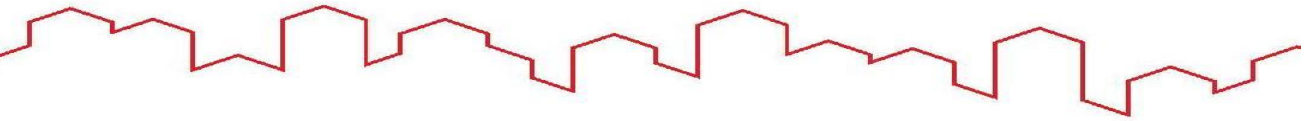

Department of Economics

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Ahmet Ali Taşkin[1]
Ulm University

Firat Yaman
City, University of London

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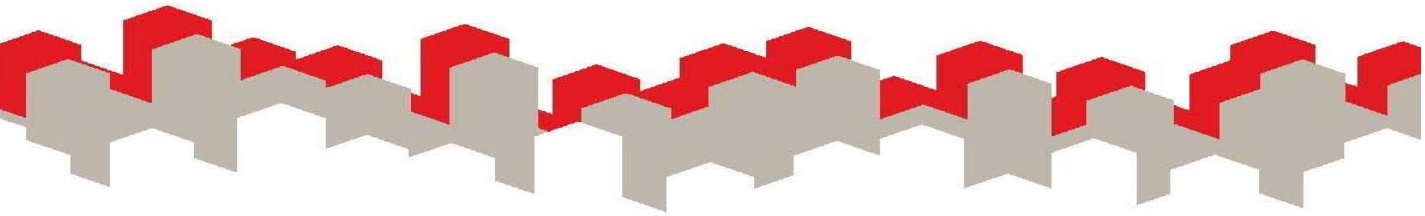

[1] Corresponding author: Ahmet Ali Taşkin, Ulm University, Helmholtzstraße 16, 89081 Ulm, Germany. Email: Ahmet.Taskin@uni-ulm.de

Credit Supply, Homeownership and Mortgage Debt

Ahmet Ali Taşkın* Fırat Yaman†

Abstract

We analyse the effect of credit supply on households' homeownership status and mortgage debt, as well as other variables relating to housing costs and home equity. We demonstrate that banking deregulation as enacted by the Interstate Banking and Branching Efficiency Act (IBBEA) together with states' autonomy to set the degree and timing of deregulation provides an exogenous shift in credit supply which shows variation across states and time. We use this variation to isolate the effect of credit supply from confounding factors which could simultaneously affect credit supply and demand. Using a rich individual-level panel covering the period 1996 to 2008, and controlling for individual and region-year fixed effects, we find that a shift from full regulation to full deregulation increases the probability of owning a home by one, and of having a mortgage by two percentage points. The deregulation observed between 1990 and 2005 can explain at least one fifth, and up to 45% of the increase in homeowneship and the share of households with mortgages. For observations residing in non-metropolitan areas, we also find significant effects of deregulation on the amount of mortgage debt, reported home values, monthly mortgage payments, and debt to value as well as debt to income ratios. Most of these effects are driven by young households, and by individuals with higher incomes. Our results inform on the causes of the rise in homeownership and mortgage debt in the 1990s and 2000s which have led up to the housing crisis in the late 2000s.

JEL classification: G21, G28, R21, R31

Keywords: Banking deregulation; Housing demand; Mortgage; Household debt; Credit supply; Homeownership; Household finance

*Ulm University. Email: ahmet.taskin@uni-ulm.de.

†Department of Economics; City, University of London. Email: Firat.Yaman.1@city.ac.uk.

1 Introduction

The United States have experienced two major housing booms in the post WW2 period. During the first boom, between 1940 and 1960, the homeownership rate increased from 44 percent to 62 percent. After a long stable period, it started to rise again in the early 90s, from 64 percent in 1994 to 69 percent in 2004. Although the role of policy-induced credit availability in the first boom is also substantial,[1] the later boom benefited from a combination of homeownership promoting policy initiatives,[2] changes in the structure of the mortgage market and ever increasing house prices. All these developments spurred on a dramatic increase in the availability of mortgage credit and relaxed lending standards which created a feedback cycle in house prices and in the likelihood of becoming a homeowner.[3] The later part of this cycle in the early 2000s and the subsequent housing crash which unfolded the Great Financial Crisis in 2008 have received vast attention. Discussions about the causes and the consequences of the so called "housing bubble" are still ongoing.[4]

Although house prices and homeownership rates have been steadily increasing in the early 90s, this build-up period is often overlooked since most of the plausible risk indicators – i.e. interest rates, mortgage-backed securities boom, loan-to-value, and price-to-rent ratios etc. – showed little or no sign of alarm until the beginning of the 2000s. This paper focuses on this build-up period and exploits the Interstate Banking and Branching Efficiency Act (IBBEA) of 1994 as an exogenous shift in credit supply and analyzes its effect on household homeownership and mortgage decisions between 1996 and 2005 using micro data from the Survey of Income and Program Participation (SIPP). The panel nature of the SIPP allows us to condition on the fixed individual characteristics, hence we estimate the effect of a change in credit supply on the change in households' housing

[1] Fetter (2013) argues that the self-amortizing long-term fixed rate mortgage with lower down payments, introduced by the Federal Housing Administration, was a major factor in this increase.

[2] See Goodman and Mayer (2018) and Olsen and Zabel (2014) for an overview of housing policy developments.

[3] Agarwal et al. (2015) show that individuals who experience higher house price growth in their neighborhood become homeowners earlier. This is consistent with the survey evidence in Case et al. (2012) that demonstrates the role of expectations in future house price growth. For a theoretical argument see Kaplan et al. (2017).

[4] See Mian and Sufi (2009), Glaeser et al. (2013), Foote et al. (2016), Adelino et al. (2016), Di Maggio and Kermani (2017), and Saadi (2016) for thorough discussion.

tenure and mortgage debt decisions.

Our event of interest is branching deregulation. It was adopted in 1994 and made interstate branching legal. However, states retained rights to put up several barriers for interstate branch entries. Rice and Strahan (2010) showed that states lifted these barriers over time and constructed a time-varying index capturing these differences in regulatory constraints between 1994 and 2005. Following deregulation, states with lower barriers to entry experienced an increase in the share of interstate branches (Johnson and Rice, 2008) and supply of bank branches overall (Célerier and Matray, 2019). Moreover, this branching expansion constituted a major shock to the housing market: it increased mortgage supply both in originations and volume (Favara and Imbs, 2015). This rise in mortgage supply fueled housing demand and increased house prices. The previous literature has also shown that this index is unrelated to other real economic variables such as local economic growth, employment and wages (Célerier and Matray, 2019). We follow these papers in using the interstate branch deregulation index as an exogenous measure of credit supply, and analyze individual housing and mortgage decisions over the course of 2 to 4 years.

We find that credit supply induced by interstate branching expansion increases the likelihood of being a homeowner and having a mortgage. This result is more prominent in rural[5] locations which seem to benefit more from the interstate branching expansion and ensuing competition. Moreover, the effect is almost exclusively concentrated on young households, highlighting the life-cycle nature of the housing decision as pointed out in Agarwal et al. (2015), Fisher and Gervais (2011) and Attanasio et al. (2012). Low income households, on the other hand, do not seem to benefit from this credit expansion. The estimates suggest that the increase in credit supply due to branching expansion explains up to 1 percentage point (1.5 for young households) of the rise in the homeownership rate during this period. The probability of having a mortgage increases by up to 2 percentage points. This suggests that not only do renters become homeowners due to this

[5]We mostly use the word *urban* to describe MSAs with at least 100,000 inhabitants, and *rural* to mean non-urban.

expansion of credit, but also outright homeowners take out loans on their houses. Our benchmark estimates are able to explain one-fifth to half of the aggregate rise in the homeownership rate and the share of mortgagors in the housing boom period.

