Small Business Lending and Household Credit Shocks*

Berrak Bahadir† Inci Gumus ‡ Matthew Schaffer§

July, 2021

Abstract

This paper studies how changes in household credit affect small business lending. First, we empirically investigate the effect of an exogenous increase in household credit on small business credit by exploiting the 1997 liberalization of home equity lending in Texas. We find that the relaxation of borrowing constraints on household lending crowds out business lending, as small business loan growth declines by roughly 20 percentage points following the liberalization. However, the negative effect is weaker in counties that experienced strong house price growth, providing evidence for a collateral effect working through house prices. Then, we build a closed economy model with borrowing constraints that differentiates between household and business lending and study the interaction between the two types of lending. We show that an expansion in household credit leads to a decline in firm borrowing. Even though there is a positive collateral effect, the crowding out effect dominates in both the theoretical model and the empirical analysis.

Keywords: Household credit shock, small business lending, collateral channel.

JEL Classification code: E44, E51, G21.

---

*Declarations of interest: none

†Florida International University

‡Sabanci University

§University of North Carolina at Greensboro

1 Introduction

One key trend observed in the data during the period preceding the Great Recession is the increase in lending towards households. In the United States, household credit-to-GDP ratio has increased from 70 percent to 99 percent between 2000-2008. Other advanced economies have also experienced rapid growth in household credit during the same time period, peaking at 82 percent before the Global Financial Crisis, a 20 percentage point increase from 62 percent.[1]

A large body of research conducted since the onset of the Great Recession focuses on the implications of rapid expansions in household credit and studies the link between household debt, business cycles and financial crises to identify the channels through which changes in household credit affect the economy. Several studies in this literature provide strong evidence that large increases in household and mortgage credit may generate financial instability and contribute to financial crises, through their effects on households' leverage and asset prices (e.g. Mian and Sufi (2009), Büyükkarabacak and Valev (2010); and Jordà, Schularick, and Taylor (2016)). Regarding the effect of household debt on business cycles, Mian, Sufi, and Verner (2017) shows that an increase in the household debt-to-GDP ratio predicts lower GDP growth and higher unemployment in the medium run. In a related study, Mian and Sufi (2018) emphasizes the link between household debt and subsequent recessions, arguing that expansions in household credit supply generate an increase in household demand and are an important driver of business cycles.

In this paper, we aim to contribute to this literature by studying an alternative channel that has the potential to influence the real economy. Specifically, we investigate the effect of household credit on small business loans, a link that has been understudied in the literature. Theoretical studies on financial frictions and business cycles show that changes in collateral values affect business cycles though borrowing of households or firms (Iacoviello (2005); Iacoviello and Neri (2010); and Liu, Wang, and Zha (2013)). This "collateral channel" plays an important role for the link between household and business credit, as a positive shock to the loan-to-value (LTV)

[1]Source: Bank for International Settlements (BIS), Credit to the Financial Sector data set. We use the aggregate series for advanced countries computed by BIS.

ratio of households raises house prices and relaxes the credit constraints faced by firms and therefore should lead to an increase in business lending. In contrast, household credit expansions may have a negative effect on business lending if there is a limited supply of funds and an increase in lending to households crowds out business lending, generating a "crowding out effect". Hence, the relationship between the two types of credit depends on which channel dominates and the net effect is not clear theoretically, warranting an empirical analysis.

Our focus on small business loans is motivated by the fact that small businesses do not have direct access to other types of financing and heavily rely on bank loans. Therefore, they are likely to be competing for bank loans with households and expansions in household credit may affect the availability of small business loans. A possible relationship between these two types of credit is therefore important to identify from the perspective of policy makers and regulators.

A change to Texas' state constitution in the late 1990's provides an ideal natural experiment for studying this relationship. Prior to 1998, a home in Texas could only be used as collateral in an original purchase mortgage or in a loan designated for home repairs. An amendment passed in late 1997 significantly relaxed these restrictions, allowing home equity loans, cash-out refinance loans, and reverse mortgages for the first time. This liberalization of home equity loans loosened household credit constraints, as it appreciably broadened the ability of Texans to use their homes as loan collateral (Abdallah and Lastrapes (2012)). We therefore begin by empirically studying the effects of the Texas home equity loan liberalization on small business credit.

We estimate the impact of the liberalization on county-level small business loan originations using a difference-in-differences framework and find that the removal of restrictions on home equity loans negatively affected small business loans. Specifically, our results indicate that the growth of small business loan originations declined by approximately 20 percentage points following the household credit shock. The baseline results suggest the positive houshold credit shock led to a crowding out of small business credit. Consistent with this interpretation, banks operating in Texas increased loans secured by real estate and decreased small commercial and industrial loans following the liberalization. While a negative crowding out effect appears to

dominate in the wake of the Texas liberalization, the negative effect on small business credit was weaker in counties with higher house price growth, suggesting that an opposing collateral channel was operational.

To understand these empirical findings, we develop a closed economy model with borrowing constraints and study the link between household and business credit. In the model, borrowing by impatient households and entrepreneurs are financed by savings of patient households. Borrowing is a function of the collateral agents own and changes in house prices and LTV ratios determine the borrowing limits agents face. We study the effect of changes in household credit on business lending by altering household's LTV ratio, which is modeled as an exogenous shock. Setting up the model in this way enables us to study the general equilibrium effects of an exogenous change in household credit on model dynamics, including business loans.

Our model also allows us to study and compare the relative importance of the two channels described above that link the two types of lending. In the model, the collateral channel relaxes the borrowing constraints faced by the entrepreneurs and leads to an expansion in business lending as more household borrowing results in higher house prices and collateral values. The crowding out channel, on the other hand, generates a decline in business lending due to higher interest rates and lower availability of funds for firms. Our goal in the model is to analyze the effects of these two channels on business credit and quantify their relative strengths.

The simulation results of the model show that firm borrowing decreases as a result of an exogenous increase in household borrowing. These results suggest that the crowding out effect dominates the collateral effect and the total effect on firm borrowing in negative. When the collateral effect of real estate is shut down in an alternative model, firm borrowing decreases even more after a positive shock to household credit, which shows that the collateral effect is positive but not large enough to generate an increase in business loans after the positive household credit shock. Hence, the theoretical model generates responses that are consistent with the results obtained in the empirical analysis.

Our paper is related to the recent literature that studies differential effects of household

and business credit on several key macroeconomic variables such as GDP growth and unemployment (Mian, Sufi, and Verner (2017); Beck, Büyükkarabacak, Rioja, and Valev (2012)); trade balance (Büyükkarabacak and Krause (2009)); and probability of having a banking crisis (Büyükkarabacak and Valev (2010)). The findings from this literature suggest that household credit is more likely to have detrimental effects on the real economy whereas firm credit is either beneficial or does not have any significant negative effect. Our paper contributes to this literature by studying the interaction between the two types of credit and documenting another potential effect of household credit.

One particular paper that is closely related to our study is Bezemer, Samarina, and Zhang (2020), which is the first paper that studies the effects of mortgage credit expansions on business credit. In their extensive work, Bezemer, Samarina, and Zhang (2020) first present evidence for a "debt-shift", which is the process of private credit being shifted towards household credit. Then, they study the link between mortgages and business lending using a panel data analysis for a large group of countries and find a positive association between mortgage credit expansions and business credit growth in the short run and a negative relationship in the medium run. We complement this study in several ways. First, our empirical approach tackles the identification problem by studying a policy change, allowing us to isolate the effects of an exogenous change in household credit. Second, focusing on lending to small businesses provides a more direct way to capture the effects generated by credit constraints, which may not be observed at the aggregate level. Finally, we present a general equilibrium model that allows us to study and quantify the collateral and crowding out channels that generate the dynamic relationship between household and business credit.

Our paper also belongs to the literature that uses the Texas liberalization as a natural experiment to study the effect of relaxing credit constraints on economic outcomes such as retail sales (Abdallah and Lastrapes (2012)), GDP growth (Kumar and Liang (2019)), and home prices (Zevelev (2020)). One recent paper is by Lastrapes, Schmutte, and Watson (2021), which investigates the role of increased access to home equity borrowing in new business and job creation,

as well as firm exit and job loss using Census data. In Section 2.1 we discuss these papers in more detail.

