Credit Market Power: Branch-level Evidence from the Great Financial Crisis

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Abstract

This paper investigates the credit market power channel of macroeconomic transmission. I propose a novel measure of competition on the asset side of bank balance sheets by estimating demand elasticities across local U.S. credit markets. My empirical approach exploits within-bank cross-regional variation in weekly changes in branch-level interest rates during the Great Financial Crisis. The average nationwide elasticity is 1.2, a low value which is consistent with localized monopolistic competition in bank lending. I show that credit market power can have real economic implications: regional variation in elasticities was a good predictor of growth in small business lending, employment, output, wages, and establishment dynamism during the Financial Crisis. My results are robust to bank heterogeneity and measures of deposit market concentration.

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1 Introduction

There is growing empirical evidence suggesting that competition in the global financial industry has declined.[1] Financial competition can have far-reaching implications for the macroeconomy, monetary policy, and financial stability.[2] However, credible estimates of competition and market power on the asset side of bank balance sheets are not readily available.[3] Is financial competition in the U.S. indeed low? What is the impact of competition and market power in the financial sector on real economic outcomes?

This paper attempts to answer these questions with two broad contributions. First, I offer new reduced-form evidence showing that nationwide credit market competition in the U.S. is low. My strategy involves estimating reduced-form elasticities of credit demand - a critical metric that measures the degree of competition in the credit market. Importantly, my estimates are robust to bank heterogeneity and measures of deposit market concentration. Second, I show that credit market competition has had a large and statistically significant effect on real economic outcomes during the Crisis. My paper is the first, to the best of my knowledge, to establish a causal transmission mechanism from credit market power to the macroeconomy.

I propose a new identification strategy that treats the 2008-2009 Great Financial Crisis as a quasi-experiment. My empirical approach involves computing within-bank, cross-regional interest rate and quantity elasticities with respect to a well-instrumented credit demand shock.[4] My approach is robust to bank heterogeneity in risk aversion[5], skill, or monitoring capacity since we study price and quantity responses to changes in local demand across branches of the *same* bank. I also control explicitly for measures of deposit market power and state-specific regulatory

[1]The U.S. banking sector has become more concentrated over the past four decades: the number of banks has fallen from 15,000 in 1980 to under 5,000 in 2020 and the loan market Herfindahl-Hirschman index (HHI) has risen by a factor of four. De Loecker et al. (2020) and Diez et al. (2018) calculate that banking markups in the U.S. and across the Globe have risen by over 100% since the 1970s. Philippon (2015) finds that the unit cost of financial intermediation is as high today as it was in 1900, despite continuing product innovation and technological progress. Monopolistic financial intermediation and rising loan markups is a potential resolution for that puzzle.

[2]Corbae and Levine (2018) review the state of the literature in their 2018 Jackson Hole Symposium address. Their work stresses in particular the theoretical interactions between competition and financial fragility.

[3]Existing studies suffer from three problems with identification. First, estimates are confounded by a plethora of bank-level factors such as risk appetite, skill, and lending opportunities. Second, one must control for the role of deposit market concentration (Drechsler et al., 2017). Finally, existing measures of competition rely on indices that capture industry *concentration*, such as the Herfindahl index (e.g. Wheelock (2011)). However, concentration may not be a valid proxy for competition (Berger et al., 2004).

[4]I use the Mian et al. (2013) cross-section of housing net worth changes over 2006-2009 as an instrument for quasi-idiosyncratic local demand shocks. Authors perform numerous validation checks and conclude that the shock is best explained only by the Saiz (2010) housing supply elasticity index, that is shown to be predetermined by geographical features such as mountains and lakes. Additionally, over the 2006-2009 period quantities and prices of consumer credit were strongly positively correlated. This makes it unlikely that the housing shock identifies shifts in credit supply, in which case we would witness a negative association between quantities and rates.

[5]Coimbra and Rey (2019) show that cross-sectional heterogeneity in banks' value-at-risk constrains has significant aggregate implications for the business and financial cycles.

idiosyncracies. I find that the average countrywide reduced-form elasticity of credit demand is roughly 1.2, statistically different from zero but generally very low. A low elasticity is consistent with imperfect substitutability across local credit markets and low competition on the asset side.

An index of local credit market power is computed for 47 U.S. states.[6] First, we find that states with high local credit market power (low credit demand elasticity) experienced significantly lower small business lending over 2007-2009. That result is true for both the volume of loans and the number of new loans issued. Second, as a result of weaker lending opportunities, local economic conditions worsened considerably: states with high credit market power experienced weaker GDP and employment growth, lower wage and total income growth, and poorer establishment-level business dynamism. We can interpret these results as the first empirical evidence for the effect that local credit market competition has on local real economic outcomes. Balance sheets of imperfectly competitive financial intermediaries were instrumental in the transmission of housing net worth shocks during the Financial Crisis. This result adds to and complements existing papers that identified the important contributions of household (Mian and Sufi, 2009) and firm balance sheets (Giroud and Muller, 2017).

Literature review. Consolidation in the financial services industry has been an active area of research over the past decades. De Loecker et al. (2020) calculate that markups in banking have risen by over 100% since the 1970s. Diez et al. (2018) also document a large, 50%+ increase in markups in the U.S. financial industry over 1980-2016. Corbae and Levine (2018) review the state of the literature on financial competition in their 2018 Jackson Hole Symposium address. Their work stresses the theoretical interactions between competition, financial fragility, and monetary policy.[7]

The paper argues that financial competition and banking market power played an important role in the transmission of housing net worth shocks during the Great Financial Crisis. There is a large literature that employs granular, zipcode-level data to identify the impact of the housing market collapse on economic aggregates. Mian et al. (2013) identify the impact on consumption via household balance sheets. Authors also construct and make publically available an index of housing net worth shocks that we use in this paper. Giroud and Muller (2017) emphasize the role of firm leverage and corporate balance sheets in the transmission of consumer demand shocks. This paper's contribution is to propose banking market power and financial competition as a complementary

[6] Technically, these are state slope dummies. We could not obtain enough data for Hawaii, Mississippi, Puerto Rico, and the District of Columbia.

[7] Related recent papers include Azar et al. (2019) who analyze the relationship between bank competition and fees-setting capacities. Aguirregabiria et al. (2016) explore the link between local banking competition and diversification of geographic risk. Stavrakeva (2019) studies the impact of imperfect banking competition on emerging markets. Afanasyeva and Guntner (2019) study how bank market power complements the risk taking channel of monetary policy. A growing literature also looks at imperfect competition in the deposit market (Drechsler et al., 2017; Egan et al., 2017).

channel of transmission and amplification during the Great Recession.

The rest of the paper is structured as follows. In Section 2, I present stylized facts on US banking concentration and the Great Financial Crisis. Section 3 describes the data. Section 4 lays out the identification strategy. Section 5 presents the results. Finally, Section 6 concludes. Supplementary details are provided in the Appendix.

2 Stylized Facts

2.1 The Rise of Credit Concentration

The trend in U.S. banking concentration can be summarized with two simple facts. First, the within-industry Herfindahl-Hirschman Index (HHI) captures consolidation of market shares in the market.[8] We compute the Herfindahl using bank balance sheet data from Compustat. We build the index for total bank assets. Second, we compute the total number of active banks using FDIC data. We count the total number of active, unique bank holding companies.

Figure 1 reports the statistics. We first observe that the bank assets Herfindahl has risen sharply over the 1980-2016 period. Second, the number of active commercial banks has decreased dramatically from over 15,000 in 1980 to just under 5,000 in 2020. Taken together, these two observations strongly suggest that the credit market has become more concentrated over the years. Throughout our empirical analysis, we argue that the Financial Crisis took place when credit market concentration was close to its highest historical levels, which played a role in the transmission of consumer demand shocks.

Figure A.1 in Appendix A.1 reports the HHI for total loans as well as three sub-categories of loans: corporate, consumer, and mortgage loans. We see that the trend is somewhat concentrated in consumer loans but is still quantitatively significant for corporate and mortgage credit. We also plot the HHI for bank deposits and total equity and observe similar trends.

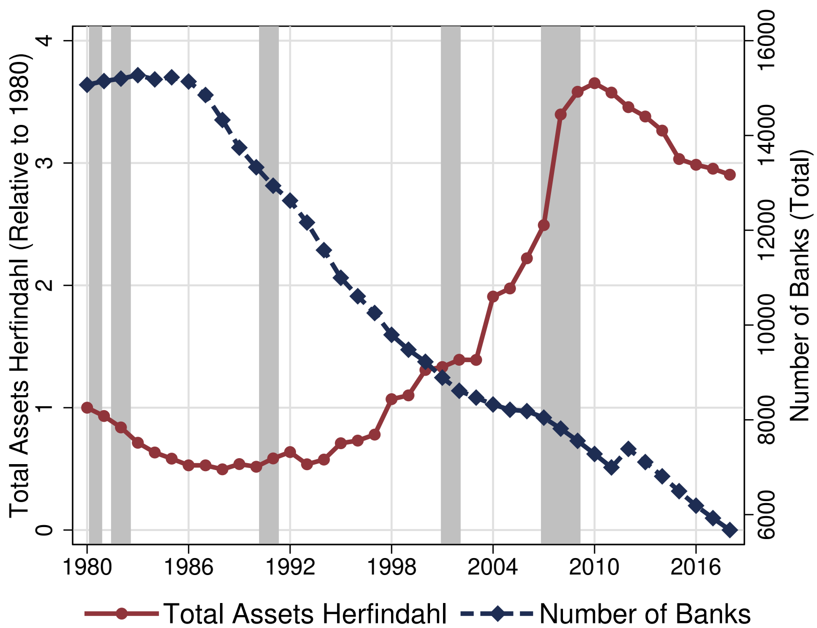
2.2 Small Business Lending

The first fact of the Financial Crisis that we focus on is the collapse in small business lending. Bank-dependency of non-financial firms as a perennial feature of the Crisis has been a focal point of the literature for years. Among many others, some of the most salient studies include Ivashina