We then focus on the households that already own a home and investigate the effect of credit supply on mortgage debt, home valuation, and leverage as measured by debt-to-value and debt-to-income as in Leth-Petersen (2010), Mian et al. (2013), and Sodini et al. (2016). We find that refinancing existing mortgages was not particularly affected by this increase: only households that live in rural areas extended further mortgage debt, and assessed an increase in the home value against changes in credit supply. On the other hand, in line with Mian and Sufi (2009), we observe that low income individuals experienced an increase in mortgage debt against no home value change. This shows that an increase in credit supply yields higher leverage for low income individuals. Finally, we find that for some households leverage rose with credit supply: households' debt-to-income ratios, in line with Favara and Imbs (2015), increased significantly in rural areas.[6]

We contribute to the literature in a number of ways: First, we focus on the initial housing expansion phase rather than the crisis, to better understand the causes of the housing bubble in the first place. Second, we use individual level panel data which substantially mitigates concerns with regards to selection of individuals into certain locations and its correlation with regulatory differences between states. Third, we quantify the contribution of deregulation triggered by IBBEA to the overall rise in homeownership and mortgagor shares. Fourth, the individual level data enable us to analyze the effect of credit supply on different locations (urban vs rural), demographics (young vs old) and income groups (low income vs high income).

The US Housing boom and the consequent bust in 2008 attracted a lot of attention to the role

[6]This also reinforces the finding that credit supply increases due to interstate branching deregulation do not affect the economic developments such as income and unemployment as in Célerier and Matray (2019).

of credit supply on house prices and homeownership. Glaeser et al. (2013) have argued that the elasticity of house prices (or housing demand for that matter) is not sensitive to interest rates, while others have found that relaxations of the terms of mortgage contracts other than interest rates have contributed substantially to this housing cycle (Anenberg et al., 2017; Adelino et al., 2012; Duca et al., 2011; DeFusco and Paciorek, 2017). Moreover, the increase in credit supply has been attributed to a variety of policy measures such as the Community Reinvestment Act (Saadi, 2016), pre-emption of anti-predatory-lending laws (Di Maggio and Kermani, 2017) and the Interstate Banking and Branching Efficiency Act (Favara and Imbs, 2015). We contribute to this literature using the latter policy as a measure of credit supply and investigate its effects on individual housing tenure and mortgage debt outcomes. While most of this literature focuses on the years 2000 and after, we argue that it is also important to account for the sharp rise in homeownership and mortgagor shares in the 1990s.

Our paper provides empirical insight into the theoretical discussion with regards to the role of borrowing vs. lending constraints in promoting housing tenure decision and household leverage in Justiniano et al. (2019) and Favilukis et al. (2017). Our policy instrument, interstate branching expansion, has been shown to increase local bank competition with higher branch density and lower interest rates (Célerier and Matray, 2019; Rice and Strahan, 2010; Favara and Imbs, 2015). Therefore, the increase in credit supply due to interstate branching expansion would most likely work through a relaxation of lending constraints.[7] We test whether the theoretical propositions implied by a positive shift in lending hold in the individual data.

Our paper is further related to the literature that studies homeownership as a decision over the life-cycle. The theoretical models argue that housing demand is strongly related to a large menu of individual and aggregate factors such as marriage, earnings risk, local housing and rental price

[7]This is especially true in the early stages of expansion as multi-state banks carry their excess liquidity to the new market. Gilje et al. (2016) show that banks that enjoy local liquidity inflows originate new loans in other localities through their branches.

volatility and credit constraints (Fisher and Gervais, 2011; Attanasio et al., 2012; Sinai and Souleles, 2005; Ortalo-Magne and Rady, 2006). The empirical literature demonstrates that changes in these conditions have more profound effects on young households as they mostly affect the timing of the homeownership decision (Agarwal et al., 2015; Fetter, 2013; Ortalo-Magne and Rady, 1999). Our results suggest that the increase in credit supply due to interstate branching expansion strongly shifted housing and mortgage demand of young households.

Finally, our paper contributes to the discussion on the extent of rising mortgage debt along the income distribution. Mian and Sufi (2009) argue that despite stagnant growth in earnings low-income neighborhoods experienced an uneven increase in mortgage debt in the early 2000s. Adelino et al. (2012) and Foote et al. (2016) challenge this argument and claim that mortgage growth took place in all income groups. We show that although the deregulation episode does not yield an increase in housing demand for low income individuals in most of the cases, their leverage against home equity rises. Moreover, we also find a slight surge in households' leverage as measured by debt-to-income ratios.

2 Background

Since the seminal paper by Kiyotaki and Moore (1997), household credit constraints have been modelled as a collateral limit against the home value. Numerous papers use relaxations of this borrowing constraint to account for the housing boom in the 1990s and 2000s (Kiyotaki et al., 2011; Sommer et al., 2013; Favilukis et al., 2017). In contrast, Justiniano et al. (2019) suggest a slackening of lending constraints as an explanation for the housing boom. A relaxation of lending constraints, they argue, matches four aggregate observations qualitatively and quantitatively: home prices increased, and so did household debt. The debt to home value ratio remained stable, and mortgage rates fell. In contrast, a relaxation in borrowing constraints should lead to an increase in mortgage rates, and consequently a decrease in house prices.

While the aggregate data support the lending constraint argument in Justiniano et al. (2019), their calibration exercise does not give a clean identification of how key outcomes are affected by an increase in credit supply, as they do not have arguably exogenous and precisely measured variation in credit supply. Instead, they argue that lending constraints have been relaxed by a general increase in available mortgage credit through the spreading use of mortgage-backed securities and other international factors.

One such exogenous change in credit supply has been identified and used by Johnson and Rice (2008) and Rice and Strahan (2010) and subsequent papers (Favara and Imbs, 2015; Célerier and Matray, 2019). They construct an index of banking and branching deregulation which derives from the Interstate Banking and Branching Efficiency Act (IBBEA), passed in 1994, which lifted restrictions on bank expansion across state limits, but gave states some discretion to limit the expansion of out-of-state banks. The act allowed for mainly four provisions to limit bank expansion: 1) setting a minimum age of the target institution for bank acquisitions, 2) prohibiting de-novo branching by out-of-state banks, 3) setting a cap on the state-wide deposit concentration that a merger with an out-of-state bank would create, and 4) prohibiting acquisition of bank branches by an out-of-state bank. The IBBEA is described in detail in Rice and Strahan (2010) who construct a simple index ranging from 0 to 4, measuring the number of restrictions that a state has in place in a given year to suppress banking competition. We invert this index and call it deregulation index I for more intuitive interpretation. Thus, I exhibits variation across states, and over time, as states change the provisions that govern inter-state banking.

We thus put the predictions in Justiniano et al. (2019) to the test by looking at how key outcomes in the housing market and the household balance sheet were affected by changes in the regulatory framework of banking competition as captured by changes in the deregulation index. Célerier and Matray (2019) show that a complete deregulation increases the bank branch density

Table 1: Deregulation and bank branch density

Log bank branch density	By population		By area	
	All counties	MSAs only	All counties	MSAs only
Deregulation index	0.0607***	0.0180**	0.0620***	0.0201**
	(0.0151)	(0.0080)	(0.0151)	(0.0088)
Deregulation index ×	-0.0434***	-0.0227***	-0.0452***	-0.0261***
Urban	(0.0127)	(0.0054)	(0.0140)	(0.0069)
County fixed effects	yes	yes	yes	yes
Year fixed effects	yes	no	yes	no
MSA × year fixed effects	no	yes	no	yes
Number observations	34,441	10,031	34,441	10,031

Notes: Observations are county-years. The observation period is 1994-2006. The first two columns measure bank branch density as number of bank branches per 1,000s of people. The last two columns measure it per square mile of area. The odd columns include all counties, the even columns include only counties within an MSA. All variables are at the county level, except the deregulation index, which is at the state level. All regressions include the change in income per capita, log of income per capita, log of population, unemployment rate, and poverty rate of the county. Standard errors are clustered by state and reported in parentheses. *** p-value<0.01, ** p-value<0.05, * p-value<0.1.

in a county by 20 percent, lending support to using the index change as a proxy for credit supply increases. At the same time, they show that the index does not correlate with income or employment at the county level, thus arguing that the index is truly an exogenous measure of banking competition. Similarly, Rice and Strahan (2010) find no correlation between economic conditions and the deregulation index for their sample period, and Favara and Imbs (2015) show that the index does not correlate with lending by lenders who were not affected by deregulation, ruling out concerns of reverse causality and omitted variable bias.

