Finance and Economics Discussion Series

Federal Reserve Board, Washington, D.C.
ISSN 1936-2854 (Print)
ISSN 2767-3898 (Online)

The Collateral Channel and Bank Credit

Arun Gupta, Horacio Sapriza, and Vladimir Yankov

2022-024

Please cite this paper as:
Gupta, Arun, Horacio Sapriza, and Vladimir Yankov (2025). "The Collateral Channel and Bank Credit," Finance and Economics Discussion Series 2022-024r1. Washington: Board of Governors of the Federal Reserve System, https://doi.org/10.17016/FEDS.2022.024r1.

The Collateral Channel and Bank Credit

Arun Gupta* **Horacio Sapriza†** **Vladimir Yankov‡**

November 9, 2025

Abstract

We examine the firm-level and aggregate effects of the collateral channel using administrative bank-firm-loan level data. We introduce novel instrumental variables related to the efficiency of federal district bankruptcy courts and show their importance as predictors of collateral use and banks' expected losses given default across collateral types. Our estimates reveal that following increases in real estate values, firms that pledge real estate experience an expansion in bank credit, reductions in credit spreads, and an extension in the maturity of loans that allows for increases in firm leverage, capital expenditures, total assets, and sales. Unlike existing studies focused on publicly traded firms, the effects are economically important only for private, high bank-dependent borrowers and are not present for firms that borrow unsecured, even if those firms own real estate. The elasticity of bank credit to collateral values is substantially larger when estimated at the MSA level, which suggests significant credit multiplier effects. However, the sign and magnitude of the total aggregate effects on credit allocations and employment growth are heterogeneous across markets and depend on the size of the share of firms pledging real estate and the magnitude of the appreciation of real estate values.

JEL Classification: E44, G21

Keywords: Collateral channel, firm borrowing constraints, bank credit allocation, corporate investment, macro-finance, transmission mechanism.

Acknowledgments: The views in this paper do not reflect the official position of the Board of Governors of the Federal Reserve System, the Federal Reserve Bank of Richmond, or the Federal Reserve System. We are grateful to Viral Acharya, Niel Bhutta, Dean Corbae, John Driscoll, Matt Darst, Simon Gilchrist, Òskar Jordà, Şebnem Kalemli-Özcan, Adriano Rampini, Yueran Ma, Atif Mian, Esteban Rossi-Hansberg, Sam Hughes, Joseph Nichols, Stijn Van Nieuwerburgh, and Manuel García-Santana for their thoughtful suggestions and comments. We thank our discussants David Glancy, Jan-Peter Siedlarek, Pascal Paul, Fulvia Fringuellotti, and Mauricio Larrain as well as participants at workshops and conferences at the Federal Reserve Board, FRB Richmond, FRB Kansas City, FRB Philadelphia, the Central Bank of Chile, and the University of Miami for their invaluable feedback. We also benefited from discussions with participants at the 2022 , the 2021 and 2022 IFABS Conferences, the 2022 meetings of the European Economic Association, the 2023 Western Finance Association, and the 2025 American Economic Association annual meeting. We thank Matthew Land, Kushal Patel, and Sara Harrison for their excellent research assistance. First draft: April 15, 2021. This draft: November 9, 2025

*Federal Reserve Board, E-mail: arun.gupta@frb.gov

†Federal Reserve Bank of Richmond, E-mail: horacio.sapriza@rich.frb.org

‡Corresponding author, Federal Reserve Board, E-mail: vladimir.l.yankov@frb.gov

1 Introduction

The pledging of collateral mitigates problems of asymmetric information and incompleteness in debt contracts. In such contractual situations, fluctuations in the values of collateral affect borrowing capacity and credit allocations. Higher values relax collateral constraints, allowing firms to secure more credit and increase investment, leading to an expansion of economic activity. This amplification mechanism, known as the *collateral channel*, is frequently featured in theoretical models of financial frictions and macroeconomic fluctuations.

While the predictions of theory regarding the role of collateral values in credit allocations and business cycles are unambiguous, empirical analysis of the role of real estate values in firm borrowing capacity has been limited by data availability. Empirical studies have either focused on large, publicly listed firms or relied on aggregate data. Most studies also lack information on the pledging of collateral and instead rely solely on measures of firm ownership of real estate. Finally, the identification of changes in borrowing constraints in the existing literature does not condition on firm credit demand and bank credit supply conditions.

Our study attempts to fill these gaps in the literature by examining the role of pledging commercial real estate collateral for bank credit and by quantifying the real effects of bank credit allocations that result from the relaxation of borrowing constraints. We use confidential supervisory bank-firm-loan data derived from supervisory reports, FR Y-14Q, for both publicly traded and private firms in the United States, covering the period from 2013:Q1 to 2019:Q4. The data allow us to identify and quantify the collateral channel, conditioning on both borrower and lender characteristics, as well as on the type of collateral pledged.

We document the pledging of different types of collateral in the cross section of firms and compare the relative relaxation of borrowing constraints based on the use of collateral. Importantly, we argue that to identify the collateral channel, it is essential to distinguish between the pledging and ownership of commercial real estate. Consistent with the stylized facts in Lian and Ma (2021), we find that most large publicly traded firms use earnings-based types of collateral with no tangible assets pledged. However, in our sample, which includes small, medium-sized, and private corporate borrowers, 68 percent of borrowers pledge asset-based forms of collateral, including 21 percent of all borrowers pledging real estate, with notable heterogeneity in the cross section of MSA areas.

The identification of the collateral channel effects is equivalent to describing the extent to which firms' borrowing constraints bind and restrict those firms from achieving their optimal levels of capital. Binding collateral constraints create a tight link between asset values and credit growth. However, the challenge is that such associations can be confounded with changes in both credit demand and supply conditions that co-move with real estate values. In addition, the form of collateral pledged is also an endogenous choice that is jointly determined by the bank and the borrower and could be influenced by asset valuations.

To address these endogeneity issues, we first use the real estate supply elasticities constructed by Saiz (2010) as instruments for real estate values. Markets with low real estate supply elasticities experience higher appreciation in property values relative to markets with high supply elasticities following declines in interest rates. Second, to address the endogeneity of the choice to pledge real estate collateral, we construct a set of instrumental variables based on the efficiency with which bankruptcy courts resolve Chapter 7 and 11 cases and the choice of defaulting borrowers to shop for the district court that is most likely to preserve the firm as a going concern. Court efficiency differs across jurisdictions and over time. This creates an exogenous variation in the expected recovery values and the ability of lenders to repossess pledged collateral that is orthogonal to local demand conditions and CRE prices. To control for the ability of large firms to select their preferred bankruptcy court, we use the distance of the borrower to the district court of Delaware, a favored bankruptcy court destination for handling Chapter 11 cases, as an instrument for this choice.

Third, we exploit the richness of the data to decompose changes in bank lending into borrower-specific loan demand factors and lender-specific credit supply factors, following Khwaja and Mian (2008), Amiti and Weinstein (2018), and Degryse et al. (2019). Such a decomposition allows us to identify the collateral channel separately from the effects of bank credit supply conditions and firm credit demand conditions. Consistent with the existence of binding credit constraints, we show that bank lending is significantly more sensitive to the credit demand conditions of unconstrained borrowers than to those of constrained borrowers.

For constrained borrowers who pledge real estate, a 1 percentage point increase in values contributes to a 5 to 9.5 basis points annual increase in credit. The elasticity of investment in fixed assets is approximately 27 basis points. We also document large and statistically significant collateral channel effects for firms categorized as credit constrained based on high leverage and low profitability. These estimates are similar to those in the literature using a sample of publicly traded firms. For example, Chaney et al. (2012) identifies an elasticity of investment of about 6 to 44 basis points and an elasticity of net debt issuance of 7 to 9 basis points for constrained publicly traded firms. However, unlike the existing literature based on Compustat data, in most of our empirical specifications, we do not find statistically significant effects of the collateral channel for the sample of publicly traded firms or for firms that borrow unsecured, even if those firms own real estate.

Finally, although the firm-level effects are economically large and statistically significant only for nonpublic and high bank-dependent borrowers, which tend to be small and mid-sized companies, those firms are important for aggregate employment because they have a disproportionately higher share of employment. The relaxation of borrowing constraints at credit-constrained firms increases overall bank credit in geographic areas with a large share of such constrained borrowers pledging real estate as collateral and under sufficiently large appreciations of real estate values. We estimate robust credit multiplier effects that scale the firm-level elasticities by a factor that varies between 3 and 11, depending on the specification.

The paper is organized as follows. Section 2 places our contributions in the broad theoretical and empirical literature on the effects of the collateral channel and financial acceleration mechanisms. Section 3 describes our data sources and presents key summary statistics. Section 4 outlines our empirical framework and identification strategy, focusing on our approach to addressing the endogeneity of both collateral values and collateral choice. Section 5 presents our main empirical findings on the firm-level and aggregate effects of the collateral channel. Section 6 concludes with implications for policy and future research.

2 Related literature and contributions

The theoretical foundation for our empirical analysis lies in a large body of literature that studies the role of collateral in credit allocations and macroeconomic fluctuations, including studies by Barro (1976), Stiglitz and Weiss (1981), Besanko and Thakor (1987), Bernanke and Gertler (1989), Hart and Moore (1994), Kiyotaki and Moore (1997), Holmstrom and Tirole (1997), Bernanke et al. (1999), Rampini and Viswanathan (2010), Miao and Wang (2018), Gorton and Ordonez (2019), and Asriyan et al. (2021). The theoretical body of work is unambiguous in its conclusions and identifies the *collateral channel* and the closely related *financial accelerator mechanism* as key amplification mechanisms for credit boom and bust cycles and aggregate fluctuations. Increases in asset values boost firms' net worth and expand borrowing capacities, leading to significant increases in aggregate activity.

The empirical analysis of the role of the collateral channel has been less clear-cut. Gertler and Gilchrist (1994) provides indirect evidence of the role of the collateral channel by documenting that small manufacturing firms are more cyclical and reduce their activity more following monetary policy tightening. More direct evidence, albeit limited to one sector, is presented in Benmelech and Bergman (2011), which documents that following the bankruptcies of airlines, the non-defaulting airlines experience tighter credit conditions due to a reduction in collateral values.

The first systematic study that quantifies the collateral channel effects was provided by Chaney et al. (2012) on a sample of publicly traded firms. They estimate an increase in investment of six cents for every dollar increase in the value of a firm's commercial real estate. Cvijanovic (2014) documents that changes in real estate values have persistent effects on firm leverage and capital structure. Similarly, Campello et al. (2021) estimates the sensitivity of corporate investment and capital structure to changes in real estate values, taking into account the locations of companies' real estate holdings. However, none of these studies explicitly condition on whether firms are pledging their real estate to back up debt issuance. Lian and Ma (2021) points out that most publicly traded firms do not pledge real estate as collateral, even if a firm owns real estate properties. Instead, most large firms have debt contracts that are either unsecured or based on earnings-based collateral, such as covenants tied to firm profitability, the recovery value of which depends on the continuation value of the firm in Chapter 11 restructuring. These stylized facts have raised questions about the relevance of the collateral channel for economic fluctuations.

Our paper makes several important contributions. First, we find that the collateral channel operates primarily through firms that explicitly pledge real estate as collateral rather than through the broader set of firms that own real estate, providing evidence for the distinction raised in Lian and Ma (2021). Following the appreciation of commercial real estate values, firms pledging real estate collateral experience significant expansions in bank credit, reductions in interest spreads, increases in loan maturity, and relaxation of borrowing constraints that enable greater leverage, investment, and asset growth. Importantly, these effects are not present for firms that borrow unsecured, even when these firms own real estate assets that have appreciated in value. These findings highlight the importance of collateral pledging in the manifestation of the collateral channel effects in the presence of conflicts of interest among secured and unsecured lenders that need to be resolved in bankruptcy.

A number of studies have also examined bank lending to small bank-dependent firms using bank-firm-loan level data, including the FR Y14Q data. Berger and Udell (1990) studies the role of collateral using the Federal Reserve's Survey of Terms of Business Lending (STBL) and documents that riskier borrowers are more likely to pledge real estate collateral. Glancy (2021) and Favara and Imbs (2015) highlight the importance of controlling for bank credit supply conditions when evaluating the effects of real estate prices on credit allocations. Luck and Santos (2024) examines how the use of different types of collateral affects the interest rates that banks set on loans. Caglio et al. (2021) studies the effect of monetary policy on bank risk-taking behavior. Haque et al. (2022) documents that private equity funds can influence the choice of collateral. Ma et al. (2021) explores the link between banks' heterogeneous expectations for declines in housing prices and their credit decisions. Greenwald et al. (2020) and Chodorow-Reich et al. (2021) show that while large firms were able to draw on their credit lines during the pandemic, small firms were significantly more restricted in their access to bank credit. Favara et al. (2024) and Faria-e-Castro et al. (2024) quantify the extent to which banks continue to provide funding to borrowers near default. Though complementary to our work, none of these studies aim to quantify the firm-level and aggregate effects of the collateral channel using information on all three components needed to identify those effects—the collateral use, the credit demand condition of the borrower, and the credit supply condition of the lender. In this regard, the evidence in these studies for the workings of a collateral channel is indirect.

The effects of the collateral channel have been documented in several papers that use non-U.S. data. Gan (2007) documents the effects of the collateral channel on firm investment decisions following the collapse of real estate prices in Japan in the early 1990s. Bednarek et al. (2021) finds evidence that foreign capital inflows into Germany during the European debt crisis impacted local economic growth for firms owning real estate. Cerqueiro et al. (2016) examines how a change in bankruptcy laws in Sweden, which lowered collateral values and reduced the expected recovery values for lenders in bankruptcy, impacted firm borrowing capacity, increased bank monitoring, and raised the cost of credit. Banerjee and Blickle (2021) studies the positive relationship between changes in housing prices and the growth of small firms across European countries. They find that these correlations are significantly higher for more opaque borrowers and in countries with more complex and costlier bankruptcy resolution frameworks. Bahaj et al. (2020) documents that the appreciation of home values of a firm's directors leads to higher investment. Schmalz et al. (2017) and Corradin and Popov (2015) present evidence that higher house prices predict entrepreneurial choices and business start-ups. However, similar to studies based on the U.S., these papers offer only indirect evidence because they lack information on the collateral pledged.

Our second contribution is to document substantial heterogeneity in the collateral channel across firm types. The effects are economically significant only for private bank-dependent borrowers, with a limited impact on larger firms that have access to market-based financing. These findings reveal that the collateral channel primarily operates by relaxing financing constraints for firms that would otherwise have limited borrowing capacity. Furthermore, we show that pledging real estate that has appreciated in value results in a decrease in credit spreads and an increase in the maturities of loans, reflecting banks' expectations for lower default and loss given default. Finally, consistent with lower credit constraints, we show that bank credit allocations are more sensitive to the credit demand conditions of low bank-dependent borrowers, both at the firm level and at the market level.

Third, our market-level analysis reveals significant credit multiplier effects from the firm-level elasticities. The elasticity of bank credit to collateral values is substantially larger at the MSA level than at the individual firm level, suggesting important feedback mechanisms between credit allocation, asset prices, and economic activity. Our estimates indicate that a notable portion of employment growth from 2013 to 2019 can be attributed to the easing of borrowing constraints. The effects are stronger in MSA areas with large shares of firms pledging real estate as collateral and experiencing rapid growth in real estate values. However, we document that the standalone effect of commercial real estate prices on economic activity is negative, and for the collateral channel to have positive aggregate effects, a sufficient share of firms needs to pledge real estate as collateral.

Our findings contribute to empirical studies that quantify the relevance of the collateral channel for aggregate fluctuations. Recent studies have questioned this relevance. For example, Crouzet and Mehrotra (2020) reexamine the evidence on the higher cyclicality of small firms using Census data from four sectors—manufacturing, mining, wholesale, and retail trade. They conclude that financial frictions and proxies for financial constraints do not explain the differences in cyclicality between small and large firms. Furthermore, they document that even if small firms are subject to tighter credit constraints, those firms do not matter for aggregate GDP fluctuations. Greenstone et al. (2020) use data from the Small Business Administration to examine the role of bank lending during the Great Recession and document that small businesses were less likely to switch lenders and were disproportionately more likely to be credit constrained following a credit supply shock affecting their bank. However, the restricted access to credit did not have a significant effect on economic activity.

The importance of the collateral channel for aggregate fluctuations has also been challenged in works by Mian and Sufi (2011) and Mian and Sufi (2014), who argue that the main transmission channel of financial shocks to the real economy during the Great Recession was the significant reduction in aggregate demand driven by declines in households' net worth, whereas the tightening of firm borrowing constraints was a less likely cause. However, Gertler and Gilchrist (2018) provides additional empirical evidence that highlights the roles of distress at banks and nonfinancial firms as contributing factors to employment dynamics during the Great Recession.

In contrast to these studies, we provide direct micro-level evidence for the workings of the collateral channel in a broader set of firms, covering all nonfinancial industries and both public and private firms. Importantly, we document that the micro-level effects aggregate to economically significant macroeconomic effects, consistent with the collateral channel. In this regard, our results are closest to Adelino et al. (2015), who document that small businesses in geographic markets with greater increases in real estate prices experienced stronger growth in employment than large firms in the same areas and industries. They attribute 15 to 25 percent of employment variation across geographic markets to differences in real estate price dynamics. Our estimates indicate that, over our sample period from 2013 through 2019, for the median MSA area, around 6 percent of employment growth can be attributed to the relaxation of borrowing constraints for borrowers who pledge real estate.

Finally, our findings relate to Rampini and Viswanathan (2025), which highlights an important distinction between secured debt, including leasing, and unsecured debt. Secured debt uses explicit collateral, whereas unsecured debt is a claim on the unencumbered assets of the firm and, thus, is implicitly collateralized. Although explicitly collateralized debt is costlier, it enables a higher borrowing capacity and protects banks from future debt dilution. Donaldson et al. (2020) explores the effects of debt dilution on collateralized borrowing. However, these theoretical frameworks do not take into account the automatic stay protection for borrowers in bankruptcy, the preference of borrowers to file under Chapter 11, or the efficiency of courts in resolving bankruptcy cases.

We contribute methodologically by introducing a novel set of instrumental variables based on bankruptcy court efficiency. We show that lenders' willingness to accept real estate as collateral is influenced in part by the expected recovery value in bankruptcy, which varies with the relative efficiency of bankruptcy courts. This approach helps address the endogenous matching between firms and collateral types, a challenge that has received limited attention in previous research. Our instrumentation of the endogenous choice to pledge collateral relates to a large literature that has studied the efficiency of the bankruptcy process (e.g. Aghion et al. (1992), Bris et al. (2006), Morrison (2007), Iverson (2018), Corbae and D'Erasmo (2021)). To the best of our knowledge, these are novel stylized facts that relate judicial efficiency to collateral use and the degree to which the collateral channel affects credit allocations and employment outcomes across MSA areas.

3 Data

Our analysis is based on data collected by the Federal Reserve for the purposes of the annual Dodd-Frank Act Stress Test (DFAST) and the Comprehensive Capital Analysis and Review (CCAR). Schedule H1 of the FR-Y14Q report collects detailed loan-level and borrower-level information on the commercial and industrial (C&I) loans of the largest bank holding companies operating in the United States with total consolidated assets exceeding $100 billion.[1] The data contain information on all corporate credit facilities with total committed balances greater than $1 million.

We restrict our sample to U.S.-domiciled nonfinancial borrowers for whom we observe consistent balance sheet and income statement information. We also focus on borrowers who operate in one of the 68 major metropolitan statistical areas (MSAs) for which we have commercial real estate prices and real estate supply elasticities, which we obtain from Saiz (2010). Our final analysis sample spans the period from 2013:Q1 to 2019:Q4 and consists of

[1] More detailed information is contained in the instructions to the FR Y-14Q reporting forms. Because of the confidentiality of the data, our analysis presents only aggregated results that do not reveal the identities of the individual banks or borrowers in our sample.

Table 1: Descriptive statistics of corporate borrowers and bank lenders

Statistic	mean	sd	p5	p25	p50	p75	p95
			A. Borrower characteristics				
Total assets ($mln)	1637	15565	2	7	21	101	3782
Growth in assets (pct)	5	15	-18	-2	3	13	33
Committed credit ($mln)	48	248	1	2	4	16	184
Credit line ($mln)	57	231	1	3	6	24	265
Term loan ($mln)	19	141	1	2	3	8	67
Utilization rate (pct)	46	38	0	2	47	81	100
Utilization at default (pct)	68	35	18	48	69	93	100
Share bank credit (pct)	53.96	34.98	1.75	21.53	53.21	90.45	100
Growth in bank credit (pct)	5.4	21.59	-33.24	-2.32	0	18.49	44.44
Growth in total debt (pct)	-1.88	41.48	-83.97	-13.77	0.89	20.86	55.86
Cash-to-assets (pct)	11.69	16.18	0	1.42	5.72	15.14	44.58
Capex-to-assets (pct)	6.13	14.64	-12.76	0	0.85	10.18	37.63
Sales-to-assets (pct)	44	30	5	16	40	70	94
Growth in sales (pct)	5	14	-18	-1	4	12	29
Share accounts receivable (pct)	20	21	0	3	14	30	65
Share fixed assets (pct)	32	30	1	6	21	51	92
Credit rating	BB		CCC	BB	BB	BBB	A
Expected PD (pct)	2.81	10.25	0.06	0.27	0.7	1.7	9.06
Expected LGD (pct)	32.62	18.22	5	20.7	34	42	60
Debt-to-assets (pct)	64	23	23	48	66	81	100
Debt-to-EBITDA (pct)	3.52	3.24	0.14	1.02	2.53	5.09	10.51
Distance to Delaware (km)	1523	1311	99	479	1066	2163	3863
			B. Bank characteristics				
Total assets ($mln)	488,788	674,996	65,951	122,034	176,900	381,451	2,191,626
CET1 ratio (pct)	12.7	3.5	9.5	10.7	11.9	13.6	17.8
CET1 buffer (pct)	4.5	2.3	1.9	2.9	4	5.4	9
HQLA-assets (pct)	17.1	11.4	4.8	9.8	14.5	19.9	47.9
Number of borrowers	3391.9	3463	117.6	1441	2291	3598	12687.2
Committed credit ($mln)	88,389	115,338	6,830	22,719	42,150	85,143	399,007
Number of markets	59.1	11.5	35	57	62	66	68
Market concentration [HHI] (0,100)	7	4	4	4	6	8	13
Largest market share [0,1]	0.21	0.1	0.11	0.13	0.21	0.25	0.37
Share of largest 3 markets [0,1]	0.34	0.1	0.22	0.25	0.35	0.41	0.53
Credit to low-elasticity markets [0,1]	0.4	0.13	0.2	0.29	0.4	0.48	0.6
Credit to high-elasticity markets [0,1]	0.16	0.08	0.06	0.1	0.16	0.21	0.32

NOTE: Panel A contains summary statistics of 92,069 nonfinancial corporate borrowers headquartered in one of 68 MSA areas over the period from 2013:Q1 through 2019:Q4. The sample includes both publicly traded and private companies that borrow from at least one of 34 large multi-market banks reporting in FR Y-14. Capital expenditures are net of depreciation and are shown as percent of the lag of total assets. Total bank credit measures the sum of committed amounts on credit lines and term loans. Expected utilization at default is based on the bank reported expected exposures at default. Share of bank credit is the ratio of bank term loans and credit lines to total liabilities and unused credit lines of obligors. Panel B summarizes the average characteristics of the banks in the FR Y-14 dataset. Balance sheet and income statement information for those banks is obtained from FR Y-9C. HQLA stands for high quality liquid assets and includes holdings of reserves, U.S. Treasuries, U.S. government agency debt, and agency mortgage backed securities (MBS). The CET1 buffer is the additional common equity tier 1 capital (CET1) above regulatory requirements and buffers. SOURCE: Federal Reserve Board, Forms FR Y-14 and FR Y-9C, Call Reports, and authors' calculations.

32 bank holding companies and 92,069 borrowers across 68 MSA-level markets. For some of the analysis, we require that firms appear in our sample for at least 2 years, which further

reduces the sample to 49,242 borrowers.

Panel A of Table 1 provides summary statistics of the borrower characteristics in our sample. The median firm has total assets of about $21 million, which is significantly less than the total assets of a typical publicly traded firm. For example, the median publicly-traded firm in Compustat has total consolidated assets close to $900 million, and the median firm that obtains credit through loan syndication recorded in DealScan has total assets of $2.4 billion. Compared with those datasets, our sample is representative of small and medium-sized firms. Borrowers with no more than $7 million in total assets make up 25 percent of our sample, and 5 percent of our sample are firms with total assets of $2 million or less.[2]

The median firm obtains about $4 million in committed bank credit, which may be either in the form of a credit line or a term loan. Because larger firms are more likely to obtain credit lines, the average committed amount on credit lines is more than twice the size of the average term loan. The average utilization rates of credit lines are about 46 percent, with more than a quarter of credit lines remaining undrawn or having a very low utilization rate. In addition, banks report the expected utilization at default, which takes into account covenants and other contractual characteristics of credit lines that would allow a firm to utilize its credit lines even in distress. The average expected utilization at default is about 68 percent, indicating significant additional borrowing capacity for firms that have credit lines.

For the average borrower, bank credit represents more than half of overall liabilities. We define high bank-dependent borrowers as all non-publicly traded firms whose bank credit comprises more than 50 percent of their reported liabilities. High bank-dependent borrowers comprise close to 45 percent of our sample.[3] In terms of credit risk, the median firm in our sample has a bank-assessed internal credit rating that corresponds to an S&P credit rating of BB. Banks also report the expected probability of default (PD) and the expected loss given default (LGD) for each loan. The median firm in our sample has an expected PD of 70 basis points and an LGD of 34 percent.[4] Finally, the average debt-to-asset ratio of firms in our sample is 64 percent.

Panel B summarizes information on the average characteristics of banks in our sample based on FR Y-9C data. Our sample contains the largest banking holding companies that

[2]To validate balance sheet and income statement information for the largest firms in FR Y-14Q, we use Compustat data. For the small and nonpublic companies, we rely on reports submitted by the banks. We employ a multi-step procedure described in the appendix to construct and validate the data. See our data appendix A for further details on our data construction as well as additional summary statistics.

[3]Our definition of high bank-dependence takes into account the unused portion of credit lines. We define the total credit of a firm as the sum of all of its on-balance sheet liabilities, funded bank loans, other corporate debt, and the unused portion of credit lines. We also classify borrowers with missing information on total liabilities as high bank-dependent.

[4]Each bank uses its own internal credit rating system. The loan-level internal credit ratings are mapped into S&P rating equivalents and aggregated to the firm level.

became subject to enhanced capital and liquidity regulations in the period following the Great Recession. All banks operate with common equity tier 1 (CET1) capital well above the regulatory requirements under the Basel III capital requirements, with some notable variation in CET1 buffers. Similarly, banks in our sample have large stocks of high-quality liquid assets (HQLA) and comply with the liquidity coverage ratio (LCR) requirement, maintaining liquidity buffers that exceed the requirements, which vary across banks. The average bank held close to $90 billion in C&I credit to about 3,400 borrowers and operated in about 60 out of the 68 markets in our sample. Banks have geographically diversified loan portfolios with an average Herfindahl–Hirschman (HHI) index of about 7 percent. The largest market share in a single geographic area is, on average, 21 percent of a bank's portfolio, and the share of the three largest markets is 34 percent. If we group markets based on the quartile of the real estate supply elasticities, approximately 40 percent of bank credit is allocated to the lowest quartile, while 16 percent is allocated to the highest quartile, indicating larger credit allocations to the markets with low supply elasticities.

Table 2 provides further information on the 68 MSAs that are part of our sample. In panel A, we document that market-level bank credit grew by approximately 7 percent on an annual basis, with significant dispersion in growth rates across markets and over time. On average, the credit growth to high bank-dependent borrowers is higher and more volatile than the credit growth to low bank-dependent borrowers. Similarly, the decomposition of credit growth into credit supply and demand factors, which we describe in detail in section (C) of the Appendix, reveals that the growth in credit demand by high bank-dependent borrowers is higher and more volatile compared with the average growth and volatility of demand by low bank-dependent borrowers. In terms of loan volumes, about 80 percent of the aggregate credit is to low bank-dependent borrowers. This significant share is explained by the fact that high bank-dependent borrowers, even if more numerous, are significantly smaller firms than low bank-dependent borrowers. When broken down by tradable and nontradable sectors, around 55 percent of high bank-dependent firms are in the nontradable sector, compared to only 37 percent of low bank-dependent borrowers.

