that monetary policy may not impact all secured borrowing equally. If borrowing capacity and costs depend on the type of asset backing the loan, then facilities secured by different collateral should exhibit different responses to monetary policy. The next section tests this prediction directly by examining whether loan commitments and borrowing

[13]Table 22 in the online appendix B.4 confirms this pattern using finer detail, reporting collateral shares by deciles of firms assets.

costs respond differently across collateral types.

4.3 Loan-Level Regressions: The Role of Collateral Type

We first test whether the differences in collateral documented above translate into heterogeneous monetary policy transmission. Specifically, we estimate loan-level regression that interact monetary policy surprises with indicators for the collateral securing each facility. If collateral affects firms' borrowing capacity, both loan quantities and borrowing costs should respond differently across collateral categories. Hence we run:

$$\log \mathrm{Y}_{l,f,b,q} = \alpha_{f,b,q} + \alpha_{s,q} + \beta \textbf{Collateral Type Dummy}_l + \lambda \left(\textbf{Collateral Type Dummy}_l \times \frac{1}{N} \sum_{k=0}^{N} \mathrm{MP}_{q-k} \right) + \vartheta_{l,f,b,q} \tag{2}$$

where $\log(Y)$ is either total committed loan amount or $\log(1+i)$ where i is the loan-level interest rate. Each dummy is equal to one when a loan is collateralized with a given 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 is omitted, thus, all of the results are still interpreted against not collaterizing a loan with triple fixed effects within a firm-bank pair.

The key identifying variation comes from firms that maintain multiple facilities with the same bank at a point in time but pledge different types of collateral across those facilities. Accordingly, the interaction coefficients compare loans that differ only in their collateral type within the same firm-bank relationship and quarter. Because collateral is predetermined for existing facilities, the specification exploits differences in collateral type rather than contemporaneous collateral choice. These contract-level regressions including firm–bank–quarter fixed effects absorb all borrower-specific demand shocks and bank-specific funding conditions that are common within a firm–bank pair in a given quarter. In addition, our pricing results are based on loan spreads, i.e., direct measures of the external finance premium. A demand shock shifts the loan demand curve but does not change the relative pricing of two loans extended to the same borrower by the same bank in the same period. The differential pricing effects we document across collateral types therefore cannot be explained by credit demand. Instead, they reflect changes in the marginal cost of funds associated with different contractual features, consistent with the financial accelerator mechanism.

Table 6 reports the loan-level regressions by collateral category. The results provide strong evidence that monetary policy transmission differs systematically across collateral types. Three main takeaways emerge. First, the normal time effects, shown in the first four rows, suggest that collateral determines borrowing capacity for private borrowers (the coefficients in column (3) on all the collateral categories are all positive and statistically significant). For public firms, collateral appears to be required selectively on facilities where lenders demand additional protection. Because these firms generally have access to public debt and equity markets, the use of collateral is less likely to reflect the creation of borrowing capacity and more likely to reflect facility-specific risk. The normal time effects shown in column (5) for public borrowers are generally negative and statistically significant.

Second, the magnitudes of the loan spread coefficients on accounts receivable and inventory and blanket lien collateral are larger for private borrowers; these forms of collateral are associated with lower rates compared to fixed asset and real estate collateral. The Wald tests reported in Table 6 strongly reject the null hypothesis that AR&I and BL collateral have equal effects as real estate and fixed assets, across all three firm samples.

In terms of magnitudes, in normal times, an AR&I-secured loan is 185.7 percent larger than an otherwise comparable unsecured loan to the same firm, bank, and quarter ($(e^{1.0497}-1)\times 100 = 185.7$).[14] The premium holds up across the full range of monetary conditions observed in the sample—171.3 percent at the tightest observed shock to 215.8 percent at the easiest—despite the interaction coefficient governing that movement not being separately significant. This is itself informative: the debt-capacity advantage of operating collateral is a persistent, first-order feature of private-firm credit access under every monetary environment observed, not an artifact of normal times. The direction is also consistent with a debt-capacity/financial-accelerator mechanism—larger under easing, smaller under tightening, as expected if AR&I's pledgeable value tracks the firm's operating conditions.

The spread results provide direct evidence on the financial accelerator mechanism. Columns (2), (4), and (6) show that monetary policy pass-through to the marginal cost of funds generally operates through accounts receivable and blanket liens. Relative to unsecured borrowing, loans secured by these types of collateral experience more muted spread movements following monetary policy shocks. During contractions, spreads on collateralized loan increase less than spreads on otherwise comparable unsecured loans. During expansions, spreads also decline by less. Thus, loans secured by AR&I and blanket lien collateral compress the cyclical variation in the marginal costs of funds insulating these borrowers from fluctuations

[14] Because this is a semi-elasticity measuring the proportional difference between secured and unsecured loan sizes—not a bounded share or probability—there is no reason for it to be capped at 100 percent; the underlying comparison is a ratio between two loan sizes, which has no natural upper bound.

Table 6.— The Role of Collateral: Pre-Covid Period

	All		Private		Public	
	Log (Loan)	Log $(1+i)$	Log (Loan)	Log $(1+i)$	Log (Loan)	Log $(1+i)$
Fixed assets and real estate	-0.6277***	0.0100***	0.1282*	0.0029**	-1.7963***	0.0200***
	(0.0546)	(0.0007)	(0.0516)	(0.0009)	(0.0651)	(0.0012)
Cash and marketable sec.	-0.1398+	-0.0024*	0.3672***	-0.0078***	-0.5649***	0.0023
	(0.0686)	(0.0011)	(0.0640)	(0.0012)	(0.1070)	(0.0017)
Act. receiv. and inventory	0.4618***	-0.0006	1.0497***	-0.0067***	0.0048	0.0047***
	(0.0797)	(0.0008)	(0.0670)	(0.0011)	(0.1061)	(0.0011)
Blanket lien and other	0.0566	0.0019**	0.6315***	-0.0043***	-0.4092***	0.0078***
	(0.0584)	(0.0007)	(0.0476)	(0.0009)	(0.0822)	(0.0007)
Fixed assets and real estate × MP Surprise$_q$	-1.2635	-0.0647**	-0.6050	-0.1128***	4.4256+	-0.0114
	(2.1146)	(0.0198)	(2.0896)	(0.0286)	(2.3073)	(0.0315)
Cash and marketable sec. × MP Surprise$_q$	-1.7673	0.0186	-2.5600	-0.0827+	0.5335	0.1403
	(3.1619)	(0.0564)	(2.4598)	(0.0469)	(5.4523)	(0.0964)
Act. receiv. and inventory × MP Surprise$_q$	-6.2497	-0.1013**	-3.8422	-0.1187**	-10.4708+	-0.1633***
	(4.3905)	(0.0304)	(3.7467)	(0.0396)	(5.2223)	(0.0446)
Blanket lien and other × MP Surprise$_q$	1.5884	-0.1354***	2.2989	-0.1719***	2.5576	-0.1225**
	(2.8106)	(0.0274)	(2.1147)	(0.0309)	(3.9427)	(0.0346)
(Wald tests)						
Individual tests (p-values)						
H0: (AR&I) = (RE/FA)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
H0: (Blanket) = (RE/FA)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Observations	1925694	1920684	1432549	1431797	491699	487444
Adjusted R^2	0.411	0.406	0.318	0.375	0.341	0.400
Bank × Firm × Quarter F.E.	Yes	Yes	Yes	Yes	Yes	Yes

Notes: $^{+}$ $p < 0.1$,* $p < 0.05$,** $p < 0.01$, and *** $p < 0.001$. Each category is a dummy indicating the type of collateral pledged for the loan. The category "Unsecured" is omitted. The monetary policy shock is the surprise component of the 3 month ahead Fed Funds future contract. Double-clustered standard errors by firm and time are reported in parentheses. Wald tests report p-values for the null hypothesis that coefficients on the indicated collateral types are equal. AR&I is Account receivable and inventory; RE/FA is Real Estate and Fixed Assets; Blanket is blanket lien. P-values below 0.05 indicate significant differences between collateral types.

in financing conditions.

Although the level effects differ markedly across private and public firms, the interaction effects reveal a common contractual role for collateral. For private firms, collateral primarily expands debt capacity by allowing firms to borrow against pledgeable assets. For public firms, collateral appears to be required selectively on facilities where lenders demand additional protection. These distinct motives explain the opposite signs of the normal-time coefficients (positive and significant among the private firm sample and negative and significant among the public firm sample). Conditional on collateral being pledged, however, its role in monetary transmission is remarkably similar across the two groups. In both cases, collateral significantly mutes the extent to which lenders adjust borrowing costs following monetary policy shocks, while the mix of loan sizes across collateral types does not shift significantly with monetary policy at the loan level. Because our loan-level specification holds each firm's total quarterly borrowing fixed by construction, it cannot speak to whether total borrowing responds; Section 4.7 shows that it is at the firm level, where total credit is not held fixed, that quantity becomes the primary margin through which collateral-driven debt capacity adjusts.

Table 7 shows that our main findings are not driven by differences in loan repricing or

Table 7.— The Role of Collateral: Robustness, All Firms

	Excl. Floating-Rate Loans Pre-COVID	Excl. Term Loans Pre-COVID	Excl. Term Loans Full Period, Tightening
	Log $(1+i)$	Log $(1+i)$	Log $(1+i)$
Fixed assets and real estate	0.0193***	0.0019*	0.0016
	(0.0011)	(0.0009)	(0.0013)
Cash and marketable sec.	-0.0071***	-0.0051***	-0.0059**
	(0.0013)	(0.0012)	(0.0018)
Act. receiv. and inventory	-0.0064***	-0.0045***	-0.0022
	(0.0011)	(0.0011)	(0.0015)
Blanket lien and other	-0.0025**	-0.0017*	-0.0013
	(0.0008)	(0.0007)	(0.0009)
Fixed assets and real estate × MP Surprise$_q$	0.0070	-0.1173**	-0.0907
	(0.0305)	(0.0350)	(0.1285)
Cash and marketable sec. × MP Surprise$_q$	-0.1292$^+$	-0.0639	0.0704
	(0.0639)	(0.0611)	(0.2588)
Act. receiv. and inventory × MP Surprise$_q$	-0.0409	-0.1733**	-0.6208***
	(0.0371)	(0.0490)	(0.1406)
Blanket lien and other × MP Surprise$_q$	-0.1087**	-0.1848***	-0.2721**
	(0.0349)	(0.0315)	(0.0928)
Adjusted R^2	0.561	0.411	0.592
Observations	629463	937683	1320789
Bank × Firm × Time F.E.	Yes	Yes	Yes

Notes: $^+$ $p < 0.1$,* $p < 0.05$,** $p < 0.01$, and *** $p < 0.001$. Each category is a dummy indicating the type of collateral pledged for the loan. The category "Unsecured" is omitted. The monetary policy shock is the surprise component of the 3 month ahead Fed Funds future contract. The results in columns (1) and (2) only include observations through 2020Q1, pre-COVID. The Full Period specification in column (3) includes all observations through 2024Q4, controlling impact of COVID-era government support programs to SMEs. Column (3) separates contractionary and easing components of the monetary policy surprises, Tightening = $\max(MP_q, 0)$ and Easing = $\min(MP_q, 0)$). Both components are included simultaneously and interacted with the collateral-category indicators.For brevity, the table reports only the interaction coefficients on the contractionary component, (MP_q^+), indicated in the table by MP_q. Double-clustered standard errors by firm and time are reported in parentheses.

facility structure. Columns (1) and (2) reestimate the pre-COVID specification after excluding floating-rate loans and term loans, respectively. The negative interaction coefficients for AR&I and blanket liens generally remain, indicating that their more muted spread response relative to unsecured borrowing is not simply a consequence of floating-rate repricing or the composition of revolving and term facilities. Although the estimates vary across the restricted samples, the relative stability of borrowing costs on loans backed by operating collateral remains visible.