Since the credit supply shock delivered by the IBBEA works through the increase in bank branches and the ensuing competition, it would follow that the deregulation would have its strongest impact for households who live in areas which are not saturated with bank branches, that is areas with low branch density in counties with smaller populations. Using a similar approach as Célerier and Matray (2019) we regress county level bank branch density against the deregulation index together with its interaction with Urban – a dummy variable equal to one if the county's population

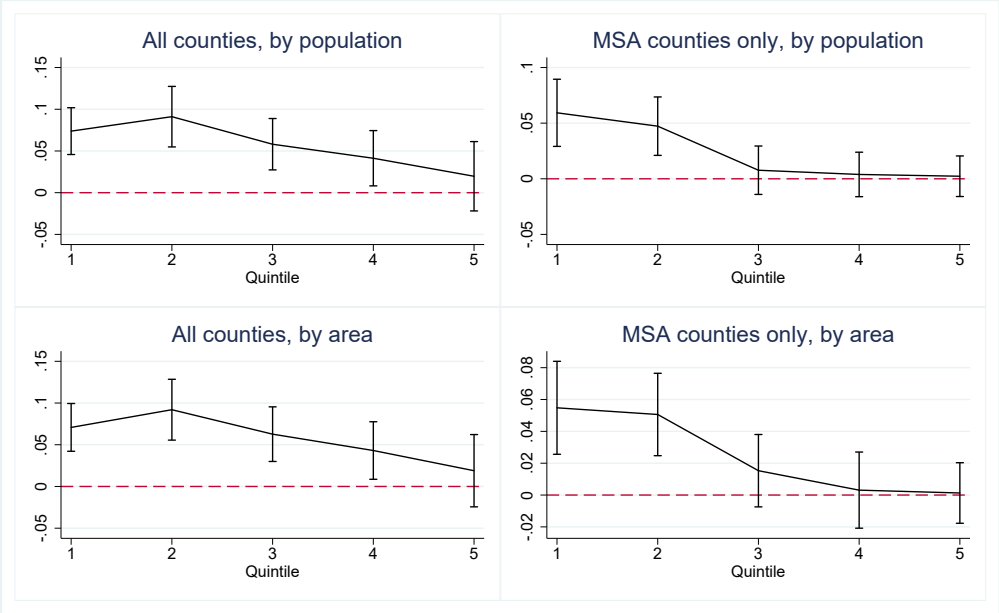

Figure 1: Graphs show the estimated effect of deregulation on the log of bank branch density for counties by population quintile. The vertical bars cover the 95% confidence interval. The upper (lower) graphs define branch density as number of bank branches per 1,000 inhabitants (per square mile). The y-axes are not on the same scale.

is above 100,000 – and other county-level control variables.[8] The results in Table 1 clearly confirm that bank branch density has increased after deregulation mostly in non-urban and smaller urban counties, in line with our expectations.

The differential effects between urban and non-urban is not just an artifact of dividing them at the 100,000 threshold. Figure 1 summarizes results from regressions which instead estimate the effect of deregulation for each quintile of the population distribution of counties. Using all counties (left-hand side), we can see that deregulation increases bank branch density mostly in counties in the second population quintile. The effect is strong in the first quintile, too, but peters out for higher quintiles. For counties within MSAs only (right-hand side), we observe an unambiguously monotonic relationship: The smaller the county's population, the stronger the effect of deregulation

[8]Data on bank branches come from the Sum of Deposits (SOD) maintained by the Federal Deposit Insurance Fund (FDIC). We observe for each bank branch its zip code. The data are annual, from 1994 to 2006. Information on population, per capita income, the unemployment and the poverty rate are from the Census Bureau, the Bureau of Labor and Statistics, and the Bureau of Economic Analysis.

on the increase in bank branch density.

3 Data and Empirical Strategy

Our empirical models are of the form

$$Y_{isrt} = \beta_0 + \beta_1 I_{srt} + \beta_2' X_{it} + \beta_3' Z_{srt} + c_i + d_{rt} + \epsilon_{isrt} \tag{1}$$

where Y is our dependent variable (described below), I is the deregulation index described in the previous section, X is a vector of person characteristics, Z a vector of state characteristics, and the subscripts refer to person i, year t, state s and census region r. We index also by the latter because the regressions include census region–year fixed effects d_{rt}, which capture regional business-cycle effects. We also include individual fixed effects c_i to capture individual traits and characteristics which affect the outcome variable.

The model is a difference-in-differences estimator with different degrees of treatment. Holding X and Z fixed, for a person living in a state in census-region r which keeps deregulation unchanged, the change in the outcome is simply $d_{r,t+1} - d_{rt}$. For a person living in the same census region but whose state of residence deregulates by one index point, the change in the outcome variable would be $d_{r,t+1} - d_{rt} + \beta_1$. The inclusion of person fixed effects implies that identification of the coefficients rests on within-person variation of the variables. Thus, a significant estimate of β_1 could not be a result of changes in the composition of the population of a state, but can only be attributed to a change in I causing a change in the (average) behavior of a person which induces a change in Y.

Data We use data from the Survey of Income and Program Participation (SIPP), in particular the 1996, 2001, and 2004 panels. The SIPP is described in detail elsewhere,[9] so we highlight its

[9] Data are available online: http://www.nber.org/data/survey-of-income-and-program-participation-sipp-data.html. User guides are available on the website of the US Census Bureau.

features relevant to our study. The SIPP is a panel study covering three (the 2001 panel) to four (the 1996 and 2004 panels) years, and individuals are surveyed every four months. A battery of core questions are asked for each wave. In addition, each wave contains a changing topical module which can cover topics such as well-being, health, fertility history, and assets and liabilities. The assets and liabilities module is included in every third wave of the panels and forms the basis for our variables relating to mortgage characteristics. After merging the assets and liabilities module with the corresponding wave of the core data, we end up with a panel at annual frequency — we do not use the waves whose topical modules did not cover assets and liabilities. The sample is completely renewed with each new SIPP panel so that, even though our data span twelve years, each person is observed for no more than four years.

Our independent variable of interest — the deregulation index — varies across states and over time. We therefore remove observations in the SIPP who move across states as such a move would possibly endogenously determine the value of the index. To abstract from questions of how assets and liabilities are divided or pooled upon a division or merging of households, we consider only observations whose marital status does not change over the panel period.[10] For homeowners, we restrict our attention to households who report to own the house and drop the rest of household members who live under the same dwelling with no share on the ownership. We only consider individuals aged between 21 and 65 as changes in ownership and mortgage debt are rare outside of this age range. Finally, as we rely on person fixed effect for identification, we use individuals with multiple observations over time after these filters. This leaves us with 237,376 person-year observations between 1996 and 2005.

We consider the following dependent variables: 1) **Is Homeowner** is a dummy equal to 1 if the person is a (joint) owner of the occupied dwelling, 2) **Has Mortgage** is a dummy equal to 1 if the person has a mortgage or home equity loan on their home, and 0 otherwise (including if

[10] In the raw data interstate migration is around 3.5 percent and marital status change is 5.2 percent.

they rent). 3) **Log Mortgage Debt** is the natural logarithm of the amount of mortgage debt, 4) **Log Home Value** is the natural logarithm of the reported value of the home, 5) **Log Mortgage Payment** is the natural logarithm of the monthly mortgage payment, 6) **Log Rent** is the natural logarithm of the monthly rent payment, 7) **Debt to Value** is the ratio of mortgage debt to the reported home value, and 8) **Debt to Income** is the ratio of mortgage debt to monthly household earned income.[11] We drop observations for whom wealth variables (including homeownership and mortgage status) are imputed, following Gruber and Yelowitz (1999) and Célerier and Matray (2019), due to the unreliability of imputed results regarding wealth variables.

Our person-specific variables are: whether the person's household has received any income from assets in the last four months (dummy), whether the person's household has received any unemployment benefits in the last four months (dummy), dummies for belonging to each decile of the real household earned income distribution (across all years and observations), the number of adults in the household, and the number of persons below 18 in the household. The state characteristics we control for are: the unemployment rate, the natural logarithm of the state population, and the natural logarithm of per capita income.

In addition to the above, we check the heterogeneous effect of deregulation on demographic classifications. The branch density analysis in the previous section demonstrated that locations with lower population experience a further increase in branch density after the deregulation. Accordingly, we check whether this expansion of branching has stronger effects on individual housing and mortgage outcomes in rural locations. We therefore classify a person as Urban if they live in a metropolitan area (MSA) with a population of at least 100,000, and Rural otherwise.[12] We

[11] Each SIPP wave collects information on income for the reference period, that is, the previous four months. We average these values to construct monthly household income.