Moving to panel B, the average market receives about $31 billion in credit from close to 28 banks in our sample. In comparison, C&I credit originated by small regional banks is less than $3 billion for the average market. For the average market, 86 percent of C&I credit comes from the sample of large multi-market banks, indicating the importance of those banks for market-level bank credit. The within-market concentration of lending is also relatively low, with the HHI index at around 11 percent for the average market. In terms of supply elasticities, the average market has a supply elasticity of about 1.74. We define markets with a supply elasticity of less than 1, the bottom quartile, as low supply elasticity markets, and those with a supply elasticity exceeding 2.35, the top quartile, as

Table 2: Descriptive statistics of geographic markets

Statistic	mean	sd	p5	p25	p50	p75	p95
	A. Credit growth						
Annualized growth in credit	6.95	32.91	-32.5	-6.36	5.18	17.49	49.13
—high bank-dependent	8.93	56.95	-40.88	-8.55	4.87	21.37	68.93
—low bank-dependent	6.96	36.61	-38.02	-7.83	4.68	18.91	55.57
Credit supply factor	1.36	3.42	-2.46	-0.45	0.7	2.62	6.8
Credit demand factor high-bank dependent	3.29	9.24	-7.12	-1.22	2.15	6.05	17.12
Credit demand factor low-bank dependent	1.7	7.1	-8.01	-1.68	1.29	4.62	12.68
Share of credit to low-bank dependent borrowers	80	8	66	75	81	85	89
—nontradable sector	30	13	12	21	28	39	52
—tradable sector	49	15	23	39	51	60	73
Share of credit to high-bank dependent borrowers	20	8	11	15	19	25	34
—nontradable sector	11	6	5	8	10	14	20
—tradable sector	9	5	4	6	8	11	20
	B. Market characteristics						
Credit (multi-market)	31,034	35,326	3,559	9,516	21,509	38,638	86,869
Credit (regional)	2,960	9,059	42	292	772	1,954	10,322
C&I share of multi-market banks (pct)	86	15	60	81	92	96	99
Multi-market HHI (0,100)	10.52	3.33	7.54	8.44	9.49	11.11	17.66
Number of multi-market banks	27.86	5.98	11	27	29	31	34
Supply elasticity	1.74	0.86	0.66	1	1.61	2.35	3.29
Commercial real estate price growth (pct)	6.39	5.61	-2.69	3.22	6.34	9.59	15.18
	C. Use of collateral (percent of firms)						
Share of real estate collateral	21	8	9	15	20	26	35
Share of accounts receivable	21	6	12	16	2	26	31
Share of cash and securities	8	5	3	5	7	10	16
Share of other fixed assets	10	3	6	8	10	12	16
Share of blanket lien	20	6	10	16	20	23	29
Share of unsecured	18	6	9	14	19	23	28
Share of other	9	3	5	6	8	11	14
	D. Economic activity						
Unemployment rate	4.87	1.69	2.8	3.7	4.5	5.6	8.1
Growth in employment: all	2.34	8.66	-9.6	-2.89	1.21	6.95	16.57
Growth in employment: nontradable sector	2.03	9.58	-13.12	-3.51	1.31	7.18	18.3
Growth in employment: tradable sector	1.72	22.13	-22.85	-4.62	0.98	7.15	25.8
Share of nontradable sector employment	72	5	65	69	71	75	80
Share of nontradable establishments	77	3	72	74	76	79	82

NOTE: The sample covers 68 geographic markets and over the period from 2013:Q1 to 2019:Q4. The credit supply and demand factors are aggregated to the market level using bank-level and firm-level lagged loan volume weights, respectively. SOURCE: Federal Reserve Board, Forms FR Y-14 and FR Y-9C; Bureau of Labor Statistics; Call Reports; Federal Deposit Insurance Corporation, Summary of Deposits; Census Bureau, Country Business Patterns; real estate supply elasticities Saiz (2010), and authors' calculations.

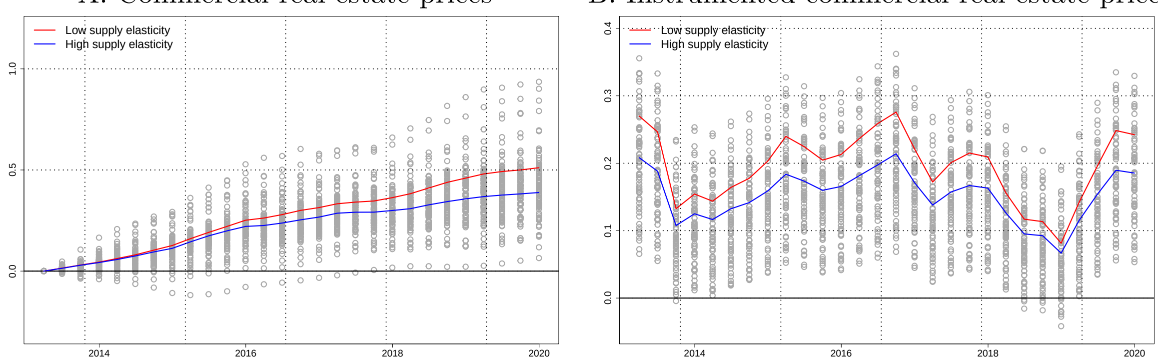
high supply elasticity markets. Markets experience significant variations in the average annual growth rate in real estate prices. The annualized quarterly growth in commercial real estate prices is 6.4 percent for the average market, with some notable cross-sectional and time-series variations. Some markets experience declines in commercial real estate prices, whereas other markets experience growth in prices that exceeds 15 percent.

Panel C documents the distributions of the market-level shares of firms that use the different collateral types observed in the data. The average share of real estate collateral is 21 percent, with across-market variation ranging from 9 percent for the 5th percentile market to 35 percent for the 95th percentile market. The second most common form of collateral is accounts receivable, followed by blanket liens, non-real estate fixed assets, cash and securities. For the average market, about 18 percent of firms obtain unsecured bank credit.

We combine information on real estate supply elasticities with quarterly market-level commercial real estate prices from CBRE Econometric Advisors. Panel A of Figure 1 shows the time-series variation in the commercial real estate price index across the 68 geographic areas in our sample. Over our sample period, the median market experiences about a 42 percent cumulative increase in commercial real estate prices. Markets with low supply elasticities experience larger price increases of about 51 percent, whereas prices in markets with high supply elasticities reach a cumulative appreciation of 41 percent over our sample period. The real estate supply elasticities are constructed by Saiz (2010) and are based

Figure 1: Commercial real estate prices

A. Commercial real estate prices | B. Instrumented commercial real estate prices

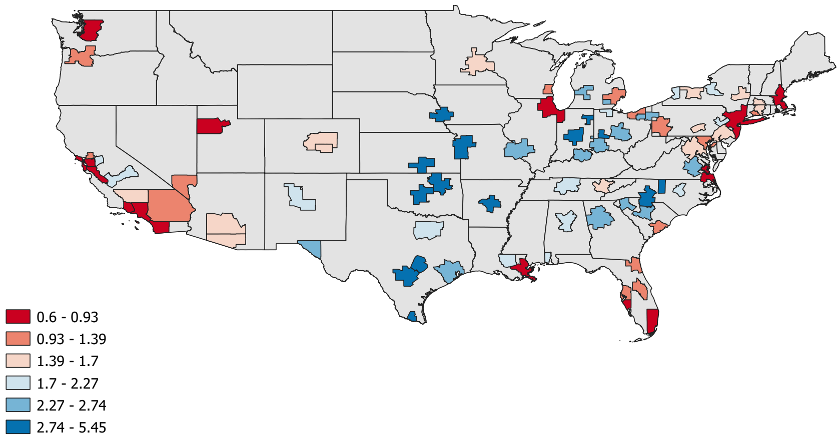


NOTE: The commercial real estate index is a composite price index of office, retail, industrial, and hotel properties. Each gray circle represents a market-level price. Low supply elasticity markets are markets with supply elasticities in the first quartile, whereas high supply elasticity markets are those with supply elasticities in the third quartile. The instrumented commercial real estate prices are the fitted values of regression specification (2) in Table 3. SOURCE: CBRE Econometric Advisors, Saiz (2010), and authors' calculations.

on the topography of a geographic area, which takes into account the presence of large bodies of water or steep terrain that make additional land development and construction increasingly costly. Figure 2 shows the supply elasticities across the geographic areas in our sample. Coastal areas and areas close to mountains have significantly lower supply elasticities and are shown in dark red. Those lower supply elasticities indeed translate into notable differences in real estate prices between low- and high-elasticity markets.

We obtain information on market-level economic activity from the Quarterly Census of Employment and Wages published by the Bureau of Labor Statistics, as well as from

Figure 2: Real estate supply elasticities by MSA



NOTE: The housing supply elasticities are plotted for the 68 MSA areas in our data. Red color indicates markets with relatively low real estate supply elasticities (less then 1.7), whereas blue color indicates markets with high real estate supply elasticities (more then 1.7). SOURCE: Saiz (2010).

the County Business Patterns (CBP) dataset published by the Census Bureau. Panel D shows summary statistics of economic activity, measured by indicators such as the unemployment rate and growth in employment. The bulk of economic activity is concentrated in nontradable sectors and in small firms, which tend to be high bank-dependent borrowers. For example, the average market has 72 percent of employment and 77 percent of establishments in nontradable sectors. It is worth noting that our sample period from 2013:Q1 until 2019:Q4 covers the recovery period from the Great Recession, during which most markets experienced positive growth in employment and improvements in unemployment rates. However, there is significant heterogeneity in those growth rates in the cross-section of markets, and approximately one-fourth of our sample includes periods during which some markets experience declines in total employment.

4 Empirical framework

Our empirical framework examines the behavior of a credit-constrained firm $f(m)$, which pledges its capital $K_{f(m)}$ (real estate properties) located in market m to obtain a loan from bank b. Even though each geographic area has its own asset price dynamics and firm investment opportunity set, our firm-level identification relies on the assumption that the representative firm is small enough that its asset demand and pledging of collateral do not affect the market price of collateral. The borrowing constraint that the firm faces has the following form

$$L_{f(m),b,t+1} \leq \psi_{b(m),t} \times \underbrace{P_{m,t+1} \times K_{f(m),t+1}}_{\text{Market value of collateral}}. \tag{1}$$

The credit constraint indicates that the loan amount $L_{f(m),b,t+1}$ from bank b cannot exceed the market value of the firm's real estate collateral, scaled by loan-to-value ratios $\psi_{b(m),t} \in (0, \bar{\psi}]$ that vary with the banks' liquidity and capital constraints, their monitoring activity in the market, or the lending opportunities in other markets in which the banks operate. The loan-to-value ratio is determined by banks' risk-adjusted expectations for recovery values in the event of default in market m. The recovery values are driven by the efficiency of the courts in resolving bankruptcy cases and the ease with which banks can repossess collateral following a default. All else being equal, the higher efficiency of bankruptcy courts increases borrowing capacity by enhancing recovery values for lenders.

Banks are also likely to be constrained in their lending by their available regulatory capital and liquidity, as well as by differences in the opportunity costs of lending in different geographic areas. Because changes in bank credit supply conditions are observationally equivalent to changes in firm-level credit constraints, it is important to control for the credit supply conditions of banks across geographic markets.

Taking into account all these considerations, we can write our baseline empirical specification as follows

$$\begin{aligned} Y_{f(m),b,t} = &\psi_0 \mathcal{I}\{\text{Real estate}_{f(m),b,t}\} + \Psi' \mathcal{I}\{\text{Non-real estate}_{f(m),b,t}\} + \\ &\psi_1 \Delta \text{Market value RE}_{f(m),t-1} \times \mathcal{I}\{\text{Real estate}_{f(m),b,t}\} + \\ &\Gamma' \mathbf{X}_{f,t-1} + \phi_f + \gamma_\alpha \alpha_{f,t} + \beta_{b,m,t} + \epsilon_{f(m),b,t}, \end{aligned} \tag{2}$$

where the indicator $\mathcal{I}\{\text{Real estate}_{f(m),b,t}\}$ equals one if the borrower pledges commercial real estate as collateral and zero otherwise. This allows us to gauge the relative importance of real estate collateral for credit growth vis-à-vis other forms of collateral. Therefore, the coefficient ψ_0 quantifies the relationship between the pledging of real estate collateral and the firm's credit growth relative to the credit growth experienced when firms pledge other forms of collateral or borrow unsecured. We also include as controls a vector of dummy variables for the use of other forms of collateral that are not real estate $\mathcal{I}\{\text{Non-real estate}_{f(m),b,t}\}$, and the omitted category is unsecured loans.

As outcome variables $Y_{f(m),b,t}$, we explore the year-over-year growth in firm f bank credit, overall debt, net sales, capital expenditures, and total assets, where m indicates the MSA area in which the firm operates, and b indicates the bank from which the firm obtains bank credit. We also examine the effects on credit spreads and the maturity of newly issued loans, as well as the reported expected loss given default (LGD) and the expected probability of default (PD). In some specifications, we also examine log-log specifications to quantify the effects of the collateral channel using firm debt, assets, capital expenditures (capex), and sales.

The variable ΔMarket value $\text{RE}_{f(m),t-1}$ captures the cumulative growth in the market value of commercial real estate properties of firm f before they are pledged as collateral in new borrowing or refinancing of existing debt in the MSA area m and the bank b. For a subset of firms, we observe the market value of collateral at origination when CRE collateral is pledged. We construct the updated market value using the cumulative change in the CRE price index since the date of acquisition or previous borrowing. However, for the bulk of our sample of firms, information on the market values of collateral or ownership of CRE properties is missing. Therefore, we use the cumulative growth in CRE prices $P_{m,t-1}$ in the market m to approximate the change in the market value of the firms' real estate properties.

We control for macroeconomic factors, as well as bank-specific and bank-market-specific credit supply conditions, using bank-market-time fixed effects $\beta_{b,m,t}$. The absorption of those factors allows us to focus on all across-firm and within-firm variations in credit outcomes. First, the collateral channel effects are identified by comparing two firms located in the same market and borrowing from the same bank. One firm pledges real estate collateral, while the other firm pledges a different form of collateral or borrows unsecured.

Second, the regression specification compares two firms borrowing from the same bank; however, each firm operates in a different market with a distinct appreciation of real estate values. The magnitude of the coefficient ψ_1 incorporates the additional relaxation of credit constraints for firms in markets with higher collateral values. Finally, the regression compares the same firm over time. In some periods, the firm does not pledge real estate; however, in other periods, it does pledge real estate collateral. The additional borrowing capacity of the firm when pledging real estate is captured by the combined effect of using real estate as collateral relative to other forms of collateral, as well as the changes in collateral value at the time of pledging.

Most of the specifications involve regressions of the growth rate in firm-level outcome variables and the growth rate in the value of CRE collateral. Therefore, in such specifications, the coefficient ψ_1 measures the elasticity of bank credit or firm-level outcomes to changes in real estate values.[5] In other specifications, in which the left-hand side variable is an interest rate, maturity, loss given default, or a ratio, ψ_1 captures a semi-elasticity of the outcome variable concerning the cumulative growth in the value of collateral.

The magnitude of the coefficient ψ_1 is a function of the mass of credit constrained

[5]Note that our specification does not suffer from the criticism of Welch (2020) regarding spurious correlations due to regressions that involve the same scaling variable on both sides of the regression. See also Chaney et al. (2020) for a discussion of alternative specifications for robustness.

firms (an extensive margin) and the degree to which credit constraints are binding (an intensive margin). We expect that when ψ_1 measures elasticities with respect to bank credit, total debt, total assets, and capital expenditures, the results will be positive because firms pledging real estate collateral benefit from the relaxation of borrowing constraints when collateral prices increase. We expect this coefficient to be larger for non-publicly traded, high bank-dependent firms because those firms are more credit constrained due to a lack of access to market-based or other forms of nonbank financing. In robustness specifications, we also explore other proxies for credit constraints, namely high leverage and low profitability.

The degree to which credit constraints are binding also depends on credit demand. All else being equal, firms with a higher marginal product of capital and, hence, higher loan demand are more likely to be credit constrained compared with firms without good investment opportunities. To control for firm-level loan demand, we include a credit demand factor $\alpha_{f,t}$ based on the decomposition introduced by Amiti and Weinstein (2018) and an implementation similar to Degryse et al. (2019).[6]

Finally, we control for lagged observable firm characteristics $\mathbf{X}_{f,t-1}$ that incorporate different measures of firm creditworthiness, such as leverage, investment-grade status, and profitability, measured by return on assets. We use firm fixed effects ϕ_f to condition on unobservable and time-invariant firm characteristics.

4.1 Endogeneity of commercial real estate values

The first endogeneity issue in identifying the coefficients of interest in equation (2) is that firm loan demand and collateral values are jointly determined by local economic conditions. Therefore, the ordinary least squares (OLS) coefficient estimates would identify a positive correlation between collateral values and bank credit, even without the presence of credit constraints. In other words, the OLS estimate of ψ_1 is expected to be positively biased if such associations are not controlled for.

We address this concern using Saiz (2010) supply elasticities as instruments for commercial real estate values. This instrument is standard in the literature and has been applied in a number of studies such as Himmelberg et al. (2005), Mian and Sufi (2011), Chaney et al. (2012), Adelino et al. (2015), Campello et al. (2021), and Asriyan et al. (2021). The real estate supply elasticity measure is a static characteristic of a geographic area. We create time-series variation in the local demand for real estate properties by interacting the supply

[6]See the appendix for details regarding the implementation of the identification of the credit supply and demand factors.

elasticity with the 30-year national mortgage rate

$$P_{m,t} = \mu_m + \beta \times \text{Elasticity}_m \times \text{30Y-Mortgage rate}_{t-1} + u_{m,t}, \tag{3}$$

where μ_m are market fixed effects. The interaction of the mortgage interest rate and supply elasticity identifies the differential price response across markets to a common aggregate demand shock. All else being equal, lower interest rates increase the demand for real estate properties. In markets with high supply elasticities, higher demand translates into a greater supply of properties and a lower price impact. Conversely, in low supply-elasticity markets, higher demand results in less supply of properties and a greater impact on real estate prices.

The results of the first-stage regression are summarized in Table 3. In column (1), we show the coefficient estimate of our baseline specification, which implies that a 100 basis point decrease in mortgage rates leads to a 5 basis point increase in the prices of commercial real estate properties. To account for nonlinearity, in specification (2), we fit a linear spline function with different slope coefficients for the lowest quartile, the interquartile range, and the upper quartile. As expected, markets with the lowest supply elasticities have the highest sensitivities of real estate values to changes in interest rates. Specifically, for a 100 basis point decrease in mortgage rates, markets with supply elasticities in the lowest quartile experience an average price appreciation of 18 basis points, whereas high supply-elasticity markets appreciate by less than 4 basis points. Based on the goodness-of-fit and F-test statistic, we chose the nonlinear model in column (2) as our preferred specification for the first stage.

It is useful to compare our estimates based on commercial real estate prices to those based on house prices. Columns (3) and (4) of Table 3 present the results of the baseline specifications using house prices. First, the coefficient estimates reveal that house prices are less sensitive to changes in aggregate interest rates compared to commercial real estate prices, especially in low supply-elasticity markets. Following a 100 basis point decrease in mortgage rates, house prices increased by about 12 basis points, compared with an 18 basis point increase in commercial real estate prices. Second, in terms of model fit, as measured by the F-test, the regressions with commercial real estate prices dominate the house price regressions, further validating the use of commercial real estate prices in our analysis and the relevance of the Saiz (2010) supply elasticity instrument for commercial real estate prices.[7]

Panel B of Figure 1 presents the fitted commercial real estate prices based on specifi-

[7] The validity of the real estate supply elasticities constructed from geographic constraints has been questioned by recent studies. For example, Davidoff (2013) and Guren et al. (2021) discuss potential problems with those supply elasticities and offer alternative measures. Our empirical framework addresses those concerns by controlling for industry composition, firm-level credit demand, and bank-level credit supply conditions.

Table 3: Supply elasticities and real estate prices

	Dependent variable: Real estate prices			
	Commercial		Residential	
	(1)	(2)	(3)	(4)
Elasticity × Mortgage rate 30yr,t-1	−0.051***		−0.036***	
	(0.004)		(0.003)	
Elasticity × {Elasticity $< Q1$}× Mortgage rate 30yr,t-1		−0.178***		−0.122***
		(0.014)		(0.019)
Elasticity × {Elasticity $\in (Q1, Q3)$}× Mortgage rate 30yr,t-1		−0.058***		−0.045***
		(0.006)		(0.004)
Elasticity × {Elasticity $> Q3$}× Mortgage rate 30yr,t-1		−0.036***		−0.026***
		(0.003)		(0.003)
Observations	5,606	5,606	5,341	5,341
R^2	0.314	0.404	0.301	0.335
F-test	35.68	51.40	33.92	38.57

NOTE: The regression sample includes 68 MSA areas and covers 2000:Q1 through 2019:Q4. Regressions in columns (2) and (4) fit linear splines that allow for different slope coefficients for markets with supply elasticities in the first quartile, the interquartile range, and the fourth quartile. All regressions include market fixed-effects. Heteroscedasticity consistent standard errors are clustered at the market level and are shown in parenthesis with statistical significance at *p<0.1; **p<0.05; ***p<0.01.

cation (2) of Table 3. The fitted values do not exhibit the upward trend observed in the underlying price indices. Consistent with the differences in the slope coefficients between low and high supply-elasticity markets, the average gap in commercial real estate values between these markets is time-varying and ranges between 1 and 6 percentage points over our sample period.

4.2 Endogeneity of the collateral choice

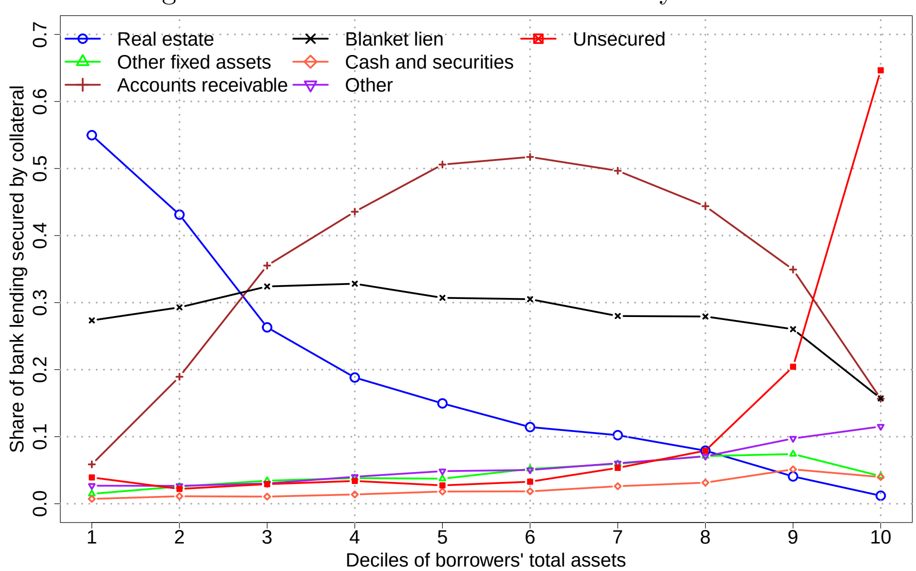
A credit constrained firm chooses to pledge real estate if it is the unencumbered form of collateral that would allow the firm to optimize its current and future borrowing capacity. All else being equal, higher real estate values should increase the preference for pledging real estate. However, this choice could also reflect high loan demand or lenders' preferences for specific collateral pledges, given the expected recovery values in bankruptcy.

To address the endogeneity of the choice of collateral to local demand conditions, we examine three different groups of factors that determine this choice, which are arguably unrelated to credit demand conditions. First, we construct instrumental variables based on measures of federal district court specific efficiency in handling corporate bankruptcy cases under Chapter 11 "Reorganization" and Chapter 7 "Liquidation". Second, we examine pre-determined firm characteristics that predict the pledging of real estate collateral, such as firm size, the existing stock of fixed assets, and alternative forms of collateral, such as accounts receivable and inventories. Third, we examine bank characteristics that influence the choice, such as regulatory capital and underwriting policies. Finally, we control for the exogenous variation in commercial real estate values using the projected collateral values from the previous section.

4.2.1 Firm characteristics and collateral choice

A defining characteristic of firms using CRE collateral is firm size. The pledging of CRE properties declines monotonically with firm asset size, as shown in Figure 3. Close to 60 percent of the credit to firms in the first decile of the firm size distribution is collateralized with real estate. As size increases, firms substitute away from real estate and increase their use of accounts receivable and inventories. The third category of collateral is a blanket lien, which gives the lender the power to seize and liquidate all assets that are not already encumbered by other liens and pledged to other lenders. The use of blanket liens is relatively constant across the size distribution, hovering around 30 percent up to the largest decile, at which point its use declines to about 15 percent.

Figure 3: Collateral use in bank credit by firm size



NOTE: For each decile of the firm size distribution, we compute the loan-volume share of loans secured by the particular type of collateral. FR Y-14 collect information on collateral at the credit facility level into seven mutually exclusive categories: real estate, cash and marketable securities, accounts receivable and inventories, fixed assets excluding real estate, blanket lien, other, and unsecured. Data are as of the last quarter in our sample 2019-12-31. SOURCE: Federal Reserve Form Y-14Q H1 Schedule and authors' calculations.

Borrowers in the top decile have more than 60 percent of bank credit in the form of unsecured loans, which is in stark contrast to smaller firms. This finding, however, is in line with the stylized facts documented for large publicly-traded firms. Lian and Ma (2021) document that, for the sample of publicly traded firms, around 80 percent of debt contracts use earnings-based forms of collateral, and only 20 percent of debt contracts are secured by specific assets. In contrast, in the sample of both public and private borrowers of different sizes, 68 percent of borrowers use some form of asset-based collateral, and about 37 percent of borrowers pledge real estate as collateral.[8]

Firms that pledge real estate are different from the group of firms that pledge other forms of asset-based collateral. The median firm that pledges real estate properties has $4 million in total assets, which is less than half the size of the median firm that pledges accounts receivable and more than 15 times smaller than the median firm that borrows unsecured. The firms that pledge real estate have higher shares of fixed assets in total assets, lower shares of accounts receivable, a higher dependence on bank credit, and are also more likely to have below-investment-grade status. Even though the firms that pledge real estate are riskier borrowers, banks expect that losses given default on loans secured by real estate will be lower than the losses on loans secured by other fixed assets or on loans that are not secured. This aligns with the notion that commercial real estate collateral can be relatively easily repossessed by the bank during bankruptcy, and its value can be assessed without much difficulty, as it is not tied to the borrower's specific business model. We offer further evidence for this in the following sections.

Finally, more than 96 percent of loans secured by real estate or other forms of collateral are first-lien loans. This indicates that the main method for a firm to extract the increase in the value of collateral is through the refinancing of existing loans.

4.2.2 Efficiency of bankruptcy courts and collateral choice

Judicial efficiency determines the relative speed with which a bank, as a secured lender, can repossess pledged collateral. Under the U.S. bankruptcy code, borrowers have automatic stay protection that allows them to continue operations without the need to immediately liquidate assets, and most large corporate borrowers seek protection from disorderly liquidation by filing under Chapter 11 "Reorganization". Smaller firms are more likely to file under Chapter 7 "Liquidation". Bank preferences for asset-based collateral, such as commercial

[8] The use of asset-based collateral by bank dependent borrowers is consistent with stylized facts documented in previous studies based on micro-level bank data (e.g. Berger and Udell (1990)). Using the nomenclature of Lian and Ma (2021), we group collateral types into asset-based collateral and earnings based collateral. Asset-based collateral includes real estate, accounts receivable, inventories, fixed assets other than real estate, and cash and securities, whereas earnings based collateral is based on blanket liens and unsecured loans. This classification is also consistent with the treatment of such collateral by bank supervisors, as discussed in the Comptroller's Handbook OCC (2000).

real estate, depend on the expected losses borne by the bank in the event of default. Those losses are tied to the expected market value of the collateral pledged, but they also critically depend on the duration of the bankruptcy proceedings and the preferences of courts to convert cases originally filed under Chapter 11 to Chapter 7.