[8] The HHI_t of x_{jt} is defined using the usual formula, where s_{jt} is the share of bank j in market x in time t:

$$H_t(x) = \sum_{j}^{N_t} s_{jt}(x)^2$$

Figure 1: **The Rise of Credit Concentration**



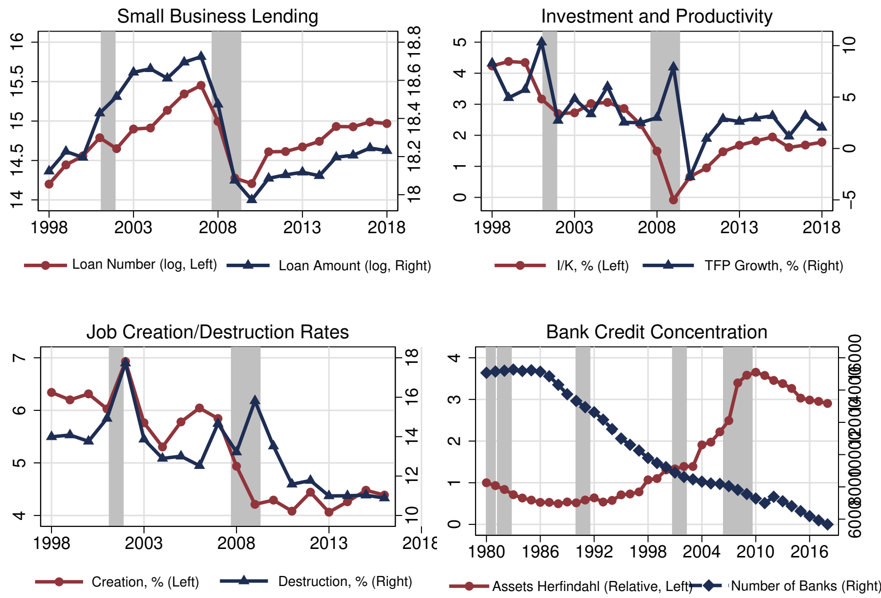
Note: The Herfindahl-Hirschman index for U.S. commercial banks total assets and the number of unique bank holding companies. Data sources: Compustat Bank Fundamentals and FDIC. Shaded areas are U.S. recessions based on the NBER classification.

and Scharfstein (2010), Chodorow-Reich (2013), Justiniano et al. (2019), and Favara and Imbs (2015). Recently, Bord et al. (2017) and Chen et al. (2017) showed using granular microeconomic data that strong local dependency on banks that experienced negative shocks during the Crisis led to persistently weaker local economic outcomes. In order to illustrate this point, we obtain regional data on small business lending from the U.S. Federal Financial Institutions Examination Council, which is available as part of the Community Reinvestment Act. We compute the total volume of loans granted and the number of unique new loan contracts. As can be seen from Figure 2, both series have declined considerably during the Crisis and have barely rebounded to pre-crisis levels as of 2018.

2.3 Investment and Productivity

The second feature of the Crisis is the collapse of the investment to capital ratio and of the measured TFP. The investment to capital ratio is constructed as the ratio of net private domestic investment to the total stock of private fixed assets. Both series are from the U.S. Bureau of Economic Analysis. The TFP series is the utilization-adjusted quarterly TFP series for the U.S. Business Sector from Fernald (2014). Figure 2 plots the two series. Investment has been on the

Figure 2: **The Great Financial Crisis - Some Stylized Facts**



Notes: Top-left panel plots the time-series of bank lending to small businesses: total volume and the number of new contracts. Both data series are in logs and are from the U.S. Federal Financial Institutions Examination Council. The top-right panel plots the time-series of the investment to capital ratio and TFP growth. The investment to capital ratio is constructed as the ratio of net private domestic investment to the total stock of private fixed assets. Both series are from the U.S. Bureau of Economic Analysis. The TFP series is the utilization-adjusted quarterly TFP for the U.S. Business Sector from Fernald (2014). The bottom-left panel plots aggregated establishment-level job creation and destruction rates. Both series are from the Bureau of Economic Analysis. The bottom-right panel plots the the time-varying Herfindahl-Hirschman index for the U.S. commercial bank total assets and the number of active banks. Data is from Compustat.

downward trajectory since the early 1980s, a point that we will return to in later sections. However, 2008-2009 was associated with a dramatic drop much beyond what was predicted by a linear trend. Business sector TFP had also declined considerably in 2009. In our cross-sectional empirical analysis, we will attempt to reconcile the two facts with the credit markup channel of economic transmission.

2.4 Business Dynamism

Finally, we also report time-series statistics on business dynamism. The gradual slowdown of business dynamism in the U.S. has a been a focal point of research for the past decade. The literature has linked sluggish business dynamism with the rise of market concentration (Akcigit and Ates, 2019). In this paper, we argue that concentration in the *credit market* has played an important contributing factor. We capture business dynamism with two benchmark indicators -

establishment-level job creation and destruction rates. We obtain the series from the BEA and plot them in Figure 2. We observe that the Crisis was accompanied by a sharp decline (spike) in job creation (destruction) rates. Our cross-sectional analysis will show that these facts are correlated with the aforementioned decline in small business lending, which was in turn related to credit market power and concentration.

3 Data

We now describe and summarize the data that is used in the empirical analysis.

Loan rates. Data on loan interest rates comes from RateWatch, subsidiary of S&P Global since 2018. They collect weekly data on interest rates on various loan products such as auto, home equity, commercial loans, etc. Our weekly dataset spans January 2001-January 2020. We are particularly interested in the data on home equity (HE) loan rates[9]. HE loan products are particularly in high demand if the underlying of the credit (residence) is appreciating in value. Because our time period of interest is the immediate build-up to and aftermath of the U.S. Housing Crisis (precisely, 2006-2009), we believe that HE credit is ideal for our purposes of identifying local credit demand elasticities.

Within the HE product space, data is available for 5 different maturities and 3 different loan to value ratios (LTV). Our baseline analysis will focus on the average HE loan rate, however we will also explore heterogeneity by loan maturity and LTV. The unit of aggregation is branch-week. Each branch carries a unique identifier and is matched with the underlying bank holding company. We use FDIC bank identifiers to match all banks with accounting data from Call Reports. RateWatch reports whether each given bank branch is an active rate-setter for a particular product. We restrict our main estimation sample to active rate-setters for HE loans, which constitute roughly 30% of all unique branches. We also eliminate all suspicious observations such as rates that are above 100% p.a. or below the risk-free rate.

Bank data. Bank data is from the U.S. Call Reports that are provided by the Federal Reserve Bank of Chicago. We have accessed these data through Wharton Research Data Services. The data we are interested in is quarterly balance sheet information on loans to individuals, total loans, and real estate loans. We construct a proxy for commercial loans as total loans minus real estate and individual loans. The dataset spans January 2001-December 2020. Call Report data is matched with RateWatch using the FDIC bank identifier.

[9]Home equity loans are secured secondary-market consumer loans that allow mortgagors to borrow against their residential equity. Effective loan amounts are equal to the difference between the mortgage's current balance and the market value of the residence. HE loan products are not to be confused with home equity lines of credit which provide borrowers revolving lines of credit and adjustable rates.

Local demand shocks. I instrument local (in a spatial sense) idiosyncratic demand for bank credit with housing net worth shocks from Mian et al. (2013). The housing net worth *shock* is defined as variation in net worth that comes from changes in house prices, normalized by initial net worth. The cross-section of housing shocks is for the 2006-2009 period. We were not able at this time to obtain county-level data. However, data at the level of a core-based statistical area (CBSA) is publically available.

Deposit market concentration. We obtain county-level data on deposit market concentration (the Herfindahl-Hirschman index) from Drechsler et al. (2017) and aggregate them to the level of a CBSA or a state, depending on the exercise. We refer the interested reader to that article for further details on the sample and index construction.

Small business lending. We collect county-level data on bank lending to small business from the Federal Financial Institutions Examination Council. The data is made available through the Community Reinvestment Act, a federal law enacted in 1977 to encourage depository institutions to meet the credit needs of low- and moderate-income neighborhoods.

County data. Regional data on GDP, employment, business dynamism, worker compensation is collected from the U.S. Bureau of Economic Analysis. All data is aggregated to the level of a CBSA or state using the FIPS crosswalk provided by the National Bureau of Economic Research.

Summary Statistics Table 1 provides a comprehensive summary of all key data used in the empirical analysis that is to follow. The first panel summarizes branch-level interest rate data from RateWatch. The data is over January 2001-December 2020. The dataset covers information from over 18,146 unique bank branches throughout the U.S. As mentioned before, we work with active rate-setting branches only. This reduces the sample to 9907 branches and 24.19 million records. Throughout the paper, as mentioned before, we zoom in on home equity (HE) loans as our main price variable. The average HE interest rate pooled across all branches and years is 2.57% p.a. and ranges from just over 10 bps to 15+% p.a.

Rows 2-4 and 5-7 of the first panel provide summary statistics of the HE product by LTV and loan maturity, respectively. Both cuts of the data serve as useful validation checks and dimensions for heterogeneity analysis. First, LTV of a loan captures its fundamental credit riskiness, ceteris paribus. Higher LTV products are thus typically priced at higher rates. Second, loans with longer maturity usually carry greater inherent interest risk for the lender and thus demand an equilibrium premium. Both risk factor prices are clearly visible from the table: rates scale by LTV (from 3.99% for <80% to 5.32% for 91-100%) and by maturity (from 3.91% for 5 years and 4.28% for 15 years). The second panel of Table 1 summarizes bank balance sheet data from the Call Reports. Our key quantity variable of interest is commercial credit, which varies from just above $1 million to almost $274 billion. Bank-level data is pooled across all quarters over 2006q1-2009q4.