Finally, our paper is related to some recent theoretical studies on the channels through which changes in household credit affect business cycles. This literature mostly studies the effect of shocks to loan-to-income (LTI) and LTV ratios in a general equilibrium setting. Favilukis, Ludvigson, and Van Nieuwerburgh (2017) shows that an increase in the LTV ratio leads to large increases in house prices and a boom in the housing market, a link that has also been widely studied empirically (e.g. Duca, Muellbauer, and Murphy (2011)). Bahadir and Gumus (2016) show that a shock to household's LTI ratio affects business cycles through household demand and real exchange rate, whereas Bahadir and Gumus (2018) emphasizes the role of real estate in the transmission of household and business credit shocks to the real economy.

2 Empirical Evidence

In this section we empirically investigate the effects of a household credit shock on small business credit by exploiting the liberalization of home equity loans in Texas.

2.1 Texas Amendment

Prior to 1998, Texas was unique among US states in that its constitution prohibited mortgage lending other than for the original purchase of a home and a few other narrow uses, such as home improvements. An amendment passed by Texas voters in late 1997 and enacted in 1998 significantly relaxed these restrictions by allowing for home equity loans, cash-out refinance loans, and reverse mortgages. The reform loosened credit constraints for homeowners who suddenly had a greater capacity to borrow, presenting a clear empirical example of a positive household credit shock.[2]

The Texas Constitution of 1876 effectively banned home equity lending, as homesteads were protected from foreclosure except in cases of failure to pay the purchase loan, property taxes, or a mechanic's lien. The Texas Senate Interim Committee on Home Equity Lending supported

[2]While the amendment significantly increased the ability of households to use their homes as collateral, it nevertheless limited the value of new equity loans to no more than 80% of the home's appraised price.

the easing of these restrictions in December 1994 and initiated an amendment proposal which surpassed the required two-thirds majority in the state Senate, but not in the House of Representatives. A similar amendment proposal passed both houses a few years later in May 1997, allowing Texans to vote on and ultimately pass the amendment in November 1997. The amendment took effect shortly after, with home equity loans becoming legal on January 1, 1998. Abdallah and Lastrapes (2012) argue January 1, 1998 is indeed the appropriate date for identifying the impact of the amendment, as both the results and the precise details of the proposal were uncertain ahead of time.[3] Furthermore, Abdallah and Lastrapes (2012) review accounts of the debate surrounding home equity borrowing in Texas and conclude the liberalization was largely driven by exogenous political circumstances, with little evidence to suggest that local credit demand played a deciding role. The liberalization accordingly serves as an appealing natural experiment.

Abdallah and Lastrapes (2012) initiated the literature exploiting the Texas liberalization as a natural experiment, providing evidence that retail sales increased following the amendment, indicating a meaningful loosening of household credit constraints. Given the unique suitability of the liberalization to serve as a plausibly exogenous household credit shock, additional studies have since investigated its effects along other dimensions. Kumar (2018) finds that limits on home equity lending in Texas decreased the probability of mortgage default during the collapse of the mid-2000's housing bubble. Kumar and Liang (2018) study the effect of the liberalization on the Texas labor market and report a decline in labor force participation. Kumar and Liang (2019) suggest that, although the amendment effectively loosened household credit constraints, it did not result in higher GDP growth. Zevelev (2020) finds that Texas home prices increased significantly as a result of the liberalization.[4] Finally, in a related paper that will be discussed in more detail below, Lastrapes, Schmutte, and Watson (2021) investigate the increasing role of home equity loans in small business finance following the amendment.

[3] In addition to Abdallah and Lastrapes (2012), see the following for details on the legal history of home equity borrowing in Texas: McKnight (1983), Forrester (2002), Stolper (2014), Kumar (2018), and Zevelev (2020).

[4] An increase in house prices following a positive household credit shock is consistent with our impulse response analysis in Section 3.6.

2.2 Data and Empirical Strategy

Our baseline empirical model is a difference-in-differences specification with county and time fixed effects:

$$\Delta log(L_{cst}) \;=\; \alpha_c \;+\; \delta_t \;+\; \beta_1 HELoan_{st} \;+\; X_{st}\gamma \;+\; Z_{ct}\psi \;+\; \epsilon_{it} \tag{2.1}$$

where the dependent variable $\Delta log(L_{cst})$ is small business loan growth in county c and state s in year t. The independent variable of interest, $HELoan_{st}$, is a dummy variable equaling 1 if the county is located in Texas and the year is after 1997 (after the home equity loan liberalization). X_{st} contains two state-level controls: an index of banking restrictions from Rice and Strahan (2010) and an economic freedom index from the Fraser Institute. The Rice-Strahan index of branch banking restrictions controls for varying bank regulatory environments and the economic freedom index controls for differences in overall business climate across states. Finally, X_{ct} contains county-level annual growth rates of per capita income and population to control for local economic conditions.[5]

We use Community Reinvestment Act (CRA) data on county-level small business loan originations. The CRA data measures new loan originations under $1 million to all businesses on an annual basis beginning in 1996.[6] The data is categorizied as loans under $100,000, loans between $100,000 and $250,000, and loans between $250,000 and $1 million. L_{cst} is constructed by summing loans between $100,000-250,000 and loans between $250,000-1 million originated in county c during year t. The smallest category of loans under $100,000 is excluded, as it is disproportionately composed of credit card loans which are unrepresentative of most small business lending.[7] Since our dependent variable is a log change, the first year available for our regression analysis is 1997. Our data therefore only includes one year before the home equity loan liberalization goes into effect. As a result, we choose to focus on a symmetric sample period of 1997-1998 containing

[5] The county-level controls are from the US Bureau of Economic Analysis Regional Data.

[6] While the CRA data tracks small loans to all businesses, the majority go to small firms that lack access to other sources of external funding.

[7] Our baseline results do not change if loans under $100,000 are included in L_{cst}. See Adams, Brevoort, and Driscoll (2020) for details on credit card loans in the CRA data.

one pre- and one post-treatment period.

Our primary empirical result is that a positive household credit shock leads to a crowding out of small business credit. For such a crowding out effect to occur, one would naturally expect there to be an increase in household credit. To confirm that household credit did in fact increase following the liberalization, we also estimate equation 2.1 with a measure of household credit growth as the dependent variable. County-level household credit data is not available, and state-level data compiled by the Federal Reserve Bank of New York Consumer Credit Panel does not begin until 1999. As an alternative, we turn to bank-level data on real estate loans secured by 1-4 family residential properties from the Call Reports.

We also use bank-level data on commercial and industrial (C&I) loans under $1 million as a robustness check for our baseline results. CRA data has the advantage of capturing new loan originations, rather than merely capturing the change in the volume of loans on bank balance sheets. However, the CRA data is limited in only being available for one pre-treatment period. Data on small C&I loans, on the other hand, becomes available in the Call Reports in 1994, allowing us to include multiple pre-treatment periods in our estimation sample. For regressions with bank-level outcome variables, $HELoan_{st}$ will equal 1 from 1998 on for banks that operate in Texas only.

Table 1 provides summary statistics for all variables used in the empirical analysis. The outcome variables of interest (small business loan originations, real estate loans secured by 1-4 family residential properties, and C&I loans under $1 million) have large outliers in both tails of their distributions. Accordingly, in the following regression analysis we winsorize the outcome variable at the 5th and 95th percentiles.[8]

2.3 Results

The difference-in-differences framework necessitates a treatment group and control group. The treatment group consists of all counties in Texas, however the most appropriate control group is not obvious. We therefore estimate equation 2.1 with four control groups: 1) all

[8] As will be detailed below, the sign and statistical significance of the coefficient estimates are robust to a variety of approaches for handling outliers.

non-Texas counties in the United States, 2) counties in states with similar banking regulation to Texas (as captured by the Rice-Strahan index),[9] 3) counties in states that border Texas, and 4) counties in states that border Texas or states that border a border state.[10]

Results are presented in Table 2, with standard errors clustered by state in parentheses. The first column presents estimates using the rest of the country as the control group. The coefficient on the home equity loan liberalization dummy is negative and statistically significant at the 1 percent level, indicating that small business loan growth in Texas fell by roughly 20 percentage points following the positive household credit shock. The control group in the additional columns is counties in states with similar banking restrictions in column (2), counties in states that border Texas in column (3), and counties in border states or states that border a border state in column (4). While the magnitude declines slightly to 17.9 percentage points in column (3) and 15.8 percentage points in column (4), the estimated effect remains negative and statistically significant relative to all four control groups.[11] Our baseline empirical results therefore indicate that there was a substantial decline in small business loan growth following Texas' home equity loan liberalization.