A large body of literature has documented that the direct and indirect bankruptcy costs can be substantial. For example, Bris et al. (2006) estimates that the direct costs can amount to 2 to 10 percent of firm value. Others have documented indirect costs related to excessively long bankruptcy proceedings that often preserve businesses that should have been liquidated. For example, Hotchkiss (1995) documents that over 40 percent of firms resolved under Chapter 11 continue to operate at a loss three years after bankruptcy, and 32 percent re-enter bankruptcy or privately restructure their debt. Therefore, we explore the hypothesis that banks' preference for the different forms of collateral is influenced, in large part, by the relative efficiency with which federal district courts resolve bankruptcy cases under Chapter 7 and Chapter 11.

We measure the efficiency of federal district courts in two ways. First, we examine the duration of bankruptcy case resolution. The duration of resolution depends on the speed with which courts settle disputes between secured and unsecured lenders, as well as disputes between the bank and the borrower. We use a regression framework to remove variation due to observable characteristics of specific bankruptcy cases, as well as macroeconomic and regional factors. We construct court-specific residual durations under the two chapters. All else being equal, banks would prefer to accept tangible assets as collateral in geographic areas where the district court resolves Chapter 7 cases more quickly.

Second, we examine the propensity of courts to convert cases originally filed under Chapter 11 to Chapter 7. All else being equal, because the conversion allows banks to repossess the collateral pledged, banks would be more willing to accept tangible assets in geographic areas where district courts are more likely to convert Chapter 11 cases into Chapter 7 cases. That said, banks can have different strategic considerations that vary with the type of collateral and projections about the value of a borrower's assets, both within and outside the firm.

Table 4 documents that there is significant variation in the duration of bankruptcy cases. On average, cases under Chapter 11 take 7 months longer than those filed under Chapter 7. About 16 percent of cases originally filed under Chapter 11 are switched and closed under Chapter 7, and less than 1 percent of cases are switched from Chapter 7 to Chapter 11. Note that the conversion from Chapter 11 to Chapter 7 includes cases that take significantly longer than a typical case, likely reflecting a failure to achieve a consensus on the firm's reorganization plan.

Finally, we take into account that many firms file their bankruptcy cases in a court

Table 4: Duration of bankruptcy cases from date of filing to closure in months

	mean	s.d.	5	25	50	75	95
Filed under Chapter 11	22	21	2	8	15	30	67
Filed under Chapter 7	15	17	1	3	8	22	52
	Closing chapter different from chapter at filing						
Switched from Chapter 11 to 7	46	31	9	22	39	61	106
Switched from Chapter 7 to 11	25	23	3	9	17	32	74
	Filed in different jurisdiction ("Forum shopping")						
Filed under Chapter 11	25	23	3	9	16	33	73
Filed under Chapter 7	32	32	1	5	18	51	99

NOTE: Durations are expressed in months and measure the time from the date of filing to the date of final closure. The sample contains 216,763 bankruptcy filings over the period from 2008-01-01 through 2023-09-30. Of those, 27,415 are filed in a jurisdiction different from the headquarters of the borrower indicating potential "Forum shopping". There are 17,351 cases that were converted from Chapter 11 to 7 and 543 cases converted from Chapter 7 to 11. In our sample, 16,373 cases are still pending by the end of the sample period and their duration is missing. SOURCE: FJC database from WRDS and authors' calculations.

different from the local federal district court. About 12 percent of cases involve borrowers filing for bankruptcy in a jurisdiction different from their local federal court in a process often referred to as "forum shopping".[9] , As documented by Antill and Bellon (2024) and further explored in the appendix. the district court of Delaware has historically shown higher efficiency in resolving bankruptcy cases filed under Chapter 11. Many large companies, even if headquartered outside the state of Delaware, prefer to file their Chapter 11 cases with the Delaware district court, and more than half of the forum shopping under Chapter 11 occurs in the federal district court of Delaware.

On average, cases that involve forum shopping take longer to resolve. However, this is due to the fact that such cases involve larger firms with more complex cases, involving a greater number of lenders and different types of secured and unsecured debt. Therefore, using the raw duration of cases as measures of judicial efficiency would miss the significant heterogeneity in the nature of court cases across firms that file for bankruptcy, as well as the local and macroeconomic conditions that influence default rates across jurisdictions.

In Table 5, we provide summary information on the observable characteristics of borrowers in the FJC dataset. About 54 percent of bankruptcy cases are originally filed under

[9]Bankruptcy laws allow companies to file for bankruptcy in any district where they have their principal place of business, principal assets, or are incorporated. If a company has significant assets in Delaware, it may argue that its "principal assets" are located there, allowing it to file in the state. Some companies create a new entity in Delaware shortly before filing for bankruptcy. This new entity can then file in Delaware, and the rest of the corporate structure can join the filing as affiliated debtors. This flexibility can sometimes lead to debtors filing in jurisdictions far from their actual headquarters or main operations

Table 5: Summary statistics of FJC bankruptcy data

	mean	s.d.	5	25	50	75	95
Debtor total debt quartile	2.14	1.09	1	1	2	3	4
$\mathcal{I}\{\text{Chapter 11}\}$	0.54	0.50	0	0	1	1	1
$\mathcal{I}\{\text{Chapter 11 to 7}\}$	0.16	0.37	0	0	0	0	1
$\mathcal{I}\{\text{Num.lenders} \geq 50\}$	0.28	0.45	0	0	0	1	1
$\mathcal{I}\{\text{Secured debt}\}$	0.65	0.48	0	0	1	1	1
$\mathcal{I}\{\text{Owns real estate}\}$	0.30	0.44	0	0	0	1	1
$\mathcal{I}\{\text{Secured debt} \times \text{Owns RE}\}$	0.30	0.46	0	0	0	1	1
$\mathcal{I}\{\text{Forum shopping}\}$	0.12	0.32	0	0	0	0	1
$\mathcal{I}\{\text{Forum shopping: Chapter 11}\}$	0.11	0.31	0	0	0	0	1
$\mathcal{I}\{\text{Forum shopping: Chapter 11: Delaware}\}$	0.06	0.23	0	0	0	0	1
District: Percent cases closed	12	4	6	9	12	14	19

NOTE: The sample contains 216,763 corporate bankruptcy filings over the period from 2008-01-01 through 2023-09-30 in the 94 federal district courts. Of those 117,926 or 54 percent are filed under Chapter 11 and 17,351 cases filed under Chapter 11 or 15 percent are converted to Chapter 7. There are 27,415 cases that are filed in districts outside the borrower main court district, which we label as forum shopping. Of those, 14,294 are filed in the district of Delaware. There are 17,959 cases still pending by the end of the sample period and their durations are thus censored. SOURCE: FJC database from WRDS and authors' calculations.

Chapter 11, and the rest are filed under Chapter 7. The FJC data contain information on the number of original lenders as a categorical variable, from which we construct the indicator variable $\mathcal{I}\{\text{Num.lenders} \geq 50\}_i$ that takes the value of one for debtors who have more than 50 lenders at the time of filing.[10] About 28 percent of cases involve more than 50 lenders. Sixty-five percent of cases include secured debt, and thirty percent involve borrowers who own real estate properties. A similar fraction of debtors reports owning real estate and having secured debt. Finally, around 12 percent of all cases in the sample are categorized as forum shopping, in which the borrower files in a district court different from its local district. About 52 percent of those cases are handled by the district of Delaware, and more than 90 percent of forum shopping cases are filed under Chapter 11.[11] On average, around 12 percent of bankruptcy cases are resolved each quarter out of all pending cases.

Overall, the large heterogeneity in the time it takes for a bankruptcy case to be re-

[10]Lenders could be any entity to which the defaulting firm owes money, such as banks, nonbank financial institutions, as well as other entities including the federal government, state and local governments, utility companies, workers, suppliers, and other contractors. The FJC dataset on WRDS does not allow us to distinguish among these categories. A larger number of lenders serves as a proxy for the size of the firm and the complexity of the bankruptcy case.

[11]Together with Delaware, which handles 52 percent of all "forum shopping" cases, 4 district courts (New York Southern, Texas Southern, Virginia Eastern, Texas Northern) handle more than 84 percent of all out-of-state cases categorized as "forum shopping".

solved depends on observable and unobservable characteristics of the borrower, the local and macroeconomic conditions, and the caseload of the judges and the courts.[12] We are interested in decomposing the variation in case durations into court-specific durations that are unrelated to the observable characteristics of the borrower case and the state of the economy. To do so, we estimate the district court residual duration as the district court fixed effect $\Delta^k_{d,y}$ for bankruptcy case i in district court d filed under Chapter $k = \{7, 11\}$ by a firm in county c on date t, year y as follows

$$\begin{aligned} \text{Dur}_{i,t} =& \Delta^k_{d,y} + \alpha_1 \text{Percent cases closed}_{d,t-1} + \alpha_2 \mathcal{I}\{\text{Chapter 11}\}_i + \\ & \alpha_3 \mathcal{I}\{\text{Num.lenders} \geq 50\}_i + \alpha_4 \text{Debt quartile}_i + \\ & \alpha_5 \mathcal{I}\{\text{Owns real estate}\}_i + \alpha_6 \mathcal{I}\{\text{Secured debt}\}_i + \\ & \alpha_7 \mathcal{I}\{\text{Owns real estate}\}_i \times \mathcal{I}\{\text{Secured debt}\}_i + \\ & \alpha_8 \mathcal{I}\{\text{Forum shopping}\}_{c \notin d} + \sigma_{c,t} + \epsilon_{i,k,c,d,t}, \end{aligned} \tag{4}$$

where *Percent cases closed*$_{d,t-1}$ is the lagged number of cases closed in a given quarter as a fraction of all outstanding cases in district d at quarter t. The variable $\mathcal{I}\{\text{Chapter 11}\}_i$ is an indicator of whether borrower i filed under Chapter 11. To control for borrower size, we use the reported outstanding debt of the borrower at the time of filing and group borrowers based on the quintiles of the debt size distribution.[13]

Because, in the FJC data, we do not observe the collateral pledged for secured debt, the interaction term $\mathcal{I}\{\text{Owns real estate}\}_i \times \mathcal{I}\{\text{Secured debt}\}_i$ proxies for borrowers with reported real estate that pledge these assets in secured debt. We observe that in most situations in which the borrower has real estate, the borrower has also secured debt. Finally, we include a set of county-time fixed effects $\sigma_{c,t}$ to absorb the local macroeconomic conditions of the borrower. We control for the effects of "forum shopping" by including a dummy variable for whether the case is handled by a court out-of-state of the headquarters of the borrowers. We also include an interaction term with the indicator for whether the case is filed under Chapter 11.

The results from the estimation are summarized in Table 6. The first column shows least squares estimates without fixed effects, and columns two and three recursively add county-time and district-chapter-year fixed effects, respectively.

The estimates reveal that bankruptcy cases of borrowers with a larger number of lenders (exceeding 50) require an additional 10 months to resolve, which is consistent with the fact that those cases involve more complex debt obligations and the potential for conflicts

[12] See Iverson (2018) for a description of the bankruptcy process and the role of judges.

[13] This grouping is partly due to the reporting of the data, which, in certain periods, is based on intervals of the outstanding debt and, in other periods, is based on the actual amount. FJC WRDS also reports the assets of the borrower, but these data fields are not as well populated.

Table 6: Determinants of bankruptcy case duration

	Dependent variable:		
	Case duration		
	(1)	(2)	(3)
$\mathcal{I}\{\text{Num.lenders} \geq 50\}, i$	10.317***	10.303***	10.380***
	(1.068)	(1.029)	(0.929)
Debtor debt quartile, i	10.099***	9.571***	9.266***
	(0.583)	(0.555)	(0.535)
$\mathcal{I}\{\text{Secured debt}\}, i$	−1.999**	−1.686**	−1.850**
	(0.798)	(0.812)	(0.852)
$\mathcal{I}\{\text{Owns real estate}\}, i$	2.328	0.850	0.675
	(1.829)	(1.708)	(1.699)
$\mathcal{I}\{\text{Secured debt}\} \times \mathcal{I}\{\text{Owns real estate}\}, i$	−6.605***	−5.932***	−5.779***
	(2.064)	(1.917)	(1.774)
$\mathcal{I}\{\text{Forum shopping}\}, i$	−0.786	−16.039***	−9.457***
	(1.525)	(2.781)	(2.161)
Share cases closed$_{d,t}$	−0.331***	−0.139***	−0.056***
	(0.096)	(0.045)	(0.018)
$\mathcal{I}\{\text{Chapter 11}\}, i$	2.734	2.219	
	(2.151)	(1.858)	
Constant	10.519***		
	(2.461)		
County × date-quarter fixed effects	N	Y	Y
District fixed effects	N	Y	N
District × Chapter × year fixed effects	N	N	Y
Observations	1,054,459	1,054,459	1,054,459
R^2	0.121	0.301	0.328
Adjusted R^2	0.121	0.235	0.262

NOTE: Heteroscedasticity consistent standard errors are clustered at the district level. Significant at *p<0.1; **p<0.05; ***p<0.01. SOURCE: FJC database from WRDS and authors' calculations.

of interest regarding resolution. In addition, bankruptcy cases of the largest borrowers with debts in default in the 5th quintile take, on average, more than 3 years longer to be closed than cases involving borrowers in the first quintile. All else being equal, the size and complexity of a borrower's debt increase the time needed to resolve a bankruptcy.

The next three variables reveal that debtors who have secured debt, on average, have resolutions that are shorter by about 2 months. The ownership of real estate does not have a statistically significant effect on duration. However, bankruptcy cases of debtors that have both secured debt and own real estate are resolved, on average, 7 to 8 months faster. Finally, courts that have a higher share of cases closed in a given quarter also result in a faster resolution of pending cases, which is a proxy for the observable productivity of a court.

The largest borrowers in our sample, especially those close to the state of Delaware, are likely to file under Chapter 11 and seek a court district that is more efficient in resolving such cases. Indeed, once we condition on time fixed effects, forum shopping results in a significant reduction in the average duration of bankruptcy resolution by 10 to 16 months. Finally, note that once we condition on the observable characteristics of the bankruptcy case, the estimated effect of filing under Chapter 11 is small and statistically insignificant.

Our second measure examines the tendency of federal district courts to convert bankruptcy cases originally filed under Chapter 11 to Chapter 7.[14] This measure is important because about 16 percent of cases filed under Chapter 11 are closed under Chapter 7, and there is significant variation over time and in the cross-section of districts. Similar to the duration measures, we want to identify the court-specific preference for converting Chapter 11 cases to liquidation. For example, bankruptcy judges across districts may differ in their stance on debtor reorganization, and some may favor liquidation of assets under Chapter 7 over reorganization under Chapter 11.[15]

To do so, we estimate the district-specific preference for such conversions that are unrelated to local market conditions. We examine a linear model as well as a panel probit regression on the propensity of a court district to convert a case originally filed under Chapter 11 to Chapter 7. We use the same control variables as in regression (4), but our sample includes only cases originally filed under Chapter 11. We also control for the time since the filing of the case.

The results of these regressions are reported in Table 7, where the linear model is presented in columns (1) through (3), and the probit model is reported in column (4). The results indicate that courts are more likely to convert Chapter 11 cases to Chapter 7 the longer the case has been under review since filing. Cases with a larger number of lenders are also more likely to be converted, whereas cases involving larger borrowers based on their outstanding debt at default are less likely to be converted. All else being equal, cases that involve forum shopping are less likely to be converted, indicating that borrowers seek to file their Chapter 11 cases in districts that favor reorganization over liquidation. Interestingly, when the borrower reports ownership of real estate, the court is less likely to convert the case to liquidation, and this likelihood does not change if the borrower also has secured debt, which may involve pledging the real estate as collateral. Finally, districts that have higher shares of cases closed are less likely to resolve Chapter 11 filings under Chapter 7, indicating that the efficiency with which courts process cases or the case workload could also play a role.

[14] See Morrison (2007) for a description of the process used by judges to convert bankruptcy cases originally filed under Chapter 11 to Chapter 7.

[15] Even though PACER collects information on bankruptcy judges, the FJC data on WRDS do not provide this information. Nonetheless, to the extent that there is no significant reallocation of judges across districts, the fixed effects should capture district-specific preferences of judges.

Table 7: Conversion of Chapter 11 filing to Chapter 7 at closing

	Dependent variable: Conversion from Chapter 11 to 7			
	Linear model			Probit
	(1)	(2)	(3)	(4)
Months since filing$_{i,t}$	0.005***	0.006***	0.006***	0.017***
	(0.0004)	(0.0005)	(0.0005)	(0.0001)
$\mathcal{I}\{$Forum shopping$\}, i$	−0.199***	−0.147***	−0.074**	−0.340***
	(0.036)	(0.022)	(0.037)	(0.014)
$\mathcal{I}\{$Num.lenders $\geq 50\}, i$	0.024**	0.018	0.022*	0.067***
	(0.011)	(0.013)	(0.012)	(0.005)
$\mathcal{I}\{$Secured debt$\}, i$	0.014	0.011	0.008	0.016***
	(0.018)	(0.017)	(0.015)	(0.006)
$\mathcal{I}\{$Owns real estate$\}, i$	−0.108***	−0.083**	−0.086***	−0.336***
	(0.036)	(0.034)	(0.031)	(0.017)
$\mathcal{I}\{$Secured debt$\} \times \mathcal{I}\{$Owns real estate$\}, i$	0.013	−0.017	−0.013	0.002
	(0.032)	(0.032)	(0.029)	(0.018)
Debt quartile, i	−0.030***	−0.026***	−0.026***	−0.082***
	(0.008)	(0.006)	(0.005)	(0.003)
Share cases closed$_{d,t}$	−0.002*	0.002	−0.001**	−0.004***
	(0.001)	(0.003)	(0.0002)	(0.001)
County × date-quarter fixed effects	N	Y	Y	N
District × year fixed effects	N	N	Y	Y
Observations	563,530	563,530	563,530	563,530
R^2	0.101	0.306	0.321	
Adjusted R^2	0.101	0.208	0.223	
Log Likelihood				−296,390
Akaike Inf. Crit.				593,007

NOTE: The sample contains 117,976 bankruptcy cases originally filed under Chapter 11 over the period from 2008-01-01 through 2023-09-30. Of those, 17,357 are converted to Chapter 7. Heteroscedasticity consistent standard errors are clustered at the district level. Significant at *p<0.1; **p<0.05; ***p<0.01. SOURCE: FJC database from WRDS and authors' calculations.

Table 8: Measures of judicial efficiency of bankruptcy resolution

	mean	s.d.	5	25	50	75	95
Resid.duration Ch.7	1.98	18.94	-29.12	-8.75	0	13.2	36.07
Resid.duration Ch.11	0.97	17.7	-28.16	-8.99	0	10.94	32.58
Chapter 11 to 7	0.07	0.25	-0.34	0	0.01	0.19	0.55

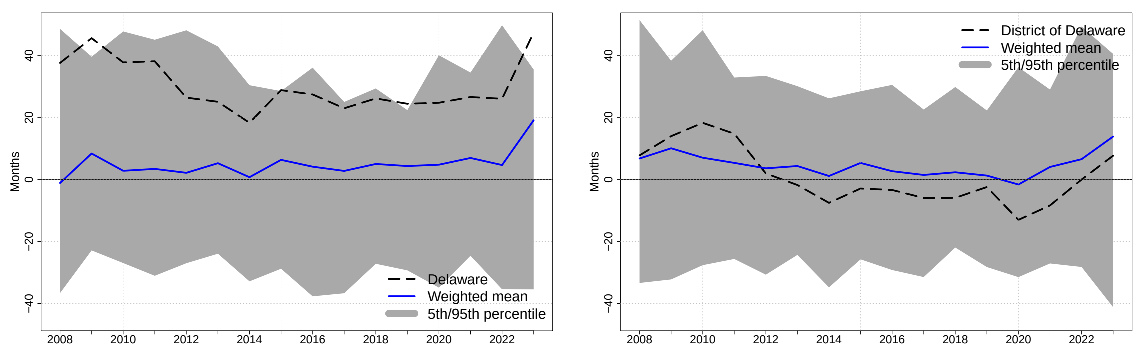
NOTE: Residual duration measures are based on the district court fixed effect estimates of regression (3) of Table 6, whereas the district court tendency to convert Chapter 11 cases to Chapter 7 is based on the district court fixed effects of regression (4) of Table 7. SOURCE: FJC database from WRDS and authors' calculations.

Summary statistics of the three measures of judicial bankruptcy efficiency are summarized in Table 8. The district court residual durations are plotted in panels A and B of Figure 4 for Chapter 7 and Chapter 11 cases, respectively. There is significant variation in the residual durations across the federal district courts. Examining the residual duration of the courts that handle more cases captured by the weighted mean, this mean has hovered close to zero or the median and has increased since the COVID-19 pandemic to about 20 months. In comparison, the district of Delaware has a residual duration of Chapter 7 cases that is higher than the weighted mean, averaging over 20 months. In contrast, in panel B, Delaware has, on average, a lower residual duration than the median court for the period from 2012 through 2022.

Figure 4: Relative duration of bankruptcy resolution

A. Residual duration of Chapter 7

B. Residual duration of Chapter 11



NOTE: All residual durations are deviations from the median residual duration. The weighted mean uses the number of pending bankruptcy cases as weights. The sample covers the period from 2008 through 2023. SOURCE: FJC database from WRDS and the authors' calculations.

The ranges of outcomes are tighter for Chapter 11 cases, with the interquartile range capturing a difference of about 2 years between the 25th percentile district and the 75th percentile. The district of Delaware has experienced a negative residual duration for most of the time since 2012 but has climbed to around zero by the end of the sample, following the COVID-19 pandemic.

4.2.3 Bankruptcy court efficiency, collateral use, and loss given default

To understand the mechanism behind the role of bankruptcy court efficiency in the choice of collateral, we examine the extent to which banks incorporate judicial efficiency into their projected losses given default (LGD). In particular, we examine the following regression of the LGDs on the collateral pledged and the interactions of the collateral pledged with judicial efficiency.

$$LGD_{f,b,m,c,t} = \gamma^{c}\mathcal{I}\{\text{Collateral= c}\} + \gamma^{cj}\mathcal{I}\{\text{Collateral= c}\} \times \text{Judicial Efficiency}_{m,t} + \alpha_{f,t} + \beta_{b,t} + u_{f,b,m,c,t}, \tag{5}$$

where $\alpha_{f,t}$ and $\beta_{b,t}$ absorb all the firm and bank time-varying characteristics, respectively. Judicial Efficiency includes our measure of residual duration for resolving Chapter 7 and Chapter 11 cases, the preference for courts to convert Chapter 11 to Chapter 7, as well as the distance of the borrower to the federal district court of Delaware, which is a preferred destination for forum shopping by large borrowers filing under Chapter 11.

Table 9: Judicial efficiency measures and expected loss given default

		Judicial efficiency measures $\hat{\gamma}^{jc}$			
Collateral	Effect	Conversion	Delaware	Residual duration	
	$\hat{\gamma^c}$	Ch11 to 7	$> 200km$	Ch11	Ch7
CRE collateral	-9.02***	-14.08***	6.57***	0.02	-0.08
	(1.62)	(3.86)	(1.74)	(0.07)	(0.06)
Blanket lien	-2.83***	4.60**	1.62*	0.01	0.02
	(0.79)	(1.97)	(0.83)	(0.03)	(0.03)
Accounts receivable and inventories	-1.80**	0.18	0.81	0.01	0.03
	(0.80)	(1.87)	(0.84)	(0.03)	(0.03)
Other	-1.42*	-3.19*	0.66	0.03	0.00
	(0.77)	(1.93)	(0.82)	(0.03)	(0.03)
Cash and securities	-1.70	2.78	1.17	-0.10**	0.04
	(1.28)	(3.15)	(1.38)	(0.05)	(0.05)
Other fixed assets	-1.22	-1.53	-0.96	0.04	0.04
	(0.93)	(2.09)	(0.98)	(0.03)	(0.03)
Unsecured	4.24***	-0.87	-1.40*	-0.04	0.06**
	(0.74)	(1.96)	(0.79)	(0.03)	(0.03)

NOTE: The table presents the coefficient estimates of regression (5), where the arrangement of the coefficient estimates for each collateral type are arranged in rows. The regression includes bank-time and firm-time fixed effects. Significant at *p<0.1; **p<0.05; ***p<0.01.

Results from the estimation are summarized in Table 9, where each row represents the coefficient estimates for each collateral type. The first row examines banks' projected losses given default for loans secured with CRE collateral. All else being equal, pledging CRE collateral is valuable for banks, as the reported loss given default is significantly lower for this type of collateral compared to other forms, including cash and securities or blanket liens. Keeping all else fixed, CRE collateral pledged by a firm is assigned a loss given default that is 9 percentage points lower. Banks assign 6.6 percent higher LGD values for firms located more than 200 km from the district court of Delaware, likely reflecting the differences in the efficiency of courts in resolving Chapter 11 cases and the higher likelihood of courts other than Delaware converting Chapter 11 cases into Chapter 7.

Banks recognize that courts have a higher preference for converting Chapter 11 cases to Chapter 7 because, in areas where courts favor liquidation over restructuring, banks assign lower losses given default for CRE collateral. A one standard deviation increase in this conversion probability reduces the LGD for CRE collateral loans by 3.5 percentage points. Note that this is not generally true across all collateral types, as banks report higher LGD when blanket liens are used as collateral. A likely explanation is that the blanket lien is not specific about which collateral the lender would repossess in bankruptcy, and banks may prefer to keep the firm as a going concern under reorganization.

Pledging a blanket lien on the firm's unencumbered assets results in a 2.83 percent lower LGD, followed by accounts receivable, other forms of collateral, cash, and securities. Banks assign the lowest reductions in LGD for loans secured by other fixed assets. Finally, unsecured loans are costly for banks, as they have, on average, a higher loss given default of about 4 percentage points, which increases with the residual duration of Chapter 7 bankruptcy and decreases for firms located more than 200 km away from the district court of Delaware.

4.2.4 Predicting use of real estate collateral

It is important to note that the realized choices of collateral are the result of a bargaining process between the lender and the borrower and reflect the preferences of both parties. We model the endogenous choice of pledging real estate as a probit regression

$$\begin{aligned}\mathbb{E}_{t-1}\ \mathcal{I}\{\text{CRE collateral}_{f(b),m,t}\} = \Phi(&\beta_1' \text{Judicial efficiency}_{m,t-1} + \\ &\beta_2 \widehat{P_{m,t-1}} + \\ &\beta_3 \widehat{P_{m,t-1}} \times \text{Share fixed assets}_{f,t-1} + \beta_5' X_{f,t-1} + \\ &\beta_6' Z_{b,t-1} + \tau_t + \mu_m),\end{aligned} \tag{6}$$

where CRE collateral use in period t is predicted based on observable information as of period $t-1$ and $\Phi(\cdot)$ is the standard normal cumulative density function. This addresses potential simultaneity in the determination of collateral use and CRE prices. Our set of exogenous instruments that affect the choice of collateral use comprises measures of bankruptcy court efficiency, which we collapse at the firm-county level. We include the court-specific residual duration of Chapter 7 cases, the court-specific propensity to convert Chapter 11 cases to Chapter 7, and the distance of the borrower headquarters to the district court of Delaware. In addition, we use the exogenous variation in the CRE prices $\widehat{P_{m,t-1}}$ and its interaction with firms' shares of fixed assets as additional exogenous determinants of real estate collateral pledging.

As firm controls $X_{f,t-1}$, we use the lagged share of fixed assets (property, plant, and equipment) in total assets as a proxy for the firms' ownership of unencumbered real estate assets. We include the instrumented CRE price and its interaction with the firm shares of fixed assets to proxy for the change in the market value of fixed assets.[16] We include the lags of firm size, debt to assets, profitability as measured by the return on assets, share of accounts receivables in firms' assets, and the log of firms' total assets.

