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Sheffield Economic Research Paper Series.

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ISSN 1749-8368

SERPS no. 2018009

May 2018

Credit Supply Shocks and Household Leverage: Evidence from the US Banking Deregulation*

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Abstract

We use a quasi-natural experiment framework provided by the staggered removals of inter-state banking restrictions to identify the effect of increased availability of credit on household finances in the US. Analysing US household panel data, we explore the effects of state level banking deregulation on a range of aspects relating to household balance sheets including debt levels and leverage. Employing a range of panel data techniques to control for potential heterogeneity in the households' financial situation, we show that deregulation increased both the propensity to hold debt and the amount of debt held. Our results also show an increased level of leverage following the credit supply shock. Furthermore, we find that the deregulation had a more pronounced effect on non-white headed households. Finally, we show how deregulation increased debt and leverage at the middle and the top of the debt and leverage distributions, and had a relatively large effect on non-white headed households at the top 20% of the debt distribution.

Keywords: Access to Credit; Banking Competition; Household Finances; Leverage.
JEL classification: G28, D14, J15.

*This paper has benefited from comments and advice from Alessandro Bucciol, Alex Kontonikas, Arne Risa Hole, Georgios Efthyvoulou and Mirko Moro. All errors belong to the authors. † Corresponding author.

1 Introduction and Background

Household debt has received a large amount of attention in recent years from both policy makers and researchers, with concern expressed regarding the increasing levels of debt accumulated at the household level relative to low levels of household saving. Over the past three decades, the level of household debt has increased significantly. For example, in the US, in the third quarter of 2017, household debt stood at $12.96 trillion (FED, 2017) exceeding the pre-recession peak of 2008. In contrast, the personal saving rate in the US has fallen from 8% in the 1980s to 5.2% in the third quarter of 2015 (US Bureau of Economic Analysis, 2015). It is apparent that the high level of household debt could impact on macroeconomic outcomes as well as influencing the financial fragility of households. Consequently, from a policy perspective, it is important to fully understand the impact both supply and demand side factors have on household debt holding. Furthermore, in the US, the supply side of credit is dominated by the fact that the banking sector has been one of the most heavily regulated sectors in the US and limited research has been conducted on the implications of changes in supply shocks, as captured by changes to such regulation, for household finances. Hence, we contribute to the household finance literature by exploiting the US interstate banking deregulation as an exogenous supply side shock, which allows us to uncover whether an increase in the availability of credit had a positive effect on household liabilities. In related research, Mian et al. (2017) explore how the financial liberalization of the early 1980s impacted on business cycles across US states. Their key result suggests that the stronger the credit supply expansion, the more amplified the business cycles. Our analysis complements such findings and explores whether a household level dimension to such liberalization exists.

Specifically, we contribute to the literature that explores the real effect of the repeal of the McFadden Act with the Interstate Banking and Branching Efficiency Act (IBBEA). We examine the effects of the interstate bank branch deregulation based on an index first compiled by Rice and Strahan (2010) on household liabilities and other measures of their financial position. We augment models of household debt holding with controls for banking deregulation to formally test whether a credit supply shock has a positive effect on household debt as well as on the level of household leverage. We find that the increased availability of credit led to an increased level of household debt and that the positive effect of the banking deregulation on the level of total debt is entirely driven by household secured debt. In contrast, the results suggest that

the effect of the banking deregulation on unsecured debt is statistically insignificant. We also provide evidence that measures of household leverage increased as a result of the interstate bank branching deregulation. In addition, we document, through the application of quantile regression models, how the banking deregulation had differential impacts across the debt and leverage distributions. The results suggest that the bank deregulation had a greater impact in the center of the debt and leverage distributions as opposed to at the tails of the distributions.

We also explore whether individuals who were more likely to be credit rationed before the banking liberalization benefited from these policies. We build on previous work by Blanchflower et al. (2003) which finds that non-white individuals have a higher probability than white individuals of being credit rationed. Hence, to further our understanding of the impact of the credit supply shock, we evaluate the effect of the credit supply shock on the liabilities of white and non-white headed households by exploring the effects of the banking deregulation on debt and leverage across different racial groups. We find that, although white headed households had a higher probability of holding debt, after the liberalization both groups took advantage of this new economic regime, and that the effects for non-white headed households were more pronounced.

Finally, in order to gain further insights into the long-term macroeconomic implications of our household level findings, we conclude our empirical analysis by presenting some state level correlations between household debt and economic growth around the latest financial crisis. We find a negative correlation between business cycle expansions and household debt; as expected this correlation is larger, in absolute value, for the period post-crisis and for those states with a higher level of banking liberalization.

This paper links, as well as contributes to, two strands of the finance literature; the first deals with analysing the determinants of debt at the household level. More specifically, this strand of the literature explores both the propensity to hold debt and the amount of debt held at the household level. Such studies include Castronova and Hagstrom (2004), Yilmazer and DeVaney (2005), Bertaut et al. (2009) and Brown and Taylor (2014), amongst many others. Many of these studies exploit a life-cycle model to account for demand-based determinants and, in this context, age and earnings as well as a range of household and individual characteristics are important determinants of debt accumulation. For instance, Malmendier and Nagel (2011) found that individuals born during the US Great Depression of the 1930s are more likely to be risk averse

and therefore take on less debt. The findings of Brown and Taylor (2008) suggest that the poorest and the youngest households in Germany, the UK and the US are the most vulnerable to adverse changes in their financial circumstances given their debt holdings relative to the level of their financial assets. A related strand of the household finance literature has devoted attention to the rise in household indebtedness with the aim to assess both the macroeconomic sustainability of the debt and the possible link between household liabilities and macroeconomic outcomes. For example, Adelino et al. (2016), using data from the Home Mortgage Disclosure Act and Internal Revenue Service for the US, find that financial development in the form of mortgage origination increased across all levels of income and not at the sub-prime level as previously argued by Mian and Sufi (2009). They show that delinquencies increased particularly for middle-income and high-income borrowers, hence casting some doubt on the conventional narrative of a link between sub-prime borrowers, the housing market crisis of 2007/8 and the consequent financial crisis.

The second strand of the finance literature that this paper relates to concerns the effects of banking liberalization. This area of research began with Jayaratne and Strahan (1996), who showed how the intrastate branching deregulation in the US significantly increased the rates of real per capita growth in income and output. Following this study, a number of authors have examined how the intrastate branching and interstate banking deregulation events that occurred in the US in the 1970s and 1980s had real economic consequences. These studies find that deregulation spurs entrepreneurship (Black and Strahan, 2002), makes state business cycles smaller and more alike (Morgan et al., 2004), allows firm entry and access to bank credit (Cetorelli and Strahan, 2006), promotes creative destruction (Kerr and Nanda, 2009), and increases personal bankruptcy rates (Dick and Lehnert, 2010). Rice and Strahan (2010) show that the interstate branching deregulation that occurred in the US in the mid-1990s expanded credit supply by reducing the cost of credit but had no effect on the amount borrowed by small firms.

Our focus is on a different sector of the economy - households rather than firms. This paper is related to Célérier and Matray (2017) and Tewari (2014). In the former they find a positive association between interstate deregulation and the probability that households hold a bank account, while in the latter Tewari (2014) explores the effect of intrastate state banking deregulation on home ownership and reports an increase in the flow of mortgage lending and

the stock of ownership equal to 2% over a five year horizon.[1]

The outline of the paper is as follows: Section 2 provides a description of the data and the econometric methodology; Section 3 presents the results; and Section 4 provides a discussion of the link between banking liberalization, household debt and the financial crisis at the state level. Section 5 concludes.

2 Data

2.1 Banking Deregulation

The banking sector has always been one of the mostly heavily regulated sectors in the US economy. An important piece of US legislation introduced by the McFadden Act of 1927 forbade the geographic expansion of banking activities across states; each bank was allowed only to branch within the state in which it was headquartered.[2] By 1994 the majority of the states (42 states) did not permit interstate branching although the majority allowed interstate banking.[3] Of the eight states that allowed interstate branching only six allowed it on a reciprocal basis (see for example, Johnson and Rice (2008)). Throughout the 1980s and early 1990s, the US embarked on a process of liberalization of the finance industry. An important part of this liberalization was the 1994 IBBEA, which allowed for unrestricted interstate banking and legalized branching across the US; states had until June 1, 1997, to choose whether to opt-out of the new law's branching provisions, also known as the Riegel-Neal Act.[4] As shown by Rice and Strahan

[1] As we will explain in greater detail below, our focus is on the interstate deregulation as opposed to the intrastate deregulation focused on by Tewari (2014).

[2] The McFadden Act was a highly contested act and "was motivated by the federal government's desire to resolve the ambiguity about the powers of national banks, and preserve the attractiveness of national bank charters and membership in the nascent Federal Reserve System against regulatory competition from state bank regulators. It provided that in states where state branch banking existed, or could exist in the future, both national and state bank members of the Federal Reserve System would be allowed to operate branches within the city limits of the parent bank. This was viewed as a step towards further branching liberalization and greater bank competition at the local level." Rajan and Ramcharan (2016, p. 1846). The act was supposed to address concerns relating to the concentration of financial activity and concerns about the difficulty of supervising large banking operations expanding to multiple states.

