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**How do credit supply shocks affect the real economy?
Evidence from the United States in the 1980s**

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How Do Credit Supply Shocks Affect the Real Economy? Evidence from the United States in the 1980s
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Abstract

We explore the 1982 to 1992 business cycle in the United States, exploiting variation across states in the degree of banking deregulation to generate differential local credit supply shocks. We show that expansion in credit supply operates primarily by boosting local demand, especially by households, as opposed to improving labor productivity of firms. States with a more deregulated banking sector see a large relative increase in household debt from 1983 to 1989, which is accompanied by an increase in the price of non-tradable relative to tradable goods, an increase in wages in all sectors, an increase in non-tradable employment, and no change in tradable employment. Credit supply shocks lead to an amplified business cycle, with GDP, employment, residential investment, and house prices increasing by more in early deregulation states during the expansion, and then subsequently falling more during the recession of 1990 and 1991. The worse recession outcomes in early deregulation states appear to be related to downward nominal wage rigidity, household debt overhang, and banking sector losses.

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1 Introduction

A growing body of research argues that credit supply shocks and economic fluctuations are closely connected.[1] However, there remains a lack of empirical research on the exact mechanisms through which credit supply affects aggregate real economic activity. One view holds that credit supply shocks affect the economy primarily through boosting demand, especially by households. An alternative view is that credit supply shocks affect the economy by improving labor productivity at firms. Such a rise in labor productivity could be the result of loosening firm borrowing constraints or through a better allocation of resources across firms. Our goal in this study is to develop and test a methodology for distinguishing which of these two is the more dominant channel.

An analysis of these potential mechanisms faces a number of challenges. To begin, such an analysis requires a plausibly exogenous source of variation in the expansion in credit supply at a sufficiently aggregated level. Further, it is necessary to look beyond the short-run, as credit supply shocks may boost the economy initially, only to be followed by worse performance afterward. In addition, empirical strategies that focus uniquely on firm-level or household-level variation in the data may miss spill-overs caused by credit supply shocks. For example, if the dominant effect of credit expansion is to temporarily boost local household demand, then wages may rise leading to a less competitive tradable sector. There may also be a reallocation of labor toward a less productive non-tradable sector. In such a scenario, even if credit expansion also relaxes firm borrowing constraints, any beneficial effect on labor productivity may be offset by the negative effects on wages and productivity coming from the boost to demand.

In order to address these challenges, we focus on the United States from the late-1970s to the mid-1990s, with a particular focus on the 1982 to 1992 cycle. As Figure 1 shows, the United States experienced a major expansion and subsequent contraction in credit supply from 1982 to 1992 that corresponded with the expansion and contraction phase of the business cycle. More specifically, between 1982 and 1989, the United States experienced an increase in credit supply as measured

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[1]For empirical evidence, see Jordà et al. (2013), Krishnamurthy and Muir (2016), Reinhart and Rogoff (2009), Baron and Xiong (2016), Greenwood and Hanson (2013), López-Salido et al. (2016) and Mian et al. (2017). Credit supply shocks have been modeled as an exogenous decline in the interest rate in a small open economy (e.g. Schmitt-Grohé and Uribe (2016)), or as a relaxation of constraints on debt to income or debt to collateral ratios, possibly related to financial liberalization (e.g., Favilukis et al. (2015), Justiniano et al. (2015), Bahadir and Gumus (2016)). Credit supply shocks may originate from fundamentals such as shifts in the lending technology or global savings, or from behavioral factors as in Gennaioli et al. (2012), Bordalo et al. (2015), Landvoigt (2016), and Greenwood et al. (2016).

by either the high-yield share of corporate debt issuance as in Greenwood and Hanson (2013) or corporate credit spreads as in Krishnamurthy and Muir (2016) and López-Salido et al. (2016). Credit supply then subsequently contracted sharply in 1989, which also can be seen in either of these measures.

As is well-known, there was substantial deregulation of the banking sector in the 1980s in the United States, with significant variation across states in the nature and pace of deregulation (Kroszner and Strahan (2014)). States differed in the timing of when they allowed banks from other states to operate in their jurisdiction, and they also differed in how many other states were allowed access. Another source of variation is the timing of when states allowed banks to operate multiple branches within the state. We use this variation to construct differential state-level credit supply shocks during the 1983 to 1989 period: states with a more deregulated banking sector saw a relative expansion in credit supply compared to states with a more regulated banking sector. We combine this variation in state-level credit supply shocks with new state-level measures of household debt, firm debt, house prices, consumer prices, wages, and real economic outcomes for this time period.

We begin by showing that states that deregulated their banking systems earlier saw a larger increase in debt during the expansion stage from 1982 to 1989. Early deregulation states witnessed stronger growth in almost all measures of borrowing, including the household debt to income ratio, mortgage applications, and measures of bank loans to firms and households. The larger increase in lending to households in early deregulation states is robust to inclusion of several control variables, including a state's exposure to oil prices and indicator variables for the four main regions of the United States. The magnitude is large. A one standard deviation increase in our deregulation measure implies a one-third to one-half standard deviation increase in household debt growth.

Did the larger credit supply shock in early deregulation states affect the aggregate state economy through an expansion in the labor productivity of firms or through a boost to local demand? We build a simple model based on the theoretical insights of Schmitt-Grohé and Uribe (2016) and Bahadir and Gumus (2016) to show that one can distinguish between these channels by examining the evolution of consumer prices and employment in a state experiencing a stronger credit supply shock. In particular, a credit supply shock that primarily works through local demand leads to a larger increase in employment in industries producing non-tradable goods as opposed to tradable goods. It also leads to an increase in local prices of non-tradable goods. In contrast, shocks to

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credit availability that increase labor productivity of firms producing either non-tradable or tradable goods do not lead to these joint predictions.[2]

The evidence favors the view that credit supply shocks on net affect the economy through local demand. From 1982 to 1989, early deregulation states experienced a significant relative increase in non-tradable employment but no relative change in tradable employment compared to late deregulation states. Further, early deregulation states witnessed a relative rise in the price of non-tradable goods compared to late deregulation states, with no change in the price of tradable goods. The simultaneous real exchange rate appreciation, growth in non-tradable employment, and stability of tradable employment is consistent with a model in which credit supply shocks boost local demand; these patterns are inconsistent with the view that deregulation operated primarily by boosting aggregate firm labor productivity.[3] We also find evidence of significantly stronger wage growth in early deregulation states relative to late deregulation states, which is important for understanding what happens during the subsequent recession.

The fact that credit supply expansion works primarily through a boost to local demand is important for understanding what happens in the years after 1989. Many models in which credit supply shocks boost the economy through a local demand effect predict a decline in growth and employment when the credit supply shock subsequently reverts.[4] For example, Schmitt-Grohé and Uribe (2016) use a small open economy model in which interest rates fall and then subsequently rise. We build on their model by showing wages and employment in the non-tradable sector rise during the credit expansion. But in the presence of downward nominal wage rigidity, wages cannot adjust downward during the credit contraction, which leads to a decline in employment, especially in the non-tradable sector. More generally, credit supply expansions that boost local demand may lead to a decline in the economy when credit supply subsequently contracts because of banking sector

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[2]As we show in Section 2.2, under reasonable assumptions, a credit supply shock that boosts labor productivity at firms producing non-tradable goods leads to a relative decline in the price of non-tradable goods, and a credit supply shock that boosts labor productivity for firms producing tradable goods leads to an increase in employment in the tradable sector.

[3]At the micro level, credit supply expansion may lead to a more efficient allocation of labor across firms. See Bai et al. (2016) for evidence of the labor reallocation channel for small manufacturing firms in the aftermath of banking deregulation. However, our results suggest that the rise in local demand on net is the dominant channel at the state level. The aggregate state level results are important because while labor productivity may improve within one sector, the demand effects may re-allocate labor to less productive industries or lead to an overall rise in wages which hurts competitiveness.

[4]We are agnostic on the reasons why the credit supply shock reverts in the late 1980s. Krishnamurthy and Muir (2016) and López-Salido et al. (2016) show evidence that periods of rapid credit expansion are often followed by a sharp reversion, which is consistent with behavioral models such as Bordalo et al. (2015).

problems or household debt overhang. As a result, credit supply shocks that operate primarily on the demand side of the economy may lead to an amplified business cycle: boosting demand during the expansion but leading to a more severe subsequent contraction.

We find evidence supporting this view. More specifically, from 1982 to 1989, relative to late deregulation states, early deregulation states experienced a larger increase in house prices, residential construction, and GDP. Further, the unemployment rate declined by more in early deregulation states. But when aggregate conditions deteriorated from 1989 to 1992, the opposite pattern occurred. Early deregulation states witnessed a larger drop in house prices, residential construction, GDP, and household spending. Further, the unemployment rate increased more in early deregulation states. We summarize this higher cyclicality in specifications where we estimate the "beta" of a given state's outcome on measures of the aggregate economy from 1982 to 1992, and we show that this beta is systematically larger for states that deregulated their banking systems earlier. A more deregulated banking sector is associated with a larger "loading" of real economic activity on aggregate economic conditions.

Why is the recession worse in early deregulation states? Downward nominal wage rigidity is likely a culprit. The significant relative increase in nominal wages in early deregulation states from 1982 to 1989 does not subsequently reverse from 1989 to 1992. There is evidence of a slight relative decline by 1993 and 1994, but they remain significantly higher even as of 1995 relative to their 1982 level. Wages in the tradable sector do not decline from 1989 to 1995, despite the large relative increase during the 1983 to 1989 period. This hints that the credit supply expansion may have reduced the long-term competitiveness of labor in the tradable sector in early deregulation states.[5]

In addition to downward nominal rigidity, we also show evidence that banking sector problems and household debt overhang played a role in explaining the worse recession in early deregulation states. We find that in the cross-section of states, of all the outcomes we measure during the boom phase, the rise in household debt from 1982 to 1989 is the strongest predictor of recession severity from 1989 to 1992. These results for the early 1990s recession confirm the pattern found by other researchers across U.S. counties during the Great Recession (Mian and Sufi (2014a)), across countries during the Great Recession (Glick and Lansing (2010), IMF (2012)), across countries

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[5]Rodrik and Subramanian (2009) argue foreign finance can inhibit long-run growth because capital inflows appreciate the real exchange rate and reduce the returns to tradable sector investment.

during the 1990 to 1991 recession (King (1994)), and in a large panel of countries from the 1960s through 2010 (Mian et al. (2017)).

One concern with our results is that early banking deregulation states are different on other dimensions that can explain stronger lending growth and a more amplified cycle. There is already an established body of research examining the plausibility of treating bank branch restrictions as exogenous to other state-wide conditions (e.g., Kroszner and Strahan (2014)). Moreover, our result that the economic expansion is driven by demand indicates that stronger credit growth in early deregulating states was not caused by an unobserved positive productivity shock in these states.[6]

In addition to the evidence from the existing literature, we provide support for the exclusion restriction assumption through placebo tests where we examine whether states that deregulated their banking sectors in the late 1970s and early 1980s had more cyclical lending and economic outcomes in previous economic cycles in the 1960s and 1970s. We find no evidence of a differential loading on macroeconomic conditions using data from the 1960s and 1970s. In particular, states that deregulated their banking sector earlier in 1980s did not see stronger loan growth nor stronger employment growth in the non-tradable sector during the expansions from 1975 to 1979, or 1970 to 1973, or 1962 to 1967. Likewise, when we measure other expansion and contraction phases in the 1960s and 1970s, we find no evidence of a larger beta on aggregate economic growth in states that deregulated their banking sector earlier in the 1980s.