We control for lagged bank characteristics $Z_{b,t-1}$ such as the lagged regulatory common equity tier 1 (CET1) capital buffers above regulatory requirements and the loan-to-value (LTV) ratios on loans backed by non-owner-occupied CRE properties at the market level, which capture differences in credit supply conditions across banks.[17]

The results of the analysis are summarized in Table 10. The first specification examines the role of bankruptcy court efficiency. All three measures have a statistically significant correlation with the pledging of real estate collateral. In particular, geographic areas in which courts are more efficient at resolving Chapter 7 cases are also areas where bank loans are more likely to include the pledging of real estate collateral. Markets in which district courts have a higher tendency to convert bankruptcy cases originally filed under Chapter 11 to Chapter 7 are also more likely to have borrowers who pledge real estate as collateral. Finally, firms that are within a 200 km radius of the Delaware district court are less likely to pledge real estate, as those companies are more likely to file their cases under Chapter 11 in Delaware.

The results are consistent with the hypothesis that lenders would prefer real estate as collateral if they are more likely to repossess the property in the case of default under Chapter 7 resolution. In contrast, in geographic areas where borrowers are close to the federal district court of Delaware—a preferred destination for 'forum shopping' that is more efficient at resolving Chapter 11 cases—there is a lesser tendency to pledge real estate. Finally, a higher preference for the conversion of Chapter 11 cases into Chapter 7 also increases the likelihood of pledging real estate, except when firm and bank characteristics are added; then, the effect is reversed. The coefficient estimates represent, in reduced form, the joint preferences of the borrower and the lender when choosing whether real estate is the optimal form of collateral. Importantly, the statistical significance of the bankruptcy court efficiency measures is preserved when we include the instrumented CRE price in

[16] Unfortunately, we do not measure the book or market value of firms' real estate holdings separately from the total fixed assets (property, plant, and equipment). Following the influential work of Chaney et al. (2012), many studies have used methodologies based on historical real estate holdings data, often utilizing the last comprehensive report of property book values in Compustat from 1993, and updating these values using real estate price indices to estimate firms' real estate assets over time. While this approach allows for computing market values of properties owned by firms, it suffers from survivorship bias and other selection issues.

[17] Information on property values and LTV ratios is taken from Schedule H2 of FR Y14Q, which contains information on banks' lending to companies that rent CRE properties.

Table 10: Determinants of the choice to pledge CRE collateral

	Dependent variable: $\mathcal{I}\{Real\ estate_{f,b,t}\} \in \{0,1\}$			
	Probit			Linear
	(1)	(2)	(3)	(4)
$\mathcal{I}\{\text{Distance to Delaware} > 200km\}_f$	0.238***	0.238***	0.102***	0.020***
	(0.012)	(0.012)	(0.013)	(0.003)
Residual duration Chapter 7, $_{m,t-1}$	−0.012***	−0.012***	−0.005***	−0.001**
	(0.002)	(0.002)	(0.002)	(0.0003)
District Chapter 11 to 7 conversion, $_{m,t-1}$	0.150***	0.150***	−0.029***	−0.011***
	(0.010)	(0.010)	(0.011)	(0.002)
$\widehat{P_{m,t-1}}$		0.321***	0.065	0.029***
		(0.042)	(0.053)	(0.010)
$\widehat{P_{m,t-1}} \times$ Share of fixed assets$_{f,t-1}$			0.341***	0.039***
			(0.065)	(0.013)
Share of fixed assets$_{f,t-1}$			0.981***	0.240***
			(0.011)	(0.002)
Share of accounts receivable$_{f,t-1}$			−0.315***	−0.142***
			(0.010)	(0.002)
log(Total assets)$_{f,t-1}$			−0.239***	−0.048***
			(0.001)	(0.0001)
Debt-to-assets$_{f,t-1}$			−0.074***	0.020***
			(0.006)	(0.001)
Return on assets$_{f,t-1}$			−0.004***	−0.001***
			(0.0001)	(0.00002)
$\mathcal{I}\{\text{Investment grade}\}_{f,t-1}$			0.021***	0.013***
			(0.004)	(0.001)
Bank CET1 capital surplus $_{b(f),t-1}$			0.086***	0.018***
			(0.001)	(0.0002)
Bank CRE LTV $_{b(f),m,t-1}$			0.209***	0.028***
			(0.013)	(0.003)
Constant	−1.415***	−1.495***	−1.592***	
	(0.032)	(0.033)	(0.038)	
Bankruptcy efficiency, F-test	687	686.6	79.5	91.6
Observations	1,392,786	1,392,786	1,392,786	1,392,786
R^2				0.268
Adjusted R^2				0.268
Log Likelihood	−593,651	−593,623	−476,003	
Akaike Inf. Crit.	1,187,491	1,187,435	952,214	

NOTE: Commercial real estate prices are instrumented based on column (2) of Table 3. The federal court efficiency measures are constructed at the county level and matched with the firm headquarter location. The F-test court efficiency is a joint test for the statistical significance of the federal district court efficiency measures. There are 14,971 borrowers in the sample with headquarters within 200km radius from the Delaware district court and 76,516 borrowers located outside this radius. All specifications include full set of MSA, 2-digit NAICs code, and year fixed effects. Significant at *p<0.1; **p<0.05; ***p<0.01.

specification (2), firm controls in specification (3), and bank controls in specification (4). The F-test results for the joint statistical significance of the court efficiency measures show that the judicial efficiency measures remain statistically significant across all specifications, and the values exceed 10, indicating the robustness of the three instrumental variables (see Stock et al. (2002)).

It is also worth noting that a higher appreciation of CRE properties is associated with a higher likelihood of firms pledging real estate, and this is especially true for firms with higher shares of fixed assets. In contrast, firms with higher shares of accounts receivable are significantly less likely to pledge real estate. These are consistent with the notion that the pledging of specific assets is pre-determined by the ownership of such assets. Consistent with patterns documented in Figure 3, larger firms are less likely to pledge commercial real estate (CRE), whereas smaller firms, firms with higher debt-to-assets ratios, and firms with lower profitability are more likely to pledge real estate properties. As regards bank characteristics, firms borrowing from better capitalized banks or banks that have higher LTV underwriting policies are more likely to pledge real estate as collateral.

To evaluate the relative importance of the different factors, we estimate a linear probability model in column (5), which allows us to quickly assess the marginal effects of the various factors. For example, borrowers who are located more than 200 km from the Delaware federal district court are 2 percent more likely to pledge CRE. An increase in the residual duration of resolving Chapter 7 cases reduces the likelihood of pledging CRE by approximately 1 percentage point. A standard deviation increase in the preference of courts to convert Chapter 11 to Chapter 7 cases reduces this likelihood by about 28 basis points. A one standard deviation increase in the share of fixed assets increases the likelihood of pledging by 7 percent. A percentage increase in CRE prices increases the likelihood of pledging by about 4 basis points, with an additional 1 basis point for firms with a 30 percentage point higher share of fixed assets.

Because our main regression specification is non-linear, in the analysis that follows, we are going to use the residual from the probit regression in column (3) as a control function for the endogenous choice to pledge real estate, following the control function approach to addressing endogeneity in non-linear models examined in Heckman and Robb (1985), Wooldridge (2010), and Wooldridge (2015).[18] This approach is similar to the Heckman sample selection correction (e.g., Heckman (1979)), which we also explore in some of our second-stage specifications.

5 Estimates of the collateral channel effects

5.1 Elasticity of bank credit to collateral values

We present a summary of the firm-bank estimates in Table 11. The first two columns are based on an OLS estimation, whereas the last three columns summarize regression results using the instrumented price indices. Columns (4) and (5) also introduce a control function correction for the endogenous choice of pledging real estate as collateral. To simplify

[18] The control function approach is also referred to as two-stage residual inclusion estimation (e.g., Terza et al. (2008)).

the notation and the interpretation of the economic magnitudes of the estimates, we have expressed the price indices in decimals as shown in Figure 1, whereas the growth in lending is expressed in annualized percentage points. Therefore, the estimate of the elasticity ψ_1 in column (1) implies that a 1 percentage point appreciation in commercial real estate prices results in about 6.5 basis points higher bank credit. In column (2), we introduce an indicator function for whether the borrower is as high or low bank-dependent as of period $t-1$. Credit to high bank-dependent borrowers has a higher elasticity of 7.4 basis points compared to 5.8 basis points for low bank-dependent borrowers.

Given the expected positive bias introduced by the positive association of CRE prices and investment demand, instrumenting for the commercial real estate prices reduces the elasticity to CRE prices to about 5.1 basis points, as reported in column (3). As we introduce the control function for the endogenous choice of pledging real estate, the elasticity is slightly higher but still lower than its OLS estimate.

A significant difference between the two groups of borrowers relative to the OLS estimates in column (2) appears in column (5) as we implement our instrumentation strategy. The elasticity estimate for the collateral channel term implies that for every percentage point increase in the CRE price index, high bank-dependent borrowers grow their bank credit by an additional 9.5 basis points, whereas low bank-dependent borrowers have a statistically insignificant elasticity with a point estimate close to zero.

The difference in outcomes between high and low bank-dependent borrowers is due to differences in the degree to which credit constraints bind across the two groups, and the instrumentation strategy removes sensitivities related to credit demand as well as correlations between credit demand and real estate prices. All else being equal, high bank-dependent borrowers are more credit constrained; hence, exogenous variation in the value of collateral results in a greater relaxation of borrowing constraints, which is consistent with higher values of the collateral channel term. There are also notable differences in the sensitivity of bank credit to the credit demand conditions of firms. Credit growth among low bank-dependent borrowers is twice as sensitive to credit demand conditions as that among high bank-dependent borrowers, which is again related to less binding borrowing constraints for low bank-dependent borrowers.

Note that correcting for the endogeneity of CRE prices also affects the estimate of ψ_0, which switches signs from negative in columns (1) and (2) to positive in column (3). Controlling for the endogenous choice of collateral in columns (4) and (5) further increases the estimate to about 9 percentage points. The CRE collateral control function term is negative in value and statistically significant, indicating that the choice of pledging CRE as collateral is endogenous. When we examine the coefficient estimates for the other collateral types, we note that the inclusion of the control function does not significantly affect those

Table 11: Elasticity of bank credit to collateral values

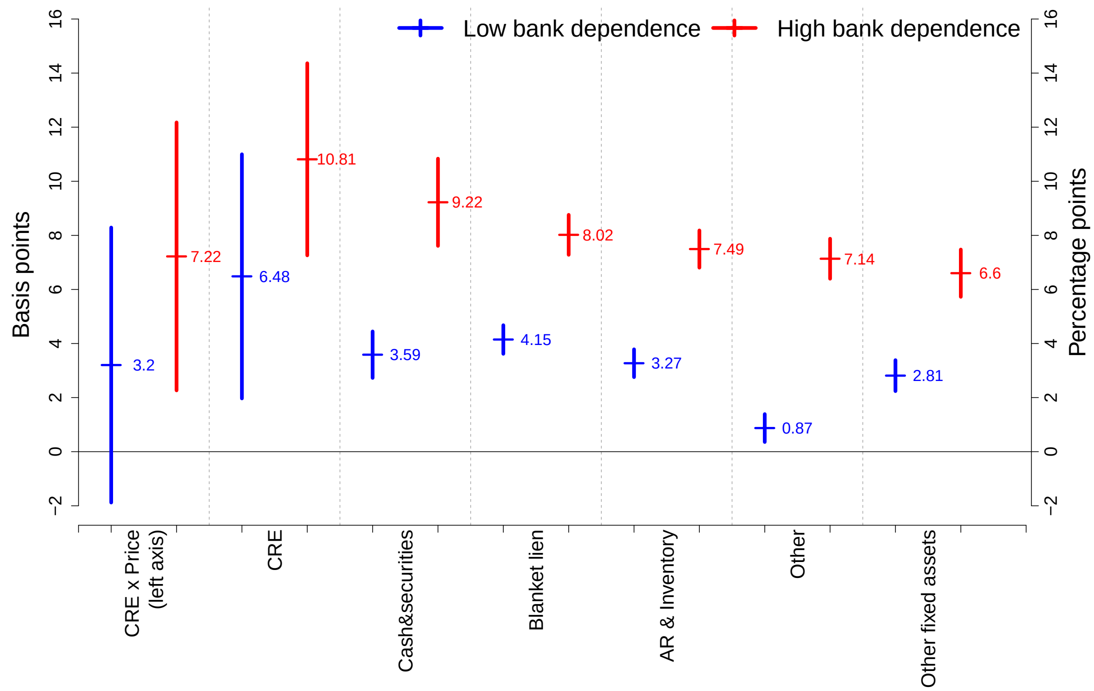
	Dependent variable: Growth in bank credit $\Delta_4 L_{f,b,t}$				
	OLS		IV		
	(1)	(2)	(3)	(4)	(5)
$\mathcal{I}\{\text{Real estate}_{f,b,t}\} \times P_{m,t-1}$	6.47***		5.08***	5.11***	
	(0.74)		(1.75)	(1.75)	
$\mathcal{I}\{\text{Real estate} \times \text{High BD}_{f,b,t}\} \times P_{m,t-1}$		7.44***			9.45***
		(0.75)			(1.82)
$\mathcal{I}\{\text{Real estate} \times \text{Low BD}\ _{f,b,t}\} \times P_{m,t-1}$		5.82***			−0.02
		(0.74)			(1.91)
$\mathcal{I}\{\text{Real estate}_{f,b,t}\}$	−3.75***	−3.97***	3.75***	9.38***	8.54***
	(0.98)	(0.99)	(0.38)	(1.31)	(1.32)
$\mathcal{I}\{\text{Cash and securities}_{f,b,t}\}$	5.18***	5.16***	5.16***	5.17***	5.16***
	(0.37)	(0.37)	(0.37)	(0.37)	(0.37)
$\mathcal{I}\{\text{Accounts receivable and inventories}_{f,b,t}\}$	4.87***	4.84***	4.85***	4.86***	4.84***
	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)
$\mathcal{I}\{\text{Other fixed assets}_{f,b,t}\}$	3.01***	2.99***	3.01***	3.01***	3.00***
	(0.21)	(0.21)	(0.21)	(0.21)	(0.21)
$\mathcal{I}\{\text{Blanket lien}_{f,b,t}\}$	5.84***	5.82***	5.83***	5.83***	5.82***
	(0.21)	(0.21)	(0.21)	(0.21)	(0.21)
$\mathcal{I}\{\text{Other collateral}_{f,b,t}\}$	4.09***	4.08***	4.10***	4.10***	4.09***
	(0.24)	(0.24)	(0.24)	(0.24)	(0.24)
$\log(\text{Assets})_{f,t-1}$	−0.92***	−0.80***	−0.93***	−0.64***	−0.60***
	(0.08)	(0.08)	(0.08)	(0.11)	(0.11)
Return on $\text{assets}_{f,t-1}$	0.08***	0.08***	0.08***	0.09***	0.08***
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Debt-to-$\text{assets}_{f,t-1}$	−0.08***	−0.08***	−0.08***	−0.09***	−0.09***
	(0.003)	(0.003)	(0.003)	(0.004)	(0.004)
$\mathcal{I}\{\text{Investment grade}\}_{f,t-1}$	0.91***	0.91***	0.92***	0.91***	0.91***
	(0.13)	(0.13)	(0.13)	(0.13)	(0.13)
CRE collateral control $\text{function}_{f,t-1}$				−2.00***	−1.69***
				(0.44)	(0.45)
Credit demand factor $\alpha_{f,t}$	0.01***		0.01***	0.01***	
	(0.001)		(0.001)	(0.001)	
Credit demand factor $\alpha_{f,t} \times \mathcal{I}\{\text{Low BD}\}_{f,t-1}$		0.02***			0.02***
		(0.002)			(0.002)
Credit demand factor $\alpha_{f,t} \times \mathcal{I}\{\text{High BD}\}_{f,t-1}$		0.01***			0.01***
		(0.002)			(0.002)
Observations	641,424	641,424	641,424	641,424	641,424
R^2	0.32	0.32	0.32	0.32	0.32
Adjusted R^2	0.23	0.23	0.23	0.23	0.23

NOTE: The sample is an unbalanced panel of 32 banks, 68 MSA markets, and 49,242 borrowers, for which we observe all control variables and for which have consistent reporting for at least 8 quarters. There are 16,485 borrowers that pledge real estate as collateral and 68 percent of borrowers are categorized as high bank-dependent. All regressions include firm and bank-market-date fixed effects. The heteroskedasticity-consistent standard errors are clustered at the bank-market-date level with statistical significance at $^{*}p<0.1$; $^{**}p<0.05$; $^{***}p<0.01$.

estimates, indicating that the choice to pledge other forms of collateral is driven by different factors than those we included in our first stage collateral choice regression.[19]

[19] Conducting a Hausman test to compare the OLS and IV estimates in columns (2) and (5) in Table 11 results in a test statistic with a value of 14.82, 12 degrees of freedom, and a p-value of 0.251. This implies that the OLS estimates are not significantly different from the IV estimates. However, the test is not necessarily

Figure 5: Collateral types, CRE values, and bank credit by degree of bank dependence



Note: Coefficient estimates from a regression similar to column (4) of Table 11 estimated on a subsamples of high and low bank-dependent borrowers, which allows for different slope coefficients across the two groups. Low bank-dependent borrowers are all publicly traded companies or private companies with committed bank credit less than 50 percent of their total debt. The 5th to 95th percentile confidence intervals are based on heteroskedasticity-consistent standard errors clustered at the bank-market-date level.

We examine these relationships further in Figure 5 in which we present coefficient estimates of a regression similar to column (4) of Table 11 but estimated separately for high- and low-bank-dependent firms. To conserve space, we do not report all the regression estimates, but rather plot the coefficient estimates on the different types of collateral along with the collateral channel term for high- and low bank-dependent borrowers. We report the point estimates along with the 5th and 95th percentile confidence intervals. The estimate of the collateral channel elasticity is 7.22 basis points, which is lower than its estimate in column (4). Importantly, the elasticity of credit to low-bank-dependent borrowers remains statistically not significant.

As Figure 5 demonstrates, there is a clear rank-order of the effects of different collateral types on bank credit for the two groups of firms. Because the excluded category in both Table 11 and Figure 5 is borrowing unsecured, the estimates compare the impact of specific

an invalidation of the goodness of the IV strategy but rather indicates that the biases from the endogeneity problems are not too large for most coefficient estimates.

collateral pledging on credit growth relative to borrowing unsecured. High bank-dependent borrowers experience greater sensitivity compared to low bank-dependent borrowers across all collateral pledged. Because the confidence intervals are non-overlapping, the differences in sensitivities are statistically significant. High bank-dependent firms experience between 4 and 6 percentage points higher credit growth when pledging accounts receivable and inventories, cash and securities, blanket liens, and fixed assets other than real estate. Examining the sensitivity to pledging CRE collateral, the point estimates are 6.5 and 11 percentage points for low and high bank-dependent borrowers, respectively. However, unlike the other collateral types, the differences between the two groups are not statistically significant because the confidence intervals overlap.

Apart from the effects on credit growth, changes in collateral values affect loan terms and the expected credit risks of newly originated loans. The estimates of those effects are summarized in Table 12. Higher collateral values reduce the cost of credit, increase the maturity of loans, reduce the expected loss given default, and decrease the probability of default reported by banks. The effects are also economically and statistically different across the groups of high and low bank-dependent borrowers, with stronger effects for high bank-dependent borrowers.

The estimates in column (1) indicate that a one percentage-point increase in the value of commercial properties results in about a 0.12 basis point decline in credit spreads for high bank-dependent borrowers, with no effect on low bank-dependent borrowers. A similar increase in property values increases the maturity of term loans for high bank-dependent borrowers by 0.06 months. Higher collateral values reduce the reported loss given default for both groups of borrowers and decrease the expected probability of default for high bank-dependent borrowers. A one percentage-point increase in real estate values reduces the loss given default (LGD) by 6 basis points and the expected probability of default (PD) by 2 basis points for high bank-dependent borrowers. For low bank-dependent borrowers, the decline in LGD is approximately 9 basis points.

Keeping the real estate prices fixed, pledging real estate also significantly reduces interest rates by about 28 basis points, with the magnitude of the effect significantly exceeding that of other forms of collateral. However, the maturity of the loan decreases by about 2 months. These large effects could be rationalized by the significant reduction in the expected probability of default, which declines by 2.5 percentage points relative to unsecured borrowing. Note also that pledging other forms of collateral reduces the probability of default, but significantly less than the reduction achieved by pledging real estate.

Table 12: Collateral values, loan spreads, maturity, and expected losses on new loans

	Dependent variable:			
	Spread (bps)	Maturity (months)	LGD (pct)	PD (pct)
	(1)	(2)	(3)	(4)
$\mathcal{I}\{\text{Real estate} \times \text{High BD}_{f,b,t}\} \times \widehat{P}_{m,t-1}$	−11.76***	6.01**	−6.31***	−2.17***
	(3.96)	(2.42)	(0.87)	(0.50)
$\mathcal{I}\{\text{Real estate} \times \text{Low BD}_{f,b,t}\} \times \widehat{P}_{m,t-1}$	0.38	−3.66	−8.64***	−0.59
	(4.18)	(2.40)	(0.88)	(0.54)
$\mathcal{I}\{\text{Real estate}_{f,b,t}\}$	−28.20***	−2.25**	−1.38***	−2.52***
	(2.24)	(1.15)	(0.31)	(0.27)
$\mathcal{I}\{\text{Cash and securities}_{f,b,t}\}$	7.37***	−0.35	−4.51***	0.10
	(0.92)	(0.40)	(0.15)	(0.09)
$\mathcal{I}\{\text{Accounts receivable}_{f,b,t}\}$	2.40***	0.47***	−3.96***	−0.18***
	(0.48)	(0.17)	(0.08)	(0.05)
$\mathcal{I}\{\text{Fixed assets}_{f,b,t}\}$	3.05***	1.01***	−1.95***	−0.08*
	(0.53)	(0.22)	(0.07)	(0.05)
$\mathcal{I}\{\text{Blanket lien}_{f,b,t}\}$	1.63***	1.50***	−1.45***	−0.27***
	(0.52)	(0.22)	(0.08)	(0.05)
$\mathcal{I}\{\text{Other collateral}_{f,b,t}\}$	4.47***	−0.57**	−1.58***	−0.11*
	(0.57)	(0.23)	(0.10)	(0.06)
CRE collateral control function$_{f,t-1}$	10.50***	1.02***	−0.03	0.91***
	(0.73)	(0.35)	(0.09)	(0.09)
log(Assets)$_{f,t-1}$	−2.23***	−0.04	0.11***	−0.34***
	(0.24)	(0.10)	(0.03)	(0.03)
Return on assets$_{f,t-1}$	−0.27***	0.01*	−0.004***	−0.05***
	(0.01)	(0.005)	(0.001)	(0.001)
Debt-to-assets$_{f,t-1}$	0.23***	−0.02***	0.01***	0.02***
	(0.01)	(0.003)	(0.001)	(0.001)
$\mathcal{I}\{\text{Investment grade}\}_{f,t-1}$	−5.31***	0.22*	−0.05	−0.33***
	(0.29)	(0.13)	(0.04)	(0.02)
Credit demand factor $\alpha_{f,t}$	−0.01***	0.002*	0.0002	−0.001**
	(0.003)	(0.001)	(0.0004)	(0.0003)
Observations	541,314	427,266	767,535	769,100
R^2	0.80	0.87	0.74	0.62
Adjusted R^2	0.77	0.85	0.71	0.57

NOTE: Maturity of credit facilities is measured in months. LGD and PD are measured in percentage points and stand for expected loss-given default and one-year expected probability of default, respectively. Commercial real estate prices are instrumented based on specification (2) in Table 3. All regressions include firm and bank-market-time fixed effects. Heteroscedasticity consistent standard errors are clustered at the bank-market-time level. Significant at *p<0.1; **p<0.05; ***p<0.01.

5.2 Firm-level effects

5.2.1 Elasticity of capex, sales, debt, and assets

While most small firms in our sample have a single bank relationship, many large firms have more than one bank relationship, typically through a bank syndicate. Furthermore, firms of all sizes can switch between banks, and some large firms have access to market financing, such as commercial paper or corporate bonds. To account for potential substitutions of borrowing among different bank lenders and between bank loans and market-based finance, we next quantify the collateral channel effects at the firm level by summing across all bank loans and bank relationships and examining the total debt outstanding of firms.

Table 13: Firm-level outcomes in full sample

	Dependent variable:				
	Δ_4Capex	Δ_4Sales	Δ_4Total debt	Δ_4Assets	$\frac{\text{Debt}}{\text{Assets}}$
	(1)	(2)	(3)	(4)	(5)
$\widehat{P_{m,t-1}} \times \mathcal{I}\{\text{Real estate}_{f,b,t} \times \text{High BD}_{f,t-1}\}$	26.51**	0.82	6.91***	1.82*	0.84***
	(10.74)	(0.99)	(2.52)	(1.06)	(0.31)
$\widehat{P_{m,t-1}} \times \mathcal{I}\{\text{Real estate}_{f,b,t} \times \text{Low BD}_{f,t-1}\}$	−1.16	3.39***	0.09	3.10***	−0.31
	(10.16)	(1.11)	(3.78)	(1.06)	(0.27)
$\mathcal{I}\{\text{Real estate}_{f,t-1}\}$	−8.85***	−0.53*	2.48***	−0.76***	0.90***
	(3.22)	(0.31)	(0.74)	(0.24)	(0.11)
$\mathcal{I}\{\text{Cash and securities}_{f,t-1}\}$	1.89	−0.09	−0.09	−0.10	0.05
	(1.50)	(0.15)	(0.43)	(0.13)	(0.05)
$\mathcal{I}\{\text{Accounts receivables}_{f,t-1}\}$	−1.57*	0.35***	0.46**	0.39***	0.09***
	(0.81)	(0.06)	(0.20)	(0.06)	(0.03)
$\mathcal{I}\{\text{Other fixed assets}_{f,t-1}\}$	0.69	0.34***	1.22***	0.56***	−0.06**
	(0.93)	(0.07)	(0.21)	(0.09)	(0.03)
$\mathcal{I}\{\text{Blanket lien}_{f,t-1}\}$	−0.78	0.30***	0.15	0.12**	0.05**
	(0.69)	(0.07)	(0.19)	(0.06)	(0.02)
$\mathcal{I}\{\text{Other collateral}_{f,t-1}\}$	1.17	0.17*	0.81***	0.21*	0.12***
	(0.97)	(0.10)	(0.25)	(0.11)	(0.03)
$\log(\text{Assets})_{f,t-1}$	1.51***	−0.01	0.69***	0.02	0.08***
	(0.19)	(0.02)	(0.05)	(0.02)	(0.01)
Return on assets$_{f,t-1}$	0.15***	0.01***	−0.02**	0.04***	0.001
	(0.03)	(0.002)	(0.01)	(0.003)	(0.001)
Debt-to-assets$_{f,t-1}$	0.01	0.003**	0.07***	−0.01***	
	(0.01)	(0.001)	(0.005)	(0.001)	
$\mathcal{I}\{\text{Investment grade}\}_{f,t-1}$	1.54**	0.33***	−1.16***	0.23***	−0.34***
	(0.75)	(0.09)	(0.16)	(0.07)	(0.02)
CRE collateral control function$_{f,t-1}$	3.39***	0.12	−0.59***	0.21**	−0.33***
	(1.07)	(0.12)	(0.22)	(0.09)	(0.04)
Credit demand factor, $\alpha_{f,t}$	0.01	0.001	−0.01*	0.0005	−0.001**
	(0.01)	(0.001)	(0.003)	(0.001)	(0.0004)
Lagged dependent variable$_{f,t-1}$	0.57***	0.69***	0.67***	0.68***	0.97***
	(0.01)	(0.004)	(0.01)	(0.003)	(0.001)
Observations	326,190	326,190	326,190	326,190	326,190
R^2	0.38	0.54	0.49	0.53	0.96
Adjusted R^2	0.33	0.51	0.45	0.49	0.95

NOTE: The regression sample includes 40,913 borrowers for which we observe all control variables. Of those, 11,178 pledge commercial real estate. All regressions include bank-market-time fixed effects. For borrowers with multiple banks, we select the bank with the highest committed amounts as the main bank. The year-over-year percent growth rate is computed as follows $\Delta_4(x_t) \equiv 100 * \frac{x_t - x_{t-4}}{(x_t + x_{t-4})/2}$. The instrumented price index is expressed in decimals. Heteroscedasticity consistent standard errors are clustered at the MSA level. Significant at *p<0.1; **p<0.05; ***p<0.01.

