# Does Relaxing Household Credit Constraints Hurt Small Business Lending? Evidence from a Policy Change in Texas[*]

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## Abstract

This paper studies the relationship between household credit and small business loans using the 1997 liberalization of home equity lending in Texas. First, we build a closed economy general equilibrium model that examines two opposing channels: a negative crowding out effect and a positive collateral effect. Our analysis shows that, following a household credit expansion, the crowding out effect dominates and leads to an overall decline in firm borrowing. We test this result empirically by exploiting the liberalization of home equity loans in Texas. The exogenous increase in household credit brought on by the liberalization results in a crowding out of business lending, as small business loan growth declines by roughly 20 percentage points. This negative effect is dampened in counties that experienced stronger house price growth, providing evidence of a subsidiary collateral effect.

**Keywords:** Household credit, small business lending, collateral channel, credit constraints.

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# 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) show that an increase in the household debt-to-GDP ratio predicts lower GDP growth and higher unemployment in the medium run. In the short-run, on the other hand, household credit expansions have been shown to be highly correlated with the business cycle through generating an increase in household demand (Bahadir and Gumus (2016), Mian and Sufi (2018)).

Because of these widely documented effects, governments have at times used policies to curb household credit growth to maintain financial stability or eased credit access to stimulate economic growth. In this paper, we focus on such a policy change to study the relationship between household credit and small business lending. Specifically, we analyze the response of small business loans to the 1997 liberalization of home equity lending in Texas that eased access to household credit. To this end, we first build a closed economy general equilibrium model to examine two opposing channels through which household lending may affect small business loans:

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[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.

a negative crowding out effect and a positive collateral effect. We then test the predictions of the model empirically by exploiting the Texas home equity loan liberalization, which provides an ideal setting to empirically analyze how an exogenous increase in household credit affects business loans.

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. The liberalization relaxed these restrictions, allowing home equity loans, cash-out refinance loans, and reverse mortgages for the first time, which broadened the ability of Texans to use their homes as loan collateral (Abdallah and Lastrapes (2012)). The Texas amendment therefore allows us to identify an exogenous increase in household credit as it loosened the credit constraints faced by households.

Theoretical studies on financial frictions and business cycles show that changes in collateral values affect business cycles through 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) 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 both theoretically and empirically.

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. Small firms being financially more constrained than large firms has been widely established in the literature and firm size is usually used as a proxy for how constrained a firm is in terms of access to funds (Beck and Demirguc-Kunt (2006), Beck, Demirgüç-Kunt, Laeven, and Maksimovic (2006), Hadlock and Pierce (2010)). Because of the limited access to external funds, small businesses are more likely to compete 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.

To study the link between household and business credit, we first develop a closed economy general equilibrium model with housing and collateral constraints. In the model, borrowing by impatient households and entrepreneurs is financed by savings of patient households. The amount of borrowing is constrained by the collateral agents own and changes in house prices and LTV ratios determine the borrowing limits. 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. This finding suggests that the crowding out effect dominates the collateral effect and the total effect on firm borrowing is 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.

To test the validity of our theoretical results, 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 policy change. The baseline results suggest that the increase in household credit brought on by the liberalization 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. Hence, the results from the empirical analysis are consistent with the implications of the theoretical model.

The 1997 liberalization of home equity lending in Texas allows us to identify an exogenous household credit shock and is the main empirical strategy used in the paper. However, studying this policy change restricts our empirical analysis to a specific period. To support the external validity of these findings, we also analyze the relationship between household credit and small business lending for all US counties over a longer 2000 to 2019 sample. These results show that higher household debt-to-income ratios within a county are associated with significantly lower growth rates in small business loan originations the following year. Taken with the results from our theoretical model, this supplementary evidence suggests that the dominance of the crowding out effect identified in the wake of the Texas liberalization holds in more general circumstances.

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)). 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. Using a panel data analysis for a large group of countries, they 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.

Another strand of literature our paper contributes to is the empirical finance literature, which uses firm-level data to study how changes in real estate prices affect firms through collateral and crowding out channels. Higher collateral values have been shown to have positive effects on corporate investment (Chaney, Sraer, and Thesmar (2012), Gan (2007)), entrepreneurship (Schmalz, Sraer, and Thesmar (2017)) and small business employment (Adelino, Schoar, and Severino (2015)). On the other hand, Chakraborty, Goldstein, and MacKinlay (2018) and Martín, Moral-Benito, and Schmitz (2021) show that real estate price booms cause banks to increase housing credit while simultaneously decreasing credit to firms. We contribute to this literature by studying the effects of a change in *household credit* rather than real estate prices and separately analyzing the collateral and crowding out channels to quantify their relative strengths, both theoretically and empirically.

Our paper also belongs to the literature that uses the Texas liberalization as a quasi-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 (2021)). One recent paper is by Lastrapes, Schmutte, and Watson (2022), which shows that the Texas amendment led to higher home equity borrowing by small business owners. Our work complements theirs by focusing on total business loans, rather than personal home equity loans, which constitutes only a part of external financing for small firms. Our goal is to capture how relaxing credit constraints on households changes the overall financing conditions for small businesses, which distinguishes our contribution from theirs. In Section 3.1 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) show 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 the real exchange rate, whereas Bahadir and Gumus (2018) emphasize the role of real estate in the transmission of household and business credit shocks to the real economy.

The paper has three remaining sections. Section 2 presents a theoretical model to study the effect of an exogenous increase in household credit on business credit. We lay out the empirical strategy and discuss the results in Section 3. Finally, we conclude in Section 4.

## 2 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.

## 2.1 PATIENT HOUSEHOLDS

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

$$E_0 \sum_{t=0}^{\infty} (\beta^p)^t \left[ \ln\left(c_t^p\right) - (n_t^p)^\eta / \eta + \gamma \ln h_t^p \right], \tag{2.1}$$

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, $\eta$ is the parameter that governs the intertemporal elasticity of substitution in labor supply, and $\gamma$ is the weight of housing in the utility function.

The budget constraint of patient households is given by

$$c_t^p + R_{t-1} b_{t-1}^p + q_{h,t}(h_t^p - h_{t-1}^p) = w_t^p n_t^p + b_t^p, \tag{2.2}$$

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.

## 2.2 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

$$E_0 \sum_{t=0}^{\infty} (\beta^h)^t \left[ \ln\left(c_t^h\right) - (n_t^h)^\eta / \eta + \gamma \ln h_t^h \right], \tag{2.3}$$

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

$$c_t^h + R_{t-1} b_{t-1}^h + q_{h,t}(h_t^h - h_{t-1}^h) = w_t^h n_t^h + b_t^h. \tag{2.4}$$

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

$$R_t b_t^h \leq m_t^h E_t \left( q_{h,t+1} h_t^h \right). \tag{2.5}$$

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:

$$m_t^h = \bar{m}^h \exp(\tilde{m}_t^h), \tag{2.6}$$

and

$$\tilde{m}_t^h = \rho^h \tilde{m}_{t-1}^h + \varepsilon_t^h \tag{2.7}$$

where innovations $\varepsilon_t^h$ 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. This way of simulating our model aligns well with our empirical analysis, which uses the Texas amendment to identify an exogenous household credit shock and studies the response of small business loans to the expansion in household credit.

