Credit and the Labor Share: Evidence from U.S. States*

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Abstract

We investigate the role of credit markets as a cause for changes in the U.S. labor share. Causal evidence is provided that the labor share declined between 0.8 to 1.2 percentage points following the interstate banking deregulation, explaining more than half of the overall reduction during that period. Lower cost of credit and greater bank competition in each state are mechanisms that led to the decline. To quantify the relationship between credit and factor payments, we calibrate a model with financial frictions and highlight financial development as a potential channel for the reduction in labor share observed globally.

JEL Classification: E21, E22, E25, G21, G28

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Research into the determinants of the share of value added paid to labor has had a resurgence recently due to the observation that it is no longer holding steady as it did during most of the post-war era. Labor share data over the last 40 years provide clear evidence that this statistic has significantly and persistently decreased from its long-run trend. The seminal papers on this topic concentrate on structural changes in the economy during the years contemporaneous with the sharpest aggregate decline in the U.S. labor share. Elsby et al. (2013) conclude that globalization – more specifically offshoring – deserves most of the blame, while Karabarbounis and Neiman (2014) concentrate on the growing role of capital in production, initiated by the lower price of investment goods.[1] In this study we focus on the role of credit in explaining the changes in the labor share. It is well known that financial development has important implications for real economic activity and has direct consequences on how firms finance inputs. As such, it constitutes a potential driver of changes in the relative factor payments. However, finding variation in financial development independent of other structural changes has proved to be challenging.[2] We make use of quasi-experimental variation to provide rigorous evidence showing that U.S. states experienced a reduction in the labor share of income as a result of banking deregulation, which was characterized by a lower cost and increased availability of credit.

The deregulation of the banking sector was a process through which individual states opted to allow out of state banks to operate in their state and also expanded the ability of in-state banks to open new branches within the state. Until the 1970s banks were strictly constrained by state statutes in their ability to expand, but this changed starting in the late 1970s, when states began removing the restrictions on intrastate bank branching and interstate bank expansions. The deregulation led to tougher competition, greater efficiency,

[1]Piketty and Zucman (2014) similarly find evidence for the growing role of capital. On the other hand, using microeconometric estimates of the elasticity of substitution between capital and labor, Oberfield and Raval (2014) find that the decline in the labor share originates from factors that affect technology, including automation and offshoring, rather than mechanisms that work mainly through factor prices.

[2]Although recent literature has attempted to bridge trends in finance and macroeconomics (Eggertsson et al., 2018), identification of reasons for the structural change in the labor share remains elusive.

and a reduction in monopoly power in the banking sector, which increased the availability of credit and lowered its cost in the states that adopted the deregulations (Jayaratne and Strahan (1996); Jayaratne and Strahan (1998); Cetorelli and Strahan (2006)). We utilize the time series variation in the adoption of interstate banking and intrastate branching deregulations between 1976-1996 and conduct a difference-in-differences estimation, which compares the labor share in states that implement the policy to those that do not.[3]

Financial development is a potential driver of changes in the labor share because of the role that credit markets have in the allocation of capital. If firms use debt in order to finance capital investment, more efficient financial markets will reallocate capital to more productive uses, ultimately altering relative factor returns.[4] Recent work has tied financial development to allocative efficiency (Buera et al., 2011; Midrigan and Xu, 2014; Moll, 2014), but to our knowledge, this is the first paper that ties the reduction in financial frictions to factor shares. We contribute to the literature in two ways. First, our use of state-level data offers an important advantage over a cross-country analysis, as it implicitly accounts for many characteristics common to all states, such as macroeconomic, trade and federal policies that can affect the labor share. The state-by-state implementation of the deregulation, along with the panel feature of the data, provides a clean difference-in-differences strategy to argue for a causal impact of the policy on the labor share. Banking deregulation acts as an exogenous shock to the supply of credit at the state level, which affects the labor share negatively. The magnitudes are economically significant and suggest that a large part of the reduction in the labor share seen in the 1980s can be directly attributed to states implementing this policy. Second, we show in a model with financial frictions – where firms use debt to finance capital costs and banks have imperfect information on the firms' productivity – that if changes in

[3]While data availability determine the beginning of our sample, the end is determined by the fact that we have no more "treated" states after 1994, the year in which the Riegle-Neal Interstate Banking and Branching Efficiency Act (IBBEA) deregulating interstate banking nationwide was passed. In the Online Appendix, we show the results from separate specifications for 1997-2005 using the dates when banks adopted and later removed the provisions to IBBEA.

[4]Bai et al. (2018) finds evidence for the reallocation of capital in response to banking deregulation.

the financial system lower the borrowing costs, the number of firms that remain solvent and continue to finance capital increases, and the return to capital increases. These structural changes result in a reduction in the labor share.

We start our empirical analysis by estimating the impact of the interstate banking and intrastate branching deregulations on labor's share of value added in the state. Hence, in the first set of specifications, we focus on within state variation in the credit conditions, following the adoption of these policies. We provide robust evidence showing the states that adopted the interstate banking deregulation experienced a labor share reduction relative to the states that did not implement the policy. With an event study specification that traces the impact of the banking deregulation over a range of 9 years prior to 9 years after the policy implementation, we find no evidence of a pre-trend in the labor shares. This event study also suggests that the labor share continued to decline further up to 6-7 years after the policy is adopted. Reduced form specifications that utilize treatment effects that grow over time, as well as the regular pre-post deregulation treatment, indicate that on average a state that adopted the policy experienced a decline in the labor share between 0.8 to 1.2 percentage points. Economically, this change constitutes a significant determinant of the decline in the labor share, which averaged about 2 percentage points during our sample period. We also find the changes are driven by states characterized as manufacturing-intensive that have a concentration of large, capital-intensive firms.

To further examine the mechanisms behind this decline, we consider some of the structural changes in the banking industry that were caused by the deregulation. These include changes in the average loan yield, loan volume, and the concentration in the banking sector as measured by a Herfindahl Index of deposits. Using an instrumental variables (IV) technique, where we use the policy experiment and exploit the exogenous variation in the interstate banking and intrastate branching deregulations as instruments for the changes in the banking structure, we show that more competition in the banking sector and lower loan yields contributed to the decline in the labor share. The IV estimates yields an elasticity

of the aggregate labor share with respect to the lending rate equal to 0.9 percent. Using the fact that states that deregulated experienced a decline in the average loan yield of 1.39 percentage points, combined with the aforementioned elasticity, implies a reduction in the labor share by about 1.25 percentage points. This implies that the lending rate is the main channel that explains the change in the labor share.[5]

We conduct various robustness tests to our main results, and confirm they are not driven by data frequency, missing controls, other state policies, or the timing of state deregulation policies. However, the reliability of these estimates from the state-level specifications depend on our ability to control for other important determinants of the labor share, such as firm markups and factor-specific technical changes, which are measures that are not available at the state level. In order to better account for the industry-level determinants of labor share, we move onto a more disaggregated analysis, where we analyze the changes in the labor share within an industry and state over time. With these more disaggregated specifications, we show that the impact of banking deregulation on labor share remains robust. We then turn our focus to the services and manufacturing sectors given the attention these two sectors have received in the literature on structural change. Our results show the decline in the labor share operating within both of these sectors.[6] Moreover we find that the decline in the labor share is larger for the "capital intensive" and "financially dependent" manufacturing and service industries (2-digit SIC). These results provide further evidence on the importance of access to cheaper credit as a mechanism that leads labor's share of income to decline, and motivates our quantitative analysis of a model with financial frictions.

An interpretation of the link between financial development – reflected in lower lending rates – and a *lower* labor share is not obvious, and has not been investigated in any previous

[5]We do caution that the IV estimate presumes that banking deregulation affects labor share only through changes in the average loan yield, which is a restrictive assumption. The coefficients we estimate with the treatment effects (0.8-1.2) capture the net effect of the policy change through various channels, and these are similar in magnitude to the lending rate channel considering the confidence intervals of these estimates.

[6]We also point out that we find no evidence for the policy causing any reallocation of labor into any particular industry.

literature. For this reason we turn to a model that illustrates a clear mechanism through which changes in the financial sector can be linked to the labor share of income in the aggregate value added. The model, where firms produce with a standard CES production function, incorporates financial frictions as in Carlstrom and Fuerst (1997) and Bernanke et al. (1999) by allowing for asymmetric information between banks (lenders) and firms that borrow a part of the cost of capital rented from households. The banking sector provides the loans via an optimal financial contract that defines the size of the loan and a fixed interest rate. After renting capital, firms receive a random productivity shock that determines whether they will be able to repay their loan after wage payments. Given the uncertainty about the productivity realizations and the potential debt repudiation, the optimal contract generates a spread between the deposit rate that banks pay households for funds and the lending rate they charge firms. In general equilibrium, the spread is determined jointly with firms' solvency conditions (survival rates), and the return to capital. We calibrate the model in order to run a numerical exercise consistent with the fall in the lending rates following the banking deregulation in the data, and report the changes in return to capital, solvency rates and the labor share of income in response to lower lending rates. The key result is that total rental income of capital *increases* as lending rates are reduced, which reflects the fact that more firms become solvent at the lower rates. Thus, taking the case where capital and labor are complements in production – as is typically found in the literature – the labor share decreases as the return to capital increases. The quantitative exercise we carry out not only sheds light on the underlying mechanism of our empirical results showing banking deregulation led to a lower labor share, but it also illustrates more broadly how financial development can lower the labor share by lowering the cost of credit and endogenously raising the return to capital.

Our paper fits in most closely with the recent literature focusing on the deviation from Kaldor's stylized fact stating that the share of GDP paid to labor is stable over time (Kaldor (1961)). In an attempt to track the movements in the labor share over a 35 year period in

an empirically consistent way, Elsby et al. (2013) conclude that the average U.S. labor share dropped 6 percentage points between 1987 and 2012, and that the stability in the prior period masked offsetting movements within industries. Their study is less conclusive in finding a clear determinant of the recent decline, though they argue that offshoring of the labor-intensive component of the supply chain is the most plausible explanation. Our paper examines a period before the sharp drop in the average labor share, and before the integration of most modern supply chains, but identifies changes in the labor share within industries and states nonetheless. Karabarbounis and Neiman (2014) identify a decline in the price of investment relative to consumption which induces producers to change their capital to labor ratios. In the case where capital and labor are substitutes in production, a reduction in the cost of investment has negative effects on the labor share. In our model, the reduction in the labor share is also related to the availability of capital. However, rental income increases with financial development as the composition of firms that invest changes. We therefore reconcile the fall in the labor share with labor-capital complementarity. Empirically, the reduction in financial frictions is identified through the credit shock in our difference-in-differences estimation strategy, while changes in the price of investment are common to all states. Our explanation is also consistent with Caballero et al. (2017), which provides an accounting framework that integrates the labor share decline with the fall in the risk-free interest rate, the real return to productive capital, markups, and the earnings yield. They argue for the importance of the decline in the risk-free rate, which points to the role of finance as in our findings, and show that this decline continues through the 1990's and 2000's. Finally, our focus on the changes in the banking industry complements the results in Gonzalez and Trivin (2016), who attribute the decline in the labor share to a steady increase in Tobin's Q, which *raises* equity returns.

Other mechanisms that are complementary to the results in our paper also merit discussion. The labor share can be affected by institutional changes in the labor market or imperfect competition in the product markets (see e.g. Blanchard and Giavazzi (2003)). We

control for state unionization rates and corporate tax rates to account for the labor market factors and business conditions, and include industry-year fixed effects in robustness tests to absorb the variation in industry concentration. Autor et al. (2017) attribute the decline in the labor share to a rise in firm concentration within industries that has reallocated production to the largest firms, which also have relatively low labor shares. Relatedly, Kehrig and Vincent (2017) find that the majority of the labor share is due to shifts in firm market shares. Eden and Gaggl (2018) argue that the decline in the labor share is driven by *routine* labor. We examine aggregate (state-level) labor shares and therefore cannot speak to the micro (firm-level) reallocation that very well could be a channel through which the credit shock operates. Finally, there are also studies that look at accounting and measurement factors that can explain the changes in the labor share. Rognlie (2015) points out that the treatment of housing might affect the measured labor share, while Koh et al. (2018) argue that a rise in capital intensity can be explained by the capitalization of intellectual property products in the national income accounts.

The impact of banking deregulation across the U.S. states on real economic activity has been explored at length both in the domestic and international contexts.[7] In particular relevance to our study, Demyanyk et al. (2007) provide evidence showing that personal income insurance improved after banking deregulation, with a larger effect on proprietors' income than on other components of personal income. Concentrating on income inequality, Beck et al. (2010) find that banking deregulation increased the relative wage rates and working hours of unskilled workers, and thereby tightened the distribution of income. Additionally, Bai et al. (2018) show that banking deregulation shifted the composition of bank credit supply towards more productive firms and increased relative employment and capital growth. We add onto the previous findings in the literature by focusing on not just employment, or labor

[7]Some examples on the international side are Cacciatore et al. (2015), who study the effects of banking deregulation on domestic business entry, exchange rate appreciation, and international borrowing, and Kandilov et al. (2016), who focus on the foreign investment in the U.S. On the domestic side, examples include Cetorelli and Strahan (2006) and Kerr and Nanda (2009), who have found that firm entry and entrepreneurship among domestic firms respond positively following banking deregulation.

income, but its share in the value added and show that banking deregulation contributed to the decline in the labor share, potentially by increasing the return to capital.