[12] All panels have an identifier for whether a household lives in an MSA. The 1996 and 2001 SIPP panels also identify the MSA a person lives in only when the population is at least 100,000. The 2004 SIPP does not disclose the identity of the MSA. For the latter panel we are restricted to use more broad MSA identifier for Urban classification. While we do not use the identity of an MSA, we treat unidentified MSAs in the 1996 and 2001 panels as rural to have a more balanced division of our sample between urban and rural, at the cost of not having a consistent classification across panels. Classifying any MSA as urban does not change results for our full and rural samples. For the urban

further classify the households by their age as the decision of housing and related debt instruments depend heavily on the life-cycle events.[13] Therefore, credit demand response with respect to an expansion of credit supply is age dependent. To address these potentially diverse responses, we classify a person as Young if they are between 21 and 45 when they are first observed in the panel, and Old otherwise. Finally, we introduce heterogeneity at the income margin to assess the change in credit risk due to this deregulation. For that purpose, a person is classified as having low income if their household earned income is below twice the poverty threshold as defined by the SIPP. This threshold adjusts for number of household members and age of the household head. In analysing heterogeneity along the above dimensions, we decided to split the samples by location and age, but account for income heterogeneity by including an interaction term between the low income dummy and the deregulation index. Movements between urban and rural areas for individuals are negligible, and between age classifications impossible, while transitions between income classifications are more common. Splitting the sample by income could allocate the same individual to different sub-samples over time and be a source of sample-selection bias.

Table 2 presents an overview of our data. The first column reports means for the first year of the 1996 panel (31%), and the second means for the first years of the merged 2001 and 2004 panels (69%), where all means are taken over individuals (e.g. even for state-wide variables). The third column shows the difference between the two samples. We observe a pronounced increase in the deregulation index by more than one index point. At the same time, the differences in means for all our outcomes variables are statistically significant at the 1% level. The directions of the changes are reflecting the aggregate observations documented for this period in Justiniano et al. (2019): the likelihood of being a homeowner and having a mortgage increased by more than 4%, a dramatic development leading to the housing boom.[14] Mortgage debt and house prices

sample, the only difference is in the effect of deregulation on homeownership and having a mortgage. See section 5 and appendix table A1 for further discussion and results.

[13] For modeling the housing tenure decision over the life cycle see Fisher and Gervais (2011) and Attanasio et al. (2012).

[14] The share of mortgagors among homeowners rose about 2 percent in the same period.

Table 2: Means of variables, by panel

Panel	1996	2001 and 2004	Difference
Main independent variable			
Deregulation index	0.946	1.985	1.039***
Outcomes			
Is Homeowner (in %)	63.4	67.5	4.1***
Has Mortgage (in %)	49.0	53.4	4.3***
Log Mortgage Debt	10.91	11.30	0.40***
Log Home Value	11.54	11.96	0.42***
Log Mortgage Payment	6.51	6.76	0.25***
Log Rent	6.16	6.36	0.21***
Debt to Value	0.587	0.578	-0.009***
Debt to Income	17.5	21.1	3.6***
Household controls			
Log earned household income (real)	8.028	8.105	0.077***
Has asset income (in %)	66.3	65.7	-0.6*
Receives unemployment benefits (in %)	3.4	3.5	0.0
Household members	3.110	3.054	-0.056***
Children in household	0.971	0.911	-0.059***
State controls			
Unemployment rate	5.53	5.10	-0.43***
Log per capita income	10.07	10.35	0.28***
Log population	15.97	15.90	-0.06***

Notes: Sample only includes the first wave with asset and liability information (wave 3) from each panel. *** p-value<0.01, ** p-value<0.05, * p-value<0.1.

also experienced sharp increases (40% and 42% in nominal terms). To put this into context, the increase in the baseline consumer price index between 1996 and 2003 is recorded to be around 17%. Monthly mortgage payments also increased, but not much more than rents. Since home values increased more than mortgage debt, the debt to value ratio has decreased. At the same time, we can also see that household level and state level characteristics have not stayed fixed over time. For example, households' earned income has increased by close to 8%, but the fraction of households enjoying income from assets has dropped. Unemployment rates have risen. There is thus a need to employ regression analysis to isolate the effect of deregulation from these confounding changes at the household and state level.

4 Results

Table 3 summarizes the main results. Panel A reports the effect of deregulation by one index point on the probability of becoming a homeowner (left) and on having a mortgage (right). For the full sample we observe that going from a state of full regulation (0) to full deregulation (4) of inter-state banking increases the probability of becoming a homeowner by one percentage point (4×0.0026) and the probability of having a mortgage by almost two percentage points (4×0.0048). Both effects are significant at the 1% level. Since the effect on having a mortgage is twice the effect on being a homeowner, and both regressions are run on the same sample, some of the new mortgages taken out in response to deregulation are for new home purchases, and others are home equity loans. In further regressions (not reported) we find that deregulation by one index point increases the probability of the former by 0.59 and the latter by 0.38 percentage points.[15] Distinguishing by location, we observe that the effects are almost entirely drive n by rural observations, lending support to our hypothesis that rural areas are more likely to see an increased penetration by new bank branches than more saturated, urban areas. Indeed, the effect of deregulation for the urban

[15]We arrive at these results by regressing the Has Mortgage variable on the deregulation index, separately by homeownership status, while constraining all other variables' effects to be equal to the coefficients estimated for the full sample (so that a regression on the deregulation index on the full sample would again yield the original coefficient of 0.48). Homeownership status is determined by the initial status observed in the panel.

Table 3: The effect of easier credit supply

Sample	Full	Urban	Rural	Full	Urban	Rural
	(1)	(2)	(3)	(4)	(5)	(6)
A: Ownership Status	Is Homeowner			Has Mortgage		
Coefficient	0.0026***	0.0004	0.0033**	0.0048***	0.0013	0.0075***
Standard errors	(0.0010)	(0.0011)	(0.0015)	(0.0016)	(0.0022)	(0.0029)
Number observations	237,376	152,731	82,028	237,376	152,731	82,028
B: Home Equity	Log Mortgage Debt			Log Home Value		
Coefficient	0.0041	-0.0136	0.0308***	0.0049	-0.001	0.0156**
Standard error	(0.0076)	(0.0115)	(0.0094)	(0.0045)	(0.0057)	(0.0073)
Number observations	89,515	59,866	29,228	136,564	88,133	47,875
C: Housing Cost	Log Mortgage Payment			Log Rent		
Coefficient	0.0037	-0.0026	0.0169**	-0.0077**	-0.0109***	-0.0012
Standard error	(0.0035)	(0.0035)	(0.0066)	(0.0035)	(0.0039)	(0.0066)
Number observations	101,367	67,804	33,126	44,376	30,411	12,996
D: Leverage	Debt to Value			Debt to Income		
Coefficient	0.0008	-0.0027	0.0053*	0.0791	-0.0365	0.2659**
Standard error	(0.0018)	(0.0022)	(0.0027)	(0.0774)	(0.0906)	(0.1172)
Number observations	86,064	57,672	27,984	83,980	56,159	27,411

Notes: The coefficients report the estimated effect of a relaxation of inter-state banking by one index point. The full sample comprises of all observations aged 21 to 65 at the beginning of the observation period, who do not move across states and do not change their marital status over their observation period. The Urban (Rural) sample refers to observations (not) residing in MSAs with a population of at least 100,000. All regressions control for individual and region-year fixed effects, number of household members, number of children under 18 in the household, and dummies for: the presence of asset income, the receipt of unemployment benefit, each household earning decile. State-wide controls are the unemployment rate, population, and per capita income. Standard errors are clustered by state-years and reported in parentheses. *** p-value<0.01, ** p-value<0.05, * p-value<0.1.

Table 4: Deregulation and the housing market 1990 to 2005

	Is Homeowner		**Has Mortgage**	
	Actual	Counterfactual	Actual	Counterfactual
1990	0.612	0.612	0.478	0.478
2005	0.643	0.624	0.525	0.512
Change 1990 to 2005	0.031	0.013	0.047	0.035
Explained change	0.005	0.005	0.011	0.011
Share explained	18%	45%	22%	31%

Notes: Homeownership rates and share of mortgagors in 1990 (US census) and 2005 (American Community Survey). The counterfactual share measures what the share of the respective variable would have been, if the ratio of young to old people had been the same as in 1990. The explained change is the change in the respective variable that can be explained by the deregulation that occurred over this time period. It is the (population-) weighted average across states of the change in the deregulation index times the estimated effect of deregulation on ownership and mortgage status (Table 3). The last row quantifies the proportion of the change in the respective variable that can be accounted for by the explained change.

sample is much smaller and insignificant.