Our paper is closely related to the extensive literature examining the effects of banking deregulation during the 1980s on various economic outcomes, a literature started by Jayaratne and Strahan (1996). We believe the finding that states with a more deregulated banking system in the 1980s experienced an amplified business cycle is new to the literature, as is our separation of the effects of deregulation on local demand versus labor productivity. We further relate our study to this literature in the next section.

Our work linking financial deregulation to house prices is related to Favara and Imbs (2015) who exploit variation in US bank branching deregulation from 1994 to 2005 to show that an increase in credit supply due to deregulation causes an increase in house prices.[7] More generally, our work is

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[6]In a panel of 34 countries Gorton and Ordoñez (2016) argue that credit booms start with a positive productivity shock. However, in booms that end in a bust ("bad booms") this productivity shock is temporary and disappears quickly.

[7]Landier et al. (2017) show that financial integration through interstate banking deregulation led to increased co-movement in house prices across US states.

related to research exploring causes of business cycle fluctuations of the 1980s and 1990s (e.g., Hall (1993) and Blanchard (1993)). Di Maggio and Kermani (2016) focus on the 2004 to 2009 economic cycle and use variation in predatory lending laws across states as an instrument for mortgage credit supply expansion. They also find an amplified business cycle in states more exposed to the aggregate credit supply shock. Borio et al. (2016) show that periods of rapid growth in credit are associated with labor reallocation to lower productivity growth sectors, construction in particular.

The rest of this study proceeds as follows. In the next section, we discuss banking deregulation in the 1980s, our methodology, and the relation of our study with existing research on banking deregulation. Section 3 presents the data and summary statistics. Sections 4 through 6 present results, and Section 7 concludes.

2   Banking Deregulation, Methodology, and Relation to Literature

2.1   Banking deregulation

The United States experienced a period of significant deregulation of the banking sector in the 1980s, with the pace of deregulation differing across states. Deregulation consolidated the fragmented banking system in multiple ways. First, out-of-state banks were gradually allowed to operate in various states. Second, intra-state branching restrictions were removed to allow banks to expand their branch network within a state.[8] Our empirical methodology uses variation in the timing and pace of the implementation of deregulation across states to estimate the impact of credit supply shocks on the financial and economic activity in the state from 1978 to 1995.

Table 1 lists each state and the year in which it removed restrictions on inter-state bank branching and intra-state bank branching. The two types of deregulation are positively correlated with a correlation coefficient of 0.46. Following the existing literature on deregulation, our methodology excludes South Dakota and Delaware, two states that took advantage of elimination of usury laws to attract credit card businesses.[9]

Table 1 shows that there is not a single date (or year) when a state's banking system went

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[8]These changes only applied to commercial banks.

[9]Arkansas did not fully deregulate the intra-state restrictions until 1996. Although Maine permitted out-of-state bank holding companies (BHC) to operate in 1978, the statute only permitted this if the home state of the acquiring BHC reciprocated by permitting Maine-based BHCs to operate in their state. This only happened in 1982, when Alaska, Massachusetts, and New York permitted out-of-state BHCs to enter.

from strong regulation to weak regulation. Instead, deregulation was a continuous process that occurred across states at different times. Moreover, the years shown in Table 1 reflect the start of a deregulation process that expanded over time. For example, the year of inter-state banking deregulation is the first year that a state allowed *some* out-of-state banks to open a branch. The decision to allow out-of-state banks to open branches was based on bilateral arrangements between states, until the Riegle-Neal Act of 1994 opened inter-state banking everywhere. Once states allowed some out-of-state banks to operate within their state, the state typically expanded the list of states over time.[10]

To take into account the continuous process and varying pace of bank deregulation across states, we utilize a measure of state-level banking deregulation that is based on the number of years since deregulation began in the state as of 1989. A higher measure indicates more deregulation as of 1989, as the state began deregulating further into the past. More specifically, we use 1989 minus the initial year of inter-state and intra-state branching deregulation as the two variables of interest. Since we focus on the aggregate credit supply expansion during the 1980s, we cap this value at 10, treating states that deregulated before 1979 equally. For each state we then take the average of these two deregulation variables to obtain a single "deregulation measure" that captures the combined effect of the two types of deregulation.[11] For Connecticut, for example, the first measure takes on the value (1989-1983=) 6 and the second measure takes on the value (1989-1980=) 9, which gives it a high deregulation score relative to the mean. The last column of Table 1 shows the deregulation measure by state.[12]

As we explain below, we are exploiting the positive aggregate credit supply shock that occurred during the 1980s. As a result, one concern with the measure of deregulation described above is that it exploits variation in state decisions on deregulation that occurred during the credit boom. An alternative measure of deregulation is to create an indicator variable that is one if a state implemented either intra- or inter-state deregulation as of 1983 or earlier, and zero otherwise.

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[10]Michalski and Ors (2012) report in detail how these bilateral arrangements expanded over time in each state until the Riegle-Neal Act.

[11]Specifically, our deregulation score for a state s is defined as the standardized value of $.5 \sum_{j \in \{inter, intra\}} \min\{\max\{1989 - DeregYear_{j,s}, 0\}, 10\}$.

[12]In Table A1 in the appendix, we show regressions relating credit expansion in a state during the 1980s to the year of removal of inter-state branching restrictions and intra-state branching restrictions separately. For both intra- and inter-state branching restriction removal, states with earlier deregulation years see larger growth in credit during the 1980s.

Twenty-two states are early deregulators according to this measure, and this measure is highly correlated with our main measure described above. A univariate regression of our main measure on the 1983 measure yields an R^2 of 0.84.

2.2 Theory

We outline a simple two-sector small open economy model that yields two predictions about the real consequences of credit supply expansions. First, we show that credit supply shocks that boost household demand will tend to raise employment in the non-tradable sector relative to the tradable sector. At the same time, higher demand will push up the prices of local non-tradable goods. In contrast, credit supply shocks that expand tradable or non-tradable firms' labor productivity do not make this joint prediction.[13] Second, in the presence of frictions such as downward nominal wage rigidity, a reversal of the credit supply expansion will lower employment after the boom, generating a more amplified business cycle relative to a counterfactual with a less pronounced credit cycle.[14]

In what follows we refer to household credit shocks as shocks that raise local demand and firm credit shocks as shocks that improve the labor productivity of firms. In many cases this distinction between household and business credit is a reasonable approximation, but we note that in some cases firm borrowing can also raise local demand. We discuss this issue in more detail below.

2.2.1 Environment

Consider a state in a currency union with a tradable (T) and non-tradable (N) production sector. Time is discrete and is indexed by $t = -1, 0, 1, \ldots$ In the model $t = 0$ refers to the boom phase, and $t = 1$ is the bust. We therefore think of one period as representing the duration of half a cycle (e.g., an expansion of 5 years). To minimize notational clutter we omit the state subscript. There is a representative households with preferences

$$\sum_{t=-1}^{\infty} \beta^{t+1} u(C_t - v(L_t)),$$

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[13]This prediction draws on insights from Bahadir and Gumus (2016).

[14]This mechanism is central to the model in Schmitt-Grohé and Uribe (2016).

where below we assume $u(C_t - v(L_t)) = \log(C_t - \frac{1}{2}L^2)$. Consumption, C_t, is a Cobb-Douglas aggregate over tradable and non-tradable consumption, $C_t = A(C_{T,t}, C_{N,t}) = C_{T,t}^\alpha C_{N,t}^{1-\alpha}$. We assume that a fraction θ_H of the household's members can borrow at the risk free rate i_t plus a spread s_t, while the remaining fraction $1 - \theta_H$ borrow at the risk free rate i_t. The interest rate faced by the household as a whole is thus $i_t + \theta_H s_t$. The value of θ_H captures the household sector's exposure to the state's credit supply shock s_t. The household is subject to the sequence of budget constraints

$$C_{T,t} + P_{N,t}C_{N,t} + B_t = W_t L_t + \frac{B_{t+1}}{1 + \theta_H s_t + i_t} + \Phi_t,$$

where $P_{N,t}$ is the price of the non-tradable good relative to the tradable *numeraire*, W_t is the nominal wage, B_t is one-period debt brought into period t, and Φ_t is profits from ownership of the firms in the tradable and non-tradable sectors. The risk-free rate is set a the union-wide level, and we assume that $i_t = i = \frac{1}{\beta} - 1$, so that debt is constant in a steady state with $s_t = 0$. For simplicity we assume that the household starts off with zero debt, $B_{-1} = 0$.

The household's first order conditions are

$$\frac{A_{C_{N,t}}}{A_{C_{T,t}}} = P_{N,t}$$

$$\frac{v'(L_t)}{A_{C_{N,t}}} = \frac{W_t}{P_{N,t}}$$

$$u'(C_t - v(L_t))A_{C_{T,t}} = \beta(1 + \theta_H s_t + i_t)u'(C_{t+1} - v(L_{t+1}))A_{C_{T,t+1}}$$

Firms in the tradable and non-tradable sectors produce output with labor as the only input using a decreasing returns production function, $Y_{j,t} = A_j L_j^{1-\eta}$, where $j \in \{T, N\}$. As in Neumeyer and Perri (2005), firms face an intra-period working capital constraint and need to borrow $\theta_j \in [0, 1]$ fraction of the wage bill, $W_t L_{j,t}$, between the start and end of each period at a cost $r_t = i_t + s_t$. The sector j firm's first order condition for labor is

$$W_t = (1 - \eta)P_{j,t}\frac{A_{j,t}}{1 + \theta_j r_t}L_{j,t}^{-\eta}, \qquad j \in \{T, N\}.$$

When the working capital constraint is positive $\theta_j > 0$, a reduction in the cost of working capital r_t leads to a rise in labor demand for a given wage. A reduction in r_t is thus similar to an increase

in the firm's productivity.

In each period the labor market and non-tradable goods market clear

$$L_{N,t} + L_{T,t} = L_t$$

$$C_{N,t} = A_{N,t}L_{N,t}^{1-\eta},$$

and the state's budget constraint satisfies

$$C_{T,t} + B_t = A_{T,t}L_{T,t}^{1-\eta} - \omega_t + \frac{B_{t+1}}{1 + \theta_H s_t + i_t},$$

where $\omega_t = \theta_T r_t W_t L_{T,t} + \theta_N r_t W_t L_{N,t}$ is the working capital expense.

2.2.2 Outcomes during the expansion

We model the aggregate credit supply expansion in the 1980s as a temporary reduction in the interest rate faced by households and firms, and we assume that early deregulation states experience a larger decline in the interest rate. Specifically, we assume that there is a nationwide credit supply process S_t that declines for one period in $t = 0$. A state that deregulated early is assumed to load more on this aggregate supply process and therefore experience a larger decline in s_0 than a late deregulator. So starting in $t = -1$, a state that deregulated early experiences the sequence of interest rates $(i, i + s_0^{early}, i, i, ...)$, whereas a state that deregulated late faces interest rates $(i, i + s_0^{late}, i, i, ...)$, with $s_0^{early} < s_0^{late} < 0$.[15] We explore the effect of this shock separately for case when the shock operates mainly through household demand (high value of θ_H), through supply of non-tradables (high θ_N), or through supply of tradables (high θ_T).