The remainder of the paper is organized as follows. Section 1 describes the staggered adoption of the interstate banking and intrastate branching deregulations. Section 2 discusses the data that we use in our estimations, and reports the summary statistics. In Section 3 we present our empirical methodology, discuss our findings, and report a series of robustness tests. The penultimate section presents a model with financial frictions and provides a quantitative analysis illustrating how a reduction in borrowing costs can lower the labor share. Section 5 concludes.

1 Banking Deregulation across U.S. States

In this paper we aim to highlight the relationship between the efficiency of the credit market and the aggregate labor share of income. Our empirical contribution is to uncover an exogenous shock to the market structure of the banking system – namely an increase in competition – and isolate the movement in the labor share that is driven by this shock. We do so by taking advantage of deregulation in the banking sector conducted at the state-level in different years, which we summarize in this section. In the empirical results section, we provide convincing evidence that the staggered implementation of reforms by states is exogenous to the level of the labor share and that this policy has the effect of raising competition in the banking industry and reducing lending rates. Additionally, we complement the empirical analysis with a model that relates the bank lending rate to factor shares.

Until the 1970s, banks in the U.S. were severely constrained by state statutes in their ability to expand across state borders and to branch within a state. States did not allow banks headquartered in a different state to buy local banks or open a branch in their own state. Furthermore, a majority of the states restricted in-state banks from opening new branches within the state. Beginning in the late 1970s, states began allowing bank holding companies

headquartered in other states, with which they had entered into reciprocal agreements, to acquire local banks. In 1978 Maine was the first state to pass a law allowing entry by bank holding companies from any state that allowed reciprocal entry of Maine banks. It was followed by more states passing similar laws, mostly in the 1980s. The specific dates of implementation are shown in Table A1, which can be found in the Online Appendix. Most states adopted the deregulation policy before the 1990s, but in 1994 the Riegle-Neal Interstate Banking and Branching Efficiency Act (IBBEA) deregulated interstate banking nationwide.[8] We count a state as being "treated" when it implements the interstate banking deregulation, and end our sample in 1996 after all states were required to allow interstate banking.[9]

Similarly, only a few states allowed unrestricted within state branching until the 1970s. State branching deregulation allowed banks to establish multiple branches within a state through mergers and acquisitions (M&As) and de novo branching throughout the 1970s and 1980s. Since branching through M&As dominates the state branching deregulation reform (Cetorelli and Strahan (2006); Demyanyk et al. (2007)), we use those dates to mark a state's adoption of intrastate branching deregulation. In the robustness analysis, we consider the states' incorporation of IBBEA provisions in the 1997-2005 period, which allowed the states to influence the manner in which out-of-state branching was implemented, as a separate policy variation.

The advantage of using policy reforms to capture the impact of credit market conditions is that states were "treated" in different years, which allows for a difference-in-difference identification strategy. A natural question in the application of this strategy is *why* states deregulated, with the potential concern being that banking deregulation may have been

[8]Texas and Montana opted out of the interstate banking provisions of Riegle-Neal Act until 1997 (Kroszner and Strahan (1999)).

[9]This state-by-state policy change has been used in a number of economic studies; hence, there is a lot of information in the literature on the details of the deregulation. See, for example, Jayaratne and Strahan (1996), Kroszner and Strahan (1999), Cetorelli and Strahan (2006), Demyanyk et al. (2007), Kerr and Nanda (2009), and Kandilov et al. (2016) among others.

driven by factors that determine the labor share of income in the deregulating state, rather than the other way around. Kroszner and Strahan (1999) conduct a rigorous analysis to isolate the determinants of deregulation and find that the relative strength of certain interest groups – winners and losers from deregulation – can explain the timing across states. States with fewer and weaker small banks tended to deregulate earlier, as these banks stood to lose out to bigger banks. The prevalence of small firms was also an important factor in deregulating earlier, as these firms stood to gain from a more competitive lending environment. Kroszner and Strahan (1999) also argue that financial innovations raised the potential profitability of large banks, which gradually increased the opportunity costs of the banking restrictions. These innovations are aggregate forces that we control for using year fixed effects. Although the most important factors for the timing of reforms appear unlikely to be driven by economic conditions that relate to the labor share, in Section 3.1 we conduct several tests to confirm this is indeed the case. Most importantly, we provide an event-study framework that shows there are no pre-deregulation trends in the labor share. Relatedly, we check whether the lagged labor share is a predictor of reforms in and find a zero effect.

Subsequent literature has investigated additional determinants of the timing of state deregulation. Freeman (2002) and Berger et al. (2012) point out that the timing is correlated with a state's past economic performance, while Huang (2008) suggests that the timing of deregulation could also be correlated with anticipated changes in future economic activity. To alleviate such concerns, in our empirical specifications we report results that control for state's real GDP growth, as well as its unemployment rate, and population growth rate. These statistics account for the state's economic performance, which might be correlated with labor share. Further, we check the pre- and post-trends of these economic variables in response to the policy adoption. In regards to the lobbying efforts, it is unlikely that these were related to wage-capital income distributions. However, if firm dynamics (entry/exit) are correlated with both the labor share and the policy adoption, not accounting for such dynamics could result in an omitted variable bias. In robustness checks, we additionally

include firm entry and exit using the Business Dynamics Statistics (BDS) provided by the Census Bureau and do not find any change in the results. Also in the robustness checks, we control for the anti-takeover laws adopted by the states, as these might be correlated with whether states adopt banking deregulation or not, and find our results remain unchanged.[10]

We point out that, as in Black and Strahan (2002), Demyanyk et al. (2007), and Kerr and Nanda (2009), we allow for both interstate banking and intrastate branching deregulation to affect our outcome variable (labor share).[11] We exploit the staggered adoption of the interstate banking and intrastate branching deregulation laws in the 46 contiguous states. We exclude Delaware and South Dakota because of the preponderance of credit card banks in these states (Black and Strahan (2002); Berger et al. (2012)).

2 Data

The information to construct the labor share comes exclusively from the Bureau of Economic Analysis (BEA) Regional Accounts, which decomposes the gross domestic product of each state (GSP) into compensation to employees,[12] taxes on production and imports, (less) subsidies, and gross operating surplus. Labor share is defined as the ratio of labor compensation to state GDP. All measures are for private industries only. In addition to calculating the labor share at the state-year level, we are also able to disaggregate the labor share within states across the 2-digit SIC industries. The BEA decomposes the data into 64 separate industries; however, we combine some industries to get a total of 56 industries within each

[10]These are laws that constrained hostile takeovers and placed restrictions on mergers among other transactions (Bertrand and Mullainathan (2003); Atanassov (2013)).

[11]Other studies have opted to include only one type of deregulation in their analysis. We believe that either policy could plausibly affect the labor share if they improve bank efficiency or limit market power (Black and Strahan (2002)).

[12]Labor compensation includes wages and salaries plus supplements to wages and salaries (employer contributions). GSP numbers are based on income generated in establishments, with industrial censuses as the main sources. Additional information is available from the BEA using the link: https://www.bea.gov/regional/methods.cfm.

state.[13]

Figure 1 plots our labor share data aggregated to the U.S. level (right axis) by summing up labor compensation and GDP across all states in each year. This way of calculating labor share differs slightly from that used in Karabarbounis and Neiman (2014), who for the most part only use information on the corporate sector to compute the share of value added going to labor compensation. Since we require data at the state level, we stick to the methods of the BEA regional accounts. Also, Elsby et al. (2013) point out that there are deviations in the labor share calculations depending on the way one accounts for how sole proprietors report their wages. These issues should not affect our study as our variation is across states over time, and there is no reason to believe that any error generated due to the way we construct the labor share is correlated with when states implemented the deregulation policy. Nevertheless, in the next section we do construct alternative labor share measures and discuss further possible issues.

[Figure 1 about here.]

We also add the fraction of states that have implemented the branching and banking deregulation policies to Figure 1 (left axis). In 1970, there were no states implementing interstate banking deregulation, while 20% of states had already deregulated intrastate branching. The labor share declined slightly during this time period, although not in the significant way it did in the 25 years after the period we study (as documented by the papers cited above). The difference between the labor share in 1970 and in 1996 is around 3 percentage points, but if we use an average over the 1970's, then the difference with the end of the sample is closer to 2 percentage points. This comparison of ad hoc starting and end dates might confound business cycle effects in those years, so another comparison would be to compare the averages in the periods 1970-1982 and 1983-1996.[14] The aggregate labor share drops

[13]We drop the industries that are double-counted in the 64 original industries. Also, we combine some of the industries to be able to match one to one the employment data from the Bureau of Labor Statistics.

[14]Most states start to implement the policy around 1982. As described above, Maine is the first state to do so in 1978, but it is not followed by other states until later.

about 1.2 percentage points between the two periods.

We point out that although the magnitude of the labor share decline (approximately 2 percentage points) sounds small, it is not necessarily an insignificant number. In the data examined by Elsby et al. (2013) and other papers about the more recent decline in the labor share, usually the reported magnitude is around 6 percentage points, and in the context of the stability of the labor share since the post-war era, this is regarded as an important decline. Our data span a period with a more stable labor share on average, but we find that the effect of banking deregulation on the supply of credit can explain a large part of the decline. Given that credit continued to grow after the period that we study, it is possible that the mechanism we identify in this paper continued to be a factor in the following years and might have contributed to the larger decline in the quarter century thereafter. In fact, as a robustness check, we extend our analysis to 1997-2005 by using state policies enacted after IBBEA was passed federally.[15] We show these provisions had the predicted effects on loan yields and their removal lowered the labor share in the same manner as our main policy treatments.

In order to capture the structural changes in the state's banking sector brought about by banking deregulation (see, for example, Jayaratne and Strahan (1998)), we use data from the Federal Deposit Insurance Corporation (FDIC) and Federal Financial Institutions Examinations Council's Consolidated Reports of Condition and Income (Call Reports) to construct state-level banking variables. First, we ask whether banking deregulation lowered the labor share by reducing the cost of financing capital. We construct the average loan yield in state s during year t as a measure of the cost of credit, by dividing all banks' total interest income on loans and leases by their total loans and leases given out in that state and year. Second, we check if banking deregulation did in fact lead firms to take out more credit by looking at the total commercial and industrial loans as a fraction of the state's GSP. Lastly,

[15]The interstate branching provisions contained in IBBEA granted states the right to set up obstacles to branch expansion, such as forbidding out-of-state banks from opening new branches or acquiring existing ones, or by limiting the amount of total deposits any one bank could hold (Rice and Strahan (2010)).

we also analyze if enhanced bank competition, resulting from the deregulation, affected labor's share of income. To measure competition, we calculate the Herfindahl-Hirschmann index (HHI) of bank deposit concentration using bank-level data from the Call Reports.

Additionally, we control for some time-varying state factors in our empirical specification to account for the state economic conditions, labor market conditions, and the local cost of doing business. These include state corporate tax rate (source: World Tax Database, Office of Tax Policy Research, University of Michigan), state unemployment rate (source: U.S. Bureau of Labor Statistics), union membership (source: Current Population Survey, Hirsch et al. (2001)), population growth rate (source: U.S. Census), growth rate of GSP (source: BEA), and the "all-transactions" house price index (source: Federal Housing Finance Agency).[16] Table 1 reports summary statistics for the variables used in the analysis by subperiod: 1970-1982 and 1983-1996. As our baseline specification focuses on the state-year panel, we report the summary statistics using information at the state-year level.

[Table 1 about here.]

3 Empirical Analysis

In this section we conduct a difference-in-differences estimation strategy that leverages the staggered implementation of banking deregulation across states to study the impact of credit on the aggregate labor share. Previous literature has highlighted the impact of a more efficient credit market on economic activity, but no paper to our knowledge has extended these results to investigate the distributional effects. As firms use debt to finance factor payments, credit shocks can potentially alter factor shares. There are several potential channels for the decline in the labor share studied in the existing literature, such as markups,

[16]The price of land is considered as a factor affecting the capital's share of income in Rognlie (2015), who argues that it can be part of what is picked up by the gross operating surplus measure in value added. The house price index data is from the Federal Housing Finance Agency and can be downloaded from the following site: https://www.fhfa.gov/DataTools/Downloads/Pages/House-Price-Index-Datasets.aspx.

prices of investment goods, and non-neutral factor productivity growth. Our strategy allows us to plausibly control for alternative explanations of industry-specific or nation-wide factors using various fixed effects, and therefore helps us isolate the contribution of improved credit conditions on the decline in state labor shares. A structural model in Section 4 provides a direct mechanism that connects the financial sector to factor shares and complements the reduced form results in the empirical analysis.

The first set of results we present focus on labor share data at the state level from 1970-1996, though our main specification starts in 1976 due to data availability of controls. We consider some state characteristics that help us substantiate the mechanism behind the link between credit and the labor share, followed by a brief description of the robustness results. Given that there are possible industry-specific, time-varying determinants of the labor share, and industries are not equally represented across states, we then disaggregate the data further and present results using industry-state-year labor shares. We also examine whether the results are especially strong within specific industries and find this to be the case for manufacturing and services. Using more disaggregate data allows us to also look at specific industry characteristics as mechanisms for the impact of banking deregulation on the labor share. Finally, we examine some implications of banking deregulation at the state level for the aggregate U.S. labor share.