To check the robustness of our baseline results we consider alternative sample constructions. First, we include small business loans under \$100,000 in L_{cst} and re-estimate equation 2.1, with results presented in Appendix Table A.2. The magnitude of the coefficients decline, but remain negative and statistically significant. Next, we consider alternative approaches for dealing with extreme values in the small business loan growth outcome variable. Rather than winsorizing at the 5th and 95th percentiles as in the baseline results, all observations are retained without

[9]The Rice-Strahan index takes on discrete values from 0 to 4, with 0 representing the maximum possible restrictions on interstate banking and 4 representing no restrictions. Texas' Rice-Strahan value was 0 in 1998, as it implemented the maximum number of restrictions allowed by the federal Riegle-Neal Interstate Banking and Branching Efficiency Act. The control group in column (2) is therefore all states with a Rice-Strahan Index value of 0 in 1998. Following Favara and Imbs (2015), we use an inverted index (relative to the original presented in Rice and Strahan (2010)) so that higher values represent less restrictive states. See Rice and Strahan (2010) for details on the index's construction.

[10]Louisiana, Arkansas, Oklahoma, and New Mexico are border states. Mississippi, Tennessee, Missouri, Kansas, Colorado, Utah, and Arizona are states that border a border state.

[11]Appendix table A.1 shows the results are essentially unchanged when county fixed effects are replaced with state fixed effects.

winsorizing in Table A.3, observations below the 5th or above the 95h percentiles are dropped in Table A.4, and observations below the 10th or above the 90th percentiles are dropped in Table A.5. While the coefficients differ in magnitude, we obtain a significant decline in small business loan growth regardless of how extreme values are treated.

Next, we turn to bank-level data to provide additional evidence on the effect of the Texas liberalization on small business credit. If a positive household credit shock acts to crowd out small business loans, we would expect there to be a corresponding increase in household credit. We therefore estimate equation 2.1, with the annual growth rate in real estate loans secured by 1-4 family residential properties as the dependent variable. The effect of the home equity loan liberalization is once again estimated relative to the four control groups detailed above, over the 1997-1998 sample period, with results presented in Table 3.[12] As expected, the coefficient on the liberalization dummy is positive and statistically significant in all four columns, indicating that bank loans secured by residential real estate increased by 1.5 to 4.4 percentage points following the household credit shock.

As discussed in Section 2.2, the main weakness of the CRA small business loan origination data is that it provides only one pre-treatment period, making it difficult to test the parallel trends assumption underlying our difference-in-differences framework. An attractive alternative variable is C&I loans under $1 million, which is available starting in 1994. We first re-estimate equation 2.1 with the annual growth rate in small C&I loans as the dependent variable, over a longer sample period: 1995-2003.[13] Table 4 presents results, with columns (1)-(4) corresponding to the same control groups as above. They confirm that the growth rate of small C&I loans on Texas bank balance sheets declined by 1.4-2.6 percentage points following the home equity loan liberalization.

[12]Specifically, the control groups in the bank-level regressions are: 1) all non-Texas banks in the United States, 2) banks in states with similar banking regulation to Texas (as captured by the Rice-Strahan index), 3) banks in states that border Texas, and 4) banks in states that border Texas or states that border a border state. During this time, at the onset of interstate branch banking, the vast majority of banks operated in one state only. We therefore drop the small number of banks operating in multiple states from our bank-level estimations.

[13]1995 is the first year that can be included in the estimation with small C&I loans in log change form. We end the sample in 2003, to avoid confounding with a second amendment enacted in 2004, which removed additional restrictions on home equity lines of credit.

The above results depend on the assumption that small business loan growth in Texas was not already declining, relative to other states, prior to the enactment of the amendment in 1998. The longer sample (1995-2003) provided by the small C&I data allows us to test this assumption by re-estimating equation 2.1 with individual Texas year dummies replacing the home equity loan liberalization dummy. If the parallel underlying trends assumption holds, we should not observe a significant decline in small C&I loan growth on Texas bank balance sheets until after the liberalization takes effect. The Texas year dummy coefficients are plotted in Figure 1, with the vertical lines representing 90% confidence intervals. The year before the amendment was enacted is omitted so that the plotted coefficients can be interpreted relative to 1997. The estimated coefficients for the years prior to the liberalization (1995 and 1996) are small in magnitude and statistically insignificant, whereas the coefficients for the two years immediately following the liberalization (1998 and 1999) are negative and significant. Figure 1 therefore indicates no evidence of pre-trends and provides justification for our difference-in-differences framework.

Overall, the results in Tables 2-4 indicate that the positive household credit shock brought on by the liberalization of home equity loans led to an increase in household credit and a resulting crowding out of small business credit. This is consistent with Lastrapes, Schmutte, and Watson (2021) who, using survey data from the US Census Bureau's Survey of Business Owners, find that small business owners in Texas significantly increased their reliance on home equity loans following the amendment, while simultaneously decreasing their use of other (non-home equity) loans. Our results suggest that the crowding out of small business loans may have induced small business owners to turn towards home equity finance as an alternative.

Moreover, Tables 2-4 provide empirical evidence of the crowding out channel dominating the potentially offsetting collateral channel. Under the collateral channel, a positive household credit shock leads to an increase in real estate prices which can ultimately relax the credit constraints faced by firms themselves. Indeed, Zevelev (2020) provides detailed evidence that house prices increased in Texas following the 1998 amendment, suggesting that there may have been a positive collateral effect that was ultimately offset by the stronger crowding out effect. To investigate

this possibility, we amend equation 2.1 as follows:

$$\Delta log(L_{cst}) = \alpha_c + \delta_t + \beta_1 HELoan_{st} + \beta_2 HPI_{cs,t-1} + \beta_3 (HELoan_{st} \times HPI_{cs,t-1}) + X_{st}\gamma + Z_{ct}\psi + \epsilon_{it} \tag{2.2}$$

where $HPI_{cs,t-1}$ is the growth rate of the county-level Federal Housing Finance Agency all-transactions house price index. The variable of interest then becomes the interaction between the Texas liberalization dummy and the house price index.[14] If the collateral channel was operative, it should have been stronger in counties experiencing stronger growth in house prices, implying that the overall negative impact of the household credit shock on small business credit should have been weaker in such counties.

Equation 2.2 is estimated with small business loan origination growth as the dependent variable over the baseline 1997-1998 sample. Results are presented in Table 5, with columns (1)-(4) corresponding to the four control groups discussed above. Panel (a) presents results from estimating equation 2.2 as written. The coefficient on the liberalization dummy is once again negative and statistically significant in all four columns. The interaction between the dummy and house price index growth is positive and significant at the 1% level, indicating that the decrease in small business loan growth was roughly half in Texas counties which experienced a standard deviation increase in house price growth prior to the liberalization.[15] Panel (b) presents results from an alternative specification, where the state-level variables are removed and replaced by state-year fixed effects. The estimated coefficients on the interaction terms remain unchanged, indicating that the results in Panel (a) are not driven by any omitted, time-varying state-level characteristics. We also estimate equation 2.2 over the longer 1995-2003 sample with the growth rate of small C&I loans as the dependent variable. Results, presented in Table 6, are consistent with those in Table 5. While the magnitudes are once again smaller using the bank-level C&I data, Panels (a) and (b) both confirm lesser declines in small C&I loan growth for Texas banks

[14] The house price index is entered with a lag to mitigate simultaneity concerns.

[15] House price growth is standardized so that a unit change is one standard deviation.

located in counties that experienced higher house price growth prior to the liberalization.

The estimates in Tables 5 and 6 suggest there was a positive collateral effect following the Texas amendment's enactment in 1998. The effect, however, was dominated by a stronger crowding out effect. The relative strength of the crowding out effect may explain why our results differ from those of Bezemer, Samarina, and Zhang (2020), who find a positive association between mortgage debt and business credit in the short-run for a panel of advanced and emerging countries. While a direct comparison is difficult given the differences in the data structure and empirical approach, open economies with access to international credit markets may not face tight credit limits in financing domestic borrowing. Therefore, an increase in household credit does not necessarily crowd out business loans at the aggregate level.

Overall, our analysis of this natural experiment establishes that there was an overall decline in small business loan growth in Texas following the household credit shock, with deeper declines occurring in areas with lower house price growth, and consequently a weaker collateral channel. These empirical results inform a broader, theoretical investigation into the relationship between household and small business credit in the following section.