How much of the observed increase in the share of homeowners and mortgagors could be explained by this deregulation? To answer this question we compute the counterfactual increase in the share of homeowners and mortgagors based on states' deregulation experiences over the expansion period (1994-2005) and corresponding estimates reported in Table 3. We first calculate homeownership and mortgagor shares using Census micro data and the same age categories introduced in the previous section.[16] Table 4 shows that between 1990 and 2005 the homeownership rate increased by 3.1 percent and the mortgagor share increased by 4.7 percent. For each state, we multiply the coefficient on the deregulation index from table 3 with the change in regulation observed in that state, thus obtaining its predicted change in ownership due to de-regulation. We then take the population-weighted average of the predicted changes to calculate the explained change. Interstate branching expansion due to deregulation alone induces a 0.6 percentage point increase in homeownership and 1.1 percentage point increase in the mortgagor share. Overall, this explains about one fifth of the increase in this period. This calculation, however, does not account for population

[16]We rely on the IPUMS 5 percent 1990 Census sample for the pre policy period and IPUMS 2005 American Community Survey for the post policy period.

ageing in the same period. If we were to fix the young-old distribution in 1990 levels, the observed increases in the homeownership rate and the mortgagor share are much smaller. In that counterfactual scenario the deregulation experience explains up to one-half of the observed change.

Turning to variables characterizing home equity (Panel B), in the full sample we do not observe any effects on the value of mortgage debt nor on the home values as reported by the interviewees. However, as for ownership, we do find strong effects of deregulation on both variables in our rural sample — mortgage debt increases by 3% and reported home values by 1.6% per index point. Note that the effect on mortgage debt is not driven by new mortgage originations. Since we control for individual fixed effects, it is the change in existing mortgage debt as a response to a change in the regulation index that identifies the coefficient. While the right side of panel A is informative on the extensive margin of the mortgage market, the left part of panel B tells us something about the intensive margin of existing mortgagors. The fact that we find an insignificant effect of deregulation on home values in the full sample begs further inquiry as it is in contrast to both theoretical predictions of a credit supply shock (Justiniano et al., 2019) as well as the empirical finding in Favara and Imbs (2015). For home value analysis, we use the self-reported assessment by the interviewee. This is a biased proxy for market values as shown in Chan et al. (2016): Homeowners with mortgage debt systematically misreport home values against the developments in the housing market. Moreover, homeowners with no debt on the house are less likely to have a good assessment on market prices. To check whether this drives our results, we include a mortgage dummy in the home value regressions. Results in Table A3 in the appendix suggest that in almost every specification homeowners having a mortgage report an increase in home value compared to outright owners. The effect of deregulation on home values conditional on obtaining a new mortgage is still the same for all areas.

Panel C displays the estimated effects of deregulation on the monthly mortgage payments of mortgagors (left) and rent payments of renters (right). Mortgage payments show an increase of

1.7% per index point in the rural sample, but are not affected in the urban sample. An increase in mortgage payments could be due to more mortgage debt, higher interest on the debt, or a reduction in the years to maturity. Holding maturity and the amount of debt constant one could think of changes in mortgage payment as proxy for cost of borrowing. The data shows little variation in terms of maturity and (unreported) results controlling for the amount of mortgage debt demonstrate similar coefficients. This suggests that the increase in credit supply due to deregulation did not lower the cost of borrowing reported by the households. Theoretically, it is possible that a relaxation of borrowing constraints (via loan-to-value or loan-to-income limits) could lead to a rise in the interest rate as opposed to a relaxation in lending constraints (Justiniano et al., 2019). It is therefore important to identify whether interstate branching deregulation also caused a relaxation on borrowing constraints. The analysis below on housing leverage sheds further light into this.[17]

When we look at the housing costs from the point of renters (right side of panel C), we find that in urban areas credit expansion induced a reduction of rents by 1% per index point. In principal, if housing in the owner and rental markets are not perfect substitutes, more homeownership could reduce rents by decreasing demand for rented accommodation. Indeed, Gete and Reher (2018) show that the decline in mortgage supply after the Great Recession induced an increase in housing rents. However, we observe an increase in mortgage payments due to deregulation for the rural sample, while the reduction in rents occurs for the urban sample. We will revisit this issue in the next section.

Panel D focuses on variables relating to home equity and risk exposure. The (outstanding) loan to value ratios (left side) in the full sample are not affected. This is not surprising given that the effect of deregulation on debt and reported home values are very close (Panel B), and also in line

[17]The SIPP also provides information on the interest rate of the first two mortgages. However, this measure suffers from measurement errors due to inconsistent reportings over time (especially individuals with multiple mortgages) and difficulties in assessing the variable rate mortgages which became more prominent later in the sample. Unreported results on interest rates do not provide any significant effects.

with the argument in Justiniano et al. (2019) that higher credit supply would increase debt and asset prices in roughly equal measure. Only in rural areas did the increase in mortgage debt exceed the increase in home values slightly, thus driving up the loan to value ratios. Home prices might be overvalued and at any rate are much more volatile than income. Moreover, self-reported home valuation does not necessarily mark to market as argued in Chan et al. (2016). A better measure of risk exposure is debt to earned income (right side), since the former needs to be served by the latter. Here we see an increase in rural areas. For a given income, the amount of mortgage debt would increase by a month's earned household income for states which go from full regulation to full deregulation. This suggests that deregulation induces an increase in household leverage though it is not economically sizeable. We conclude that interstate branching deregulation has limited effects on household credit risk due to leverage.[18]

Taken together, we find stark differences of the effect of deregulation between urban and rural areas. Célerier and Matray (2019) find that the same deregulation index increased bank branch densities in poorer counties within a state and the financial inclusion of poorer individuals. Thus, it is not a surprise to see the effect mainly outside of larger cities. Urban areas already had high bank branch penetration and financial inclusion to begin with, while in less dense areas there was scope for banks to expand and increase competition. For the rural sample, most results are in accordance with similar findings in the literature. Following deregulation more people bought homes, more mortgages were issued, and mortgage loan volumes increased, as did reported home values. Furthermore, LTV ratios increased, and so did debt to income ratios. We next explore which demographic groups, segmented by age and income, were more affected by the deregulation.

[18]Mian and Sufi (2009) and Mian and Sufi (2017) suggest that credit expansion in early 2000s yield dramatic rise in household leverage. For an opposing view see Adelino et al. (2016) and Foote et al. (2016).

Table 5: The effect of easier credit supply on owning a home

	By age					
	All		Young		Old	
By location	(1)	(2)	(3)	(4)	(5)	(6)
A: All						
Deregulation index	0.0026***	0.0042***	0.0036***	0.0052***	0.0014	0.0016
	(0.0010)	(0.0012)	(0.0014)	(0.0015)	(0.0010)	(0.0014)
Deregulation index ×		-0.0071***		-0.0091***		-0.0004
Low income		(0.0023)		(0.0031)		(0.0023)
B: Urban						
Deregulation index	0.0004	0.0017	0.0003	0.0014	0.0008	0.0017
	(0.0011)	(0.0013)	(0.0017)	(0.0020)	(0.0010)	(0.0012)
Deregulation index ×		-0.0066***		-0.0064		-0.0035
Low income		(0.0025)		(0.0042)		(0.0024)
C: Rural						
Deregulation index	0.0033**	0.0039**	0.0041*	0.0045*	0.0021	0.0015
	(0.0015)	(0.0019)	(0.0024)	(0.0026)	(0.0021)	(0.0029)
Deregulation index ×		-0.0024		-0.0016		0.0015
Low income		(0.0030)		(0.0042)		(0.0037)

Notes: Dependent variable: Dummy equal to one if observation owns dwelling. The deregulation index ranges from 0 to 4. Low income is a dummy equal to one if the observation's household income is below twice the poverty level. The Young (Old) sample includes observations aged 21(46) to 45(65). The Urban (Rural) sample includes observations (not) residing in an MSA with a population of at least 100,000. All regressions include the same controls as listed in the notes to table 3. Standard errors in parentheses. *** p-value<0.01, ** p-value<0.05, * p-value<0.1.