3.1 State-level specifications

We begin with a state-year panel estimation, which can control for factors that are time and/or state specific. The dummy policy variables $Bank$ and $Branch$ are equal to one when a state adopts the interstate banking and intrastate branching deregulations, and remain equal to one afterwards. The following summarizes our identifying equation:

$$LS_{st} = \beta_{Bank} Bank_{st} + \beta_{Branch} Branch_{st} + \eta X_{st} + \alpha_s + \alpha_t + \epsilon_{st} \tag{1}$$

where LS_{st} is the labor share in state s at year t. X_{st} includes time-varying state covariates such as union membership rate, one year growth-rate in state GDP and population, a house price index, and the unemployment rate. We include state and year fixed effects to control for time-invariant differences across states and aggregate shocks. The former account for factors like the power of interest groups and the level of competition across states that might affect the timing of deregulation, as described in Section 1. Year fixed effects capture macroeconomic shocks common to all states, such as monetary policy changes, technology growth, and financial innovation. We argue that β_{Bank} and β_{Branch} correspond to the impact of changes in bank market structure, as we later show that the consequences of banking deregulation policies are to raise competition in credit markets, lower the cost of borrowing, and raise the credit supply. Standard errors are always clustered at the state level.[17]

Timing of the Reforms and the Growing Effects The key identifying assumption in specification (1) is that pre-trends in the labor share do not impact the decision to deregulate. Furthermore, the specification does not account for the fact that the magnitude of the effect might depend on the number of years since the reform was passed. Before turning to this baseline specification, we conduct a separate analysis that allows us to check for possible pre-trends and the possibility that firms reorganized their capital and labor over time as the local banks adjusted to the deregulation. In order to examine the policy's impact *before and/or after* its adoption, we modify our difference-in-differences specification to include not just interstate banking and intrastate branching dummies for the year of policy implementation, but also add dummies for different number of years before and after the policy adoptions:

$$LS_{st} = \sum_{q=-9}^{9} \beta_{Bank,t+q} \Delta Bank_{s,t+q} + \sum_{q=-9}^{9} \beta_{Branch,t+q} \Delta Branch_{s,t+q} + \eta X_{st} + \alpha_s + \alpha_t + \epsilon_{st}. \tag{2}$$

[17] We cluster by state to allow for an arbitrary serial correlation within state over time following Bertrand et al. (2004), since the main policy variables (interstate banking and intrastate branching) vary at the state level.

Considering nine years before and after the policy implementation, there can be up to 18 separate indicator variables for each deregulation. Given the sample size, estimating 18 indicator variables for each policy would lower the precision of the estimates. In order to alleviate this issue, we group some years to reduce the number of coefficients to be estimated.[18] Figure 2 presents these coefficients and the 5% confidence intervals, with year 0 as the year of deregulation and all coefficients evaluated relative to one year prior to the policy adoption. The figures clearly illustrate that there are no significant movements in the labor share prior to the reforms— the estimated coefficients corresponding to the years prior to the reforms are not statistically significant— and there are no pre-reform trends. Figure 2 foreshadows the main results of the paper: deregulated states experienced a reduction in the labor share relative to regulated states after the policy adoption. Moreover, we also find that the negative impact of interstate banking deregulation on the labor share grew over time in the years following the policy change, which is expected if firms do not immediately take advantage of the new opportunities in the credit markets. Adding to the immediate negative effects of the interstate banking deregulation on the labor share right after the policy (year 0), the magnitude grows larger over time, and levels off after 6-7 years. It is also apparent that intrastate branching deregulation does not have any effect on the labor share (panel (b)). We will show this is consistent with there being no evidence that this type of deregulation reduces lending rates or raises competition in the banking sector.

[Figure 2 about here.]

It is also useful to conduct a similar analysis for other real economic outcomes to get an idea of how business cycle measures should be taken into account. For example, if GSP growth is an *outcome* of deregulation, then controlling for it introduces a form of selection bias (see page 64 in Angrist and Pischke (2009)). At the same time, it is also necessary

[18]We run regressions with the following dummies: (9, 8), (7, 6), (5,4), (3,2) years before the policy, and (0), (1), (2,3), (4,5), (6,7), (8,9) years after the policy implementation. Parentheses denote the years that we group together into one dummy variable. Results that allowed for separate dummies for each year (no grouping) did not affect our interpretation of the dynamic effects of banking deregulation.

to control for factors that influence state policymakers. We present the dynamic effect figures for unemployment and GSP growth in Figure A1 of the Online Appendix. The plot suggests that GSP growth responds to the banking policy, but does not necessarily predict the policy. Therefore, there is an argument to not control for GSP growth, so we present results both with and without this control. By contrast, there are significant pre-trends for unemployment, as well as a decline after the policy, as displayed in the middle panel of Figure A1. This suggests that we should control for unemployment since it might be a factor in the timing of the policy adoption. We have also carried similar analyses for the other controls listed in the data section, but none of those respond significantly to the policy implementation, nor display pre-trends.[19] Hence, our preferred specification includes all the state-specific controls except for the GSP growth, although we present several alternative specification results below.

As one last check to test the important assumption on the randomness of the deregulation timing with respect to the labor share, we ask whether the lags of the labor share can be accurate predictors of the deregulation. Table A2 (in Appendix) reports a lagged fixed effects model with the deregulation dummies as the dependent variable and the lagged labor share (and controls) as regressors. The first two columns relate to the banking deregulation, while the latter two to the branching deregulation. The lagged labor share is *not* shown to predict either of the two policies, confirming the exogeneity of the deregulation.

Baseline Results Table 2 presents the results from our baseline specification for the effects of banking deregulation on the labor share at the state level. In the first column, we present results with the following controls that are available from 1971: corporate tax rates, union membership rates, GSP growth rate, and population growth. In the second column we also control for the state unemployment rate and a state house price index, for which the data start in 1976. The third column replicates the previous one omitting GSP growth to take into

[19]We conduct a similar analysis for capital intensity, which we summarize below.

account the type of selection bias discussed above. The fourth column presents results where the labor share is calculated by eliminating the finance industry. We aggregate the state-industry-year compensation and GSP data up to the state level sans the finance industry to check whether the results are driven especially by an industry that could be directly impacted by the deregulation. In column (5) we investigate another alternative labor share measure, this time including self-employed income. Although the compensation data do not include "proprietor's income" of unincorporated businesses, we do have the number of self-employed workers and total self-employed income by state.[20] Proprietor's income includes both capital and labor payments, so various imperfect methods have been used to include self-employment income in the labor share estimate (Elsby et al., 2013). We present the one closest to the BLS calculation, which is to use only the *number* of self employed by state, assume their share of income to labor is identical to regular payroll workers, and add their imputed compensation to the measure that includes only payroll workers' compensation.[21]

Across all five specifications the results are consistent with interstate banking, but not intrastate branching deregulation, leading to the decline in the labor share. The coefficient on the interstate banking dummy is significant at the 1% level in the first three columns.[22] The magnitude of the coefficients in columns (2) and (3) imply that on average, states that have adopted interstate banking deregulation have a labor share that is 0.8 to 0.9 percentage points lower relative to states that have not implemented the policy. The results are extremely robust in favor of the conclusion that the deregulation in the banking industry, at least

[20]The main problem with this income is it includes both capital and labor payments which are not possible to separate. In addition to the presented method, we also checked the results by counting *all* proprietor's income as labor income.

[21]Specifically, we use the equation: $LS_{st} = (1 + \frac{L^s_{st}}{L^p_{st}})LS^p_{st}$, where p stands for payroll workers (those in the main data), and e are self employed workers. LS^p_{st} is the labor share used in our other specifications (for payroll workers), now scaled up (at the state level) with the relative number of self-employed workers.

[22]The lack of a significant effect from the intrastate branching deregulation is aligned with the findings of Kerr and Nanda (2009), who show that while interstate banking brought about significant growth in entrepreneurship, intrastate branching did not have much effect. The authors hypothesize that this result could be due to intrastate branching having a smaller impact on competition in the banking sector. We confirm their hypothesis in Panel A of Table A3 in the Online Appendix by showing that intrastate branching had no significant effect on the average loan yields, credit to GSP ratio or on bank concentration.

the interstate deregulation, had a negative impact on the labor share. Union membership and the corporate tax rate are mildly positively associated with the labor share, but the coefficients are very small and insignificant. As for the state's economic conditions, GSP growth, higher house prices, and the unemployment rate are negatively associated with a lower labor share, while population growth within a state is positively correlated with the labor share.

Columns (4) and (5) display results with the alternative labor share measures. It is reassuring that the effect of interstate banking is almost identical. Excluding finance industries there is a slight increase in the standard error, but the main policy variable is significant at the 5% level. When we include the estimated compensation to the self-employed, which results in a higher average labor share,[23] we get a small increase in the coefficient of interest that is almost exactly proportional to the increase in the average outcome measure. Also, in unreported results we confirm that when we include the deregulation indicators one at a time, we obtain almost identical effects on labor share as the reported results.

In order to incorporate the fact that the deregulation's effect seems to get larger a few years after the policy change (Figure 2), we consider a treatment effect that grows over time, similar to the growing treatment effect in Kerr and Nanda (2009). Specifically, we create a treatment effect that is equal to the number of years since the policy change (only letting it get up to 4). Hence, the treatment takes a value of 1 during the year of the policy adoption, 2 the year after, 3 the year after that, and then continues to take the value of 4 thereafter. The last column of Table 2 allows for the fact that banking deregulation has long-lasting effects using this "growing treatment" variable. The results confirm the previous findings. Although the coefficient is smaller than the one in column (3), the interpretation is different: states that have been deregulated for at least 4 years have labor shares *1.2* percentage points (0.3x4) lower relative to regulated states. In order to account for effects that accumulate

[23]The exclusion of self-employment income is the main reason our average labor share measure presented in Section 2 is lower than in other studies. Once we include proprietor's income, the labor share increases by about 10 percentage points.

over time, in the rest of the analysis, we consider columns (3) and (6) our baseline results, and use specifications to obtain the treatment effects.

[Table 2 about here.]

Mechanisms Next, we investigate more directly the mechanisms through which the banking deregulation policy impacts the labor share. These will motivate our structural quantitative exercise in Section 4 and help us generalize the results to other settings with changes in the credit markets. We consider three banking measures that are directly affected by the deregulation (see e.g., Jayaratne and Strahan (1998)), and potentially impact factor shares: average loan yields, value of total credit relative to state GDP, and a Herfindahl Index (HHI) of concentration in bank deposits. In the Online Appendix (Table A3) we show that lower loan yields, which proxy for cost of credit, decline following interstate banking deregulation. Banking concentration (proxied with HHI of deposits) is also reduced. Credit starts to grow after 2-3 years.

We estimate the direct effects of these banking outcomes on the labor share by running instrumental variable (IV) regressions. Since the labor share and banking indicators, such as loan yields and total credit given, can be endogenously determined, we utilize the policy experiment and use the exogenous variation in the interstate banking deregulation as an instrument for the changes in the banking industry. We do point out that our identifying assumption for the IV regression is that deregulation, through its impact on the banking market structure, affects the labor share *only* through the mechanisms listed above. For example, when interstate banking is an instrument for the average loan yield, the reduction in the loan yield is the only channel through which the change in the banking system reduces the labor share. While it is plausible to assume that banking deregulation affects labor share mainly through the changes in the banking industry, it is too restrictive to think the policy change operates only through one of the three banking indicators that we consider. Given the lack of extra (over-identifying) instruments, we cannot test the exclusion restriction. For

this reason, we consider the results from the IV specifications as further evidence for the mechanism in our model, but in the rest of the paper we keep it general and focus on the reduced form specification following equation (1).

In Table 3, each column uses the regular pre-post interstate banking treatment variable as an instrument for the three banking outcomes.[24] The results show that a lower average loan yield (column (1)) and more intensified competition in the banking industry (a reduction in HHI in column (3)) reduce the labor share. The estimate in column (1) is interpreted as an elasticity. A one percentage point reduction in the average loan yield brought about by banking deregulation leads to a 0.9 percentage point decrease in the labor share. Combined with the impact of interstate banking deregulation on the average loan yields obtained from the first stage regressions, our results suggest that cheaper credit available in states that deregulated their banking system led to a reduction in the labor share by about 1.25 percentage points ($= (-1.39) * (0.9)$). We obtain a slightly larger impact arising from increases in the total loans but do not rely on these results because the instrument is weak. The sign on the banking concentration variable suggests that lower concentration in bank deposits also works to lower the labor share, and this is significant at the 1% level.[25]

[Table 3 about here.]

Economic Magnitudes and Interpretation In summary, we find states that reformed their banking sector to foster competition and raise efficiency experienced a decline in the share of income that goes to labor of around 0.8 to 1.2 percentage points relative to non-reform states. The IV results suggest every one percentage point decline in the lending rate reduces the labor share by 0.9 percentage points, which combined with the effect on

[24]Panel A of Table A3 in the Appendix provides the first stage results for each of the banking measures. We also ran the same IV regressions using the growing treatment policy dummy as the instrument instead of the pre-post dummy. The results are consistent with the baseline table.