Table 1: **Summary Statistics**

	Mean	Std. Dev.	Min	Max
Branch Interest Rates (Ratewatch)				
H.E.L. Interest Rate (Pooled)	2.57	1.85	0.11	15.38
H.E.L. Interest Rate (LTV <80%)	3.99	1.77	0.33	12.99
H.E.L. Interest Rate (LTV 81-90%)	4.45	1.92	0.49	20.66
H.E.L. Interest Rate (LTV 91-100%)	5.32	2.13	0.63	21.81
H.E.L. Interest Rate (60months)	3.91	2.18	0.66	32.75
H.E.L. Interest Rate (120months)	4.15	2.28	0.66	35.62
H.E.L. Interest Rate (180months)	4.28	2.38	0.75	65.51
Observations	Rate-Setting Branches	9907	Records	24.19 Mil
Bank Quantities (Call Reports)				
Total Credit	861 Mil	14.2 Bil	15 Mil	756 Bil
Commercial Loans	244 Mil	4.78 Bil	1 Mil	274 Bil
Real Estate Loans	496 Mil	7.71 Bil	2 Mil	478 Bil
Loans to Individuals	115 Mil	2.72 Bil	1 Mil	168 Bil
Observations	Banks	8519	Records	147,383

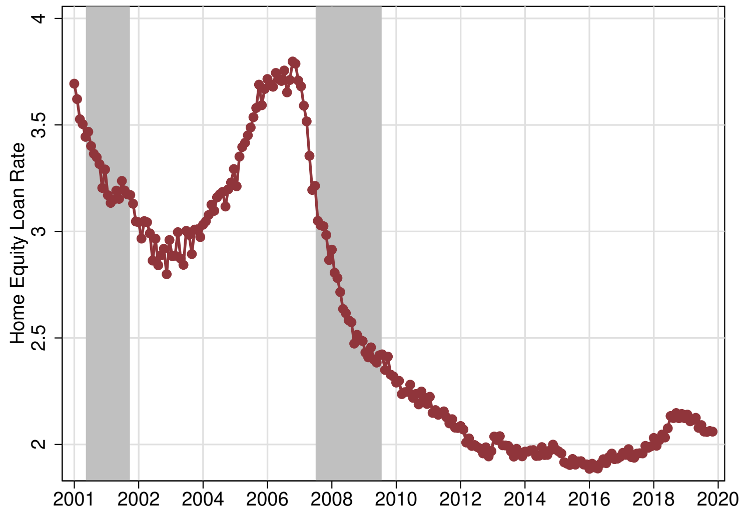
Notes: This table summarizes all data used in this paper's empirical exercises. The top panel presents summary statistics on bank branch-level interest rates on home equity loan (H.E.L.) products. Weekly rate data over 2001:w1-2020:w1 comes from RateWatch. The second panel presents summary statistics on bank loans. Quarterly loan data over 2001:q1-2020:q1 comes from the Chicago Federal Reserve Bank's Call Reports.

Figure 3 plots the average interest rate on home equity loans across all maturities and LTV ratios. The period of particular interest for us is 2007-2009, which coincides with the price response to the 2006-2009 housing demand shock. Note that the rate has decreased substantially during the direct aftermath of the housing price collapse. Quantitatively, the decline is staggering: from the global peak rate of roughly 3.75% p.a. at the end of 2007, the price has collapsed by 33% to about 2.5% p.a. in 2009. Coupled with a simultaneous decline in aggregate housing net worth, this implies a negative shock to credit *demand*. For the remained of the empirical part, the research question for us is whether the high price sensitivity w.r.t. to this demand shock (a) also arises in the geographical cross-section and (b) had any implications on real economic activity.

Figure A.2 in Appendix A.1 cuts the average home equity loan rate alongside two dimensions. The left panel plots the prices on products with different Loan-to-Value ratios; the right panel - with different maturities.[10] Three observations are worth stating. First, the price spread is consistent with the two corresponding risk factors: rates are on average the highest for products with high LTV and long maturity. Second, the 2007-2009 change in HE loan rates was not driven by any particular

[10]We focus on the three HE product maturities that have the most observations.

Figure 3: **Home Equity Loan Interest Rate**



Notes: Time-series of monthly interest rates on home equity loan products. The series is pooled over all maturities and Loan to Value (LTV) ratios. Data comes from RateWatch.

sub-group of the dataset: rates have adjusted in unison for all LTV ratios and maturities. Third, the LTV rate spread has compressed considerably during the housing crisis. The compression was driven particularly by the fall in rates on products with the highest, 91-100%, LTV ratios.

Finally, Figure A.3 in Appendix A.3 presents a descriptive map of state-level credit market concentration across the U.S. The top panel plots the geographical variation of the Herfindahl-Hirschman index for all bank loans. The bottom panel presents the HHIs for personal loans and commercial loans. There is substantial variation in credit market concentration across geographical areas with the indices ranging from 0.02 (very low concentration) to 0.99 (total concentration). Not only is the average level of credit concentration high, but cross-state dispersion is also considerable. In our empirical exercise, we will determine if our estimated measure of state-level credit market competition is correlated with this index of concentration.

4 Identification

Our empirical approach estimates credit demand elasticities by exploiting bank branches' loan price and quantity responses to the 2006-2009 build-up and collapse of housing wealth in the U.S. We instrument shifts in the credit demand curve with spatial variation in housing net worth. Our main right-hand-side variable is the Mian et al. (2013) housing net worth shock $\mathrm{H_c}$, indexed by U.S. core-based statistical areas (CBSA) c. The shock is defined as a price-driven change in regional housing net worth from 2006 to 2009. Our main left-hand-side price variable is the interest rate on home equity loans $r_{i,c}$ indexed by branch i in CBSA c, state s, and belonging to bank j. Similarly, the main quantity is commercial loans $q_{i,c}$, indexed accordingly.[11] Our naive specification is the following linear regression:

$$\Delta y_{i,c}^{07\text{–}09} = \beta \Delta H_{c}^{06\text{–}09} + \epsilon_{i,c} \tag{1}$$

where Δy is the percentage change in either the quantity or the price of loans for bank j's portfolio in branch i and state $s(c)$, both from 2007 to 2009.

Before proceeding, we note that branch-level credit quantity data is not available. We impute that information with the following procedure. First, we take advantage of branch-level information on total deposits from RateWatch. This data is available for many bank branches across the country. We then aggregate total deposits to the level of a bank portfolio. We compute deposit leverage of each bank for the total countrywide balance sheet. Leverage is defined as the ratio of total deposits to total loans. Finally, we assume that banks establish their preferences for risk-taking at the franchise level. In other words, deposit leverage that is acceptable at the level of the whole franchise will also be adhered to (on average) within the bank and across individual geographical locales. We thus take the countrywide bank-level deposit leverage ratio and use it to impute branch-level total, commercial, real estate, and individual loans with the help of branch-level total deposits. This imputation approach serves one main purpose: to have a ballpark gauge for the quantity elasticity and to make sure that it is not very large. The key step in our analysis is the estimation of price elaticities, for which we do have quality data at the branch level.

There are at least five significant challenges to identification based on the naive specification 1. First, our approach to identify reduced-form credit demand elasticities rests on the ability to disentangle credit *demand* and *supply* effects of the total response to the housing shock. We are therefore worried that our main coefficient of interest β could be confounded by bank-side factors. For example, high local price elasticity could be correlated with banks' capacity to diversify local idiosyncratic risks, monitoring skills, or aversion to risk-taking. A valid empirical test therefore separates demand elasticities from measures of bank lending skill and opportunity. To this end, we introduce bank fixed effects μ_j into the naive specification 1. By comparing branch-level credit portfolios *within* the same bank, we absorb all time-invariant bank-specific factors into the fixed effect.

A second considerable challenge to identification is deposit market power. In an important paper, Drechsler et al. (2017) document rich heterogeneity in deposit market concentration across U.S. counties. This cross-sectional variation in deposit market power is shown by the authors to carry information that is useful to sort areas by their sensitivity to aggregate monetary policy shocks. It's therefore possible that what we are identifying in β is in fact market power on the

[11] We perform additional robustness checks with alternative types of loans and the results do not change.

liability side of the bank balance sheet. To combat this problem, we formally control for the deposit market Herfindahl index, made publically available in Drechsler et al. (2017).

Third, it's possible that bank competition and concentration are not necessarily related (Berger et al., 2004). We use various measures of credit market and banking concentration as explicit controls in various stages of the empirical analysis to determine if degrees of competition and concentration are correlated empirically or not.

Fourth, there could be concerns with the validity of our instrument - the housing net worth shock. For example, the shock series could be reflective of an array of confounding factors such as financial literacy or local demographics. Mian et al. (2013) perform a plethora of validation checks and find that the only factor that consistently explains the spatial variation in housing net worth shocks is the Saiz (2010) housing supply elasticity. This elasticity is shown by Saiz (2010) to be largely predetermined by geographic terrains such as lakes, and mountains. These features are validated using complex geographic information system (GIS) techniques. To first order, the housing net worth shock is thus driven by factors that are beyond any realistic control of credit market participants.

Fifth, differences in state-level legislature and tax regimes could also confound our estimates of β. For example, borrowers of certain type could self-select into establishing in and/or borrowing from credit markets that are more or less structurally competitive or concentrated. Giroud and Rauh (2019) estimate large corporate tax elasticities and find evidence of substantial state tax-induced capital flows and reallocation of resources. The geographical re-distribution of firm productivity could then endogenously explain why banks can exert more credit market power in certain areas. For these reasons, we also introduce a state fixed effect into the naive specification.

The baseline regression now takes on the following form

$$\Delta \mathrm{y}_{\mathrm{i,c}}^{07\text{–}09} = \mu_{\mathrm{j(i)}} + \mu_{\mathrm{s(c)}} + \beta \Delta \mathrm{H}_{\mathrm{c}}^{06\text{–}09} + \gamma \mathbf{X} + \epsilon_{\mathrm{i,c}} \tag{2}$$

where $\mu_{\mathrm{j(i)}}$ and $\mu_{\mathrm{s(c)}}$ are, respectively, bank and state fixed effects and $\mathbf{X}$ is a vector of controls that includes measures of deposit market concentration, credit market concentration, and banking concentration (number of branches in CBSA c). We also control explicitly for branch size, proxied by total deposits registered in the branch's books. The reduced-form credit demand elasticity $\hat{\theta}$ is then measured as the ratio of the quantity to rate elasticities, both with the respect to the housing shock:

$$\hat{\theta} = \frac{\hat{\beta}_{\mathrm{q}}}{\hat{\beta}_{\mathrm{r}}} = \frac{\partial \Delta \mathrm{q}_{\mathrm{i,c}}}{\partial \Delta \mathrm{H}_{\mathrm{c}}} / \frac{\partial \Delta \mathrm{r}_{\mathrm{i,c}}}{\partial \Delta \mathrm{H}_{\mathrm{c}}} \tag{3}$$

A necessary condition for rejecting the null of perfect credit market competition is for the denominator in Equation 3 to be positive and statistically significantly different from zero.