[3] Specifically, "(1) interstate banking (acquiring or establishing a charter in a state outside the main bank's home state), (2) interstate branching (acquiring or establishing a branch office, an office which is not separately chartered or capitalized, in a state outside the main bank's home state)", Johnson and Rice (2008, p.85).

[4] "Although all fifty states and the District of Columbia have opted into interstate branching, there was considerable debate and activity in many states over whether their state should opt out of interstate branching. The pressure to opt out of interstate branching under IBBEA was based on the small bank versus big bank special interest issues that had thwarted interstate branching in the past. Some argued that interstate branching might imperil smaller communities by siphoning deposits out of the towns and using them to make loans to larger clients in financial centers elsewhere. States that debated opting out included Iowa, Texas, Colorado, Missouri, Oklahoma, Montana, New Mexico, Nebraska, and Kansas, with Texas and Montana opting out initially, though they later opted in", Johnson and Rice (2008, p.87).

(2010), this deregulation translated into an increase in the number of bank branch openings which brought about an increased level of competition in the banking sector. Ultimately, this translated into a lower cost of capital and a higher availability of credit for individuals and households. This deregulation has also been shown to have increased bank branch density in poor counties, see Célérier and Matray (2017). At the household level, this supply shock is shown by Célérier and Matray (2017) to have reduced the number of households without a bank account and this effect was more pronounced for households which were previously credit rationed.

With the IBBEA, states were also allowed to erect barriers to out-of-state entry from the time of enactment in 1994 until the branching trigger date of June 1, 1997. These restrictive measures relate to four different areas: i) the minimum age of the targeted institution (5 years, 3 years or less); ii) *de-novo* interstate branching;[5] iii) acquisition of branches without acquiring the entire bank; and iv) a statewide deposit cap.[6]

Utilizing these four restrictions and following Rice and Strahan (2010), we construct a *5-point* time-varying index, *RSIndex*, that takes the value of 4 when the state is fully regulated and 0 with the highest level of openness towards interstate entry. More specifically, if a state imposed one of the above restrictions the index takes the value of one, if the restrictions imposed by a state are two then the index takes the value of two and so on.[7]

2.2 Household Data

Our household level data is drawn from the US Panel Study of Income Dynamics (PSID). The PSID is a longitudinal survey, which began in 1968, and initially included approximately 5,000 families and 18,000 individuals. Until 1997, the main survey was conducted annually, however since 1997 it has been collected biennially. The PSID contains an extensive range of socio-demographic information relating to households, which enables us to control for a wide variety of explanatory variables. Given that we are concerned with the effect of banking deregulation on household debt accumulation, we focus on information contained in the supplementary wealth modules. These wealth modules were collected in 1984, 1989, 1994 and biannually from 1999

[5]Section 613 of the Dodd-Frank Act eliminates the requirement that a state expressly "opt-in" to *de novo* branching. The Act allows banks to establish branches in any state if that state would allow the establishment of a branch by a state bank chartered in that state.

[6]See Rice and Strahan (2010) for a full description of the specific details of these barriers.

[7]We then reverse the index in order to aid the interpretation of the results.

onwards. Given the staggered timings of the banking deregulation, with the majority occurring between 1994 and 1997, we focus on the 1984, 1989, 1994, 1999, 2001, 2003 and 2005 waves of the survey. We restrict the analysis to the pre-financial crisis period due to the timings of the state level deregulations. Furthermore, as is standard in the literature, see for example, Brown and Taylor (2008), we focus on the head of the household and obtain, a sample of 13,985 individuals which corresponds to 41,741 observations. Given that the PSID contains information on the state of residence of the household, we are able to merge information on the level of banking deregulation that households experience at a given point of time in a given state.

In line with Yilmazer and DeVaney (2005), Brown and Taylor (2008) and Brown and Taylor (2014), we start by exploring a range of household debt measures, specifically, total debt, unsecured debt and secured debt, including both the incidence of holding debt and the level of debt held. Thus, we aim to investigate whether the effects of banking deregulation differ by debt type. Secured debt is based on the responses to the following questions: "Do you have a mortgage on this property?" and "about how much is the remaining principal on this mortgage?"; and "do you also have a second mortgage?" and "about how much is the remaining principal on this mortgage?" Summary statistics are provided in Table 1 Panel A. Of the sample considered, 61.7% households do not hold a mortgage. The level of unsecured debt is based on the question: "If you added up all these [debts/debts for all of your family], about how much would they amount to right now?" These include the levels of non-mortgage debt such as: credit card charges; student loans; medical or legal bills; or loans from relatives. This forms the measure of unsecured debt, where 51.3% of households report zero unsecured debt. Finally, total debt is given as the summation of both secured and unsecured debt, with 36.6% reporting zero household total debt. As a consequence of the skewed nature of the debt variables, see Friedline et al. (2015), in the analysis we apply an inverse hyperbolic sine (IHS) transformation to the dependent variables, which is given as follows:

$$asinh(x) = ln(x + (x^2 + 1)^{1/2}). \tag{1}$$

This can be interpreted in the same way as a logarithmic transformation, however, the IHS transformation allows the occurrence of zeros and negative values.[8] Table 1 also presents

[8]We have also conducted the analysis using the standard logarithm transformation, $ln(y + 1)$, and obtain similar results.

summary statistics relating to the distributions of the dependent variables that are considered in the subsequent analysis. The statistics indicate that total debt displays a negative skew, whereas both secured and unsecured debt display positive skewness. Figure 1 presents the distribution of household total debt whilst Figure 4 shows how the distribution of total debt has changed over time for regulated and deregulated states. Figure 4 suggests that, where there was banking deregulation, the level of debt increased (as represented by a shift to the right and an increase in density) compared to those states where deregulation was not implemented. Figures 5 and 6 provide a better understanding of what drives the shift in total debt. It is evident that this is driven entirely by the increase in secured debt. This is also confirmed by Panels B and C in Table 1, where we report the summary statistics split by deregulation status, that is, those states which experienced no deregulation, $RSIndex = 0$, and those states which had some deregulation, $RSIndex > 0$, respectively.[9] These summary statistics provide some interesting insights. Specifically, it is clear that debt holdings and the propensity to hold debt are higher in deregulated states. For example, in the non-deregulated states, the probability of any debt holding is 61.5% compared to 65.6% in a state which experienced some deregulation, a pattern consistent with both unsecured and secured debt holding. In addition, the level of debt is considerably higher in deregulated states ($RSIndex > 0$) as compared to non-deregulated states ($RSIndex = 0$), for example, the average level of total debt is \$628 in regulated states compared to \$1447 in deregulated states.

We also explore the effects of banking deregulation on the leverage of the household. Such measures provide an indication of the household's financial position and allow us to investigate whether household financial fragility has increased as a result of the credit supply expansion. To conduct this analysis, we use three leverage ratios, which are defined as the proportion of total debt with respect to: i) the household level of income; ii) the house value and; iii) the value of financial assets. The leverage position of the household is an indicator of whether the debt accumulated by the household is at a sustainable or at an excessive level.

The measures of leverage are defined as follows:

$$Leverage_{ist} = \frac{Debt_{ist}}{Income_{ist}}; \tag{2}$$

[9]For example, New Hampshire has an $RSIndex = 0$ in 1997, indicating no deregulation, while there is complete deregulation by 2002, that is, $RSIndex = 4$; this implies that observations relating to New Hampshire from the survey waves 2003 and 2005 are included in Panel B while data for all other waves are in Panel A.

$$Leverage_{ist} = \frac{Debt_{ist}}{HouseValue_{ist}}; \tag{3}$$

and

$$Leverage_{ist} = \frac{Debt_{ist}}{FinancialAssets_{ist}}. \tag{4}$$

The subscripts i, s and t identify the household, state of residence and the year of the survey, respectively. Income refers to the household's total annual income, house value is the self-reported house value, while the value of financial assets is defined as the sum of the household's levels of stocks, savings, bonds and pension wealth. The total debt-to-income ratio is a measure of the household's overall financial position, and it has been used extensively in the existing literature, see, for example, Iacoviello (2008), Mian and Sufi (2011) and Philippon and Midrigan (2011). Moreover, this ratio is important because it is used by lenders to determine households' repayment capacity. The second measure captures the fact that mortgages tend to be the largest component of household debt. Hence, increases in house values can affect household leverage since new homeowners may have to borrow larger sums to buy a house, while for existing homeowners a wealth channel may be observed; increases in house prices make them feel richer and they may decide to borrow against their increased collateral to fund spending on consumer goods and services.[10] Finally, we employ the ratio between total debt and the financial assets held by the household. This ratio captures the household's vulnerability to economic shocks, such as becoming unemployed or ill. The value of assets provides a better understanding of the household's ability to pay down the debt. The smaller (higher) the leverage defined as the debt-to-assets ratio the higher (lower) will be the household's resilience to such shocks.