3 Model

We develop a closed-economy real model with housing to study the effects of an exogenous household credit shock on business credit. Our model follows Iacoviello (2005) but abstracts from nominal rigidities. There are three types of infinitely lived agents in the economy: patient households, impatient households, and entrepreneurs. Impatient households and entrepreneurs discount the future more heavily than patient households and face a borrowing constraint. Borrowing of impatient households is constrained by the collateral value of their housing and entrepreneurs use both capital and real estate as collateral. Labor services are provided by households while capital is held by entrepreneurs. There is a fixed stock of housing, which is used by all agents as households get utility from housing services and entrepreneurs use real estate in production.

3.1 Patient Households Patient households choose consumption, labor and housing services to maximize their expected lifetime utility given by

$$E_0 \sum_{t=0}^{\infty} (\beta^p)^t \ln(c_t^p) - (n_t^p)^\eta / \eta + \gamma \ln h_t^p, \tag{3.1}$$

where $\beta^p \in (0,1)$ is the discount factor of the patient household, c_t^p is patient household's consumption, n_t^p represents patient household's labor, h_t^p is patient household's holdings of housing, η is the parameter that governs the intertemporal elasticity of substitution in labor supply, and γ is the weight of housing in the utility function.

The budget constraint of patient households is given by

$$c_t^p + R_{t-1} b_{t-1}^p + q_{h,t}(h_t^p - h_{t-1}^p) = w_t^p n_t^p + b_t^p, \tag{3.2}$$

where b_t^p denotes the amount borrowed by the patient household at time t, R_{t-1} is the gross interest rate, $q_{h,t}$ is the housing price, and w_t^p is the wage rate of patient households.

3.2 Impatient Households Impatient households have the same utility function as patient households but they have a lower discount factor and face a borrowing constraint. They choose consumption, c_t^h, labor, n_t^h, and housing, h_t^h, to maximize their expected lifetime utility given by

$$E_0 \sum_{t=0}^{\infty} (\beta^h)^t \ln\left(c_t^h\right) - (n_t^h)^\eta / \eta + \gamma \ln h_t^h, \tag{3.3}$$

where $\beta^h \in (0,1)$ is the discount factor of the impatient household and $\beta^h < \beta^p$.

The budget constraint of impatient households is given by

$$c_t^h + R_{t-1} b_{t-1}^h + q_{h,t}(h_t^h - h_{t-1}^h) = w_t^h n_t^h + b_t^h. \tag{3.4}$$

where b_t^h denotes the amount borrowed by the impatient household at time t, and w_t^h is the wage rate of impatient households.

Impatient households face a constraint on their borrowing where the total value of their debt including both interest and principal cannot exceed a fraction of the expected value of their housing stock. The borrowing constraint of impatient households is of the form

$$R_t b_t^h \leq m_t^h E_t \left(q_{h,t+1} h_t^h \right). \tag{3.5}$$

The loan-to-value (LTV) ratio, denoted by m_t^h, determines the credit availability and is modeled as a stochastic process in the following way:

$$m_t^h = \bar{m}^h \exp(\tilde{m}_t^h), \tag{3.6}$$

and

$$\tilde{m}_t^h = \rho^h \tilde{m}_{t-1}^h + \varepsilon_t^h \tag{3.7}$$

where innovations ε_t^h are normally distributed and serially uncorrelated.

In our simulation analysis, we focus on the effects of an exogenous increase in household credit, generated by a positive shock to m_t^h, on business credit and study the mechanisms generated by the shock.

3.3 Entrepreneurs

Entrepreneurs produce output by a Cobb-Douglas technology using capital, real estate and households' labor services:

$$y_t = k_{t-1}^{\alpha} (h_{t-1}^e)^{\mu} (n_t^h)^{\nu(1-\alpha-\mu)} (n_t^p)^{(1-\nu)(1-\alpha-\mu)}, \tag{3.8}$$

where k_{t-1} and h_{t-1}^e denote entrepreneur's capital and real estate holdings, respectively, at the start of period t.

The capital accumulation decision is made by entrepreneurs and the equation for capital accumulation is given by

$$i_t = k_t - (1-\delta) k_{t-1}. \tag{3.9}$$

Entrepreneurs also face a borrowing constraint and they use capital and real estate as collateral. The borrowing constraint of entrepreneurs takes the following form:

$$R_t b_t^e \leq m^e E_t(k_t + q_{h,t+1} h_t^e), \tag{3.10}$$

where b_t^e is the amount borrowed by the entrepreneur at time t and m^e denotes the LTV ratio, which is taken as constant since we focus on the effects of a shock to household credit.

Formally, the entrepreneur's problem is to maximize her expected lifetime utility

$$E_0 \sum_{t=0}^{\infty} (\beta^e)^t \ln(c_t^e), \tag{3.11}$$

where β^e is the discount factor of the entrepreneur with $\beta^e < \beta^p$ and c_t^e is entrepreneur's consumption, subject to technology, capital accumulation and borrowing constraints, as well as the following flow of funds constraint:

$$c_t^e + w_t^p n_t^p + w_t^h n_t^h + i_t + q_{h,t}(h_t^e - h_{t-1}^e) + R_{t-1} b_{t-1}^e = y_t + b_t^e. \tag{3.12}$$

3.4 Equilibrium

Given initial conditions b_0^p, b_0^h, b_0^e and k_0, a constant real interest rate R, and the shock to the impatient household's LTV ratio, the competitive equilibrium is defined as a set of allocations and prices $\left\{y_t, c_t^p, c_t^h, c_t^e, n_t^p, n_t^h, k_t, i_t, h_t^p, h_t^h, h_t^e, b_t^p, b_t^h, b_t^e, w_t^p, w_t^h, q_{h,t}\right\}$ such that (i) the allocations solve the problems of households and entrepreneurs at the equilibrium prices, (ii) factor markets clear, (iii) the loanable funds market clears, $b_t^p + b_t^h + b_t^e = 0, (iv)$ the real estate market clears, $h_t^p + h_t^h + h_t^e = H$, where H denotes the fixed stock of real estate, and (v) the resource constraint holds, $c_t^p + c_t^h + c_t^e + i_t = y_t$.

3.5 Parameters

We follow the literature on housing and financial frictions to determine the values for the parameters of the model. The parameter values are set such that the frequency used in the model solution is annual as in the empirical analysis. For the discount factors we use the annual counterparts of the values used in citeiacoviello2005house, which correspond to

$\beta^p = 0.96$, $\beta^h = 0.82$ and $\beta^e = 0.92$. These values guarantee that the credit constraints of impatient households and entrepreneurs remain binding in the model solution. The weight of housing services in the utility functions of patient and impatient households, γ, is set to 0.1, which we also borrow from Iacoviello (2005). The parameter that governs the intertemporal elasticity of labor supply, η, is set to 1.5 following Mendoza (1991). The LTV ratio for the impatient household is set to 0.8, which is within the range of LTV ratios used in the literature.

For the production parameters, we again use the values from Iacoviello (2005) and set the share of capital, α, to 0.30, the share of real estate, μ, to 0.03 and the share of imptaient households' labor in total labor ν to 0.36. Depreciation rate of capital, δ, is set to 0.115, which corresponds to a 3% quarterly depreciation. Finally, we set m^e equal to 0.32 to match the average business credit-to-GDP ratio of 62.6% in the U.S. for the 1997-2020 period.

The model is solved with a positive shock to the LTV ratio of the impatient household, m_t^h. The size of the shock is set such that the LTV ratio increases from 0.80 to 0.85 and the persistence of the shock is set to 0.9.

3.6 Impulse Response Analysis

In Figure 2, we analyze the effects of a positive shock to the LTV ratio of the impatient household, i.e. an increase in m_t^h, on model variables that are related to the empirical analysis. With an increase in the borrowing limit, the impatient household increases its borrowing. The higher demand for loans leads to an increase in the interest rate. With a higher interest rate, patient households start saving more and entrepreneurs reduce their borrowing. The increase in borrowing by impatient households also raises their demand for housing and leads to an increase in house prices. Impatient households increase their real estate holdings by purchasing housing from patient households. Entrepreneurs also increase their real estate holdings for two periods but this is reversed in the later periods.