We first examine the full sample of firms and run a specification similar to that of the bank-firm level regressions. We then focus on a sub-sample of firms for which we observe the market value of commercial real estate properties at the origination of the loan when they are pledged as collateral. Importantly, we also examine other firm-level outcomes, such as changes in capital expenditures, sales, total assets, and debt-to-asset ratios.

Table 13 summarizes the set of regressions on the full sample of firms. The collateral channel terms indicate that, following increases in the value of real estate, high bank-dependent firms that pledge real estate collateral experience significant increases in their capital expenditures, total debt, total assets, and debt-to-asset ratios. All these results are indicative of a relaxation of borrowing constraints that allows firms to increase their investments in tangible assets and sustain higher debt-to-asset ratios. A percentage point increase in collateral values increases capital expenditures by about 27 basis points, increases total debt by about 7 basis points, increases total assets by about 2 basis points, and increases the debt-to-asset ratio by 84 basis points. In contrast, low bank-dependent firms experience only increases in sales and total assets, but there are no statistically significant effects on capital expenditures or total debt.

The estimate of the effect of the CRE collateral control function also indicates that the collateral choice is endogenous and correlated with firm level outcomes. Keeping the CRE prices fixed, pledging real estate results in increases in total debt and debt-to-asset ratios but has a negative effect on capital expenditures, sales, and total assets. This indicates that all else being equal, the firms that choose to pledge real estate have lower asset growth, sales, and capital expenditures.[20]

In Table 14, we examine the collateral effects on a sample of 3806 firms for which banks report the value of commercial real estate (CRE) collateral at loan origination for loans secured by CRE collateral. We construct updated market values for periods following origination by using the instrumented CRE price index relative to the date of loan origination. To quantify the collateral channel effects on firm outcomes, we use a log-log specification for all variables except for the debt-to-asset ratio. This specification results in coefficient estimates that measure the elasticities of firm outcomes with respect to changes in the value of real estate. To make these regressions operational, we drop negative values for capital expenditures and sales.

Note that we observe the real estate values only if the firm pledges real estate as collateral. This potentially creates sample selection bias, which we control for with a Heckman correction term based on the inverse Mills ratio (IMR) of the estimated probit model in column (3) of Table 10. We report the estimates of the collateral channel terms for the estimation with the Heckman correction in panel A and the estimates without the Heckman correction in panel B.

The estimates indicate that the collateral channel appears to operate for both high- and low bank-dependent firms. With the Heckman correction in panel A, positive and

[20]It is also worth noting that the pledging of real estate collateral is not necessarily used to purchase buildings or land. In robustness specifications, we also exclude the subset of loans that have a stated purpose for the acquisition of commercial real estate or land, and this exclusion does not significantly affect the reported results.

Table 14: Firm-level outcomes in sample with reported market values of CRE collateral

	log(Capex)	log(Sales)	log(Debt)	log(Assets)	$\frac{\text{Debt}}{\text{Assets}}$
	(1)	(2)	(3)	(4)	(5)
A. With Heckman correction for CRE collateral pledge					
$\log(\text{Value CRE})_{f,t-1} \times \mathcal{I}\{\text{High BD}\}_{f,t-1}$	0.035***	0.028***	0.034***	0.030***	0.161**
	(0.009)	(0.009)	(0.006)	(0.006)	(0.078)
$\log(\text{Value CRE})_{f,t-1} \times \mathcal{I}\{\text{Low BD}\}_{f,t-1}$	0.033***	0.041***	0.046***	0.040***	0.195**
	(0.010)	(0.009)	(0.008)	(0.007)	(0.085)
IMR CRE $\text{collateral}_{f,t}$	0.033	0.031*	−0.004	0.005	−0.925***
	(0.022)	(0.016)	(0.014)	(0.010)	(0.339)
$\log(\text{Assets})_{f,t-1}$	0.149***	0.041***	0.049***	0.952***	−0.256***
	(0.014)	(0.008)	(0.016)	(0.006)	(0.042)
Return on $\text{assets}_{f,t-1}$	0.003***	−0.001**	−0.001***	−0.001***	0.001
	(0.0004)	(0.0003)	(0.0003)	(0.0002)	(0.007)
$\text{Debt-to-assets}_{f,t-1}$	0.0001	0.00002	0.0002	−0.0003***	0.908***
	(0.0002)	(0.0002)	(0.0004)	(0.0001)	(0.004)
$\mathcal{I}\{\text{Investment grade}\}_{f,t-1}$	0.036**	0.071***	0.005	0.038***	−0.828***
	(0.014)	(0.013)	(0.012)	(0.006)	(0.224)
Credit demand $\text{factor}_{f,t}$	−0.0001	−0.00003	0.0003	0.0001	0.004*
	(0.0002)	(0.0002)	(0.0002)	(0.0001)	(0.002)
Lagged dependent $\text{variable}_{f,t-1}$	0.818***	0.912***	0.899***		
	(0.013)	(0.005)	(0.013)		
Observations	33,119	41,060	41,260	41,260	41,260
R^2	0.918	0.941	0.939	0.970	0.884
Adjusted R^2	0.901	0.930	0.927	0.964	0.862
B. Without Heckman correction					
$\log(\text{Value CRE})_{f,t-1} \times \mathcal{I}\{\text{High BD}\}_{f,t-1}$	0.035***	0.029***	0.034***	0.030***	0.163**
	(0.009)	(0.009)	(0.006)	(0.006)	(0.077)
$\log(\text{Value CRE})_{f,t-1} \times \mathcal{I}\{\text{Low BD}\}_{f,t-1}$	0.032***	0.041***	0.046***	0.040***	0.210**
	(0.010)	(0.009)	(0.008)	(0.007)	(0.088)
Observations	33,119	41,412	41,260	41,260	41,260
R^2	0.918	0.939	0.939	0.970	0.884
Adjusted R^2	0.901	0.927	0.927	0.964	0.862

NOTE: The regressions are based on a sample of 3806 borrowers for which we measure the market value of real estate collateral when those firms pledge real estate as collateral. Because post origination market values are not updated, the market values following origination are computed from the reported value of CRE collateral at origination and updated using the instrumented price index from column (2) in Table 3. To control for the selection, we compute the inverse Mills ratio (IMR) from the probit regression following Heckman (1979). In panel B, we report the results only for the coefficients of interest without Heckman correction. An online appendix contains the full set of estimates. All regressions include market-time fixed effects. Heteroscedasticity consistent standard errors are clustered at the market level. Significant at *p<0.1; **p<0.05; ***p<0.01.

significant effects are documented across all outcomes. A one percentage-point increase in CRE collateral value is associated with a 3.5 basis point increase in capital expenditures, a 2.8 basis point increase in sales, a 3.4 basis point increase in debt, a 3 basis point increase in assets, and a 16 basis point increase in the debt-to-assets ratio. The similarity of results with (panel A) and without the Heckman correction (panel B) suggests that selection bias, due to the pledging of real estate, while present, may not substantially affect the main findings.

The estimates for the low bank-dependent firms are larger for the elasticities of sales, total debt, assets, and debt-to-assets ratios. This is in contrast to our estimates for the full sample of firms. Those differences in estimates are likely due to the sample selection of the firms that ultimately have reports on the market values of real estate assets at origination. Unfortunately, there is no feasible way to correct for this reporting selection bias and the missing values for the bulk of our sample. In Table 15, we report summary statistics of the sample of firms for which we observe market values of real estate collateral. Those are, on average, slightly larger firms than the typical high bank-dependent firm or firm that pledges real estate, but they are significantly smaller than the typical low bank-dependent publicly traded borrower. Therefore, the closeness in the estimates of the elasticities for the two groups of borrowers in the sample of 3806 firms is likely due to the fact that the groups of high and low bank-dependent firms have more similarities in the smaller sample than in the full sample of firms.[21]

Table 15: Descriptive statistics of corporate borrowers with reported CRE collateral value

Statistic	mean	sd	p5	p25	p50	p75	p95
Total assets ($mln)	143	3133	2	4	10	35	320
Committed credit ($mln)	10	61	1	2	3	6	33
Credit line ($mln)	24	104	1	2	6	18	80
Term loan ($mln)	6	20	1	1	2	4	17
Cash-to-assets (pct)	10	13	0	2	6	14	36
Debt-to-assets (pct)	65	23	23	49	68	83	100
Sales-to-assets (pct)	30	29	3	9	15	49	91
Share accounts receivable (pct)	15	19	0	0	6	24	56
Share fixed assets (pct)	42	34	1	11	33	73	98
Return on assets (pct)	15	15	0	6	11	19	46
Capital expenditures to assets	3.66	13.53	-14.63	0	0	5.01	32.46
Credit rating	BB		B	B	BB	BBB	BBB
Expected PD (pct)	2.91	9.23	0.15	0.37	0.93	2.26	8.6
Debt-to-EBITDA	4.4	4.3	0.08	1.04	2.94	6.72	13.24
Expected LGD (pct)	29	12	10	22	29	38	50
Utilization rate (pct)	64	37	0	36	76	100	100
Distance to Delaware (km)	2044	1492	153	698	1511	3811	3999
Share bank credit (pct)	60.53	35.01	4.1	27.48	66.13	97.58	100
	Market value of real estate collateral pledged						
Market value CRE ($mln)	11.8	75.8	1.2	2.4	4.1	8	33.7
Implied LTV	3.3	113.4	0.2	0.5	0.7	1	2.6

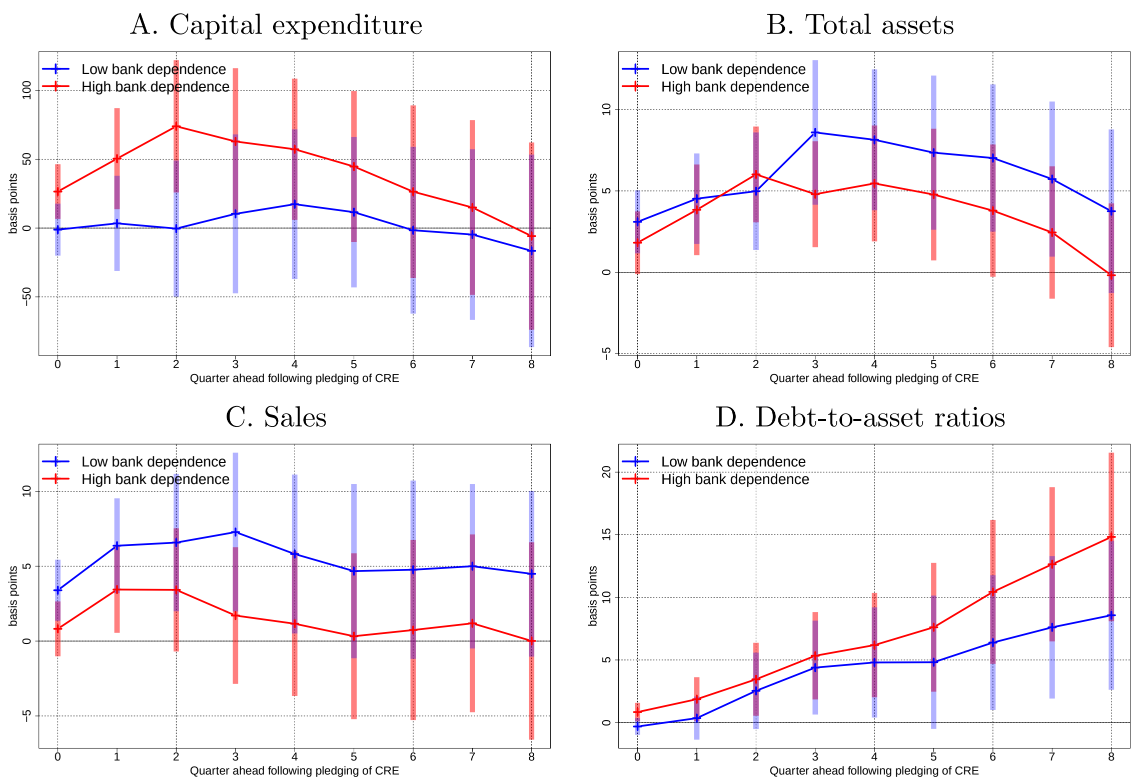
NOTE: The sample period covers 2013:Q1 through 2019:Q4. SOURCE: Federal Reserve Form FR Y-14 and authors' calculations.

[21] See the online appendix for additional summary statistics across the different sub-samples of corporate borrowers in our data.

5.2.2 Dynamic firm level effects

The results presented so far examine the static elasticity of firm outcomes to changes in the values of pledged real estate collateral in the quarter when a firm pledges real estate as collateral. However, some of the firm-level effects may take time to materialize. Therefore, we estimate the dynamic effects of the relaxation of borrowing constraints by examining firm-level outcomes over 8-quarter horizons following the pledge of real estate. We apply the local projections method of Jorda and Taylor (2025) to our firm-level panel dataset to estimate a sequence of elasticities of outcomes following the initial pledge of real estate collateral. The results of this analysis are summarized in Figure 6, which plots the point estimates along the 8-quarter horizons for high and low bank-dependent borrowers, along with their symmetric 90 percent confidence intervals.

Figure 6: Dynamic firm-level effects of collateral channel



NOTE: The plots are based on regressions that modify specifications presented in Table 13 with the dependent variable including leads of up to 8 quarters following pledging of CRE collateral, i.e., $Y_{t,t+h}$, where h = 0,1,..8 and h=0 is the quarter of pledging. The point estimates of the elasticity term $\hat{\psi}_1^h$ are plotted along with their confidence intervals. The lower and upper limits of the confidence intervals are the 5th and 95th percentiles, respectively. All remaining controls and specifications are the same as in Table 13.

Panels A and B examine the elasticities of capital expenditures and assets in response to changes in commercial real estate values, respectively. High bank-dependent borrowers experience significant increases in their capital expenditures, starting from 26 basis points at origination, as reported in column (1) of Table 13, and peaking at 73 basis points two quarters following the pledging of collateral. In comparison, low bank-dependent firms do not experience a statistically significant increase in capital expenditures; rather, those firms' total assets increase, peaking at about 8.6 basis points in the third quarter, indicating increases in intangible assets.[22] The elasticity of asset growth for high bank-dependent borrowers is also statistically significant and peaks around the second quarter at 6 basis points.

Panel C reports the elasticities of firm sales following the pledging of real estate. Although there is no statistically significant difference between the two groups of firms, low bank-dependent borrowers have higher elasticities of sales to collateral values. Those sensitivities peak in the third quarter at approximately 7.3 basis points. In contrast, the elasticity of high bank-dependent borrowers' sales is not statistically significant, except for a quarter ahead, when the elasticity is marginally statistically significant at 3.4 basis points.

Finally, panel D examines the sensitivity of the debt-to-asset ratios of firms to commercial real estate (CRE) prices. High bank-dependent borrowers show persistently higher and statistically significant sensitivities of leverage to commercial real estate values compared to low bank-dependent borrowers. By quarter 8, the elasticities of debt-to-assets relative to CRE values reach 15 basis points for high bank-dependent firms and 9 basis points for low bank-dependent borrowers.

The analysis in this section indicates that the relaxation of borrowing constraints at the firm level results in persistent increases in leverage, whereas the effects on capital expenditures, asset growth, and sales are more temporary. With the exception of sales and total assets, the collateral channel effects are consistently stronger and statistically different from zero for high bank-dependent borrowers.

5.2.3 Collateral channel elasticities across leverage and profitability

We have used the degree of dependence on bank credit as our preferred proxy for credit-constrained firms, which separates firms with access to public equity and corporate bond markets from private ones that have a high reliance on bank credit. This choice was, in part, determined by our attempt to provide comparisons with existing empirical work that has focused on samples of publicly-traded firms. In this section, we examine alternative firm characteristics that could indicate more restrictive access to credit. In particular, we examine sub-samples of firms that are either highly leveraged, have low profitability, or

[22] There are no statistically significant effects on firms' cash and cash equivalents.

both. We define high-leverage firms ("High Lev") as those firms that have debt-to-assets or debt-to-EBITDA ratios in the upper quartile of their distributions among firms.[23] . We define low profitability firms ("Low ROA") as the firms in the lower quartile for return on assets.

The results from this analysis are presented in Table 16. In the first three columns, we document the elasticity of total debt to collateral values for high-leverage firms, low ROA firms, and high debt-to-EBITDA firms, respectively. The elasticity is higher than our high bank-dependence characteristic, indicating that the relaxation of borrowing constraints at those firms is even larger. The elasticity of total debt is between 12 and 13 basis points, which is notably higher than the 7 basis points elasticity documented for high bank-dependent borrowers. Similar to our previous estimates, the elasticities for firms with better financial metrics (low leverage, high ROA, low D/E) are lower and not statistically significant.

In columns (4) through (6), we use only the high and low debt-to-EBITDA (D/E) criterion across three firm outcome variables. In column (4), we document that high D/E firms have an elasticity of capital expenditures of about 35 basis points to changes in collateral values, which is a larger sensitivity than that reported for high bank-dependent borrowers. In column (5), we examine the elasticity to assets; here, the elasticity is approximately 2 basis points, which is comparable to our previous estimates. Finally, in column (6), we document that the elasticity of sales of high D/E firms to real estate values is statistically not significant.

These results reinforce the earlier conclusion that more financially constrained firms (high leverage, low profitability, high D/E) are more sensitive to changes in collateral values. The magnitudes of the effects are generally larger than those found for the high bank-dependent firms in our baseline analysis, suggesting that these financial metrics may reflect tighter credit constraints than those based on bank dependence.

5.2.4 Placebo test on unsecured lending

In this section, we examine several placebo tests on samples of data for which the collateral channel effects should not matter. In particular, we examine the sample of firms that always borrow unsecured or never pledge commercial real estate as collateral, even though some of these firms own real estate. We identify ownership of real estate by examining firms that acquire commercial real estate using bank loans but do not pledge the acquired properties as collateral either when they purchase the properties or in subsequent borrowings. The

[23]Using the debt-to-EBITDA ratio is justified by the higher supervisory scrutiny on banks for loans to firms with debt-to-EBITDA ratios exceeding 4. The supervisory guidelines issued by the Federal Reserve in 2013 provide further details https://www.federalreserve.gov/supervisionreg/srletters/sr1303.htm

Table 16: Collateral channel effects for high leverage and low profitability firms

	Dependent variable:					
	Δ_4Total debt			Δ_4 Capex	Δ_4 Assets	Δ_4 Sales
	(1)	(2)	(3)	(4)	(5)	(6)
$\widehat{P_{m,t-1}} \times \mathcal{I}\{\text{Real estate} \times \text{High Lev}\}_{f,t-1}$	13.08**					
	(6.03)					
$\widehat{P_{m,t-1}} \times \mathcal{I}\{\text{Real estate} \times \text{Low Lev}\}_{f,t-1}$	5.74					
	(5.64)					
$\widehat{P_{m,t-1}} \times \mathcal{I}\{\text{Real estate} \times \text{Low ROA}\}_{f,t-1}$		12.30**				
		(5.94)				
$\widehat{P_{m,t-1}} \times \mathcal{I}\{\text{Real estate} \times \text{High ROA}\}_{f,t-1}$		6.08				
		(5.53)				
$\widehat{P_{m,t-1}} \times \mathcal{I}\{\text{Real estate} \times \text{High D/E}\}_{f,t-1}$			13.13**	34.52***	2.06**	−0.05
			(6.26)	(10.25)	(1.03)	(1.10)
$\widehat{P_{m,t-1}} \times \mathcal{I}\{\text{Real estate} \times \text{Low D/E}\}_{f,t-1}$			4.90	5.55	2.04**	2.12**
			(5.65)	(10.35)	(0.97)	(0.94)
$\mathcal{I}\{\text{Real estate}_{f,b,t}\}$	12.61**	12.94**	10.63*	−9.77***	−0.72***	−0.52
	(6.31)	(6.33)	(6.30)	(3.08)	(0.25)	(0.32)
$\mathcal{I}\{\text{Cash and securities}_{f,b,t}\}$	0.73	0.72	0.84	2.10	−0.12	−0.09
	(1.02)	(1.02)	(1.05)	(1.46)	(0.13)	(0.15)
$\mathcal{I}\{\text{Accounts receivable}_{f,b,t}\}$	0.86*	0.86*	0.92*	−1.18	0.40***	0.32***
	(0.49)	(0.49)	(0.49)	(0.85)	(0.06)	(0.06)
$\mathcal{I}\{\text{Other fixed assets}_{f,b,t}\}$	1.96***	1.96***	1.93***	0.91	0.56***	0.32***
	(0.52)	(0.52)	(0.55)	(0.95)	(0.09)	(0.07)
$\mathcal{I}\{\text{Blanket lien}_{f,b,t}\}$	0.88	0.87	0.91*	−0.92	0.11**	0.27***
	(0.53)	(0.53)	(0.54)	(0.72)	(0.06)	(0.07)
$\mathcal{I}\{\text{Other}_{f,b,t}\}$	1.89***	1.89***	2.00***	1.50	0.20*	0.17*
	(0.52)	(0.52)	(0.54)	(1.07)	(0.11)	(0.10)
$\log(\text{Assets})_{f,t-1}$	−1.30**	−1.28**	−1.45**	1.37***	0.03*	−0.01
	(0.59)	(0.59)	(0.61)	(0.19)	(0.02)	(0.02)
Return on $\text{assets}_{f,t-1}$	0.11***	0.11***	0.11***	0.16***	0.04***	0.01***
	(0.02)	(0.02)	(0.02)	(0.03)	(0.003)	(0.003)
$\text{Debt-to-assets}_{f,t-1}$	−0.09***	−0.09***	−0.09***	−0.01	−0.01***	0.004***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.001)	(0.001)
$\mathcal{I}\{\text{Investment grade}\}_{f,t-1}$	−1.08***	−1.08***	−1.10***	1.36*	0.22***	0.34***
	(0.33)	(0.33)	(0.34)	(0.78)	(0.06)	(0.09)
CRE collateral control $\text{function}_{f,t-1}$	−4.39*	−4.55*	−3.61	3.65***	0.21**	0.13
	(2.28)	(2.28)	(2.29)	(1.03)	(0.10)	(0.12)
Credit demand factor, $\alpha_{f,t}$	−0.01**	−0.01**	−0.01**	0.01	0.0003	0.0005
	(0.003)	(0.003)	(0.003)	(0.01)	(0.001)	(0.001)
Lagged dependent $\text{variable}_{f,t-1}$	0.56***	0.56***	0.56***	0.57***	0.68***	0.69***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.003)	(0.004)
Observations	324,604	324,604	311,715	311,715	311,715	311,715
R^2	0.58	0.58	0.58	0.38	0.53	0.55
Adjusted R^2	0.48	0.48	0.48	0.33	0.49	0.51

NOTE: The regression sample includes 40,913 borrowers for which we observe all control variables. Of those, 11,178 pledge commercial real estate. "High lev" includes firms with debt-to-asset ratios in the highest quartile of the cross sectional distribution, whereas "Low lev" includes all other firms. Similarly, "Low ROA" are firms in the lowest quartile of return on assets and "High D/E" are firms with debt-to-EBITDA ratios in the highest quartile of the cross-sectional distribution. All regressions include bank-market-time fixed effects. For borrowers with multiple banks, we select as the main bank the bank with the highest committed amounts. The year-over-year percent growth rate is computed as follows $\Delta_4(x_t) \equiv 100 * \frac{x_t - x_{t-4}}{(x_t + x_{t-4})/2}$. The instrumented price index is expressed in decimals. Heteroscedasticity consistent standard errors are clustered at the MSA level. Significant at *p<0.1; **p<0.05; ***p<0.01.

final sample is composed of 7,153 companies that borrow unsecured loans. In this sample, there are 3,313 firms for which we have information on the ownership of commercial real estate.[24]

[24] Unfortunately, because these firms do not pledge their CRE properties, FR Y14 does not collect information on the collateral value of CRE. For some of these firms, we confirm information on CRE ownership using transaction level data from Real Capital Analytics (RCA). We also identify additional firms that own real estate properties if, in the RCA data, these firms purchase commercial real estate properties during our sample period.

Table 17: Firm-level outcomes for unsecured borrowing and real estate ownership

	Dependent variable:				
	Δ_4Capex	Δ_4Sales	Δ_4Total debt	Δ_4Assets	$\frac{\text{Debt}}{\text{Assets}}$
	(1)	(2)	(3)	(4)	(5)
$\widehat{P_{m,t-1}} \times \mathcal{I}\{\text{CRE own} \times \text{High BD}\}_{f,t-1}$	−27.06	2.54	8.18	−0.70	1.05
	(27.33)	(1.94)	(7.14)	(1.81)	(0.74)
$\widehat{P_{m,t-1}} \times \mathcal{I}\{\text{CRE own} \times \text{Low BD}\}_{f,t-1}$	−30.13	2.64	9.17	−0.32	1.14
	(27.03)	(2.00)	(7.04)	(1.80)	(0.72)
Share of fixed assets$_{f,t-1}$	−8.71***	−0.32	0.48	−0.05	0.04
	(2.73)	(0.25)	(0.76)	(0.26)	(0.09)
log(Assets)$_{f,t-1}$	2.27***	−0.05	0.85***	0.06	0.03***
	(0.35)	(0.05)	(0.10)	(0.04)	(0.01)
Return on assets$_{f,t-1}$	0.24***	0.01**	−0.04**	0.05***	−0.001
	(0.07)	(0.01)	(0.02)	(0.01)	(0.002)
Debt-to-assets$_{f,t-1}$	−0.003	0.01*	0.10***	−0.001	0.98***
	(0.04)	(0.004)	(0.01)	(0.003)	(0.001)
$\mathcal{I}\{\text{Investment grade}\}_{f,t-1}$	0.75	0.25	−0.77	0.18	−0.21***
	(1.97)	(0.22)	(0.59)	(0.14)	(0.05)
Credit demand factor, $\alpha_{f,t}$	−0.03	0.001	−0.01	0.002	−0.001
	(0.04)	(0.004)	(0.01)	(0.003)	(0.001)
Lagged dependent variable$_{f,t-1}$	0.54***	0.68***	0.65***	0.68***	
	(0.02)	(0.01)	(0.01)	(0.01)	
Observations	46,531	46,531	46,531	46,531	46,531
R^2	0.49	0.64	0.58	0.63	0.97
Adjusted R^2	0.30	0.51	0.43	0.49	0.96

NOTE: The regression sample includes 7,153 borrowers which obtain only unsecured bank loans and never pledge real estate as collateral. For 3313 of those borrowers we have some information about ownership of real estate through past purchase of real estate property. All regressions include bank-market-time fixed effects. For borrowers with multiple banks, we select as the main bank the bank with the highest committed amounts. The year-over-year percent growth rate is computed as follows $\Delta_4(x_t) \equiv 100 * \frac{x_t - x_{t-4}}{(x_t + x_{t-4})/2}$. The instrumented price index is expressed in decimals. Heteroscedasticity consistent standard errors are clustered at the MSA level. Significant at *p<0.1; **p<0.05; ***p<0.01.

In Table 17, we estimate regressions that parallel the analysis presented in Tables 13. The collateral channel term is statistically not significant across all firm outcomes. In additional regressions reported in the appendix, we also examine the sample of firms that obtain unsecured loans with high shares of fixed assets. We also distinguish between firms with information on CRE ownership and those without such information. We obtain results that are very similar to those reported here.

The placebo test provides additional evidence for our main claim that observing the pledging of commercial real estate is important for identifying the collateral channel effects. Ownership of real estate is not enough to observe the relaxation of borrowing constraints following the appreciation of real estate values, because it ignores the incentives of lenders to provide additional credit if there is uncertainty regarding whether, in bankruptcy, lenders would benefit from the higher collateral values.

5.3 Aggregate effects

The economically significant firm-level elasticities at high bank-dependent firms documented so far suggest that the collateral channel affects both the financial conditions of those firms and results in real outcomes, such as increased investment, sales, and asset growth. However, an important question emerges: do the firm-level effects of the collateral channel, which appear only for firms with a high dependence on banks, have economically substantial aggregate impacts, considering that these firms are predominantly small to medium-sized? Recent studies (e.g., Crouzet and Mehrotra (2020)) have questioned the role of the collateral channel in macroeconomic fluctuations on the grounds of the increasing concentration of economic activity in large firms.