Considering the summary statistics presented in Table 1 relating to the leverage measures, a similar picture to the level of debt held is apparent. Across all of the leverage measures, the mean is higher in the deregulated states than in regulated states. Interestingly, for all three measures the level of skewness is lower, whilst the level of kurtosis is higher in the deregulated states; this suggests a more concentrated distribution, and less extreme positive values.

[10]The existing literature has provided convincing evidence on the link between house price value, borrowing and ultimately consumer spending (see, for example, Adelino et al. (2016) and Mian et al. (2013) for the US and Cloyne et al. (2017) for UK evidence).

2.3 Methodology

The baseline models estimate the effects of the banking deregulation on the probability of holding debt, the level of debt held and leverage. The basic relationship is given by the following equation:

$$y^*_{ist} = \alpha RSIndex_{st} + x^{'}_{ist}\beta + \phi MacroEconomic_{st} + \delta_t + \nu_s + \epsilon_{ist}. \quad (5)$$

where y^*_{ist} is the dependent variable of interest, *RSIndex* is the level of deregulation in state s at time t, and X_{ist} is a vector household characteristics. The household characterstics include head of household characteristics such as age, age squared, gender, ethnicity, education, health, labour market status, marital status as well as household controls such as whether there is a child present in the household, the log of total assets held by the household and home ownership. $MacroEconomic$ is a vector of state level control variables, which includes the unemployment rate, GDP growth and house price growth.[11] δ_t and ν_s are state and year fixed effects, respectively. For each type of debt (total debt, secured debt and unsecured debt), we explore the determinants of the propensity to hold debt by specifying random effects probit models, as well as exploring the determinants of the amount of debt held and household leverage using random effects tobit models, given that debt is censored in nature. Following Mundlak (1978), in order to account for potential individual heterogeneity, we also include averages of the time varying variables.[12,13]

3 Results

3.1 Banking Deregulation, Debt and Leverage

The results in Table 3 show the determinants of the probability of holding each type of debt considered and also the determinants of the level of debt held. The results relating to the head of household and household characteristics are in line with the existing literature. Hence, we only

[11] House price growth is calculated using the Freddie Mac house price index, the state level GDP is from the Bureau of Economic Analysis and the unemployment statistics are collected from the US Bureau of Labor Statistics.

[12] These include age, income and financial assets.

[13] We have also explored fixed effects linear models and obtain similar results. In line with the previous literature, we have also estimated the model using standard probit and tobit models with the standard errors clustered at the state/year level and obtain similar results. As an additional robustness check, we have also run a censored hurdle model, which separates the decision to hold debt and the level of debt held. As exclusion restrictions we include risk tolerance from the 1996 wave of the PSID in the hurdle stage. Again the estimations led to quantitatively and qualitatively similar results.

comment briefly on these findings. The propensity to hold any type of debt is positively related to household income, being employed and the level of financial assets held by the household. In addition, the level of education has a significant impact on the propensity to hold all debt types, with college education having a positive impact on the likelihood of debt holding.[14] Similarly, total debt levels are positively associated with age, income and financial assets, whilst being in better health is inversely associated with debt accumulation. Being married, having college education and home ownership are strongly positively related to total debt levels. Turning our attention to the separation of debt into secured and unsecured debt reveals some significant differences. For example, age is positively related to total debt levels, however, this effect is driven by the relationship with secured, as opposed to unsecured, debt. Conversely, gender and health status influence unsecured, rather than secured, debt. The dummy variable identifying the racial group of the respondent is found to be positive and statistically significant for secured debt, but not for unsecured debt and total debt. On the leverage side (see Table 4), the picture is slightly different, we find that being white is positively related to the total debt to income ratio and the total debt to asset ratio, whereas an inverse effect is found for the level of leverage as measured by the total debt to house value. Given the focus on race in the existing literature, in the next section, we explore these race effects in more detail.

Turning attention to our key explanatory variable reveals that, after controlling for both household characteristics and state level macroeconomic conditions, the level of banking deregulation had an impact on the probability of holding debt at the conventional statistical level (see Table 3). Specifically, an increase in banking competition due to the banking deregulation is associated with a higher probability of holding any type of debt, albeit small in absolute value.[15] However, relative to other variables, this corresponds to approximately 1.4 times the impact of a 1% increase in financial asset levels and approximately one tenth of the impact of being employed compared to be retired. Splitting total debt into secured and unsecured debt reveals that this relationship is driven by secured, as opposed to unsecured, debt. We also find that the magnitude of the impact is increased, with a one-point increase in the *RSIndex* being associated with a 0.07% increase in the probability of holding secured debt. This result is in

[14] In order to control for possible heterogeneity in the effect of banking liberalization in different states, we have also explored controlling for bank branch data density using data collected from the Federal Deposit Insurance Corporation (FDIC). The results are qualitatively and quantitatively similar in all specifications and are available upon request.

[15] A one-point increase in the *RSIndex* is associated with a 0.005% increase in the probability of holding debt.

line with Tewari (2014) who finds that the removal of intrastate banking barriers had a positive effect on home ownership. The deregulation of the banking sector is also found to influence the level of total debt, and this relationship is again driven by the amount of secured, as opposed to unsecured, debt. A one-point increase in the deregulation index corresponds to an 8.5% increase in the level of secured debt, holding all other factors constant.[16]

Finally, Table 4 presents the results relating to debt leverage. The results suggest that the deregulation had a significant impact on household leverage in the case of total debt relative to income and total debt relative to house value. The *RSIndex* increased the ratios of total debt to income and to house value but did not influence the ratio of total debt to financial assets. Furthermore, the magnitude of the increase is stronger when leverage is measured as a ratio of the total income level. For example, the marginal effects relating to these impacts indicate that a one-unit increase in the index corresponds to about a 1% (0.5%) increase in the ratio of total debt to income (house value).[17]

The credit supply shocks identified by the staggered deregulation of the US banking system could be due to other state level factors which occurred around the years of the deregulation. To rule out the possibility that these shocks were not truly exogenous to changes in households' financial position, we implement two falsification tests. Firstly, in line with the literature relating to difference-in-differences methods, we explore the effect of the deregulation in a prior time-period. Specifically, we shift the timing of the deregulation to a period between 1984-1989, that is at least five years prior to the actual deregulation, and explore whether the deregulation has a statistically significant impact on our dependent variables. The results presented in Panel A of Table A1 suggest that the shifted deregulation fails to have an impact across all the dependent variables considered.[18] Second, we perform a falsification test that incorrectly randomly assigns a value of *RSIndex*, that is a score between 1 and 4, to states which were not deregulated, between 1994 and 1999. Panel B in Table A1 presents the results, which are statistically insignificant for

[16]Throughout the discussion, the marginal effects of the RE tobit models relate to the average marginal effect of the independent variable on the expected value of the censored outcome.

[17]In order to further explore the impact of the *RSIndex* across different groups of households, we interact the *RSIndex* with financial assets. We explore whether there is a differential impact of the *RSIndex* across the asset distribution. Specifically, we separate financial assets into five categories, one indicating those holding zero financial assets, and quartiles for positive asset amounts. The results indicate that, in general, across the dependent variables considered, the *RSIndex* has a statistically significant impact for those households in the lowest positive asset category, relative to those holding zero assets. This suggests that the banking deregulation gave households with relatively low levels of financial assets access to the credit market, as opposed to those households with higher levels of financial assets, who arguably would have been able to access credit markets even without the deregulation. The results are available upon request.

[18]The results do not change when the 1994 wave is included.

this random assignment of the index. This suggests that our results are not driven by unobserved shocks, given that incorrect assignment of deregulation weakens the results, and are generally statistically insignificant determinants of our outcomes of interest. Overall, our baseline results appear to be robust, indicating that the US interstate branching deregulation generated an exogenous expansion in secured credit and household leverage.

3.2 Banking Deregulation, Debt and Leverage across Racial Groups

In the previous section, we found that the race variable (*white*) had a significant effect on debt and leverage. The aim of this section is to explore this result in more detail and, specifically, to test whether the banking liberalization had different effects on households based on their race. There is a large literature documenting racial discrimination in the credit market; for instance, Blanchflower et al. (2003) find that non-whites have a higher probability than whites of being credit rationed. Peoples and Talley (2001) found that a more competitive market reduces wage discrimination by race following the deregulation of trucking. Investigating deregulation of credit cards in the US market, Chatterji and Seamans (2012) find that access to credit improves particularly among black households. Levine et al. (2014) explore the impact that interstate and intrastate bank deregulation in the US had on racial inequalities, focusing on the racial wage gap. Their results support the notion that a more competitive market reduces racial wage discrimination and enhances the economic opportunities of the more disadvantaged group. They also find that the credit market improvements had a real impact on reducing racial prejudices related to labor market opportunities. More recently, Célérier and Matray (2017) explore the effect of the US banking deregulation on unbanked households. Their results show that, following an increase in the density of bank branches in poor counties, there is a lower number of unbanked households. Moreover, they find that this increased credit supply increases the likelihood that low-income households hold a bank account and that this effect is more pronounced for individuals who are more likely to have restricted access to credit, such as black households living in states with historic racial biases.