Consider first the case where credit supply operates solely through household demand, so that $\theta_H > 0$ and $\theta_T = \theta_N = 0$. The top left panel of Figure 2(a) shows an example of the path of $(i + s_t)$ for an early and late deregulator. Since households in the more deregulated state experience a larger decline in the interest rate in $t = 0$, debt rises more to fuel a boost in consumption (top middle-left panel). The boost to local demand in $t = 0$ raises non-tradable employment and the price on the

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[15]The credit supply expansion here is modeled simply as a reduction in the interest rate. One could instead assume that credit supply expansion relaxes borrowing constraints for households and firms, and the qualitative results would be unchanged. See Bahadir and Gumus (2016) for an example of such a model.

non-traded good, as the non-tradable good becomes relatively scarce. The *real appreciation* leads to a reallocation of labor from the tradable to the non-tradable sector.

Next suppose that only non-tradable firms are exposed to the credit supply shock, $\theta_N > 0$ and $\theta_H = \theta_T = 0$. Since the credit supply expansion is assumed not to affect households, Figure 2(b) shows that household debt does not rise more in the deregulated state in $t = 0$. The reduction in the cost of funds for non-tradable firms acts as an increase in non-tradable productivity, raising labor demand. Labor in the non-tradable relative to tradable sector thus increases more in the more deregulated state. However, in contrast to the first case where non-tradable employment growth is driven by household demand, in this case the price of the non-tradable good *declines* because of the credit supply shock boosts non-tradable firm supply.

Third, Figure 2(c) shows an example where the working capital constraint only applies to tradable sector firms, $\theta_T > 0$ and $\theta_H = \theta_N = 0$. As in the previous case, households are not exposed, so household borrowing does not increase. The lower cost of working capital increases the tradable firm's demand for labor, leading to an expansion in tradable relative to non-tradable employment. Since the household's preferences are homothetic over tradable and non-tradable consumption, this leads to a rise in the price of the non-tradable good, mitigating the increase in the tradable employment share.

In sum, a credit supply expansion that operates through household demand makes the joint prediction that the non-tradable employment share and the price of non-tradables both increase. Credit shocks that boosts tradable or non-tradable firm supply make the opposite prediction either for the price of non-tradables or the non-tradable employment share. This is a key qualitative prediction we take to the data to investigate whether banking deregulation operated mainly by stimulating household demand or by expanding firm supply.

2.2.3   Outcomes during the contraction

To capture the reversal of the aggregate credit supply process in 1989 and 1990 depicted in Figure 1, we assume that the negative interest rate shock s_0 reverts to zero in period $t = 1$. From $t = 1$ onward households and firms in both early and late deregulating states face the same interest rate $i = \frac{1}{\beta} - 1$.

Following Schmitt-Grohé and Uribe (2016) we assume that the nominal wage cannot adjust

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downward between period $t = 0$ and $t = 1$. That is, we assume $W_1 \geq W_0$. From period $t = 2$ onward the economy is in the long-run steady state, and the wage is fully flexible.[16] Since the evidence presented below indicates that banking deregulation operates in large part through a demand channel, we focus the discussion on the case where $\theta_H > 0$ and $\theta_T = \theta_N = 0$.[17]

The bottom right panel of Figure 2(a) shows that the demand expansion in period $t = 0$ boosts the nominal wage W_0. In period $t = 1$, however, debt growth stalls in response to the reversal of the interest rate, and local demand contracts. Because of downward nominal wage rigidity, the household is off the labor supply condition $(\frac{v'(L_1)}{A_{C_{N,1}}} \neq \frac{W_1}{P_{N,1}})$, and there is an excess supply of labor at the elevated wage $W_1 = W_0$. As a result the economy experiences a bust in non-tradable and total employment in $t = 1$. As in Schmitt-Grohé and Uribe (2016), the bust is caused by the fact that during the boom agents do not internalize that an increase in the wage will generate unemployment if the boom subsides. The expansion in local demand combined with the assumption of downward nominal wage rigidity can therefore generate a more *amplified* business cycle in more relative to less deregulated states.

Our discussion has focused on the effect of deregulation on product demand through an increase credit supply. However, we believe that similar predictions for the real economy would obtain if deregulation boosted demand by stoking overoptimistic beliefs about future income. In this case, if households can borrow to finance higher consumption there is also a local demand boom. Since beliefs are overoptimistic, the boom is temporary and reverses once households revise their expectations down. The boom drives up wages, the non-tradable price, and non-tradable employment, but with downward wage rigidity the subsequent fall in demand again leads to a fall in employment.[18] Note that if deregulation operates through elevated beliefs and households have limited liquid assets, the expansion in demand only materializes when households can borrow to finance a boost to consumption.

Finally, our model is stylized and abstracts from several potentially important effects of credit shocks. An obvious omission is that the model does not include capital. In Bahadir and Gumus

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[16] More generally, we could assume that the wage could only adjust partially downward in each period so that convergence to the steady state takes several periods.

[17] In section 6, however, we present evidence that banking sector losses from 1989-1992 led to a contraction in bank lending to firms that reduced employment even in the tradable sector. This can be captured as an increase in interest rates faced by firms, raising the cost of working capital, as in Figures 2(b) and 2(c).

[18] A similar logic applies if deregulation boosts house prices, fueling home equity extraction and a temporary consumption boom.

(2016) firms produce with capital and labor, and capital is is produced from tradable output. They find similar effects of credit shocks on employment and prices. If, however, producing the investment good requires a non-tradable input, then a tradable credit shock also expands demand for non-tradable goods, boosting non-tradable employment. An example is a tradable credit shock that increases firms' investment in commercial real estate. Similarly, a tradable credit shock would also boost non-tradable employment if preferences over tradable and non-tradable consumption are complements (elasticity of substitution less than one). Nevertheless, even if a tradable credit shock increases non-tradable employment, as in both of these examples, we would still expect a rise in tradable employment.[19] As we discuss in section 4, we find no evidence that credit supply expansion boosts tradable employment.

2.3   Empirical Methodology

As in the theoretical model above, our empirical methodology starts with the assumption that there is an underlying process determining the aggregate credit cycle from 1982 to 1992 in the United States. We are agnostic on the fundamental source of this underlying process. Behavioral biases of lenders, changes in financial technology, or monetary policy are all potential drivers of this process. Existing research points to monetary policy shocks as playing an important role in the economic cycle of the 1980s (Walsh (1993) and Feldstein (1993)). For example, when discussing economic growth during the mid- to late-1980s, Walsh (1993) argues that "almost half of the rise in GDP is attributed to monetary expansion." He also attributes the 1990-91 recession to tightening monetary policy and its associated fall in spending. Feldstein (1993) also suggests that Fed's monetary easing, starting in mid-1982, created an environment for growth and Fed tightening in 1990 contributed to the 1990/1991 recession.

Our methodology requires that we define the turning points of the aggregate credit cycle. Perhaps the easiest definition comes from the NBER recession dates, which have the expansion period beginning in November 1982 and the recession beginning in July 1990. The turning points using credit measures are similar. As shown in Figure 1, the Baa-Aaa spread peaked in September

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[19]In the extreme case where preferences are Leontief over tradable and non-tradable consumption, a rise in tradable labor productivity would actually reduce tradable employment as workers are reallocated to the non-tradable sector. An implicit assumption for the predictions of the sectoral effects of credit shocks is therefore that complementarities between the tradable and non-tradable sector are not too strong.

of 1982 but did not begin falling sharply until January 1983. We only have information on the high yield share on an annual basis. It was relatively steady from 1981 to 1982, and then rose sharply afterward. The contraction phase is less consistent across the measures. The high yield share fell by 16 percentage points from 1988 to 1989, and then fell by 35 percentage points from 1989 to 1990. In contrast, the Baa-Aaa spread continued to decline until the summer of 1990 when it began to rise. Based on these patterns, we define the expansion phase from 1982 to 1989, and the contraction phase from 1989 to 1992. But we present results for the each year in graphical from to show the full timing transparently.

Following the model above, our goal is to understand how this aggregate credit cycle differentially affects states based on how deregulated their banking system was during the 1980s. We begin by exploring the differential increase in lending, employment, consumer prices, and wages during the expansion phase from 1982 to 1989. More specifically, we estimate equations of the following form:

$$\Delta_{82,89} Y_s = \alpha^{boom} + \pi^{boom} \cdot DEREG_s + \Gamma^{boom} \cdot Z_s + \epsilon_s^{boom} \tag{1}$$

where $\Delta_{82,89} Y_s$ reflects the growth in a given outcome variable from 1982 to 1989, $DEREG_s$ is the deregulation measure capturing the extent of deregulation in the 1980s (described above), and Z_s is a set of control variables. The key coefficient is π^{boom} which measures whether early deregulation states witness lower or higher growth in outcome Y from 1982 to 1989.

We then turn toward empirical tests to assess whether states with a more deregulated banking sector see an amplified business cycle from 1982 to 1992. We use three different techniques. First, we run first difference regressions separately for the boom and bust, showing that outcomes Y such as GDP or residential construction increase by more in early deregulation states from 1982 to 1989 and fall by more in early deregulation states from 1989 to 1992. The boom equation is already shown above in equation 1, and the bust equation takes the following form:

$$\Delta_{89,92} Y_s = \alpha^{bust} + \pi^{bust} \cdot DEREG_s + \Gamma^{bust} \cdot Z_s + \epsilon_s^{bust} \tag{2}$$

We also exploit the full state-year panel by estimating equations of the following sort:

$$Y_{st} = \alpha_s + \gamma_t + \sum_{q \neq 1982} \mathbb{1}_{t=q} \cdot DEREG_s \cdot \beta_q + \epsilon_{st} \tag{3}$$

This specification yields a series of estimates of β_q in order to show the full dynamics for outcome Y, and how they differ for early versus late deregulation states.

Finally, we also use a specification motivated by asset pricing tests where one wants to under-stand the "loading" of a specific asset return on aggregate factors such as the overall market return. As mentioned above, we believe there are two aggregate states during our time period: expansion from 1982 to 1989, and contraction from 1989 to 1992. And we want to understand how a state's loading on the aggregate state differs based on the extent of banking deregulation in the 1980s. The specification takes the following form:

$$\Delta Y_{sb} = \alpha + \beta \cdot \Delta S_b \cdot DEREG_s + \gamma \cdot \Delta S_b + \delta \cdot DEREG_s + \epsilon_{sb} \tag{4}$$

The equation is estimated in changes using two periods, the boom from 1982 to 1989 and the bust from 1989 to 1992 (i.e., $b = \{boom, bust\}$). The key coefficient of interest is β, which measures the differential loading of early deregulation states for outcome Y on the aggregate cycle S_b. We use log aggregate GDP as our aggregate S_b measure. For example, one of the outcomes we examine is state level GDP. In this case, ΔY_{sb} is the log change in state level GDP during the boom and bust, and β measures whether log state GDP in early deregulation states changes more for a given change in log aggregate GDP.