Because monetary policy surprises in our sample skew toward easing, a natural concern is whether our results are specific to expansionary episodes rather than a general feature of monetary transmission. Column (3) addresses this directly by using the full sample, excluding term loans, and separating contractionary from expansionary monetary policy surprises—a meaningful test given that our extended sample includes the rapid 2022–2023 tightening cycle, when the policy rate rose from near zero to over 6 percent. During contractions, the interaction coefficients for AR&I and blanket liens are negative and statistically significant, whereas those for fixed assets and real estate and for cash and marketable securities are statistically indistinguishable from zero. Thus, when monetary policy tightens, spreads on loans secured by operating collateral rise substantially less than spreads on otherwise comparable unsecured loans, confirming that the insulation effect is not an artifact of an easing-dominated sample. The effect is particularly strong for AR&I collateral.[15]

Taken together, Tables 6 and 7 are consistent with a financial-accelerator interpretation in which collateral limits the range over which firms' marginal cost of funds fluctuates. Unsecured borrowing is exposed to larger increases in spreads during contractions and larger declines during expansions. By contrast, collateral—especially AR&I and blanket liens—partially insulates borrowers from these movements. Collateral therefore does not eliminate monetary-policy pass-through; rather, it compresses the cyclical variation in borrowing costs relative to unsecured debt. This stabilization is most evident for operating collateral, whose borrowing base adjusts with the firm's ongoing sales and production.

The stronger insulation provided by AR&I and blanket liens points to a hierarchy in debt capacity across collateral types. Some collateral derives its pledgeable value from ongoing business activity, while other collateral derives its value primarily from liquidation in secondary markets. Monetary policy therefore affects the pledgeable value of these assets through different channels: operating collateral responds through changes in firms' cash flows and production, whereas fixed assets and real estate depend more heavily on resale values.

The empirical evidence therefore suggests that the relevant distinction is not simply between secured and unsecured borrowing, but between collateral whose pledgeable value is determined by firm operations and collateral whose value is determined primarily by liquidation markets. To formalize this intuition, consider the standard borrowing constraint in Kiyotaki and Moore (1997):

$$Rb_t \leq q_{t+1}k_{t+1},$$

where Rb_t denotes gross repayment on borrowing at time t, and k_{t+1} and q_{t+1} represent the quantity and price of collateralizable assets in the next period. In this framework, borrowing capacity depends on the pledgeable value of assets.

The important distinction in our setting is between tangible fixed assets—such as real estate and machinery—and operating collateral comprising accounts receivable and inventory (AR&I) and blanket liens. Tangible assets derive collateral value primarily from resale or liquidation value in external markets (q_{t+1}). By contrast, AR&I arises directly from firm operations: receivables reflect realized sales awaiting payment, while inventory reflects production tied to expected sales. Their collateral value therefore depends on the firm's ability

[15] Table 17 in the Online Appendix reports the full-sample tightening only specification.

to generate revenue and maintain operating scale. Consequently, monetary policy affecting firm sales and internal liquidity directly impacts borrowing capacity through operating collateral. Using the Kiyotaki and Moore (1997) metaphor, the fruit firms produce becomes input for further collateralizable borrowing.[16] This distinction matters especially for smaller private borrowers with limited tangible fixed assets. For such firms, blanket liens function as broad claims on receivables, inventory, and other unencumbered assets, effectively extending borrowing capacity based on operating performance.[17]

Taken together, the evidence suggests that monetary policy transmission depends not simply on whether firms borrow, but on the amount of debt capacity embedded in the assets supporting that borrowing. Collateral therefore shapes monetary transmission not merely because it secures lending, but because different assets generate different amounts—and different cyclicality—of pledgeable borrowing capacity

Debt capacity, however, depends not only on the assets firms can pledge but also on the liabilities already carried on their balance sheets. We therefore next examine leverage as a complementary determinant of debt capacity and ask whether more highly leveraged firms are more financially vulnerable to monetary policy shocks.

4.4 Firm Leverage and Risk of Default

Debt capacity depends not only on the assets firms can pledge but also on the liabilities already carried on their balance sheets. Before studying heterogeneous monetary policy transmission, we therefore verify that leverage identifies financially vulnerable firms. Leverage is defined as the ratio of debt to assets, using either short-term debt or total debt. A highly leveraged firm enters a monetary tightening with a larger stock of outstanding obligations and less remaining debt capacity. It should therefore be more exposed to increases in borrowing costs and contractions in the amount of credit available, particularly when its borrowing is not fully insulated by pledgeable collateral.

Table 8 shows that leverage measured in prior quarters strongly predicts subsequent default probabilities. This relationship is particularly pronounced for private firms and remains after conditioning on whether the firm already has a non-performing loan. Importantly,

[16] AR&I loans are classified as asset-based loans with advance rates based on book value fractions—up to 85 percent for receivables and 65 percent for inventory. Most AR&I loans are tied primarily to the AR component (see OCC *Comptroller's Handbook on Asset-Based Lending*).

[17] Based on interviews with SME CEOs, receivables represent roughly 20 percent of annual sales among firms with $50--100$ million in revenue. Firms submit weekly AR and inventory reports to banks; eligible AR collateral is typically defined over receivables due within 60 days, linking borrowing capacity tightly to current sales and collection performance.

Table 8.— Firm Leverage and Default

	Default Probability								
	All Firms			Private Firms			Public Firms		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Firm Leverage$_{q-1}$	0.037***		0.039***	0.038***		0.039***	0.044*		0.036
	(0.005)		(0.004)	(0.005)		(0.004)	(0.023)		(0.032)
Non-Performing Loan$_{q-1}$		0.032***	0.032***		0.074***	0.074***		0.008	0.008
		(0.005)	(0.005)		(0.010)	(0.010)		(0.006)	(0.006)
Observations	2751717	1174512	1174512	2393088	925897	925897	358629	248643	248,643
Adjusted R^2	0.485	0.618	0.618	0.522	0.698	0.698	0.296	0.326	0.326
Firm F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Quarter F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: $^{+}$ $p < 0.1$,* $p < 0.05$,** $p < 0.01$, and *** $p < 0.001$. 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 default probability is the bank-provided probability that a firm fails to repay a loan in the next 12 months. The non-performing loan dummy is equal to 1 if a firm has any non-performing loans in the prior period. Leverage is the ratio of total debt liabilities over total assets.

leverage remains highly predictive even after controlling for whether the borrower already has a non-performing loan, indicating that it captures latent financial vulnerability rather than realized distress. The results are robust to measuring leverage using either short-term or total debt, indicating that leverage captures forward-looking financial vulnerability rather than simply reflecting contemporaneous loan performance.

If collateral determines the asset side of firms' debt capacity, leverage captures the liability side. The default results indicate that leverage identifies firms whose balance sheets are more financially vulnerable before monetary policy shocks occur. Monetary policy should therefore generate larger changes in borrowing and investment among these firms, particularly private firms that depend more heavily on bank finance.

4.5 SMEs and Leverage

The preceding analysis identifies the two determinants of firms' debt capacity. Collateral determines the assets that can be pledged, while leverage captures the liabilities already carried on the balance sheet. The remaining question is which firms are most likely to be constrained by this debt-capacity channel. We argue that these mechanisms should bind most strongly for leveraged SMEs. Relative to larger firms, SMEs rely disproportionately on bank credit, possess fewer alternative financing sources, and more frequently pledge operating assets as collateral. Consequently, changes in debt capacity arising from monetary policy should translate more directly into their borrowing decisions.

We start by aggregating all loans between a firm and a bank to the pair–quarter level. We create 'High Leverage Firm' as a dummy equal to one for firms with leverage in the first quarter of the sample (or average leverage) higher than the median leverage, and zero otherwise. Our credit regressions are at firm-bank-quarter level, as shown below:

$$\log \sum_{l \in \mathcal{L}(f,b,q)} L_{f,b,q}(l) = \alpha_{f,b} + \alpha_{b,q} + \alpha_{s,q} + \kappa \left(\textbf{High Leverage Firm}_f \times \frac{1}{N} \sum_{k=0}^{N} \text{MP}_{q-k} \right) + \vartheta_{f,b,q} \tag{3}$$

where, in equation (3) $\log \sum_{l \in \mathcal{L}(f,b,q)} L_{f,b,q}(l)$, is the total loan amount for a given firm-bank pair, (b, f), and quarter, (q). $\alpha_{f,b}$ is the firm×bank fixed effect and $\alpha_{b,q}$ is the bank×quarter fixed effect. We additionally include sector×quarter fixed effects, $\alpha_{s,q}$, to absorb industry-specific credit conditions: collateral composition varies sharply by industry [18], so without $\alpha_{s,q}$ sector-level shocks correlated with monetary policy could be conflated with the firm-leverage channel we study. This fixed effect specification accounts for 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. Quarter fixed effects absorb the common risk-free rate and direct effect of monetary policy. The log of total loans as a dependent variable allows expansionary monetary policy to create new firm entry into the credit market. A Δ log formulation (credit growth for a given firm) would restrict the analysis to existing firms throughout the sample.

Table 9.— Monetary Policy and Credit Outcomes: The Role of Firm Leverage and Size

	Log(Loan)		
		Baseline	
	(1)	(2)	(3)
High Leverage Firm × MP Surprise$_q$	-0.0893		0.3622
	(0.2387)		(0.2588)
SME × MP Surprise$_q$		1.7671**	2.5423**
		(0.6319)	(0.7981)
High Leverage Firm × SME × MP Surprise$_q$			-1.2182***
			(0.3328)
Observations	3598185	3598185	3598185
Adjusted R^2	0.934	0.934	0.934
Controls	Yes	Yes	Yes
Bank × Firm F.E.	Yes	Yes	Yes
Bank × Quarter F.E.	Yes	Yes	Yes
Sector × Quarter F.E.	Yes	Yes	Yes

Notes: $^{+}$ $p < 0.1$,* $p < 0.05$,** $p < 0.01$, and *** $p < 0.001$. The specification includes all observations through 2024Q4, controlling impact of COVID-era government support programs to SMEs. SME is a dummy variable equal to 1 for firms with sales below \$50 million. High Leverage Firm is a time-invariant dummy variable equal to 1 if the firm's leverage in the first quarter of the data is above the median leverage. The monetary policy shock is the surprise component of the 3 month ahead Fed Funds future contract. Double-clustered standard errors by firm and time are reported in parentheses.

[18] See Tables 20 and 21 in Online Appendix for a breakdown of collateral composition used to secure loans by industry.

Because leverage and firm size are strongly correlated, separating firms into private and public categories alone may obscure the balance-sheet mechanism identified above. Large public firms are, on average, substantially more leveraged than the median U.S. firm, yet also possess access to public debt and equity markets. We therefore examine leverage and firm size jointly by introducing a time-invariant SME indicator–equal to one if the firm's average revenue over the sample period is less than \$50 million–while retaining the high-leverage classification. This specification isolates whether monetary policy transmission is concentrated among firms that are simultaneously small and financially vulnerable.

The results are reported in Table 9. The results indicate that leverage alone is not sufficient to generate heterogeneous monetary policy transmission.[19] Once the interaction with firm size is introduced, the leverage effect changes sign (though not significant) while the triple interaction between leverage, SME status, and monetary policy remains economically and statistically significant. Interestingly, the SME interaction by itself indicates that small firms respond less to monetary policy expansion than larger firms: at the sample's average expansionary surprise of 4bps (0.04pp for the calculation), SME lending growth is 6.8 percentage points lower than that of large firms in the unconditional specification of column (2). Column (3), which additionally interacts with firm leverage, isolates this effect for non-leveraged SMEs specifically; holding leverage at its low-leveraged baseline, the differential widens to 9.7 percentage points.[20] The negative triple interaction shows that this dampened response is substantially attenuated among highly leveraged SMEs: combining all three interaction terms in column (3), the net differential for a leveraged SME falls to rough 6.5 percentage points–closer to the sensitivity of large, low-leverage firms than to that of non-leveraged SMEs. Hence, leverage does not push SMEs' transmission further from the typical firm's; it pulls leveraged SME's back toward it. Finally, combining the High Leverage Firm $\times$ MP interaction with the High Leverage Firm $\times$ SME $\times$ MP triple interaction isolates the additional effect of leverage among SMEs, holding SME status fixed. Evaluated at the samples average expansionary surprise, the implied change in log lending corresponds to 5.1 percent.[21] That is, following a typical monetary expansion, leveraged SMEs increase borrowing by rough 3.5 percent more than non-levered SMEs, holding firm-size fixed. This evidence suggests that debt capacity, and not size alone, drives the amplified transmission of monetary policy among smaller firms. This non-monotonic pattern is itself difficult to reconcile with a pure credit-demand story in which smaller firms are simply more

[19] Table 18 in the Online Appendix breaks this results out by facility type (credit line, term loan, other).
[20] The calculations are: $(e^{1.7671\times(-0.04)} - 1) \times 100 = -6.8\%$, and $(e^{2.5423\times(-0.04)} - 1) \times 100 = -9.7\%$
[21] The calculation is: $(e^{(0.3622-1.2182)\times(-0.04)} - 1) \times 100 = 5.1\%$, and is significant at 5 percent.

cyclical borrowers, since such a story predicts a monotonic size effect rather than one in which size alone dampens the response while leverage layered on top of size restores and amplifies it. The specification also controls directly for sales growth, which should absorb much of the firm-level cyclicality in real activity that a pure demand-based explanation would otherwise require.