4.1 Ownership Status

Table 5 and Table 6 present detailed results on the effect of deregulation on homeownership and having a mortgage, respectively. The panels A to C distinguish the samples by location. Even-numbered columns present results from regressions which include the deregulation index, as well as the interaction of the index with a dummy for low income households, while odd-numbered columns refer to regressions which do not include this interaction term. Columns 3 and 4 restrict the sample to observations younger than 46 when they were first observed in the data, and columns 5 and 6 to observations aged 46 to 65. The first two columns do not restrict the sample by age.

The first columns of both tables repeat the results from table 3, panel A, with the familiar result that deregulation leads to increased homeownership and mortgage origination in rural areas.

Table 6: The effect of easier credit supply on holding a mortgage

	By age					
	All		Young		Old	
By location	(1)	(2)	(3)	(4)	(5)	(6)
A: All						
Deregulation index	0.0048***	0.0058***	0.0062***	0.0081***	0.0032	0.0008
	(0.0016)	(0.0018)	(0.0017)	(0.0018)	(0.0027)	(0.0031)
Deregulation index ×		-0.0043		-0.0108***		0.0087*
Low income		(0.0030)		(0.0029)		(0.0049)
B: Urban						
Deregulation index	0.0013	0.0020	0.0011	0.0024	0.0022	0.0010
	(0.0022)	(0.0024)	(0.0027)	(0.0029)	(0.0036)	(0.0039)
Deregulation index ×		-0.0034		-0.0075*		0.0050
Low income		(0.0031)		(0.0040)		(0.0047)
C: Rural						
Deregulation index	0.0075***	0.0074**	0.0103***	0.0113***	0.0037	-0.0006
	(0.0029)	(0.0032)	(0.0034)	(0.0037)	(0.0036)	(0.0050)
Deregulation index ×		0.0004		-0.0044		0.0126
Low income		(0.0046)		(0.0048)		(0.0087)

Notes: Dependent variable: Dummy equal to one if observation holds a mortgage. See notes to table 5 for further information.

Our extended results reveal that this effect is mainly driven by younger individuals (columns 3 and 4). This is not surprising as homeownership is a life-cycle decision and changes in credit conditions would affect individuals' timing of purchasing a home. In this particular case, homeownership among the young was in secular decline since the 1980s (Fisher and Gervais, 2011). The mortgage credit expansion seems to decelerate this trend. Turning to income heterogeneity, in the complete sample (both by location and age), we see that the benefits of easier homeownership accrue entirely to high-income individuals, suggesting that the marginal individual to benefit from deregulation did not fall into the low income category as we defined it. While there are some nuances (e.g., there is no significant difference between young low-income and young high-income individuals in rural areas), the general finding is that individuals who are young and enjoy higher incomes have been affected most positively in terms of their probability of becoming homeowners. As expected, the findings are similar for holding a mortgage with more sizable effects. Here, too, deregulation affects mainly the young, and those on relatively higher incomes.

4.2 Home Equity

Next we look in detail at components of home equity. Table 7 shows results for the log of mortgage debt, and Table 8 for the log of reported home value. Young individuals in the rural sample increase their mortgage debt by 4% per index point, if they have high incomes, but not at all if their income is low (Table 7, panel C, column 4). Unlike for the case of simply having a mortgage, we also find that deregulation increases the mortgage debt amount of old individuals with low incomes compared to old individuals with high incomes, at least in urban areas. What drives these results? We think the most intuitive explanation is that young individuals become more likely to take out a mortgage, while older — and poorer — individuals become more likely to draw more debt on their home equity. On the other hand, young and better-off individuals in rural areas might be benefiting from more competition among lenders to secure larger loans. As for home values, the only significant result we find is for young and rural individuals. Here, too, it is mainly home owners with higher incomes who report higher home values after deregulation. Since this is the same demographic to have seen an increase in mortgage debt, these individuals might have better or more recent information about home values. Alternatively, since their debt has increased, they might be psychologically inclined to believe that the market value of their homes increases so as to keep their net position stable. Results in Chan et al. (2016) suggest support for this phenomenon.

4.3 Housing Cost

We look at how deregulation has affected the cost of housing for mortgagors (Table 9) and renters (Table 10). Mortgage payments mostly mirror the results for mortgage debt as ceteris paribus more debt would imply higher monthly payments. Those individuals whose debt increased (young, rural) have to make higher payments. The size of the effect is 1.7% while the effect on mortgage debt was 3.1% (table 7). Young and urban individuals, on the other hand, experienced a slight decrease in mortgage payment implying a potential fall in borrowing costs. Keeping mortgage debt and maturity constant, household refinancing together with declining mortgage interest rates could

Table 7: The effect of easier credit supply on amount of mortgage debt (in logs)

	By age					
	All		Young		Old	
By location	(1)	(2)	(3)	(4)	(5)	(6)
A: All						
Deregulation index	0.0041	0.0022	0.0111	0.0116*	-0.0075	-0.0156
	(0.0076)	(0.0077)	(0.0068)	(0.0068)	(0.0134)	(0.0150)
Deregulation index ×		0.0220		-0.0093		0.0608*
Low income		(0.0229)		(0.0328)		(0.0358)
B: Urban						
Deregulation index	-0.0136	-0.0182	-0.0101	-0.0112	-0.0214	-0.0332
	(0.0115)	(0.0115)	(0.0088)	(0.0081)	(0.0197)	(0.0223)
Deregulation index ×		0.0529*		0.0190		0.0848*
Low income		(0.0297)		(0.0465)		(0.0444)
C: Rural						
Deregulation index	0.0308***	0.0329***	0.0369***	0.0403***	0.0186	0.0169
	(0.0094)	(0.0103)	(0.0123)	(0.0128)	(0.0182)	(0.0186)
Deregulation index ×		-0.0240		-0.0490		0.0137
Low income		(0.0317)		(0.0370)		(0.0480)

Notes: Dependent variable: Log of amount of mortgage debt. Sample includes only observations with positive mortgage debt. See notes to table 5 for further information.

Table 8: The effect of easier credit supply on amount of reported value of home (in logs)

	By age					
	All		Young		Old	
By location	(1)	(2)	(3)	(4)	(5)	(6)
A: All						
Deregulation index	0.0049	0.0063	0.0128**	0.0140**	-0.007	-0.0037
	(0.0045)	(0.0049)	(0.0057)	(0.0059)	(0.0050)	(0.0064)
Deregulation index ×		-0.0106*		-0.0160		-0.0004
Low income		(0.0063)		(0.0122)		(0.0074)
B: Urban						
Deregulation index	-0.001	0.0000	0.0052	0.0054	-0.0115	-0.0068
	(0.0057)	(0.0059)	(0.0069)	(0.0071)	(0.0072)	(0.0089)
Deregulation index ×		-0.0082		-0.0033		-0.0059
Low income		(0.0072)		(0.0127)		(0.0099)
C: Rural						
Deregulation index	0.0156**	0.0180**	0.0273***	0.0311***	0.0004	-0.0007
	(0.0073)	(0.0087)	(0.0100)	(0.0109)	(0.0096)	(0.0119)
Deregulation index ×		-0.0142		-0.0376*		0.0096
Low income		(0.0115)		(0.0219)		(0.0124)

Notes: Dependent variable: Log of amount of reported home value. Sample includes only home owners. See notes to table 5 for further information.

Table 9: The effect of easier credit supply on amount of monthly mortgage payment (in logs)

	By age					
	All		Young		Old	
By location	(1)	(2)	(3)	(4)	(5)	(6)
A: All						
Deregulation index	0.0037	0.0047	0.0028	0.0031	0.0050	0.0070
	(0.0035)	(0.0037)	(0.0040)	(0.0041)	(0.0056)	(0.0061)
Deregulation index ×		-0.0098*		-0.0039		-0.0137
Low income		(0.0057)		(0.0060)		(0.0098)
B: Urban						
Deregulation index	-0.0026	-0.0023	-0.0066*	-0.0067*	0.0030	0.0041
	(0.0035)	(0.0037)	(0.0037)	(0.0039)	(0.0062)	(0.0065)
Deregulation index ×		-0.0037		0.0012		-0.0079
Low income		(0.0066)		(0.0095)		(0.0091)
C: Rural						
Deregulation index	0.0169**	0.0191***	0.0177**	0.0186**	0.0134	0.0185
	(0.0066)	(0.0070)	(0.0073)	(0.0077)	(0.0124)	(0.0140)
Deregulation index ×		-0.0191*		-0.0100		-0.0287
Low income		(0.0098)		(0.0111)		(0.0188)

Notes: Dependent variable: Log of amount of monthly mortgage payment. Sample includes only observations with positive mortgage payments. See notes to table 5 for further information.

lead to this result. Renters seem to have benefited from deregulation, especially young renters in Urban areas. It is conceivable that demand for rented housing might have dropped as demand for owner-occupied housing increased, even though the increase in ownership and decrease in rents seem to be happening in geographically separate markets. Low income renters do not seem to be affected any differently from high income renters in a statistically significant sense.