2.3 ENTREPRENEURS   The entrepreneur maximizes her expected lifetime utility given by

$$E_0 \sum_{t=0}^{\infty} (\beta^e)^t \ln(c_t^e), \tag{2.8}$$

where $\beta^e$ is the discount factor of the entrepreneur with $\beta^e < \beta^p$ and $c_t^e$ is the entrepreneur's consumption. The utility function of entrepreneurs only depends on consumption since they do not provide labor services and do not get utility from housing services. They use real estate in production along with capital and households' labor services, and produce output by a Cobb-

Douglas technology:

$$y_t = k_{t-1}^{\alpha}(h_{t-1}^e)^{\mu}(n_t^h)^{\nu(1-\alpha-\mu)}(n_t^p)^{(1-\nu)(1-\alpha-\mu)}, \tag{2.9}$$

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

$$i_t = k_t - (1-\delta)k_{t-1}. \tag{2.10}$$

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

$$R_t b_t^e \leq m^e E_t(k_t + q_{h,t+1}h_t^e), \tag{2.11}$$

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.

The flow of funds constraint for the entrepreneur takes the form:

$$c_t^e + w_t^p n_t^p + w_t^h n_t^h + i_t + q_{h,t}(h_t^e - h_{t-1}^e) + R_{t-1}b_{t-1}^e = y_t + b_t^e. \tag{2.12}$$

2.4 EQUILIBRIUM   Given initial conditions $b_0^p, b_0^h, b_0^e$ and $k_0$, a constant real interest rate $R$, and the stochastic process for 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, $c_t^p + c_t^h + c_t^e + i_t = y_t$.

2.5 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 Iacoviello (2005), 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, $\gamma$, is set to 0.1, which we also borrow from Iacoviello (2005). The parameter that governs the intertemporal elasticity of labor supply, $\eta$, 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, $\alpha$, to 0.30, the share of real estate, $\mu$, to 0.03 and the share of impatient households' labor in total labor $\nu$ to 0.36. Depreciation rate of capital, $\delta$, 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.

2.6 IMPULSE RESPONSE ANALYSIS   In Figure 1, 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 1 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 impulse response analysis show that the crowding out effect dominates and the total effect on firm borrowing is 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.

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 2. 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.[2] 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 2 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 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.[3]

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

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

The impulse response analysis overall shows that an exogenous increase in household borrowing leads to a decline in firm borrowing. This decline is due to the crowding out effect being greater than the collateral effect. In the next section, we use the liberalization of home equity loans in Texas as an exogenous shock to household borrowing and empirically analyze the effects of this policy change on small business loans. We test the implications of the model by, first, estimating the total effect of the policy change on small business loans. Then, we empirically analyze whether there is a positive collateral effect as implied by the model.

# 3  EMPIRICAL EVIDENCE

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

3.1  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, providing an appealing empirical example of a positive household credit shock.[4]

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 ban remained in place for well over a century. The Texas Senate Interim Committee on Home Equity Lending first suggested easing 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. After that first failure, a similar amendment proposal ended up passing both houses a few years later in May 1997. That put the

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[4]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.

amendment on the ballot and allowed Texans to vote on, and ultimately approve the change to the constitution in November 1997. The amendment took effect shortly after, with home equity loans becoming legal on January 1, 1998.

Abdallah and Lastrapes (2012) argue in detail that the passage of the amendment, and subsequent liberalization of home equity loans, can be considered an exogenous source of variation in the availability of credit for households.[5] A first consideration is whether passage of the amendment was widely anticipated. If it was, then firms, households, and financial institutions may have adjusted their behavior prior to enactment. This could bias estimates of the amendment's impact if January 1, 1998 is incorrectly taken to be its effective date. Abdallah and Lastrapes (2012) note, however, that there were strong views on both sides of the issue and that passage of the amendment was far from guaranteed, suggesting that anticipatory effects prior to 1998 were unlikely. In our context, had financial institutions correctly predicted passage of the amendment and altered their small business lending prior to its enactment, this would merely bias our estimates downwards and understate the actual effects of the amendment.[6]

A second potential concern is whether the amendment was an endogenous response to changes in the demand for credit in Texas. If the amendment was passed in order to satisfy higher household credit demand, our interpretation of the event as a credit supply shock would clearly be inappropriate. Abdallah and Lastrapes (2012) reviewed accounts of the debate over the amendment and conclude "the impetus for change ultimately came from the desire of Texans to have what citizens of other states had in terms of financial innovations, for both practical and philosophical reasons, regardless of perceived trends in income or the demand for credit."[7] They specifically identify three "exogenous" legal/political factors as driving the amendment's passage. Home equity lending throughout the US expanded greatly after the 1986 passage of the US Tax Reform Act, which eliminated income tax deductibility of all forms of consumer interest except mortgage interest. The inability of Texas citizens to maximize this tax benefit

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[5]See Section I(B) of Abdallah and Lastrapes (2012) for the full argument.

[6]Given that we have annual data, the fact that the Amendment was not passed until late in 1997 also mitigates concerns over anticipatory effects.

[7]Abdallah and Lastrapes (2012) p. 101-102.

motivated early interest in amending the state constitution. Then, in 1994 a US Court of Appeals decision temporarily overruled Texas' home equity loan restrictions. Though the decision was nullified by subsequent congressional changes to federal banking laws, the back-and-forth again brought attention to the state's unique circumstances. Finally, the Republican party, which in the mid-1990s was philosophically predisposed to removing governmental restrictions on economic activity, gained power in Texas around this time. Contemporary accounts did not list an unmet demand for credit as a key driver of the amendment's passage.

A third potential concern is confounding factors that may have influenced the trajectory of small business lending in Texas around the same time. Any other legal or institutional changes that affected small businesses would be particularly worrisome. In that regard, Texas passed 14 additional constitutional amendments in 1997, none of which were related to small business lending. Furthermore, Texas' primary tax on business, the franchise tax, was held constant from 1991 to 2006. Lastly, a broader search of Texas' Summary of Enactments of the 75th Legislature (1997 Regular Session) fails to uncover any significant and relevant legislative changes in the areas of banking and finance, business relations, or economic development. Our regression analysis will directly control for state banking and business environments, as well as changes in local economic conditions.