We examine the collateral channel effects on aggregate outcomes by aggregating our firm-level analysis to the MSA area. Panel A of Figure 7 reveals that markets with low supply elasticities experienced larger increases in bank credit compared to those with high supply elasticities. The divergence in cumulative credit growth exceeds 20 percentage points by the end of 2019. Panel B shows the same comparison but restricts the sample to high bank-dependent borrowers. The figure reveals that high bank-dependent borrowers in low supply-elasticity markets experienced larger increases in bank credit compared to other high bank-dependent borrowers in high supply-elasticity markets, as well as compared to other borrowers in low supply-elasticity markets in panel A. The divergence in cumulative credit growth for high bank-dependent sectors between low and high supply-elasticity markets in panel B reached close to 60 percentage points by the end of 2019.

These MSA-level patterns suggest a strong statistical relationship among commercial real estate values, credit allocations, and economic activity. To establish a causal interpretation of these relationships, we turn to our regression framework. We aggregate the micro-level empirical specifications to the market level. Unlike the firm-level regressions, here we exploit the large heterogeneity in the cross section of market characteristics documented in Table 2 to identify the aggregate effects of the collateral channel. Our regression framework takes the following form

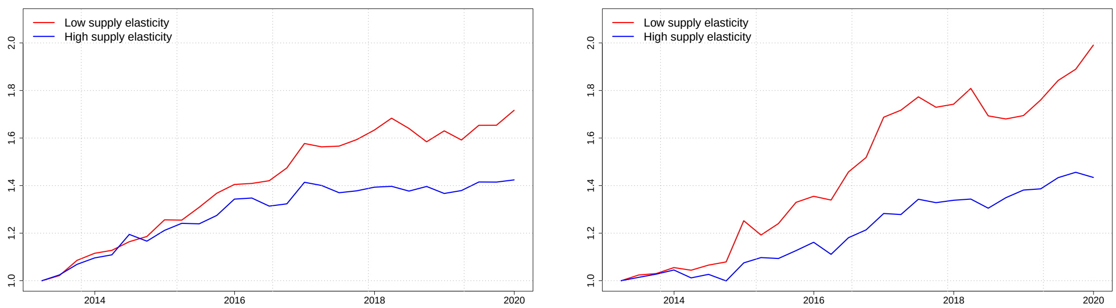
$$
\begin{aligned}
Y_{m,t} = {} & \psi_0^m \text{Share CRE}_{m,t-1} + \psi_1^m P_{m,t-1} \times \text{Share CRE}_{m,t-1} + \\
& \Theta^{m\prime} \text{Share non-real estate}_{m,t-1} + \gamma_P^m P_{m,t-1} + \\
& \gamma_\alpha^m \alpha_{m,t} + \gamma_\beta^m \beta_{m,t} + \mu_m + \tau_t + \epsilon_{m,t}^m.
\end{aligned} \tag{7}
$$

We identify the effects of the collateral channel as the sensitivity of the market-level outcome variable $Y_{m,t}$ to the lagged share of firms that pledge real estate collateral Share $\text{CRE}_{m,t-1}$, and the interaction of that share with the lagged commercial real estate values. All else being equal, markets with higher appreciation in collateral values and higher shares of firms

Figure 7: Commercial real estate prices and MSA level bank credit

A. Credit to all borrowers

B. Credit to high bank-dependent borrowers



NOTE: Panel A examines the cumulative growth in bank credit in low- and high-supply-elasticity markets over the sample period. Panel B examines the cumulative growth in bank credit in low- and high-supply-elasticity markets for high bank-dependent borrowers. SOURCE: CBRE Econometric Advisors, Federal Reserve Form Y-14Q H1 Schedule, and Saiz (2010).

that pledge commercial real estate are expected to contain more borrowers who experience expansion in their borrowing capacities, larger increases in bank credit, capital expenditures, and expansion in employment.

The aggregation transforms the firm-level collateral use indicators into shares of firms pledging a particular type of collateral, as summarized in panel C of Table 2. Those shares represent the relative composition of different types of collateral constraints faced by borrowers in each market. We aggregate the firm-level credit demand factor $\alpha_{m,t}$ using the lagged loan amounts as weights and similarly construct a market-level credit supply factor $\beta_{m,t}$. Finally, to control for unobservable market-level effects and macroeconomic conditions, we use market μ_m and time-fixed effects τ_t, respectively.

To address the endogeneity of the collateral choice and the share of firms pledging collateral, we use the predicted share of firms pledging real estate.

$$\widehat{\text{Share CRE}}_{m,t} = \sum_{f \in m} \mathbb{E}_{t-1}\, \mathcal{I}\{\text{CRE collateral}_{f(b),m,t}\},$$

which is a simple market-level average of the firm-level predicted values from the probit regression in column (3) of Table 10. In most of our specifications, we use the predicted share to control for the endogeneity of Share $\text{CRE}_{m,t}$. This allows us to also condition on the pre-determined firm-level information. We also conduct a first-stage regression of the share of CRE pledging firms on our instrumental variables.

Table 18: Predicting the share of firms pledging CRE

	Dependent variable:				
	Share $\text{CRE}_{m,t}$				
	(1)	(2)	(3)	(4)	(5)
$P_{m,t}$	-0.264^{**}				
	(0.116)				
$P_{m,t-1}$	0.181				
	(0.115)				
Supply $\text{elasticity}_m \times$ 30Y-Mortgage rate_{t-1}		0.013^{***}		0.011^{***}	
		(0.003)		(0.003)	
Residual duration Chapter 7 $_{m,t-1}$			0.001^{***}	0.001^{***}	
			(0.0003)	(0.0003)	
Chapter 11 to 7 $\text{conversion}_{m,t-1}$			-0.020	-0.019	
			(0.018)	(0.018)	
Residual duration Chapter $11_{m,t-1}$			-0.001^{***}	-0.001^{***}	
			(0.0003)	(0.0003)	
$\widehat{\text{Share CRE}}_{m,t}$					0.854^{***}
					(0.133)
F-test	7.5	14.57	16.2	31.7	41.55
Observations	1,932	1,932	1,932	1,932	1,932
R^2	0.876	0.875	0.878	0.879	0.908
Adjusted R^2	0.869	0.868	0.871	0.872	0.903

NOTE: All regressions include a set of MSA and time fixed effects. The F-test is the statistical significance of the main variables in the regression. Heteroscedasticity consistent standard errors are clustered at the MSA level. Significant at *p<0.1; **p<0.05; ***p<0.01.

We summarize the first-stage regression that relates Share $\text{CRE}_{m,t}$ to our instrumental variables in Table 18. First, column (1) indicates that the share of firms pledging real estate is indeed correlated with local CRE prices. Then, in column (2), we examine the real estate supply interacted with the 30-year mortgage rate and show that it predicts the share of firms pledging real estate. This indicates that the supply elasticity is a good instrument for both CRE prices and the share of firms pledging CRE. In column (3), we examine the judicial efficiency variables separately, and the F-test reveals that these variables are also strong predictors of the share of firms pledging real estate and exhibit similarly large F-test statistics as those in column (2). Next, in column (4), we combine all instrumental variables and show that both market real estate supply elasticities and the judicial efficiency measures predict the share of firms that pledge real estate collateral. Finally, in column (5), we examine the correlation between the actual share and the one predicted from the probit model $\widehat{\text{Share CRE}}_{m,t}$. We document that the predicted share can serve as an instrument for the actual share, and the F-test statistic exceeds that of the combined set of instruments in column (4).

The estimates of the market-level elasticity of bank credit to collateral values are summarized in Table 19. Column (1) examines the OLS estimates; columns (2) and (3) examine two-step 2SLS estimation using the projected CRE price and Share CRE. Finally, column

Table 19: Market-level bank credit and the collateral channel

	Dependent variable:			
	Dependent variable: Market level credit growth.			
	OLS	2SLS two-step		2SLS one-step
	(1)	(2)	(3)	(4)
$P_{m,t-1}$ × Share $\text{CRE}_{m,t-1}$	95.38**			
	(45.48)			
$\widehat{P_{m,t-1}}$ × Share $\text{CRE}_{m,t-1}$		510.30***		
		(153.52)		
$\widehat{P_{m,t-1}}$ × $\widehat{\text{Share CRE}}_{m,t-1}$			564.44***	695.58***
			(161.44)	(239.26)
$P_{m,t-1}$	−3.26			
	(14.71)			
Share $\text{CRE}_{m,t-1}$	−98.00**	−84.65***		
	(44.03)	(21.37)		
Share $\widehat{\text{CRE}}_{m,t-1}$			−112.10***	−548.36**
			(30.68)	(221.64)
$\widehat{P_{m,t-1}}$		−106.75*	−115.36*	−38.69
		(62.59)	(63.95)	(122.57)
Share accounts $\text{receivable}_{m,t-1}$	−30.50	−27.70	−22.70	67.07
	(22.43)	(21.52)	(21.68)	(97.09)
Share cash and $\text{securities}_{m,t-1}$	164.28*	160.17*	145.63*	270.91***
	(90.67)	(84.22)	(76.83)	(73.43)
Share other fixed $\text{assets}_{m,t-1}$	53.63	49.58	46.31	160.02
	(39.17)	(39.38)	(37.84)	(98.89)
Share blanket $\text{lien}_{m,t-1}$	−11.81	−14.35	−10.07	64.95
	(13.67)	(15.27)	(12.95)	(81.85)
Credit demand high $\text{BD}_{m,t}$	0.05	0.04	0.04	0.03
	(0.04)	(0.04)	(0.04)	(0.04)
Credit demand low $\text{BD}_{m,t}$	0.21***	0.21***	0.20***	0.18***
	(0.02)	(0.02)	(0.02)	(0.03)
Credit supply $\text{factor}_{m,t}$	−0.26	−0.26	−0.27	0.08
	(0.20)	(0.20)	(0.20)	(0.30)
Observations	1,652	1,652	1,652	1,652
R^2	0.22	0.22	0.22	0.45
Adjusted R^2	0.17	0.17	0.17	0.43

NOTE: Bank credit growth is the year-over-year growth in market-level committed amounts of bank credit lines and term loans. The regressions are based on a panel of 68 MSA areas from 2013:Q1 to 2019:Q4. In columns (2) and (3) commercial real estate prices are instrumented based on specification (2) in Table 3. Column (3) uses the fitted Share CRE from the firm-level probit regression in column (3) of Table 10. Column (4) presents estimates from a one-step 2SLS estimation using the set of instrumental variables from column (4) of Table 18. All regressions include market and time fixed effects. Heteroscedasticity and autocorrelation robust standard errors are clustered at the market level. Significant at *p<0.1; **p<0.05; ***p<0.01.

(4) examines a one-step 2SLS estimation. Keeping the price of real estate collateral fixed, the share of firms that pledge CRE alone has a negative effect on MSA-level bank credit. The median market, with a share of about 20 percent, has, on average, 21 basis points lower credit growth compared to a hypothetical market in which firms do not pledge commercial real estate. This is consistent with the stylized facts that firms pledging real estate are smaller and more likely to be credit constrained. Except for cash and securities, no

other collateral type has a statistically significant effect on bank credit allocations across markets.[25]

The estimate of the interaction term in column (1) implies that for every percentage point increase in the value of commercial real estate properties, the median market with a 20 percent share of firms pledging CRE as collateral experiences an increase in bank credit of about 19 basis points. The standalone term on the CRE price is relatively small and not statistically significant. Taking the standalone term into account results in an elasticity of about 16 basis points.

In column (2), we instrument the CRE price index, and the estimate of the collateral channel term increases substantially. A percentage point increase in CRE prices increases bank credit by about 102 basis points for the median market. Note that the standalone effect of CRE prices is negative at approximately 85 basis points. Taking the standalone effect into account, the total elasticity of bank credit to collateral values is close to negative 5 basis points for the median market. It is only for markets with Share CRE exceeding 21 percent or slightly above the median market that the total effect becomes positive. Based on summary statistics in Table 2, at least a quarter of MSA areas have shares of firms pledging real estate collateral that exceed 26 percent. For markets with sufficiently high CRE shares, the increase in CRE prices results in a total positive effect on bank lending of 48 basis points or more.

Column (3) introduces the projected Share CRE from the probit regression at the firm level, along with the fitted values of the CRE price. The estimate of the coefficient on the interaction term increases further, implying an elasticity of about 112 basis points for the median market. The total effect for the median market is negative 2.5 basis points, and the break-even Share CRE is 20.4 percent, which is slightly above the median. For a quarter of the MSA areas with CRE shares exceeding 26 percent, the elasticity of bank credit to CRE prices is 34 basis points or more.

Finally, in column (4), we estimate the model as a single-step 2SLS using the set of instrumental variables in column (4) of Table 18. The estimate on the collateral channel term increases to 139 basis points for the median market, and the total effect of a percentage point increase in CRE values is around 100 basis points for the median market, with break-even Share CRE close to 6 percent.

There are two important points to be made regarding the standalone coefficient on the Share CRE. First, the coefficient estimate for the Share CRE is negative 548 basis points in the single-step 2SLS estimation, which is significantly larger in absolute value than the

[25] To reduce the potential for collinearity among the collateral shares, which sum to one across all collateral types and unsecured borrowing, we exclude the shares of firms pledging other collateral and those that borrow unsecured in our regressions. We run different specifications excluding other collateral types, with results remaining qualitatively unchanged.

estimate based on the OLS or the two-step 2SLS. This large difference is to be expected, given that the two-step estimation relies on a different method to instrument Share CRE and does not depend on the firm-level and bank-level information incorporated in the two-step procedure.

Second, similar to the total effect of changes in the price of real estate, the variation in the share of firms that pledge real estate defines a break-even condition for the appreciation of CRE collateral, above which a higher share of firms pledging real estate has a net positive effect on MSA level credit. Using our two-step estimator, CRE prices need to appreciate by at least 20 percent for the total effect of a higher share of CRE pledging firms to increase bank credit. The one-step estimator results in a break-even value for CRE price appreciation of at least 78 percent.

Market-level bank credit responds differently to the credit demand conditions of the two groups of firms. Overall, bank credit is significantly more sensitive to the demand conditions of low bank-dependent borrowers. The pass-through of credit demand conditions for these borrowers is relatively high, with a 1 percentage point increase in credit demand conditions raising credit growth by about 21 basis points. Similar to the firm-level results, the low elasticity of high bank-dependent borrowers is consistent with more binding credit constraints.

Finally, the credit supply factor does not have a statistically significant effect. Because the time fixed effects absorb the macroeconomic variation in the credit supply conditions of the multi-market banks in our sample. Excluding the bank credit supply conditions does not affect the coefficient estimates, and we keep the variable for consistency. The median MSA area has 29 of the 35 banks in our sample, resulting in small across-market variation in bank credit supply conditions.

Our empirical design maps into the credit multiplier framework of Mian et al. (2023). In particular, we can think of the coefficient ψ_1^m as reflecting the aggregation of the effects of the relaxation of firm-level borrowing constraints ψ_1 from equation (2), as well as the agglomeration and general equilibrium effects that occur within a geographic market with the expansion of credit supply to that market and the feedback loops between credit and asset prices. The coefficient estimates of equations (2) and (7) allow us to compute a market-level credit multiplier, defined as the ratio of the micro-level to the market-level elasticity estimates, scaled by the average share of firms pledging real estate; that is $\kappa_m \equiv \frac{\psi_1^m}{\psi_1} \times \text{Share CRE}_m$. The credit multiplier captures the general equilibrium effects of the feedback loop between asset prices, collateral constraints, and bank credit, as well as any agglomeration effects that occur within an MSA that clusters firms in different industries. Based on our OLS estimates, the credit multiplier effect for the median market is approximately 3. In contrast, using our IV estimates, the credit multiplier for the median market increases to between 9 and 11, depending on the different specifications. In comparison, Mian et al. (2023) estimates a credit multiplier of about 5 for mortgage origination.

Table 20: The effect of the collateral channel on market-level employment

	Dependent variable:			
	Unemployment rate	Growth in employment		
		Total	Non-tradable	Tradable
	(1)	(2)	(3)	(4)
$\widehat{P_{m,t-1}} \times$ Share $\widehat{\text{CRE}}_{m,t-1}$	-5.45^{*}	30.23^{**}	18.26^{*}	75.99^{*}
	(2.84)	(12.88)	(10.20)	(43.06)
$\widehat{P_{m,t-1}}$	2.24^{**}	-9.05^{*}	-5.62^{*}	-27.49^{*}
	(0.92)	(4.55)	(3.36)	(15.63)
Share $\widehat{\text{CRE}}_{m,t-1}$	1.79^{**}	-0.53	2.09	-20.71^{*}
	(0.73)	(3.46)	(3.29)	(11.82)
Share accounts receivable pledged$_{m,t-1}$	-1.15^{**}	1.97	1.61	1.59
	(0.46)	(1.56)	(1.36)	(8.18)
Share cash and securities pledged$_{m,t-1}$	-0.07	6.04	6.34	22.25
	(1.14)	(6.81)	(6.28)	(27.98)
Share other fixed assets pledged$_{m,t-1}$	0.73	-1.84	-1.20	-17.92^{*}
	(0.67)	(1.67)	(1.67)	(9.77)
Share blanket lien pledged$_{m,t-1}$	-0.77^{*}	1.35	2.41	-8.87
	(0.45)	(1.13)	(1.46)	(6.10)
Credit demand high BD$_{m,t}$	0.0001	-0.002	-0.0001	-0.005
	(0.001)	(0.002)	(0.001)	(0.01)
Credit demand low BD$_{m,t}$	-0.0000	-0.001	0.003	-0.01
	(0.001)	(0.003)	(0.002)	(0.01)
Credit supply factor$_{m,t}$	0.0001	0.01	0.02	-0.09
	(0.01)	(0.01)	(0.01)	(0.07)
Lagged dependent variable$_{m,t-1}$	0.78^{***}	0.51^{***}	0.53^{***}	0.29^{***}
	(0.02)	(0.08)	(0.05)	(0.09)
Observations	1,697	1,583	1,583	1,583
R^2	0.96	0.59	0.83	0.30
Adjusted R^2	0.96	0.56	0.82	0.25

NOTE: The regression is based on a panel of 68 MSA areas from 2013:Q1 to 2019:Q4. Commercial real estate prices are instrumented based on specification (2) in Table 3. All regressions include market and time fixed effects and are weighted by the lagged bank credit. Heteroscedasticity and autocorrelation robust standard errors are clustered at the market level. Significant at $^{*}p<0.1$; $^{**}p<0.05$; $^{***}p<0.01$.

We next evaluate the effect of the collateral channel on market-level economic activity. Although the relaxation of borrowing constraints had statistically significant effects on relatively small high bank-dependent borrowers, small and medium-sized firms have disproportionately larger shares in employment, as documented by Neumark et al. (2011). As a result, changes in borrowing constraints for those borrowers are expected to drive employment growth and affect the unemployment rate in areas with a high concentration of high bank-dependent borrowers who pledge commercial real estate as collateral.

The results of this analysis are summarized in Table 20. The coefficient estimates of the collateral channel term for the unemployment rate and the growth in employment capture both the disproportionately higher shares of employment in small and medium-sized businesses as well as any agglomeration effects of the collateral channel. To better capture the aggregate effects of the MSA-level credit allocations documented in Table 19, we estimate weighted regressions with weights based on the one-quarter lagged bank credit.

The elasticity estimates imply that a 1 percentage point increase in collateral values for the median market leads to about a 1.1 basis point decrease in the unemployment rate and about a 6 basis point increase in the growth of total employment. The collateral channel has a large and statistically significant impact on employment in the nontradable sector of about 4 basis points for the median market. We also find evidence that the collateral channel affects employment growth in the tradable sector, with an elasticity to CRE prices of about 15 basis points for the median market. Consistent with the fact that the nontradable sectors concentrate more than 70 percent of employment, the overall impact on total employment is roughly the weighted average of the elasticities of the two sectors.

The economic magnitude of the collateral channel effects can be further evaluated by comparing the elasticities with the average CRE price growth and the average growth rates of employment over our sample period. According to Table 2, the average price growth was 6.4 percent, and the average growth in employment was 2.3 percent. The collateral channel effects contributed to about 38 basis points of growth in total employment, or about 6 percent of the average MSA-level growth in total employment over our sample period.[26]

We would like to conclude the section with a discussion. Despite evidence of significant credit multiplier effects for the median market in our sample, the transition from the micro firm-level effects to the market-level effects of the collateral channel is not monotonic. In particular, the sign and magnitude of the total aggregate effects of the collateral channel on credit allocations and employment growth are heterogeneous across markets and depend on the size of the share of firms pledging real estate and the magnitude of the appreciation of real estate values.

Similar to the regressions for bank credit, the standalone effect of the price of CRE is negative for employment and positive for unemployment. These negative effects on economic activity are consistent with studies that document how constraints on the supply of real estate, which result in higher real estate prices, reduce economic activity, as higher prices raise rents and the user cost of capital. For firms that do not own real estate buildings and, thus, do not benefit from the collateral channel effects, the increased operational costs of higher real estate prices, rents, and wages lower profit margins, reduce the scale of operations, and result in lower hiring and capital expenditures. Hsieh and Moretti (2019) quantifies in a spatial equilibrium model that high-cost real estate, due to low supply elasticities, resulted

[26]As a comparison, Adelino et al. (2015) attributes between 15 and 25 percent of employment growth to collateral channel effects over the period 2002–2007.

in a 36 percent decline in U.S. growth over the period from 1964 to 2009.

6 Conclusion

We have provided robust firm-level evidence demonstrating that the collateral channel significantly impacts non-publicly traded and high bank-dependent firms. Following the appreciation of real estate in an MSA area, firms that pledge real estate properties as collateral experience an increase in bank credit, a reduction in credit spreads, and increases in the maturity of bank loans that fund higher capital expenditures, sales, and total assets. We have shown that the firm-level effects of the collateral channel are present only if firms pledge real estate as collateral.

We have documented that firms which borrow unsecured loans do not experience the same benefits of higher real estate valuations, even if they own real estate assets. We have attributed this dichotomy to how lenders perceive the value of collateral in the state of bankruptcy. We have documented significant differences in the efficiency of federal district bankruptcy courts in resolving firms in bankruptcy through Chapter 7 and Chapter 11. We have shown that judicial efficiency is an important predictor of the use of collateral and serves as a novel instrumental variable that allows for exogenous variation in collateral use unrelated to local economic conditions.

Our data and methodology allow us to aggregate the micro-level effects of collateral constraints and examine their aggregate effects while controlling for other credit allocation mechanisms and the endogenous choice of collateral. We have estimated significant credit multiplier effects related to the general equilibrium and agglomeration effects of the additional credit to bank-dependent borrowers, which manifest in higher bank credit allocations and increases in employment in markets that experience significant appreciation in commercial real estate prices and have high shares of firms pledging real estate.

Nonetheless, we document that the positive effects at the firm level do not necessarily translate into positive effects at the aggregate level. Our analysis indicates that only markets with a sufficiently large number of firms pledging real estate as collateral and a sufficiently large appreciation in real estate experience positive expansion in credit and employment from the relaxation of borrowing constraints at high bank-dependent and credit-constrained firms that pledge commercial real estate.

Our estimates could be useful in calibrating structural models to assess the general equilibrium and welfare effects of the collateral channel. Such models need to take into account the presence of heterogeneous firms with different access to market-based and bank-dependent finance, as well as the endogenous choice of collateral. The economically significant credit multiplier effects and their geographic dispersion also have potential implications for the study of business cycles, firm dynamics, and spatial economics. We leave these implications of our findings for future research.

References

Adelino, Manuel, Antoinette Schoar, and Felipe Severino (2015), "House prices, collateral, and self-employment." *Journal of Financial Economics*, 117, 288–306, URL https://www.sciencedirect.com/science/article/pii/S0304405X1500029X.

Aghion, Philippe, Oliver Hart, and John Moore (1992), "The economics of bankruptcy reform." *Journal of Law, Economics, & Organization*, 8, 523–546.

Amiti, Mary and David E Weinstein (2018), "How much do idiosyncratic bank shocks affect investment? evidence from matched bank-firm loan data." *Journal of Political Economy*, 126, 525–587.

Antill, Samuel and Aymeric Bellon (2024), "The real effects of bankruptcy forum shopping." *Available at SSRN 5052176*.

Asriyan, Vladimir, Luc Laeven, and Alberto Martín (2021), "Collateral booms and information depletion." *The Review of Economic Studies*, 89, 517–555, URL https://doi.org/10.1093/restud/rdab046.

Bahaj, Saleem, Angus Foulis, and Gabor Pinter (2020), "Home values and firm behavior." *American Economic Review*, 110, 2225–70, URL https://www.aeaweb.org/articles?id=10.1257/aer.20180649.

Banerjee, Ryan and Kristian Blickle (2021), "Financial frictions, real estate collateral and small firm activity in Europe." *European Economic Review*, 138, 103823.

Barro, Robert J (1976), "The loan market, collateral, and rates of interest." *Journal of money, Credit and banking*, 8, 439–456.

Bednarek, Peter, Daniel Marcel te Kaat, Chang Ma, and Alessandro Rebucci (2021), "Capital flows, real estate, and local cycles: Evidence from german cities, banks, and firms." *The Review of Financial Studies*, 34, 5077–5134, URL https://doi.org/10.1093/rfs/hhab017.

Benmelech, Efraim and Nittai K. Bergman (2011), "Bankruptcy and the collateral channel." *The Journal of Finance*, 66, 337–378.

Berger, Allen N. and Gregory F. Udell (1990), "Collateral, loan quality and bank risk." *Journal of Monetary Economics*, 25, 21–42, URL https://www.sciencedirect.com/science/article/pii/0304393290900423.

Bernanke, Ben and Mark Gertler (1989), "Agency costs, net worth, and business fluctuations." *American Economic Review*, 79, 14–31.

Bernanke, Ben S, Mark Gertler, and Simon Gilchrist (1999), "The financial accelerator in a quantitative business cycle framework." *Handbook of macroeconomics*, 1, 1341–1393.

Besanko, David and Anjan V. Thakor (1987), "Collateral and rationing: Sorting equilibria in monopolistic and competitive credit markets." *International Economic Review*, 28, 671–689, URL http://www.jstor.org/stable/2526573.

Bris, Arturo, Ivo Welch, and Ning Zhu (2006), "The costs of bankruptcy: Chapter 7 liquidation versus chapter 11 reorganization." *The Journal of Finance*, 61, 1253–1303.

Caglio, Cecilia R, R Matthew Darst, and Sebnem Kalemli-Ozcan (2021), "Risk-taking and monetary policy transmission: Evidence from loans to SMEs and large firms." *National Bureau of Economic Research, Working Paper 28685*.

Cameron, A. Colin, Jonah B. Gelbach, and Douglas L. Miller (2008), "Bootstrap-Based Improvements for Inference with Clustered Errors." *Review of Economics and Statistics*, 90, 414–427.

Campello, Murillo, Robert A. Connolly, Gaurav Kankanhalli, and Eva Steiner (2021), "Do real estate values boost corporate borrowing? Evidence from contract-level data." *Journal of Financial Economics*, URL https://www.sciencedirect.com/science/article/pii/S0304405X21002919.

Cerqueiro, Geraldo, Steven Ongena, and Kasper Roszbach (2016), "Collateralization, bank loan rates, and monitoring." *The Journal of Finance*, 71, 1295–1322.

Chaney, Thomas, David Sraer, and David Thesmar (2012), "The collateral channel: How real estate shocks affect corporate investment." *American Economic Review*, 102, 2381–2409, URL https://www.aeaweb.org/articles?id=10.1257/aer.102.6.2381.

Chaney, Thomas, David Alexandre Sraer, and David Thesmar (2020), "Response to welch (2020): Real estate collateral does affect corporate investment." *Available at SSRN 3599277*.

Chodorow-Reich, Gabriel, Olivier Darmouni, Stephan Luck, and Matthew Plosser (2021), "Bank liquidity provision across the firm size distribution." *Journal of Financial Economics*.