[25]Table 3 reports first-stage F-statistics as a test for weak identification. The interstate banking deregulation dummy can be rejected as a weak instrument at the 1% level for both loan yields and the Herfindahl Index. We cannot reject weak identification as an instrument for credit supply.

lending rates suggests that our reduced form result can be explained via the lending rate channel. Although the magnitude might seem small, we emphasize that the 1.2 percentage point decline states experienced following the banking deregulation policies is *more than half of the overall reduction* in the U.S. labor share.[26] Overall, these results are supportive of the claim that banking deregulation lowered the labor share through the financial markets, especially through a reduction in the cost of borrowing.

In Section 3.2 we move to an industry-state level analysis, which allows us to look at characteristics that drive these results, such as capital intensity and external financial dependence of the industry. At the state-level there are also some characteristics that help us explain how deregulation led to lower labor shares. One important component is the size distribution of firms within a state, as bank deregulation will not reduce credit frictions uniformly across firms of all sizes. We also consider the change in the labor share in states that are "manufacturing intensive" and analyze the endogenous response of capital intensity at the state level.

The first three columns of Table 4 interact the interstate banking indicator with the state characteristic dummies. We consider a state "Manufacturing" if its share of manufacturing employment in state total is above the median value for the overall sample.[27] We find that the reduction in the labor share due to deregulation is significantly larger in manufacturing states (column (1)). To measure firm size distribution we construct two measures: the fraction of employees that work in firms with at least 100 employees, and the fraction of active firms in the state that employ at least 100 workers.[28] The former is used to construct a dummy for "Large Employer State" and the latter a dummy for "Large Firm State". Columns (2) and (3) provide evidence the labor share reduction is larger in states with relatively more large firms, or with a larger share of the workforce working in large firms.

[26]In Section 2 we argue the average labor share declines by approximately 2 percentage points depending on the data range we use to measure the decline.

[27]For all characteristic dummies, we use only the year 1977 and fix the indicator over time.

[28]The Business Dynamics Statistics (BDS) of the US Census provides the number of firms in different size categories, and the total number of employees working in firms within each size category.

In the last two columns we evaluate a continuous measure of capital intensity as the outcome constructed using state capital stock per worker data graciously provided by Turner et al. (2013). Deregulated states become more capital intensive (column (4)), reflecting the role of capital investment as a mechanism for the lower labor share.[29] Finally, the last column of Table 4 provides clear evidence that the response of capital intensity is driven entirely by manufacturing states.

In short, a consistent story of what drives the reduction in the labor share in deregulated states emerges from our results. States with concentrated labor markets, more likely to be in the manufacturing sector, are most affected. This is likely because firms in these states take advantage of the more competitive lending markets and demand more capital. In fact, our reduced form results on the labor share seem to be at least partially explained by changes in capital intensity. In Section 4 we reconcile these results with a model in which firms borrow to fund capital. We discuss in detail how in the presence of financial frictions, improvements in the credit markets lead to lower lending rates, raise the demand for borrowing and the return to capital, which in turn result in a lower labor share.

[Table 4 about here.]

Robustness We conduct several robustness tests, which we present and discuss in the Appendix. To summarize, our findings do not change if we take into account firm creation, self employment, anti-takeover laws, late adopting states, or macro shocks in the 1980's that affected certain states disproportionately. We also show that our results are robust to using low-frequency data. More importantly, we check whether our story of financial development holds in a later episode with state variation in banking policies by considering the restrictions states imposed on interstate branching after 1997. We again find that changes

[29] In the Appendix we also show the results for capital intensity using the dynamic specification in equation (2). Figure A1 shows that capital intensity rises every year after a state deregulates, consistent with results in Jerzmanowski (2017). By contrast, we do not find evidence showing deregulation leads to *changes* in the rate of self employment, or states becoming more dominated by "large" firms.

in the branching restrictions that lowered the average loan yields led to a decline in the labor share between 1997-2005.

3.2 Industry-State Labor Share

We now disaggregate the data to the industry-state level in order to investigate whether the results can be attributed to certain industries of the economy. Additionally, at the industry-state level, we can control for factors such as automation and markup shocks at the 2-digit industry level, which might not be accounted for using only state and year fixed effects.[30] Automation has long been a rationale for wage inequality, but we are not aware of a reasonable control at the state-year level. Recent work by Autor et al. (2017) finds that the reduction in the labor share can be partly attributed to more market concentration at the industry level, and Elsby et al. (2013) cite offshoring in certain industries as being correlated with reductions in the labor share. Although both of these mechanisms seem to gather steam after the period we investigate, it is useful to control for these factors using industry and industry-year fixed effects.[31] The policy changes continue to be at the state-year level, but the labor share is computed for each industry-state-year (jst). The empirical specification is given by:

$$LS_{jst} = \beta_{Bank} Bank_{st} + \beta_{Branch} Branch_{st} + \eta X_{st} + \alpha_s + \alpha_{jt} + \epsilon_{jst}. \tag{3}$$

The penultimate term captures the industry-year fixed effects, although we also show results for a specification with separate state, industry, and year fixed effects. Industry-year fixed effects control for time-varying industry-specific factors, such as the markups or differences

[30]For example, if automation is especially important in the automobile industry, and this industry is concentrated in a few states, not accounting for these industry specific changes can bias the results.

[31]State-year export/import data would be a useful control as well, but we do not have access to that data for a reasonable period that goes back until at least the late 1970s.

in the way factors like automation have affected specific industries.[32]

Baseline State-Industry-Year Results We begin by estimating the specification given in equation (3). Table 5 presents the effect of banking and branching deregulation policies on the labor share computed at the state-industry-year level. The effect of banking deregulation on the labor share has similar patterns to what we found using the aggregate state-year data. In columns (1) and (3) we include separate state, industry and year fixed effects and find that the labor share results are less noisy using the growing treatment effects (column (3)) than the simple pre-post regression (column (1)). In columns (2) and (4), we run the more restrictive model with industry-year interacted fixed effects to control for shocks that might occur at the industry level. The coefficient is negative and significant when using the growing treatment indicators— with a coefficient of the same magnitude as column (6) of Table 2— and again the results are noisier in the simple pre-post analysis. The former coefficient implies that on average, the labor share in individual industries declined by 1.2 percentage points four years after interstate banking deregulation, which is consistent with the dynamic effects in Figure 2. We therefore find these results to be supportive of the claim that banking deregulation lowered industry labor shares in states that implemented the deregulation.[33]

[Table 5 about here.]

Manufacturing and Services Next, we focus our attention on manufacturing and services, two industries that have been highlighted as part of U.S.'s structural change (e.g. Herrendorf et al. (2014)). Table 6 displays the results from the specification with industry-year fixed effects for the manufacturing and services industries separately.[34] While the first

[32]This would be true as long as 2-digit industry disaggregation is enough to capture the industry-level changes affecting labor shares.

[33]In omitted results, we confirm that the IV results also look similar to the ones found in Table 3.

[34]There are a total of 56 2-digit SIC industries, which we combine into eight 1-digit groups to analyze the changes in the labor share in the aggregate industries. We report the results from the state and industry-year

and fourth columns present the results with the regular pre-post treatment, the second and fifth columns report the growing treatment effects. Overall, there is evidence of a large drop in the labor share in response to interstate banking deregulation for both industries. To further investigate the mechanisms behind the decline in the labor share, we consider two industry characteristics– "capital intensity" and "financial dependence" of the 2-digit industries. Capital intensity is available for both manufacturing and services, so we investigate it first in Table 6. Financial dependence is available only for manufacturing industries, so we report those results independently in the next table.

There is an extensive literature on investment in machinery and equipment, its role in economic growth (Delong and Summers (1991), Greenwood et al. (1997), Krusell et al. (2000)), and how the adoption of capital might be influenced by the expansion in the supply of credit (King and Levine (1993)). As cheaper credit make it easier for firms to finance the adoption of capital, we expect the labor share in capital intensive industries to decline by more following banking deregulation. We define a capital intense industry as one if the stock of net fixed assets per worker is above the sample median.[35] We then interact this indicator with the interstate banking and intrastate branching deregulation dummies, and include the interaction terms in the preferred specification with industry-year effects (equation 3), along with the capital intensity indicator. As expected, column (3) of Table 6 shows that the effect of deregulation on the labor share is stronger in capital intensive manufacturing industries. The interaction of capital intensity in equipment with the treatments is negative but not statistically significant (though it is in the sub-samples below). The last column in Table 6 investigates whether capital intensity is a significant factor across the service industries in determining the role of banking deregulation on the labor share. This is indeed

fixed effects analysis for each of the individual 1-digit SIC sectors in Appendix Table A6. Other than the results discussed above for manufacturing and services, we find a marginally *positive* coefficient on interstate banking for the Mining industry.

[35]The stock of net fixed assets are taken from BEA's national accounts. The BEA disaggregates total fixed assets by equipment and structures. We only present the results using assets of *equipment* per worker. The signs are the same if we use total stock of fixed assets to define capital intensity.

the case. Given the strongly significant negative interactions of capital intensity with both interstate banking and intrastate branching deregulations, results highlight capital intensity as an important determinant in the labor share reduction for service industries.

[Table 6 about here.]

Finally, we analyze the importance of cheaper and more available credit as a channel through which banking deregulation can affect labor share by showing that manufacturing industries which are more reliant on external finance (Rajan and Zingales (1998)) experienced a larger reduction in their labor shares following the deregulation. To that end, we categorize industries as *more* external finance dependent and *less* external finance dependent industries based on a measure of external finance dependence defined in Cetorelli and Strahan (2006). The external finance dependence variable takes on a negative value when the median firm in a 2-digit SIC industry has free cash flow, and therefore is *less* external finance dependent, and a positive value when the median firm in an industry must issue debt or equity to finance investment. As with the capital intensity case, we expect industries more dependent on external finance to experience larger declines in the labor share in response to deregulation.

To provide evidence on the roles of capital intensity and external financial dependence in explaining the reduction in the labor share in manufacturing following banking deregulation, we carry out a sub-sample analysis.[36] In the first two columns of Table 7 we estimate the state-industry-year specification, for *more* external finance dependent industries (FD=1), and then for *less* external finance dependent industries (FD=0). The results are much stronger in the more external finance dependent industries. There are no significant effects of banking deregulation in the rest of the manufacturing industries and the coefficients are of much smaller magnitude. These results suggest that by reducing borrowing costs and making credit more available, banking deregulation allowed firms that rely on external

[36]We also tested whether the impact of banking deregulation on the labor share varies with the external finance dependence by including interaction terms between the external finance dependence dummy (equal to 1 for *more* external finance dependent industries) and the interstate banking and intrastate branching indicators in (3). The interpretation of those results are the same as the sub-sample.

finance to increase their use of capital, and lowered the share of labor in value added. The last two columns estimate the same specification for the capital intensive (KI=1), and non-capital intensive industry (KI=0) sub-samples. The results are consistent with the evidence presented in the previous table.

[Table 7 about here.]

The state and industry level results highlight finance as an important component of income's factors of production, and that heterogeneity plays a role, as firm size and capital intensity both matter. In order to understand the potential channels through which cheaper credit lowers the aggregate labor share more clearly, in Section 4 we calibrate a structural model with firm heterogeneity and financing frictions, which illustrates how an improvement in credit conditions can lead to changes in the labor share.

3.3 Average U.S. Labor Share

Before turning to the theoretical model, we consider a natural question that ensues our analysis, which is how much banking deregulation contributed to the changes in the aggregate U.S. labor share over our sample period (1976-1996 in most specifications). One interesting exercise to quantify this overall effect is to compare the predicted values of the average U.S. labor share given our estimated coefficients to the counter-factually predicted values imposing no banking or branching deregulation and setting all other covariates to their estimated values. To that end, we first compute the predicted labor share, $\widehat{labor sh}_{st}$, from equation (1) using data on all the covariates, and also calculate the same predicted variable imposing $Bank_{st}$ and $Branch_{st}$ equal to zero for all years. This gives us state-year labor shares, which we then aggregate to an overall U.S. labor share using state GSP weights. We implement this in two ways: first with a constant weight for each state computed in 1976, and second with time varying weights, which we calculate as the average of states' weights over year t and $t-1$. We report the results with base weights since they are almost identical.

The predicted aggregate U.S. labor share series are displayed in Figure 3. In 1994 (when all states were required to deregulate their banking sector), the labor share in the counterfactual case is calculated to be right around 1 percentage point higher than the labor share with the actual policies implemented.[37] The magnitude of an overall 1 percentage point reduction in the labor share is consistent with the interpretation once again that banking deregulation can explain about *half* of the overall change in the labor share in the 20 year period of the mid 1970s to the mid 1990s. If the actual change in the U.S. labor share is calculated using the average of the pre-1982 period and average of the post-1982 then the 1 percentage point reduction explains almost all of the labor share decline, which suggests the labor share might have been constant during the period if banking deregulation had not occurred. Of course, the usual disclaimer about this type of counterfactual, where all the parameters are held constant over time, should be taken into account.

[Figure 3 about here.]