Overall, careful analysis of the amendment's passage by Abdallah and Lastrapes (2012) suggests that the liberalization of home equity loans in Texas resulted in an unanticipated expansion in the supply of household credit, which was plausibly exogenous to credit demand. Moreover, there were no alternative legal or institutional developments in Texas at the time that may have had a confounding effect on small business credit. The liberalization therefore appears to be suitable for identifying the response of small business lending to a household credit shock within a difference-in-differences framework.[8]

Abdallah and Lastrapes (2012) initiated the literature exploiting the Texas liberalization as a quasi-natural experiment, providing evidence that retail sales increased following the amendment,

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[8]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 (2021).

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 (2021) finds that Texas home prices increased significantly as a result of the liberalization.[9] Finally, in a related paper that will be discussed in more detail below, Lastrapes, Schmutte, and Watson (2022) investigate the increasing role of home equity loans in small business finance following the amendment.

### 3.2 DATA AND EMPIRICAL STRATEGY 

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

$$\Delta log(L_{cst}) = \alpha_c + \delta_t + \beta_1 HELoan_{st} + X_{st}\gamma + Z_{ct}\psi + \epsilon_{cst} \qquad (3.1)$$

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, $Z_{ct}$ contains county-level annual growth rates of per capita income and population to control for local economic conditions.[10] Given that our source of variation (the Texas amendment) is across

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[9] An increase in house prices following a positive household credit shock is consistent with our impulse response analysis in Section 2.6.

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

states, we cluster standard errors at the state-level in order to address potential serial correlation.

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.[11] The data is categorized 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.[12] 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 one pre- and one post-treatment period.

Our primary goal is to explore how an exogenous change in household credit impacts small business credit. While the Texas liberalization of home equity loans prima facie appears to qualify as such an exogenous shock, we nevertheless aim to provide empirical justification. To confirm that household credit did in fact increase following the liberalization, we also estimate equation 3.1 with a measure of household credit growth as the dependent variable. There are limited sources of disaggregated data on household credit for our sample period.[13] 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 an alternative measure of small business lending. 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

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[11]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.

[12]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.

[13]For instance, county and state-level data compiled by the Federal Reserve Bank of New York Consumer Credit Panel does not begin until 1999.

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. There is a 0.87 correlation between CRA loan originations and small C&I loans when aggregating to the state-level over 1997-1998, providing confidence that, while there are notable differences in the construction of the two measures, they ultimately account for much of the same variation in small business lending dynamics. 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 the variables used in our 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.[14]

The difference-in-differences framework requires a treatment group and a control group. Specifically, in order for estimates from equation 3.1 to have a valid causal interpretation, it must be the case that small business lending would have evolved in parallel in both groups had the Texas home equity loan liberalization not occurred. The treatment group naturally consists of all counties in Texas, however the most appropriate control group is less straightforward. We therefore estimate equation 3.1 with three control groups: 1) all non-Texas counties in the United States, 2) counties in states with similar banking regulation to Texas, and 3) counties in states that border Texas or in states that border a border state.

The first control group, including the rest of the country, has the advantage of offering the broadest comparison. On the other hand, it has the disadvantage of potentially being the most susceptible to a failure of the parallel trends assumption. One particular concern is that state-level banking sectors underwent a transition in the second half of the 1990's, following the 1994 passage of the Riegle-Neal Interstate Banking and Branching Efficiency Act. Riegle-Neal allowed for nationwide interstate branch banking, but also gave state governments the ability to

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

restrict the entrance and activities of out-of-state banks to various degrees. Some states, such as North Carolina and Virginia, quickly removed all restrictions whereas others, such as Texas, initially maintained the most stringent level of restrictions. As a result, banking sector trends, including the allocation of credit, may have evolved heterogeneously in states with varying levels of interstate banking regulation.

Our second control group therefore includes states with the same level of banking restrictions as Texas at the time of the amendment. The degree of state-level restrictions is quantified into an index by Rice and Strahan (2010). 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 Riegle-Neal. The second control group, therefore, includes all states with a Rice-Strahan Index value of 0 in 1998.[15]

Differences in the structure of state economies may also lead to divergent trends in small business credit allocation. In the late 1990's, states in close geographical proximity tended to have similar economies. This can be observed for Texas in Figure 3, which compares the industry share of private nonfarm employment in Texas in 1998 to (a) states that are in close geographical proximity and (b) states in the rest of the country. We consider states in close geographical proximity to be states that directly border Texas and states that "border a border state." As can be seen in the figure, the industry mix in Texas bears a closer resemblance to nearby states than to the rest of the country. As a result, the third control group in our difference-in-differences analysis will include the states that border Texas: Louisiana, Arkansas, Oklahoma, and New Mexico, and the states that border one of the "border states:" Mississippi, Tennessee, Missouri, Kansas, Colorado, Utah, and Arizona. We will report difference-in-differences estimates relative to all three control groups in the following section.

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[15]These states include Arkansas, Colorado, Hawaii, Iowa, Kansas, Kentucky, Mississippi, Missouri, Montana, Nebraska, New Hampshire, and Oklahoma. 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 additional details on the index's construction.

3.3 Results   Results from estimating equation 3.1 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 policy change. The control group in the additional columns is counties in states with similar banking restrictions in column (2) and counties in border states or states that border a border state in column (3). While the magnitude declines slightly to 15.8 percentage points in column (3), the estimated effect remains negative and statistically significant relative to all three control groups.[16] 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 3.1, 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 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 scope to our analysis. If our interpretation of the Texas home equity loan liberalization as a positive household credit shock is accurate, we would expect there to be a measurable increase in household credit. We therefore estimate equation 3.1, 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

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[16]Appendix Table A.1 shows the results are unchanged when county fixed effects are replaced with state fixed effects.

in Texas is once again estimated relative to the three control groups detailed above, over the 1997-1998 sample period, with results presented in Table 3.[17] As expected, the coefficient on the liberalization dummy is positive and statistically significant in all three columns, indicating that bank loans secured by residential real estate increased by 2.7 to 4.4 percentage points in Texas following the enactment of the amendment. This increase could plausibly be driven by a substitution away from other types of household loans that are not secured by real estate (e.g., consolidation loans, auto loans, installment loans, etc.). To ensure that the liberalization led to an increase in *total* household credit, and not just a shift in composition, we sum together real estate loans secured by 1-4 family residential properties and loans (unsecured by real estate) to individuals for household, family, and other personal expenditures, and repeat the exercise with this broader dependent variable. The estimates presented in Appendix Table A.6 show that total household loan growth in Texas increased relative to all three control groups. These results, therefore, provide explicit empirical justification for our interpretation of the liberalization as a positive household credit shock.

As discussed in Section 3.2, 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 required by our difference-in-differences framework. An attractive alternative measure of small business lending is C&I loans under $1 million, which is available starting in 1994. First, to ensure we obtain consistent results with this alternative measure, we re-estimate equation 3.1 with the annual growth rate in small C&I loans as the dependent variable, over a longer sample period: 1995-2003.[18] Table 4 presents results, with columns (1)-(3) 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

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[17]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), and 3) 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 estimation.