Taken together, the evidence suggests that debt capacity binds most tightly for leveraged SMEs. These firms rely heavily on bank-intermediated finance while possessing limited access to alternative funding sources. Consequently, monetary policy affects not only the cost of credit but also the quantity of borrowing available to the firms whose balance sheets are least able to absorb financing shocks. We next examine the economic role of operating collateral itself. Specifically, we show that AR&I and blanket liens represent a distinct source of borrowing capacity rather than merely proxies for fixed-asset collateral.

4.6 Collateral and Leverage

The preceding analysis identifies operating collateral as a key determinant of firms' debt capacity. We next provide additional evidence that blanket liens and AR&I are economically distinct from traditional fixed-asset collateral and therefore represent an independent source of borrowing capacity rather than simply another way of pledging physical assets.

Technically, blanket liens are loans secured by all 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 a specific asset–such as real estate or some other fixed asset–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 9 provides direct evidence that blanket liens are not merely proxies for fixed-asset collateral. If blanket liens primarily reflected claims on physical assets, their use should increase with firms' holdings of fixed assets. Instead, the opposite pattern emerges. Blanket liens become less prevalent as firms' fixed-asset holdings increase, indicating that they primarily facilitate borrowing by firms with relatively limited tangible collateral.[22]

Table 10 reinforces this interpretation. Conditional on firms already pledging fixed assets or real estate, a substantial fraction of subsequent borrowing is instead secured by AR&I or blanket liens. Rather than substituting for fixed-asset collateral, operating collateral expands

[22] We thank Yueran Ma for suggesting this figure during her NBER-EFG meeting discussion of our paper.

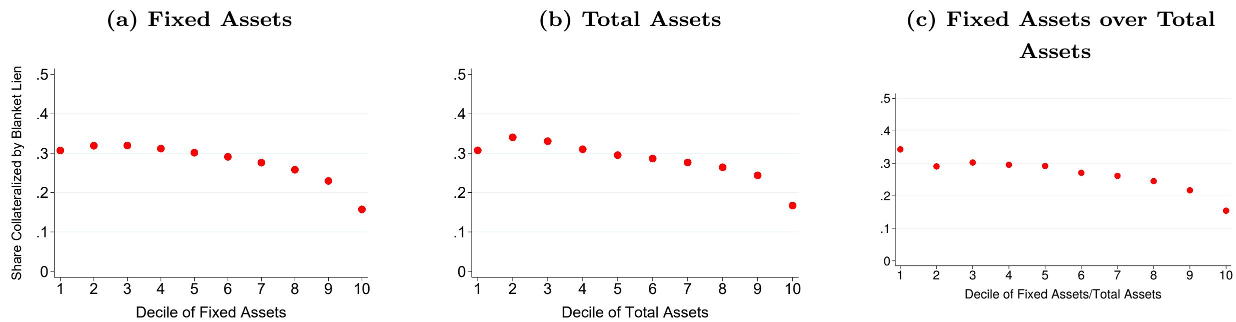


Figure 9.— Relation Between Blanket Liens and Fixed Assets. Notes: Each panel shows the share of loans secured by blanket liens across: (a) each decile of the fixed assets distribution, (b) each decile of the total assets distribution and (c) each decile of the ratio of fixed assets over total assets.

Table 10.— Multiple Loans Secured by Different Types of Collateral

Share of Additional Loans Collateralized by	
Blanket Lien (1)	0.183
AR&I (2)	0.204
AR&I and Blanket Lien (3)	0.370

Notes: (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.

firms' borrowing capacity once traditional collateral has already been exhausted.

4.7 Combining Collateral and Leverage into Debt Capacity

The preceding analysis has identified two complementary determinants of firms' debt capacity. On the asset side, operating collateral expands borrowing capacity by increasing the pledgeable value of firms' assets. On the liability side, leverage determines how much of that borrowing capacity has already been utilized. Rather than studying these mechanisms separately, we now combine them into a single firm-level measure of debt capacity.

We construct a firm-level measure in three steps:

1. First, for each firm i in industry j, we compute the share of total debt secured by operating collateral (AR&I and blanket liens).

2. Second, within each industry j, we compute the maximum leverage ratio (debt-to-assets) observed in the sample.

3. Third, we define firm i's operating-collateral debt capacity as the difference between its operating-collateral debt share and the industry maximum leverage ratio.

Firms whose operating collateral supports borrowing close to the industry's observed leverage frontier possess greater effective debt capacity.

Finally, we construct a time-invariant dummy equal to one if a firm's operating-collateral debt capacity measure is above the sample median. Because the difference is weakly negative by construction, firms with values closer to zero have higher relative borrowing capacity. Unlike leverage alone—which primarily captures default risk—this measure reflects the extent to which a firm's borrowing is backed by AR&I and blanket liens and therefore tied to cash-flow-generating operations.

Table 11 provides a direct test of the debt-capacity mechanism developed throughout Section 4.7. Rather than considering collateral and leverage separately, the debt-capacity measure combines both dimensions into a single balance-sheet characteristic. The negative and statistically significant interaction coefficients for all firms in column (1) and private firms in column (2) imply that firms with greater operating-collateral debt capacity expand borrowing significantly more during monetary easing. The result is strongest among private firms, precisely where bank-intermediated finance and operating collateral play the largest role. Turning to borrowing costs in columns (4) and (5), high-capacity firms exhibit less cyclical rate movements: their rates decline less during monetary easing and rise less during monetary tightening than those of lower-capacity firms. This joint pattern is informative about the underlying mechanism. A pure demand-side explanation—in which high-capacity firms simply want more credit for reasons unrelated to their borrowing constraint—amounts to a shift along a given supply curve, which should move price and quantity in the same direction: more desired borrowing should come with a larger, not smaller, change in the rate charged. Instead, quantity and price move in opposite directions: high-capacity firms borrow more while facing smaller rate changes in both directions. This is a supply-side shift, consistent with a loosening debt-capacity constraint that lets the lender extend more credit on better terms at the same time, rather than a shift in firms' demand for credit alone. Thus, debt-capacity adjustments operate through quantities while muting equilibrium rate movements. This complements the loan-level evidence in Section 4.3: there, holding each firm's total quarterly borrowing fixed, operating collateral mutes price while the loan-type mix does not move measurably; here, once total borrowing is free to move, quantity moves while the price response remains muted.

Importantly, this specification shows that the mechanism documented throughout the preceding sections survives when summarized by a single measure. Firms whose borrowing capacity is jointly supported by operating collateral and available balance-sheet capacity exhibit the strongest credit response to monetary policy.

Viewed together, the evidence suggests that monetary policy transmission is governed

Table 11.— Debt Capacity and Monetary Policy

	Log(Loan)			Log(1+i)		
	All firms	Private Firms	Public Firms	All firms	Private Firms	Public Firm
	(1)	(2)	(3)	(4)	(5)	(6)
High AR&I/BL-Collateral Capacity Firm × MP Surprise$_q$	-1.0095*	-1.2356**	-1.0834	-0.0764*	-0.0967**	0.0018
	(0.4855)	(0.5398)	(0.7042)	(0.0293)	(0.0347)	(0.0157)
Observations	3,404,459	2,942,275	459,071	3,404,459	2,942,275	459,071
Adjusted R^2	0.932	0.922	0.818	0.739	0.74	0.7835
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Bank × Firm F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Bank × Quarter F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Sector × Quarter F.E.	Yes	Yes	Yes	Yes	Yes	Yes

Notes: $^+$ $p < 0.1$,* $p < 0.05$,** $p < 0.01$, and *** $p < 0.001$. High AR&I/BL-Collateral Debt Capacity Firm is a dummy equal to 1 if firm i's AR&I and BL-collateral debt capacity is above the sample median, where debt capacity is defined as in Section 4.7. Controls include sales growth and its interaction with monetary policy shocks. The monetary policy shock is base on the 3 month ahead feds future contract. The results use all-firms for the full sample period from 2012Q3-2024Q4, controlling impact of COVID-era government support programs to SMEs. Standard errors are clustered by firm-time and reported in parentheses.

not simply by firms' leverage or collateral in isolation, but by their joint effect on debt capacity. Debt capacity is jointly determined by the assets firms can pledge and the liabilities they already carry. Operating collateral links that capacity to firms' cash-flow-generating activity, while leverage determines how much balance-sheet room remains available. Firms with greater operating-collateral debt capacity consequently exhibit the largest borrowing response to monetary policy.

4.8 Direct Evidence on the Collateral Value Channel

Table 12.— Collateral Value Sensitivity: 1st Stage

	Public Firms	Private Firms
	(1)	(2)
Fixed assets and real estate × MP Surprise$_q$	-79.6496***	-6.2837***
	(23.9554)	(1.8703)
Cash and marketable securities × MP Surprise$_q$	-70.2076**	-8.2710***
	(25.1800)	(2.1302)
Accounts receivable and inventory × MP Surprise$_q$	-86.2570***	-10.2662***
	(24.4557)	(2.0378)
Blanket lien and other × MP Surprise$_q$	-78.3658***	-8.2913***
	(24.1619)	(1.9097)
(Wald/F-tests)		
Individual tests (p-values)		
H0: (AR&I × shock) = (RE/FA × shock)	0.0000	0.0000
H0: (Blanket × shock) = (RE/FA × shock)	0.2661	0.0000

Notes: Robust standard errors in parentheses. $^+p < 0.10$, $^*p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$. The table reports the semi-elasticitites of collateral values to identified monetary policy shocks, by collateral type. The results use all-firms for the full sample period from 2012Q3-2024Q4, controlling impact of COVID-era government support programs to SMEs. The monetary policy shocks are extracted from the 3 mo ahead feds future contract.

The preceding analysis establishes that monetary policy transmission operates through firms' debt capacity. The proposed mechanism requires that monetary policy alter the value

Table 13.— Collateral Value Sensitivity by Type: 2nd Stage

	Log (Loan)		Log $(1+i)$	
	Private Firms (1)	Public Firms (2)	Private Firms (3)	Public Firms (4)
$\widehat{CV}_{\text{Fixed Assets and Real Estate}}$	1.8753**	-0.9337***	-0.0381	0.0020
	(0.5856)	(0.1219)	(0.0255)	(0.0029)
$\widehat{CV}_{\text{Cash and Marketable Securities}}$	2.7262***	-0.3169***	-0.0312**	0.0000
	(0.5007)	(0.0808)	(0.0097)	(0.0012)
$\widehat{CV}_{AR\&I}$	5.2401***	0.1533**	-0.0220**	0.0016
	(0.7869)	(0.0490)	(0.0066)	(0.0010)
$\widehat{CV}_{\text{Blanket Liens}}$	4.7047***	-0.0085	-0.0160+	0.0034***
	(0.9092)	(0.0914)	(0.0089)	(0.0010)
Observations	1,740,201	627,719	1,662,591	570,082
Adjusted R^2	0.309	0.304	0.533	0.581
Bank × Firm × Quarter F.E.	Y	Y	Y	Y

Notes: Robust SEs in parentheses. $^+p < 0.10$, $^*p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$. The Table reports the instrumented elasticity of loan prices to collateral value changes due to identified monetary policy shocks, by collateral type. The monetary policy shocks are extracted from the 3 mo ahead feds future contract.

of the assets backing that debt capacity. We now test this implication directly by examining how identified monetary policy shocks affect the market value of pledged collateral.