2.4 Exclusion restriction

Our strategy above assumes that the extent of deregulation across states generates state-level credit supply shocks, and then we examine how these differential state-level credit supply shocks affect economic outcomes. An obvious concern is that states that deregulate earlier experience other shocks during the 1980s that explain our results. For example, if deregulation occurred earlier in states that had better income prospects, then the more rapid expansion in credit or residential construction from 1982 to 1989 may be due to better income prospects as opposed to more credit

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supply from a more liberalized banking sector.

The source of variation in banking deregulation has already been researched extensively. Kroszner and Strahan (2014) provide an excellent review of the banking deregulation literature. States initially restricted bank entry and geographical expansion in order to generate revenue through granting state charters, owning bank shares and taxes. Kroszner and Strahan (1999) argue that a combination of public and private interest kept these banking restrictions in place until the 1980's, but technological innovations, e.g. the advent of money market funds, the ATM and credit scoring models, eroded the competitive edge of small local banks. Such developments reduced opposition to deregulation, and states started to deregulate with Republican controlled states typically deregulating earlier.[20]

While a number of political and technological factors contributed to the varied timing of deregulation across U.S. states, Kroszner and Strahan (2014) argue that "there is no correlation between rates of bank failures or the state-level business cycle conditions and the *timing* of branching reform." They further argue based on results from earlier work that "states did *not* deregulate their economies in *anticipation* of future good growth prospects."[21]

We also conduct a number of placebo tests using prior economic cycles. As we will show, states that deregulated their banking sectors earlier in the 1980s did not see differentially large credit growth during the economic expansions of the 1960s and 1970s. Likewise, before the 1980s, we find no evidence that early deregulation states had an amplified economic cycle relative to late deregulation states.

An alternative concern is that some states responded to the positive credit supply shock by deregulating their banking sector during the mid-1980s, and such states are those that otherwise would expand the most given a credit supply shock. To address this concern, we conduct all results using the alternative deregulation measure described above which categorizes a state as an early deregulator if it removed either intra- or inter-state branch restrictions as of 1983. As we show in Appendix Tables A8-A11, the results we find are robust to the use of this alternative deregulation measure, which does not use information on deregulation decisions during the credit boom.

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[20]Kane (1996) further argues that failure of geographically concentrated banks that imposed costs on local population also lowered the appetite of restrictive regulation among the public. For example, exemptions were specifically granted for out of state banks to acquire failing banks and savings institutions.

[21]These results are based on the work of Jayaratne and Strahan (1996), Kroszner and Strahan (1999), and Morgan et al. (2003).

2.5 Comparison to literature

Our focus on how banking deregulation during the 1980s amplified the business cycle is different from the analysis in the extensive existing body of research exploring deregulation. More specifically, our empirical methodology generates state-level credit supply shocks from 1982 to 1992 based on the extent of banking deregulation in the state during the 1980s, and explores how these differential shocks affected the overall economic cycle during this period. In contrast, the existing literature, summarized by Kroszner and Strahan (2014), examines the short-run effects of banking deregulation on various outcomes in a given state after removing state and year fixed effects.[22] The core specification used in these studies estimates the coefficient on a deregulation indicator variable that turns on at a particular time in a state:

$$Y_{st} = \alpha_t + \alpha_s + \beta * DEREG_{st} + \epsilon_{st} \tag{5}$$

Here, β measures the within-state change in Y from before to after deregulation relative to states that have either already deregulated or not yet deregulated.[23]

There are some key distinctions between our methodology and the methodology in equation 5. Equation 5 focuses on the short-term impact of deregulation instead of the medium-term impact.[24] For example, consider two states that deregulate three years apart. Equation 5 estimates the effect of deregulation by comparing differences between the two states when one state has started the deregulation process but the other has not. However, once both states have deregulated, differences between these states are not attributed to deregulation. In this way, the specification is designed to focus on the shorter-term immediate impact of deregulation.

A focus on the immediate short-term may miss medium-term effects of financial deregulation over the full business cycle. For example, Mian et al. (2017) show that three to four year increases

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[22] Strahan (2003) shows that interstate deregulation as opposed to intra-state branching deregulation led to significantly increased banking acquisitions. Kroszner and Strahan (2014) and Black and Strahan (2001) follow specification 5 to estimate the (short-term) effects of deregulation in panel-data. They find that the share of small banks falls significantly, and bank efficiency as measured by noninterest costs, wages, and loan losses increases when states deregulate. Jayaratne and Strahan (1996) follow equation 5 and find that intra-state branching deregulation leads to a higher growth rate of about one-half to one percentage point.

[23] In Tables A4 through A6 of the appendix, we replicate the specifications from Jayaratne and Strahan (1996). We find similar results for economic growth, and we also find a significant effect of deregulation on bank loan growth using Call Report data.

[24] Jayaratne and Strahan (1996) acknowledge this implication of the specification, and perform additional tests to focus on longer term impact.

in credit supply boost economic growth contemporaneously, but then lead to subsequently lower growth between four and seven years after the initial shock. In the setting of Mian et al. (2017), a methodology that focuses exclusively on the contemperaneous period will find that higher credit supply boosts growth, but it will miss the subsequent reversal. Our methodology outined above is meant to capture both the short- and medium-run effects of deregulation on financial and economic outcomes.

Another key difference is that our specifications are designed to capture the higher loading on aggregate credit supply shocks that comes from a longer cumulative period of deregulation. In contrast, the methodology in equation 5 treats two states equally once they are both deregulated even if one deregulated much earlier than the other. For example, let us compare a state that deregulates its banking sector in 1982 versus a state that deregulates in 1988, and let us assume that deregulation boosts lending gradually over the subsequent five years after deregulation. As of 1989, we would expect for the state that deregulated in 1982 to have a larger cumulative increase in lending from deregulation than the state that deregulated in 1988, and hence be more vulnerable to a credit supply contraction in 1989. Our methodology is designed to capture exactly this heightened vulnerability, whereas the methodology in equation 5 would miss it by treating both states as the same as of 1989.

Another related study is Morgan et al. (2003), who find that state-level idiosyncratic volatility in economic growth declined with banking integration across states after deregulation. More specifically, Morgan et al. (2003) first estimate the idiosyncratic component of economic growth in a state-year by obtaining the residual from regressing growth in a state-year on year and state indicator variables. They then show that these residuals decline in a given state as the banking system becomes more integrated due to deregulation. The finding of lower idiosyncratic volatility in economic growth after deregulation in Morgan et al. (2003) is distinct from our finding of a higher loading, or "beta," on aggregate GDP growth.

3 Data and Summary Statistics

We construct a state-year level data set for the 1980s and 1990s with information on bank credit, household debt, house prices, retail sales, employment by industry, wages, unemployment, resi-

dential construction, inflation, and GDP. The state-year level data on household debt and retail sales are new to the literature. Information on household debt comes from three sources. First, we calculate household debt using a random sample of individual tax return data at the NBER. We follow the capitalization methodology used by Saez and Zucman (2016) to impute total household debt and income at the state level. This calculation excludes the top 2 to 3% of filers for whom state identifiers are missing for confidentiality reasons. Our second source of household debt is HMDA data which reports data at the loan application level. We aggregate this data at the state level to compute total number and amount of loan applications. Unlike HMDA data from 1991 onwards, the earlier sample does not tell us whether a loan is actually originated.

Third, we measure credit to households using bank-level Call Report data at the state level.[25] We use two different measures of loans to the household sector derived from Call Report data. Household loans include real estate loans and loans to individuals. Consumer loans are loans to individuals, and "loans secured by 1-4 family residential properties, revolving open end loan." The first measure includes all mortgage debt, whereas the second measure is the cleanest measure of consumer loans other than mortgages used to purchase a new home. The second measure includes home equity loans, but not primary mortgages. Consumer loans are a sub-set of household loans.

One potential problem with using Call Report data to measure household debt is that a significant fraction of household mortgages are ultimately securitized and held by the GSEs. Moreover, as Kroszner and Strahan (2014) report using data from Frame and White (2005), the share of mortgages held by GSEs expanded by more than 20 percentage points during the 1980's. The corresponding share fell for banks and saving institutions. While banks were actively involved in originating mortgages during this period, they increasingly sold these mortgages to the GSEs. We have three sources from which we measure the growth in household debt from 1982 to 1989: the IRS, HMDA, and Call Report data. As mentioned above, each has certain drawbacks. As a result, we construct a variable *household leverage index* which is the first principal component of the change in the household debt to income ratio, growth in mortgage loan applications, and growth in consumer loans.

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[25] More specifically, Call Report data come from the Commercial Bank Database from the Federal Reserve Bank of Chicago, which contains data of all banks filing the Report of Condition and Income that are regulated by the Federal Reserve System, Federal Deposit Insurance Corporation (FDIC), and the Comptroller of the Currency. We do not have data from savings institutions (e.g., S&L associations) that file with the Office of Thrift Supervision (OTS).

In terms of real variables, our data set includes total employment from the County Business Patterns data set published by the U.S. Census Bureau. We classify employment into non-tradable, construction, and tradable industries using the classification scheme in Mian and Sufi (2014b). Our data set also includes state-level retail sales data from 1986 to 1996 for 19 states from the Census, which were obtained from the Census website. Our measure of residential construction is based on new building permits collected by the Census, and is available at the state-year level for our full sample starting in 1980.

We utilize state-level inflation series from Del Negro (1998), which is also utilized in Nakamura and Steinsson (2014). In addition, to construct state-level CPI inflation for subcategories of goods, we use the Bureau of Labor Statistics MSA level CPI series, which begin in 1984. More specifically, to proxy for the price of non-tradable goods in an MSA, we use the BLS price index for services, and to proxy for the price of tradable goods in a given state, we use the BLS price index for commodities. We average across all MSAs in a state to obtain the state-level index. This is available for only 26 states in our sample.

We also estimate state level wages from the CPS Outgoing Rotation Group using the CEPR extracts, which are cleaned and adjusted for top-coding.[26] We construct both raw and residualized state average hourly wages for workers age 21-55. Residual wages are constructed by estimating log hourly wages on age dummies, education dummies, and race dummies for each year. We estimate the wage equations separately for males and females and construct average wages for all workers, separately for males and females, and by industry.

Table 2 reports state-level summary statistics of the key variables used in this study. We break the sample period of 1982 to 1992 into two sub-periods: the expansion phase from 1982 to 1989 and the contraction phase from 1989 to 1992. The household debt to income ratio increased by an average of 0.21 during the expansion phase. Loans to households (which include mortgages) grew by 72%, while consumer loans (which exclude mortgages through 1987 but include home equity loans after 1987) grew 70%. Commercial and industrial loans increased by only 42%. House prices grew by 26% on average during the boom phase, but then grew by only 1% during the contraction phase. The unemployment rate fell from 1982 to 1989 on average by 4 percentage points, but then increased from 1989 to 1991 by 1.8 percentage points. The boom and bust in employment in the

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[26]The data are available from the CEPR's webpage.

non-tradable and construction sectors was especially pronounced. On average across states, prices rose by 24% from 1982 to 1989.