4 Credit Frictions and Labor Share

The goal of this section is to provide a model that can shed light on one of the underlying mechanisms through which a more developed banking sector – reflected in the lower lending rates as we have shown– can be linked to the reduction in the labor's share of income. To that end, we consider a model with information asymmetries between the firms and the banks. In particular, we consider a model with costly state verification as in Townsend (1979), Carlstrom and Fuerst (1997), and Bernanke et al. (1999). We assume that due to liquidly requirements, firms borrow funds from banks when they rent capital from the households. This assumption is partly motivated by our empirical findings showing labor share is impacted more in capital intensive and external finance dependent industries. The productivity of the firms in the model are subject to idiosyncratic shocks that are not observable

[37]The predicted values are created using the "growing treatment" regressions (see Table 2, column 6). If we were to use the pre-post results, the difference drops to about 0.5 percentage points.

by banks. Due to the uncertainty about the productivity of firms and the possibility of debt repudiation, banks charge a risk premium on the loans determined optimally in a debt contract. We embed this debt contract in an otherwise standard model with competitive markets and CES production technology. Then, we evaluate the impact of a reduction in the credit risk premium (as observed in the data following banking deregulation) and discuss the mechanisms that result in a decline in the labor share.

4.1 Firm's problem

There is a continuum of perfectly competitive firms that hire labor, and rent capital from the households.[38] We assume a one period lag in the the use of capital; that is, firm i rents capital k^i_{t-1} to be used in the production during period t at the end of period $t-1$. Once the capital is rented, it is augmented by a productivity shock ω^i_t, which is observed at the beginning of period t. For simplicity, we assume that the productivity shock is independently distributed across time and across firms with a log-normal cumulative density function (cdf) $\Phi(\omega)$, where the mean (m) and the variance (v^2) are such that $E_{t-1}(\omega_t) = e^{m+\frac{1}{2}v^2} = 1$ (see e.g., Carlstrom and Fuerst (1997)). There is no aggregate uncertainty.

The time-line for the firm's decisions going from period $t-1$ to period t, depicted in Figure 4, can be described as follows. Firm i rents capital k^i_{t-1} at the end of period $t-1$ combining its retained earnings n^i_{t-1} with the funds it borrows from the banks, b^i_{t-1}. After renting the capital, the firm observes the value of its productivity ω^i_t at the beginning of period t, and then chooses optimal labor l^i_t. With the optimal level of inputs, it produces output, y^i_t, and uses part of it to pay the labor costs. Depending on the realization of productivity, the firm can become insolvent after paying the wage bill. In that case, it declares bankruptcy, defaults on its debt, and exits the market. Following bankruptcy, the bank collects the firm's

[38] We assume that the firms are competitive in order to make the model as tractable as possible and to focus the attention on financial frictions. As such, the model does not generate any predictions about the role of mark-ups in the labor share changes. However, as mentioned in the previous section, we account for mark-ups in the empirical model with firm fixed effects and industry-year effects.

assets after paying some monitoring costs. On the other hand, if the productivity of the firm is high enough to remain solvent, the firm pays its debt back. After paying debt, the firm chooses the optimal level of retained earnings (n_t^i) and the new amount to be borrowed from the bank (b_t^i) to be able to rent k_t^i in order to maximize expected dividends.

[Figure 4 about here.]

4.1.1 Optimal labor and output

Given the amount of capital chosen in the previous period and the realized productivity, the firm produces output with the following CES technology:

$$y_t^i = \left(\gamma \left(\omega_t k_{t-1}^i\right)^{\frac{\sigma-1}{\sigma}} + (1-\gamma)(l_t^i)^{\frac{\sigma-1}{\sigma}}\right)^{\frac{\sigma}{\sigma-1}}, \tag{4}$$

where σ is the elasticity of substitution between capital and labor, and γ is the distribution parameter determining the capital intensity in production. Since productivity is observed at the beginning of period t and the markets are competitive, the firm optimally chooses labor by setting the marginal product of labor equal to the given wage rate, W_t. The optimal choice of labor yields

$$l_t^i = \Omega \omega_t^i k_{t-1}^i, \tag{5}$$

where

$$\Omega \equiv \gamma^{\frac{\sigma}{\sigma-1}} \left[\left(\frac{W_t}{1-\gamma}\right)^{\sigma-1} - (1-\gamma)\right]^{\frac{\sigma}{1-\sigma}}. \tag{6}$$

Substituting optimal labor into the production function, we get the level of output as

$$y_t^i = \Omega \left(\frac{W_t}{1-\gamma}\right)^{\sigma} \omega_t^i k_{t-1}^i. \tag{7}$$

4.1.2 Demand for Capital and the Optimal Debt Contract

Once production takes place, and the wage bill is paid, the firm decides on the optimal level of capital to rent (which will be used in next periods production), along with retained earnings and the optimal level of borrowing. In order to finance total rental cost of capital given the current rental rate q_t, the firm combines its retained earnings n_t^i with the amount it borrows from the bank b_t^i as follows

$$b_t^i = q_t k_t^i - n_t^i. \tag{8}$$

The marginal return to capital, which is rented at the end of period t,is next period's output net of labor costs per one unit of capital and can be written as $R_t^{k,i} = \frac{y_t^i - W_t l_t^i}{k_{t-1}^i}$. Substituting in the expressions for output and labor obtained in equations (7) and (5), we can write the firm specific return as

$$R_t^{k,i} = \omega_t^i \gamma^{\frac{\sigma}{\sigma-1}} \left[1 - (1-\gamma) \left(\frac{W_t}{1-\gamma} \right)^{1-\sigma} \right]^{\frac{1}{1-\sigma}} = \omega_t^i R_t^k. \tag{9}$$

Since the return in equation (9) is firm-specific up to the realization of the productivity shock, and the other terms are common to all firms, we group them in R_t^k and call it the aggregate return to capital.[39] Firm i pays back the loan it obtained from the bank at rate $R_t^{b,i}$ if the total return to capital is higher than the debt repayment. If the firm receives a bad productivity shock, resulting in a low return to capital, then repayment becomes infeasible. Hence, there is a cut-off productivity level, $\bar{\omega}_{t+1}^i$ for which the firm breaks-even:

$$\bar{\omega}_{t+1}^i R_{t+1}^k k_t^i = R_t^{b,i} b_t^i \tag{10}$$

[39] In a setting where credit is needed to finance intermediate inputs, Akıncı (2013) sets-up a model with endogenous financial frictions and credit risk spread in emerging markets, and formulates the firm-specific return in a similar way.

If the productivity is below $\bar{\omega}^i_{t+1}$, the firm becomes insolvent. In this case, the bank spends resources equal to a fraction μ of the realized return to capital, and seizes the firm's assets net of auditing costs equalling $(1-\mu)\omega^i_{t+1}R^k_{t+1}k^i_t$.

Bank's problem A representative bank collects funds from the households and lends them to the firms. Letting R_t denote the interest rate bank pays the households for funds, the bank's profit function is given by

$$\pi^{bank}_t = \int_{\bar{\omega}^i_{t+1}}^{\infty} \bar{\omega}^i_{t+1}R^k_{t+1}k^i_t d\Phi(\omega^i_{t+1}) + (1-\mu)\int_0^{\bar{\omega}^i_{t+1}} \omega^i_{t+1}R^k_{t+1}k^i_t d\Phi(\omega^i_{t+1}) - R_t b^i_t, \tag{11}$$

where the first two terms are the expected returns from solvent firms and insolvent firms (net of resources paid for auditing), and the last term is the bank's funding costs. Following Carlstrom and Fuerst (1997) and Bernanke et al. (1999), we assume that the banks do not make any profits on these loans, which implies the following zero profit condition

$$R_t b^i_t = R^k_{t+1}k^i_t G(\bar{\omega}^i_{t+1}) \tag{12}$$

with

$$G(\bar{\omega}^i_{t+1}) \equiv \left[1-\Phi(\bar{\omega}^i_{t+1})\right]\bar{\omega}^i_{t+1} + (1-\mu)\int_0^{\bar{\omega}^i_{t+1}} \omega^i_{t+1}d\Phi(\omega^i_{t+1}) \tag{13}$$

denoting the expected marginal return to the bank.

Optimal contract The optimal contract defines the amount of funds to be borrowed and the interest rate. The conditions of the loan contract are chosen in order to maximize the net present value of the stream of expected dividends firm pays to the households. Expected dividends for period $t+1$ are defined as the return to capital net of debt repayment and the retained earnings put aside for next period's expenditures:

$$d^i_{t+1} = \omega^i_{t+1}R^k_{t+1}k^i_t - R^{b,i}_t b^i_t - n^i_{t+1}. \tag{14}$$

Substituting the debt repayment condition in equation (10) and rearranging the terms, we can rewrite expected dividends as

$$d^i_{t+1} = R^k_{t+1} k^i_t F(\bar{\omega}^i_{t+1}) - n^i_{t+1}, \tag{15}$$

where

$$F(\bar{\omega}^i_{t+1}) = \int_{\bar{\omega}^i_{t+1}}^{\infty} \omega^i{}_{t+1} d\Phi(\omega^i_{t+1}) - \bar{\omega}^i_{t+1} \left[1 - \Phi(\bar{\omega}^i_{t+1})\right] \tag{16}$$

captures the return to capital net of debt repayments. Notice that given the break-even condition in (10), and the choices for the retained earnings and capital (which jointly determine the necessary amount of borrowing), the optimal contract defining the lending rate $R^{b,i}_t$ can equivalently be thought as defining $\bar{\omega}^i_{t+1}$, the productivity level below which the firm becomes insolvent. Hence, the optimal contract can be formulated as choosing the amount of capital, retained earnings, and the cut-off productivity level in order to maximize the sum of expected dividends:

$$\max_{\{k^i_{t+j}, n^i_{t+j}, \bar{\omega}^i_{t+1+j}\}_{j=0}^{\infty}} \mathbf{E}_t \sum_{j=0}^{\infty} \beta_f^j d^i_{t+j} \tag{17}$$

subject to the bank's zero profit condition in (12) and the solvency condition in (10), with the firm's discount factor being β_f. We list the full set of first order conditions in the Appendix, where we also show that combining the optimality conditions yields an equation that pins down the value of the threshold level of productivity for solvency:

$$\beta_f R_t \left[\Phi(\bar{\omega}^i_{t+1}) - 1\right] + 1 - \Phi(\bar{\omega}^i_{t+1}) - \mu \bar{\omega}^i_{t+1} \Phi'(\bar{\omega}^i_{t+1}) = 0. \tag{18}$$

Notice that the equation above does not depend on any firm-specific characteristic such as firm's net worth or capital, which shows that the productivity level necessary for solvency defined in the optimal contract is not firm-specific (i.e., $\bar{\omega}^i_{t+1} = \bar{\omega}_{t+1}$, $\forall i$). Hence, in the optimal contract the bank charges the same interest rate to all the firms since it is costly for them to verify the productivity level. Moreover, combining the firm's break-even condition

in (10) and the bank's profit condition in (12), we can define an external finance premium the bank charges, which also does not depend on the level of net-worth or the demand for capital:

$$S_t \equiv \frac{R_t^{b,i}}{R_t} = \frac{\bar{\omega}_t}{G(\bar{\omega}_t)}. \tag{19}$$

The equation above shows that the finance premium only depends on the factors that determine the productivity threshold $\bar{\omega}$ for solvency, and the marginal return to the bank defined with the function $G(\bar{\omega})$. Taking a total differentiation of equation (19), we can show that a lower finance premium is associated with a lower solvency threshold; that is, $\frac{\partial \bar{\omega}}{\partial S} > 0$ (see the Appendix for further details). Hence, improvements in the credit markets that reduce the external finance premium also lower the minimum productivity necessary for the firms to be solvent, which increases the probability of firm survival $(1 - \Phi(\bar{\omega}))$. Importantly, as we show with a calibration exercise below, these changes lead to an increase in the total return to capital in general equilibrium. How an increase in the total return to capital affects the labor share can be seen from the equilibrium expression below:

$$s_L = 1 - \gamma^{\sigma} \left(R^k\right)^{1-\sigma}. \tag{20}$$

Assuming an elasticity of substitution between capital and labor, σ, less than one, as supported by micro evidence found in Raval (2014) and Oberfield and Raval (2014), we can see that the rise in the return to capital (R^k) leads to a reduction in the labor share.

4.2 Household's problem

We assume that there is a continuum of households, whose mass is normalized to 1. The representative household chooses consumption, investment, and saving in terms of deposits in the banks in order to maximize lifetime utility

$$\sum_{t=0}^{\infty} \beta \left(\frac{C_t^{1-\theta}}{1-\theta} - \frac{L_t^{1+\upsilon}}{1+\upsilon} \right) \tag{21}$$

subject to their budget constraint and the capital accumulation equation:

$$C_t + I_t + \frac{\varphi_1}{\varphi_2} I_t^{\varphi_2} + B_t = R_{t-1} B_{t-1} + W_t L_t + q_t K_t + D_t + \Pi_t, \tag{22}$$

$$K_t = (1-\delta) K_{t-1} + I_t, \tag{23}$$

where $q_t K_t$ is the total rental income received from the firms at the end of period t; $D_t = \int_0^\infty d_t(\omega) d\Phi(\omega)$ denotes total dividends received from the continuum of firms indexed with ω; B_t denotes the funds deposited in banks, which must be equal to the total borrowing by the firms ($B_t = \int_0^\infty b_t(\omega) d\Phi(\omega)$); and Π_t is the bank profits that are distributed to the households.[40] Aggregate capital, labor and output are defined as $K_t = \int_0^\infty k_t(\omega) d\Phi(\omega)$, $L_t = \int_0^\infty l_t(\omega) d\Phi(\omega)$, and $Y_t = \int_0^\infty y_t(\omega) d\Phi(\omega)$. When investing in physical capital, the household incurs adjustment costs that are convex in investment expenditures, $\frac{\varphi_1}{\varphi_2} I_t^{\varphi_2}$, in addition to the cost of buying one unit of capital.[41] We close the model by imposing market clearing conditions, which yield a resource constraint that we describe in the Appendix. Next, we describe the way we quantify the impact of improved credit conditions on the labor share, and discuss the mechanism through which labor share declines.