To do so, we exploit the *market value of pledged collateral* reported in the FR Y-14 supervisory data.[23] Unlike the earlier reduced-form evidence, this exercise directly links monetary policy shocks to changes in collateral values and then asks whether those predicted changes explain borrowing quantities and borrowing costs.

We begin by estimating how the reported market value of pledged collateral responds to monetary policy shocks. Specifically, we estimate (2) with a different left-hand-side variable:

$$\begin{aligned}\Delta\log(CV_{l,q}) = \alpha_{f(l),b(l)} + \alpha_{b(l),q} + \sum_k \beta_k 1[\textbf{Collateral Type}_{l=k}] \\ + \sum_k \lambda_k \left(1[\textbf{Collateral Type}_{l=k}] \times \frac{1}{N}\sum_{k=0}^{N} \text{MP}_{q-k}\right) + \varsigma l, q,\end{aligned} \tag{4}$$

where $\Delta\log(CV_{l,q})$ is the quarterly change in log collateral value for loan l; $1\,[\textbf{Collateral Type}_{l=k}]$ indicates loan l uses collateral type k (fixed assets, cash and marketable securities, accounts receivable and inventory, or blanket liens); $\alpha_{f(l),b(l)}$ are firm-bank fixed effects; and $\alpha_{b(l),q}$ are bank-time fixed effects to absorb relationship-level heterogeneity and bank-specific factors that may influence the underlying value of collateral. The coefficients λ_k measure the semi-elasticity of collateral value to monetary policy shocks for each collateral type during normal times.[24] This first stage does not require firm-bank-quarter fixed effects:

[23]This data are reported for only a subset of the total loan facilities totaling 917,385 loans.

[24]We estimate the model over the full sample period (2012-2024) with interactions between collateral types,

we are only estimating how monetary policy affects the value of a given collateral type, which does not require a firm to hold multiple, differently-collateralized loans with the same bank in the same quarter.

The first-stage estimates in Table 12 provide direct evidence that monetary policy changes the value of pledged collateral. Consistent with the debt-capacity mechanism developed above, operating collateral—particularly AR&I—exhibits the greatest sensitivity to monetary policy shocks.The Wald tests strongly reject equality between AR&I and fixed assets for both public and private firms, confirming that operating collateral responds significantly more to monetary policy than traditional fixed-asset collateral. Unlike the earlier reduced-form loan-level evidence, these estimates directly identify the intermediate object underlying the debt-capacity mechanism: monetary policy changes the value of the collateral itself rather than merely the terms on which collateralized loans are extended.

Having established that monetary policy systematically changes collateral values, we next ask whether these predicted changes translate into differences in loan quantities and borrowing costs. If the debt-capacity mechanism proposed in the preceding sections is correct, predicted changes in collateral values should explain both the quantity of credit extended and the cost at which that credit is supplied. Specifically, we use the predicted collateral values from the first stage, denoted $\widehat{CV}_k$, where k indexes the different collateral types. By construction, $\widehat{CV}_k$ isolates the component of collateral value movements explained by identified monetary policy shocks. Intuitively, it measures how strongly the value of the collateral backing a given loan is expected to respond to monetary policy. We then estimate how these predicted collateral value changes affect loan quantities and borrowing costs:

$$\log Y_{l,q} = \alpha_{f(l),b(l),q} + \sum_k \theta_k \widehat{CV}_{k,l,q} + \varsigma_{l,q}, \tag{5}$$

where $Y_{l,q}$ is either the loan commitment amount or interest rate for loan facility l in quarter q; $\alpha_{f(l),b(l),q}$ are bank-firm-time fixed effects that absorb all time-varying bank-firm relationship factors; and $\widehat{CV}_{k,l,q}$ is the predicted collateral value change from the first stage for collateral type k. Unlike the first stage, here we want to identify the effect on loan quantities and pricing, so we use our tightest identification and include bank-firm-quarter fixed effects. The key feature of this decomposition is that it constructs collateral-type-specific predicted collateral values for each loan. For collateral type k, $\widehat{CV}_{k,l,q}$ equals the predicted collateral-value response to the realized monetary policy shock and is zero for collateral types not

MP shocks, and a COVID-period indicator (2020Q2-2022Q2) to avoid biasing the normal-times estimates.

backing that loan. All four predicted collateral-value components jointly allows us to estimate separate coefficients θ_k thereby identifying which collateral categories drive heterogeneous loan quantities and borrowing costs.

The decomposition in Table 13 shows that especially for private firms, the lending responses for AR&I and blanket liens are strongest, while loans secured by fixed assets or real estate exhibit weaker responses. Similarly for rates, the coefficients on loans secured by AR&I and blanket liens are negative and statistically significant as in the baseline specifications. The second-stage results complete the mechanism developed throughout Section 4.8. Monetary policy first changes the value of pledged collateral. Those collateral-value changes then translate into larger borrowing responses while simultaneously generating the muted borrowing-cost responses documented in the baseline regressions. The strongest effects again occur for ARI and blanket liens, precisely the collateral types identified throughout the paper as generating the greatest debt capacity.

Taken together, the evidence traces the complete transmission mechanism from monetary policy shocks to firms' borrowing outcomes. We show that collateral values are a central component of the balance-sheet channel of monetary policy transmission. Next we show that this is also the case for the investment channel.

5 Additional Analysis

5.1 Investment

The preceding sections establish that monetary policy affects borrowing conditions through firms' debt capacity. We now ask whether those heterogeneous financing conditions translate into heterogeneous investment responses.

Following Ottonello and Winberry (2020), we measure leverage as the within-firm deviation from a firm's historical average, q as $L_{f,q} - \overline{L}_f$. This measure captures whether a firm is currently more or less levered than is typical for that firm and therefore isolates temporary changes in financial vulnerability. The interaction coefficient measures how these temporary changes alter the firm's investment response to monetary policy.

$$\begin{aligned}\Delta \log K_{f,q} = {} & \alpha_f + \alpha_{s,q} \\ & + \kappa \left[\left(L_{f,q} - \bar{L}_f \right) \times \frac{1}{N} \sum_{k=0}^{N} MP_{q-k} \right] + \vartheta_{f,q}, \end{aligned} \tag{6}$$

where $\Delta \log K_{f,q}$, is the quarterly growth rate of firm fixed assets, α_f denotes firm fixed effects, and $\alpha_{s,q}$ denotes sector-by-quarter fixed effects.

Table 14.— Monetary Policy and Investment

	$\Delta \log K_{f,q}$		
	Full Sample w/ COVID Control		
	All Firms (1)	Private Firms (2)	Public Firms (3)
Leverage × MP Surprise$_q$	-1.3675** (0.508)	-1.4714** (0.518)	0.5872** (0.225)
Observations	2,594,345	2,543,748	50,579
Demand Controls	Yes	Yes	Yes
Firm F.E.	Yes	Yes	Yes
Sector × Quarter F.E.	Yes	Yes	Yes

Notes: $^{+}$ $p < 0.1$,* $p < 0.05$,** $p < 0.01$, and *** $p < 0.001$. The results use all-firms for the full sample period from 2012Q3-2024Q4, controlling impact of COVID-era government support programs to SMEs. Investment is measured as log difference in fixed assets. Leverage is measured as the within-firm deviation from a firm's historical average following Ottonello and Winberry (2020). The monetary policy shock is the surprise component of the 3 month ahead Fed Funds future contract. Controls include sales growth. Standard errors are clustered by firm times quarter and are reported in parentheses.

Columns (1)–(3) of Table 14 show that temporary increases in leverage amplify the investment response to monetary policy, with the effect driven entirely by private firms. The positive coefficient for public firms indicates that our results do not overturn the evidence in Ottonello and Winberry (2020) for publicly traded firms. Rather, our contribution is to show that the financial accelerator operates much more strongly among private firms, which rely more heavily on bank-intermediated finance.

These findings complete the transmission mechanism developed throughout the paper. Earlier sections show that monetary policy affects debt capacity through the interaction of borrower balance sheets and collateral characteristics, leading to heterogeneous borrowing quantities and borrowing costs. The investment regressions demonstrate that these heterogeneous financing conditions are not confined to loan contracts but translate into heterogeneous real investment outcomes. Taken together, the evidence shows that collateral characteristics shape how monetary policy is transmitted through credit markets and that these heterogeneous financing conditions have economically meaningful consequences for firms' investment decisions.

5.2 Average Dynamic Responses

The heterogeneity estimates above are identified relative to the average firm by absorbing time variation with sector-by-quarter and bank-by-quarter fixed effects. To gauge the overall magnitude of the responses, we also estimate the average dynamic effect of monetary policy on each outcome using local projections that follow the same specification but omit the time fixed effects, so that the coefficient traces out the average response to the shock at each horizon h. Figure 10 plots these responses for investment (cumulative change in fixed assets), loan commitments, and loan rates, following a contractionary monetary policy surprise.

The average responses are economically meaningful and reinforce the mechanism. A contractionary shock generates a cumulative decline in investment that builds to roughly -1 percentage point by the eighth quarter (Panel a). The interaction between within-firm demeaned leverage and the monetary policy shock is (-1.3675). Because leverage is a continuous variable, these coefficients should be scaled by the size of the leverage deviation rather than compared mechanically with the average local-projection coefficient. For example, a 10-percentage-point increase in leverage above a firm's own historical average implies an additional investment response of approximately (-0.14) percentage point for the average firm following a one-percentage-point tightening shock. This is roughly 14 percent of the (-1) percentage-point average cumulative investment response. For commitments, a 1 pp shock decreases in loan commitments by about -0.5 log points over the medium run (Panel b). At the average shock of 0.04 pp, this implies a 2 percent reduction in commitments. Compared to the debt-capacity estimates, the same 0.04 pp shock implies a 4 percent difference between high versus low debt capacity firms (coefficient on the interaction term in column (1) of Table 11 is -1.0095). The average rate response is modestly positive at short horizons, reaching approximately $+0.05$ in $\log(1+i)$. This gradual pass-through of the policy shock into borrowing rates is consistent with the medium-run contraction in credit quantities documented above. The debt-capacity estimates on rates in Table 11 reveal economically meaningful heterogeneity around this average response. In the full sample, the interaction between High Debt Capacity and the monetary policy shock in columns (4) and (5) is approximately -0.08 for all firms and -0.10 for private firms.

5.3 Monetary Policy and Operating Decisions: Sales and Inventories

The previous section established that heterogeneous financing conditions translate into heterogeneous investment responses. There, we followed the framework of Ottonello and Winberry (2020) to facilitate comparison with the existing literature, showing that the leverage channel is tied to debt capacity for private firms. In this section, we organize the analysis around SME status, which the preceding sections identify as the economically relevant dimension of firms' financing environment. Our earlier results show that SMEs rely disproportionately on bank-intermediated finance, pledge different forms of collateral,

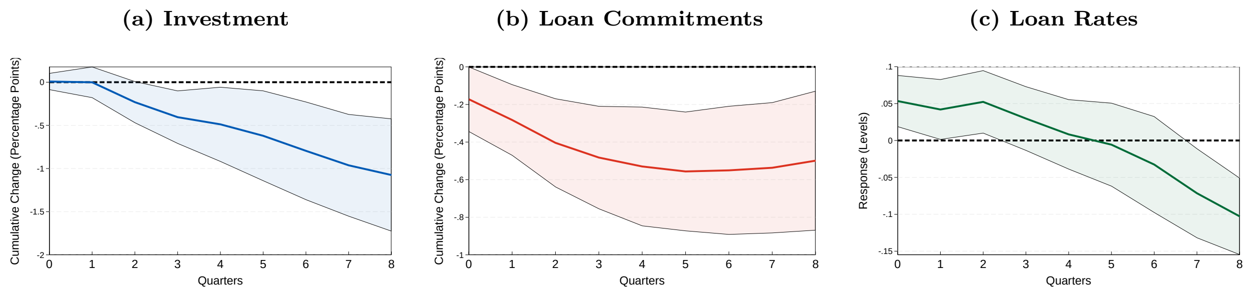


Figure 10.— Average dynamic responses to a contractionary monetary policy surprise. Notes: Each panel plots the local-projection coefficient on the monetary policy surprise at horizon h (quarters), with 95% confidence bands. Panel (a) is the cumulative change in log fixed assets; panels (b) and (c) are the level of loan commitments and the loan rate ($\log(1+i)$). Specifications include firm-bank and sector fixed effects, a sales-growth control, and no time fixed effects; standard errors are two-way clustered by firm and quarter. Sample is pre-COVID (through 2020Q1).

and exhibit stronger borrowing responses to monetary policy. We now ask whether these heterogeneous financing conditions influence not only firms' capital accumulation decisions (fixed capital investment), but also their day-to-day operating decisions (inventory and sales).