4   Deregulation and Local Demand

4.1   Credit growth

Figure 3 shows growth in aggregate loans made by the U.S. banking sector during the deregulation wave of the 1980s. The figure splits bank credit from the Call Report data into two main categories: C&I loans to businesses and household loans, where the latter category includes real estate and consumer loans. Growth in household loans is much stronger than growth in C&I loans during the period of deregulation. Household loans more than double from 1982 to 1989, but then level off during the recession. In contrast, C&I loan growth is modest after 1982.[27] The aggregate patterns suggest that the impact of banking deregulation on credit operated through household credit.

Table 3 presents estimates of the specification in equation 1 from section 2.3. Panel A presents the baseline estimates without control variables. All measures of household credit increase relatively more in states that deregulated their banking sector earlier. In terms of magnitudes, a one standard deviation increase in the deregulation measure (1.01) leads to a 0.04 increase in the household debt to income ratio, which is almost one-half a standard deviation. Growth in mortgage loan applications is also larger in early deregulation states.

All measures of credit from the Call Report data show stronger growth from 1982 to 1989 in early deregulation states. Household loan and consumer loan growth is stronger, as is commercial and industrial loan growth. This latter results suggests that the larger increase in credit in early deregulation states was not isolated to household loans. However, some caution is warranted in evaluating this result. C&I loans include loans to construction companies and local businesses, which are likely influenced by local demand effects coming from the rise in credit to the household sector. As illustrated in Section 2.2, evaluation of consumer prices and employment patterns is more informative on whether credit expansion operates more through the household versus firm sector.

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[27]The slowdown in bank loans to businesses coincides with the increase in bond financing. See Contessi et al. (2013) for evidence.

The final column reports the estimate for growth in the household leverage index from 1982 to 1989, which as mentioned above is the first principal component of the three measures of household debt growth shown in columns 1, 2, and 7. A one standard deviation increase in the deregulation measure leads to a 0.74 increase in household leverage, which is more than half a standard deviation. The specifications reported in Panel B add control variables for pre-1982 growth in the outcome variables where available. The estimates on the deregulation measure are similar.

Figure 4 presents coefficient estimates of β_q from equation 3 from section 2.3 for five measures of credit growth: the household debt to income ratio, household loans, commercial and industrial loans, consumer loans, and mortgage application volume. For all five measures, we see similar results. Prior to 1982, there is no differential increase in credit in early deregulation states. From 1982 to 1989, credit grows more strongly in early deregulation states.[28] After 1989, measures of credit growth in early deregulation states decline relative to the peak. Figure 4 shows no strong pre-trend for any of the credit variables, and it also shows a clear amplification of the credit cycle from 1982 to 1992 in states that deregulated their banking systems early relative to states that deregulated late.

The specifications reported in Table 4 test the robustness of the stronger growth in credit in early deregulation states. More specifically, we estimate equation 1 using growth in the household leverage index from 1982 to 1989 as the outcome variable and including extensive control variables. The positive estimated coefficient on the deregulation measure is robust to extensive control variables, even in this small sample of just 49 states. The estimate remains positive even when including measures of exposure to the oil industry, regional indicator variables, unemployment levels prior to the credit boom, and contemporaneous measures of GDP growth and C&I loan growth.

4.2 Employment, prices, and wages during credit expansion

The discussion in section 2.2 highlights how the behavior of tradable versus non-tradable employment and prices can be used to analyze whether credit supply shocks impact the economy primarily through their impact on local demand or labor productivity. Figure 5 presents state-level scatter plots of employment growth by sector from 1982 to 1989 against the deregulation measure. As the

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[28]Household debt-to-income in the top-left panel of Figure 4 only rises in 1987 because household debt and income grow at a similar rate before then.

upper left panel shows, employment growth is stronger in early deregulation states. Consistent with the hypothesis that credit supply shocks work through household demand, the higher employment growth in early deregulation states is driven by employment in the non-tradable and construction sector. There is no relative rise in employment in the tradable sector in early deregulation states.

We confirm these results in a regression context in Table 5. Columns 1 through 4 estimate equation 1 using measures of employment as the outcome variable. They confirm that there is a statistically significant and economically meaningful relative rise in employment in the non-tradable and construction sectors in early deregulation states. In contrast, there is no differential increase in employment in the tradable sectors in early deregulation states. In terms of magnitudes, a one standard deviation increase in the deregulation measure leads to a 6% and 16% larger increase in employment in the non-tradable and construction industries, respectively. For both industries, this is one-half a standard deviation of the outcome variable.[29]

In columns 5 through 8, we utilize a data set covering employment growth from 1982 to 1989 at the state by 2 digit industry level. This data set allows us to fully control for 2-digit industry fixed effects and state fixed effects. We do so in the specification reported in column 8, which shows a relative increase in employment in the non-tradable and construction sectors from 1982 to 1989 in early deregulation states. The inclusion of 2-digit industry fixed effects ensures that the coefficient estimate on the deregulation variable is independent of any secular trends related to a state's industrial composition.

In Figure 6, we explore predictions from the model on consumer price inflation. As the top left panel shows, early deregulation states see higher inflation rates during the credit expansion phase from 1982 to 1989. When we split the prices of consumer goods into non-tradable (services) and tradable (commodities) categories, we see that the positive correlation is significantly stronger for the price of non-tradable goods. Table 6 presents similar results in a regression context. There is a larger rise in consumer prices in early deregulation states from 1982 to 1989 which is driven in particular by consumer prices of non-tradable goods. In terms of magnitudes, a one standard deviation increase in deregulation leads to 2% larger increase in prices of all goods from 1982 to 1989 and a 4% larger increase in prices of non-tradable goods. In column 5 of Table 6, we show

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[29]In Table A2 of the appendix, we include a control variable for the exposure of the labor force in a state to Chinese import competition from Autor et al. (2013). The results are similar with inclusion of this control variable.

that the relative rise in consumer prices of non-tradable goods is statistically significantly larger compared to prices of tradable goods.

Overall, the results on the growth in employment and prices are consistent with a model in which credit supply expansion boosts household demand in early deregulation states. The results are inconsistent with the view that the dominant impact of credit supply expansion is to boost labor productivity among either tradable or non-tradable firms.

As shown in Section 2.2, all three types of credit shocks result in higher wage growth. We confirm this pattern in Figure 7 and Table 7. Wage growth is significantly stronger in early deregulation states from 1982 to 1989. This is true for both males and females, and across all industries. The magnitude is large. A one standard deviation increase in the deregulation measure leads to more than a half standard deviation increase in average wages. The relative growth of wages in early deregulation states is especially strong for construction and non-tradable firms. As we will show below, the stronger growth in wages does not revert during the recession.

4.3 Placebo tests from earlier expansions

One concern with the results above is that states that deregulated their banking sector earlier are more cyclical states. Perhaps early deregulation states always experience a larger expansion in credit, consumer prices, wages, and employment in the non-tradable sector during economic expansions? We test this hypothesis in Table 8, and we find no evidence supporting it.

More specifically, we measure economic expansions using the NBER recession dates, where an expansion is measured from the trough of the last recession to the peak before the next recession. For the 1960s, we present also an alternative definition of the expansion from 1960 to 1967 given some evidence that the credit cycle peaked in 1967 instead of 1969. We then present specifications similar to equation 1, but using the dates of previous economic expansions instead of 1982 to 1989. We estimate specifications for whichever outcomes we can measure going back in time.

Across the 15 specifications for which we have outcome variables available, we find only one positive and statistically significant coefficient for previous expansions (consumer price growth from 1970 to 1973). Overall, the evidence is difficult to reconcile with the view that states that deregulated their banking sectors early in the 1980s always witnessed larger credit growth or a

larger boost in demand for non-tradable goods during economic expansions.[30]

5   Business Cycle Amplification

5.1   Main results

The relative rise in debt, non-tradable employment, consumer prices, and wages in early deregulation states all point to a boom in economic activity. Further, credit supply expansion that fuels demand could be followed by a more severe subsequent downturn when credit supply contracts. To examine this hypothesis, we focus in Figure 8 on four measures of economic activity available for the full sample period: the unemployment rate, real GDP, new construction of residential units, and house prices. More specifically, Figure 8 presents coefficient estimates of β_q from estimation of equation 3 using these four outcome measures.

For all four outcomes, we see an amplified cycle in states that deregulated their banking system earlier. For example, the unemployment rate fell more in early deregulation states from 1982 to 1989, before rising sharply during the recession. Real GDP expanded significantly more in early deregulation states during the expansion, and then fell more in the recession, although the fall is not as large as with other outcomes. The patterns are most pronounced in the housing market. House prices and residential construction see a significantly stronger boom-bust pattern in early deregulation versus late deregulation states, suggesting that banking deregulation had strong effects on the housing market during this time period. For three of the four outcomes, there is no differential pre-trend, and the differences begin during the heart of the aggregate credit expansion from 1982 onwards. There is evidence that the unemployment rate was already falling in early deregulation states prior to 1982.

In Figure 9, we present scatter-plots of the change in economic outcomes in a state from 1989 to 1992 against the deregulation measure. This corresponds to equation 2 in section 2.3. The patterns for all five measures indicate significantly worse recession in early deregulation states. The upper right panel uses retail sales data which are only available from 1986 onwards. As this panel shows, early deregulation states experienced significantly lower growth in retail sales during the recession.

We test the robustness of these patterns in Table 9, which reports coefficients from both equa-

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[30]We do not have data on wages prior to 1979.

tions 1 and 2. The first four columns present results for the expansion phase from 1982 to 1989, and the fifth through eighth column presents results for the contraction phase from 1989 to 1992. The boom-bust pattern in these four outcomes is robust to control variables for exposure to oil prices, demographics, and regulatory forbearance. In terms of magnitudes, a one standard deviation increase in the deregulation measure leads to a 0.6 percentage point decline in the unemployment rate from 1982 to 1989, and a 0.9 percentage point increase from 1989 to 1992. The former is almost a third of a standard deviation and the latter is two-thirds a standard deviation. Overall, the correlation between the deregulation measure and the decline in economic outcomes during the contraction is larger in magnitude and more statistically robust than the correlation between the deregulation measure and the increase in economic outcomes during the expansion period.

Panel A of Table 10 presents estimates from equation 4 described in section 2.3. The data set is a state-level panel where the two time periods for the outcome variables are 1982 to 1989, and 1989 to 1992. Contemporaneous aggregate GDP growth is the aggregate measure we employ. For any given state, we calculate GDP growth excluding the state in question to avoid mechanical correlation. As the coefficient on the interaction term shows, early deregulation states see a stronger loading on aggregate GDP growth for all five measures. For example, a state with a deregulation measure of zero has a β of its own GDP growth on aggregate GDP growth of 0.7 to 0.9. A state with a deregulation measure of one (which is one standard deviation relative to the mean) has a β that is 1.2 to 1.3, and the difference is statistically significant at the one percent level.

5.2 Placebo tests for amplification

In Panels B and C of Table 10, we conduct placebo tests for prior economic cycles that are similar to the analysis presented in Panel A of Table 10. For the previous cycles, we use the NBER dates for expansions and recessions to define the dates of the cycle. Panel B presents results for the 1975 to 1982 cycle, where we define the end of the expansion in 1979. In contrast to the 1982 to 1992 period, there is no evidence of a differential loading on the aggregate GDP growth in the earlier cycle. If anything, there is some evidence of a smaller loading for house price growth. In Panel C, we examine the 1970 to 1975 cycle, where we define the end of the expansion in 1973. Once again, for the three outcome variables for which we have data available, we see no evidence of a differential loading on aggregate GDP growth. Taken together, the results in Table 10 Panels B

and C are inconsistent with the hypothesis that states deregulating their banking sectors in the late 1970s or early 1980s are inherently more cyclical states.