[18]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.

liberalization. The evidence therefore suggests a crowding out of small business lending following the policy change, regardless of which measure of small business lending is used.

This conclusion, however, depends on the assumption that small business loan growth in Texas was not already declining relative to the control groups prior to the enactment of the amendment in 1998. The longer sample (1995-2003) provided by the small C&I data allows us to explicitly test this assumption by re-estimating equation 3.1 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, relative to banks in the control states, until after the liberalization takes effect.

We perform this event study specification for all three control groups, with results displayed in Figure 4. The Texas year dummy coefficients are plotted 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. In all three panels, 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 statistically significant, indicating that the parallel trends assumption does indeed hold for our alternative measure of small business lending.

Due to the CRA data limitations, we are unable to explicitly produce an analogous result when small business loan origination growth is our outcome variable. However, the fact that CRA small business loan originations are highly correlated with small C&I loans on bank balance sheets over our sample period (correlation of 0.87), that small C&I loan growth in Texas evolved in parallel with all three control groups prior to the liberalization, and that we find consistent declines in both small business lending outcomes after the liberalization, provides reassurance that a violation of the parallel trends assumption is highly unlikely to be driving our baseline results in Table 2.

To summarize, the results in Tables 2-4 show 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. In a related paper, Lastrapes, Schmutte, and Watson (2022) also study the effect of the Texas amendment on small businesses and provide important insights as to how the composition of small business loans changed as a result of the amendment. Using survey data on the source of financing used to start or acquire a business, they find that small business owners in Texas significantly increased their reliance on home equity loans following the amendment and decreased their use of other (non-home equity) loans, which suggests a substitution between the two types of loans. While their study only covers loans used for starting or acquiring a business, which represent a subset of total loans used by firms, their results may still imply that small businesses substituted business loans with home equity loans, without necessarily crowding out small business financing in total.

To analyze whether the decline in small business loans that we obtain in our analysis following the policy change is caused by a switch to home equity loans, we run the baseline regressions using only loans that are over $250,000, which are more difficult to finance using limited home equity loans.[19] The results in Table A.7 show that the effect remains negative and significant, providing evidence that substitution of business loans with home equity loans does not explain the overall decline in small business loans. This result is consistent with the observation that only 6.8 percent of small business owners reported to have used home equity lending in 2007 according to the survey data used by Lastrapes, Schmutte, and Watson (2022). Given the small share of home equity loans used by small business owners, focusing on total business loans provides a more complete picture as to how access to credit for small businesses was affected by the policy change.

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

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[19]Since home equity loan amounts are based on the difference between a home's current market value and the homeowner's mortgage balance due, the amounts borrowed are more likely to substitute the loans on the lower end of our sample.

firms themselves. Indeed, Zevelev (2021) provides detailed evidence that house prices increased in Texas following the 1997 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 3.1 as follows:

$$\Delta log(L_{cst}) = \alpha_c + \delta_t + \beta_1 HELoan_{st} + \beta_2(HELoan_{st} \times HPI_c) + X_{st}\gamma + Z_{ct}\psi + \epsilon_{cst} \qquad (3.2)$$

where $HPI_c$ is the growth rate of the county-level Federal Housing Finance Agency all-transactions house price index.

Given our earlier results, we expect a negative $\beta_1$, indicating an overall crowding out of small business loan growth. The variable of interest then becomes the interaction between the Texas liberalization dummy and the house price index.[20] Its coefficient, $\beta_2$, captures how heterogeneity in house prices may have amplified or dampened the overall negative effect of the household credit shock. Under the collateral channel, stronger growth in house prices should relax firm credit constraints to a greater degree, resulting in a relative increase in small business credit and a corresponding dampening of the crowding out effect. A positive $\beta_2$ would therefore provide evidence of an active, albeit subsidiary, collateral channel.

Equation 3.2 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)-(3) corresponding to the three control groups discussed above. Panel (a) presents results from estimating equation 3.2 as written. The coefficient on the liberalization dummy ($\beta_1$) is once again negative and statistically significant in all three columns. The coefficient on the interaction between the dummy and house price index ($\beta_2$) is positive and significant at the 1% level, indicating that small business loan growth decreased by roughly half as much in Texas counties which experienced a standard deviation increase in house price growth prior to the

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[20]The house price index is entered as a county's value prior to the enactment of the liberalization in order to mitigate simultaneity concerns. Since it lacks time variation, $HPI_c$ is perfectly collinear with the county fixed effects, hence we will not obtain an estimated coefficient on $HPI_c$ itself.

liberalization.[21]  Column (1), for instance, indicates that a county with average house price growth prior to the amendment experienced a 29.5 percentage point decrease in small business loan growth, whereas a county with house price growth one standard deviation above average experienced only a 16 percentage point $(-29.5 + 13.5)$ decrease.

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 3.2 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 less pronounced declines in small C&I loan growth for Texas banks 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 the home equity loan liberalization establishes that there was, on average, a decline in small business loan growth in Texas following the amendment, with deeper declines occurring in areas with lower house price growth, and consequently a weaker offsetting collateral channel. These results are consistent with our theoretical investigation into the rela-

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

tionship between household and small business credit in the preceding section. To further confirm the generality of these findings, we next look at the empirical relationship between household credit and small business lending in a broader setting.

3.4 EXTERNAL VALIDITY    While exploiting the 1997 Texas home equity loan liberalization allows us to identify the causal impact of a household credit shock on small business lending, one may question whether the estimated relationship from this episode extends to the present day. To probe the external validity of our baseline results, we next relate small business lending and household credit over a longer sample extending from 2000 to 2019. Specifically, we estimate the following regression equation using county-level annual data:

$$\Delta log(L_{cst}) \;=\; \alpha_c \;+\; \delta_t \;+\; \beta HHDebt_{c,t-1} \;+\; X_{st}\gamma \;+\; Z_{ct}\psi \;+\; \epsilon_{cst} \tag{3.3}$$

where the dependent variable $\Delta log(L_{cst})$ is again small business loan growth in county $c$ (and state $s$) in year $t$. The independent variable of interest in this specification, $HHDebt_{c,t-1}$, is county $c$'s median household debt-to-income ratio lagged by one year. The household debt-to-income ratio, obtained from the Board of Governors of the Federal Reserve System's Enhanced Financial Accounts, is available beginning in 1999 and hence cannot be used in our analysis of the Texas liberalization. In the succeeding years, however, it represents the most comprehensive county-level measure of household access to credit. We include it in the regression with one lag in order to minimize simultaneity concerns. $X_{st}$ and $Z_{ct}$ once again contain state and county-level controls.