To examine whether heterogeneous financing conditions extend beyond investment, we estimate the same empirical specification as in Equation 3, replacing the dependent variable with measures of firms' operating decisions. Specifically, we consider inventory growth, sales growth, and the inventory-to-sales ratio while maintaining the same interactions between monetary policy, leverage, and SME status shown in Table 9. This allows us to isolate whether the heterogeneous financing channel documented for investment also shapes firms' day-to-day operations.

Table 15.— The Effects of Monetary Policy on Working Capital

	Full Sample			Fixed-Firm Sample		
	Inventory (1)	Sales (2)	Inventory/Sales (3)	Inventory (4)	Sales (5)	Inventory/Sales (6)
SME × MP Surprise$_q$	0.0685	-0.1633^{+}	0.0610***	0.0711	-0.1530**	0.0410***
	(0.1038)	(0.0992)	(0.0087)	(0.0563)	(0.0536)	(0.0088)
High Leverage Firm × MP Surprise$_q$	0.0493	0.0587	0.1901***	0.1486	0.2947**	0.1441***
	(0.0947)	(0.0985)	(0.0082)	(0.0910)	(0.0935)	(0.0083)
High Leverage Firm × SME × MP Surprise$_q$	-0.1200	-0.0143	-0.1280***	-0.1338	-0.2891*	-0.0989***
	(0.1265)	(0.1217)	(0.0118)	(0.1233)	(0.1165)	(0.0119)
Observations	1994707	2763026	2954604	1825308	2482945	2634792
R^2	0.039	0.038	0.860	0.035	0.032	0.860
Firm F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Quarter F.E.	Yes	Yes	Yes	Yes	Yes	Yes

Notes: $^{+}$ $p < 0.1$,* $p < 0.05$,** $p < 0.01$, and *** $p < 0.001$. The dependent variable in columns (1) and (4) is log inventory; the dependent variable in columns (2) and (5) is log sales; the dependent variable in columns (3) and (6) is I/S, the inventory to sales ratio (since inventory and sales are in logs, this is equivalent to log inventory minus log sales). "Full Sample" columns use the full panel 2012Q3–2024Q4. "Fixed-Firm Sample" columns restrict to firms present both before and during COVID. The results use all-firms for the full sample period from 2012Q3-2024Q4, controlling impact of COVID-era government support programs to SMEs. Standard errors are clustered by firm-time and are reported in parentheses.

Table 15 reports the effects of monetary policy on inventory growth, sales growth, and the inventory-to-sales ratio.[25] Consistent with the investment results, monetary easing generates stronger operating responses among highly leveraged SMEs. Sales growth increases significantly following an easing, while inventory growth also rises, although the estimate is less precisely estimated. Most notably, highly leveraged SMEs experience a significant increase in the inventory-to-sales ratio.

The inventory-to-sales ratio provides a direct link between the financing channel documented earlier in the paper and firms' operating decisions. A higher inventory-to-sales ratio indicates that firms carry a larger inventory position relative to current sales, implying greater working-capital financing needs. Earlier sections show that SMEs rely disproportionately on operating collateral—particularly accounts receivable, inventory, and blanket liens—and that borrowing secured by these assets responds most strongly to monetary policy. The evidence here is consistent with that mechanism. As monetary easing expands borrowing capacity, highly leveraged SMEs finance larger inventory positions relative to their sales, suggesting that improved financing conditions allow these firms to expand working capital alongside current operations.

Taken together, the loan, investment, and operating results describe a coherent transmission mechanism. Monetary policy first affects firms' borrowing capacity through the collateral they are able to pledge. These heterogeneous financing conditions then translate into differences in investment and, finally, into firms' short-run operating decisions through their ability to finance working capital. The evidence therefore suggests that the debt-capacity channel extends beyond capital accumulation to firms' ongoing production and inventory management.

5.4 Aggregation

The preceding analysis establishes that debt capacity amplifies firms' responses to monetary policy. We next ask whether heterogeneity in debt capacity is quantitatively important for aggregate credit dynamics. To answer this question, we aggregate the predicted firm-level responses using lagged credit shares to construct a predicted aggregate credit series. To facilitate comparison with the macroeconomic literature, we estimate the aggregate response using specifications that exclude firm-time and bank-time fixed effects, thereby mimicking aggregate credit-growth regressions.[26]

[25] Appendix B.3 reports complementary dynamic local projections showing that the sales response to a monetary policy shock builds over the horizon, consistent with the static results here.

[26] See, for example, Gertler and Karadi (2015).

We begin by estimating the average response of credit to monetary policy:

$$\log \sum_{l \in \mathcal{L}(f,b,q)} Y_{f,b,q}(l) = \alpha_{f,b} + \kappa_0^{\text{Agg}} \text{MP}_q^{MA} + \vartheta_{f,b,q}. \tag{7}$$

The corresponding predicted change in credit is

$$\widehat{\Delta \log Y}_{f,b,q} = \widehat{\kappa}_0^{\text{Agg}} \Delta \text{MP}_q^{MA}. \tag{8}$$

Let $\omega_{f,b,q-1}$ denote the lagged share of aggregate credit accounted for by bank-firm pair (f,b), where $\sum_{f,b} \omega_{f,b,q-1} = 1$. Aggregating across bank-firm pairs gives

$$\begin{aligned} \Delta \widehat{\log Y}_q &= \sum_{f,b} \omega_{f,b,q-1} \widehat{\Delta \log Y}_{f,b,q} \\ &= \widehat{\kappa}_0^{\text{Agg}} \Delta \text{MP}_q^{MA}. \end{aligned} \tag{9}$$

Using the realized sequence of monetary policy surprises during our sample, we calculate the predicted net contribution of monetary policy to aggregate credit growth:

$$\frac{\text{Avg}\left(\Delta \widehat{\log Y}_q\right)}{\text{Avg}\left(\Delta \log Y_q^{\text{Agg}}\right)} = 0.06. \tag{10}$$

Over the sample, the predicted net contribution of monetary policy amounts to approximately 6 percent of net aggregate credit growth. This statistic captures the cumulative signed contribution of the realized monetary policy surprises rather than the share of quarterly credit-growth variation explained by those shocks. The smaller magnitude relative to estimates from longer historical samples is consistent because most studies evaluate responses at 25 basis point shocks, which are rare events in the data.[27]

We next quantify the incremental contribution of the debt-capacity channel to aggregate monetary transmission. Because our objective is to measure the amplification generated by debt-capacity heterogeneity, we focus on monetary easing episodes. During easing, both low- and high-debt-capacity firms expand credit, differing only in the magnitude of their response. This allows the aggregate response to be decomposed naturally into a baseline component common to all firms and an incremental component attributable to debt-capacity heterogeneity.

We separate monetary policy shocks into easing and tightening components:

$$\text{MP}_q^- = \min\left(\text{MP}_q^{MA}, 0\right) \quad \text{(easing: rates fall)}, \tag{11}$$

[27] See Figure 18 in the Online Appendix.

$$\mathrm{MP}_q^+ = \max\left(\mathrm{MP}_q^{MA}, 0\right) \quad \text{(tightening: rates rise).} \tag{12}$$

We estimate the response to easing shocks interacted with the operating-collateral debt-capacity indicator defined in Section 4.7 and used in Table 11. To account for the extraordinary COVID period, we allow the coefficients to differ during 2020Q2–2022Q2:

$$\begin{aligned}\log \sum_{l \in \mathcal{L}(f,b,q)} Y_{f,b,q}(l) &= \alpha_{f,b} + \kappa_0 \mathrm{MP}_q^- + \kappa_1 \left(\textbf{High Collateral Capacity}_f \times \mathrm{MP}_q^-\right) \\ &\quad + \gamma_0 \left(\mathrm{MP}_q^- \times \mathrm{COVID}_q\right) + \gamma_1 \left(\textbf{High Collateral Capacity}_f \times \mathrm{MP}_q^- \times \mathrm{COVID}_q\right) + \vartheta_{f,b,q}.\end{aligned} \tag{13}$$

The shock is classified according to the sign of MP_q^{MA}, and the predicted quarterly credit-growth contribution is obtained by differencing the fitted monetary policy component.

For non-COVID periods, 2012Q3–2020Q1 and 2022Q3–2024Q4, the predicted aggregate credit response to monetary easing is

$$\begin{aligned}\Delta \widehat{\log Y}_q &= \left(1 - \omega_{q-1}^{\mathrm{HDC}}\right) \widehat{\kappa}_0 \Delta \mathrm{MP}_q^- + \omega_{q-1}^{\mathrm{HDC}} \left(\widehat{\kappa}_0 + \widehat{\kappa}_1\right) \Delta \mathrm{MP}_q^- \\ &= \underbrace{\widehat{\kappa}_0 \Delta \mathrm{MP}_q^-}_{\text{Baseline component}} + \underbrace{\omega_{q-1}^{\mathrm{HDC}} \widehat{\kappa}_1 \Delta \mathrm{MP}_q^-}_{\text{Incremental debt-capacity component}},\end{aligned} \tag{14}$$

where $\omega_{q-1}^{\mathrm{HDC}}$ is the lagged share of aggregate commitments associated with high-debt-capacity firms. The baseline component measures the predicted aggregate response if all firms responded like low-debt-capacity firms. The incremental component captures the additional response generated by the greater sensitivity of high-debt-capacity firms.

We measure the contribution of the incremental debt-capacity component as

$$Z = \frac{\mathrm{Avg}\left[\omega_{q-1}^{\mathrm{HDC}} \widehat{\kappa}_1 \Delta \mathrm{MP}_q^-\right]}{\mathrm{Avg}\left[\Delta \widehat{\log Y}_q\right]} = 0.77. \tag{15}$$

The incremental debt-capacity component therefore accounts for 77 percent of the predicted aggregate credit expansion following monetary easing. Both low- and high-debt-capacity firms expand credit when interest rates fall ($\widehat{\kappa}_0 = -0.43$ and $\widehat{\kappa}_0 + \widehat{\kappa}_1 = -2.37$), but the response of high-debt-capacity firms is more than five times as large. Thus, most of the predicted aggregate easing response arises from the additional sensitivity associated with operating-collateral debt capacity rather than from the response common to all firms. The firm-level debt-capacity channel documented above is therefore quantitatively important for aggregate monetary transmission.[28]

[28] During the COVID period, the incremental debt-capacity component accounts for 60 percent of the predicted aggregate easing response. Although somewhat smaller than the non-COVID estimate, the result indicates that the channel remained quantitatively important during a period marked by extraordinary fiscal interventions, Federal Reserve facilities, and disruptions to normal credit relationships.

Aggregation across loan types. Our aggregate measure intentionally combines credit lines and term loans, fixed- and floating-rate facilities, and both existing and newly originated loans. Monetary policy may affect aggregate credit not only through changes within a given facility type but also through substitution across loan types. Restricting the exercise to credit lines or new originations would therefore omit an important margin of aggregate adjustment. Figures 13, 14, and 15 in Online Appendix B.2 document these compositional dynamics. Figure 13 shows that floating-rate loans closely track policy rates for both public and private borrowers; Figure 14 shows that borrowing costs for new originations on floating-rate credit lines increased more rapidly during the 2017 lift-off than those on fixed-rate term loans; and Figure 15 shows that the share of term loans increased relative to credit lines over time.