4.4 Leverage

Finally, we look more closely at variables relating to individuals' home equity and risk exposure. Table 11 reports the estimated effects of deregulation on mortgage debt to home value ratios, and Table 12 on mortgage debt to household income ratios. On average, we have seen that for rural observations home values have increased (Table 8), but the debt on their homes has increased even more (Table 7) leading to an overall increase of debt to value ratios in rural areas. This has been the case for both high- and low-income individuals. In urban areas we detect a decrease in this ratio

Table 10: The effect of easier credit supply on amount of monthly rent payment (in logs)

	By age					
	All		Young		Old	
By location	(1)	(2)	(3)	(4)	(5)	(6)
A: All						
Deregulation index	-0.0077**	-0.0089**	-0.0093**	-0.0101**	-0.0041	-0.0056
	(0.0035)	(0.0041)	(0.0043)	(0.0051)	(0.0055)	(0.0068)
Deregulation index ×		0.0039		0.0031		0.0037
Low income		(0.0064)		(0.0083)		(0.0143)
B: Urban						
Deregulation index	-0.0109***	-0.0099**	-0.0130***	-0.0134**	-0.0061	-0.0003
	(0.0039)	(0.0047)	(0.0043)	(0.0056)	(0.0068)	(0.0068)
Deregulation index ×		-0.0039		0.0017		-0.0171
Low income		(0.0095)		(0.0103)		(0.0161)
C: Rural						
Deregulation index	-0.0012	-0.0109	-0.0065	-0.0128	0.0135	-0.0097
	(0.0066)	(0.0089)	(0.0080)	(0.0103)	(0.0095)	(0.0237)
Deregulation index ×		0.0242		0.0181		0.0435
Low income		(0.0151)		(0.0143)		(0.0459)

Notes: Dependent variable: Log of amount of monthly rent payment. Sample includes only observations with positive rent payments. See notes to table 5 for further information.

for high-income, but not for low-income individuals, at the 10% significance levels. Taking a closer look at effects by age group, we see that the strongest effects are observed among older individuals. While the directions of the deregulation effect conform with the effects on mortgage debt, it is surprising to see significant effects here, given that the effects on mortgage debt and home values were insignificant, in both urban and rural areas. In general, we can say that older individuals with higher incomes reduced their debt to value ratio in urban, but increased it in rural areas. For older low-income individuals we observe a significant increase in the ratio relative to those with high income in urban areas, and no significant difference between high and low income individuals in rural areas. Overall, these results suggest that credit expansion in this period caused only mild increases in mortgage debt to home value ratios and these increases occurred for certain groups.

To get a better sense of whether individuals have become more financially vulnerable, we look at the debt to income ratio. Here, we observe increases for old and low-income individuals, even though

Table 11: The effect of easier credit supply on mortgage debt to home value ratio

	By age					
	All		Young		Old	
By location	(1)	(2)	(3)	(4)	(5)	(6)
A: All						
Deregulation index	0.0008	0.0002	0.0017	0.0018	-0.0006	-0.0025
	(0.0018)	(0.0018)	(0.0018)	(0.0019)	(0.0031)	(0.0031)
Deregulation index ×		0.0073		-0.0029		0.0147*
Low income		(0.0050)		(0.0065)		(0.0076)
B: Urban						
Deregulation index	-0.0027	-0.0036*	-0.0015	-0.0013	-0.005	-0.0080**
	(0.0022)	(0.0021)	(0.0023)	(0.0023)	(0.0036)	(0.0040)
Deregulation index ×		0.0113*		-0.0036		0.0214**
Low income		(0.0060)		(0.0067)		(0.0096)
C: Rural						
Deregulation index	0.0053*	0.0053*	0.0038	0.0038	0.0090*	0.0092*
	(0.0027)	(0.0029)	(0.0033)	(0.0036)	(0.0049)	(0.0051)
Deregulation index ×		0.0004		-0.0005		-0.0018
Low income		(0.0081)		(0.0127)		(0.0124)

Notes: Dependent variable: Ratio of mortgage debt to reported home value. Sample includes only observations with positive mortgage debt. See notes to table 5 for further information.

the effects are imprecisely estimated. A statistically stronger result is obtained for young and rural individuals, whose debt relative to income increases by the equivalent of 37 percent of monthly household income, per index point. This is true for both high- and low-income individuals. Thus, while this same demographic has benefited from banking deregulation in terms of homeownership and financial inclusion (Célerier and Matray, 2019), they have at the same time increased their vulnerability to income or home value shocks, if only slightly.

5 Further Results

The 2004 panel records whether a household lives in an MSA, but does not disclose the identity of the MSA. We thus are not able to divide observations by the population size of the MSA for this panel, causing the urban-rural classification to be inconsistent between the 1996 and 2001 panels on the one hand and the 2004 panel on the other. To address concerns about the sensitivity of our results to the urban-rural classification we repeated our estimations for different Urban clas-

Table 12: The effect of easier credit supply on mortgage debt to household income ratio

	By age					
	All		Young		Old	
By location	(1)	(2)	(3)	(4)	(5)	(6)
A: All						
Deregulation index	0.0791	0.0782	0.1303	0.1636*	-0.0305	-0.1112
	(0.0774)	(0.0789)	(0.0793)	(0.0863)	(0.1562)	(0.1809)
Deregulation index ×		0.0160		-0.6728		1.1928
Low income		(0.4556)		(0.6849)		(1.2347)
B: Urban						
Deregulation index	-0.0365	-0.0299	-0.0736	-0.024	-0.0222	-0.1009
	(0.0906)	(0.0967)	(0.1035)	(0.1092)	(0.1491)	(0.1720)
Deregulation index ×		-0.1202		-1.0333		1.1855
Low income		(0.6728)		(0.8620)		(1.5260)
C: Rural						
Deregulation index	0.2659**	0.2504**	0.3669***	0.3685**	-0.0254	-0.0882
	(0.1172)	(0.1146)	(0.1388)	(0.1437)	(0.2838)	(0.2469)
Deregulation index ×		0.2510		-0.0282		0.8786
Low income		(0.7882)		(0.8314)		(1.5786)

Notes: Dependent variable: Ratio of mortgage debt to household income. Sample includes only observations with positive mortgage debt. See notes to table 5 for further information.

sifications and sub-samples. We refer the reader to table A1 – in particular columns 2 and 3 – in the appendix for detailed results. We consider two approaches: First, we classify an observation living in any MSA – regardless of its population – as urban, and otherwise as rural, thus having a consistent classification across all three panels (column 2 in A1). Second, we keep our population filter, but discard the 2004 panel. This, too, keeps the urban classification consistent across the two panels (column 3). We then repeat our baseline estimations for various Urban classifications.[19] For the urban sample that includes all MSAs we observe two differences compared to our main results: Deregulation increases the probability of becoming a homeowner and the probability of having a mortgage. It appears that much of the effect of deregulation on those two outcomes is occurring in smaller MSAs. Excluding the 2004 panel leaves our baseline results virtually unchanged.

[19]We only report results for estimation using various Urban classifications, with and without 2004 panel. Outcomes for all and rural areas with corresponding specification were virtually unchanged.