Corbae, Dean and Pablo D'Erasmo (2021), "Reorganization or liquidation: Bankruptcy choice and firm dynamics." *The Review of Economic Studies*, 88, 2239–2274, URL https://doi.org/10.1093/restud/rdaa091.

Corradin, Stefano and Alexander Popov (2015), "House prices, home equity borrowing, and entrepreneurship." *The Review of Financial Studies*, 28, 2399–2428, URL https://doi.org/10.1093/rfs/hhv020.

Correia, Sergio (2019), "REGHDFE: Stata module to perform linear or instrumental-variable regression absorbing any number of high-dimensional fixed effects." URL https://EconPapers.repec.org/RePEc:boc:bocode:s457874.

Crouzet, Nicolas and Neil R. Mehrotra (2020), "Small and large firms over the business cycle." *American Economic Review*, 110, 3549–3601, URL https://www.aeaweb.org/articles?id=10.1257/aer.20181499.

Cvijanovic, Dragana (2014), "Real estate prices and firm capital structure." *Review of Financial Studies*, 27, 2690–2735, URL https://doi.org/10.1093/rfs/hhu035.

Davidoff, Thomas (2013), "Supply elasticity and the housing cycle of the 2000s." *Real Estate Economics*, 41, 793–813, URL https://onlinelibrary.wiley.com/doi/abs/10.1111/1540-6229.12019.

Degryse, Hans, Olivier De Jonghe, Sanja Jakovljević, Klaas Mulier, and Glenn Schepens (2019), "Identifying credit supply shocks with bank-firm data: Methods and applications." *Journal of Financial Intermediation*, 40, 100813, URL http://www.sciencedirect.com/science/article/pii/S1042957319300154. Bank-firm relationships in the post-crisis era.

Donaldson, Jason Roderick, Denis Gromb, and Giorgia Piacentino (2020), "The paradox of pledgeability." *Journal of Financial Economics*, 137, 591–605.

Drechsel, Thomas (2023), "Earnings-based borrowing constraints and macroeconomic fluctuations." *American Economic Journal: Macroeconomics*, 15, 1–34.

Faria-e-Castro, Miguel, Pascal Paul, and Juan M. Sánchez (2024), "Evergreening." *Journal of Financial Economics*, 153, 103778, URL https://www.sciencedirect.com/science/article/pii/S0304405X24000011.

Favara, Giovanni and Jean Imbs (2015), "Credit supply and the price of housing." *American Economic Review*, 105, 958–92, URL https://www.aeaweb.org/articles?id=10.1257/aer.20121416.

Favara, Giovanni, Camelia Minoiu, and Ander Perez-Orive (2024), "Zombie lending to U.S. firms." *FRB Atlanta Working Paper, 2024-7*.

Gan, Jie (2007), "Collateral, debt capacity, and corporate investment: Evidence from a natural experiment." *Journal of Financial Economics*, 85, 709–734.

Gaure, Simen (2013), "lfe: Linear group fixed effects." *R Journal*, 5, 104.

Gertler, Mark and Simon Gilchrist (1994), "Monetary policy, business cycles, and the behavior of small manufacturing firms." *Quarterly Journal of Economics*, 109, 309–340.

Gertler, Mark and Simon Gilchrist (2018), "What happened: Financial factors in the great recession." *Journal of Economic Perspectives*, 32, 3–30, URL https://www.aeaweb.org/articles?id=10.1257/jep.32.3.3.

Glancy, David (2021), "Housing bust, bank lending and employment: Evidence from multimarket banks." *Journal of Banking and Finance*, 127, 106111, URL https://www.sciencedirect.com/science/article/pii/S0378426621000698.

Gorton, Gary and Guillermo Ordonez (2019), "Good booms, bad booms." *Journal of the European Economic Association*, 18, 618–665, URL https://doi.org/10.1093/jeea/jvy058.

Greenstone, Michael, Alexandre Mas, and Hoai-Luu Nguyen (2020), "Do credit market shocks affect the real economy? Quasi-experimental evidence from the Great Recession and "normal" economic times." *American Economic Journal: Economic Policy*, 12, 200–225, URL https://www.aeaweb.org/articles?id=10.1257/pol.20160005.

Greenwald, Daniel L, John Krainer, and Pascal Paul (2020), "The credit line channel." *Federal Reserve Bank of San Francisco, Working Papers*.

Guren, Adam, Alisdair McKay, Emi Nakamura, and Jón Steinsson (2021), "What do we learn from cross-regional empirical estimates in macroeconomics?" *NBER Macroeconomics Annual*, 35, 175–223, URL https://doi.org/10.1086/712321.

Haque, Sharjil, Young Soo Jang, and Simon Mayer (2022), "Private equity and corporate borrowing constraints: Evidence from loan level data." *Available at SSRN 4294228*.

Hart, Oliver and John Moore (1994), "A theory of debt based on the inalienability of human capital." *Quarterly Journal of Economics*, 109, 841–879, URL https://doi.org/10.2307/2118350.

Heckman, James and Richard Robb (1985), "Alternative methods for evaluating the impact of interventions: An overview." *Journal of Econometrics*, 30, 239–267.

Heckman, James J (1979), "Sample selection bias as a specification error." *Econometrica*, 47, 153–161, URL https://www.jstor.org/stable/1912352.

Himmelberg, Charles, Christopher Mayer, and Todd Sinai (2005), "Assessing high house prices: Bubbles, fundamentals and misperceptions." *Journal of Economic Perspectives*, 19, 67–92.

Holmstrom, Bengt and Jean Tirole (1997), "Financial intermediation, loanable funds, and the real sector." *Quarterly Journal of Economics*, 112, 663–691, URL https://doi.org/10.1162/003355397555316.

Hotchkiss, Edith Shwalb (1995), "Postbankruptcy performance and management turnover." *The Journal of Finance*, 50, 3–21.

Hsieh, Chang-Tai and Enrico Moretti (2019), "Housing constraints and spatial misallocation." *American Economic Journal: Macroeconomics*, 11, 1–39, URL https://www.aeaweb.org/articles?id=10.1257/mac.20170388.

Iverson, Benjamin (2018), "Get in line: Chapter 11 restructuring in crowded bankruptcy courts." *Management Science*, 64, 5370–5394.

Jorda, Oscar and Alan M. Taylor (2025), "Local projections." *Journal of Economic Literature*, 63, 59–110, URL https://www.aeaweb.org/articles?id=10.1257/jel.20241521.

Khwaja, Asim Ijaz and Atif Mian (2008), "Tracing the impact of bank liquidity shocks: Evidence from an emerging market." *American Economic Review*, 98, 1413–42, URL https://www.aeaweb.org/articles?id=10.1257/aer.98.4.1413.

Kiyotaki, Nobuhiro and John Moore (1997), "Credit cycles." *Journal of Political Economy*, 105, 211–248.

Lian, Chen and Yueran Ma (2021), "Anatomy of corporate borrowing constraints." *Quarterly Journal of Economics*, 136, 229–291.

Luck, Stephan and Joao AC Santos (2024), "The valuation of collateral in bank lending." *Journal of Financial and Quantitative Analysis*, 59, 2038–2067.

Ma, Yueran, Teodora Paligorova, and José-Luis Peydro (2021), "Expectations and bank lending." *University of Chicago, Unpublished Working Paper*.

Manove, Michael, A. Jorge Padilla, and Marco Pagano (2001), "Collateral versus project screening: A model of lazy banks." *The RAND Journal of Economics*, 32, 726–744, URL http://www.jstor.org/stable/2696390.

Mian, Atif, Andrés Sarto, and Amir Sufi (2023), "Estimating credit multipliers." *NYU Stern, Working Paper.*

Mian, Atif and Amir Sufi (2011), "House prices, home equity-based borrowing, and the U.S. household leverage crisis." *American Economic Review*, 101, 2132–56.

Mian, Atif and Amir Sufi (2014), "What explains the 2007–2009 drop in employment?" *Econometrica*, 82, 2197–2223.

Miao, Jianjun and Pengfei Wang (2018), "Asset bubbles and credit constraints." *American Economic Review*, 108, 2590–2628, URL https://www.aeaweb.org/articles?id=10.1257/aer.20160782.

Morrison, Edward R. (2007), "Bankruptcy decision making: An empirical study of continuation bias in small-business bankruptcies." *The Journal of Law and Economics*, 50, 381–419.

Neumark, David, Brandon Wall, and Junfu Zhang (2011), "Do small businesses create more jobs? New evidence for the United States from the National Establishment Time Series." *Review of Economics and Statistics*, 93, 16–29.

OCC (2000), "Comptroller's handbook: Accounts receivable and inventory financing." URL https://www.occ.treas.gov/publications-and-resources/publications/comptrollers-handbook/files/accts-rec-inventory-financing/index-accs-rec-inventory-financing.html.

Rampini, Adriano A and S Viswanathan (2010), "Collateral, risk management, and the distribution of debt capacity." *The Journal of Finance*, 65, 2293–2322.

Rampini, Adriano A and S. Viswanathan (2025), "Collateral and secured debt." *National Bureau of Economic Research, Working Paper Series, 33875*, URL http://www.nber.org/papers/w33875.

Saiz, Albert (2010), "The geographic determinants of housing supply." *Quarterly Journal of Economics*, 125, 1253–1296, URL https://doi.org/10.1162/qjec.2010.125.3.1253.

Schmalz, Martin C, David A Sraer, and David Thesmar (2017), "Housing collateral and entrepreneurship." *The Journal of Finance*, 72, 99–132.

Sharpe, Steven A. (1994), "Financial market imperfections, firm leverage, and the cyclicality of employment." *The American Economic Review*, 84, 1060–1074, URL http://www.jstor.org/stable/2118044.

Siemer, Michael (2019), "Employment effects of financial constraints during the Great Recession." *Review of Economics and Statistics*, 101, 16–29.

Stiglitz, Joseph E and Andrew Weiss (1981), "Credit rationing in markets with imperfect information." *American Economic Review*, 71, 393–410.

Stock, James H, Jonathan H Wright, and Motohiro Yogo (2002), "A survey of weak instruments and weak identification in generalized method of moments." *Journal of business & economic statistics*, 20, 518–529.

Terza, Joseph V., Anirban Basu, and Paul J. Rathouz (2008), "Two-stage residual inclusion estimation: Addressing endogeneity in health econometric modeling." *Journal of Health Economics*, 27, 531–543, URL https://www.sciencedirect.com/science/article/pii/S0167629607001063.

Welch, Ivo (2020), "Ratio of changes: How real estate shocks did not affect corporate investment." *Unpublished Working Paper*.

Wooldridge, Jeffrey M (2010), "Econometric analysis of cross section and panel data." *MIT press*.

Wooldridge, Jeffrey M (2015), "Control function methods in applied econometrics." *Journal of Human Resources*, 50, 420–445.

"The Collateral Channel and Bank Credit"
Online appendix not for publication

Arun Gupta Horacio Sapriza Vladimir Yankov[27]

A Data construction

A.1 Main dataset

Our main dataset is based on the FR Y-14Q schedule.[28] The data are submitted by banks quarterly and contain the quarter-end loan balances of all commercial and industrial (C&I) loans with total committed amounts exceeding $1 million. The $1 million threshold leaves a large number of very small borrowers. Bank lending to those borrowers is reported in a separate schedule–FR Y-14Q Schedule A. This schedule, however, collects only loan portfolio data with no individual borrower information or information on the use of collateral, which limits its usefulness for our analysis. Furthermore, those borrowers are likely to include the smallest businesses and sole proprietorships that are likely to pledge residential properties as collateral. The loans in our sample are large enough that we can rule out the possibility that these loans are collateralized by the value of an owner-occupied residential property.

The FR Y14Q distinguishes between C&I loans backed by owner-occupied properties, which are reported in schedule H1, and commercial real estate (CRE) loans backed by rental properties, which are reported in schedule H2. Although our focus is on the FR Y-14Q H1 schedule, it does not contain well-populated information on the market values of the properties used as collateral to construct reliable loan-to-value (LTV) ratios. To obtain such estimates, we use the H2 schedule, which contains information on the LTV at origination.

We restrict the sample to U.S.-domiciled nonfinancial borrowers for whom banks consistently report balance sheet and income statement information for at least two years (8 quarters). We conduct a number of screens of the data to filter out outliers and inconsistent or stale information. For example, we verify that all balance sheet quantities are non-negative and satisfy basic balance sheet identities. We also drop outliers defined as

[27]The Board of Governors of the Federal Reserve System, 20th Street and Constitution Avenue N.W., Washington, D.C. 20551. Views expressed in this paper do not reflect the official position of the Federal Reserve System. Corresponding author: Vladimir Yankov E-mail: vladimir.l.yankov@frb.gov

[28]The FR Y-14Q has two sub-schedules: H1, which includes all commercial and industrial (C&I) loans, including those secured by commercial real estate properties owned by the borrower, and H2, which contains information on all loans secured by non-owner-occupied properties that generate rental income. The distinction between loans secured by owner occupied and non-owner-occupied properties is important for the analysis and differs from the definitions in the bank-level reporting forms Call Reports for commercial banks and FR Y-9C consolidated reports for bank holding companies. A full detailed description of the FR Y-14 reporting schedules can be found here https://www.federalreserve.gov/apps/reportingforms/Report/Index/FR_Y-14Q.

extreme values exceeding the lower 5th and upper 95th percentiles of the distribution. We also drop a small number of observations with extreme interest rate spreads exceeding 30 percent and maturities exceeding 10 years. We collapse the loan-level data into a bank-firm-market panel dataset by aggregating all outstanding credit facilities between a bank and a borrower. In this process, we make distinctions between term loans, credit lines, and the utilization of credit lines. For most loans and borrowers, there is a single loan and a single type of collateral pledged. If there are multiple credit facilities with different collateral types, we select the predominant form of collateral used based on the committed loan amounts.

We merge the FR Y-14 data with data on commercial real estate prices constructed by CBRE Econometric Advisors. We use the location of the headquarters of the borrower, defined by its zip code, to assign a borrower to a particular MSA area. We assume that the real estate collateral pledged is in the same location as the reported headquarters of the borrower. This assumption is very likely to be correct for the bulk of very small borrowers in our sample. We also restrict our sample to borrowers located in one of 69 major metropolitan statistical areas (MSAs) for which we have commercial real estate prices, as well as real estate supply elasticities (Saiz, 2010).

Starting with our initial sample of 218,156 domestic non-financial borrowers and after applying our different filters and validity checks, we are left with our final analysis sample that spans the period from 2013:Q1 to 2019:Q4 and consists of 32 bank holding companies that lend to 91, 487 firms across 68 MSA-level markets. We use this sample to estimate the probit regression. Once we restrict our sample to borrowers for whom we consistently observe balance sheet and income statement information for at least 2 years, our sample for estimating the second stage regressions includes 49,242 borrowers. Below, we describe the construction of each variable used in the regression analysis:

- $\Delta_4 L_{f,b,m,t}$ is the year-over-year growth rate in total commitments (CLCOG074) of bank b to firm f in market m at time t.[29] The year-over-year growth rate removes seasonality in bank credit. The distribution of this variable is a mixture of a discrete distribution of firms that do not experience any changes in their borrowing and firms that experience changes, and a continuous distribution of growth rates for firms that obtain new loans or refinance existing loans. Source: FR Y-14Q H1 schedule and authors' calculations.

- $\mathcal{I}\{\text{Real estate}_{f,b,m,t}\}$ is a {0,1} dummy variable equal to 1 if the firm f in market m at time t uses real estate as collateral for loans obtained from bank b. For most

[29]One can use the online microdata reference manual https://www.federalreserve.gov/apps/mdrm/data-dictionary to obtain additional information on the different variables collected in the FR 14Q H1 schedule.

firms, we observe a single loan originated from a single bank with a single type of collateral pledged. When there are multiple collateral types pledged across different loans, we identify the dominant form of collateral as the one associated with the largest committed loan amount. We perform the same construction for all the other collateral types. Source: FR Y-14Q H1 schedule and authors' calculations.

- $P_{m,t}$ is the average commercial real estate price in market m at time t. We take the average of the MSA-level price indices across retail, office, hotels, and industrial properties and normalize this index to 0 at the beginning of our sample. Source: CBRE Econometric Advisors.

- Capital expenditures$_{f,t}$ represents the capital expenditures (CLCEM324) divided by total assets (CLCEM316) of f at time t. FR Y-14 reports capital expenditures net of depreciation. We exclude depreciation from our analysis and use gross capital expenditures. Source: FR Y-14Q H1 schedule and authors' calculations.

- Share of fixed assets$_{f,t}$ is the total amount of fixed assets composed of real estate properties and other fixed assets (CLCEM316) divided by total firm assets (CLCE2170). Source: FR Y-14Q H1 schedule and authors' calculations.

- Share of accounts receivable$_{f,t}$ is the total amount of accounts receivable (CLCEM309) defined as money owed by customers at the end of the reported period for merchandise or services sold on open account. The share is computed by dividing the amount of accounts receivable with the firm total assets (CLCE2170). Source: FR Y-14Q H1 schedule and authors' calculations.

- Total assets$_{f,t}$ is the firm's total assets (CLCE2170). Source: FR Y-14Q H1 schedule (FR Y-14).

- Return no assets$_{f,t}$ is the firm's net income (CLCEM306) divided by the lag of total assets (CLCE2170). Source: FR Y-14Q H1 schedule and authors' calculations (FR Y-14).

- Debt-to-assets$_{f,t}$ is the firm's total liabilities (CLCE2950) divided by its total assets (CLCE2170). Source: FR Y-14Q H1 schedule and authors' calculations (FR Y-14).

- $\mathcal{I}\{\text{Investment grade}_{b,f,t}\}$ is a $\{0,1\}$ dummy variable equal to 1 if the lender has assessed the borrower with a credit rating (CLCOG080) equivalent to BBB or higher. These credit ratings are assigned as part of the bank's reporting of risk-weighted assets to regulators. Source: FR Y-14Q H1 schedule and authors' calculations (FR Y-14).

- $\mathcal{I}\{\text{Highly bank dependent}_{f,t}\}$ is a {0,1} dummy variable equal to 1 if the borrower is a non-publicly traded firm with bank credit of more than 50 percent of reported liabilities. We also classify borrowers with missing information on total liabilities as high bank-dependent. Source: FR Y-14Q H1 schedule and authors' calculations (FR Y-14).

- Unemployment $\text{rate}_{m,t}$ is the quarterly unemployment rate in an MSA. Source: Bureau of Labor Statistics (BLS).

- Employment $\text{growth}_{m,t}$ is the annualized quarterly growth rate in employment by industry NAICs code and MSA area. Source: Bureau of Labor Statistics Quarterly Census of Employment and Wages (BLS QCEW).

Table A1: Asset-based collateral types and borrower characteristics

Statistic	mean	sd	p25	p50	p75	Borrowers
	A. Real estate					
Total assets ($mln)	52	485	2	4	14	41263
Share fixed assets (pct)	44	33	13	40	74	41263
Cash-to-assets (pct)	14	19	2	7	18	41263
Share accounts receivable (pct)	13	17	0	4	20	41263
Committed amount ($mln)	4	9	1	2	3	41263
Debt-to-assets (pct)	61	24	45	65	80	41263
Share bank credit (pct)	49	30	21	48	76	41263
Investment grade	0.16	0.36	0	0	0	41263
Expected prob. of default (pct)	3.46	10.4	0.67	1.26	2.22	41263
Expected loss given default (pct)	30.6	11.63	23.88	31	38.29	41263
	B. Accounts receivable					
Total assets ($mln)	179	1034	5	11	34	16672
Share fixed assets (pct)	16	20	3	8	22	16672
Cash-to-assets (pct)	11	14	2	6	14	16672
Share accounts receivable (pct)	23	22	4	17	37	16672
Committed amount ($mln)	13	57	2	3	10	16672
Debt-to-assets (pct)	64	22	50	68	81	16672
Share bank credit (pct)	46	27	25	46	66	16672
Investment grade	0.18	0.38	0	0	0	16672
Expected prob. of default (pct)	3.49	8.5	0.64	1.37	2.98	16672
Expected loss given default (pct)	28.97	15.72	17.9	27	37.44	16672
	C. Fixed assets other than real estate					
Total assets ($mln)	331	1521	6	22	91	10609
Share fixed assets (pct)	27	30	2	13	46	10609
Cash-to-assets (pct)	25	27	3	14	39	10609
Share accounts receivable (pct)	12	16	0	3	18	10609
Committed amount ($mln)	5	16	1	2	4	10609
Debt-to-assets (pct)	52	27	28	53	75	10609
Share bank credit (pct)	37	34	6	27	63	10609
Investment grade	0.53	0.49	0	1	1	10609
Expected prob. of default (pct)	1.11	3.04	0.09	0.32	0.93	10609
Expected loss given default (pct)	53.94	41.87	12.75	40	100	10609
	D. Cash and securities					
Total assets ($mln)	922	3262	8	26	152	8607
Share fixed assets (pct)	40	26	17	37	61	8607
Cash-to-assets (pct)	12	16	2	6	15	8607
Share accounts receivable (pct)	17	16	5	13	26	8607
Committed amount ($mln)	7	19	1	2	6	8607
Debt-to-assets (pct)	61	21	47	63	76	8607
Share bank credit (pct)	25	27	2	14	43	8607
Investment grade	0.31	0.46	0	0	1	8607
Expected prob. of default (pct)	2.59	8.02	0.39	1.01	2.18	8607
Expected loss given default (pct)	32.4	14.68	23.14	31.44	39.6	8607

NOTE: The sample period covers 2013:Q1 through 2019:Q4. SOURCE: Federal Reserve Form FR Y-14 and authors' calculations.

A.2 Summary statistics of firms by collateral type

Table A2: Earnings-based collateral types and borrower characteristics

Statistic	mean	sd	p25	p50	p75	Borrowers
	A. Blanket lien					
Total assets ($mln)	167	1233	3	8	24	19018
Share fixed assets (pct)	24	25	4	14	37	19018
Cash-to-assets (pct)	16	19	3	9	21	19018
Share accounts receivable (pct)	23	22	3	17	37	19018
Committed amount ($mln)	9	46	1	2	6	19018
Debt-to-assets (pct)	58	23	41	60	76	19018
Share bank credit (pct)	44	26	23	43	64	19018
Investment grade	0.16	0.36	0	0	0	19018
Expected prob. of default (pct)	3.29	9.48	0.64	1.08	2.17	19018
Expected loss given default (pct)	39.12	15.1	32.8	37.74	43.33	19018
	B. Other collateral					
Total assets ($mln)	595	2318	5	20	132	6310
Share fixed assets (pct)	33	31	5	22	56	6310
Cash-to-assets (pct)	13	18	2	6	17	6310
Share accounts receivable (pct)	11	16	0	3	15	6310
Committed amount ($mln)	19	72	2	4	13	6310
Debt-to-assets (pct)	62	24	45	65	80	6310
Share bank credit (pct)	37	32	7	30	63	6310
Investment grade	0.29	0.45	0	0	1	6310
Expected prob. of default (pct)	3.9	10.82	0.43	1.2	3.57	6310
Expected loss given default (pct)	32.05	19.8	17.86	30	45	6310
	C. Unsecured					
Total assets ($mln)	1566	4040	8	66	675	10536
Share fixed assets (pct)	29	29	5	18	48	10536
Cash-to-assets (pct)	14	18	2	7	19	10536
Share accounts receivable (pct)	14	17	1	8	21	10536
Committed amount ($mln)	38	188	2	4	17	10536
Debt-to-assets (pct)	55	24	37	57	73	10536
Share bank credit (pct)	26	30	1	12	42	10536
Investment grade	0.44	0.49	0	0	1	10536
Expected prob. of default (pct)	1.97	8.29	0.17	0.48	1.16	10536
Expected loss given default (pct)	44.02	17.68	37	45	49.79	10536

NOTE: The sample period covers 2013:Q1 through 2019:Q4. SOURCE: Federal Reserve Form FR Y-14 and authors' calculations.

A.3 Summary statistics of firms by degree of bank dependence

Table A3 provides summary statistics for the sample of high- and low bank-dependent borrowers in Panels A and B, respectively.

A.4 Measurement of collateral values

The FR Y-14Q schedule collects information on the value of the collateral pledged across all six collateral categories. However, the field that collects this information is sparsely populated. For example, we observe only 20,353 borrowers who at any point in time pledge real estate and report the value of the real estate pledged. Furthermore, once we apply all our data selection criteria, only 6887 of those borrowers have complete information about their balance sheets and income statements to be selected for our final regression sample. The instructions in FR Y-14Q indicate that the reason for this non-reporting is likely due to the internal risk management systems at banks, which do not always require ongoing or periodic valuation of collateral:

> "For facilities which require ongoing or periodic valuation of collateral, report the market value of the collateral as of the reporting date. If the market value of collateral is not updated in the reporting entity's internal risk management systems as of the reporting date, report NA."

A.5 Corporate bankruptcy data

We use the Federal Judicial Center's (FJC) Integrated Database from the Wharton Research Data Services (WRDS) to obtain information on corporate bankruptcies. The data contain all bankruptcy cases reported by the courts to the Administrative Office of the U.S. Courts through the Public Access to Court Electronic Records (PACER). We selected a sample of all corporate bankruptcies from 2008 through 2023 for our analysis. We exclude consumer defaults or defaults involving consumer debt, as well as a large number of bankruptcy cases of sole proprietorships and tax-exempt nonprofit companies, and focus on cases that involve liquidation under Chapter 7 or reorganization under Chapter 11 of the bankruptcy code. The sample selection leaves us with 220,958 unique corporate bankruptcy cases across all 94 federal district courts. Unfortunately, the FJC data do not contain a reliable firm identifier, and we merge this data with our main datasets for analysis using derived statistics at the county-level of the borrower, as described below.