5.5 Bank Credit Supply

Our main specifications identify firm-level borrowing responses by absorbing bank×quarter fixed effects, thereby holding constant all time-varying bank-specific shocks. A remaining concern, however, is that our results reflect changes in bank credit supply rather than heterogeneous firm borrowing capacity. In particular, if highly leveraged or riskier banks expand lending more aggressively during monetary easing, the heterogeneous loan responses documented earlier could reflect bank risk-taking instead of differences in firms' debt capacity.

To evaluate this possibility, we estimate the following supply-side specification:

$$\begin{aligned}\log \sum_{l \in \mathcal{L}(f,b,q)} Y_{f,b,q}(l) &= \alpha_{f,b} + \alpha_{f,q} \\ &\quad + \omega \left(\textbf{High Leverage Bank}_b \times \frac{1}{N} \sum_{k=0}^{N} \text{MP}_{q-k} \right) + \vartheta_{f,b,q} \qquad (16)\end{aligned}$$

This specification aggregates lending to the bank–firm-level and replaces the bank×quarter fixed effects with firm×quarter fixed effects, thereby identifying whether banks with different balance-sheet characteristics supply different amounts of credit to the same firm in a given quarter. Identification therefore comes from firms borrowing simultaneously from multiple banks; firms with only a single banking relationship do not contribute to the estimation.

Table 16 reports the results. If the heterogeneous borrowing responses documented in the main analysis reflected a supply-side risk-taking channel, highly leveraged banks should expand lending more during monetary easing. The evidence points in the opposite direction. Highly leveraged banks reduce lending during easing episodes, with the effect driven primarily

Table 16.— Monetary Policy and Credit Outcomes: Supply-Side

	Log(Loan)		
	All Firms	Private Firms	Public Firms
	(1)	(2)	(3)
High Leverage Bank × MP Surprise$_q$	0.4008	1.3782***	-0.5199
	(1.0469)	(1.2802)	(1.5362)
Observations	1028503	529490	457854
Adjusted R^2	0.855	0.913	0.8420
Bank × Firm F.E.	Yes	Yes	Yes
Firm × Quarter F.E.	Yes	Yes	Yes

Notes: $^+$ $p < 0.1$,* $p < 0.05$,** $p < 0.01$, and *** $p < 0.001$. This table presents the results of OLS regressions for bank-firm-level at a quarterly frequency. Bank Leverage is defined as total short-term debt to assets. The monetary surprise is measured using the 3 month ahead Fed futures contract. The results use all-firms for the full sample period from 2012Q3-2024Q4, controlling impact of COVID-era government support programs to SMEs. Double-clustered standard errors by firm and time are reported in parentheses.

by private borrowers. Rather than supporting a bank risk-taking channel, these results suggest that better-capitalized banks account for a larger share of credit expansion during accommodative monetary policy, consistent with the broader view that intermediary balance-sheet capacity enhances banks' ability to provide liquidity when firms demand it most (Darst, Gurrieri, Lubis, and Vardoulakis (2026))

We further examine bank risk using net charge-offs, which capture realized loan losses net of collateral recovery. Unlike delinquency measures, charge-offs reflect realized balance-sheet losses and therefore provide a direct measure of bank asset quality. Table 19 in Online Appendix B.1.4 yields a similar conclusion: banks with higher past charge-offs reduce lending to private borrowers during monetary easing,[29] again contradicting a supply-side risk-taking interpretation.

Taken together, the leverage and charge-off results provide little support for the view that our main findings are driven by bank credit supply. If anything, higher-risk banks contract lending during monetary expansions. The heterogeneous responses documented throughout the paper therefore appear to reflect differences in firms' borrowing capacity rather than changes in banks' willingness to supply credit.

6 Conclusion

Monetary policy affects firms by changing their debt capacity. We show that debt capacity depends not simply on how much collateral firms possess, but on the type of assets they pledge. Borrowing secured by operating collateral—accounts receivable, inventory, and blanket liens—responds substantially more to monetary policy than borrowing backed by

[29] Results for public borrowers are statistically insignificant.

fixed assets and real estate. These differences are strongest among private firms and among firms with tighter financing constraints, indicating that the composition of pledgeable assets is a central determinant of heterogeneous monetary transmission.

These financing differences have meaningful real consequences. Firms experiencing the largest expansion in borrowing capacity subsequently increase both investment and inventory holdings relative to sales. The latter finding is particularly revealing. Inventory first enters our analysis as an operating asset used to secure external finance, and later reappears as a real input financed by that credit. This connection links firms' collateral choices directly to their production decisions and illustrates how differences in debt capacity propagate from financial markets to the real economy.

More broadly, our findings suggest that understanding monetary transmission requires looking beyond the quantity of collateral available to firms and focusing instead on the composition of pledgeable assets and the debt capacity those assets generate. Monetary policy is transmitted most strongly where firms can pledge assets tied to ongoing economic activity, implying that the composition of balance sheets—not simply their size—is an important determinant of the real effects of monetary policy.

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Online Appendix (For Online Publication Only)

A Data Details

A.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.[30] 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.

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

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

million.[31] 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.[32] 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.[33]

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. The data also contains borrower 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

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

[32] 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)).

[33] 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.

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. Beginnig of Q1:2015 American Express Company, Citizens Financial Group, Inc. Beginnig of Q1:2016 Deutsche Bank USA Corporation, Barclays US LLC, Credit Suisse Holdings (USA), Inc., TD Group US Holdings LLC, UBS Americas Holding LLC. Beginning of 2018 BMO Financial Corp. Beginnig in 2021 Charles Schwab Corporation.

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.

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

B Robustness Appendix

This appendix provides robustness result for easing versus tightening monetary policy surprises, loan-type checks, and a break down of loans by industry and some collateral-type statistics by industry. It also provides a key robustness exercise to rule out the heterogeneity in bank credit supply. We show below that our results are not driven by supply-side risk taking as is typically the case in the literature. This analysis includes the standard supply-side regressions in the literature that include firm-time fixed effects. Moreover, we explore the impact of bank-risk on non-performing loan performance. All told, we do not find evidence that risk banks make loans to risky firms. In fact, we generally find the opposite; risky banks cut lending to risk firms during monetary policy expansions. Finally, we discuss the potential financial stability risks stemming from the build up of loans to highly levered private firms.

B.1 Robustness Results

B.1.1 Monetary Policy Pass through

We re-estimate the collateral-type spread regressions on the full sample using only the tightening component of the monetary policy surprise. The results are shown in Table 17. The ARI–collateral interaction remains negative and significant (-0.398, $p < 0.01$) while fixed-asset/real-estate and cash interactions are insignificant, confirming that operating collateral insulates borrowing costs during tightenings and that the result is not specific to the easing-dominated pre-COVID period.

B.1.2 Loan-type Facility Robustness

The analysis in the main body of the text suggests that lose monetary policy leads to high-leveraged private firms receiving more loan commitments than less-levered private firms. Table 18 breaks down this result for different loan type facilities–credit lines, term loans, and

Table 17.— The Role of Collateral: Robustness, Full Sample, Tightening

	Log(1+i)
Fixed assets and real estate	0.0085***
	(0.0021)
Cash and marketable sec.	-0.0040**
	(0.0014)
Act. receiv. and inventory	0.0010
	(0.0010)
Blanket lien and other	0.0019*
	(0.0009)
Fixed assets and real estate × MP Tightening	0.0902
	(0.2433)
Cash and marketable sec. × MP Tightening	0.2923
	(0.2658)
Act. receiv. and inventory × MP Tightening	-0.3977***
	(0.0926)
Blanket lien and other × MP Tightening	-0.1595
	(0.1199)
Observations	2816097
Adjusted R^2	0.575
Bank × Firm × Time F.E.	Yes

Notes: $^{+}$ $p < 0.1$,* $p < 0.05$,** $p < 0.01$, and *** $p < 0.001$. Each category is a dummy indicating the type of collateral pledged for the loan. The category "Unsecured" is omitted. The monetary policy shock is the surprise component of the 3 month ahead Fed Funds future contract. The results use all-firms for the full sample period from 2012Q3-2024Q4, controlling impact of COVID-era government support programs to SMEs. The results for only the tightening component of the shock *i.e.* observations for which the value of the surprise component is positive, are reported. Double-clustered standard errors by firm and time are reported in parentheses.

other facilities. The results show that the headline result is not just driven by credit lines, but also by terms loans. In fact, the sensitivity of terms loans to monetary policy shocks appears stronger than the sensitivity of credit lines.

Table 18.— Monetary Policy and Credit Outcomes for Private Firms: Facility Types

	Log(Loan)	
	Credit Line	Term Loan
	(1)	(2)
Firm Leverage × MP Surprise$_q$	-0.7629^{+}	-0.8426*
	(0.3911)	(0.3247)
Observations	2,288,491	1,119,936
Adjusted R^2	0.929	0.895
Controls	Yes	Yes
Bank × Firm F.E.	Yes	Yes
Bank × Quarter F.E.	Yes	Yes
Sector × Quarter F.E.	Yes	Yes

Notes: $^{+}$ $p < 0.1$,* $p < 0.05$,** $p < 0.01$, and *** $p < 0.001$. The results use private firms for the full sample period from 2012Q3-2024Q4, controlling impact of COVID-era government support programs to SMEs. The results show loan commitments across different subsamples: credit lines, term loans, and other facilities. High Leverage Firm is a time-invariant dummy variable equal to 1 if the firm's leverage in the first quarter of the data is above the median leverage. The monetary policy shock is the surprise component of the 3 month ahead Fed Funds future contract. Controls include sales growth and a COVID dummy equal to 1 for quarters 2020Q2-2022q2. Double-clustered standard errors by firm and time are reported in parentheses.

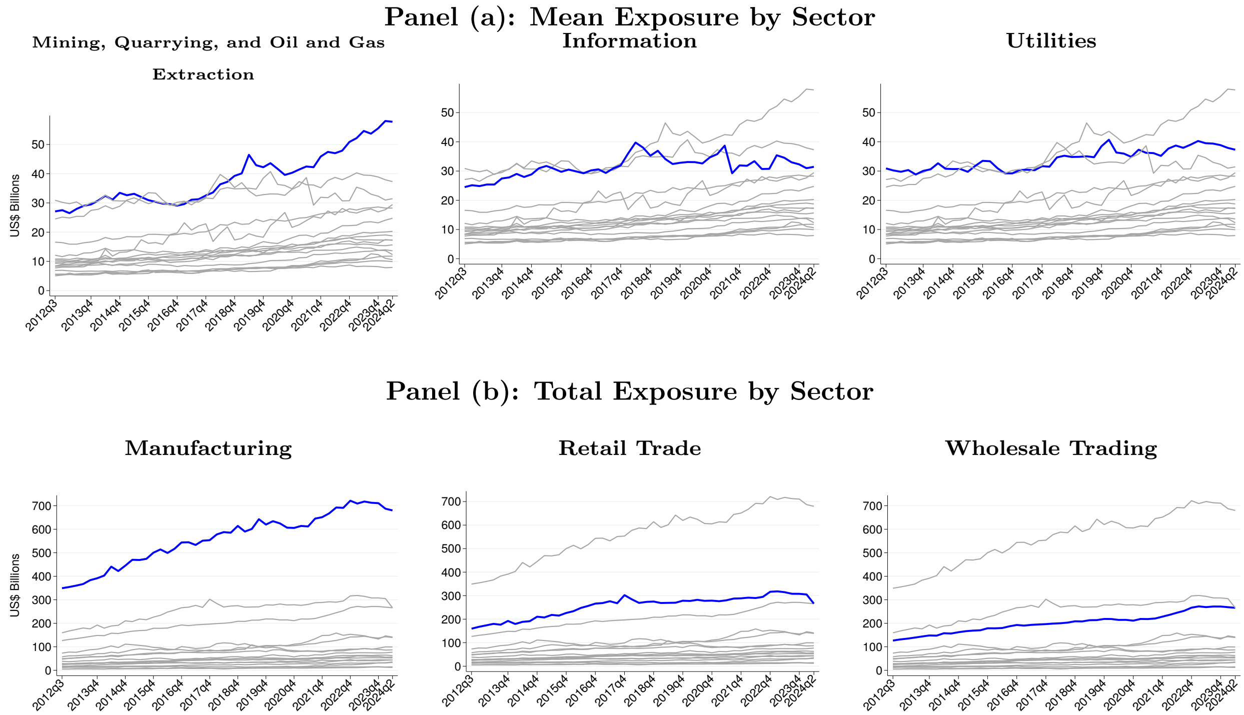

Figure 11.— Loan Commitments by Sector. Notes: Panel (a) plots the mean dollar value of loan commitments by the borrower's primary 2-digit NAICS industry. Panel (b) plots the total dollar value of committed loans by the borrower's primary 2-digit NAICS industry. Source: FR-Y14Q H.1.