6   Why a Worse Recession?

6.1   Employment, prices, and wages during the contraction

Why did early deregulation states experience a worse recession? We begin our analysis of this question by focusing on employment. In Figure 10, we present estimates of β_q from equation 3 for employment in the non-tradable, tradable, and construction industries. These estimates show the dynamic pattern in employment for early versus late deregulation states from 1975 to 1995. The results for the non-tradable and construction industries are similar to the results for other measures of real economic activity shown in Figure 8. In particular, early deregulation states see a sharp relative rise in employment in the non-tradable and construction sectors from 1982 to 1989. Subsequently, early deregulation states witness a sharp relative drop which brings employment in these industries close to its initial level. This same pattern can be seen in total employment as well.

In our theoretical framework in Section 2.2, employment declines during the recession because wages cannot adjust downward. We see evidence of downward wage rigidity in Figure 11, which presents estimates of β_q from equation 3 for wages. As the top left panel shows, average wages in early deregulation states are almost constant in relative terms from 1989 to 1992, despite the previous large relative rise in wages from 1982 to 1989 and the significant relative rise in unemployment during the recession. When we examine wages by sector, we see evidence of a some decline in wages for jobs in the non-tradable sector, but wages are still slow to adjust. In the tradable sector, there is almost no relative decline even through 1995 despite the much larger rise in wages from 1982 to 1989. This latter result suggests that the credit boom in early deregulation states may have led to long-run higher relative wages in the tradable sector, thereby reducing competitiveness. The tradable employment dynamics in Figure 10 show suggestive evidence consistent with a loss of competitiveness. Tradable employment in early deregulation states begins to gradually decline starting in 1988, prior to the recession, although the change is not statistically significant.

Figure 12 presents estimates of β_q for the overall CPI and the tradable and non-tradable price indexes. In early deregulation states, the overall CPI and non-tradable price index stop increasing

in 1990. But, similar to wages, there is limited downward price adjustment during the recession. By 1994 there is some evidence of a modest reversal in prices for early relative to late deregulation states. These results suggest that consumer prices also face some downward rigidity, which leads to longer run real exchange rate appreciation in early deregulation states.

6.2 Disruption in the banking sector

One result that is inconsistent with our theoretical framework is the relative decline in employment for early deregulation states in the tradable sector during and after the recession. This is shown in the top right panel of Figure 10. Consistent the results above, during the 1982 to 1989 period of rapid credit growth, employment in the tradable industry does not grow disproportionately in early deregulation states. But employment in the tradable sector does show a sharper decline in growth during the contraction phase after 1989. What explains this asymmetry?

In Table 12 and Figure 13, we explore an explanation based on bigger disruption in the banking sector in early deregulation states during the contraction. In particular, we use Call Report data to construct the non-performing loans to total loans ratio ("NPL ratio") for the banking sector in a state in 1990. We construct the NPL ratio for both total and household loans. In columns 1 and 2 of Table 12, we report estimates from specifications relating the NPL ratio in a state to the deregulation measure, and it shows that early deregulation states experienced a significantly higher NPL ratio in 1990 for both total loans and household loans.

In Figure 13, we show that the larger NPL ratio in early deregulation states is concentrated in the contraction phase of 1989 to 1992. More specifically, we estimate equation 3 using the NPL ratio for total and household loans as the outcome variable, and we plot in Figure 13 the coefficient estimates of β_q. As the estimates show, the higher NPL ratio in early deregulation states is only present in the 1989 to 1992 period. Outside of this contraction period, early deregulation states do not see more non-performing loans in their banking sector.[31]

These results suggest that more severe losses by banks during the recession in early deregulation states may have had spillover effects on employment even in the tradable industry. The estimates reported in columns 3 and 4 of Table 12 are consistent with this view. If we regress total employment

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[31]The estimation in Figure 13 includes control variables. We show the results without control variables in Figure A3 in the appendix.

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growth in a state from 1989 to 1992 on NPL ratio of the banking sector in 1990, we find a large negative coefficient that is statistically distinct from zero. The estimates in column 4 show that the power of the NPL ratio in predicting employment comes from the NPL ratio on household loans.

The negative effect of early deregulation on employment growth from 1989 to 1992 seems related to larger loan losses for banks during the contraction in these states. One interpretation is that expansion in credit in early deregulation states led to larger losses for banks, which then led to a negative effect on employment during the recession. Column 5 reports an instrumental variables specification where we instrument for the NPL ratio of the banking sector with the deregulation instrument. The interpretation of such a specification is that deregulation is responsible for the larger losses in the banking sector in the state, which in turn exacerbated the decline in employment during the recession.

6.3 Household debt and the recession of 1990 to 1991

As shown above, early deregulation states witnessed larger growth in household credit, firm credit, residential construction, and real GDP from 1982 to 1989, and a larger decline in the unemployment rate. Early deregulation states also saw a more severe contraction in economic activity from 1989 to 1992. How is the boom related to the bust? All of our results are estimated in reduced form, which makes it impossible to say with certainty the underlying structural relationships between measures of the boom in a state and the severity of the subsequent regression.

With this qualification in mind, we explore in this section the role of the expansion of household debt from 1982 to 1989. Our focus on household debt is motivated by the extensive body of research showing a robust correlation between a rise in household debt and subsequently lower growth (e.g., Glick and Lansing (2010), IMF (2012), King (1994), Mian and Sufi (2014a), Mian et al. (2017)). We are also motivated by the aggregate rise in household debt that occurred during the 1980s. From 1984 to 1989, the household debt to disposable personal income ratio of the United States rose from 0.58 to 0.72 after staying roughly constant from 1963 to 1984 (see Figures A1 and A2 in the appendix). We already know from Figure 4 that early deregulation states saw a substantially larger rise in household debt from 1984 to 1989.

In Table 13, we estimate "horse-race" specifications where we examine how measures of expansion in a state correlate with recession severity during the bust. As Panel A of Table 13 shows, the

rise in household debt from 1982 to 1989 in a state, as measured by the state's household leverage index, predicts recession severity for all measures except for real GDP per capita. The explanatory power is strong: The R^2 is 0.35 or above for five of the six measures we have. Figure 14 shows the scatter plot of these regressions for all outcome variables. The rise in household debt prior to 1989 is a statistically powerful predictor of recession severity.

In Panel B of Table 13, we include five other measures of the economic expansion in the state. The coefficient estimates on the household leverage index are similar, and none of the other measures has the same predictive power as the rise in household debt. Early deregulation states saw an increase in several measures of credit and economic activity from 1982 to 1989, but the rise in household debt is statistically most powerful in predicting recession severity.

7 Conclusion

The macroeconomic implications of positive credit supply shocks are substantially different whether they primarily boost demand versus improving labor productivity. As a result, it is crucial for researchers and policy-makers to better assess which of these two channels is more powerful in the data. In this study, we develop a simple empirical methodology based on movements in employment and prices to disentangle whether credit supply shocks primarily boost demand or firms' productive capacity. We believe this methodology can be used in other contexts to help uncover the nature of credit expansion.

We implement this methodology in the context of bank deregulation across the United States in the 1980s. This is a particularly interesting environment given that many argue bank deregulation improves the allocation of resources across firms, thereby increasing labor productivity. Our results suggest that banking deregulation during the 1980s primarily affected the real economy by boosting demand as opposed to improving labor productivity. In particular, early deregulation states experienced a relative rise in household debt, and a relative increase in employment in the non-tradable sector. In contrast, employment in the tradable sector was similar in early and late deregulation states. Further, early deregulation rates witnessed substantial real exchange rate appreciation during the expansion.

Consistent with demand-based models of credit supply cycles, we find that early deregulation

states witnessed an amplified business cycle from 1982 to 1992 relative to late deregulation states. The recession of 1990 to 1991 was significantly worse in states that deregulated their banking systems earlier. This is explained in part due to downward nominal wage rigidity, banking sector losses, and elevated household debt.

We are careful to avoid normative claims: states that deregulated their banking systems earlier may end up better in the long run, and we do not claim that the regulations in place prior to deregulation were optimal or better than a deregulated system. The long run effects of deregulation are difficult to estimate precisely in our empirical setting. In Table A3 of the appendix, we estimate "long-horizon" regressions of outcomes from 1982 to 1995 on the deregulation measure. The estimates are inconclusive, based largely on the fact that standard errors are large in such long-horizon specifications. The only correlation that appears robust is a positive relation between house price growth from 1982 to 1995 and deregulation. We look forward to future research that focuses on the long-term implications of deregulation for economic growth.

Table 1: Year of State Level Deregulation

State	Inter-state deregulation	Intra-state deregulation	Dereg. measure
Alaska	1982	1970	1.62
Alabama	1987	1981	0.37
Arkansas	1989	1994	-1.43
Arizona	1986	1970	0.90
California	1987	1970	0.72
Colorado	1988	1991	-1.25
Connecticut	1983	1980	1.26
Washington, DC	1985	1970	1.08
Florida	1985	1988	-0.53
Georgia	1985	1983	0.37
Hawaii	1995	1986	-0.89
Iowa	1991	1994	-1.43
Idaho	1985	1970	1.08
Illinois	1986	1988	-0.71
Indiana	1986	1989	-0.89
Kansas	1992	1987	-1.07
Kentucky	1984	1990	-0.53
Louisiana	1987	1988	-0.89
Massachusetts	1983	1984	0.55
Maryland	1985	1970	1.08
Maine	1978	1975	2.16
Michigan	1986	1987	-0.53
Minnesota	1986	1993	-0.89
Missouri	1986	1990	-0.89
Mississippi	1988	1986	-0.71
Montana	1993	1990	-1.43
North Carolina	1985	1970	1.08
North Dakota	1991	1987	-1.07
Nebraska	1990	1985	-0.71
New Hampshire	1987	1987	-0.71
New Jersey	1986	1977	0.90
New Mexico	1989	1991	-1.43
Nevada	1985	1970	1.08
New York	1982	1976	1.62
Ohio	1985	1979	1.08
Oklahoma	1987	1988	-0.89
Oregon	1986	1985	-0.17
Pennsylvania	1986	1982	0.37
Rhode Island	1984	1970	1.26
South Carolina	1986	1970	0.90
Tennessee	1985	1985	0.01
Texas	1987	1988	-0.89
Utah	1984	1981	0.90
Virginia	1985	1978	1.08
Vermont	1988	1970	0.55
Washington	1987	1985	-0.35
Wisconsin	1987	1990	-1.07
West Virginia	1988	1987	-0.89
Wyoming	1987	1988	-0.89

Notes: The intra-state and inter-state deregulation years have a correlation of 0.46. Deregulation measure is the average of the number of years during which a state is in the process of deregulating between 1979 and 1989, according to inter-state deregulation and intra-state deregulation definitions. That is, Dereg. measure is defined as the standardized value of $.5 \sum_{j \in \{inter, intra\}} \min(\max(1989 - DeregYear_j, 0), 10)$. Intra-state deregulation dates for states that deregulated intra-state branching before 1970 are truncated at 1970.