The previous difference-in-differences analysis exploiting the 1997 Texas liberalization, which compares treated counties in Texas with control counties in other states, produces estimates which can be given a causal interpretation as long as the underlying parallel trends assumption holds. Estimates from equation 3.3 must be treated more cautiously. That said, they have the potential to offer a broader perspective on the relationship between household credit and small business lending. A negative association over the last two decades, across all US counties, would

be consistent with the notion that the crowding out effect identified in the wake of the Texas liberalization generalizes to a broader range of circumstances, up to the present day.

Results from estimating equation 3.3 are presented in Table 7, with robust standard errors two-way clustered by county and time in parentheses. As noted previously, small business loan growth tends to have large outliers in both tails of the distribution. Accordingly, column (1) presents results without winsorizing the outcome variable, column (2) presents results when winsorizing at the 5th and 95th percentiles, and column (3) presents results when winsorizing at the 10th and 90th percentiles. In all three columns, higher household debt-to-income ratios within a county are associated with significantly lower growth rates in small business loan originations the following year. While not causal, these estimates suggest that the negative impact of an increase household credit on small business loan growth identified from the previous section's quasi-natural experiment is likely to extend beyond the circumstances of Texas in the late 1990's. Indeed, the estimates in Table 7 are consistent with the general impulse responses produced by our theoretical model in Section 2.6. All together, the cumulative evidence points towards the crowding out channel dominating the collateral channel in the wake of a household credit shock.

## 4  CONCLUSION

In this paper, we study the effects of a policy change that eases access to household credit on small business lending. First, we build a closed economy general equilibrium 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.

To empirically test the predictions of our theoretical model, we use the 1997 liberalization of home equity lending in Texas as a quasi-natural experiment and 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. Hence, our empirical results are in line with the responses generated by the theoretical model. A negative association between household credit and small business lending in all US counties from 2000-2019 supports the broader relevance of these findings.

The implications of our paper are important 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. Hence, policies that aim to stimulate the economy through household credit expansions may have some unintended consequences on the real economy by hurting small businesses and entrepreneurs. Our results suggest that policy makers should take this link into account when designing macro-prudential tools that target household credit growth.

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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 3.2 for further details on the data and their sources.

Table 2

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

Note: This table reports results from estimating equation 3.1, 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), and (3) counties in states that border Texas or states that border a border state. See section 3.3 for further details. * p<0.10; ** p<0.05; *** p<0.01.

Table 3

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

Note: This table reports results from estimating equation 3.1 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), and (3) banks in states that border Texas or states that border a border state. See section 3.3 for further details. * $p<0.10$; ** $p<0.05$; *** $p<0.01$.

Table 4

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

Note: This table reports results from estimating equation 3.1 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), and (3) banks in states that border Texas or states that border a border state. See section 3.3 for further details. * $p<0.10$; ** $p<0.05$; *** $p<0.01$.

Table 5

| Dependent variable: Small Business Loan Originations | | | |
|---|---|---|---|
| Panel (a) | (1) | (2) | (3) |
| HE Loan Liberalization | -0.295*** | -0.303*** | -0.245*** |
| | [0.030] | [0.032] | [0.034] |
| HE Loan * House Price Index | 0.135*** | 0.134*** | 0.132*** |
| | [0.002] | [0.004] | [0.004] |
| P.C. Personal Income | 0.028* | 0.027 | 0.034 |
| | [0.016] | [0.028] | [0.031] |
| Population | 0.010 | -0.003 | -0.013 |
| | [0.015] | [0.030] | [0.030] |
| Rice-Strahan Index | -0.062** | - | 0.103 |
| | [0.027] | | [0.060] |
| Economic Freedom Index | 0.250 | -0.738*** | -0.480 |
| | [0.202] | [0.233] | [0.352] |
| Constant | -1.700 | 4.662*** | 2.778 |
| | [1.138] | [1.341] | [2.076] |
| | | | |
| Observations | 5,136 | 1,666 | 1,612 |
| R-squared | 0.465 | 0.471 | 0.470 |
| County Fixed Effects | Yes | Yes | Yes |
| Year Fixed Effects | Yes | Yes | Yes |
| Panel (b) | (1) | (2) | (3) |
| HE Loan Liberalization | - | - | - |
| HE Loan * House Price Index | 0.135*** | 0.134*** | 0.132*** |
| | [0.002] | [0.004] | [0.004] |
| P.C. Personal Income | 0.024 | 0.021 | 0.039 |
| | [0.015] | [0.035] | [0.033] |
| Population | 0.008 | -0.002 | -0.013 |
| | [0.014] | [0.031] | [0.031] |
| Constant | -0.209 | 0.064 | -0.333 |
| | [0.381] | [0.549] | [0.980] |
| | | | |
| Observations | 5,136 | 1,666 | 1,612 |
| R-squared | 0.484 | 0.473 | 0.477 |
| County Fixed Effects | Yes | Yes | Yes |
| Year Fixed Effects | Yes | Yes | Yes |
| State-Year Fixed Effects | Yes | Yes | Yes |

Note: This table reports results from estimating equation 3.2, 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 3.3 for further details. * $p<0.10$; ** $p<0.05$; *** $p<0.01$.

Table 6

| Dependent variable: Commercial & Industrial Loans < $1 Million | | | |
|---|---|---|---|
| Panel (a) | (1) | (2) | (3) |
| HE Loan Liberalization | -0.023*** | -0.027*** | -0.019*** |
| | [0.005] | [0.006] | [0.004] |
| HE Loan * House Price Index | 0.003*** | 0.003*** | 0.003*** |
| | [0.000] | [0.000] | [0.000] |
| P.C. Personal Income | 0.001 | -0.001 | 0.001 |
| | [0.002] | [0.002] | [0.002] |
| Population | 0.003 | 0.002 | 0.002 |
| | [0.002] | [0.003] | [0.003] |
| Rice-Strahan Index | -0.004 | 0.000 | 0.002 |
| | [0.004] | [0.004] | [0.005] |
| Economic Freedom Index | 0.026** | 0.043* | 0.053*** |
| | [0.011] | [0.024] | [0.015] |
| Constant | -0.072 | -0.193 | -0.258** |
| | [0.066] | [0.156] | [0.102] |
| | | | |
| Observations | 33,646 | 11,400 | 10,233 |
| R-squared | 0.198 | 0.217 | 0.216 |
| Bank Fixed Effects | Yes | Yes | Yes |
| Year Fixed Effects | Yes | Yes | Yes |
| Panel (b) | (1) | (2) | (3) |
| HE Loan Liberalization | - | - | - |
| | | | |
| HE Loan * House Price Index | 0.003*** | 0.003*** | 0.003*** |
| | [0.000] | [0.001] | [0.001] |
| P.C. Personal Income | 0.001 | 0.000 | 0.001 |
| | [0.002] | [0.003] | [0.002] |
| Population | 0.002 | 0.002 | 0.002 |
| | [0.002] | [0.003] | [0.004] |
| Constant | 0.080*** | 0.075*** | 0.079*** |
| | [0.005] | [0.009] | [0.010] |
| | | | |
| Observations | 33,642 | 11,400 | 10,233 |
| R-squared | 0.211 | 0.226 | 0.224 |
| Bank Fixed Effects | Yes | Yes | Yes |
| Year Fixed Effects | Yes | Yes | Yes |
| State-Year Fixed Effects | Yes | Yes | Yes |

Note: This table reports results from estimating equation 3.2 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 3.3 for further details. * p<0.10; ** p<0.05; *** p<0.01.