In order to further explore the potential heterogenous effects of the banking deregulation, specifically, to explore whether the deregulation effect differs by race, we interact the *RSIndex* with the variable *white* which is a dummy variable that takes the value of one if the head of

the household is white.[19] Table 5 summarises the results relating to the interaction between the deregulation index and the race dummy, for both the propensity to hold debt and the amount of debt held. The results in Table 5 indicate that the *RSIndex* has a positive impact on total debt holding and that the effect is more pronounced for households where the head is non-white. In this context, the marginal effect reveals that the *RSIndex* fails to have a statistically significant impact on any debt holding, however for non-white households, a one-unit increase in the *RSIndex* is associated with a 0.009% increase in the probability in holding debt. Considering the effect of the race interaction on the level of total debt, again reveals that the effect of the deregulation was more pronounced for the non-white group. For example, the marginal effects reveal that, conditional on being non-white, the level of debt increases by 19%. When we split total debt into secured and unsecured debt, two interesting results emerge. Firstly, the results confirm that secured debt increased for all households, but this expansion is greater for non-white headed households. Secondly, in contrast to the results presented in Table 3, it is apparent that the increase in banking competition generated an expansion in unsecured debt held by the non-white headed households. Hence, the lack of statistical significance of the *RSIndex* in columns 4 and 5 in Table 3 appears to be driven by the white headed households. This result supports the finding of Blanchflower et al. (2003) indicating that a positive credit supply shock has a positive effect on individuals who were previously more likely to be credit rationed.

Similarly, Table 6 presents the interactions between race and the banking deregulation index for the three leverage measures. The results indicate that the *RSIndex* maintains its positive impact on the debt leverage measures (including the debt to asset ratio) and that household leverage increased more, albeit the coefficients are small in magnitude, for non-white headed households. The marginal effects reveal that, conditional on being non-white, a one-unit increase in the *RSIndex* increased the debt to income ratio by 1.4%. In comparison, for white headed households the effect was significantly smaller, with a one-unit increase in the *RSIndex* corresponding to a 0.5% increase and this effect is only significant at the 10% level. Similar results are found across the other leverage measures, with the effects of the deregulation being more pronounced amongst non-white headed households.

To further analyse the impact of the banking deregulation on racial discrimination, we explore the hypothesis first explored by Chatterji and Seamans (2012) that racial discrimination is higher

[19] In our sample 57.74% are white.

in states with a history of discrimination.[20] We do this by utilizing two discrimination controls: the first one, *slave state*, aims to exploit historical state characteristics. This variable takes the value of one if the state is identified as a state that allowed slavery in 1861. The second variable, *interracial marriage bias state*, measures the difference between actual and predicted interracial marriage rates in 1970; where states are categorized above and below the median.[21]

Panels B and C in Tables 5 and 6 report the results when the variables *white* and *RSIndex* are interacted with *slave state* and *interracial marriage bias state*, respectively. In both cases the *RSIndex* is still strongly statistically significant and *white* is positive in accordance with the results in Panel A. The interaction *RSIndex* $\times$ *slave state* is negative and statistically significant, indicating that the deregulation had a smaller effect in states with a history of racial discrimination. Looking at the triple interaction, we note that this is statistically significant for total debt and secured debt; the positive sign indicates that the effect of deregulation is smaller for non-white headed households in states with a history of discrimination. This last result contrasts with the findings of Célérier and Matray (2017, p. 23), who explore unbanked households and find that "the gap between black and non-black households reduces more in states with a history of discrimination", although the difference in the outcome variables between the two studies should be noted.

3.2.1 Quantile Regression Analysis: The Effects of Banking Deregulation across the Debt and Leverage Distributions

In order to further our understanding of the effects of the banking deregulation on household debt and leverage, we now explore the effect of banking deregulation using quantile regression analysis. The quantile regression approach will allow the exploration of the effects of banking deregulation across the entire conditional debt and leverage distributions as it may be the case that banking deregulation, or indeed other household characteristics, could have different effects at different levels of debt holding or leverage. These results may be masked by focusing solely at the mean (or median), which has generally been the approach adopted in the existing literature, as well as our approach in the previous sections. As described by Koenker and Bassett Jr (1978),

[20] This hypothesis has been explored by Levine et al. (2014) and Célérier and Matray (2017).
[21] This variable is collected from Levine et al. (2014).

the estimation is conducted by minimizing the following:

$$Min_{\beta \epsilon \mathbb{R}^K} \sum_{t \epsilon (t: y_{ist} \geq x_{ist}\beta)} \theta |y_{ist} - x_{ist}\beta| + \sum_{t \epsilon t: y_{ist} < x_{ist}\beta} (1-\theta)|y_{ist} - x_{ist}\beta| \quad (6)$$

where y_{ist} is the dependent variable, x_{ist} is the k by 1 vector of explanatory variables, β is the coefficient vector and J is the quantile to be estimated. The coefficient vector β will differ depending on the particular quantile being estimated. This approach allows the exploration of the impact of the deregulation at different parts of the distribution of the amount of debt held as well as at different parts of the leverage distribution.[22] This modelling approach will shed light on whether such deregulation has differential effects across those households holding relatively large amounts of debt (or with relatively high levels of leverage) and those households holding relatively small levels of debt (or with relatively low levels of leverage). If, for example, the effects of banking deregulation are larger at the bottom of the debt (or leverage) distribution than at the top of the distribution, then such deregulation may over time serve to reduce inequality in access to credit.[23]

For brevity, we only present the effect of the banking deregulation index at different points of the debt distributions for total debt and for secured debt, as well as for the three leverage measures.[24] In the first panel of Tables 7 to 8, we present the effect of the *RSIndex* and, in the second panel of each table, we include the analysis of the interaction of the *RSIndex* with the race control. Table 7 Panel A presents the results relating to the quantile regression estimates for the level of total debt and shows that the banking deregulation has a differential impact across the total debt distribution. The results reveal that the *RSIndex* fails to have an impact at the tails of the total debt distribution, that is, the *RSIndex* failed to have a statistically significant impact between the 10th and 30th deciles and at the 90th percentile and beyond. This indicates that the banking deregulation impacted on the middle part of the total debt distribution up to the 80th decile. It is apparent that this pattern of results is evident in the second panel of the table and that the interaction between *white* and the banking deregulation index only attains statistical significance at the 80th and 90th deciles.

Table 7 Panel B presents results relating to secured debt and the pattern of results is similar

[22] All analysis is conducted in Stata 15 using the sqreg command with 100 bootstraps.

[23] We conduct the quantile regression analysis on positive debt holding only.

[24] The results relating to unsecured debt, as in the previous analysis, yield statistically insignificant results across the entire conditional unsecured debt distribution.

to the case of total debt. The deregulation index has a statistically significant impact between the 40th and 80th deciles, where the largest impact, 0.025, was found at the 40th decile and the lowest, 0.016, at the 80th percentile. In addition, the coefficients are statistically significantly different across the debt distributions, highlighting the importance of not just focusing on the impact of the independent variables at the mean of the distribution, given the differential impacts the level of banking deregulation has at different parts of the debt distributions in terms of both magnitude and statistical significance. The interaction term in the second part of the table fails to reach statistical significance at any point of the secured debt distribution.

Turning to the effects of the banking deregulation on the three leverage measures, it is apparent that the pattern of results differs across the leverage measures. Table 8 Panel A presents the quantile regression analysis relating to the ratio of total debt to income. The results again demonstrate that the *RSIndex* has a positive association with this leverage measure in the middle part of the leverage distribution, specifically from the 30th to the 70th deciles. Interestingly, a positive effect of the banking deregulation is also found at the lower tail of the ratio of total debt to income, that is at the 10th decile. In contrast, in Table 8 Panel B, the *RSIndex* only attains statistical significance at the 80th decile of the total debt to house value ratio.

Table 8 Panel B reveals some interesting results. It is apparent from the interactions that the *RSIndex* has a positive impact above the 30th decile and that this effect is less prominent for white headed households, as indicated by the negative interaction effect. A similar pattern is presented in Table 8 Panel C, where the *RSIndex* has a positive impact in the upper-part of the distribution, but the effect was smaller for white headed households. Once again, these results demonstrate the importance of considering the impact of the *RSIndex* across the entire conditional leverage distribution, and not just exploring the effects at the mean.