The impulse responses in Figure 2 show that firm borrowing decreases as a result of an exogenous increase in household borrowing. The effect of household borrowing on firms works through two channels: a crowding out effect and a collateral effect. As households increase their

demand for loans, the interest rate in the market increases, which raises the cost of funds for firms and they reduce their borrowing. On the other hand, the increase in real estate prices resulting from higher demand for housing by households raises the collateral values of firms, which raises their borrowing limits and enables a higher level of borrowing. The total effect on firm borrowing is the sum of these two effects.

The results from the IRF analysis show that the crowding out effect dominates and the total effect on firm borrowing in negative. Numerically, a 5.4 percentage point increase in the household credit-to-output ratio leads to a 0.27 percentage point decline in the business credit-to-output ratio. The decline in firm borrowing is consistent with the results obtained in the empirical section, where the home equity loan liberalization implemented in Texas is found to have a negative effect on business loans.

To illustrate the collateral effect, we compare the impulse response of firm borrowing that we obtained in the benchmark model with a case where the collateral effect is shut down in Figure 3. Specifically, in the alternative model, we remove real estate from the borrowing constraint of the firm so that house price changes do not have any direct effect on the collateral value of firms.[16] We adjust the value of m^e in the alternative model so that the credit-to-output ratio for the firm remains the same as in the benchmark model.

As Figure 3 shows, firm borrowing decreases more after a positive shock to household credit when the collateral effect of real estate is shut down. The increase in the real estate values enables a higher level of borrowing in the benchmark model, which is absent in the alternative model. This effect persists for five years after the shock. The decline in firm borrowing in the initial period is about 67% higher in the model without the collateral effect (0.73% vs 0.44%). Even though the collateral effect is quite sizable, it is not sufficient to induce a net increase in firm borrowing.[17] These results are consistent with the empirical findings presented in Table 5, which show that higher house price growth is associated with higher borrowing by firms, indicating a positive collateral effect. Thus, in our empirical analysis the collateral effect also works in the

[16] The credit constraint for the firm in this case takes the form $R_t b_t^e \leq m^e k_t$.

[17] The total effect being negative is robust to alternative specifications with different parameter values.

opposite direction of the crowding out effect and leads to a smaller decline in business lending, although the total effect is negative.

4 Conclusion

In this paper, we study the effect of changes in household credit on small business lending. Using the 1997 liberalization of home equity lending in Texas as a natural experiment, we investigate how an increase in household credit affects lending to small businesses. Our results indicate that small business loan growth declined by approximately 20 percentage points following the policy change. We also study the role of changes in collateral values and show that the decline in small business lending is smaller in counties that experienced higher house price growth.

To better understand these empirical findings, we build a closed economy model with borrowing constraints and study the role of collateral and crowding out channels for the link between household and business credit. Our theoretical results show that while the net effect of an exogenous increase in household credit on small business lending is negative, the collateral channel offsets part of the impact generated by the crowding out channel. Hence, the model generates responses similar to those estimated from the data.

The findings of our paper are relevant for understanding the effects of macroeconomic policies that aim to ease credit constraints. Our analysis shows that relaxing credit limits for households may lower credit availability for small businesses or increase borrowing costs. Our paper further provides a theoretical framework to understand the mechanisms that link the two types of credit.

References

Abdallah, C. S., and W. D. Lastrapes (2012): "Home equity lending and retail spending: Evidence from a natural experiment in Texas," *American Economic Journal: Macroeconomics*, 4(4), 94–125.

Adams, R. M., K. P. Brevoort, and J. C. Driscoll (2020): "Is lending distance really changing? Distance dynamics and loan composition in small business lending," *Available at SSRN 3604308*.

Bahadir, B., and I. Gumus (2016): "Credit decomposition and business cycles in emerging market economies," *Journal of International Economics*, 103, 250–262.

——— (2018): "Transmission of household and business credit shocks in emerging markets: The role of real estate," *Real Estate Economics*.

Beck, T., B. Büyükkarabacak, F. K. Rioja, and N. T. Valev (2012): "Who gets the credit? And does it matter? Household vs. firm lending across countries," *The BE Journal of Macroeconomics*, 12(1).

Bezemer, D., A. Samarina, and L. Zhang (2020): "Does mortgage lending impact business credit? Evidence from a new disaggregated bank credit data set," *Journal of Banking & Finance*, 113, 105760.

Büyükkarabacak, B., and S. Krause (2009): "Studying the effects of household and firm credit on the trade balance: The composition of funds matters," *Economic Inquiry*, 47(4), 653–666.

Büyükkarabacak, B., and N. T. Valev (2010): "The role of household and business credit in banking crises," *Journal of Banking & Finance*, 34(6), 1247–1256.

Duca, J. V., J. Muellbauer, and A. Murphy (2011): "House prices and credit constraints: Making sense of the US experience," *The Economic Journal*, 121(552), 533–551.

Favara, G., and J. Imbs (2015): "Credit supply and the price of housing," *The American Economic Review*, 105(3), 958–992.

Favilukis, J., S. C. Ludvigson, and S. Van Nieuwerburgh (2017): "The macroeconomic effects of housing wealth, housing finance, and limited risk sharing in general equilibrium," *Journal of Political Economy*, 125(1), 140–223.

Forrester, J. P. (2002): "Home equity loans in texas: Maintaining the Texas tradition of homestead protection," *SMUL Rev.*, 55, 157.

Iacoviello, M. (2005): "House prices, borrowing constraints, and monetary policy in the business cycle," *American economic review*, 95(3), 739–764.

Iacoviello, M., and S. Neri (2010): "Housing market spillovers: evidence from an estimated DSGE model," *American Economic Journal: Macroeconomics*, 2(2), 125–64.

Jordà, Ò., M. Schularick, and A. M. Taylor (2016): "The great mortgaging: housing finance, crises and business cycles," *Economic policy*, 31(85), 107–152.

Kumar, A. (2018): "Do restrictions on home equity extraction contribute to lower mortgage defaults? Evidence from a policy discontinuity at the Texas border," *American Economic Journal: Economic Policy*, 10(1), 268–97.

Kumar, A., and C.-Y. Liang (2018): "Labor Market Effects of Credit Constraints: Evidence from a Natural Experiment," *FRB of Dallas Working Paper*.

——— (2019): "Credit constraints and GDP growth: Evidence from a natural experiment," *Economics Letters*, 181, 190–194.

Lastrapes, W. D., I. Schmutte, and C.-T. Watson (2021): "Home equity lending, credit constraints and small business in the US," *Available at SSRN 3655661*.

Liu, Z., P. Wang, and T. Zha (2013): "Land-price dynamics and macroeconomic fluctuations," *Econometrica*, 81(3), 1147–1184.

McKnight, J. W. (1983): "Protection of the family home from seizure by creditors: The sources and evolution of a legal principle," *The Southwestern Historical Quarterly*, 86(3), 369–399.

Mendoza, E. G. (1991): "Real business cycles in a small open economy," *The American Economic Review*, 81(4), 797–818.

Mian, A., and A. Sufi (2009): "The consequences of mortgage credit expansion: Evidence from the US mortgage default crisis," *The Quarterly Journal of Economics*, 124(4), 1449–1496.

——— (2018): "Finance and business cycles: the credit-driven household demand channel," *Journal of Economic Perspectives*, 32(3), 31–58.

Mian, A., A. Sufi, and E. Verner (2017): "Household debt and business cycles worldwide," *The Quarterly Journal of Economics*, 132(4), 1755–1817.

Rice, T., and P. E. Strahan (2010): "Does credit competition affect small-firm finance?," *The Journal of Finance*, 65(3), 861–889.

Stolper, H. (2014): "Home Equity Credit and College Access: Evidence from Texas Home Lending Laws," *Columbia University working paper.*

Zevelev, A. A. (2020): "Does Collateral Value Affect Asset Prices? Evidence from a Natural Experiment in Texas," *The Review of Financial Studies*, forthcoming.

Table 1

	Mean	Std. Dev.	Min.	5th Pctl.	Median	95th Pctl.	Max.
County-level variables							
Small Business Loan Origination	0.35	0.90	-5.01	-0.85	0.25	1.9	6.03
Per Capita Personal Income	0.04	0.05	-0.60	-0.02	0.05	0.10	0.81
Population	0.01	0.02	-0.33	-0.01	0.01	0.04	0.18
House Price Index	0.04	0.03	-0.17	-0.01	0.04	0.09	0.26
State-level variables							
HE Loan Liberalization	0.04	0.19	0	0	0	0	1
Rice-Strahan Index	1.35	1.46	0	0	1	4	4
Economic Freedom Index	6.07	0.91	3.56	4.49	6.22	7.19	7.54
Bank-level variables							
HH Loans Secured by Real Estate	0.12	0.34	-4.64	-0.20	0.08	0.56	6.65
C&I Loans < $1 Million	0.13	0.47	-5.25	-0.38	0.09	0.79	6.64

Note: This table reports summary statistics from 1997-1998 for all variables used in the empirical analysis, except C&I Loans < $1 Million, which is from 1995-2003. The county and bank-level variables are in log changes. See Section 2.2 for further details on the data and their sources.