4.3 Evaluating the impact of cheaper credit on the labor share

Our empirical results clearly establish that banking deregulation in the U.S. lowered the average loan yields and resulted in a decline in the labor share. In the calibration exercise we use this finding and quantify the response of the labor share to a reduction in the external finance premium that we derived in equation (19). To identify the mechanisms as clearly as possible, we report the results when only the finance premium changes and all other credit conditions stay the same. Then, we additionally consider the increase in the leverage ratio

[40] Since the mass of households is normalized to 1, per capita sources of labor and financial income in equation (22) are equal to the aggregate terms defined in the text.

[41] The functional forms are not essential for generating the mechanism we describe in the next subsection. We choose the particular functions to be able to match the labor share, loan rates and the leverage.

of firms as a result of the expansion in the debt volume following the banking deregulation. The simultaneous impacts of a lower finance premium and an increase in the leverage ratio work to magnify the effect on the labor share.

In calibrating the model, we choose the parameter values in order to match the initial labor share, lending rates (average loan yields), and average leverage ratio observed in our sample covering the 1970-1996 period for the U.S.[42] We adopt 0.7 as the elasticity of substitution parameter (σ in equation (4)), which is a value in the upper range of the firm-level estimates in Raval (2014). Joint with the value of σ and the other parameters, the choice for the weight on capital in production, $\gamma = 0.7$, generates an initial labor share of 0.58. We set the household's discount factor to 0.99, which implies a safe real interest rate of 1%, and the firm's discount factor to 0.9.[43] We assume an annual depreciation rate (δ) of 10%. The important parameters for the financial side of the model are the variance of the cdf of productivity shocks (v), the monitoring cost parameter (μ), and the investment adjustment cost parameter (φ_1). We pick the last two to match the average loan yield and the leverage ratio observed in the data, given the variance parameter $v = 0.5$. Since we do not directly observe the average leverage ratio (value of debt as a fraction of the value of capital), we calculate it as the fraction of total credit to GDP ratio to the capital to GDP ratio ($\frac{B}{K} = \frac{B/Y}{K/Y}$). The latter is defined as $\frac{K}{Y} = \frac{I/\delta}{Y}$, which is held constant using the average investment rate in the U.S. data of 18%.

We start our analysis by keeping the credit to GDP ratio fixed at its initial value of 25%, which implies a constant leverage ratio of 0.139. Thus, the movement in the labor share values correspond strictly to the different values of the loan rates. To allow for a general visualization of the relationship between loan rates and our variables of interest, we vary the interest rate between 10% and 4%. In the solution, a lower lending rate corresponds to higher monitoring costs (μ), implying that the banks exert more effort to monitor the

[42]The full list of parameter values are tabulated in the Appendix.

[43]The firm's discount factor is set lower than that of the household to make sure that firms are borrowing constrained in the steady state.

projects, which can for example emerge as a result of the heightened competition in the banking sector. More specifically, changes in the lending rate from 10% to 4% are generated by an increase in μ from 0.11 to 0.35, a set that is in line with the 0.2-0.36 range considered in Carlstrom and Fuerst (1997). As discussed in Levin et al. (2004), when monitoring costs or efforts are low, a high credit spread compensates the lender for the relatively higher probability of default (which we show below). Therefore, in our exercise lower lending rates matches with larger monitoring costs.

The first panel (A) of Figure 5 shows the declining labor share as the interest rate is lowered, which corresponds with a rise in the return to one unit of capital (R^k) in panel (B). The two bottom panels show the corresponding changes in the productivity threshold ($\bar{\omega}$) and the probability of survival ($1 - \Phi(\bar{\omega})$). As the cost of borrowing declines, it becomes easier to cover interest rate expenses, and the threshold level of productivity necessary to stay solvent declines. Therefore, the number of firms that survive and continue to finance capital increases. A higher survival rate along with lower external finance costs increase the total return to capital resulting in a reduction in the share of income that goes to labor. Quantitatively, lowering the borrowing costs from 8% to 4% generates approximately a 1.5 percentage point reduction in the labor share. Given the elasticity of the labor share with respect to changes in the lending rate reported in Table 3, the quantitative results imply a smaller elasticity, about half as large, than the one uncovered in our empirical analysis.[44]

[Figure 5 about here.]

Some of the discrepancies between the quantitative results above and the reduced form estimates in the empirical analysis can be accounted for using the fact that improvements in the credit markets also imply a higher amount of debt and leverage available to the firms. If we simultaneously increase the leverage ratio as we lower the lending rates, then we obtain a

[44]In Appendix C.4 we reproduce the labor share Figure under various alternative parameter assumptions. Specifically, we separately vary σ, v, and φ_2, and for each case adjust γ to keep the level of the labor share comparable across estimations. The results are described in the Appendix.

larger reduction in the labor share. As an illustration, in Table 8 we report results when the interest rate is lowered from 8% to 4% while keeping the leverage ratio constant at 0.139 (as above), and then when the leverage ratio is increased to 0.183 (calculated using the higher debt to GDP ratio observed at the end of our sample period). When both changes are jointly considered, we find an economically significant reduction in the labor share of 4.5 percentage points.

[Table 8 about here.]

To summarize, we show that when the firms are heterogeneous in their productivity levels and there are information problems between the lenders and the firms, an external finance premium in the loan rate emerges, which represses the return to capital. If there are changes in the financial system that lower borrowing costs, firms find it easier to cover interest rate expenses, the number of firms that survive and continue to finance capital increases, and the return to capital increases. The increase in the return to capital leads to a reduction in the labor share. These theoretical implications not only shed light on the underlying mechanism through which banking deregulation across the states led to a lower labor share, but they also show that in general changes in the financial development can lower the labor share by endogenously raising the return to capital. This last observation helps explain the connection between the reduction in the labor share, rise in financial wealth, and lower real interest rates (Gonzalez and Trivin, 2016; Caballero et al., 2017; Eggertsson et al., 2018). Still, note that this exercise captures only one of the channels implicit in the reduced form results we described in Section 3. Most notably, reallocation across firms is likely a further channel through which the labor share decreases (Autor et al., 2017; Kehrig and Vincent, 2017). A model with capital constraints a la Moll (2014), where financial development reallocates production to firms with high labor-biased productivity (Doraszelski and Jaumandreu, 2018) could create another mechanism that explains our results.[45] Given that our empirical analysis

[45]However, capital inflows might also *raise* capital misallocation if frictions are reduced primarily for the largest, but not the most productive, firms (Gopinath et al., 2017).

cannot capture reallocations across firms, we leave the study of this interesting mechanism for future research.

5 Conclusion

This paper contributes to the literature by uncovering the importance of credit in driving the labor's share of income. It does so by exploiting the cross-state variation in the timing of intrastate branching and interstate banking deregulations over the 1976-1996 period, which intensified the local bank competition, increased the availability of credit, and lowered its cost. We provide robust evidence showing states that adopted the interstate banking deregulation experienced a decline in their labor share. Specifically, we find that on average a state that adopted the policy experienced a decline in the labor share of 0.9 percentage points. Moreover, we find that the labor share continued to decline further up to 6-7 years after the policy was enacted. A structural model with financial frictions, where producing firms borrow from a financial intermediary to finance their capital expenditure, provides a channel through which changes in the financial markets that reduce borrowing costs can lower the labor share.

Understanding the changes in labor's share of income is important not only for macroeconomic modeling, but also for formulating policy, since a decline in the labor share has implications for socioeconomic outcomes, such as income inequality. Our takeaway is that financial development and capital allocation, recently highlighted as determinants of productivity (Buera et al., 2011; Midrigan and Xu, 2014), generate unequal returns across factors. It is likely that the reduction in the labor share is related to other structural changes in the economy (Eggertsson et al., 2018), and for this reason we emphasize that further research is needed to uncover other operating channels set off by credit shocks.

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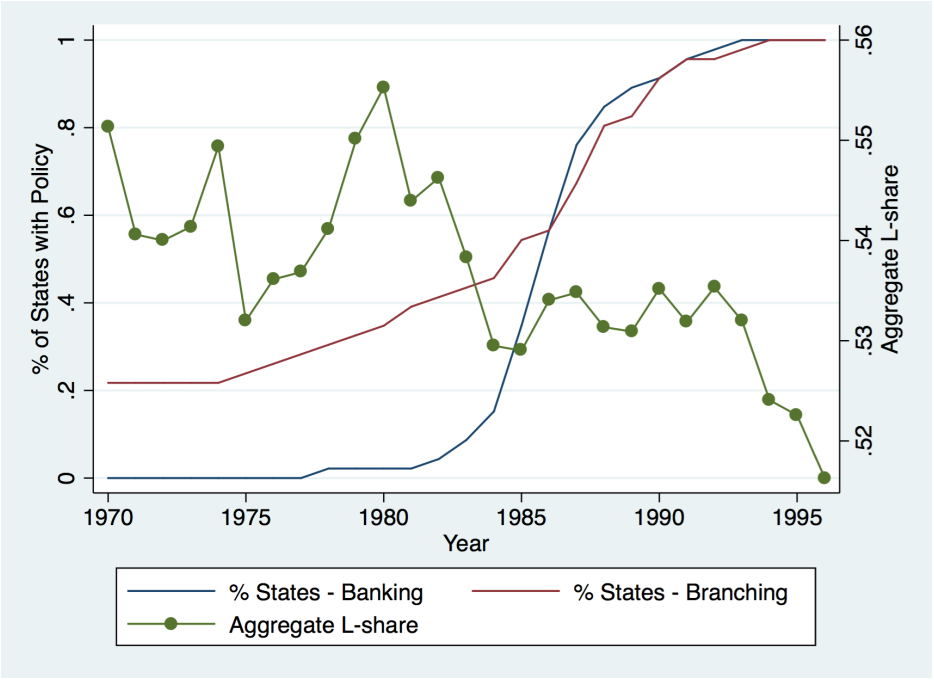
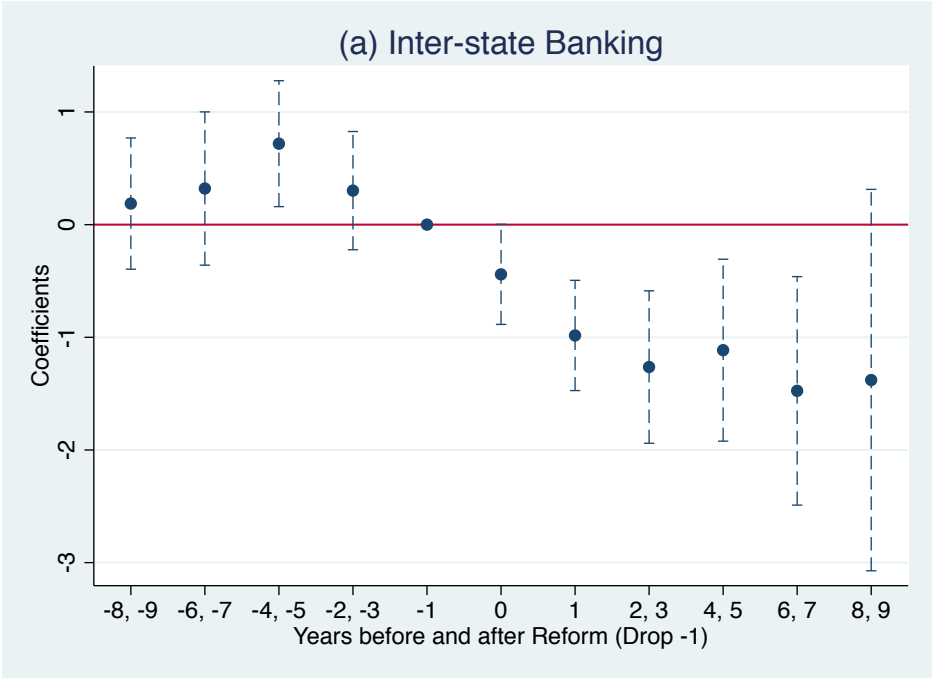
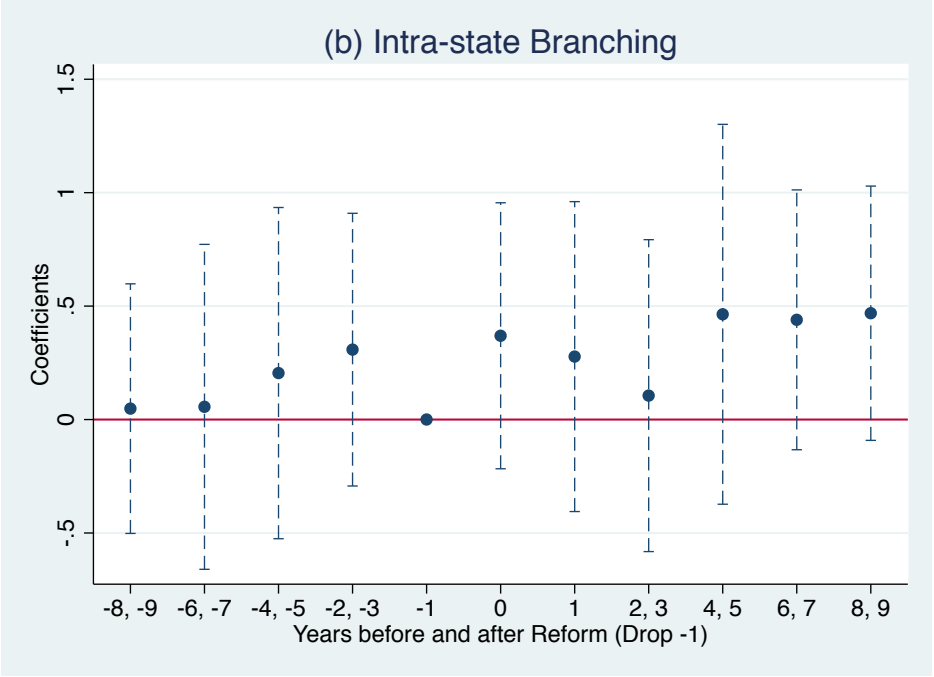
Figure 1: U.S. Aggregate Labor Share and Banking Deregulation



Notes: This figure displays the cumulative fraction of states to have adopted the interstate banking/intrastate branching deregulations (left axis) and the U.S. labor share (right axis). To compute the U.S. labor share, we sum compensation and gross output across all states for each year (no weights required). The left axis is the fraction of states that have adopted the branching/banking deregulation as defined in section 1. *Sources:* Wage compensation and gross output available from the Bureau of Economic Analysis. Dates at which states deregulate are taken from Kroszner and Strahan (1999) and Demyanyk et al. (2007).