Table 2: Summary Statistics

	N	Mean	Median	SD
Years deregulation	49	2.82	3.00	1.94
Years dereg. intra	49	4.92	4.00	4.19
Dereg. measure	49	-0.02	-0.35	1.01
Dereg. measure (1983 dummy)	49	0.45	0.00	0.50
Δ_{82-89} HH Debt to income	49	0.21	0.20	0.09
Δ_{82-89} HH leverage index	49	-0.06	-0.35	1.19
Δ_{82-89} ln(House prices)	49	0.37	0.30	0.33
Δ_{89-92} ln(House prices)	49	0.04	0.05	0.11
Δ_{82-89} Unemployment	49	-4.09	-3.80	1.88
Δ_{89-92} Unemployment	49	1.77	1.70	1.40
Δ_{82-89} ln(Real GDP per capita)	49	0.17	0.22	0.17
Δ_{89-92} ln(Real GDP per capita)	49	-0.01	-0.01	0.05
Δ_{82-89} ln(Housing unit permits)	49	0.14	0.35	0.81
Δ_{89-92} ln(Housing unit permits)	49	0.03	0.04	0.46
Δ_{82-89} ln(Total employment)	49	0.20	0.22	0.12
Δ_{89-92} ln(Total employment)	49	0.03	0.04	0.07
Δ_{82-89} ln(Tradable employment)	49	0.02	0.06	0.12
Δ_{89-92} ln(Tradable employment)	49	-0.04	-0.04	0.09
Δ_{82-89} ln(Non-tradable employment)	49	0.23	0.24	0.11
Δ_{89-92} ln(Non-tradable employment)	49	0.03	0.04	0.08
Δ_{82-89} ln(Construction employment)	49	0.20	0.30	0.31
Δ_{89-92} ln(Construction employment)	49	-0.05	-0.01	0.25
Δ_{89-92} ln(Retail sales)	19	0.10	0.10	0.06
Δ_{84-89} ln(Loan appl. volume)	49	2.39	2.24	0.99
Δ_{84-89} ln(Loan appl. number)	49	1.78	1.75	0.55
Δ_{82-89} ln(Total loans)	49	0.58	0.56	0.41
Δ_{82-89} ln(Commercial and industrial loans)	49	0.42	0.42	0.48
Δ_{82-89} ln(Household loans)	49	0.72	0.69	0.36
Δ_{82-89} ln(Consumer loans)	49	0.70	0.71	0.46
Δ_{82-89} ln(CPI) (Del Negro)	48	0.24	0.23	0.04
Δ_{82-89} ln(CPI Tradables)	25	0.12	0.12	0.02
Δ_{82-89} ln(CPI Non-Tradables)	25	0.24	0.22	0.06
Δ_{82-89} ln(Average wages)	49	1.24	-0.75	7.57
Δ_{82-89} ln(Resid. wages)	49	-0.52	-1.07	7.99
Δ_{82-89} ln(Tradable resid. wages)	49	-1.44	-2.04	9.05
Δ_{82-89} ln(Non-tradable resid. wages)	49	0.32	1.87	10.23
Δ_{82-89} ln(Construction resid. wages)	49	-4.02	-7.40	12.25

Notes: Dereg. measure is defined in Table 1. Household loans subsume the call report item Loans to Individuals and Real Estate Loans. Commercial and industrial loans are based on the call report item Commercial and Industrial Loan. Consumer loans are based on the call report item Loans to Individuals and subsume home-equity loans starting in 1987. Δ_{82-89} HH leverage index represents the first principal component of Δ_{82-89} Debt-to-income, Δ_{84-89} ln(Loan appl. volume), and Δ_{82-89} ln(Consumer loans).

Table 3: Deregulation and the Rise in Leverage from 1982 to 1989

	(1) Δ_{82-89} Debt to income	(2) Δ_{84-89} Loan appl. volume	(3) Δ_{84-89} Loan appl. number	(4) Δ_{82-89} Total loans	(5) Δ_{82-89} C&I loans	(6) Δ_{82-89} HH loans	(7) Δ_{82-89} Con. loans	(8) Δ_{82-89} HH leverage index
				Panel A: Base Line				
Dereg. measure	0.0405**	0.416*	0.193*	0.190**	0.236**	0.136*	0.233**	0.742**
	(0.0115)	(0.159)	(0.0876)	(0.0579)	(0.0619)	(0.0543)	(0.0600)	(0.147)
R^2	0.210	0.182	0.128	0.217	0.250	0.147	0.269	0.398
				Panel B: Lagged Dependent Variable Controls				
Dereg. measure	0.0296**	0.187**			0.167*	0.137*	0.219**	
	(0.0101)	(0.0485)			(0.0624)	(0.0558)	(0.0576)	
R^2	0.477	0.439			0.425	0.314	0.375	
Observations	49	49	49	49	49	49	49	49

Notes: This table presents state-level regressions of growth in leverage from 1982 to 1989 on the deregulation measure: $\Delta_{82-89}y_s = \alpha + \beta d_s + \epsilon_s$. The Δ_{84-89} Loan application number and Δ_{84-89} Loan application volume variables are computed using HMDA flows. The growth rate is calculated based on the mean flow between 1981-1983 and the mean flow between 1984-1988. Household loans (HH loans) comprise the call report items "Real Estate Loans" and "Loans to Individuals". Consumer loans (Con. loans) are based on the call report item "Loans to Individuals" and subsume home-equity loans starting in 1987. Commercial and industrial loans (C&I loans) and total loans follow their corresponding definitions in the call report. The Δ_{82-89} HH leverage index represents the first principal component of Δ_{82-89} Debt-to-income, Δ_{84-89} Loan appl. volume, and Δ_{82-89} Consumer loans. Specification in panel B control for the one-year changes in the dependent variable between 1978 and 1982. Heteroscedasticity robust standard errors in parentheses. +,*,** indicates significance at the 0.1, 0.05, 0.01 level, respectively.

Table 4: Deregulation and the Household Leverage Index from 1982 to 1989

| | Δ_{82-89} HH leverage index | | | | | | |
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Dereg. measure	0.700** (0.151)	0.680** (0.166)	0.524** (0.154)	0.777** (0.137)	0.699** (0.174)	0.349* (0.170)	0.525** (0.188)
Oil Exposure '85	-0.137* (0.0521)					-0.428** (0.148)	
Oil Empl. '82	-8.573* (3.725)					-29.04** (5.999)	
Forbearance		0.201 (0.150)				-0.0635 (0.157)	
Northeast region			1.332* (0.516)			1.412* (0.554)	
South region			0.284 (0.233)			0.677 (0.414)	
West region			0.0985 (0.336)			0.224 (0.499)	
Debt to income$_{1982}$				-0.905 (1.508)		-2.319 (2.050)	
Δ_{82-89} Real GDP per Capita				-0.560 (0.582)		3.617** (1.185)	
Unemployment$_{1982}$				-0.0920 (0.0633)		-0.0110 (0.0606)	
Δ_{82-89} C&I loans							0.918* (0.400)
R^2	0.503	0.416	0.524	0.439	0.483	0.766	0.500
Demographic controls					✓	✓	
Observations	49	48	49	49	49	48	49

Notes: This table presents regressions of the Δ_{82-89} HH leverage index on the deregulation measure and various controls. Δ_{82-89} HH leverage index represents the first principal component of Δ_{82-89} Debt-to-income, Δ_{84-89} Loan appl. volume, and Δ_{82-89} Consumer loans. Oil exposure 1985 represents the share of the state's oil production after excluding federal production. This share is further normalized by the state's population in 1985. Oil employment 1982 is the state's share of employment in the oil industry. Commercial and industrial loans (C&I loans) follows its corresponding definition in the call report. Demographic controls are the fraction of people in urban neighborhood, fraction black, fraction hispanic, fraction with a high school degree, and fraction with college degree, based on the 1980 census. Heteroscedasticity robust standard errors in parentheses. +,*,** indicates significance at the 0.1, 0.05, 0.01 level, respectively.

Table 5: Deregulation and Change in Employment by Industry from 1982 to 1989

	Δ_{82-89} Total employment	Δ_{82-89} Empl. tradables	Δ_{82-89} Empl. non-tradables	Δ_{82-89} Empl. construction	Δ_{82-89} Industry-level employment			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dereg. measure	0.0531**	0.00237	0.0564**	0.161**	0.0378*	-0.0206	-0.0181	-
	(0.0147)	(0.0174)	(0.0134)	(0.0404)	(0.0155)	(0.0215)	(0.0212)	-
Dereg. measure								
x non-tradables						0.0715**	0.0676**	0.0687**
						(0.0231)	(0.0229)	(0.0226)
x construction						0.0890**	0.0866**	0.0874**
						(0.0238)	(0.0235)	(0.0232)
x other						0.184**	0.182**	0.183**
						(0.0395)	(0.0400)	(0.0396)
Unit of Obs.	State	State	State	State	State x 2 digit Ind.	State x 2 digit Ind.	State x 2 digit Ind.	State x 2 digit Ind.
2 Digit Ind. FE							✓	✓
State FE								✓
R^2	0.193	0.000	0.256	0.276	0.004	0.023	0.446	0.478
Observations	49	49	49	49	3,762	3,762	3,762	3,762

Notes: This table reports regressions of employment growth from 1982 to 1989 by industry on the deregulation measure. The employment industry categorization is based on the SIC industries, where tradables: $2000 \leq sic \leq 3900$, $sic = 20001$, and $sic = 30001$; non-tradables: $5200 \leq sic \leq 5900$; construction: $1500 \leq sic \leq 1700$. Columns 1-4 report regressions at the state level for each industry categorization separately. Columns 5-8 report regressions of employment growth at the state by two digit industry level. In columns 6-8 the deregulation measure is interacted with industry category, with tradable employment being the omitted category. Standard errors are heteroscedasticity robust (columns 1-4) or clustered at the state level (columns 5-8). +,*,** indicates significance at the 0.1, 0.05, 0.01 level, respectively.

Table 6: Deregulation and Consumer Price Inflation from 1982 to 1989

	(1) Δ_{82-89} All items (Del Negro)	(2) Δ_{84-89} All items	Special Aggregates		
			(3) Δ_{84-89} Non-tradables	(4) Δ_{84-89} Tradables	(5) Δ_{84-89} Non-tradables or Tradables
Dereg. measure	1.780** (0.482)	2.334** (0.513)	4.017** (0.777)	0.303 (0.459)	0.303 (0.463)
Dereg. measure $\times$ NT					3.714** (0.821)
Dummy Non-tradables					11.94** (0.878)
R^2	0.261	0.434	0.476	0.021	0.807
Unit of obs.	State	State	State	State	State $\times$ NT-T
Observations	48	25	25	25	50

Notes: This table presents regressions of CPI inflation on the deregulation measure. Inflation measures in columns 2-5 are state-level aggregates computed using the BLS's MSA-level indexes and are thus only available for 26 states. Columns 2-5 exclude Alaska, which is a large outlier in the sample. Tradable and non-tradable CPI inflation are defined at the BLS "Commodities" and "Services" Special Aggregates, respectively. Heteroscedasticity robust standard errors in parentheses. +,*,** indicates significance at the 0.1, 0.05, 0.01 level, respectively.