4 Macroeconomic Implications

The findings drawn from our household level analysis presented in Section 3 indicate that the banking deregulation led to increased debt accumulation at the household level increasing the level of total and secured debt as well as household leverage. It is apparent that such effects on household debt may have important macroeconomic implications. Indeed, some recent studies have suggested that there is a link between the level of household debt and leverage and the

growth in consumer spending. Mian and Sufi (2010), Mian et al. (2013) and Dynan (2012) have shown that the sluggish growth in consumption in the years following the 2007-2009 recession can be attributed to the level of outstanding debt in household balance sheets.[25]

Starting from this premise, in order to explore the macroeconomic implications of our household level findings, we supplement our household panel data analysis by exploring the effect of household debt on GDP growth at the state level. In particular, we are interested in testing whether the increase in household debt following the banking liberalization of the 1980s and the 1990s could still be felt at the state level during the great recession. Our hypothesis is that in those states where liberalization had a large and positive effect on household debt, excessive leverage has contributed to a slower economic recovery, with households experiencing excessive leverage curbing consumption in order to pay back high levels of debt.

To test this hypothesis we initially employ a state level fixed effects analysis with GDP growth as the dependent variable and a set of state level macroeconomic explanatory variables including household debt. We then go on to explore whether there was a differential impact of state level debt on GDP growth between regulated and deregulated states. Specifically, the second relationship that we estimate is as follows:

$$GDP_{st} = \beta RSIndex_{st} \times Debt_{st} + \phi Controls_{st} + \delta_t + \epsilon_{st}. \tag{7}$$

Hence, we firstly regress GDP growth on a set of state level controls including: growth in the unemployment rate; inequality, as measured by the Gini index; the proportion of the workforce with college and high school education; an indicator of the financial crash; and the growth in the house price index.[26] We then interact the *RSIndex* with the state level of debt (leverage), where s indexes states whilst t indexes time.[27] Focusing on the effects of household debt on GDP growth, we explore three specifications to capture the level of leverage: total debt to income, mortgage debt to income and credit card debt to income. The specification given by equation (7) allow us to explore whether deregulated states are characterised by a higher

[25]This relationship has been subject to criticism given the statistical challenges in trying to identify an exogenous shock. In fact, leverage and spending are related by a direct and indirect relationship. Leverage increases households' borrowing constraints, but leverage also may have psychologically influenced the consumption decisions of the individuals, i.e. households were not technically financially constrained but were reluctant to consume given the higher level of uncertainty regarding the future.

[26]Data for the household debt measures are from the New York Fed Consumer Credit Panel/Equifax.

[27]Given that in the post crisis time period the *RSIndex* is time-invariant, and that we are controlling for state level fixed effects, we do not include this variable independently in the analysis.

correlation between economic growth and household indebtedness and, in addition, whether this relationship changed during the recovery period that followed the financial crisis. To this end, we analyse data over the period 2000-2015, split by pre 2008 and post 2008.

Panel A of Table 9 presents the results of our state level analysis without the interaction terms, some interesting patterns emerge. First, there is a negative and statistically significant coefficient on all three leverage measures for both sample periods. Second, these correlations exhibit stronger magnitudes, in absolute value, for the period post-crisis. Although the causality nexus is not fully addressed here, Panel A of Table 9 provides some support to the Mian and Sufi (2010) finding that the economic recovery was hampered by the large level of debt.

Focusing on the estimates of the interaction terms, as presented in Panel B, we notice that they are quantitatively very small and they are statistically insignificant for the period pre-2008. This suggests that the banking competition did not have an effect on the relationship between debt and economic growth in this time period. The picture changes completely however when we look at the interaction terms for the crisis period. Here the coefficients are all statistically significant at the conventional level and, moreover, the magnitudes are also economically relevant. These results suggest that household indebtedness is a drag on GDP growth and this relationship deepened after the financial crisis particularly for those states which fully liberalized their banking system. Our findings are in line with recent evidence by Mian et al. (2017), who show that intra state liberalization has increased the amplitude of the business cycles.

5 Conclusion

Household debt has received an extensive amount of attention from both researchers and policy makers, particularly since the financial crash, with concern regarding the potential financial vulnerability faced by households holding debt yet with low levels of assets to fall back on in times of economic adversity. This paper has contributed to the existing literature by exploring both demand and supply factors which influence household debt holding. Specifically, this paper has exploited longitudinal US household level data, to explore the impact interstate banking deregulation had on household debt accumulation. Our findings suggest that access to credit increased household debt accumulation, increasing the levels of both total and secured debt, in addition to a range of leverage measures. Moreover, the results from our quantile regression analysis suggest that the banking deregulation had differential impacts across the conditional debt and

leverage distributions. This has potentially important policy implications for future banking liberalisation, given that it could result in more people accruing excessive amounts of debt. The analysis has also explored the impact of the banking deregulation across different groups in society. The results indicate that the banking deregulation had differential impacts across race thereby shedding further light on the barriers to accessing credit faced by different groups in society. The analysis presented in this paper demonstrates that both supply and demand side factors impact on household debt accumulation, and highlights an important dimension that policy makers should consider if further banking liberalisation is to be implemented.

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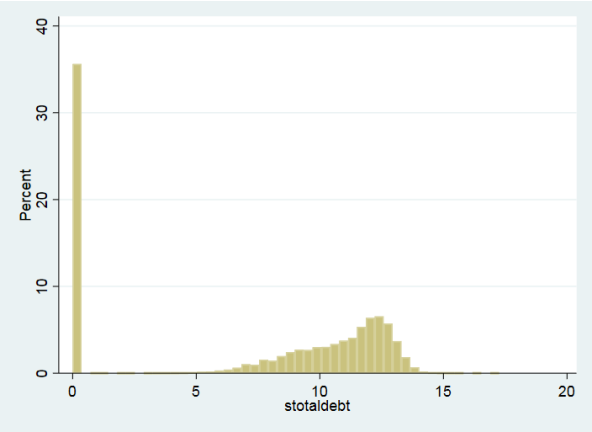