This observation is corroborated by running our regression on MSAs of different sizes. Deregulation has no effect on homeownership in consolidated MSAs,[20] but the coefficient is 0.0027 in medium sized MSAs and 0.0038 in MSAs with less than 100,000 inhabitants (albeit insignificant in both cases). As for having a mortgage, in smaller MSAs the effect of deregulation is similar to that of rural areas. A further observation here is that the negative effect of deregulation on rents is significant only in consolidated, but not in medium sized and smaller MSAs, with the effect diminishing as the MSAs become smaller.[21]

Lastly, we have repeated our regressions on a sample of household heads who do not change their dwelling over the observation period. We thus abstract from any upgrading or downsizing considerations of households. This reduces our sample by approximately half. The results are reported in the appendix, table A2. Not surprisingly, the effect on ownership becomes virtually zero, as it is very rare to observe people who become homeowners without at the same time changing their dwelling. However, nearly all other coefficients are qualitatively the same, and those which are not are insignificant for both the main and the non-mover samples.

6 Conclusion

We have analysed the effect of an increase in credit supply on the homeownership and mortgage status as well as other housing related items of individuals' balance sheets. To isolate changes in credit supply from confounding factors, we have employed an index measuring the deregulation of branch openings and acquisitions of banks, which the previous literature has shown to increase competition among banks without having a direct effect on credit demand. Moreover, by including individual fixed effects we rule out concerns with regard to selection into living in a particular state.

[20] This subgroup includes combined metropolitan areas with dense population such as New York-New Jersey-Long Island CMSA

[21] The majority of our consolidated MSA observations lie within states with rent control such as California and New York. This introduces further rigidities for substituting between rental and owner markets. Increased credit supply may have caused temporary declines in these rental markets.

Our main findings show that increases in credit supply in the period 1996 to 2005 have considerably added to increasing ownership and mortgaging rates. Consequently, households' mortgage debt and house prices have increased. Since the increase in the former exceeded the increase in the latter, the debt to value ratio increased, and so did the debt to income position of households.

However, the data revealed considerable heterogeneity in the effect of deregulation. Most importantly, deregulation had much stronger effects among rural households, probably because competition among banks in urban areas was already strong to begin with, while room for increased competition existed in less populous locations. Furthermore, most of the effects of deregulation are concentrated on young individuals, as these are more likely to change ownership status and have a longer investment horizon. Low income households were not able to take advantage of the opportunities provided by increased credit supply, at least with regard to the housing market.

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Appendix: Further results

Table A1: The effects of deregulation in urban areas, by urban classification

Sample	Baseline	SIPP urban definition	1996 and 2001 panels	1996 and 2001 panels, large MSAs	1996 and 2001 panels, medium MSAs	1996 and 2001 panels, small MSAs
	(1)	(2)	(3)	(4)	(5)	(6)
Outcome						
Is Homeowner	0.0004	0.0025**	0.0010	0.0004	0.0027	0.0038
	(0.0011)	(0.0011)	(0.0013)	(0.0013)	(0.0021)	(0.0026)
Has Mortgage	0.0013	0.0037**	0.0017	-0.0034	0.0082**	0.0073**
	(0.0022)	(0.0017)	(0.0026)	(0.0033)	(0.0034)	(0.0041)
Log Mortgage Debt	-0.0136	-0.0045	-0.0163	-0.0171	-0.0081	0.0145
	(0.0115)	(0.0089)	(0.0127)	(0.0277)	(0.0096)	(0.0123)
Log Home Value	-0.0010	0.0029	-0.0031	-0.0135	0.0110*	0.0152**
	(0.0057)	(0.0046)	(0.0061)	(0.0124)	(0.0064)	(0.0073)
Log Mortgage Payment	-0.0026	-0.0021	-0.0023	-0.0034	0.0021	-0.0001
	(0.0035)	(0.0029)	(0.0042)	(0.0057)	(0.0056)	(0.0064)
Log Rent	-0.0109***	-0.0104***	-0.0106**	-0.0156**	-0.0097	-0.0053
	(0.0039)	(0.0033)	(0.0049)	(0.0068)	(0.0091)	(0.0069)
Debt to Value	-0.0027	-0.0004	-0.0019	-0.0028	-0.0014	0.0038
	(0.0022)	(0.0018)	(0.0026)	(0.0044)	(0.0034)	(0.0035)
Debt to Income	-0.0365	0.0300	-0.0232	-0.0366	-0.0141	0.2016
	(0.0906)	(0.0785)	(0.1026)	(0.1687)	(0.1597)	(0.1693)

Notes: Cell entries are the estimated effect of deregulation on the dependent variable given in the row. Large MSAs are consolidated MSAs (CMSA). Medium MSAs are MSAs which are not CMSAs, but have a population greater than 100,000. Small MSAs are MSAs with populations smaller than 100,000. All regressions include the same controls as listed in the notes to table 3. Standard errors in parentheses. *** p-value<0.01, ** p-value<0.05, * p-value<0.1.

Table A2: The effect of easier credit supply on non-movers

Sample	Full	Urban	Rural	Full	Urban	Rural
	(1)	(2)	(3)	(4)	(5)	(6)
A: Ownership Status	Is Homeowner			Has Mortgage		
Coefficient	0.0009	0.001	0.0007	0.0041**	0.003	0.0062**
Standard errors	(0.0007)	(0.0009)	(0.0010)	(0.0016)	(0.0019)	(0.0027)
Number observations	117,390	78,518	38,872	117,390	78,518	38,872
B: Home Equity	Log Mortgage Debt			Log Home Value		
Coefficient	-0.0015	-0.0169	0.0303***	0.0041	0.0015	0.0109
Standard error	(0.0090)	(0.0129)	(0.0093)	(0.0049)	(0.0062)	(0.0069)
Number observations	46,466	31,974	14,492	71,590	47,308	24,282
C: Housing Cost	Log Mortgage Payment			Log Rent		
Coefficient	0.0029	-0.0037	0.0178***	-0.0056	-0.0071*	-0.0002
Standard error	(0.0035)	(0.0030)	(0.0068)	(0.0039)	(0.0037)	(0.0104)
Number observations	52,748	36,228	16,520	19,558	14,489	5,069
D: Leverage	Debt to Value			Debt to Income		
Coefficient	-0.0008	-0.0036	0.0039	0.0462	-0.0853	0.3089***
Standard error	(0.0020)	(0.0025)	(0.0028)	(0.0911)	(0.1042)	(0.1152)
Number observations	44,589	30,750	13,839	43156	29,701	13,455

Notes: The coefficients report the estimated effect of a relaxation of inter-state banking by one index point. The sample only includes household heads who have stayed in the same dwelling throughout the panel. See notes to 3 for further information. Standard errors are clustered by state-years and reported in parentheses. *** p-value<0.01, ** p-value<0.05, * p-value<0.1.

Table A3: The effect of easier credit supply and mortgage status on reported home value (in logs)

	By age					
	All		Young		Old	
By location	(1)	(2)	(3)	(4)	(5)	(6)
A: All						
Deregulation index	0.0046	-0.0076	0.0125**	-0.0034	-0.0041	-0.0107
	(0.0044)	(0.0076)	(0.0057)	(0.0135)	(0.0056)	(0.0084)
Has mortgage	0.0999***	0.0724***	0.0903***	0.0616*	0.1023***	0.0834***
	(0.0158)	(0.0209)	(0.0248)	(0.0314)	(0.0189)	(0.0254)
Deregulation index ×		0.0159**		0.0177		0.0106
Has mortgage		(0.0080)		(0.0136)		(0.0101)
B: Urban						
Deregulation index	-0.001	-0.0104	0.0052	0.0132	-0.0078	-0.0203*
	(0.0057)	(0.0100)	(0.0069)	(0.0164)	(0.0080)	(0.0120)
Has mortgage	0.0803***	0.0578**	0.0669**	0.0824*	0.0852***	0.0488
	(0.0176)	(0.0259)	(0.0288)	(0.0425)	(0.0206)	(0.0301)
Deregulation index ×		0.0120		-0.0088		0.0190
Has mortgage		(0.0087)		(0.0172)		(0.0111)
C: Rural						
Deregulation index	0.0145**	-0.0043	0.0262***	-0.019	0.0006	-0.0011
	(0.0072)	(0.0120)	(0.0100)	(0.0222)	(0.0094)	(0.0138)
Has mortgage	0.1171***	0.0767**	0.1089**	0.0327	0.1185***	0.1135***
	(0.0297)	(0.0329)	(0.0448)	(0.0485)	(0.0362)	(0.0432)
Deregulation index ×		0.0261*		0.0520*		0.0031
Has mortgage		(0.0154)		(0.0231)		(0.0209)

Notes: Dependent variable: Log of amount of reported home value. Sample includes only home owners. See notes to table 5 for further information.