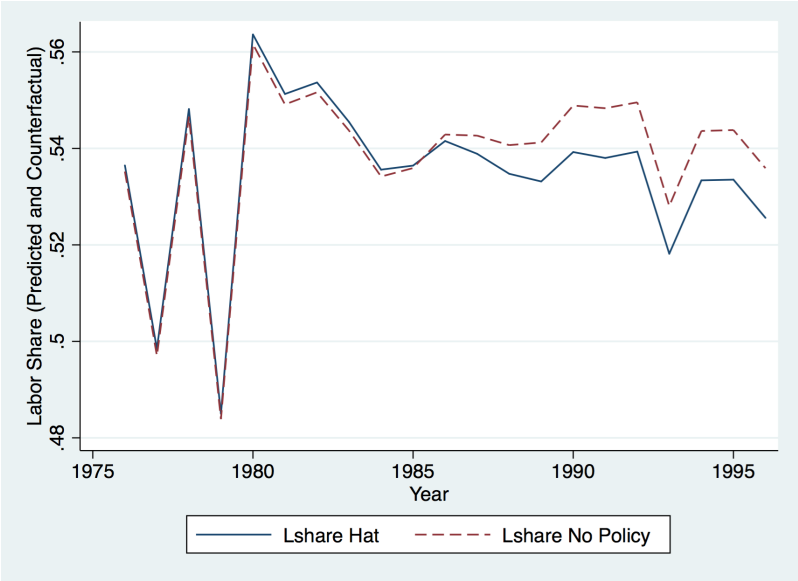
Figure 2: Dynamic Effects: Coefficients in Years Before and After Deregulation





Notes: The figures plot the coefficients we obtain from a specification that regresses the labor share on the following dummies for interstate banking and intrastate branching deregulations: (9, 8), (7, 6), (5,4), (3,2) years before the policy, and (0), (1), (2,3), (4,5), (6,7), (8,9) years after the policy implementation. Year 0 is the year of implementation and all coefficients are evaluated relative to one year prior to the policy adoption. Parentheses refer to the years we group into one dummy variable. Dashed vertical bars represent 95% confidence intervals. The coefficients are multiplied by 100 so that they can be interpreted as percentage point deviations of the labor share in deregulated states relative to non-deregulated states. Controls include corporate tax rates, union membership, unemployment, population growth, the house price index, plus state and year fixed effects. Standard errors are clustered by state.

Figure 3: US Labor Share aggregated with base weights



Notes: This figure compares the labor shares predicted by fitting specification (1) with the actual deregulation policies and with the assumption that no states deregulate. We first compute the predicted labor share, $\widehat{labor sh}_{st}$, from equation (1) using data on all the covariates, and also calculate the same predicted variable imposing $Bank_{st}$ and $Branch_{st}$ equal to zero for all years ("No Policy"). This gives us state-year labor shares, which we then aggregate to an overall U.S. labor share using state GSP weights. This figure uses weights fixed to the state share of value added in 1976.

Figure 4: Timing of the events in the firm's problem.

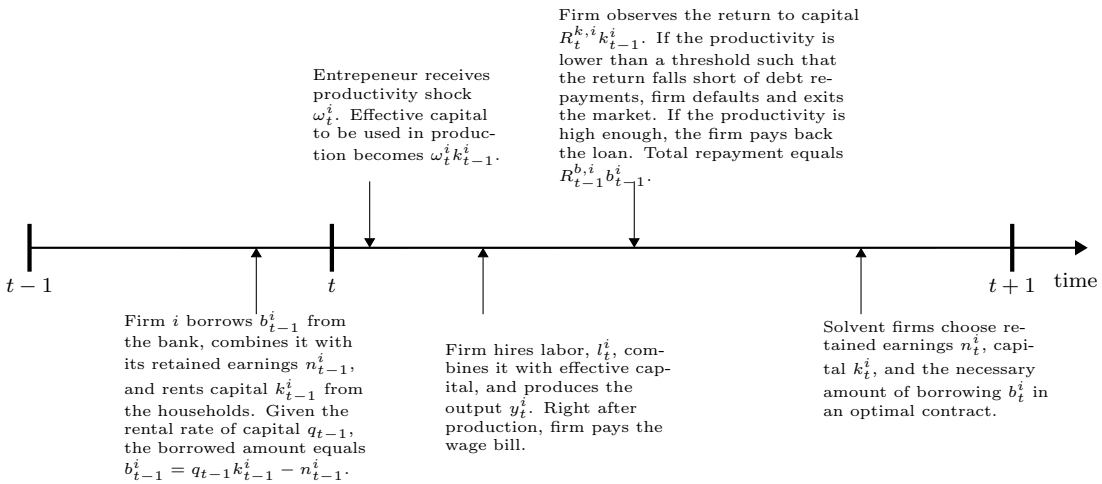
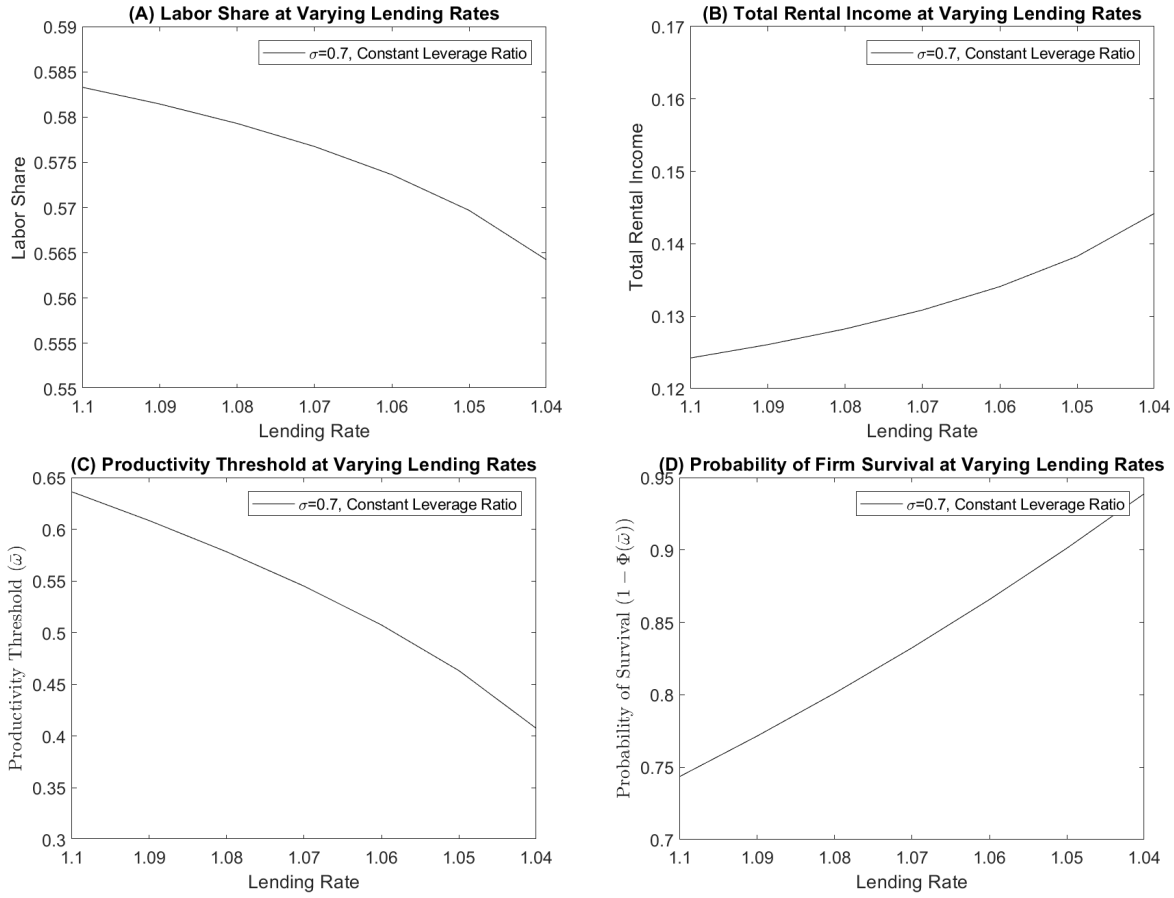


Figure 5: Labor Share, Capital Costs, and Firm Survival at Varying Lending Rates



Notes: Panels (A) through (D) represent respectively the labor share of income, total rental income for one unit of capital, the productivity threshold for which a firm pays back its loan, and the probability of survival, each for lending rates varying between 10% and 4%. We take the lending rate and leverage ratio as given by the data. Lending rates are about 8 percentage points at the start of the sample, and the leverage ratio is 13.9%. For these figures we keep the leverage ratio constant, assuming a lower bound credit ratio of 0.25 and investment rate of 0.18. We solve the model to match the finance premium and the leverage ratio, plus other model constraints. The chosen parameters are $\sigma = 0.7, \delta = 0.1, \beta = 0.99, \beta^f = 0.9, \gamma = 0.7, m = 1, v = 0.5$.

Table 1: Summary Statistics

	mean	sd	p50
1970-1982			
Labor share	0.529	0.0614	0.543
State GDP (billions $)	35.85	44.50	21.04
Total Compensation (billions $)	19.66	24.58	11.02
Avg. loan yield rate	0.135	0.0370	0.122
Credit/GDP	0.286	0.101	0.271
HHI of deposits	0.0659	0.0761	0.0328
GDP growth rate	0.0329	0.0447	0.0339
Pop'l growth rate	0.0139	0.0131	0.0119
Avg salary ($)	11158.7	2766.3	10756.5
Corporate tax rate	5.836	2.742	6
Union memb. (% of workers)	22.00	8.105	21.35
Unemployment (%)	6.835	2.051	6.600
House Price Index	87.90	18.12	90.81
1983-1996			
Labor share	0.523	0.0476	0.536
State GDP (billions $)	101.9	120.6	63.09
Total Compensation (billions $)	54.53	64.09	32.70
Avg. loan yield rate	0.141	0.0278	0.139
Credit/GDP	0.312	0.110	0.300
HHI of deposits	0.0392	0.0619	0
GDP growth rate	0.0342	0.0333	0.0343
Pop'l growth rate	0.00921	0.0111	0.00724
Avg salary ($)	20875.6	4021.7	20383.5
Corporate tax rate	6.575	2.833	7
Union memb. (% of workers)	15.07	6.173	14
Unemployment (%)	6.341	1.994	6.100
House Price Index	154.1	45.76	139.9
Total			
Labor share	0.526	0.0547	0.538
State GDP (billions $)	70.08	97.89	36.52
Total Compensation (billions $)	37.74	52.18	19.30
Avg. loan yield rate	0.138	0.0327	0.129
Credit/GDP	0.299	0.107	0.287
HHI of deposits	0.0476	0.0678	0.0199
GDP growth rate	0.0336	0.0389	0.0341
Pop'l growth rate	0.0114	0.0123	0.00877
Avg salary ($)	16650.9	5973.5	16655.5
Corporate tax rate	6.224	2.814	6
Union memb. (% of workers)	18.40	7.959	17.80
Unemployment (%)	6.506	2.026	6.231
House Price Index	130.0	49.66	117.8

Notes: Observations are state-year cells. The columns represent the mean, standard deviation, and median across all states in the given time period. The first panel describes the data in the first half of the period (1970-1982) when very few states had deregulated. The second panel describes the data in the second half of our data span. The last panel combines the two time periods. Mean/SD/Median are across the 46 states we use in the benchmark specification, with no weights. Sources are described in Section 3 of the text.