Figure 1: IHS Transformation of Total Debt

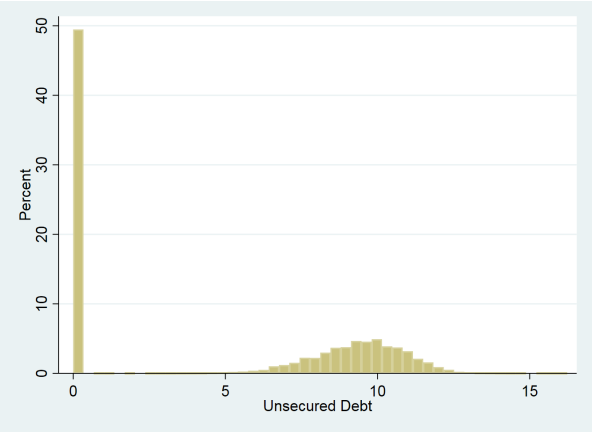

Figure 2: IHS Transformation of Unsecured Debt

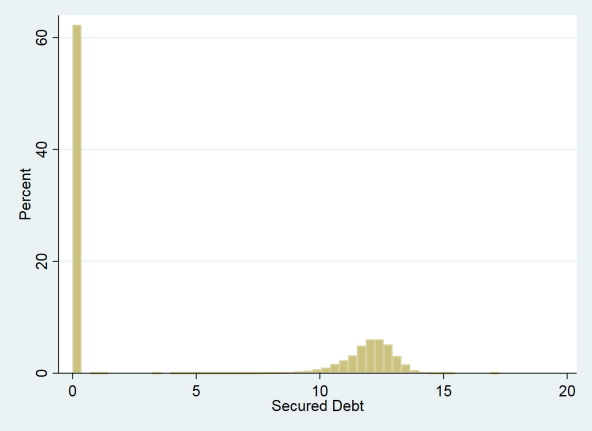

Figure 3: IHS Transformation of Secured Debt

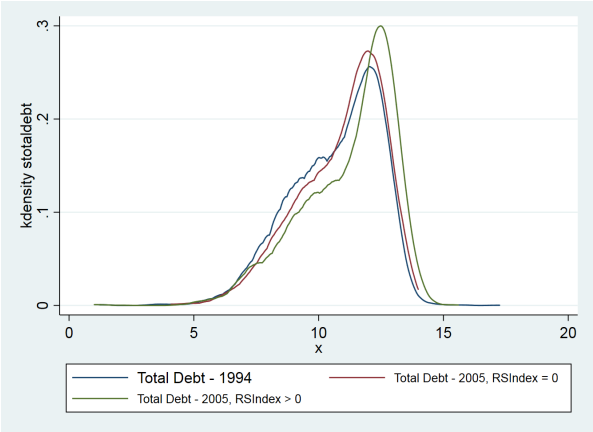

Figure 4: Change in Total Debt Over Time

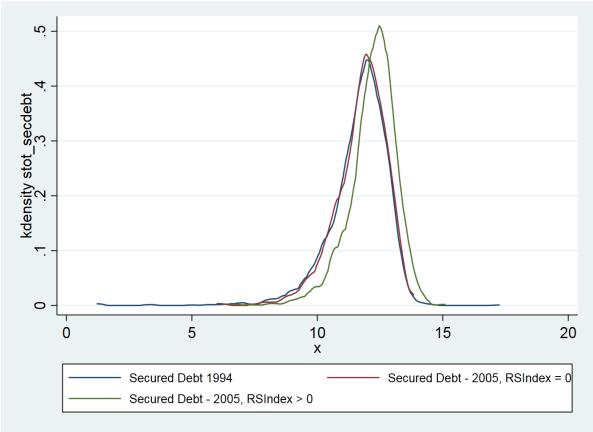

Figure 5: Change in Secured Debt Over Time

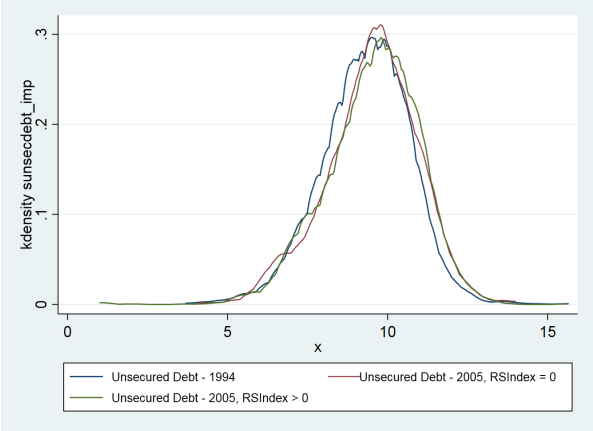

Figure 6: Change in Unsecured Debt Over Time

Table 1: Summary Statistics - Debt holding, Debt Levels and Leverage

Variable	Mean	Std. Dev.	Skewness	Kurtosis	Min.	Max.	N
Panel A: **Full sample**							
Total Debt - Binary	63.4%						41741
IHS(Total Debt)	6.827	5.395	-0.347	1.332	0	17.251	41741
Unsecured Debt - Binary	48.7%						41741
IHS(Unsecured Debt)	4.494	4.72	0.182	1.187	0	15.641	41741
Secured Debt - Binary	38.3%						41741
IHS(Secured Debt)	4.51	5.767	0.521	1.315	0	17.25	41741
Total Debt/Income	0.460	0.630	1.832	8.763	0	7.601	41741
Total Debt/House Value	0.407	0.372	1.082	7.571	0	4.467	23945
Total Debt/Financial Assets	0.581	1.066	3.922	22.67	0	11.983	33238
Panel B: **RSIndex = 0**							
Total Debt - Binary	61.5%						22530
IHS(Total Debt)	6.442	5.298	-0.267	1.281	0	17.251	22530
Unsecured Debt - Binary	47.9%						22530
IHS(Unsecured Debt)	4.324	4.616	0.217	1.207	0	15.641	22530
Secured Debt - Binary	35.8%						22530
IHS(Secured Debt)	4.125	5.559	0.630	1.445	0	17.25	22530
Total Debt/Income	0.386	0.566	2.300	13.452	0	7.601	22530
Total Debt/House Value	0.381	0.374	1.258	7.780	0	4.467	12679
Total Debt/Financial Assets	0.529	0.976	3.926	22.849	0	11.849	17644
Panel C: **RSIndex > 0**							
Total Debt - Binary	65.6%						19211
IHS(Total Debt)	7.277	5.473	-0.454	1.410	0	15.599	19211
Unsecured Debt - Binary	49.7%						19211
IHS(Unsecured Debt)	4.694	4.832	0.136	1.161	0	15.599	19211
Secured Debt - Binary	41.1%						19211
IHS(Secured Debt)	4.961	5.972	0.392	1.190	0	15.263	19211
Total Debt/Income	0.548	0.687	1.435	5.946	0	7.082	19211
Total Debt/House Value	0.437	0.368	0.902	7.568	0	4.382	11266
Total Debt/Financial Assets	0.64	1.156	3.832	21.441	0	11.983	15594

Table 2: Summary Statistics - Explanatory Variables

Variable	Mean	Std. Dev.	Min.	Max.	N
		Independent Variables			
RSIndex	1.088	1.477	0	4	41,741
Age	44.675	16.436	16	101	41,741
Age Squared	226.603	168.559	25.6	1020.1	41,741
Male	68.6				41,741
White	57.7				41,741
IHS(Assets)	7.059	4.918	0	18.518	41,741
Ln(Household Income)	10.645	1.013	4.013	15.347	41,741
College Degree	35.9				41,741
High School	37.3				41,741
Employed	70.9				41,741
Unemployed	5.3				41,741
Not in the labour force (NLF)	10.8				41,741
Child	47.6				41,741
Married	51.5				41,741
Divorced	14.1				41,741
Widow	8.9				41,741
Health	2.483	1.131	0	4	41,741
Own Home	58.8				41,741

Table 3: Debt holding, debt levels and banking deregulation

	Total Debt		Unsecured Debt		Secured Debt	
	RE Probit	RE Tobit	RE Probit	RE Tobit	RE Probit	RE Tobit
RSIndex	0.0256**	0.0972**	-0.00835	-0.0314	0.0413***	0.206***
	(0.0126)	(0.0388)	(0.0109)	(0.0539)	(0.0140)	(0.0692)
Age	-0.00101	0.0777***	-0.0127**	-0.0174	0.146***	0.793***
	(0.00620)	(0.0204)	(0.00562)	(0.0284)	(0.00761)	(0.0394)
Age Squared	-0.00330***	-0.0215***	-0.00138**	-0.0124***	-0.0161***	-0.0902***
	(0.000614)	(0.00208)	(0.000573)	(0.00294)	(0.000780)	(0.00401)
Male	-0.238***	-0.895***	-0.249***	-1.300***	-0.0731	-0.278
	(0.0363)	(0.127)	(0.0327)	(0.167)	(0.0490)	(0.278)
White	0.0605*	0.168	0.0413	0.200	0.212***	1.004***
	(0.0324)	(0.109)	(0.0283)	(0.144)	(0.0396)	(0.219)
IHS(Assets)	0.0183***	0.0594***	0.0252***	0.120***	0.00571	0.0424**
	(0.00341)	(0.0108)	(0.00305)	(0.0152)	(0.00379)	(0.0194)
Ln(Income)	0.111***	0.522***	0.0668***	0.430***	0.405***	2.249***
	(0.0170)	(0.0568)	(0.0156)	(0.0792)	(0.0227)	(0.115)
College Degree	0.447***	1.615***	0.341***	1.874***	0.161***	0.934***
	(0.0375)	(0.127)	(0.0328)	(0.168)	(0.0466)	(0.261)
High School	-0.00999	0.0588	0.0376	0.240	0.00831	0.150
	(0.0321)	(0.113)	(0.0290)	(0.151)	(0.0420)	(0.236)
Employed	0.255***	0.962***	0.156***	0.861***	0.230***	1.086***
	(0.0428)	(0.148)	(0.0402)	(0.210)	(0.0516)	(0.272)
Unemployed	0.00418	0.0492	-0.101*	-0.452	0.0345	-0.0947
	(0.0577)	(0.201)	(0.0542)	(0.282)	(0.0769)	(0.408)
NLF	0.129***	0.548***	0.0434	0.345	0.214***	0.988***
	(0.0465)	(0.163)	(0.0439)	(0.230)	(0.0601)	(0.322)
Child	-0.0176	-0.174**	-0.105***	-0.588***	0.347***	1.584***
	(0.0250)	(0.0761)	(0.0213)	(0.104)	(0.0277)	(0.137)
Married	0.332***	1.159***	0.266***	1.459***	0.934***	5.715***
	(0.0374)	(0.123)	(0.0332)	(0.166)	(0.0451)	(0.242)
Divorced	0.262***	0.845***	0.203***	1.026***	0.361***	2.556***
	(0.0387)	(0.129)	(0.0346)	(0.174)	(0.0475)	(0.261)
Widow	0.312***	0.863***	0.209***	1.025***	0.763***	4.700***
	(0.0562)	(0.200)	(0.0517)	(0.271)	(0.0744)	(0.413)
Health	-0.0704***	-0.234***	-0.0851***	-0.452***	0.0123	0.0602
	(0.0109)	(0.0351)	(0.00963)	(0.0483)	(0.0128)	(0.0661)
Own Home	1.274***	5.680***	0.0745***	0.378***		
	(0.0290)	(0.0870)	(0.0238)	(0.118)		
Constant	-4.078***	-11.42***	-2.507***	-15.07***	-14.51***	-86.34***
	(0.313)	(2.218)	(0.275)	(1.408)	(0.451)	(2.447)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	41,741	41,741	41,741	41,741	41,741	41,741
Number of ID	13,985	13,985	13,985	13,985	13,985	13,985

Notes: (1) Standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. (2) RE denotes random effects and all specifications include Mundlak corrections for continuous independent variables.