Table 2

Dependent variable: Small Business Loan Originations				
	(1)	(2)	(3)	(4)
HE Loan Liberalization	-0.206***	-0.215***	-0.179***	-0.158***
	[0.030]	[0.032]	[0.028]	[0.035]
P.C. Personal Income	0.028*	0.027	0.033	0.034
	[0.016]	[0.028]	[0.057]	[0.031]
Population	0.009	-0.005	-0.073*	-0.015
	[0.015]	[0.032]	[0.032]	[0.032]
Rice-Strahan Index	-0.062**	-	-	0.102
	[0.027]			[0.060]
Economic Freedom Index	0.250	-0.738***	0.152	-0.478
	[0.202]	[0.233]	[0.220]	[0.352]
Constant	-1.689	4.679***	-0.016	2.804
	[1.139]	[1.339]	[1.546]	[2.077]
Observations	5,136	1,666	812	1,612
R-squared	0.464	0.469	0.492	0.468
County Fixed Effects	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes

Note: This table reports results from estimating equation 2.1, with the growth rate of county-level small business loan originations as the dependent variable. Robust standard errors clustered at the state-level are in parentheses. The columns report estimates relative to the following control groups: (1) all non-Texas counties in the United States, (2) counties in states with similar banking regulation to Texas (as captured by the Rice-Strahan index), (3) counties in states that border Texas, and (4) counties in states that border Texas or states that border a border state. See section 2.3 for further details.

Table 3

Dependent variable: Household Loans Secured by Real Estate				
	(1)	(2)	(3)	(4)
HE Loan Liberalization	0.044***	0.042***	0.015**	0.027***
	[0.008]	[0.006]	[0.005]	[0.007]
P.C. Personal Income	-0.081	-0.072	0.008	-0.046
	[0.077]	[0.093]	[0.088]	[0.068]
Population	0.111	-0.151	0.499	-0.249
	[0.423]	[0.495]	[0.720]	[0.531]
Rice-Strahan Index	-0.019*	-	-	-0.033*
	[0.011]			[0.015]
Economic Freedom Index	-0.016	-0.092*	0.063**	0.007
	[0.030]	[0.048]	[0.018]	[0.048]
Constant	0.216	0.697**	-0.304*	0.070
	[0.175]	[0.306]	[0.114]	[0.308]
Observations	15,484	6,556	2,994	5,420
R-squared	0.628	0.608	0.592	0.614
Bank Fixed Effects	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes

Note: This table reports results from estimating equation 2.1 with the growth rate of bank-level household loans secured by real estate as the dependent variable. Robust standard errors clustered at the state-level are in parentheses. The columns report estimates relative to the following control groups: (1) all non-Texas banks in the United States, (2) banks in states with similar banking regulation to Texas (as captured by the Rice-Strahan index), (3) banks in states that border Texas, and (4) banks in states that border Texas or states that border a border state. See section 2.3 for further details.

Table 4

Dependent variable: Commercial & Industrial Loans < $1 Million				
	(1)	(2)	(3)	(4)
HE Loan Liberalization	-0.016**	-0.026***	-0.017**	-0.014**
	[0.006]	[0.006]	[0.004]	[0.006]
P.C. Personal Income	0.001	0.001	0.004	0.002
	[0.002]	[0.002]	[0.004]	[0.002]
Population	0.004	0.003	0.009*	0.005
	[0.003]	[0.004]	[0.003]	[0.003]
Rice-Strahan Index	-0.004	0.003	0.010	0.003
	[0.005]	[0.005]	[0.005]	[0.006]
Economic Freedom Index	0.032***	0.044*	0.050**	0.044**
	[0.011]	[0.022]	[0.012]	[0.016]
Constant	-0.096	-0.194	-0.247**	-0.198*
	[0.070]	[0.147]	[0.086]	[0.105]
Observations	37,119	12,096	6,327	11,052
R-squared	0.255	0.250	0.249	0.253
Bank Fixed Effects	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes

Note: This table reports results from estimating equation 2.1 with the growth rate of bank-level commercial and industrial loans under $ 1 million as the dependent variable. Robust standard errors clustered at the state-level are in parentheses. The columns report estimates relative to the following control groups: (1) all non-Texas banks in the United States, (2) banks in states with similar banking regulation to Texas (as captured by the Rice-Strahan index), (3) banks in states that border Texas, and (4) banks in states that border Texas or states that border a border state. See section 2.3 for further details.

Table 5

Dependent variable: Small Business Loan Originations				
Panel (a)	(1)	(2)	(3)	(4)
HE Loan Liberalization	-0.295***	-0.303***	-0.259***	-0.245***
	[0.030]	[0.032]	[0.026]	[0.034]
HE Loan * House Price Index	0.135***	0.134***	0.124***	0.132***
	[0.002]	[0.004]	[0.004]	[0.004]
PC Personal Income	0.028*	0.027	0.034	0.034
	[0.016]	[0.028]	[0.057]	[0.031]
Population	0.010	-0.003	-0.068*	-0.013
	[0.015]	[0.030]	[0.029]	[0.030]
RS Index	-0.062**	-	-	0.103
	[0.027]			[0.060]
Economic Freedom Index	0.250	-0.738***	0.144	-0.480
	[0.202]	[0.233]	[0.220]	[0.352]
Constant	-1.700	4.662***	-0.065	2.778
	[1.138]	[1.341]	[1.540]	[2.076]
Observations	5,136	1,666	812	1,612
R-squared	0.465	0.471	0.496	0.470
County fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Panel (b)	(1)	(2)	(3)	(4)
HE Loan Liberalization	-	-	-	-
HE Loan * House Price Index	0.135***	0.134***	0.124***	0.132***
	[0.002]	[0.004]	[0.004]	[0.004]
PC Personal Income	0.024	0.021	0.032	0.039
	[0.015]	[0.035]	[0.056]	[0.033]
Population	0.008	-0.002	-0.067*	-0.013
	[0.014]	[0.031]	[0.030]	[0.031]
Constant	-0.209	0.064	0.784	-0.333
	[0.381]	[0.549]	[1.960]	[0.980]
Observations	5,136	1,666	812	1,612
R-squared	0.484	0.473	0.497	0.477
County Fixed Effects	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
State-Year Fixed Effects	Yes	Yes	Yes	Yes

Note: This table reports results from estimating equation 2.2, with the growth rate of county-level small business loan originations as the dependent variable. Robust standard errors clustered at the state-level are in parentheses. See section 2.3 for further details.

Table 6

Dependent variable: Commercial & Industrial Loans < $1 Million				
Panel (a)	(1)	(2)	(3)	(4)
HE Loan Liberalization	-0.023***	-0.027***	-0.019**	-0.019***
	[0.005]	[0.006]	[0.005]	[0.004]
HE Loan * House Price Index	0.003***	0.003***	0.003***	0.003***
	[0.000]	[0.000]	[0.000]	[0.000]
PC Personal Income	0.001	-0.001	0.002	0.001
	[0.002]	[0.002]	[0.003]	[0.002]
Population	0.003	0.002	0.008*	0.002
	[0.002]	[0.003]	[0.003]	[0.003]
RS Index	-0.004	0.000	0.007	0.002
	[0.004]	[0.004]	[0.004]	[0.005]
Economic Freedom Index	0.026**	0.043*	0.060**	0.053***
	[0.011]	[0.024]	[0.014]	[0.015]
Constant	-0.072	-0.193	-0.310**	-0.258**
	[0.066]	[0.156]	[0.096]	[0.102]
Observations	33,646	11,400	6,006	10,233
R-squared	0.198	0.217	0.219	0.216
County fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Panel (b)	(1)	(2)	(3)	(4)
HE Loan Liberalization	-	-	-	-
HE Loan * House Price Index	0.003***	0.003***	0.003**	0.003***
	[0.000]	[0.001]	[0.001]	[0.001]
PC Personal Income	0.001	0.000	0.002	0.001
	[0.002]	[0.003]	[0.004]	[0.002]
Population	0.002	0.002	0.007*	0.002
	[0.002]	[0.003]	[0.003]	[0.004]
Constant	0.080***	0.075***	0.065***	0.079***
	[0.005]	[0.009]	[0.010]	[0.010]
Observations	33,642	11,400	6,006	10,233
R-squared	0.211	0.226	0.224	0.224
County Fixed Effects	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
State-Year Fixed Effects	Yes	Yes	Yes	Yes

Note: This table reports results from estimating equation 2.2 with the growth rate of bank-level commercial and industrial loans under $ 1 million as the dependent variable. Robust standard errors clustered at the state-level are in parentheses. See section 2.3 for further details.