Table 7

| Dependent variable: Small Business Loan Originations | | | |
|---|---|---|---|
| | (1) | (2) | (3) |
| HH Debt-to-Income Ratio | -0.015*** | -0.015** | -0.013** |
| | [0.005] | [0.005] | [0.005] |
| P.C. Personal Income | 0.002 | -0.004 | 0.003 |
| | [0.110] | [0.087] | [0.076] |
| Population | 0.539* | 0.500** | 0.461** |
| | [0.311] | [0.226] | [0.184] |
| Rice-Strahan Index | 0.005 | 0.006 | 0.006 |
| | [0.015] | [0.010] | [0.008] |
| Economic Freedom Index | -0.001 | 0.003 | 0.004 |
| | [0.012] | [0.011] | [0.010] |
| Constant | 0.036 | 0.012 | 0.003 |
| | [0.054] | [0.053] | [0.051] |
| Observations | 56,315 | 56,315 | 56,315 |
| R-squared | 0.065 | 0.078 | 0.087 |
| County Fixed Effects | Yes | Yes | Yes |
| Year Fixed Effects | Yes | Yes | Yes |

Note: This table reports results from estimating equation 3.3, with the growth rate of county-level small business loan originations as the dependent variable. Robust standard errors two-way clustered by county and year are in parentheses. The outcome variable is not winsorized in column (1), is winsorized at the 5th and 95th percentiles in column (2), and is winsorized at the 10th and 90th percentiles in column (3).* $p<0.10$; ** $p<0.05$; *** $p<0.01$.

Figure 1: Positive shock to household credit: Percent deviation of variables from their steady-state values
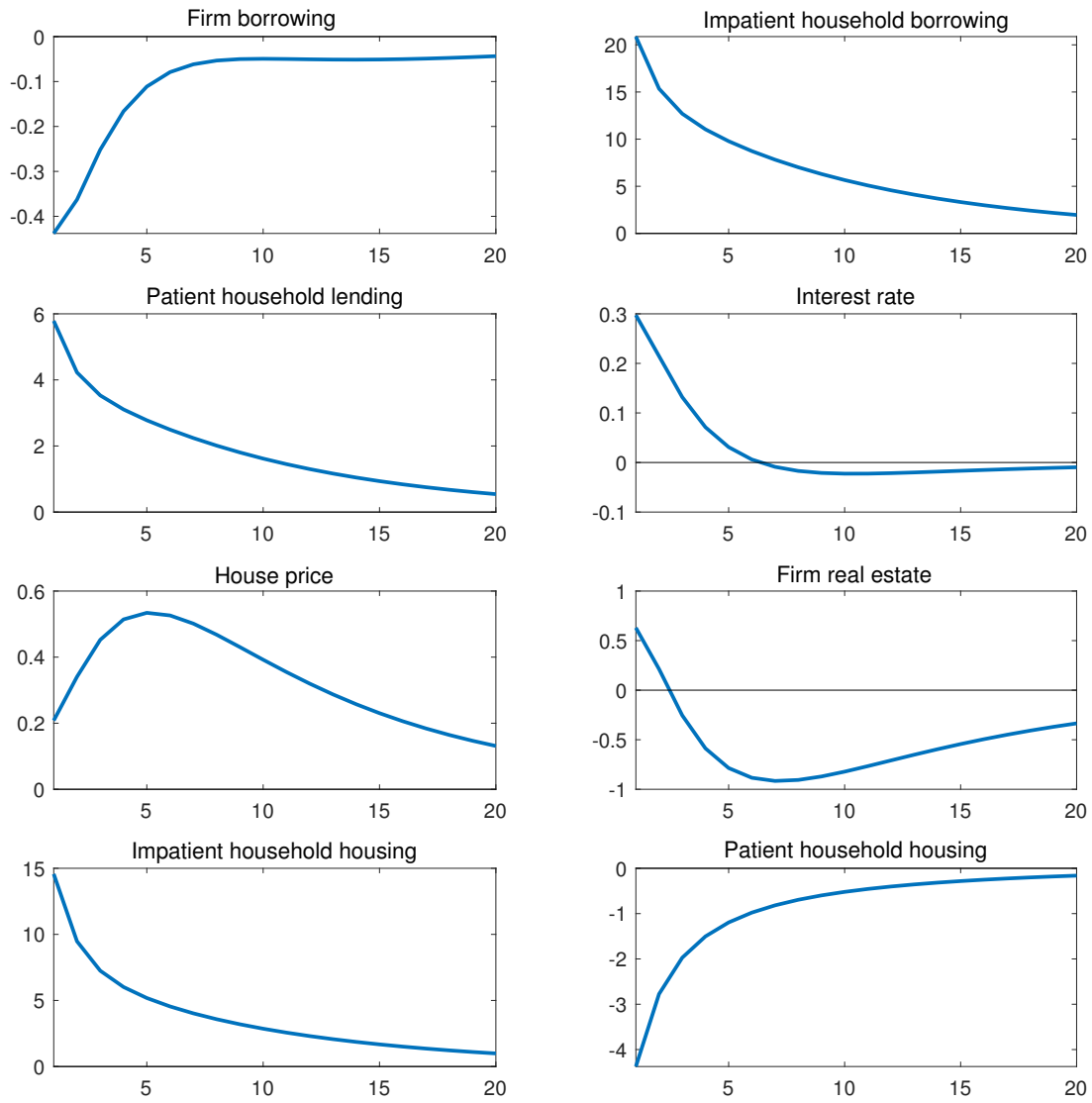
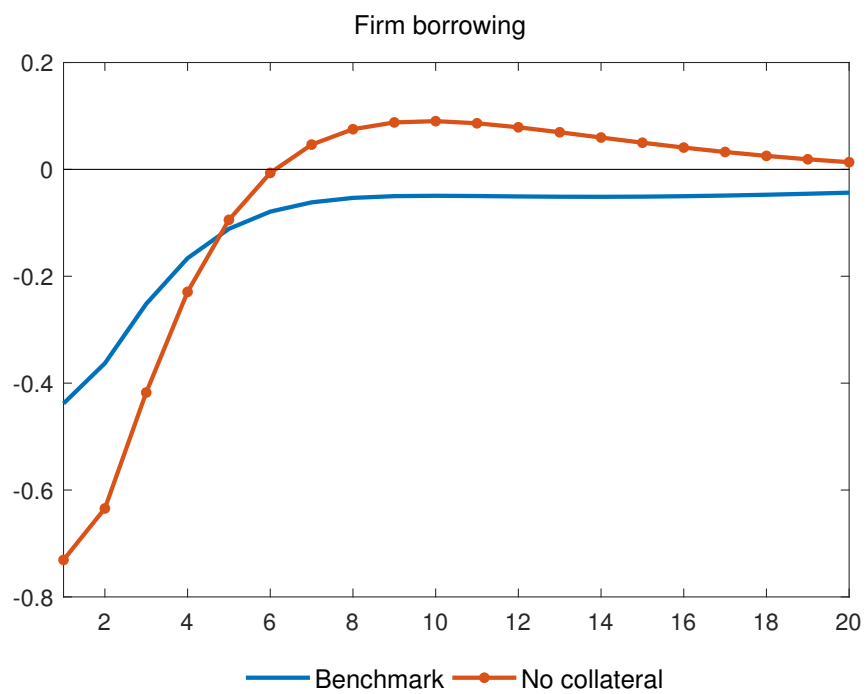Figure 2: Positive shock to household credit: Benchmark model vs. the model with no collateral