B.1.3 Industry Loan Commitment Breakdown

Figure 11 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.

B.1.4 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

Table 19.— Monetary Policy and Bank Risk-Taking via Loan Losses

	Log (Loan)	
	(1) Private Firms	(2) Public Firms
$(\text{CCO/Loan})_{q-1}$	-0.1013***	-0.3606***
	(0.0172)	(0.0985)
$(\text{CCO/Loan})_{q-1} \times$ MP Surprise_q	3.3025*	-1.7759
	(1.4088)	(5.8696)
Observations	563047	456014
Adjusted R^2	0.917	0.844
Bank × Firm F.E.	Yes	Yes
Firm × Quarter F.E.	Yes	Yes

Notes: $^{+}$ $p < 0.1$,* $p < 0.05$,** $p < 0.01$, and *** $p < 0.001$. 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 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. Standard errors are double clustered at the firm and quarter levels.

difference.

The cumulative net charge-offs are aggregated to bank-firm-level and normalized 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 19 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, there is no impact on credit among public firms.

B.1.5 Aggregate Variables

Figure 12 plots total debt growth among all firms in our data, split out by SME versus non-SME status. The normalized debt growth chart in panel (b) shows that total debt grew more rapidly initially for SMEs than non-SMEs in 2013, and has kept pace with debt growth among larger firms since.

B.2 Aggregate effect on Loan Interest Rates

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 13 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 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

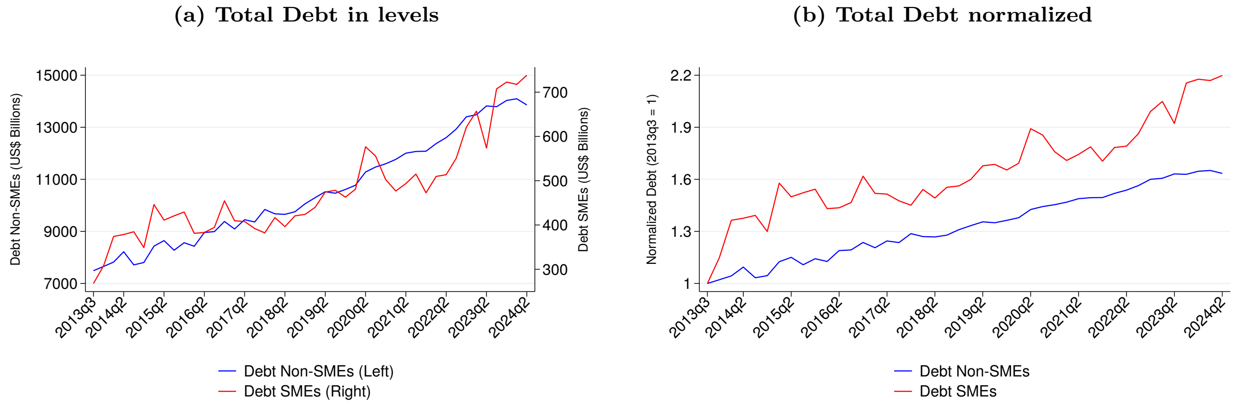

Figure 12.— Total Debt Growth for SMEs and Large Firms. Notes: This figure plots total debt amoung SMEs and non-SMEs in our sample. Total debt is the sum of short- plus long-term debt. SMEs are defined as firms with sales revenues less than \$50mn. Panel (a) is total debt in levels and panel (b) normalizes total debt to 1 in 2012Q3.

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 14 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 15 below: the share of term loans among all loans has increased 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.

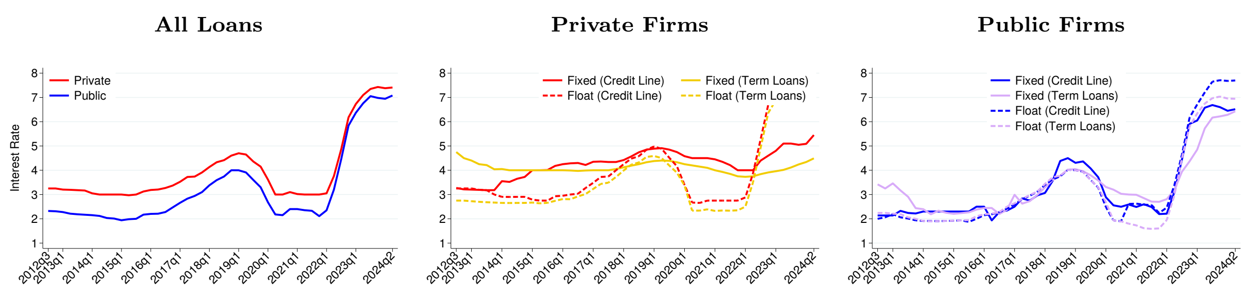

Figure 13.— Interest rates: Fixed versus Floating. Notes: The figure plots the median interest rates (in percent). The first chart plots interest rates for all loans for private borrowers in red and public borrowers in blue. The middle chart plots median interest rate for private borrowers for different 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.

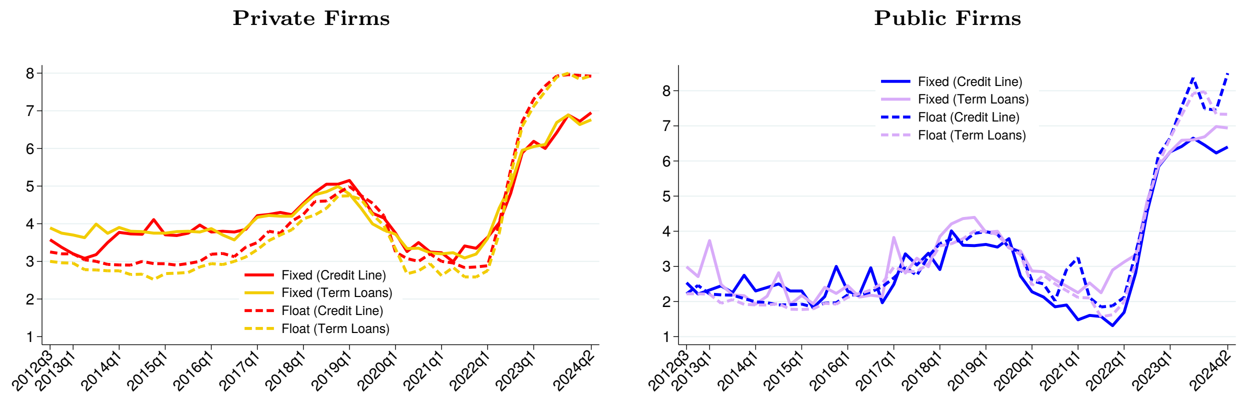

Figure 14.— Interest rates on New Originations. Notes: The figure plots the median interest rate (in percent) for new loan origination broken out by credit lines, term loans with fixed versus floating rates. The chart on the left plots the various loan rates for for private borrowers on the left and 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.

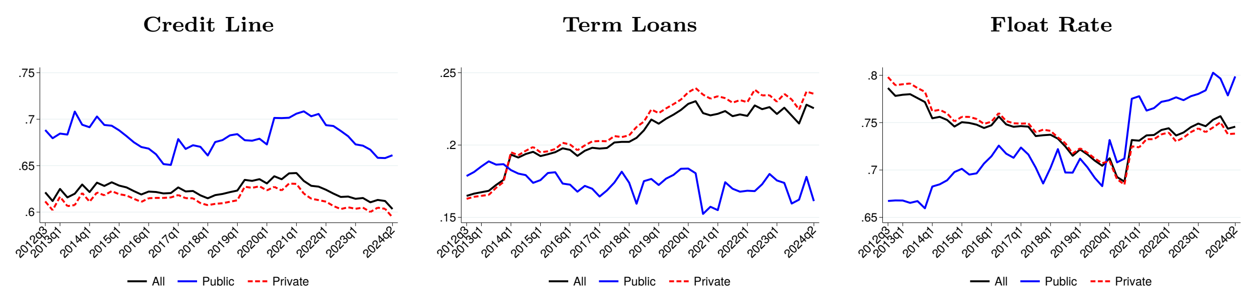

Figure 15.— Loan shares: Credit Lines/Term loans and Floating/Fixed Rates. Notes: The share of credit lines among all loan types in the left panel. The middle panel plots the term loans shares. The right panel plots the share of loans with floating interest rates. Source: FR Y-14Q H.1. Source: FR Y-14Q H.1.

B.3 Dynamic Real Effects on Sales

This subsection compliments the OLS panel regression on inventories and sales presented in Section 5.3 with dynamic local projections. The local projections are estimated with the following equation:

$$\log Y_{f,q+h}(l) = \alpha_f + \alpha_q + \kappa_h \left(\textbf{High Leverage Firm}_f \times \textbf{SME}_f \times \text{MP}_{q-k}\right) + \vartheta_{f,q+h} \tag{17}$$

The results, shown in Figure 16, show that monetary easing (negative monetary policy shocks) result in higher sales.

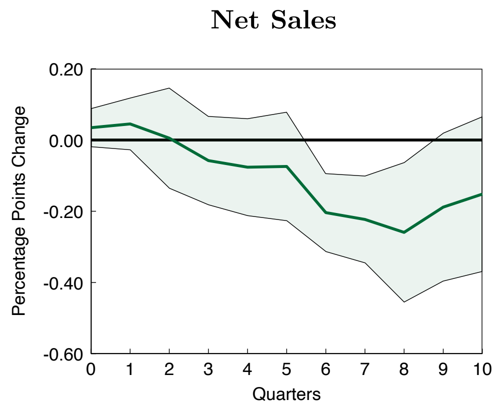

Figure 16.— Dynamic effects of monetary policy shocks on SME sales. Notes: The figure shows the dynamics of the triple interaction coefficient of, κ_h, SME$\times$ MP $\times$ Leverage over quarter h, from equation (17).

B.4 Collateral Use by Industry

There are substantial differences in collateral types across sectors, even within public and private firms, as shown in Tables 20 and 21. Although blanket liens and AR&I remain the most used collateral across all sectors, on average, there are important differences. For example about 60% of loans to private accommodation and food services firms are secured by blanket liens compared to just 18% for retail trade. By contrast, AR&I collateral accounts for nearly 60% of secured loans to private retail trade firms and only 12% for accommodation and food service firms. Real estate and fixed assets combined account for just over 12-15% of the collateral in these same industries. By contrast, real estate and fixed assets account for between 29-31% of collateralized borrowing for firms in the real estate, transportation, and warehousing industries.