Table 2: **Average Interest Rate Elasticity**

	(1)	(2)	(3)	(4)	(5)	(6)
Housing Shock	1.12	1.34	1.27	1.44	1.07	1.22
	(0.35)	(0.54)	(0.57)	(0.56)	(0.55)	(0.82)
Deposit Concentration			-0.43			
			(0.45)			
Banking Concentration				0.03		
				(0.04)		
Credit Concentration					0.06	
					(0.29)	
Branch Deposits						-0.01
						(0.02)
Bank FE	N	Y	Y	Y	Y	Y
State FE	N	Y	Y	Y	Y	Y
Observations	1284	297	295	297	288	201
R-squared	0.01	0.48	0.48	0.49	0.50	0.50

Notes: Estimates from linear regressions of branch-level changes in interest rates on home equity loans on the CBSA-level housing net worth shock. The dependent variable is pooled over all maturities and loan to value ratios at the level of a branch. The dependent and independent variables are built over 2007-2009 and 2006-2009, respectively. Column 2 introduces bank and state fixed effects into the basic specification 1. Columns 3-4 introduce deposit market Herfindal and banking concentration controls, respectively. The banking concentration control is the (log of) number of unique bank branches per CBSA as of 2006. Column 5 introduces a credit market concentration control - credit market Herfindahl that is built on commercial loans as of 2006. Column 6 introduces branch-level (log) deposits as of 2006 as an additional control. Credit data is from the Chicago Federal Reserve Bank's Call Reports. Interest rate data is from RateWatch. Housing net worth shocks come from Mian et al. (2013). Deposit market concentration data is from Drechsler et al. (2017). Deposit data is from the FDIC. Standard errors are clustered at the bank level.

5 Empirical Results

We now proceed with presenting the first set of empirical results. First, we estimate the interest rate elasticity with respect to the housing net worth shock. Table 2 reports the results. The dependent variable is the (log) difference in the average interest rate on home equity loans, pooled across all maturities and LTV ratios. We note first and foremost that throughout all specifications that have been tried the rate elasticity is statistically significant from zero. Column 1 is the naive specification without any fixed effects. Column 2 introduces bank and state fixed effects. The mean rate elasticity is 1.34 and statistically different from 0 at the 5% level. The R^2 of the model is 48%.[12]

In columns 3-6 we conduct several robustness checks. First, in column 3 we control for the

[12]Sample coverage is not higher because (a) the housing net worth shock is not available for all CBSAs, (b) we restrict the sample only to those bank branches that offer home equity loan products, and (c) we focus on active rate-setting branches only.

Figure 4: **Branch-Level Interest Rate Outcomes**

Notes: A binned scatter plot of the regression of bank branch-level home equity loan rate changes on local housing net worth shocks. The specification behind the figure is Equation 2

deposit market concentration measure from Drechsler et al. (2017). Technically, this is the pooled CBSA-level deposit market Herfindahl index. We find no statistically meaningful relationship between deposit market power and the HE loan rate changes. In addition, the coefficient β on the housing shock does not change qualitatively. In column 4 we control for a broader measure of banking concentration - the (log) number of bank branches per CBSA. Similarly, we find nothing there. Further, in column 5 we introduce the Herfindahl index that is based on commercial loans. Interestingly, we find no statistically significant association with interest rate changes, although point estimates drop slightly. Finally, in column 6 we also control for branch size, proxied by branch-level (log) deposits as of 2006. Again, we find a quantitatively similar outcome.

To illustrate our price elasticity results visually, we also present in Figure 4 the binned scatterplot of the estimates in column 1. Each dot represents 20+ branch-level observations. By eyeballing the picture we can see that the clear positively-sloped linear fit is not driven by extreme outliers. Formally, we verify that our results cannot be significantly affected by alternative modes of winsorization or truncation (at 1% or 5% levels). In addition, if the credit supply monopolist indeed faces a downward sloping demand curve for credit, then the price curve must be positively sloped and significant. The steeper the price curve is, the stronger the structural departure from perfect competition.

We now explore two dimensions of heterogeneity in our analysis of the price elasticity: het-

Table 3: **Average Quantity Elasticity**

	(1)	(2)	(3)	(4)	(5)	(6)
Housing Shock	0.30	1.37	1.36	1.38	1.52	1.89
	(0.72)	(0.54)	(0.54)	(0.54)	(0.53)	(0.69)
Deposit Concentration			0.25			
			(0.47)			
Banking Concentration				-0.01		
				(0.08)		
Credit Concentration					-0.38	
					(0.20)	
Branch Deposits						0.05
						(0.02)
Bank F.E.	N	Y	Y	Y	Y	Y
State F.E.	N	Y	Y	Y	Y	Y
Observations	243	124	124	124	115	117
R-squared	0.00	0.38	0.39	0.38	0.44	0.40

Notes: Estimates from linear regressions of bank branch-level changes in commercial credit on the CBSA-level housing net worth shock. Commercial credit is constructed from subtracting real estate loans and loans to individuals from total loans. The dependent and independent variables are built over 2007-2009 and 2006-2009, respectively. Column 2 introduces bank and state fixed effects into the basic specification 1. Columns 3-4 introduce deposit market Herfindal and banking concentration controls, respectively. The banking concentration control is the (log of) number of unique bank branches per CBSA as of 2006. Column 5 introduces a credit market concentration control - credit market Herfindahl that is built on all loans as of 2006. Column 6 introduces branch-level (log) deposits as of 2006 as an additional control. Credit data is from the Chicago Federal Reserve Bank's Call Reports. Housing net worth shocks come from Mian et al. (2013). Deposit market concentration data is from Drechsler et al. (2017). Deposit data is from the FDIC. Standard errors are clustered at the bank level.

erogeneity by LTV ratios and maturity length. Table A.1 in Appendix A.2 reports the results. First, LTV heterogeneity offers qualitatively similar outcomes - while point estimates drop relative to the baseline, they all remain statistically different from zero. Second, estimates for loans with maturities of 5, 10, and 15 years are 0.81, 1.00, and 0.63, respectively. The first two point estimates are statistically significant at the 5% level. The number of observations for loans with maturity of 15 years is low, and that particular sample is dominated by outliers in the right tail, with both factors contributing to a noisier estimate. Overall, we find that our baseline price elasticity result seems to be concentrated in low-LTV, low-to-medium maturity loans.

We conclude that the loan rate elasticity with respect to housing net worth shocks is (a) statistically different from 0 and (b) large in absolute value. We also find that our estimates are not affected by potentially confounding factors that include bank and state heterogeneity, deposit and credit market concentration, and branch size.

We now continue by reporting results for the quantity elasticity of demand. Table 3 presents quantity elasticity estimates using our imputed measure of branch-level commercial loans. First, we observe immediately that point elasticities are around 1.36-1.86 and statistically different from 0. Importantly, these point estimates are very low. Second, estimates do not change in any material way after we control for branch size or measures of deposit, banking, and credit concentration. Tables A.2, A.4, A.3 in Appendix A.2 report quantitatively very similar results for the imputed measures of total loans, individual loans, and real estate loans. Point estimates range from 1.17 to 1.96, are statistically different from 0, but again are not large.

5.1 Reduced Form Credit Demand Elasticity

Using our regression results for the credit rate and quantity responses, we can now compute the average reduced form credit demand elasticity. Assuming a conservative estimate of the average quantity elasticity of 1.32 and the rate elasticity of 1.12 (column 1 of Table 2) the ratio in expression 3 is:

$$\hat{\theta} = \frac{\hat{\beta}_{\mathrm{q}}}{\hat{\beta}_{\mathrm{r}}} = \frac{1.32}{1.12} = 1.18 \tag{4}$$

The average $\hat{\theta}$ in the U.S. is very low, in fact close to a unit elasticity. An elasticity of 1.2 implies a constant credit markup of 6, much greater than what is suggested in the recent study by De Loecker et al. (2020). Recall that some of our $\hat{\beta}_{\mathrm{r}}$ estimates for different levels of LTV ratios or maturity were lower. The smallest in absolute terms point estimate of 0.54 - corresponding to column 2 of Table A.1 - still yields a $\hat{\theta}$ of 2.44. In summary, our results imply an inelastic credit demand curve and imperfect competition on the asset side of bank balance sheets.

5.2 Spatial Heterogeneity and Economic Outcomes

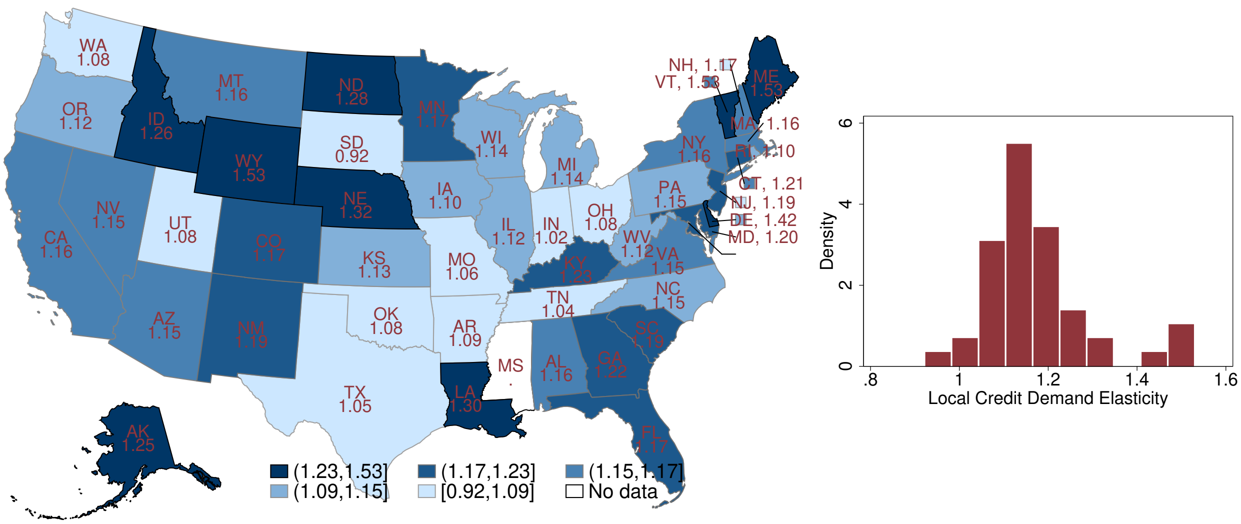
Having computed the *average* nationwide credit demand elasticity, we now construct a regional cross-section of *local* elasticities. Specifically, we re-estimate our baseline specification while also allowing for state-level slope shifters. Formally, we now estimate the following linear regression:

$$\Delta \mathrm{y}_{\mathrm{i,c}}^{07\text{–}09} = \mu_{\mathrm{j(i)}} + \beta_{\mathrm{s}} \left[\mathrm{state}_{\mathrm{s}} \times \Delta \mathrm{H}_{\mathrm{c}}^{06\text{–}09} \right] + \gamma \mathbf{X} + \epsilon_{\mathrm{i,c}} \tag{5}$$

where, again, Δy is the percentage change in either quantity or prices of loans for branch *i*, belonging to bank franchise *j*, located in CBSA *c* and state *s*. The spatial distribution of $\hat{\theta}_{\mathrm{s}}$ is thus:

$$\hat{\theta}_{\mathrm{s}} = \frac{\hat{\beta}_{\mathrm{s}}^{\mathrm{q}}}{\hat{\beta}_{\mathrm{s}}^{\mathrm{r}}} \tag{6}$$