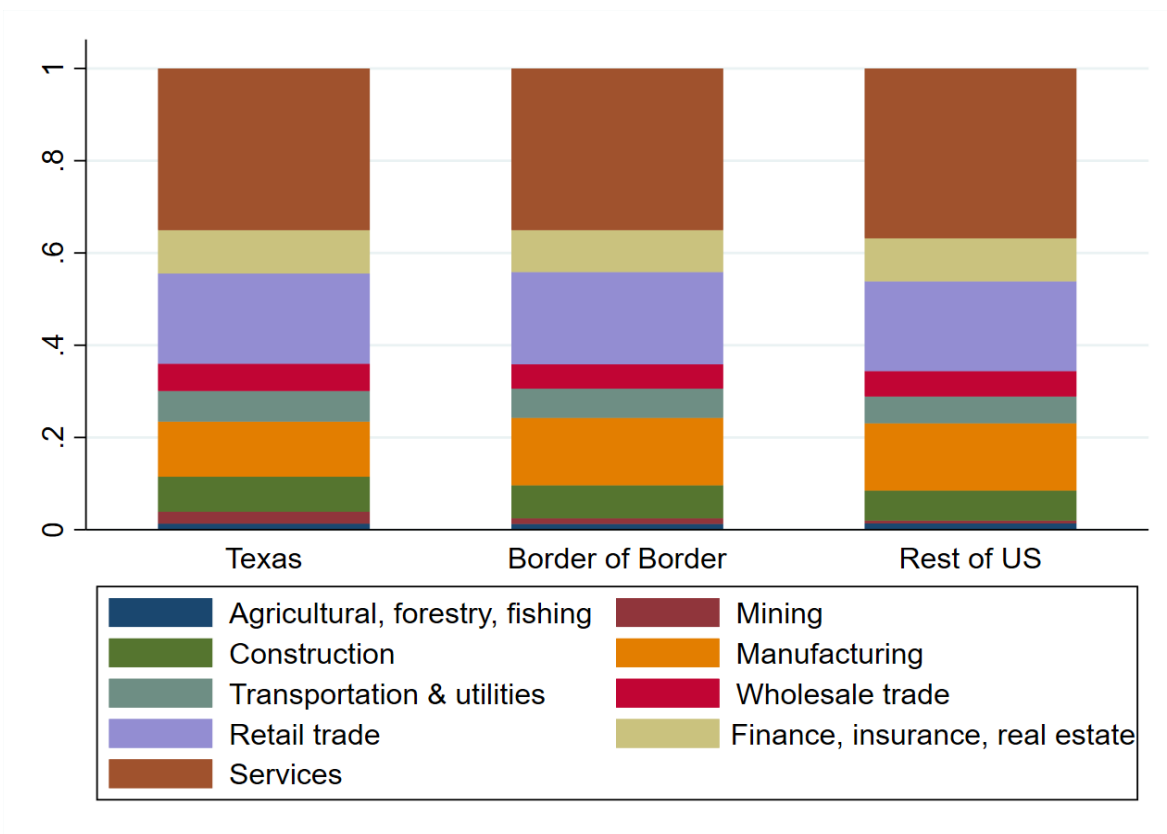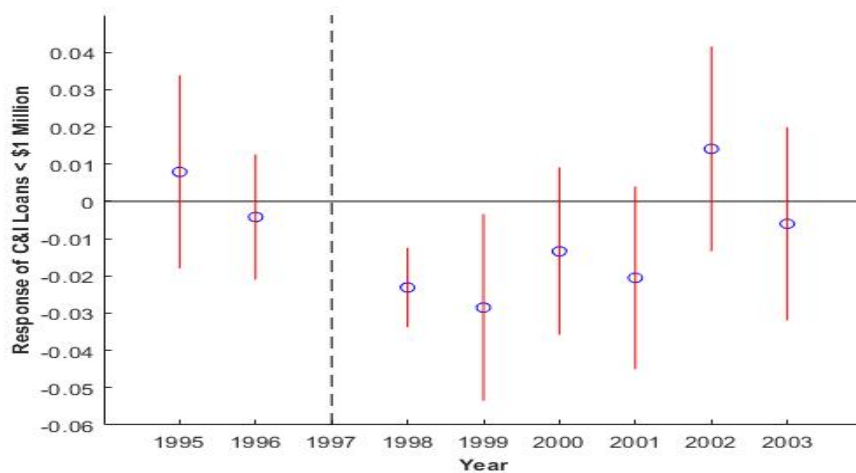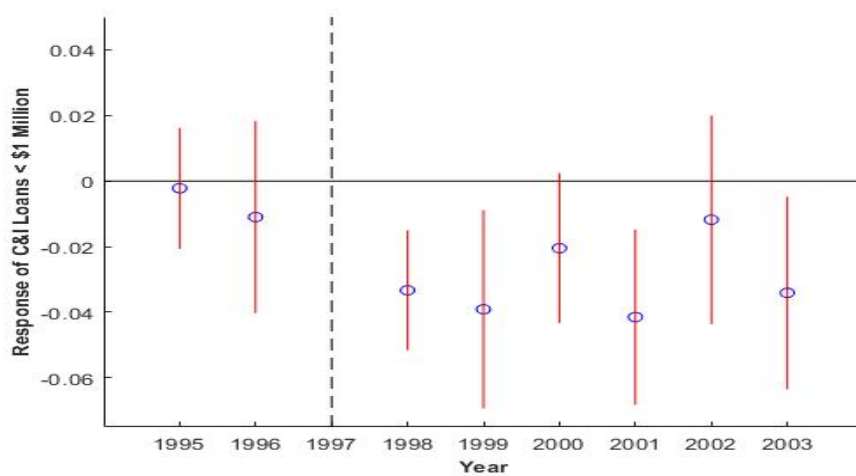Figure 3: Industry employment shares at time of the amendment