Table 2: Main Results: The Change in State-Year Labor Share in Response to State Deregulation

	Labor Share			LShare (ex Finance)	LShare (w/ Self)	Labor Share
	(1)	(2)	(3)	(4)	(5)	(6)
Interstate Banking	-0.009***	-0.008***	-0.009***	-0.008**	-0.011***	
	(0.003)	(0.002)	(0.003)	(0.004)	(0.003)	
Intrastate Branching	0.007	0.005	0.004	0.002	0.003	
	(0.005)	(0.004)	(0.004)	(0.004)	(0.005)	
Banking (growing treatment)						-0.003***
						(0.001)
Branching (growing treatment)						0.001
						(0.001)
Corp. tax rate	0.001	0.000	0.000	0.001	-0.001	0.000
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Union Membership	0.000	0.000	0.000	0.000	-0.000	0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
GSP growth	-0.164***	-0.181***				
	(0.027)	(0.023)				
Popl. growth	0.137	0.296*	0.133	-0.092	-0.166	0.116
	(0.146)	(0.162)	(0.150)	(0.182)	(0.194)	(0.149)
Unemployment		-0.022***	-0.010	-0.013	0.000	-0.009
		(0.006)	(0.006)	(0.008)	(0.008)	(0.006)
House Price Index		-0.052***	-0.042***	-0.024**	-0.033**	-0.039***
		(0.012)	(0.012)	(0.012)	(0.012)	(0.011)
Avg Labor Share	0.526	0.527	0.527	0.585	0.636	0.527
Fixed Effects	State,Year	State,Year	State,Year	State,Year	State,Year	State,Year
R^2	0.913	0.933	0.926	0.941	0.891	0.926
N	1174	954	954	954	954	954

Notes: This table presents the results to specification (1) with various sets of controls and definitions of the labor share. Labor share is calculated using total compensation and state GSP in *private* industries. The first five columns use a regular pre/post treatment: the "Interstate Banking" and "Intrastate Branching" dummies turn to one when a state deregulates. Column (4) calculates the labor share by eliminating all finance related industries. Column (5) scales up the state labor share by taking the number of self-employed into account (state compensation does not include proprietor's income). The last column presents the growing treatment, so that "Banking (growing treatment)" and "Branching (growing treatment)" equal to the number of years since the policy change (only letting this get up to 4). Hence, the treatment takes a value of 1 during the year of the policy adoption, 2 the year after, 3 the year after that, and then continues to take the value of 4 thereafter. Definition of the control variables are in the Data Section. All included controls are presented in the table. Labor shares, policy implementation dates, corporate tax rates, and union membership rates are available starting in 1970. GSP growth and population growth are available starting in 1971. House price indices start in 1975, while unemployment data starts in 1976. Therefore, column (1) spans 1971-1996, while the rest only include data from 1976-1996. All specifications include state and year fixed effects. Standard errors – clustered by state – are in parentheses. $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

Table 3: IV Results: Interstate Banking Dummy as Instrument

	Labor Share		
	(IV)	(IV)	(IV)
Avg. Yield	0.009**		
	(0.004)		
Credit/GDP		-0.008	
		(0.009)	
HHI Deposits			0.442***
			(0.156)
Corp. tax rate	0.001	0.007	0.001
	(0.002)	(0.006)	(0.003)
Union Membership	0.000	-0.001	-0.000
	(0.001)	(0.002)	(0.001)
Unemployment	-0.029**	-0.048	-0.038***
	(0.011)	(0.040)	(0.012)
Popl. growth	0.262	0.594	-0.211
	(0.228)	(0.541)	(0.221)
House Price Index	-0.032***	-0.012	-0.053***
	(0.012)	(0.056)	(0.014)
F-stat	10.45	0.80	9.51
N	954	954	862
Fixed Effects	State,Year	State,Year	State,Year

Notes: The table presents IV results with the adoption of interstate banking as an instrument for each of the 3 measures of banking market structure. We instrument the banking measures with a dummy equal to one for states that have deregulated their banking sector. For each IV regression, we report the first-stage Cragg-Donald F-statistic as a test for weak identification. The instrument can be rejected as a weak instrument at the 1% level for both loan yields and the Herfindahl Index. Average loan yield is in percentage points, so the coefficient reflects a one percentage point increase in the yields. Credit to GSP ratio is included as a percentage. "HHI Deposits" is defined as one plus the usual index construction of the sum of squared market shares. The sample covers 1976-1996 due to the availability of the control variables. Definition of the control variables are in the Data Section. All specifications include state and year fixed effects. Standard errors – clustered by state – are in parentheses. $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

Table 4: Differential Response to Deregulation by State Characteristics

	Labor Share			Log Capital Intensity	
	(1)	(2)	(3)	(4)	(5)
Interstate Banking	-0.003	-0.004	-0.003	0.017*	-0.008
	(0.003)	(0.003)	(0.003)	(0.009)	(0.012)
Intrastate Branching	0.005	0.005	0.004	-0.017	-0.022**
	(0.004)	(0.004)	(0.004)	(0.012)	(0.011)
Banking*Manufacturing State	-0.014**				0.061***
	(0.005)				(0.016)
Banking*Large Employer State		-0.012**			
		(0.005)			
Banking*Large Firm State			-0.014**		
			(0.005)		
Fixed Effects	State,Year	State,Year	State,Year	State,Year	State,Year
R^2	0.929	0.928	0.929	0.928	0.934
N	954	954	954	954	954

Notes: This table uses dummies for state characteristics to test whether certain state groups are especially affected by deregulation. Labor share is calculated using total compensation and state GSP in *private* industries. For each column (1) through (3), states are given a dummy equal to 1 if they are above the median in the respective category in 1977, and this is interacted with the "Interstate Banking" dummy. State characteristics are fixed over time. The 3 categories are: "Manufacture State," the share of labor force that is in a manufacturing industry; "Large Employer State," the percentage of workers employed in firms with over 100 workers; and "Large Firm State," percentage of firms with over 100 employees. In columns (4) and (5), log capital intensity is the outcome measure, with the rest of the specification following column (3) of Table 2. In column (5) we also add the interaction of deregulation with manufacturing state' dummies. Controls that are not included in the table include: corporate tax rate, union membership, population growth, unemployment, and HPI. Definitions of the control variables are in the Data Section. All specifications include state and year fixed effects and span 1976-1996. Standard errors – clustered by state – are in parentheses. $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.
Sources: Physical capital per worker is taken from Turner et al. (2013). Firm sizes are constructed using BDS data. Manufacturing employment as a share of total employment constructed with BEA data.

Table 5: The Change in Industry-State-Year Labor Share in Response to State Deregulation

	Labor Share			
	(1)	(2)	(3)	(4)
Interstate Banking	-0.003	-0.004		
	(0.004)	(0.004)		
Intrastate Branching	0.001	0.001		
	(0.006)	(0.006)		
Banking (growing treatment)			-0.003**	-0.003*
			(0.002)	(0.002)
Branching (growing treatment)			-0.000	0.000
			(0.002)	(0.002)
Corp. tax rate	0.001	0.000	0.001	0.000
	(0.002)	(0.002)	(0.002)	(0.002)
Union Membership	0.000	0.000	0.000	0.000
	(0.001)	(0.001)	(0.001)	(0.001)
Popl. growth	-0.073	-0.102	-0.090	-0.118
	(0.238)	(0.251)	(0.234)	(0.246)
Unemployment	-0.010	-0.009	-0.012	-0.011
	(0.009)	(0.009)	(0.010)	(0.009)
House Price Index	-0.001	0.002	0.002	0.005
	(0.018)	(0.018)	(0.017)	(0.018)
Fixed Effects	State, Industry, Year	State, Industry-Year	State, Industry, Year	State, Industry-Year
R^2	0.418	0.488	0.418	0.488
N	46963	46963	46963	46963

Notes: This table presents results for the specification given in (3). The sample covers 1976-1996 due to the availability of the control variables. The first two columns use pre-post treatment effects, while the latter two columns use the growing treatment. Growing treatments are defined as equal to the number of years since the policy change (only letting this get up to 4). Columns (1) and (3) include separate state, industry, and year fixed effects. Columns (2) and (4) include state and industry-year interacted fixed effects. Definition of the control variables are in the Data Section and all included controls are presented. Standard errors – clustered by state – are in parentheses. $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

Table 6: State-Year-Industry: Manufacturing and Services

	Labor Share					
	(M)	(M)	(M)	(S)	(S)	(S)
	(1)	(2)	(3)	(4)	(5)	(6)
Interstate Banking	-0.012**		-0.002	-0.001		0.004
	(0.006)		(0.012)	(0.002)		(0.004)
Intrastate Branching	-0.014**		-0.001	0.005		0.010**
	(0.007)		(0.010)	(0.004)		(0.005)
Banking (growing treatment)		-0.003			-0.001**	
		(0.002)			(0.001)	
Branching (growing treatment)		-0.004**			0.001	
		(0.002)			(0.001)	
Capital Intensive*Banking			-0.017			-0.018**
			(0.018)			(0.007)
Capital Intensive*Branching			-0.022			-0.017**
			(0.016)			(0.007)
Fixed Effects	State,Industry-Year	State,Industry-Year	State,Industry-Year	State,Industry-Year	State,Industry-Year	State,Industry-Year
R^2	0.423	0.423	0.423	0.937	0.937	0.937
N	15586	15586	15586	12300	12300	12300

Notes: This table presents results for the specification given in (3), for Manufacturing (M) and Service (S) aggregate industries separately. The first 3 columns restrict the data to only include manufacturing industries, while the last 3 columns are based on service industries only. "KI" equals 1 for industries with above median capital intensities. Capital intensity is calculated as the stock of net fixed assets (only equipment) per worker (averaged across all years and time-invariant). The data range covers 1976 to 1996. We include the following controls, but do not present them in the table for clarity (definition of the controls are in the main text): corporate tax rates, union membership, population growth, unemployment, house price index. All specifications include state and industry-year interacted fixed effects. Standard errors – clustered by state – are in parentheses. $***p < 0.01$, $**p < 0.05$, $*p < 0.1$.
Source: The stock of net fixed assets are taken from BEA's national accounts. The BEA disaggregates total fixed assets by equipment and structures. We only present the results using assets of *equipment* per worker.

Table 7: State-Year-Industry: Manufacturing by Type

	Labor Share			
	(FD=1)	(FD=0)	(KI=1)	(KI=0)
Inter-state Banking	-0.013	-0.010	-0.017**	-0.004
	(0.009)	(0.009)	(0.007)	(0.009)
Intrastate Branching	-0.024**	-0.005	-0.022**	-0.002
	(0.009)	(0.008)	(0.010)	(0.008)
Corp. tax rate	-0.005	-0.002	-0.005	-0.001
	(0.004)	(0.003)	(0.004)	(0.003)
Union Membership	-0.001	-0.001	-0.001	-0.000
	(0.001)	(0.001)	(0.001)	(0.001)
Popl. growth	-0.471	-0.876**	-0.374	-1.023**
	(0.465)	(0.373)	(0.431)	(0.427)
Unemployment	0.010	-0.016	0.009	-0.016
	(0.018)	(0.017)	(0.017)	(0.014)
House Price Index	0.033	-0.003	0.009	0.022
	(0.026)	(0.023)	(0.025)	(0.018)
Fixed Effects	State,Industry-Year	State,Industry-Year	State,Industry-Year	State,Industry-Year
R^2	0.480	0.353	0.363	0.487
N	8315	7271	9100	6486

Notes: This table presents results for the specification given in (3), for select subsamples of the Manufacturing sector. "FD" denotes external financial dependence and it takes on a value 1 for *more* external finance dependent industries. An industry is classified as more finance dependent when the median firm in the 2-digit SIC industry must issue debt or equity to finance investment. The first two columns differentiate between *more* (FD=1) and *less* (FD=0) external finance dependent industries within manufacturing. The latter two columns differentiate based on *more* (KI=1) and *less* (KI=0) capital intensive industries within manufacturing. "KI" equals 1 for industries with above median capital intensities. Capital intensity is calculated as the stock of net fixed assets (only equipment) per worker (averaged across all years and time-invariant). The data range covers 1976 to 1996. Definition of the controls are in the main text. All regressions include state and industry-year fixed effects. Standard errors – clustered by state – are in parentheses. $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.
Source: Financial dependence indicators are based on Rajan and Zingales (1998). Capital intensity defined in previous table.

Table 8: Labor Share at Varying Lending Rate and Leverage Ratio

		Lending Rate =	
		1.08	1.04
Leverage Ratio =	0.139	0.579	0.564
	0.183		0.533

Notes: The results in the table report the labor share at a varying interest rate and leverage ratio. The labor share in the top row represents the changes displayed in Figure 5, panel (A). The bottom row allows for the simultaneous increase in the leverage ratio. We solve the model to match each interest rate and leverage ratio, plus other model constraints. Lending rates are about 8 percentage points at the start of the sample. Leverage Ratio $= \frac{B}{K} = \frac{B/Y}{K/Y}$. The investment rate is constant at about 0.18 throughout the sample. The credit ratio (numerator) is defined as total loans to GSP, which increases from 0.25 in 1970 to 0.33 in 1996, which drives the increase in the leverage ratio. The chosen parameters are $\sigma = 0.7, \delta = 0.1, \beta = 0.99, \beta^f = 0.9, \gamma = 0.7, m = 1, v = 0.5$.