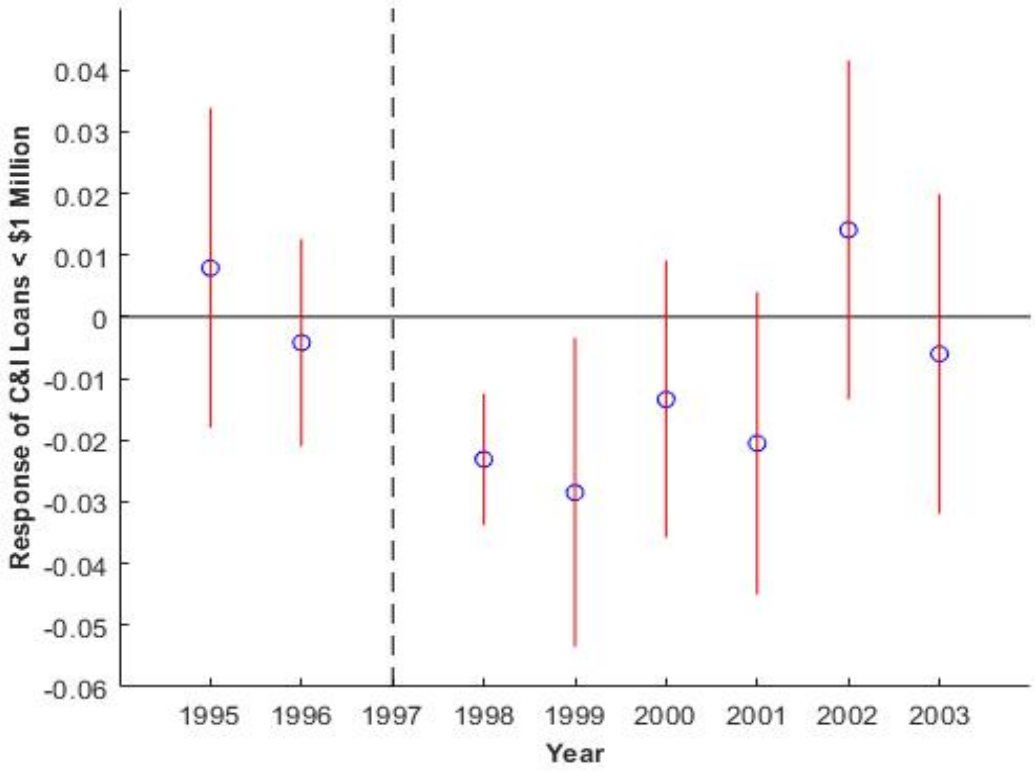

Figure 1: Coefficients and 90% confidence intervals from parallel trends event study specification

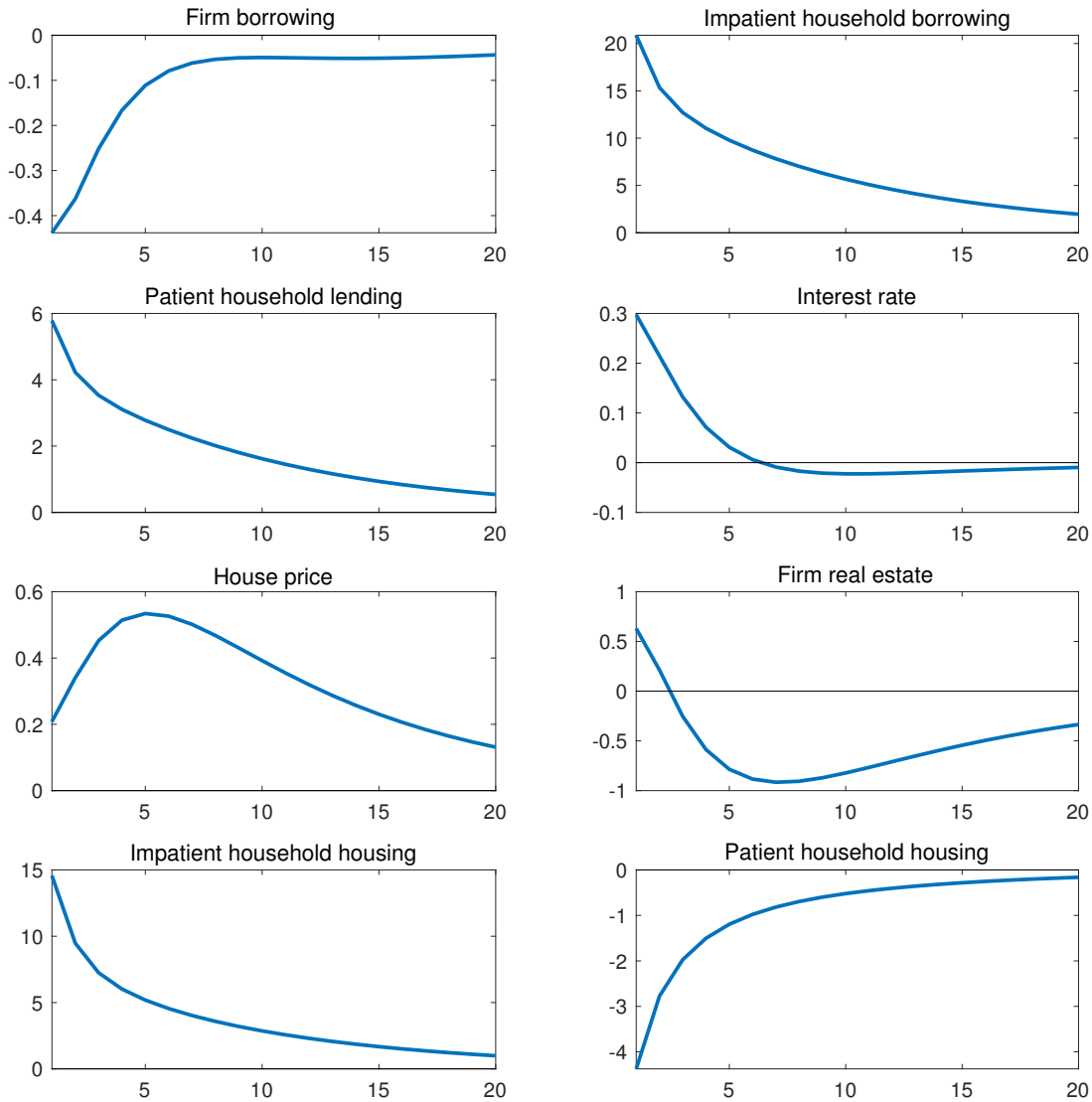

Figure 2: Positive shock to household credit: Percent deviation of variables from their steady-state values

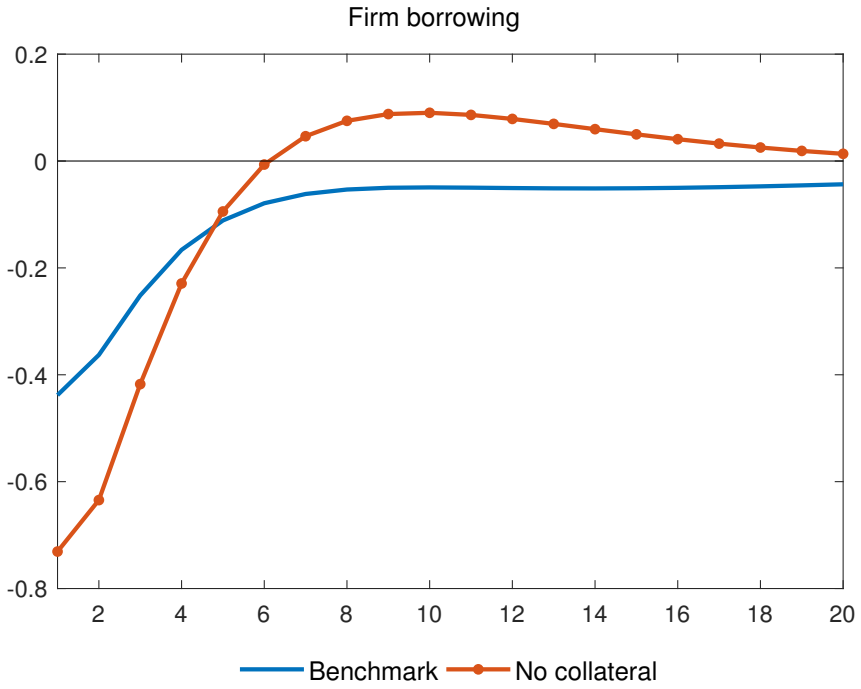

Figure 3: Positive shock to household credit: Benchmark model vs. the model with no collateral