FJC data contain information on borrowers' locations, such as zip and county codes In most, but not all cases, there is information on total assets, liabilities, net incomes, amounts of secured and unsecured debt, and ownership of commercial real estate properties. For each bankruptcy case, the courts assign a docket number that tracks information on the

Table A3: Descriptive statistics of corporate borrowers by bank dependence

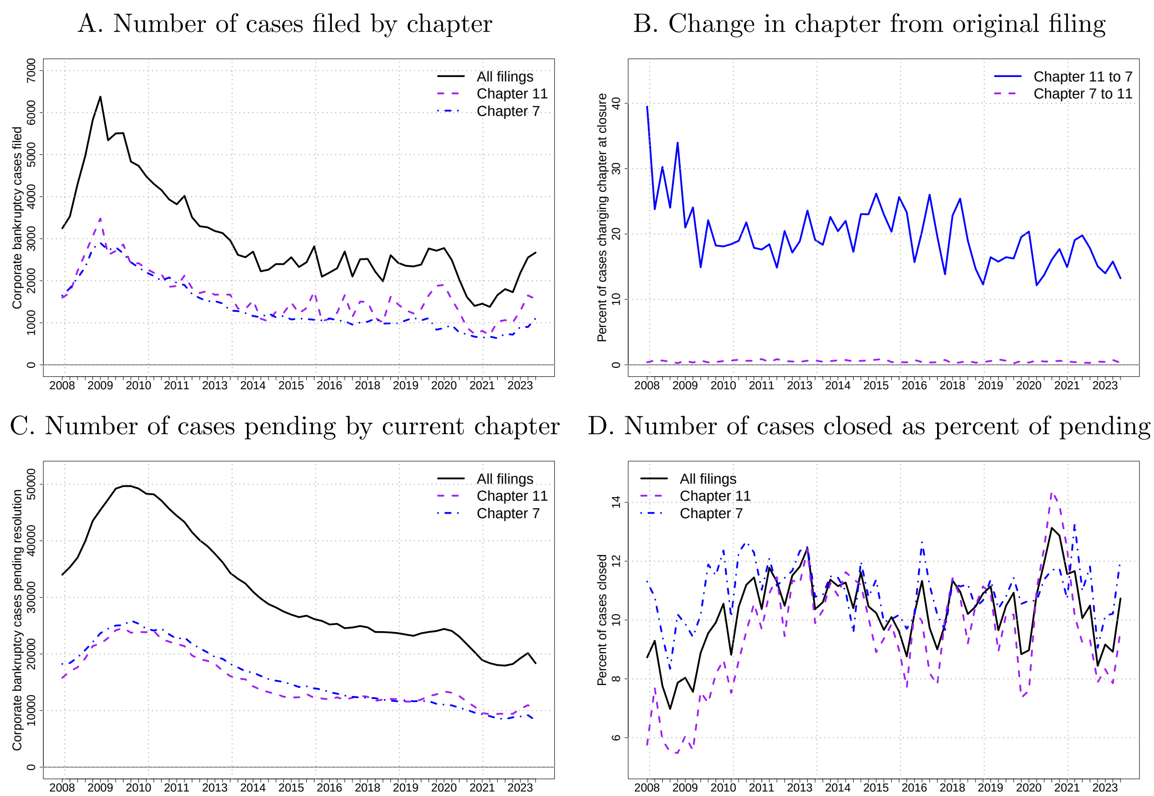
Statistic	mean	sd	p5	p25	p50	p75	p95
	A. Sample of high bank-dependent firms						
Total assets ($mln)	59	1195	2	4	10	29	162
Committed credit ($mln)	18	83	1	2	4	13	70
Credit line ($mln)	20	63	1	2	5	15	78
Term loan ($mln)	9	69	1	1	3	6	31
Cash-to-assets (pct)	10	14	0	1	4	13	37
Debt-to-assets (pct)	61	24	19	43	63	80	100
Sales-to-assets (pct)	39	30	5	12	27	65	94
Share accounts receivable (pct)	21	22	0	1	15	34	69
Share fixed assets (pct)	32	31	0	5	19	52	96
Return on assets (pct)	18	16	2	7	13	23	52
Capex to assets (pct)	5.04	14.04	-13.02	0	0.01	7.81	35.5
Use of collateral	0.97	0.16	1	1	1	1	1
Use of CRE collateral	0.3	0.46	0	0	0	1	1
Credit rating	BB		B	BB	BB	BB	BBB
Expected PD (pct)	2.61	8.97	0.16	0.45	0.94	1.91	7.87
Debt-to-EBITDA	3.64	3.87	0.05	0.8	2.31	5.2	11.92
Expected LGD (pct)	32	14	10	23	34	39	53
Utilization rate (pct)	51	36	0	15	54	83	100
Distance to Delaware (km)	1579	1341	101	519	1072	2506	3867
Share bank credit (pct)	80.91	20.01	47.93	65.2	86.17	100	100
	B. Sample of low bank-dependent firms						
Total assets ($mln)	2935	20894	4	13	46	389	9363
Committed credit ($mln)	74	327	1	2	5	22	367
Credit line ($mln)	91	310	1	3	7	40	478
Term loan ($mln)	27	176	1	2	3	11	106
Cash-to-assets (pct)	9	12	0	1	5	12	33
Debt-to-assets (pct)	66	21	29	52	68	82	100
Sales-to-assets (pct)	47	29	5	21	46	72	94
Share accounts receivable (pct)	19	19	0	4	13	28	61
Share fixed assets (pct)	31	28	1	7	23	50	88
Return on assets (pct)	14	13	1	6	11	18	37
Capex to assets (pct)	7.04	15.06	-12.51	0	2.04	12.07	39.14
Use of collateral	0.91	0.29	0	1	1	1	1
Use of CRE collateral	0.23	0.42	0	0	0	0	1
Credit rating	BB		CCC	BB	BB	BBB	BBB
Expected PD (pct)	3.09	10.78	0.12	0.35	0.82	1.91	10.15
Debt-to-EBITDA	3.88	3.84	0.1	1.1	2.69	5.37	12.18
Expected LGD (pct)	33	14	10	24	35	42	53
Utilization rate (pct)	42	38	0	0	37	79	100
Distance to Delaware (km)	1475	1283	96	465	1059	2126	3860
Share bank credit (pct)	30.77	27.73	0.6	8.59	24.42	42.89	100

NOTE: The sample period covers 2013:Q1 through 2019:Q4. SOURCE: Federal Reserve Form FR Y-14 and authors' calculations.

federal court district handling the case, the original chapter of the filing (e.g., Chapter 11 or Chapter 7), the number of lenders involved in the bankruptcy, any transfers of cases from one district to another, as well as information on the closing details of the bankruptcy case, such as the closing date and the closing chapter. For most dockets, there is a single bankruptcy case assigned; however, for around 18 percent of dockets, there may be multiple borrowers and bankruptcy cases, especially if the bankruptcy involves complex corporate organizations with multiple subsidiaries.

Both under Chapter 11 and Chapter 7, the borrower has protection against the disorderly liquidation of the borrower's assets pledged to creditors. In particular, Section 362 of the U.S. Bankruptcy Code provides for an automatic stay. The automatic stay prevents secured lenders from immediately repossessing pledged assets, even if all borrowing is secured. This applies to any attempts to foreclose, repossess, or otherwise take control of the collateral.

Figure A1: Corporate bankruptcy cases by chapter



NOTE: The data in panel A represent the number of bankruptcy cases filed in a quarter broken down by the original chapter of filing. Panel B examines closed cases for which the original chapter of filing differs from the chapter under which the case was closed. Panel C shows the stock of cases still pending and panel D shows the number of cases closed as percent of cases closed. SOURCE: FJC database from WRDS and authors' calculations.

Figure A1 presents information on the number of corporate bankruptcy filings by quarter since 2000, broken down by the chapter of the original filing in Panel A. Roughly half of the initial filings are under Chapter 11. However, as shown in Panel B, the chapter at closure may differ from the original chapter at the initial filing. We can see the spike in corporate bankruptcy cases filed at the onset of the Global Financial Crisis of 2007-2009, with a peak exceeding 6000 bankruptcies per quarter at the end of 2009:Q1. About 20 percent of cases originally filed under Chapter 11 are subsequently closed under Chapter 7, as shown in Panel B, with a notable peak at the beginning of our sample in 2008, when close to 40 percent of Chapter 11 filings were ultimately resolved under Chapter 7.

Panel C shows the stock of pending cases by the current chapter of the case, which peaks around 2009 and 2010 following the spike in bankruptcy filings in 2008 before declining for the remainder of the sample period. Of note is that the COVID-19 pandemic did not result in a significant increase in bankruptcy cases. This, in part, could be explained by an increase in the number of cases closed during this period, as documented in Panel D. In panel D, we examine the number of cases closed every quarter as a percentage of all the pending cases. Following the period around the GCF of 2007-2009, when the percentage of cases closed dipped to about 8 percent, the average percentage of cases closed in subsequent quarters hovered around 10 percent before spiking to about 13 percent in 2020 and then recovering to levels around 10 percent in 2021. It is also noteworthy that the percentage of cases filed under Chapter 11 that are closed every quarter is lower than the percentage of Chapter 7 cases closed.

This lower turnover of Chapter 11 cases is related to the significantly longer duration of a typical Chapter 11 case. Table 4 documents that a typical bankruptcy case filed under Chapter 11 can take anywhere from 16 months for the first quartile to more than 67 months for the third quartile. The significant heterogeneity is, in large part, explained by differences in the complexity of each bankruptcy case. More than 5 percent of cases take more than 10 years to resolve under Chapter 11. In contrast, a typical Chapter 7 bankruptcy case is resolved much faster. Such cases usually take between 2 months and 49 months to close from the date of filing. The duration of cases that involve the liquidation of the business is, on average, 12 months shorter than the average case under reorganization. Cases that are originally filed under Chapter 11 but are subsequently resolved under Chapter 7 are also resolved much faster, with a typical case taking about the same time as cases filed under Chapter 7. Cases that switch from Chapter 7 to Chapter 11 take substantially longer to resolve than cases originally filed under Chapter 11, which explains why such cases are rare, as documented in panel B of Figure A1.

There is significant variation in the time series and in the cross-section of districts regarding the duration of bankruptcy cases. Figure 4 shows the time-series variation of the observed median duration of cases at the date of closure. During the Global Financial Crisis, as the number of bankruptcy cases spiked, so did the median duration, indicative of congestion and crowding out effects. The median duration for Chapter 11 cases was above 25 months, and the median duration of Chapter 7 cases was above 15 months. The durations significantly dropped by the end of 2009 as many courts converted Chapter 11 cases to Chapter 7 (see panel B of Figure A1).

Durations bounced back to higher levels during the period from 2011 through 2016, with Chapter 11 cases hovering around 20 months and those of Chapter 7 hovering around 12 months. Durations declined in 2018 and 2019 before spiking again during the COVID-19 pandemic period, with a notable spike at the beginning of 2022. Durations declined following the end of 2022.

The significant cross-sectional differences in durations across districts can be attributed to a number of factors. First, the amount of time needed to close a bankruptcy case depends on the complexity of the debtor's financial situation, the level of cooperation between the debtor and creditors, and the existence of secured and unsecured debt with well defined liens and seniority. Second, the resolution of bankruptcies depends on whether the borrower has tangible assets, such as real estate, which are easy to evaluate and liquidate and are not specific to the debtor's business model.

A.6 Forum Shopping

In many instances, bankruptcy cases could be assigned to federal court districts outside the borrower's headquarters of incorporation. Corporate borrowers, especially large and complex organizations, have some discretion to choose the federal court district to handle their bankruptcy case in what is called "forum shopping". For example, certain districts, particularly Delaware and the Southern District of New York, are popular for large corporate Chapter 11 filings due to their perceived expertise in handling complex cases. Many companies are incorporated in Delaware, making it an easy venue choice even if their operations are located elsewhere. Large companies can file in locations where an affiliate has an existing case, which provides flexibility. Some courts are known for handling cases more quickly or for having a more debtor-friendly approach to case management. While corporate debtors have options, they must still comply with the venue statute and cannot simply file anywhere without a legitimate connection. The bankruptcy venue statute allows a debtor to file for bankruptcy in a district based on two main criteria.[30] First, the debtor's domicile, residence, principal place of business, or principal assets must have been located in the district for the majority of the 180 days immediately preceding the filing. Second, a

[30] See 28 U.S. Code § 1408 of the Bankruptcy Code for the rules regarding the selection of the court (venue) under Chapter 11.

case under title 11 may be commenced in the district court of the debtor's affiliate, general partner, or if a partnership has a pending bankruptcy case.

Forum shopping is important for borrowers seeking Chapter 11 reorganization. Table A4 lists the top 5 forum shopping districts by count of cases. Delaware was the most common destination for forum shopping as it handled more than 50 percent of all forum-shopping cases in our sample period. The second most popular destination was New York Southern district with about 20 percent of all forum-shopping cases. The bulk of forum shopping cases are filed under Chapter 11 and for most debtors, their headquarters were located over 1000 kilometers away from the court district where they filed. As a comparison, for those borrowers, the local court district was less than 50 kilometers away.

As column three indicates, the top forum-shopping districts are also, on average, significantly less likely to convert a Chapter 11 reorganization filing into Chapter 7 liquidation. The final two columns show the residual duration of cases handled by those courts. Conditioning on the observable characteristics of the borrower and local macroeconomic conditions, the average duration of Chapter 11 cases in Delaware was 9 months shorter than the median duration at other courts.

Table A4: Characteristics of top five court districts for forum shopping

District	Forum shopping		Converted	Debtor distance		Residual duration	
	Cases	Ch. 11 (%)	Ch.11-7 (%)	Forum	Local	Ch. 11	Ch. 7
Delaware	14294	90	8	1076	21	-9	19
New York Southern	5448	99	1	1425	19	13	16
Texas Southern	2633	98	1	1124	23	10	17
Virginia Eastern	439	99	2	460	63	3	1
Texas Northern	326	81	23	1422	46	2	-5
All other districts	4242	78	20	521	50	0	-1

NOTE: Forum-shopping Chapter 11 cases converted to Chapter 7 are expressed as percent of all Chapter 11 cases filed out-of-district. The debtor distance is measured in kilometers from the debtor zip code to the district in which the case is litigated (forum) and the distance to the local court district of the debtor. Residual duration is measured in months and is the median of the estimates of the district-chapter-year fixed effects from regression (4). SOURCE: FJC database from WRDS and authors' calculations.

We next examine the primary drivers for a debtor to engage in forum shopping. We examine a probit regression for all newly filed bankruptcy cases in which forum shopping occurs. The results of this analysis are summarized in Table A5. The first column contains estimates without fixed effects. The second and third columns add time fixed effects and time and district fixed effects, respectively. In the analysis, we distinguish between the local court district in which the debtor is located and the forum of shopping. The first variable indicates that the average duration of pending cases in the local district court plays a role in the choice to do forum shopping. As expected, debtors in districts with higher duration of Chapter 11 cases are more likely to choose a different court district. Next, the distance of the debtor to the local court and the district of Delaware play a role. The closer the debtor is to the district of Delaware, the more likely it is that the debtor shops for a forum given the dominance of Delaware as a preferred forum-shopping district. In contrast, the further away a debtor is from its local district court, the more likely the debtor is to also select a different forum.

Table A5: Determinants of forum shopping

	Dependent variable:		
	$\mathcal{I}\{$Forum shopping$\}, i$, new filings		
	(1)	(2)	(3)
Local district Ch.11 case duration,d, t	0.014***	0.007***	0.007***
	(0.001)	(0.001)	(0.001)
log(Distance to Delaware district court), i	−0.399***	−0.389***	−0.287***
	(0.009)	(0.009)	(0.021)
log(Distance to local district court), i	0.791***	0.777***	0.814***
	(0.008)	(0.009)	(0.009)
$\mathcal{I}\{$Num.lenders $\geq 50\}, i$	0.401***	0.396***	0.419***
	(0.020)	(0.022)	(0.023)
Debt quartile, i	0.477***	0.471***	0.444***
	(0.014)	(0.015)	(0.016)
$\mathcal{I}\{$Secured debt$\}, i$	−0.024	−0.039	−0.060*
	(0.028)	(0.029)	(0.031)
$\mathcal{I}\{$Owns real estate$\}, i$	−0.031	−0.165**	−0.131
	(0.075)	(0.079)	(0.082)
$\mathcal{I}\{$Secured debt$\} \times \mathcal{I}\{$Owns real estate$\}, i$	−0.623***	−0.390***	−0.338***
	(0.078)	(0.083)	(0.086)
Chapter 11 filing, i	0.620***	0.580***	0.510***
	(0.025)	(0.026)	(0.028)
Constant	−5.021***	−6.136***	−7.200***
	(0.068)	(0.110)	(0.307)
Time fixed effects	N	Y	Y
Local district fixed effects	N	N	Y
Observations	120,865	120,865	119,642
Log Likelihood	−11,657.830	−11,066.450	−7,862.158
Akaike Inf. Crit.	23,335.650	22,182.890	15,954.320

Debtors of large size and number of lenders are also more likely to do forum shopping as these borrowers are also more likely to file for Chapter 11. Secured debt and ownership of real estate reduce the likelihood of forum shopping, though their effects are not statistically significant. It is the interaction term that sorts debtors with both secured debt and ownership of real estate that decreases the likelihood for forum shopping. This result is likely driven by the relationships we have already established. Borrowers that have secured debt and own real estate are both likely to be resolved under Chapter 7 and face shorter case durations to begin with.

B Judicial efficiency measures

Table A6 examines the variance-covariance matrix of the judicial efficiency measures. The residual durations tend to be strongly positively correlated; that is, courts with higher residual duration of resolving Chapter 7 also tend to have high residual duration of resolving Chapter 11 cases. There is a less strong positive correlation between the residual duration of Chapter 11 with the tendency of courts to convert Chapter 11 cases to Chapter 7, and a slight negative correlation with the conversion tendency and the residual duration of Chapter 7 cases.

Table A6: Correlations among the judicial efficiency measures

	Dur. Ch.7	Dur. Ch.11	Ch.11-7
Dur. Ch.7	1	0.731	-0.022
Dur. Ch.11	0.731	1	0.075
Ch.11-7	-0.022	0.075	1

Table A7 reveals that the judicial efficiency measures are not correlated with the CRE prices except for a weak contemporaneous correlation with the tendency of courts to convert Chapter 11 cases into 7. However, the F-test fails to reject the null hypothesis that the coefficient estimates on the contemporaneous and lagged CRE price are jointly not different from zero.

Table A7: Correlations between the judicial measures and CRE prices

	Dur. Ch.11	Dur. Ch.7	Ch.11 to 7
	(1)	(2)	(3)
$P_{m,t}$	-19.496	-9.688	0.655^{*}
	(33.891)	(38.748)	(0.382)
$P_{m,t-1}$	13.252	-0.069	-0.636
	(38.673)	(40.307)	(0.386)
Observations	1,932	1,932	1,932
R^2	0.558	0.614	0.560
Adjusted R^2	0.535	0.593	0.537
R^2 (proj. model)	0.001	0.002	0.003
Residual Std. Error (df = 1834)	9.810	10.427	0.134
F-test (proj. model)	0.71	0.72	0.23

Note: *p<0.1; **p<0.05; ***p<0.01

C Controls for credit supply and demand

To control for firm-specific loan demand and bank-specific credit supply conditions, we adopt the methodology of Amiti and Weinstein (2018), which generalizes the fixed effects approach of Khwaja and Mian (2008), and decomposes growth in bank credit into idiosyncratic credit demand and credit supply factors that satisfy firm-level and bank-level moment conditions. To make this decomposition operational, we need to modify the original framework to our data. Unlike the Japanese firm-bank dataset used by Amiti and Weinstein (2018), most bank-dependent firms in FR Y-14 have a single bank relationship. As a result, we cannot identify the demand factors for the majority of borrowers in our data.

To incorporate those borrowers in the analysis, we assign borrowers into groups based on geographic location, 2-digit NAICs industry code, investment-grade status, and high or low bank dependence. This is similar to the approach taken by Degryse et al. (2019), who apply the Amiti and Weinstein (2018) decomposition to credit registry data from Belgium. The online Appendix of Amiti and Weinstein (2018) provides a discussion on how this framework incorporates Khwaja and Mian (2008) procedure and other methodologies as special cases.

We assume that all firms within a group have a common credit demand process. The characteristics of the groups are chosen with the purpose of isolating credit demand that is driven by the location of the firm and its industry, which allows us to pick up differences in the marginal product of capital across geographic areas and industries. Unlike Degryse et al. (2019), who use firm size, we group firms into more or less credit constrained using our bank dependence indicator, which groups firms into high and low bank-dependent borrowers. Low bank-dependent borrowers are all borrowers that are publicly traded and have less than 50 percent of their liabilities coming from bank debt.

To see how the decomposition works, suppose that firm f belongs to group i, then we assume that the growth in lending for that firm can be decomposed into group i common demand factor $\alpha_{i,t}$ and bank supply factor $\beta_{b,t}$.

$$\Delta L_{f,b,m,t} = \alpha_{i,t} + \beta_{b,t} + \xi_{f,b,m,t}, \tag{8}$$

such that for all firms $\{f_1, ..f_k\} \in i : \alpha_{f_1} = \alpha_{f_2} = .. = \alpha_{f_k} = \alpha_{i,t}$. The residual $\xi_{f,b,m,t}$ contains all the remaining bank-firm-market specific variation in bank credit including the effects of collateral use, collateral values, and bank credit policies across markets. For example, the decomposition does not model how a bank would allocate its extra lending capacity to the existing borrowers or to new lending relationships.

If there are no frictions, all firms in a market the bank lends to in period $t-1$ will experience the same growth in lending equal to the bank's supply factor $\beta_{b,t}$. However, if a bank's credit allocations are driven by additional variables such as the value of collateral pledged, those factors would be captured by the residual term $\xi_{f,b,m,t}$ and quantified in our baseline regressions conditioning on the bank credit supply condition.

Similarly, if a firm or groups of firms experience a positive demand shock, those firms will increase their borrowing from all banks in proportion to the demand shock. Therefore, any substitutions of borrowing across the different lenders, including due to borrowing constraints, would remain in the residual and be captured by our empirical framework conditioning on the firms' credit demand conditions.

Because the grouping of firms is based on the degree to which a firm is bank-dependent, we allow for differences in credit demand between more credit-constrained firms for which substitutions across different lenders are harder and less constrained firms for which such substitutions are easier. As we document in the main text, empirical results reveal that bank credit has different sensitivities to credit demand across the two groups of borrowers, validating the choice of these groupings. In particular, bank credit is more responsive to the credit demand conditions of less constrained, low-bank-dependent firms.

The firm loan demand factor $\alpha_{i,t}$ and the bank supply factor $\beta_{b,t}$ are constructed using the following decomposition. Suppose there are N_B banks and N_F firm groups. Then define the total credit growth of firms in group i as $\Delta L_{i,t}$ and, similarly, the total lending growth of bank b as $\Delta L_{b,t}$. Let $D_{b,t-1}$ denote the set of borrowers of bank b and $B_{i,t-1}$ denote the set of banks that i firms borrow from. Then supply and demand factors are identified as a solution to the system of equations

$$\begin{aligned} \Delta L_{b,t} &= \beta_{b,t} + \sum_{j \in D_{b,t-1}} \omega_{b,j,t-1} \alpha_{j,t}, \text{for } b = 1,..,N_B \\ \Delta L_{i,t} &= \alpha_{i,t} + \sum_{l \in B_{i,t-1}} \tilde{\omega}_{i,l,t-1} \beta_{b,t}, \text{for } i = 1,..,N_F, \end{aligned} \tag{9}$$

where $\omega_{b,j,t-1} = \frac{L_{j,b,t-1}}{\sum_k L_{k,b,t-1}}$ and $\tilde{\omega}_{i,l,t-1} = \frac{L_{i,l,t-1}}{\sum_k L_{i,k,t-1}}$ are the lagged shares of credit from the respective counterparty j for bank b and bank l for firms i.[31] A desirable feature of the Amiti-Weinstein decomposition is that it allows for easy aggregation by using the lagged loan volumes as weights.

[31] Because the system of equations contains $N_B + N_F$ unknowns but is only rank $N_B + N_F - 2$, the demand and supply factors are identified relative to a reference bank and reference group of borrowers. We select the largest bank and borrower based on loan volume. Following Amiti and Weinstein (2018), we re-normalize the demand factors relative to median firm demand factor and median bank supply factor, which removes the dependence on the choice of reference entity.

D Additional placebo tests for the collateral channel

We examine additional placebo tests to complement the analysis in section 5.2.4 of the main text. The regression analysis that mirrors the specification in Table 13. Tables A8 and A9 examine the interaction of local commercial real estate prices with firm-level indicators for high and low shares of fixed assets and whether the borrower owns commercial real estate properties, respectively. Similar to the results in Table 17 in the main test, in the additional placebo regressions, the interaction terms are not significant across all the firm outcome variables. Importantly, firms that borrow unsecured do not increase total debt or capital expenditures, even though the value of collateral of those firms changes.

Table A8: Firm-level outcomes for unsecured borrowing by high share of fixed assets

	Dependent variable:				
	Δ_4Capex	Δ_4Sales	Δ_4Total debt	Δ_4Assets	$\frac{\text{Debt}}{\text{Assets}}$
	(1)	(2)	(3)	(4)	(5)
$\widehat{P_{m,t-1}} \times \mathcal{I}\{\text{Share fixed assets} > 0.75\}_{f,t-1}$	−27.06	2.54	8.18	−0.70	1.05
	(27.33)	(1.94)	(7.14)	(1.81)	(0.74)
$\widehat{P_{m,t-1}} \times \mathcal{I}\{\text{Share fixed assets} \leq 0.75\}_{f,t-1}$	−30.13	2.64	9.17	−0.32	1.14
	(27.03)	(2.00)	(7.04)	(1.80)	(0.72)
Share of fixed assets$_{f,t-1}$	−8.71***	−0.32	0.48	−0.05	0.04
	(2.73)	(0.25)	(0.76)	(0.26)	(0.09)
log(Assets$_{f,t-1}$)	2.27***	−0.05	0.85***	0.06	0.03***
	(0.35)	(0.05)	(0.10)	(0.04)	(0.01)
Return on assets$_{f,t-1}$	0.24***	0.01**	−0.04**	0.05***	−0.001
	(0.07)	(0.01)	(0.02)	(0.01)	(0.002)
Debt-to-assets$_{f,t-1}$	−0.003	0.01*	0.10***	−0.001	0.98***
	(0.04)	(0.004)	(0.01)	(0.003)	(0.001)
$\mathcal{I}\{\text{Investment grade}\}_{f,t-1}$	0.75	0.25	−0.77	0.18	−0.21***
	(1.97)	(0.22)	(0.59)	(0.14)	(0.05)
Credit demand factor, $\alpha_{f,t}$	−0.03	0.001	−0.01	0.002	−0.001
	(0.04)	(0.004)	(0.01)	(0.003)	(0.001)
Lagged dependent variable$_{f,t-1}$	0.54***	0.68***	0.65***	0.68***	
	(0.02)	(0.01)	(0.01)	(0.01)	
Observations	46,531	46,531	46,531	46,531	46,531
R^2	0.49	0.64	0.58	0.63	0.97
Adjusted R^2	0.30	0.51	0.43	0.49	0.96

NOTE: The regression sample includes 7,153 borrowers which obtain only unsecured bank loans and never pledge real estate as collateral. For 3313 of those borrowers we have some information about ownership of real estate through purchase of real estate property. All regressions include bank-market-time fixed effects. For borrowers with multiple banks, we select as the main bank the bank with the highest committed amounts. The year-over-year percent growth rate is computed as follows $\Delta_4(x_t) \equiv 100 * \frac{x_t - x_{t-4}}{(x_t + x_{t-4})/2}$. The instrumented price index is expressed in decimals. Heteroscedasticity consistent standard errors are clustered at the MSA level. Significant at *p<0.1; **p<0.05; ***p<0.01.

Table A9: Firm-level outcomes for unsecured borrowing by real estate ownership

	Dependent variable:				
	Δ_4Capex	Δ_4Sales	Δ_4Total debt	Δ_4Assets	$\frac{\text{Debt}}{\text{Assets}}$
	(1)	(2)	(3)	(4)	(5)
$\widehat{P_{m,t-1}} \times \mathcal{I}\{\text{Owns real estate}\}_{f,t-1}$	−30.13	2.64	9.17	−0.32	1.14
	(27.03)	(2.00)	(7.04)	(1.80)	(0.72)
$\widehat{P_{m,t-1}} \times \mathcal{I}\{\text{No real estate info}\}_{f,t-1}$	−27.06	2.54	8.18	−0.70	1.05
	(27.33)	(1.94)	(7.14)	(1.81)	(0.74)
Share of fixed assets$_{f,t-1}$	−8.71***	−0.32	0.48	−0.05	0.04
	(2.73)	(0.25)	(0.76)	(0.26)	(0.09)
log(Assets)$_{f,t-1}$	2.27***	−0.05	0.85***	0.06	0.03***
	(0.35)	(0.05)	(0.10)	(0.04)	(0.01)
Return on assets$_{f,t-1}$	0.24***	0.01**	−0.04**	0.05***	−0.001
	(0.07)	(0.01)	(0.02)	(0.01)	(0.002)
Debt-to-assets$_{f,t-1}$	−0.003	0.01*	0.10***	−0.001	0.98***
	(0.04)	(0.004)	(0.01)	(0.003)	(0.001)
$\mathcal{I}\{\text{Investment grade}\}_{f,t-1}$	0.75	0.25	−0.77	0.18	−0.21***
	(1.97)	(0.22)	(0.59)	(0.14)	(0.05)
Credit demand factor, $\alpha_{f,t}$	−0.03	0.001	−0.01	0.002	−0.001
	(0.04)	(0.004)	(0.01)	(0.003)	(0.001)
Lagged dependent variable$_{f,t-1}$	0.54***	0.68***	0.65***	0.68***	
	(0.02)	(0.01)	(0.01)	(0.01)	
Observations	46,531	46,531	46,531	46,531	46,531
R^2	0.49	0.64	0.58	0.63	0.97
Adjusted R^2	0.30	0.51	0.43	0.49	0.96

NOTE: The regression sample includes 7,153 borrowers which obtain only unsecured bank loans and never pledge real estate as collateral. For 3313 of those borrowers we have some information about ownership of real estate through purchase of real estate property. All regressions include market-time fixed effects. The year-over-year percent growth rate is computed as follows $\Delta_4(x_t) \equiv 100 * \frac{x_t - x_{t-4}}{(x_t + x_{t-4})/2}$. The instrumented price index is expressed in decimals. Heteroscedasticity consistent standard errors are clustered at the MSA level. Significant at *p<0.1; **p<0.05; ***p<0.01.