Figure 5: **Local Credit Demand Elasticities**

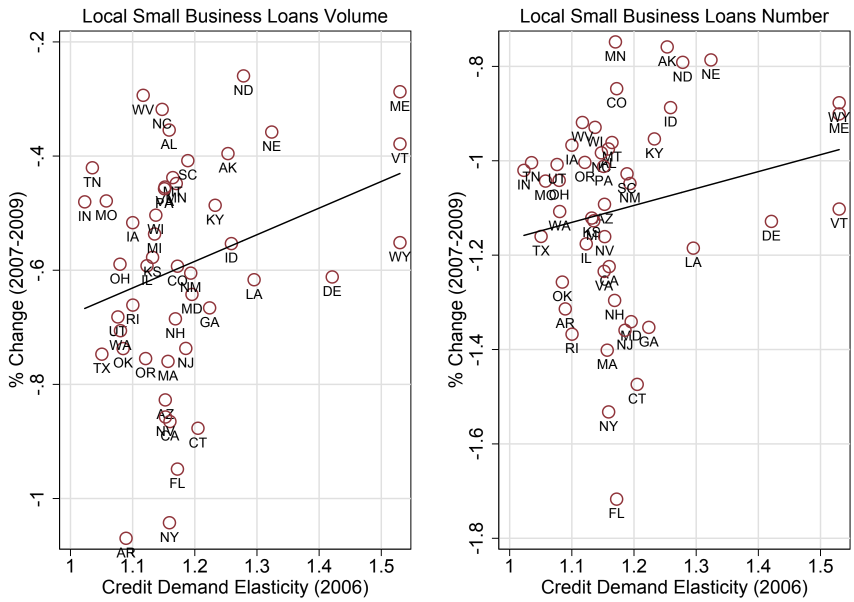


Notes: estimates of local credit demand elasticities for 47 U.S. States. High elasticity (darker color) implies high local banking competition. These estimates are computed in three steps. First, the cross-section of loan rate elasticities is calculated by regressing bank branch-level changes in interest rates on home equity loans onto the CBSA-level housing net worth shock. The dependent and independent variables are for 2007-2009 and 2006-2009, respectively. The specification includes state-level slope shifters. The loan quantity elasticity is obtained in similar fashion using an imputed measure of branch-level commercial loans. Second, credit demand elasticities are obtained by dividing the average quantity elasticity estimate by the full cross-section of state-level slope shifters from the price elasticity regression. Finally, the resulting distribution is linearly re-scaled and has its mean fixed at 1.2, the average linear effect. Interest rate data is from RateWatch. The housing net worth shock is from Mian et al. (2013). Bank lending data is from the Chicago Fed Call Reports.

In this exercise we are relaxing the assumption that the sensitivity towards the housing shock was homogenous across all U.S. states. We proceed in three steps. First, we collect the univariate distribution of slope shifters $\hat{\beta}^r_s$. Second, we linearly re-scale the distribution to the [0,1] interval and subtract the mean. Then, we add 1.12 - the average reduced-form price elasticity estimate. Third, we compute $\hat{\theta}_s = \frac{1.32}{\hat{\beta}^r_s}$ and winsorize at the 99% and 1% levels. That is, all the variation in $\hat{\theta}_s$ comes from the rate elasticity, and we normalized the quantity elasticity to 1.32, which is the average effect based on Table 3. That is done because rate elasticities are identified more cleanly and in order to boost the number of state observations.

Figure 5 portrays the cross-section of $\hat{\theta}_s$ in two different formats. The left panel presents a map of the U.S. where each state is colored in different shades of blue: darker colors symbolize higher values of $\hat{\theta}_s$ or more competition in the local credit market. The right panel plots the one-dimensional histogram of all the estimates. Estimates range from 0.92 (low relative competition) to 1.53 (high relative competition). As can be seen from both pictures, cross-sectional dispersion in credit demand elasticities is considerable. Figure A.4 in Appendix A.3 plots the underlying spatial distributions of rate and quantity elasticities.

Figure 6: **Local Credit Market Power and Small Business Lending**



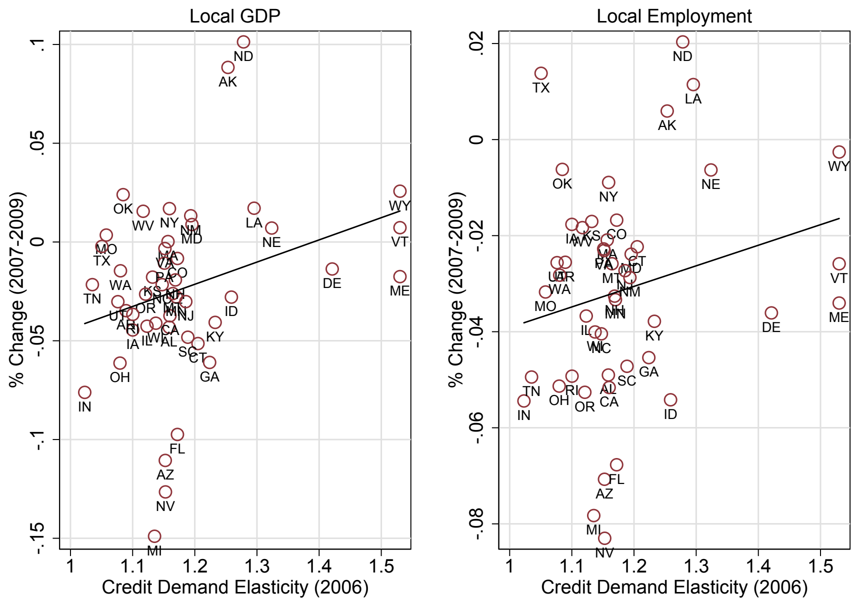
Notes: Relationship between state-level credit demand elasticities from Figure 5 (x axis) and state-level small business lending. Panel (a) plots the percentage change in the dollar volume of loans and panel (b) plots the percentage change in the number of newly issued loans. Data is from the CRA.

Impact on Small Business Lending We now begin to test whether the cross-section of state-level credit demand elasticities from Figure 5 had any meaningful impact on local financial and economic outcomes during the Great Financial Crisis. First, we check whether there was any effect on small business lending. Small firms could find sourcing funds on the equity or bond markets particularly challenging and costly and are therefore more bank-dependent than the average firm. Recent research by Bord et al. (2017) and Chen et al. (2017) explores the bank-dependency hypothesis in a spatial setting. Our independent variable throughout this exercise is the cross-section of credit demand elasticities from Figure 5. Dependent variables are various qualifiers of small business lending that we get from the CRA website.

Figure 6 and Table A.5 in Appendix A.2 report the results. Across the board, we see a strong positive correlation between $\hat{\theta}_s$ and the growth in small business lending. States with more competitive local credit markets experienced higher growth in both the number of new loan contracts and the total dollar value of business credit. From the table, we see that the effect doesn't appear to be concentrated in any loan size tier: estimates for loans under \$100K, \$250K, and \$1mil are all statistically significant. Overall, as much as roughly 12% of the growth in local small business lending over 2007-2009 could be attributed to local credit market power and competition.

Given that our estimates of $\hat{\beta}_r$ are based on home equity loan price data, one may question the

Figure 7: **Local Credit Market Power and Macroeconomic Outcomes**



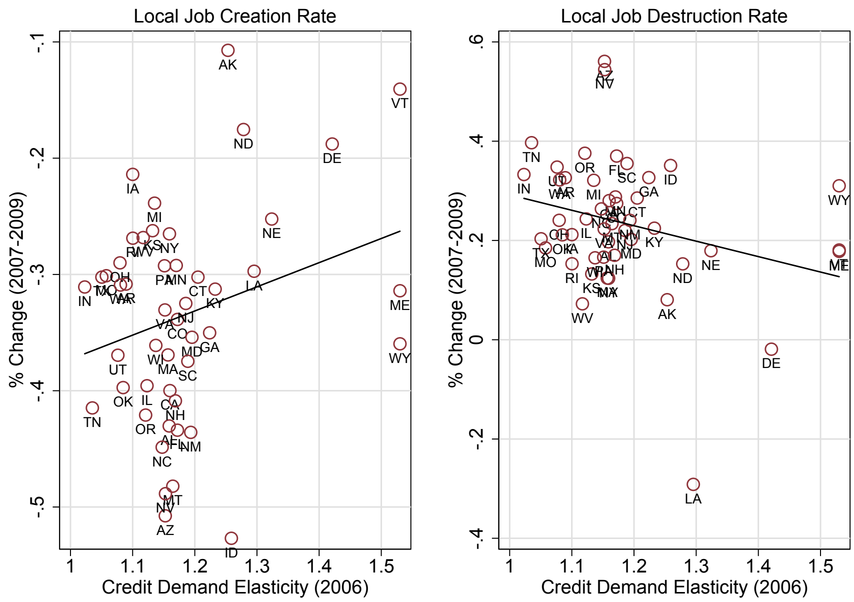
Notes: Relationship between state-level credit demand elasticities from Figure 5 (x axis) and state-level macroeconomic outcomes over 2007-2009. The left panel presents macroeconomic outcomes: % change in state-level GDP. The right panel plots the % change in total non-farm employment. Data is from the Bureau of Economic Analysis.

relevance of our estimates for other aspects of banks business such as consumer or commercial lending. In this section, we have documented that our cross-sectional distribution of $\hat{\theta}_S$ is a good predictor of the growth of small business loans, a key measure of performance for non-financial firms. This is a reassuring result for us, suggesting that elasticities are likely not heterogeneous across bank products but are instead linked to a unit of geographical space.

Real Economic Outcomes We now ask whether spatial heterogeneity in $\hat{\theta}_S$ - through the business lending channel established above - led to any significant changes in real economic activity. We use the 2007-2009 growth of state-level non-farm employment, GDP, compensation (wages), total income, and business dynamism as our dependent variables. Our RHS variable, as before, is the cross-section of $\hat{\theta}_S$ from Figure 5.