Table 20.— Pledged Collateral Within Sectors: Private Firms

Sector	Real Estate	Cash and Marketable Securities	Accounts Receivable and Inventory	Fixed Assets	Blanket Lien and Other	Unsecured
Accommodation and Food	9.70	4.99	12.12	6.06	56.02	11.10
Agriculture	4.80	1.04	36.96	9.13	36.35	11.73
Arts and Entertainment	10.09	5.54	18.65	7.22	50.87	7.62
Construction	5.61	3.79	22.72	12.73	33.07	22.07
Educational Services	16.17	0.41	4.83	14.43	34.25	29.92
Healthcare	26.17	3.22	18.20	5.04	37.43	9.93
Information	2.07	3.43	20.95	3.18	45.60	24.77
Management	6.27	7.11	27.95	3.66	34.88	20.13
Manufacturing	3.84	1.54	32.13	6.69	31.41	24.38
Mining and Gas Extraction	1.26	2.60	36.99	7.99	39.50	11.65
Other Services	19.48	2.43	19.15	5.09	37.06	16.80
Professional, Science and Technology	3.83	2.28	27.17	2.93	37.42	26.37
Public Administration	0.00	1.67	36.40	0.64	33.55	27.75
Real Estate	1.35	1.33	31.68	28.18	24.99	12.46
Retail and Trade	9.51	1.39	60.84	3.22	18.26	6.78
Transportation and Warehousing	4.83	1.26	19.70	27.51	30.45	16.24
Utilities	1.04	4.55	6.51	6.93	30.44	50.53
Waste Management Administration	3.18	3.00	30.51	5.62	44.80	12.89
Wholesale Trading	3.90	1.42	47.04	4.08	30.49	13.08
Average	6.88	3.00	27.60	8.55	36.41	17.56

Notes: Average over time between 2012Q3 – 2024Q4

Table 22 complements Tables 20 and 21 by reporting the collateral composition of loan commitments across deciles of the firm-assets distribution, rather than by sector. Real estate collateral is concentrated among the smallest decile of borrowers (47 percent) and falls monotonically to near zero among the largest firms, while unsecured borrowing rises sharply only in the top two deciles, jumping from 13 percent in the eighth decile to 73 percent in the tenth. Accounts receivable and inventory and blanket lien collateral, by contrast, remain the dominant collateral categories across the broad middle of the size distribution, together accounting for more than 60 percent of commitments from the second through the eighth decile.

Table 21.— Pledged Collateral Within Sectors: Public Firms

Sector	Real Estate	Cash and Marketable Securities	Accounts Receivable and Inventory	Fixed Assets	Blanket Lien and Other	Unsecured
Accommodation and Food	4.68	4.77	7.32	1.58	27.07	54.57
Agriculture	1.24	0.00	15.43	10.65	5.54	67.15
Arts and Entertainment	1.02	7.35	25.04	2.80	52.46	11.34
Construction	0.49	1.59	13.51	5.57	21.54	57.30
Educational Services	0.00	0.00	3.97	0.00	0.00	96.03
Healthcare	1.04	5.16	26.18	2.70	37.07	27.85
Information	0.17	2.39	8.36	2.16	20.19	66.74
Management	0.10	2.22	8.66	2.05	13.48	73.48
Manufacturing	0.31	1.55	11.00	1.96	16.22	68.96
Mining and Gas Extraction	0.44	1.32	16.77	3.11	22.04	56.32
Other Services	0.31	5.85	11.24	3.90	31.37	47.34
Professional, Science and Technology	0.66	2.42	17.21	2.24	29.00	48.47
Public Administration	0.00	4.74	0.00	0.00	71.11	24.15
Real Estate	0.59	1.22	16.18	18.40	17.66	45.95
Retail and Trade	1.12	1.12	23.42	2.52	11.33	60.48
Transportation and Warehousing	0.80	1.20	7.37	12.23	15.54	62.86
Utilities	0.35	1.73	2.16	2.72	10.05	82.98
Waste Management Administration	0.34	2.79	16.41	2.43	24.32	53.71
Wholesale Trading	0.61	1.76	25.31	2.46	20.59	49.27
Average	0.84	2.78	14.80	4.67	22.09	54.99

Notes: Average over time between 2012Q3 – 2024Q4

Table 22.— Fraction of Loan Commitments by Collateral Type and Decile of Assets

	Decile based on Assets									
Category	1	2	3	4	5	6	7	8	9	10
Real Estate	47	20	12	10	8	6	5	3	1	0
Cash and Marketable Securities	2	3	2	2	2	2	2	3	3	1
Accounts Receivable and Inventory	13	27	40	46	48	46	41	37	26	10
Fixed Assets excluding Real Estate	6	9	8	7	7	8	8	7	5	3
Blanket Lien and Other	28	39	35	33	32	34	37	37	30	12
Unsecured	3	3	2	3	3	4	7	13	35	73

Notes: Decile based on Assets. Numbers are in percentage terms.

B.5 Additional Figures

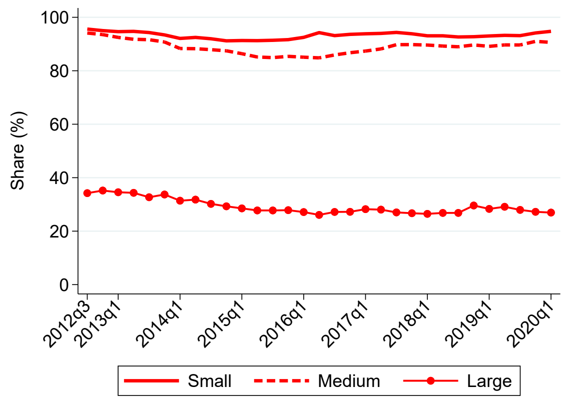

Figure 17.— Share of Bank Debt in Non-Financial Private Firms' Financing in FR Y-14. Notes: The figures plot the median loan commitment as share of total balance sheet debt for various points in the asset-size distribution among private borrowers. Source: FR-Y14Q H.1

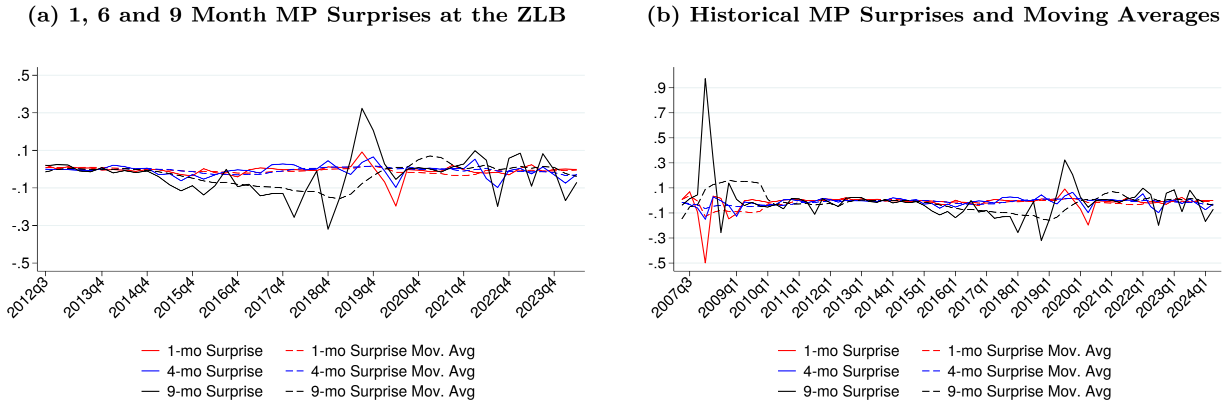

Figure 18.— Quarterly Monetary Policy Surprises. Notes: This figure plots monetary policy surprises in percentage points following the quarterly aggregation of Ottonello and Winberry (2020). Panel (a) plots the surprise component of the 6-mo and 9-mo feds funds future during our period, and panel (b) plots the historical-moving average of the same shocks to compare the size of the shocks during the ZLB period vs before.

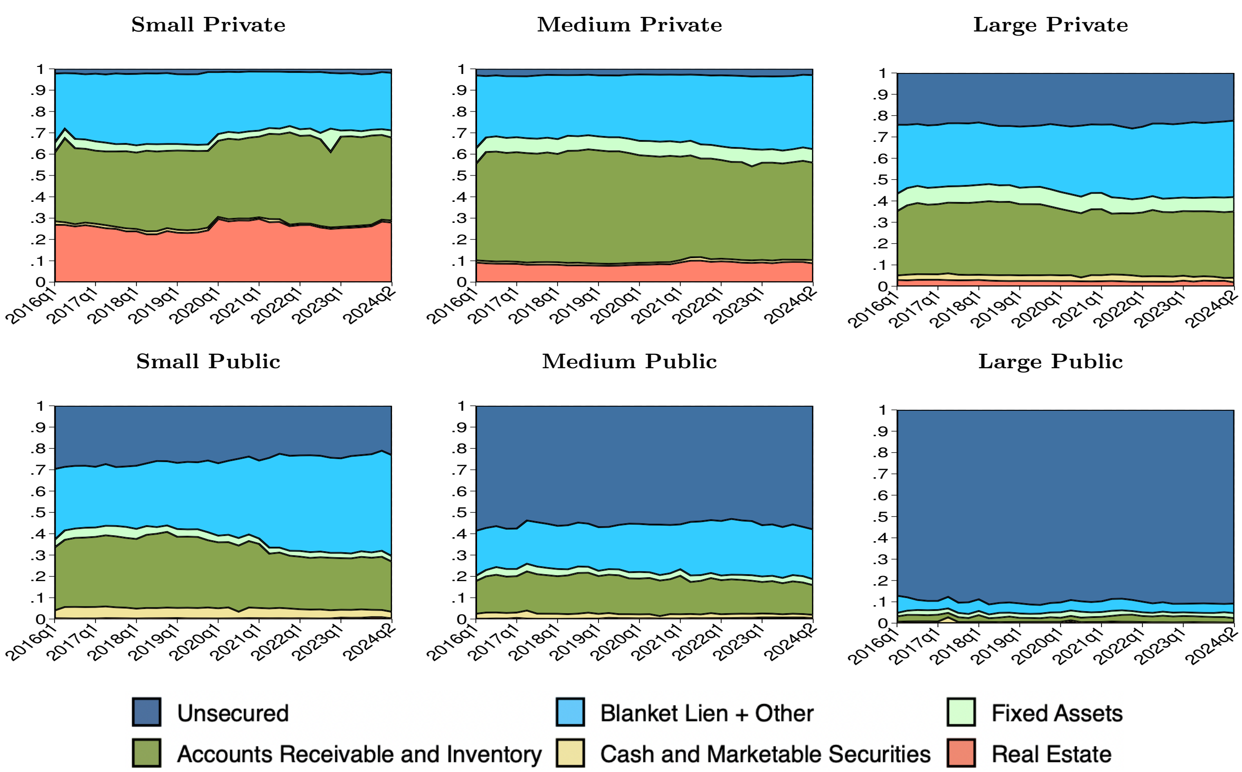

Figure 19.— Collateral Type: Public vs. Private (Based on Number of Loans). Notes: The figure plots the proportion of loans secured by different collateral types over time. The different types of collateral are cash and marketable securities (in yellow); accounts receivable, inventory (in dark green); 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.

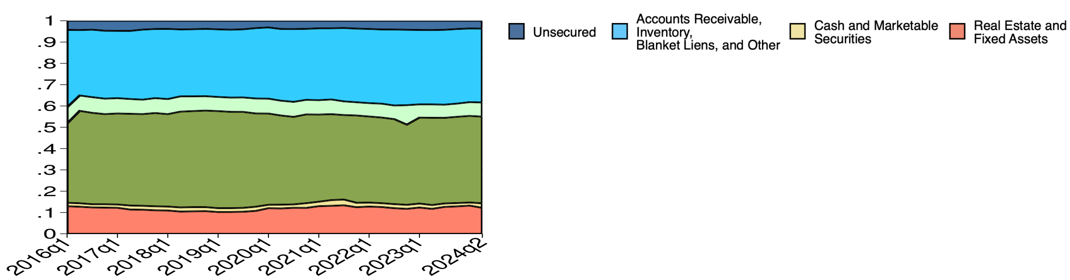

Figure 20.— Collateral Types among SMEs. Notes: The figure plots loan values secured by different collateral types over time for SME borrowers. SMEs are defined as firms with annual sales less than $50mn. The different types of collateral are real estate collateral (salmon); cash and marketable securities (yellow); accounts receivable, inventory (green); fixed assets (mint); blanket liens and other (light blue); and unsecured (dark blue). Source: FR Y14-Q H.1.