Figure 4: Parallel trends event study specification. Dependent variable: C&I loans < $1 million
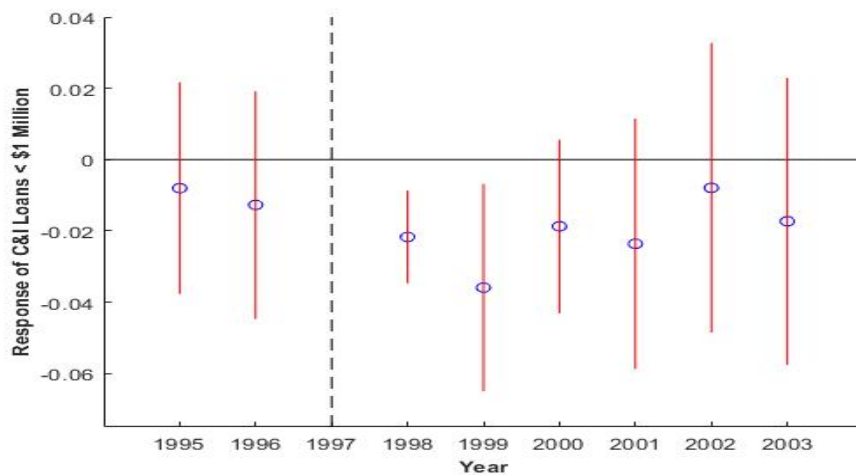
(a) All States



(b) States with Same Bank Regulation



(c) Border of Border States

# A Appendix

Table A.1

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

Note: This table reports results from estimating equation 3.1 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), and (3) counties in states that border Texas or states that border a border state. See section 3.3 for further details. * $p<0.10$; ** $p<0.05$; *** $p<0.01$.

Table A.2

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

Note: This table reports results from estimating equation 3.1, 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), and (3) counties in states that border Texas or states that border a border state. See section 3.3 for further details. * p<0.10; ** p<0.05; *** p<0.01.

Table A.3

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

Note: This table reports results from estimating equation 3.1, 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), and (3) counties in states that border Texas or states that border a border state. See section 3.3 for further details. * p<0.10; ** p<0.05; *** p<0.01.

Table A.4

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

Note: This table reports results from estimating equation 3.1, 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), and (3) counties in states that border Texas or states that border a border state. See section 3.3 for further details. * $p<0.10$; ** $p<0.05$; *** $p<0.01$.

Table A.5

Dependent variable: Small Business Loan Originations

|  | (1) | (2) | (3) |
|---|---|---|---|
| HE Loan Liberalization | -0.172*** | -0.167*** | -0.154*** |
|  | [0.026] | [0.024] | [0.041] |
| P.C. Personal Income | 0.013 | 0.009 | 0.008 |
|  | [0.011] | [0.023] | [0.023] |
| Population | -0.010 | -0.023 | -0.021 |
|  | [0.007] | [0.014] | [0.015] |
| Rice-Strahan Index | -0.080*** | - | -0.026 |
|  | [0.022] |  | [0.076] |
| Economic Freedom Index | 0.197 | -0.620*** | -0.093 |
|  | [0.138] | [0.178] | [0.317] |
| Constant | -0.826 | 4.330*** | 1.136 |
|  | [0.762] | [1.135] | [1.730] |
| Observations | 3,570 | 1,006 | 1,030 |
| R-squared | 0.594 | 0.587 | 0.598 |
| County Fixed Effects | Yes | Yes | Yes |
| Year Fixed Effects | Yes | Yes | Yes |

Note: This table reports results from estimating equation 3.1, 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), and (3) counties in states that border Texas or states that border a border state. See section 3.3 for further details. * $p<0.10$; ** $p<0.05$; *** $p<0.01$.

Table A.6

| Dependent variable: Total Household Loans (bank-level) | | | |
|---|---|---|---|
| | (1) | (2) | (3) |
| HE Loan Liberalization | 0.033*** | 0.029*** | 0.026*** |
| | [0.007] | [0.005] | [0.008] |
| P.C. Personal Income | -0.050 | -0.014 | -0.008 |
| | [0.042] | [0.045] | [0.064] |
| Population | -0.266 | -0.387 | -0.455 |
| | [0.320] | [0.255] | [0.318] |
| Rice-Strahan Index | -0.016 | - | 0.002 |
| | [0.023] | | [0.013] |
| Economic Freedom Index | -0.010 | | -0.035 |
| | [0.023] | | [0.042] |
| Constant | 0.173 | 0.659* | 0.326 |
| | [0.138] | [0.313] | [0.267] |
| | | | |
| Observations | 15,632 | 6,592 | 5,462 |
| R-squared | 0.631 | 0.625 | 0.601 |
| Bank Fixed Effects | Yes | Yes | Yes |
| Year Fixed Effects | Yes | Yes | Yes |

Note: This table reports results from estimating equation 3.1 with the growth rate of bank-level total household loans as the dependent variable. Total household loans is constructed as the sum of real estate loans secured by 1-4 family residential properties and loans to individuals for household, family, and other personal expenditures. 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), and (3) banks in states that border Texas or states that border a border state. See section 3.3 for further details. * $p<0.10$; ** $p<0.05$; *** $p<0.01$.

Table A.7

| Dependent variable: Small Business Loan Originations | | | |
|---|---|---|---|
| | (1) | (2) | (3) |
| HE Loan Liberalization | -0.184*** | -0.203*** | -0.135** |
| | [0.043] | [0.030] | [0.047] |
| P.C. Personal Income | 0.031* | 0.045 | 0.035 |
| | [0.018] | [0.031] | [0.036] |
| Population | -0.006 | -0.024 | -0.026 |
| | [0.018] | [0.040] | [0.044] |
| Rice-Strahan Index | -0.025 | - | 0.089 |
| | [0.041] | | [0.098] |
| Economic Freedom Index | 0.306 | -0.817*** | -0.349 |
| | [0.205] | [0.234] | [0.539] |
| Constant | -2.186* | 4.940*** | 2.004 |
| | [1.207] | [1.603] | [3.443] |
| Observations | 4,394 | 1,322 | 1,310 |
| R-squared | 0.310 | 0.296 | 0.283 |
| County Fixed Effects | Yes | Yes | Yes |
| Year Fixed Effects | Yes | Yes | Yes |

Note: This table reports results from estimating equation 3.1, with the growth rate of county-level small business loan originations between \$250,000 and \$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 counties in the United States, (2) counties in states with similar banking regulation to Texas (as captured by the Rice-Strahan index), and (3) counties in states that border Texas or states that border a border state. See section 3.3 for further details. * p<0.10; ** p<0.05; *** p<0.01.