Table 4: Household leverage and banking deregulation

	Ratio to Income Total Debt	Ratio to HV Total Debt	Ratio to Assets Total Debt
RSIndex	0.0152***	0.00649**	0.00824
	(0.00447)	(0.00305)	(0.00857)
Age	0.0136***	-0.0168***	-0.00524
	(0.00237)	(0.00174)	(0.00468)
Age Squared	-0.00291***	0.000262	-0.00231***
	(0.000243)	(0.000170)	(0.000473)
Male	-0.0922***	-0.0566***	-0.232***
	(0.0147)	(0.0125)	(0.0301)
White	0.0295**	-0.0383***	0.0964***
	(0.0126)	(0.00928)	(0.0246)
IHS(Assets)	0.00423***	-0.000992	-0.0510***
	(0.00124)	(0.000886)	(0.00259)
Ln(Income)	-0.272***	0.0300***	-0.00178
	(0.00646)	(0.00520)	(0.0139)
College Degree	0.219***	0.0624***	0.301***
	(0.0147)	(0.0109)	(0.0294)
High School	0.000862	-0.00513	0.0726***
	(0.0132)	(0.00993)	(0.0270)
Employed	0.0952***	0.0527***	0.0682**
	(0.0171)	(0.0108)	(0.0327)
Unemployed	-0.0191	-0.0100	0.0998**
	(0.0233)	(0.0185)	(0.0500)
NLF	0.0570***	0.0682***	0.0712*
	(0.0190)	(0.0134)	(0.0381)
Child	0.00899	-0.0125**	-0.0111
	(0.00875)	(0.00607)	(0.0167)
Married	0.139***	0.0703***	0.208***
	(0.0142)	(0.0117)	(0.0281)
Divorced	0.0940***	0.0694***	0.0347
	(0.0150)	(0.0128)	(0.0302)
Widow	0.0720***	0.0338**	-0.00232
	(0.0234)	(0.0170)	(0.0468)
Health	-0.0200***	-0.00966***	-0.0534***
	(0.00405)	(0.00289)	(0.00800)
Own Home	0.981***		-0.534***
	(0.0102)		(0.0196)
Constant	0.191	-0.258***	-0.189
	(0.123)	(0.0992)	(0.257)
Year FE	Yes	Yes	Yes
State FE	Yes	Yes	Yes
Observations	41,741	23,945	33,238
Number of ID	13,985	8,165	11,663

Notes: (1) Standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. (2) All specifications are estimated using a random effects Tobit model with Mundlak corrections of continuous variables.

Table 5: Household debt and banking deregulation - race interactions

	Total Debt		Unsecured Debt		Secured Debt	
	RE Probit	RE Tobit	RE Probit	RE Tobit	RE Probit	RE Tobit
Panel A						
RSIndex	0.0458***	0.190***	0.0105	0.0722	0.0645***	0.466***
	(0.0148)	(0.0473)	(0.0130)	(0.0651)	(0.0172)	(0.0888)
White	0.100***	0.336***	0.0769**	0.390**	0.253***	1.440***
	(0.0358)	(0.119)	(0.0313)	(0.159)	(0.0436)	(0.239)
RSIndex × White	-0.0386***	-0.159***	-0.0337***	-0.179***	-0.0392**	-0.404***
	(0.0147)	(0.0461)	(0.0127)	(0.0632)	(0.0169)	(0.0862)
Panel B: Slave State						
RSIndex		0.290***		0.127		0.648***
		(0.0616)		(0.0843)		(0.121)
Slave State		0.0731		-0.943		0.653
		(0.790)		(1.028)		(1.631)
RSIndex ×Slave State		-0.189**		-0.109		-0.303**
		(0.0745)		(0.102)		(0.146)
White		0.419**		0.411*		2.134***
		(0.165)		(0.220)		(0.333)
RSIndex × White		-0.264***		-0.228***		-0.602***
		(0.0636)		(0.0869)		(0.123)
White × Slave State		-0.114		-0.00431		-1.303***
		(0.223)		(0.297)		(0.453)
RSIndex × White × Slave State		0.211**		0.0837		0.330*
		(0.0968)		(0.133)		(0.181)
Panel C: Interracial marriage bias index						
RSIndex		0.307***		0.169**		0.689***
		(0.0563)		(0.0769)		(0.109)
Interracial marriage bias		0.0376		-0.678		1.608
		(1.640)		(2.121)		(3.423)
RSIndex×Interracial marriage bias		-0.286***		-0.248**		-0.502***
		(0.0754)		(0.103)		(0.145)
White		0.482***		0.436**		1.928***
		(0.147)		(0.197)		(0.298)
RSIndex×White		-0.286***		-0.266***		-0.617***
		(0.0588)		(0.0803)		(0.112)
White×Interracial marriage bias		-0.343		-0.0860		-1.167**
		(0.227)		(0.303)		(0.460)
RSIndex×White×Interracial marriage bias		0.314***		0.212		0.470***
		(0.0946)		(0.130)		(0.175)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	41,741	41,741	41,741	41,741	41,741	41,741
Number of ID	13,985	13,985	13,985	13,985	13,985	13,985

Notes: (1) Standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. (2) RE denotes random effects and all specifications include Mundlak corrections for continuous independent variables.

Table 6: Leverage level and banking deregulation - race interactions

	Ratio to Income	Ratio to HV	Ratio to Assets
Panel A			
RSIndex	0.0241***	0.0122***	0.0317***
	(0.00546)	(0.00412)	(0.0110)
White	0.0456***	-0.0293***	0.135***
	(0.0138)	(0.0102)	(0.0271)
RSIndex×White	-0.0150***	-0.00822**	-0.0360***
	(0.00531)	(0.00395)	(0.0106)
Panel B: Slave State			
RSIndex	0.0395***	0.0254***	0.0453***
	(0.00713)	(0.00572)	(0.0147)
Slave State	0.0634	-0.0901	-0.295
	(0.0915)	(0.0665)	(0.182)
RSIndex × Slave State	-0.0291***	-0.0250***	-0.0273
	(0.00863)	(0.00697	(0.0180))
White	0.0606***	-0.0469***	0.119***
	(0.0191)	(0.0149)	(0.0381)
RSIndex × White	-0.0330***	-0.0203***	-0.0481***
	(0.00734)	(0.00580	(0.0149))
White × Slave State	-0.0231	0.0408**	0.0420
	(0.0258)	(0.0195)	(0.0517)
RSIndex × White × Slave State	0.0380***	0.0220***	0.0224
	(0.0112)	(0.00825	(0.0221))
Panel C: Interracial marriage bias index			
RSIndex	0.0387***	0.0226***	0.0473***
	(0.00650)	(0.00518)	(0.0134)
Discrimination index	-0.0224	0.00573	-0.286
	(0.192)	(0.143)	(0.356)
RSIndex × Discrimination index	-0.0351***	-0.0231***	-0.0374**
	(0.00873)	(0.00687	(0.0180))
White	0.0754***	-0.0251*	0.133***
	(0.0171)	(0.0130)	(0.0339)
RSIndex × White	-0.0345***	-0.0165***	-0.0516***
	(0.00678)	(0.00523)	(0.0137)
White × Discrimination index	-0.0746***	-0.00497	0.0140
	(0.0264)	(0.0195)	(0.0526)
RSIndex × White × Discrimination index	0.0495***	0.0170**	0.0374*
	(0.0109)	(0.00802)	(0.0216)
Year FE	Yes	Yes	Yes
State FE	Yes	Yes	Yes
Controls	Yes	Yes	Yes
Observations	41,855	24,043	33,345
Number of ID	14,019	8,195	11,697

Notes: (1) Standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. (2) All specifications are estimated using a random effects Tobit model with Mundlak corrections of continuous variables.

Table 7: Debt level and banking deregulation: Quantile analysis

Panel A: Total Debt

	10	20	30	40	50	60	70	80	90
RSIndex	0.0427	0.0116	0.0169	0.0269***	0.0246**	0.0255***	0.0286***	0.0198**	0.00854
	(0.0296)	(0.0186)	(0.0132)	(0.0103)	(0.00979)	(0.00822)	(0.00818)	(0.00819)	(0.00928)
Interaction									
RSIndex	0.0146	0.00847	0.0202	0.0335**	0.0280**	0.0279**	0.0377***	0.0312***	0.0254**
	(0.0383)	(0.0288)	(0.0184)	(0.0138)	(0.0130)	(0.0119)	(0.0104)	(0.00972)	(0.0112)
White	-0.0274	0.00547	0.0344	0.0722**	0.0780***	0.0795***	0.0958***	0.118***	0.125***
	(0.0696)	(0.0419)	(0.0328)	(0.0289)	(0.0227)	(0.0208)	(0.0189)	(0.0206)	(0.0234)
RSIndex×White	0.0438	0.00658	-0.00672	-0.0120	-0.00484	-0.00503	-0.0141	-0.0182**	-0.0235**
	(0.0343)	(0.0240)	(0.0157)	(0.0130)	(0.0118)	(0.0112)	(0.00899)	(0.00926)	(0.0106)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	26,472	26,472	26,472	26,472	26,472	26,472	26,472	26,472	26,472