For Online Publication

A Appendix

Table A.1

Dependent variable: Small Business Loan Originations				
	(1)	(2)	(3)	(4)
HE Loan Liberalization	-0.211***	-0.224***	-0.188***	-0.175***
	[0.028]	[0.021]	[0.039]	[0.031]
P.C. Personal Income	-0.000	-0.000	0.000**	0.000**
	[0.000]	[0.000]	[0.000]	[0.000]
Population	-0.000	-0.000	-0.000	0.000
	[0.000]	[0.000]	[0.000]	[0.000]
Rice-Strahan Index	-0.079***	-	-	0.085
	[0.024]			[0.048]
Economic Freedom Index	0.312*	-0.569***	0.079	-0.337
	[0.183]	[0.152]	[0.239]	[0.279]
Constant	-1.439	3.954***	-0.087	2.465
	[1.073]	[0.959]	[1.459]	[1.757]
Observations	5,312	1,773	858	1,697
R-squared	0.117	0.096	0.136	0.115
State Fixed Effects	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes

Note: This table reports results from estimating equation 2.1 with state fixed effects (rather than county fixed effects), with the growth rate of county-level small business loan originations as the dependent variable. Robust standard errors clustered at the state-level are in parentheses. The columns report estimates relative to the following control groups: (1) all non-Texas counties in the United States, (2) counties in states with similar banking regulation to Texas (as captured by the Rice-Strahan index), (3) counties in states that border Texas, and (4) counties in states that border Texas or states that border a border state. See section 2.3 for further details.

Table A.2

Dependent variable: Small Business Loan Originations				
	(1)	(2)	(3)	(4)
HE Loan Liberalization	-0.135***	-0.135***	-0.082**	-0.059*
	[0.026]	[0.034]	[0.021]	[0.030]
P.C. Personal Income	0.007	-0.030	-0.013	-0.010
	[0.015]	[0.024]	[0.038]	[0.026]
Population	0.004	-0.008	-0.083**	-0.033
	[0.013]	[0.029]	[0.024]	[0.027]
Rice-Strahan Index	0.011	-	-	0.175**
	[0.021]			[0.070]
Economic Freedom Index	0.274*	-0.249	0.264*	-0.202
	[0.137]	[0.188]	[0.109]	[0.256]
Constant	-1.621*	2.159*	0.062	1.966
	[0.821]	[1.101]	[0.705]	[1.591]
Observations	6,144	2,290	1,056	2,062
R-squared	0.395	0.413	0.424	0.416
County Fixed Effects	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes

Note: This table reports results from estimating equation 2.1, with the growth rate of county-level small business loan originations as the dependent variable. Small business loans under $100,000 are included in the sample. Robust standard errors clustered at the state-level are in parentheses. The columns report estimates relative to the following control groups: (1) all non-Texas counties in the United States, (2) counties in states with similar banking regulation to Texas (as captured by the Rice-Strahan index), (3) counties in states that border Texas, and (4) counties in states that border Texas or states that border a border state. See section 2.3 for further details.

Table A.3

Dependent variable: Small Business Loan Originations				
	(1)	(2)	(3)	(4)
HE Loan Liberalization	-0.351***	-0.318***	-0.300***	-0.277***
	[0.034]	[0.051]	[0.043]	[0.059]
P.C. Personal Income	0.042*	0.046	0.078	0.067
	[0.022]	[0.040]	[0.087]	[0.046]
Population	0.016	-0.003	-0.102	-0.020
	[0.020]	[0.045]	[0.048]	[0.045]
Rice-Strahan Index	-0.119***	-	-	0.042
	[0.036]			[0.113]
Economic Freedom Index	0.208	-1.054**	0.458*	-0.564
	[0.258]	[0.383]	[0.193]	[0.516]
Constant	-1.670	6.461**	-2.398	2.781
	[1.435]	[2.310]	[1.879]	[3.149]
Observations	5,136	1,666	812	1,612
R-squared	0.465	0.481	0.488	0.469
County Fixed Effects	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes

Note: This table reports results from estimating equation 2.1, with the growth rate of county-level small business loan originations as the dependent variable. No observations are winsorized or dropped from the sample. Robust standard errors clustered at the state-level are in parentheses. The columns report estimates relative to the following control groups: (1) all non-Texas counties in the United States, (2) counties in states with similar banking regulation to Texas (as captured by the Rice-Strahan index), (3) counties in states that border Texas, and (4) counties in states that border Texas or states that border a border state. See section 2.3 for further details.

Table A.4

Dependent variable: Small Business Loan Originations				
	(1)	(2)	(3)	(4)
HE Loan Liberalization	-0.146***	-0.142***	-0.161**	-0.108**
	[0.031]	[0.024]	[0.037]	[0.047]
P.C. Personal Income	0.021	0.009	-0.007	0.003
	[0.014]	[0.025]	[0.041]	[0.026]
Population	-0.006	-0.008	-0.035	-0.025*
	[0.010]	[0.018]	[0.019]	[0.014]
Rice-Strahan Index	-0.084***	-	-	0.061
	[0.025]			[0.084]
Economic Freedom Index	0.250	-0.867***	0.356	-0.289
	[0.173]	[0.124]	[0.251]	[0.381]
Constant	-1.352	5.714***	-1.036	2.510
	[0.951]	[0.789]	[1.364]	[2.043]
Observations	4,298	1,286	624	1,264
R-squared	0.540	0.524	0.562	0.545
County Fixed Effects	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes

Note: This table reports results from estimating equation 2.1, with the growth rate of county-level small business loan originations as the dependent variable. Observations for which the dependent variable are less than the 5th percentile or greater than the 95th percentile are dropped from the sample. Robust standard errors clustered at the state-level are in parentheses. The columns report estimates relative to the following control groups: (1) all non-Texas counties in the United States, (2) counties in states with similar banking regulation to Texas (as captured by the Rice-Strahan index), (3) counties in states that border Texas, and (4) counties in states that border Texas or states that border a border state. See section 2.3 for further details.

Table A.5

Dependent variable: Small Business Loan Originations				
	(1)	(2)	(3)	(4)
HE Loan Liberalization	-0.172***	-0.167***	-0.201***	-0.154***
	[0.026]	[0.024]	[0.039]	[0.041]
P.C. Personal Income	0.013	0.009	-0.025	0.008
	[0.011]	[0.023]	[0.031]	[0.023]
Population	-0.010	-0.023	-0.038	-0.021
	[0.007]	[0.014]	[0.018]	[0.015]
Rice-Strahan Index	-0.080***	-	-	-0.026
	[0.022]			[0.076]
Economic Freedom Index	0.197	-0.620***	0.435	-0.093
	[0.138]	[0.178]	[0.273]	[0.317]
Constant	-0.826	4.330***	-0.779	1.136
	[0.762]	[1.135]	[1.547]	[1.730]
Observations	3,570	1,006	516	1,030
R-squared	0.594	0.587	0.614	0.598
County Fixed Effects	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes

Note: This table reports results from estimating equation 2.1, with the growth rate of county-level small business loan originations as the dependent variable. Observations for which the dependent variable are less than the 10th percentile or greater than the 90th percentile are dropped from the sample. Robust standard errors clustered at the state-level are in parentheses. The columns report estimates relative to the following control groups: (1) all non-Texas counties in the United States, (2) counties in states with similar banking regulation to Texas (as captured by the Rice-Strahan index), (3) counties in states that border Texas, and (4) counties in states that border Texas or states that border a border state. See section 2.3 for further details.