Figure 7 and Table A.6 (Appendix A.2) present the results for GDP and employment growth. We find a strong, statistically significant association between levels of local banking competition as of 2006 and growth of local economic aggregates over 2007-2009. In particular, we find that states with a larger θ experienced higher growth of local employment and output. Financial competition played a vital role in the transmission of consumer demand shocks during the Crisis. More broadly, competition and market power in the financial sector have real economic implications.

Figure 8: **Local Credit Market Power and Business Dynamism**



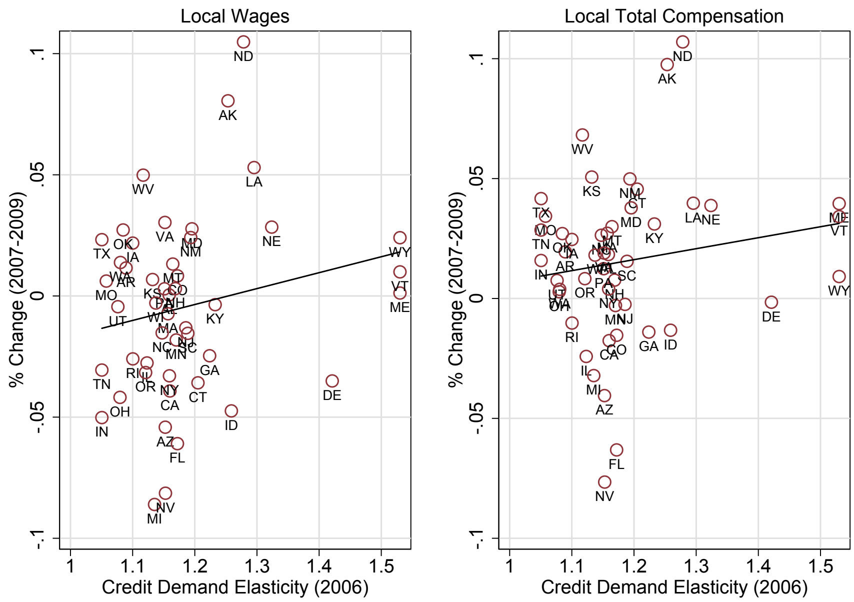
Notes: Relationship between state-level credit demand elasticities from Figure 5 (x axis) and state-level indicators of business dynamism. Left panel plots the percentage change in the aggregated establishment-level job creation rate. Right panel plots percentage change of the job destruction rate. Data is from the Bureau of Economic Analysis.

The relationship between credit market competition and the economy suggests that there is no trade-off between financial competition and economic performance. The mechanism behind this result seems to rely on the credit supply channel and bank-dependency of non-financial firms - a result we documented in the previous section.

In Figure 8 and Table A.6 (Appendix A.2) we report results on the impact of $\hat{\theta}_s$ on business dynamism indicators. We find a positive, statistically significant relationship between local credit market power and business dynamism. Specifically, we find that the local job creation rate has been higher in states with high credit market competition. In addition, the job *destruction* rate has been lower in those same high-competition states. The R^2 of these regressions is 7%-8%. Recent papers have highlighted the puzzle that is sluggish business dynamism in the U.S. Job creation and establishment entry rates in the US have been declining steadily over the years (Decker et al., 2014). Authors claim that these trends are largely driven by the shrinking contribution of high-growth young firms to economic activity. Our paper offers an explanation that is based on financial frictions: concentration and market power in the banking sector can contribute to lower investment demand of firms due to the firms' reliance on funding from intermediaries which are monopolistically competitive.

Finally, Figure 9 and Table A.6 (in Appendix A.2) present results for labor market income.

Figure 9: **Local Credit Market Power and Labor Income**



Notes: Relationship between state-level credit demand elasticities from Figure 5 (x axis) and state-level labor income indicators. Left panel plots percentage change in wage income. Right panel plots percentage change in total labor compensation. Data is from the Bureau of Economic Analysis.

We find that $\hat{\theta}_s$ were positively correlated with local wage and total compensation growth over 2007-2009. That is, states with high credit market competition also experienced more favorable labor market price outcomes. Recently, the literature on "labor market power" conjectured that workers and employers operate on a continuum of local labor markets in a way that allows firms to pay marked-down wages (Berger et al., 2020). Our paper presents a complementary view: financial frictions, particularly competition in the credit market, can spill over to non-financial firms and, through hiring and wage pricing decisions, affect labor income and compensation outcomes. More broadly, the relationship between local credit and labor markets is a novel implication of our empirical findings and an important topic for future research.

Overall, we have established two results. First, credit market competition in the U.S. is low. This finding can not be explained by bank and state heterogeneity, measures of deposit market power, or the branch scale effect. Second, we have found a strong empirical relationship between local credit market competition and real economic outcomes. More competitive local credit markets experienced significantly better outcomes during the Great Financial Crisis. Our results should not be interpreted as an argument against the demand and supply views of local propagation channels during the Recession (Mian et al., 2013; Giroud and Muller, 2017). Instead, we argue that in addition to the well-established household and firm balance sheet channels, banking competition also played a role in the transmission of consumer demand shocks. The economic mechanism behind this result is bank lending to non-financial firms that are especially bank-dependent, i.e. small businesses.

6 Conclusion

In this article I show two results. First, I measure competition on the asset side of bank balance sheets in the U.S and find that it is low. Second, I find that spatial variation in local credit market competition has had a significant effect on real economic outcomes during the Great Financial Crisis. Overall, my paper estimates and quantifies a novel channel of transmission of financial frictions to the macroeconomy - the credit market power channel.

My work suggests several an avenue for future research. We have shown that U.S. states with higher degrees of local banking competition experienced universally better real economic outcomes over 2007-2009. However, future work should take a more complete account of the measurement of local financial stability because of the canonical financial competition-stability view Hellman et al. (2000). Design of new, spatial indices of financial fragility may be necessary.

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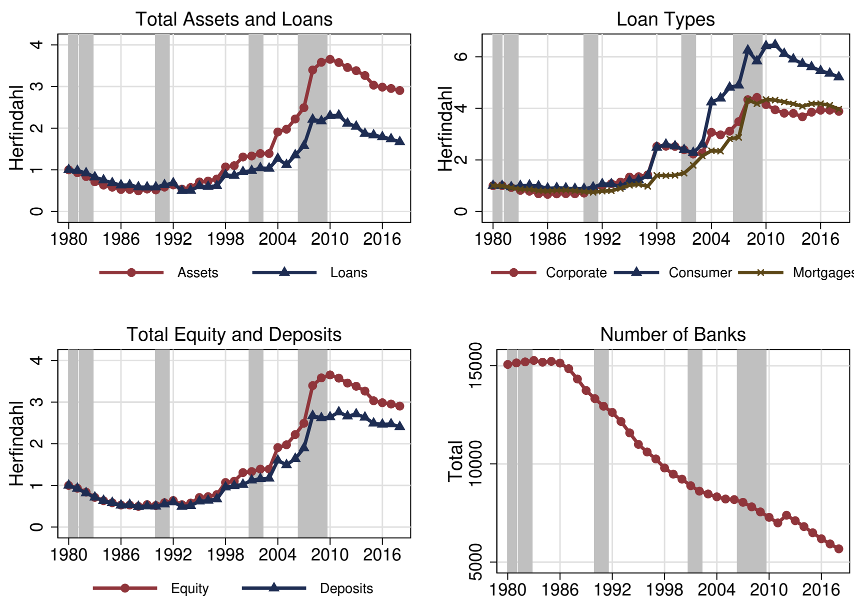
A Appendix

In this Appendix we present additional statistics and empirical evidence that supplements the main text. Section A.1 provides further details on banking concentration and the home equity loan interest rate. Section A.2 explores heterogeneity in the estimation of average quantity and rate elasticities. Section A.3 presents additional maps of local banking concentration and demand elasticities. Section A.4 reports tables with the results from regressions of local economic outcomes on the spatial distribution of credit demand elasticities. Finally, Section A.5 discusses bank branch deregulation as a potential source of spatial heterogeneity in credit demand elasticities.

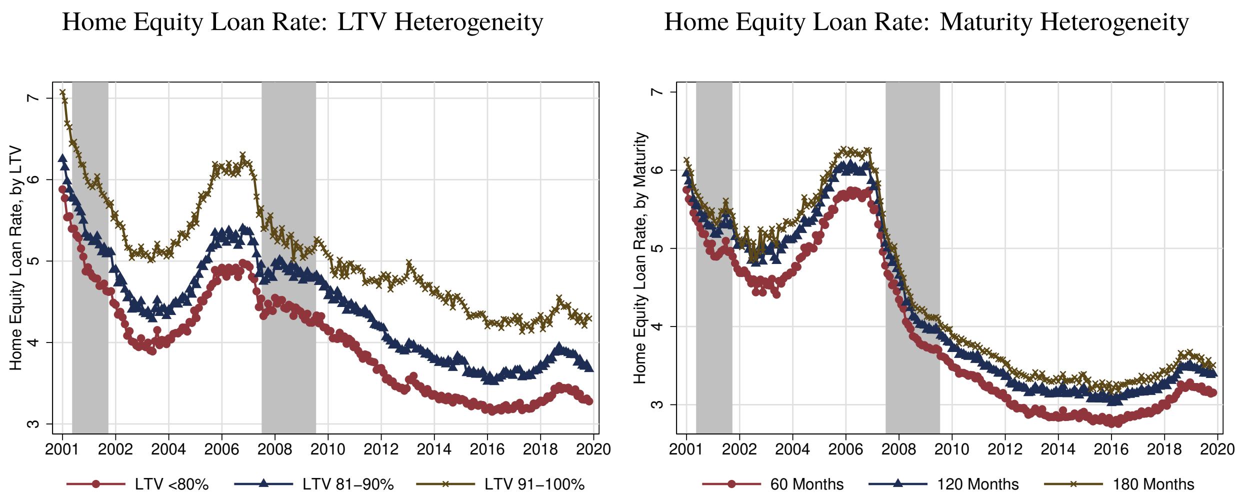
A.1 Data Summary and Further Details

Figure A.1: **Banking Concentration - Further Details**



Notes: Figure plots credit market Herfindahl indices and the number of unique bank holding companies. The Herfindahl index is relative to 1980 and is for banks total assets, total loans, total equity, total deposits, and three types of loans. Data is from Compustat and FDIC.