Panel B: Secured Debt

	10	20	30	40	50	60	70	80	90
RSIndex	0.00291	-0.00250	0.0156	0.0249**	0.0231***	0.0198**	0.0157**	0.0160**	0.0131
	(0.0222)	(0.0154)	(0.0127)	(0.0100)	(0.00865)	(0.00788)	(0.00793)	(0.00786)	(0.00975)
Interaction									
RSIndex	-0.000404	0.00488	0.0164	0.0144	0.0191**	0.0115	0.0162*	0.0221**	0.0238*
	(0.0305)	(0.0179)	(0.0148)	(0.0122)	(0.00969)	(0.0101)	(0.00943)	(0.00966)	(0.0124)
White	-0.0120	0.0140	0.0461*	0.0330	0.0425*	0.0352*	0.0607***	0.0761***	0.0940***
	(0.0476)	(0.0323)	(0.0267)	(0.0273)	(0.0229)	(0.0205)	(0.0203)	(0.0206)	(0.0229)
RSIndex×White	0.00447	-0.00896	-0.00147	0.0114	0.00781	0.0106	-0.00228	-0.00844	-0.0176
	(0.0267)	(0.0158)	(0.0134)	(0.0110)	(0.00952)	(0.00986)	(0.00889)	(0.00977)	(0.0118)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	15,971	15,971	15,971	15,971	15,971	15,971	15,971	15,971	15,971

Notes: Standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Quantile regression analysis conducted on positive debt holding only.

Table 8: Leverage and banking deregulation: Quantile Regression

Panel A: Total Debt/Income

	10	20	30	40	50	60	70	80	90
RS Index	0.00328*	0.00405	0.00762**	0.00775*	0.0109**	0.0132***	0.00978**	0.00743	0.00777
	(0.00198)	(0.00316)	(0.00360)	(0.00422)	(0.00454)	(0.00447)	(0.00460)	(0.00524)	(0.00635)
Interaction									
RSIndex	0.00215	0.00113	0.00753	0.00606	0.00846*	0.0114**	0.00851	0.00963	0.0119
	(0.00216)	(0.00385)	(0.00468)	(0.00474)	(0.00502)	(0.00550)	(0.00577)	(0.00731)	(0.00869)
White	0.000509	0.00278	0.0155**	0.0190**	0.0270***	0.0329***	0.0392***	0.0535***	0.0856***
	(0.00408)	(0.00659)	(0.00785)	(0.00868)	(0.00885)	(0.00966)	(0.0110)	(0.0142)	(0.0153)
RSIndex×White	0.00190	0.00448	0.000120	0.00297	0.00440	0.00222	0.00159	-0.00276	-0.00860
	(0.00195)	(0.00339)	(0.00408)	(0.00391)	(0.00473)	(0.00497)	(0.00509)	(0.00586)	(0.00738)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	26,472	26,472	26,472	26,472	26,472	26,472	26,472	26,472	26,472

Panel B: Total Debt/House Value

	10	20	30	40	50	60	70	80	90
RSIndex	0.00261	-0.000825	0.000609	-0.000674	0.00352	0.00467	0.00360	0.00867**	
	(0.00327)	(0.00422)	(0.00405)	(0.00328)	(0.00300)	(0.00297)	(0.00300)	(0.00350)	
Interaction									
RSIndex	0.00173	0.00407	0.0132**	0.0123***	0.0147***	0.0129***	0.0135***	0.0137***	
	(0.00508)	(0.00580)	(0.00554)	(0.00414)	(0.00387)	(0.00373)	(0.00382)	(0.00385)	
White	-0.000288	-0.0147	-0.00716	-0.0135*	-0.00950	-0.0138*	-0.00805	-0.0103	
	(0.00970)	(0.00999)	(0.00858)	(0.00755)	(0.00800)	(0.00795)	(0.00766)	(0.00814)	
RSIndex×White	0.000833	-0.00631	-0.0162***	-0.0173***	-0.0174***	-0.0145***	-0.0144***	-0.00950***	
	(0.00475)	(0.00495)	(0.00489)	(0.00368)	(0.00331)	(0.00326)	(0.00339)	(0.00360)	
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
Observations	18,532	18,532	18,532	18,532	18,532	18,532	18,532	18,532	

Panel C: Total Debt/Assets

	10	20	30	40	50	60	70	80	90
RS Index	-0.00227	-0.00536*	-0.00532*	-0.00536*	-0.00284	-0.000952	0.000582	0.00215	0.00752
	(0.00221)	(0.00302)	(0.00310)	(0.00310)	(0.00344)	(0.00347)	(0.00456)	(0.00642)	(0.0123)
Interaction									
RSIndex	-0.00307	0.00143	0.00564	0.00981**	0.0171***	0.0172***	0.0213***	0.0237**	0.0513*
	(0.00314)	(0.00516)	(0.00505)	(0.00456)	(0.00446)	(0.00498)	(0.00625)	(0.00986)	(0.0270)
White	0.00519	0.0136	0.0124	0.0113	0.0178**	0.00748	0.0125	0.0110	0.0921***
	(0.00563)	(0.00892)	(0.00822)	(0.00752)	(0.00799)	(0.0103)	(0.0117)	(0.0180)	(0.0334)
RSIndex×White	0.00117	-0.00814*	-0.0131***	-0.0191***	-0.0263***	-0.0253***	-0.0302***	-0.0280***	-0.0523**
	(0.00288)	(0.00455)	(0.00489)	(0.00421)	(0.00419)	(0.00455)	(0.00579)	(0.00871)	(0.0231)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	23,908	23,908	23,908	23,908	23,908	23,908	23,908	23,908	23,908

Notes: Standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Quantile regression analysis conducted on positive debt holding only.

Table 9: State level analysis: GDP growth, Household debt and banking deregulation

	Pre 2008			Post 2008		
			Panel A			
Debt to Income Growth	-0.0715***			-0.395***		
	(0.0184)			(0.0542)		
Mortgage Debt to Income Growth		-0.0485***			-0.366***	
		(0.0140)			(0.0521)	
Credit Card to Income Growth			-0.0810***			-0.245***
			(0.0246)			(0.0359)
Constant	-0.0336	-0.0367	-0.0001	0.0580	0.0778	-0.0112
	(0.0397)	(0.0400)	(0.0403)	(0.0746)	(0.0745)	(0.0778)
Observations	392	392	392	392	392	392
R-squared	0.394	0.389	0.387	0.425	0.419	0.415
Number of States	49	49	49	49	49	49
			Panel B			
Debt to Income Growth	-0.0911***			-0.232***		
	(0.0317)			(0.0831)		
Debt to Income Growth×RSIndex	0.0101			-0.0877**		
	(0.0130)			(0.0341)		
Mortgage Debt to Income Growth		-0.0499**			-0.233***	
		(0.0229)			(0.0728)	
Mortgage debt to Income×RSIndex		0.000921			-0.0750***	
		(0.00986)			(0.0288)	
Credit Card to Income Growth			-0.123***			-0.147**
			(0.0354)			(0.0573)
Credit Card to Income Growth×RSIndex			0.0244			-0.0493**
			(0.0148)			(0.0227)
Constant	-0.0310	-0.0362	0.00561	0.0660	0.0813	-0.00889
	(0.0399)	(0.0401)	(0.0404)	(0.0740)	(0.0739)	(0.0773)
Observations	392	392	392	392	392	392
R-squared	0.396	0.389	0.392	0.436	0.431	0.423
Number of States	49	49	49	49	49	49

Notes: (1) Standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. (2) All analysis control for state level fixed effects.

A Appendix Falsification Test

Table A1: The determinants of debt holding, debt levels and debt leverage: Falsification tests

	Total Debt		Unsecured Debt		Secured Debt		Debt to Income	Debt to HV	Debt to Asset
	RE Probit	RE Tobit	RE Probit	RE Tobit	RE Probit	RE Tobit	RE Tobit	RE Tobit	RE Tobit
Panel A									
RSIndex 1989	-0.00347	-0.0119	-0.0150	-0.0769	0.0177	0.0642	-0.00221	0.00737*	0.00119
	(0.0207)	(0.0622)	(0.0180)	(0.0887)	(0.0254)	(0.108)	(0.00597)	(0.00441)	(0.0122)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	11,744	11,757	11,757	11,757	11,757	11,757	11,757	6,364	9,137
Number of ID	7,434	7,443	7,443	7,443	7,443	7,443	7,443	4,086	5,930
Panel B									
RSIndex Random	-0.0137	0.0125	-0.0894**	-0.347*	-0.0110	-0.0452	0.0118	0.0196*	-0.0185
	(0.0482)	(0.150)	(0.0412)	(0.205)	(0.0523)	(0.261)	(0.0160)	(0.0114)	(0.0295)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	41,741	41,741	41,741	41,741	41,741	41,741	41,741	23,945	33,238
Number of ID	13,985	13,985	13,985	13,985	13,985	13,985	13,985	8,165	11,663

Notes: (1) Standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. (2) RE denotes random effects and all specifications include Mundlak corrections for continuous independent variables.