Figure A.2: **H.E.L. Rate Heterogeneity**



Notes: These figures plot the time-series of monthly interest rates on home equity loan products. The left panel presents the rates of different Loan-to-Value ratios. The right panel plots rates for loans of different maturity levels. All data comes from RateWatch.

A.2 Credit Rate and Quantity Elasticities - Robustness

Table A.1: **Credit Rate Elasticity: Heterogeneity**

	LTV Ratio		Loan Maturity		
	LTV <80%	LTV 81-90%	60m	120m	180m
	(1)	(2)	(3)	(4)	(5)
Housing Shock	0.79	0.54	0.81	1.00	0.63
	(0.23)	(0.23)	(0.32)	(0.46)	(0.43)
Bank F.E.	Y	Y	Y	Y	Y
State F.E.	Y	Y	Y	Y	Y
Controls	Y	Y	Y	Y	Y
Observations	311	155	274	221	178
R-squared	0.52	0.62	0.55	0.58	0.61

Notes: This table reports estimates from linear regressions of branch-level changes in interest rates on home equity loans on the CBSA-level housing net worth shock. The dependent and independent variables are built over 2007-2009 and 2006-2009, respectively. Column 1 reports estimates for loans with an LTV below 80%. Column 2: loans with an LTV between 80% and 90%. There were not enough observations for loans with an LTV of 91-100%. Columns 3-5 report results for loans with the three most liquid maturities: 60 months, 120 months, and 180 months, respectively. All specifications include bank and state fixed effects. Interest rate data is from RateWatch. Housing net worth shocks come from Mian et al. (2013) Standard errors are clustered at the bank level.

Table A.2: **Credit Quantity Elasticity: All Loans**

	(1)	(2)	(3)	(4)	(5)	(6)
Housing Shock	0.63	1.35	1.33	1.33	1.19	1.86
	(0.67)	(0.55)	(0.54)	(0.51)	(0.56)	(0.71)
Deposit Concentration			0.35			
			(0.48)			
Banking Concentration				-0.03		
				(0.06)		
Credit Concentration					-0.19	
					(0.20)	
Branch Deposits						0.05
						(0.02)
Bank F.E.	N	Y	Y	Y	Y	Y
State F.E.	N	Y	Y	Y	Y	Y
Observations	248	128	128	128	122	121
R-squared	0.00	0.48	0.48	0.48	0.49	0.49

Notes: This table reports estimates from linear regressions of bank branch-level changes in total credit on the CBSA-level housing net worth shock. The dependent and independent variables are built over 2007-2009 and 2006-2009, respectively. Column 2 introduces bank and state fixed effects into the basic specification 1. Columns 3-4 introduce deposit market Herfindal and banking concentration controls, respectively. The banking concentration control is the (log of) number of unique bank branches per CBSA as of 2006. Column 5 introduces a credit market concentration control - credit market Herfindahl that is built on all loans as of 2006. Column 6 introduces branch-level (log) deposits as of 2006 as an additional control. Credit data is from the Chicago Federal Reserve Bank's Call Reports. Housing net worth shocks come from Mian et al. (2013). Deposit market concentration data is from Drechsler et al. (2017). Deposit data is from the FDIC. Standard errors are clustered at the bank level.

Table A.3: **Credit Quantity Elasticity: Real Estate Loans**

	(1)	(2)	(3)	(4)	(5)	(6)
Housing Shock	0.71	1.32	1.31	1.30	1.17	1.83
	(0.65)	(0.55)	(0.54)	(0.51)	(0.56)	(0.72)
Deposit Concentration			0.34			
			(0.48)			
Banking Concentration				-0.03		
				(0.06)		
Credit Concentration					-0.18	
					(0.20)	
Branch Deposits						0.05
						(0.02)
Bank F.E.	N	Y	Y	Y	Y	Y
State F.E.	N	Y	Y	Y	Y	Y
Observations	248	128	128	128	122	121
R-squared	0.00	0.48	0.48	0.48	0.49	0.49

Notes: This table reports estimates from linear regressions of bank branch-level changes in real estate loans on the CBSA-level housing net worth shock. The dependent and independent variables are built over 2007-2009 and 2006-2009, respectively. Column 2 introduces bank and state fixed effects into the basic specification 1. Columns 3-4 introduce deposit market Herfindal and banking concentration controls, respectively. The banking concentration control is the (log of) number of unique bank branches per CBSA as of 2006. Column 5 introduces a credit market concentration control - credit market Herfindahl that is built on all loans as of 2006. Column 6 introduces branch-level (log) deposits as of 2006 as an additional control. Credit data is from the Chicago Federal Reserve Bank's Call Reports. Housing net worth shocks come from Mian et al. (2013). Deposit market concentration data is from Drechsler et al. (2017). Deposit data is from the FDIC. Standard errors are clustered at the bank level.

Table A.4: **Credit Quantity Elasticity: Loans to Individuals**

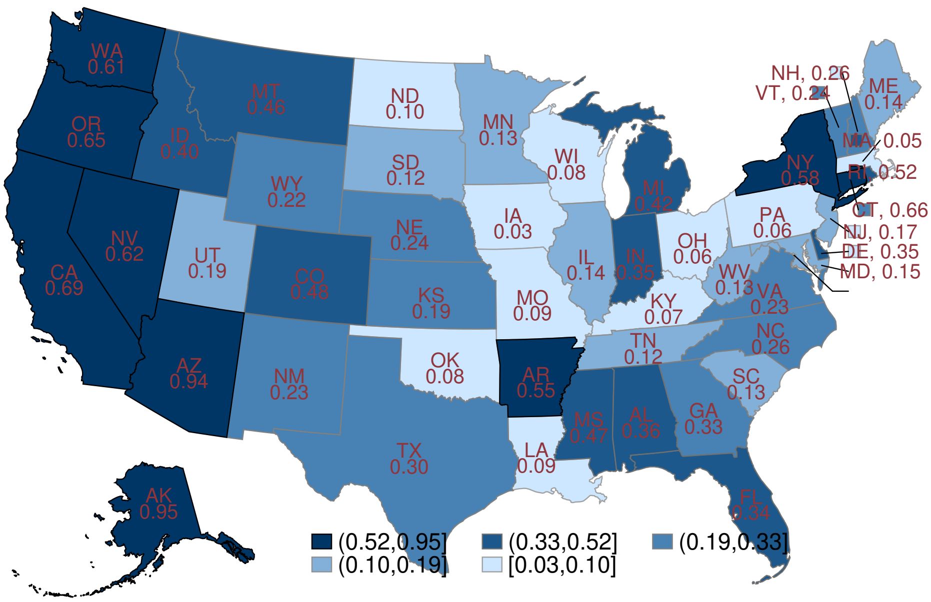
	(1)	(2)	(3)	(4)	(5)	(6)
Housing Shock	0.84	1.42	1.40	1.39	1.36	1.96
	(0.74)	(0.54)	(0.54)	(0.49)	(0.58)	(0.70)
Deposit Concentration			0.39			
			(0.48)			
Banking Concentration				-0.05		
				(0.07)		
Credit Concentration					-0.07	
					(0.28)	
Branch Deposits						0.06
						(0.02)
Bank F.E.	N	Y	Y	Y	Y	Y
State F.E.	N	Y	Y	Y	Y	Y
Observations	248	128	128	128	122	121
R-squared	0.00	0.48	0.48	0.49	0.49	0.50

Notes: This table reports estimates from linear regressions of bank branch-level changes in credit to individuals on the CBSA-level housing net worth shock. The dependent and independent variables are built over 2007-2009 and 2006-2009, respectively. Column 2 introduces bank and state fixed effects into the basic specification 1. Columns 3-4 introduce deposit market Herfindal and banking concentration controls, respectively. The banking concentration control is the (log of) number of unique bank branches per CBSA as of 2006. Column 5 introduces a credit market concentration control - credit market Herfindahl that is built on total loans as of 2006. Column 6 introduces branch-level (log) deposits as of 2006. Credit data is from the Chicago Federal Reserve Bank's Call Reports. Housing net worth shocks come from Mian et al. (2013). Deposit market concentration data is from Drechsler et al. (2017). Deposit data is from the FDIC. Standard errors are clustered at the bank level.

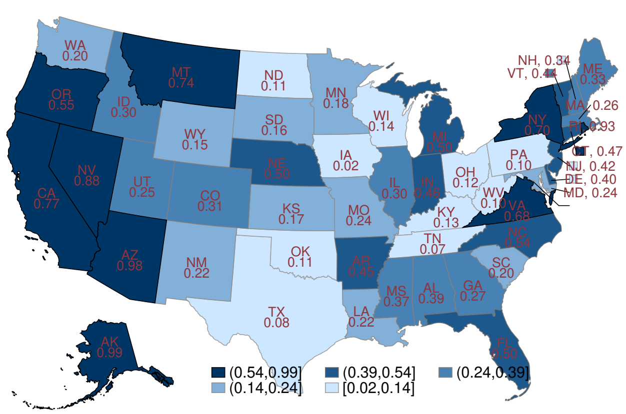
A.3 Spatial Heterogeneity in Banking Concentration and Credit Demand Elasticities

Figure A.3: **Local Banking Concentration**

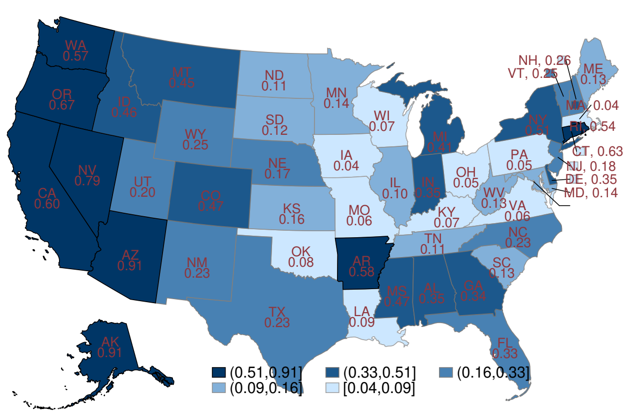
All Loans



Personal Loans



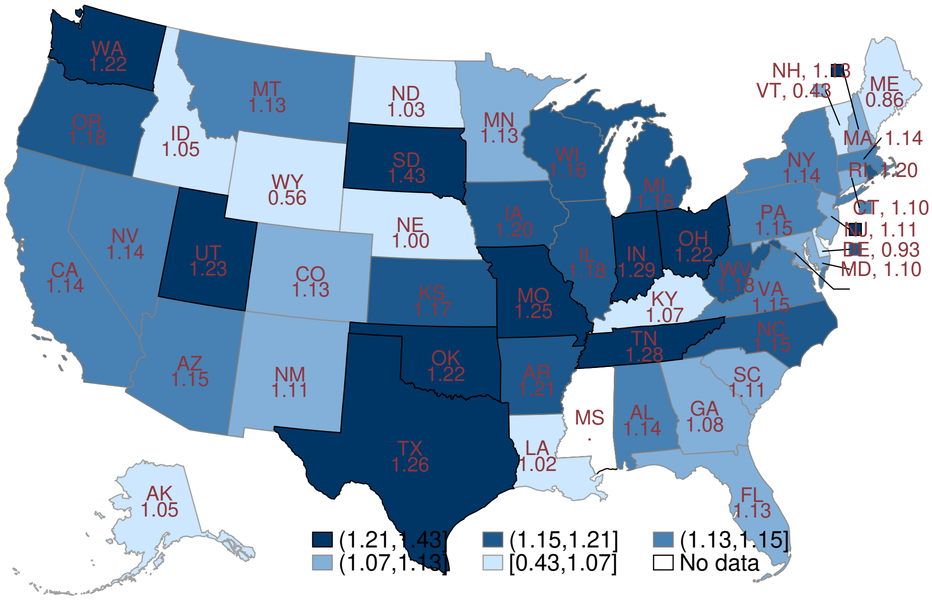
Commercial Loans



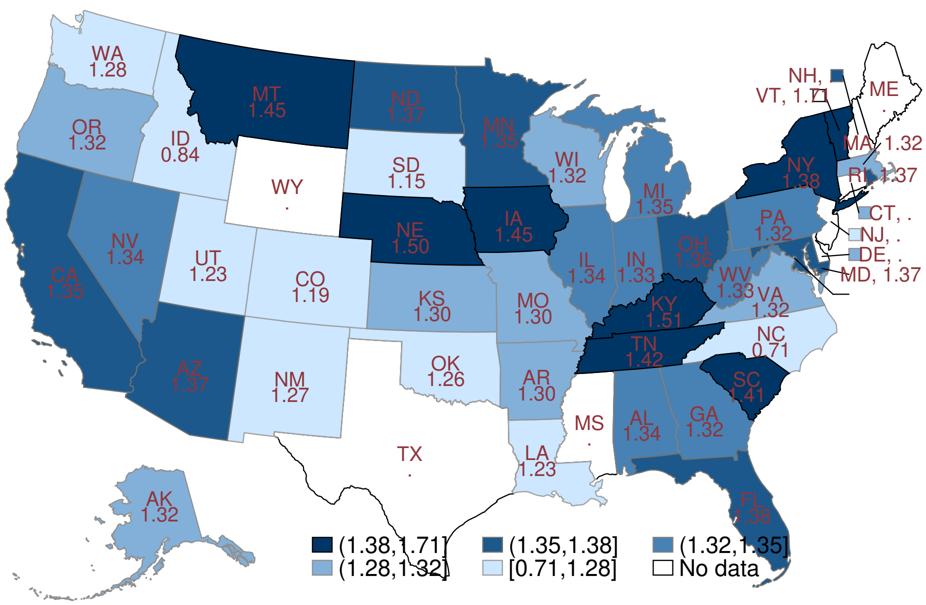
Notes: These figures plot maps of three measures of credit market concentration for U.S. states. The top panel presents the Herfindahl index built on total bank loans across the states. The bottom-left panel presents the Herfindahl index built on loans to individuals. The bottom-right panel presents the Herfindahl index built on commercial loans. Commercial loans are constructed by subtracting personal and real estate loans from total loans. All data is pooled across all banks and quarters, per state. Quarterly data runs from 2000:q1 to 2020:q1 and is obtained from the Chicago Federal Reserve Bank's Call Reports.

Figure A.4: **Local Credit Rate and Quantity Elasticities**

(a) Rate Elasticity



(b) Quantity Elasticity



Notes: These figures plot maps of state-level rate and quantity elasticities with respect to local housing net worth shocks. The top panel presents the map of state-level rate elasticities. The bottom panel presents the map of state-level quantity elasticities. Both estimates are obtained from the following empirical specification: regression of branch-level changes in loan rates or quantities on the CBSA-level housing net worth shock. Specifications allow for state-level slope dummies (shifters). The cross-section of state slope shifters is standardized and the averages fixed to respective mean linear estimates. The left- and right-hand-side variables are over 2007-2009 and 2006-2009, respectively. Interest rate data is from RateWatch; bank loans data comes from the Chicago Federal Reserve Bank's Call Reports.

A.4 Local Credit Market Power and Economic Outcomes - Tables

Table A.5: **Local Credit Market Power and Small Business Lending in 2007-2009**

	% Δ 2007-2009					
	(1)	(2)	(3)	(4)	(5)	(6)
	Loan Number <$100k	Loan Volume <$100k	Loan Number <$250k	Loan Volume <$250k	Loan Number <$1mil	Loan Volume <$1mil
Credit Demand Elasticity, 2006	0.25	0.47	0.28	0.27	0.36	0.47
	(0.10)	(0.12)	(0.14)	(0.14)	(0.16)	(0.18)
Observations	47	47	47	47	47	47
R^2	0.06	0.12	0.08	0.08	0.04	0.08

Notes: This table reports regression relationships between state-level credit demand elasticities from Figure 5 (independent variable) and the percentage change in state-level bank lending to small business over 2007-2009 (dependent variable). Columns (1) and (2) show results for the number and total volume of loans less than $100 thousand in value. Columns (3) and (4) show results for the number and total volume of loans less than $250 thousand in value. Columns (5) and (6) show results for the number and total volume of loans less than $1 million in value. All lending data is from the Federal Financial Institutions Examination Council.

Table A.6: **Local Credit Market Power and Economic Outcomes in 2007-2009**

	% Δ 2007-2009					
	Employment	Job Creation Rate	Job Destruction Rate	GDP	Wages	Total Income
	(1)	(2)	(3)	(4)	(5)	(6)
Credit Demand Elasticity, 2006	0.04	0.21	-0.31	0.11	0.07	0.05
	(0.02)	(0.11)	(0.17)	(0.04)	(0.04)	(0.03)
Observations	47	47	47	47	47	47
R^2	0.05	0.07	0.08	0.09	0.04	0.02

Notes: This table reports regression relationships between state-level credit demand elasticities from Figure 5 (independent variable) and the percentage change in state-level local macroeconomic outcomes (dependent variable). Column (1) reports results for total non-farm employment. Columns (2) and (3) report results for aggregated establishment-level job creation and destruction rates. Columns (4) and (5) report results for state-level GDP and total worker compensation. Column (6) reports results for total labor income. All macro data is sourced from the Bureau of Economic Analysis.

A.5 The Role of Bank Branching Deregulation

An interesting unanswered question is on the origins of the cross-sectional variation in $\hat{\theta}_S$. What can explain cross-state heterogeneity in local credit demand elasticities that we observe in Figure 5? In the main text, we conjecture that financial innovation and staggered adoption of automated teller machines contributed to the consolidation of market shares of ex-ante larger and more efficient banks. The literature, however, lacks a clear consensus on the causal drivers of banking concentration and market power. One view is that banking deregulation has also contributed to the banking concentration trend. From the 1960s through late 1990s, the vast majority of U.S. states had removed regulatory restrictions on intrastate bank branching. Adoptions of such laws were shown to correlate with subsequent increases in M&A activity in the banking sector and the rise of market shares at the top of the distribution (Kroszner and Strahan, 1999).

In corporate finance and banking, research has long treated the cross-state variation in the timing of adoption of branching laws as a plausible source of quasi-exogenous variation in shocks to local banking competition. Kroszner and Strahan (2014) and Beck et al. (2010) provide an exhaustive list of reasons why these inter-state timing differentials are plausibly exogenous. Below we correlated $\hat{\theta}_S$ with the staggered adoption of these deregulation laws.[13]

What we do is we correlate our distribution of state-level credit demand elasticities with the year in which each U.S. state lifted its own local bank branching restrictions. Importantly, we can differentiate across four distinct types of laws: partial intrastate branching through mergers and acquisitions only, fully unrestricted intrastate branching, interstate banking, and permission to originate multibank holding companies. We adopt these definitions and the data from Amel (1993).

Table A.7: **Bank Deregulation and Local Credit Market Competition**

	Elasticity		Rate Elasticity		Quantity Elasticity	
	(1)	(2)	(3)	(4)	(5)	(6)
Unrestricted Intrastate Branching	0.006	0.008	-0.007	-0.010	0.005	0.005
	(0.003)	(0.004)	(0.004)	(0.005)	(0.002)	(0.003)
Intrastate M&A		-0.004		0.004		0.001
		(0.004)		(0.005)		(0.003)
Interstate Banking		0.001		-0.001		-0.006
		(0.008)		(0.011)		(0.006)
Multibank Holding Companies		-0.001		0.003		0.001
		(0.003)		(0.003)		(0.002)
Observations	35	35	35	35	30	30
R-squared	0.101	0.156	0.089	0.137	0.121	0.149

Notes: Results of the regression of state-level credit demand elasticities from Figure 5 on the years in which states lifted local restrictions on bank branching. Sample excludes the 12 states who had no restrictions on intrastate branching as of 1970. Data on the years of deregulation is from Amel (1993) and Kroszner and Strahan (1999).

[13]We are not making a causal statement here. The regulation factor is hard to disentangle from inter-state heterogeneity in the spread and adoption of new technologies or evolving consumer preferences. According to Economides et al. (1996), small-bank lobbies and other political economy factors could also have played a role.

Table A.7 presents the regression results. Any consistent relationship is hard to establish for the following reasons. At least 12 states had never had any material restrictions on branching activities. So, we drop them in order to avoid clustering. Second, a lot of states deregulated in early 1990s, potentially in anticipation of the 1994 federal Riegle-Neal Interstate Banking and Branching Efficiency Act. We do not drop those states, which doesn't materially affect the outcome but preserves the number of observations. We do find some weak positive correlation between intrastate branching deregulation and $\hat{\theta}_S$. This relation suggests that states that deregulated bank branching activities *later* had *more competitive* local credit markets as of 2006. Deregulation may have contributed to credit market power and concentration. However, this relationship is subject to the empirical challenges that we document above.