Table 7: Deregulation and Wage Growth from 1982 to 1989

	Aggregate Wage Growth		By Gender		By Industry		
	(1) Average Wages	(2) Residualized Wages	(3) Male Resid. Wages	(4) Female Resid. Wages	(5) Tradable Resid. Wages	(6) Non-Tradable Resid. Wages	(7) Construction Resid. Wages
Dereg. measure	4.007**	4.249**	4.364**	3.638**	2.911*	4.735**	5.232**
	(0.888)	(0.994)	(1.013)	(0.878)	(1.366)	(1.304)	(1.618)
R^2	0.288	0.291	0.299	0.255	0.106	0.221	0.188
Observations	49	49	49	49	49	49	49

Notes: This table presents regressions of state level wage growth on the deregulation measure. State level wages are estimated from the CPS Outgoing Rotation Group. The dependent variable in column 1 is the change in log average hourly wages. Column 2 uses the change in log residualized hourly wages, where residual wages are estimate by regressing log wages on age, education, and race dummies separately for males and females. Columns 3 and 4 present separate regressions for residualized wages of male and female workers. Columns 5-7 report wage growth separately for workers in the tradable, non-tradable, and construction sectors, where sectors are defined using the same definition as employment. Heteroscedasticity robust standard errors in parentheses. +,*,** indicates significance at the 0.1, 0.05, 0.01 level, respectively.

Table 8: Placebo Regressions of Credit, CPI, and Employment Growth on Deregulation in Previous Expansions

	(1) Δ Total loans	(2) Δ C&I loans	(3) Δ HH loans	(4) Δ Con. loans	(5) Δ CPI (Del Negro)	(6) Δ Empl. tradables	(7) Δ Empl. non-tradables	(8) Δ Empl. construction
				Panel A: Boom Period 1975-1979				
Dereg. measure	-0.00109	0.000888	-0.00172	0.00138	-0.00817**	-0.00832	-0.0128	-0.0743*
	(0.000724)	(0.00143)	(0.00109)	(0.00130)	(0.00271)	(0.0139)	(0.0118)	(0.0314)
R^2	0.034	0.010	0.040	0.027	0.179	0.008	0.026	0.125
Observations	49	49	49	49	48	49	49	49
				Panel B: Boom Period 1970-1973				
Dereg. measure					0.00334*	-0.0271+	-0.0102	-0.0150
					(0.00148)	(0.0144)	(0.00983)	(0.0203)
R^2					0.126	0.083	0.026	0.011
Observations					48	49	49	49
				Panel C: Boom Period 1962-1969				
Dereg. measure					0.00327	0.0445	0.0279	
					(0.0318)	(0.0309)	(0.0436)	
R^2					0.000	0.067	0.010	
Observations					48	48	48	
				Panel D: Boom Period 1962-1967				
Dereg. measure					0.0190	0.0393	0.0212	
					(0.0344)	(0.0329)	(0.0543)	
R^2					0.010	0.055	0.004	
Observations					47	47	47	

Notes: The table reports regressions of credit growth, inflation, and employment growth in previous expansions on the deregulation measure. Panel A columns 1-4 use the change from 1976 to 1979 due to data availability. Heteroscedasticity robust standard errors in parentheses. +,*,** indicates significance at the 0.1, 0.05, 0.01 level, respectively.

Table 9: Deregulation and House Prices, Unemployment, Real GDP per Capita, and Housing Unit Permits in the Boom and Bust

Controls	Boom: Change from 82 to 89				Bust: Change from 89 to 92			
	(1) None	(2) Lagged Dep. Var.	(3) Oilshock	(4) Demographics & Forbearance	(5) None	(6) Lagged Dep. Var.	(7) Oilshock	(8) Demographics & Forbearance
	Panel A: House prices							
Dereg. measure	0.186**	0.186**	0.149**	0.191**	-0.0424**	-0.0323*	-0.0455**	-0.0438*
	(0.0397)	(0.0370)	(0.0469)	(0.0492)	(0.0133)	(0.0125)	(0.0161)	(0.0173)
R^2	0.325	0.506	0.384	0.468	0.150	0.433	0.153	0.313
	Panel B: Unemployment							
Dereg. measure	-0.597*	-0.833**	-0.214	-0.425*	0.877**	0.820**	0.781**	0.765**
	(0.225)	(0.162)	(0.216)	(0.205)	(0.137)	(0.138)	(0.157)	(0.106)
R^2	0.104	0.678	0.419	0.422	0.405	0.440	0.473	0.582
	Panel C: Real GDP per capita							
Dereg. measure	0.0615*	0.0375**	0.0425**	0.0417	-0.0225**	-0.0197**	-0.0199**	-0.0211*
	(0.0290)	(0.0112)	(0.0101)	(0.0313)	(0.00765)	(0.00666)	(0.00502)	(0.00848)
R^2	0.134	0.871	0.861	0.380	0.218	0.472	0.524	0.383
	Panel D: Housing unit permits							
Dereg. measure	0.277**	0.283**	0.0280	0.216*	-0.225**	-0.226**	-0.154*	-0.142*
	(0.0861)	(0.102)	(0.0612)	(0.0878)	(0.0577)	(0.0629)	(0.0589)	(0.0620)
R^2	0.148	0.330	0.671	0.305	0.246	0.308	0.360	0.351
Observations	49	49	49	48	49	49	49	48

Notes: This table presents regressions of changes in real outcomes from 1982 to 1989 (column 1-4) and 1989 to 1992 (columns 5-8) on the deregulation measure. The column labeled "Oilshock" controls for a state's oil production share after excluding federal production normalized by population and the oil industry's 1982 employment share. Column 4 and 8 uses only 48 observations as there is no information available for forbearance in D.C. Demographic controls include the fraction urban, fraction black, fraction hispanic, fraction with high school, and fraction with college, based on the 1980 census. Panel D columns 2 and 6 use two lagged dependent variables due to data availability. Alaska is dropped from Panel D as it is a large outlier. Heteroscedasticity robust standard errors in parentheses. +,*,** indicates significance at the 0.1, 0.05, 0.01 level, respectively.

Table 10: Beta Analysis for GDP, Unemployment, House Prices, Residential Investment

	(1) Real GDP growth	(2) Real GDP p.c. growth	(3) Unemployment Change	(4) House price growth	(5) Housing unit permit growth
Panel A: Boom-Bust Cycle 1982-89 & 1989-92					
GDP growth	0.734**	0.875**	-1.735**	1.171**	-1.552
	(0.103)	(0.0845)	(0.100)	(0.312)	(1.035)
Dereg. measure	-0.00858**	-0.00955**	0.0113**	-0.0201**	-0.0747**
	(0.00284)	(0.00253)	(0.00174)	(0.00585)	(0.0272)
Dereg. measure x GDP growth	0.539**	0.453**	-0.463**	1.304**	2.526*
	(0.102)	(0.0870)	(0.0908)	(0.303)	(1.133)
R^2	0.369	0.481	0.802	0.379	0.154
Panel B: Boom-Bust Cycle 1975-79 & 1979-82					
GDP growth	1.030**	0.981**	-1.355**	2.327**	
	(0.110)	(0.0938)	(0.0771)	(0.173)	
Dereg. measure	0.00315	0.00328	-0.00312^{+}	0.00485	
	(0.00600)	(0.00478)	(0.00174)	(0.00352)	
Dereg. measure x GDP growth	-0.164	-0.140	0.0117	-0.377*	
	(0.133)	(0.114)	(0.0870)	(0.171)	
R^2	0.378	0.489	0.795	0.630	
Panel B: Boom-Bust Cycle 1970-73 & 1973-75					
GDP growth	0.969**	0.919**	-0.420**		
	(0.134)	(0.120)	(0.0511)		
Dereg. measure	-0.00110	-0.00154	0.00293		
	(0.00896)	(0.00720)	(0.00248)		
Dereg. measure x GDP growth	-0.188	-0.186	-0.00976		
	(0.179)	(0.158)	(0.0605)		
R^2	0.401	0.462	0.501		
Observations	98	98	98	98	98

Notes: This table presents regressions of the form: $\Delta y_{sb} = \alpha + \beta X_b \cdot d_s + \gamma \Delta X_b + \delta d_s + \epsilon_{sb}$. The equation is estimated in changes using two periods, the boom and the bust (i.e. $b = \{boom, bust\}$). The dependent variables in Panel A are defined as the growth rate from 1983 to 1989 (boom) and 1989 to 1992 (bust), with the exception of unemployment, which is measured as the change from 1982 to 1989 and 1989 to 1992. Panels B and C present placebo regressions for earlier cycles. The variable ΔX_b is the change in aggregate GDP growth excluding state i. The coefficient on the interaction between the deregulation measure and the aggregate cycle variable, β, measures how a state's cyclicality varies with the deregulation measure. House price growth (column 4) and housing unit permit growth (column 5) are missing in some periods due to data availability. Standard errors are clustered at the state level. +,*,** indicates significance at the 0.1, 0.05, 0.01 level, respectively.

Table 11: Deregulation and Change in Employment by Industry from 1989 to 1992

	Δ_{89-92} Total employment	Δ_{89-92} Empl. tradables	Δ_{89-92} Empl. non-tradables	Δ_{89-92} Empl. construction	Δ_{89-92} Industry-level employment			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dereg. measure	-0.0278**	-0.0322*	-0.0313*	-0.128**	-0.0435*	-0.0438*	-0.0422*	-
	(0.00970)	(0.0140)	(0.0116)	(0.0329)	(0.0162)	(0.0188)	(0.0184)	-
Dereg. measure								
x non-tradables						0.00386	0.00135	0.000297
						(0.0192)	(0.0190)	(0.0187)
x construction						0.00814	0.00654	0.00612
						(0.0140)	(0.0136)	(0.0134)
x other						-0.0742**	-0.0758**	-0.0762**
						(0.0253)	(0.0250)	(0.0244)
Unit of Obs.	State	State	State	State	State x 2 digit Ind.	State x 2 digit Ind.	State x 2 digit Ind.	State x 2 digit Ind.
2 Digit Ind. FE							✓	✓
State FE								✓
R^2	0.181	0.140	0.166	0.264	0.005	0.009	0.468	0.500
Observations	49	49	49	49	3,816	3,816	3,816	3,816

Notes: This table reports regressions of employment growth from 1989 to 1992 by industry on the deregulation measure. The employment industry categorization is based on the SIC industries, where tradables: $2000 \leq sic \leq 3900$, $sic = 20001$, and $sic = 30001$; non-tradables: $5200 \leq sic \leq 5900$; construction: $1500 \leq sic \leq 1700$. Columns 1-4 report regressions at the state level for each industry categorization separately. Columns 5-8 report regressions of employment growth at the state by two digit industry level. In columns 6-8 the deregulation measure is interacted with industry category, with tradable employment being the omitted category. Standard errors in parentheses are heteroscedasticity robust (columns 1-4) or clustered at the state level (columns 5-8). +,*,** indicates significance at the 0.1, 0.05, 0.01 level, respectively.

Table 12: Deregulation, Non-Performing Loans and Employment from 1989 to 1992

	NPL ratio total loans 1990	NPL ratio HH loans 1990	Δ_{89-92} Total Employment		
	(1)	(2)	(3)	(4)	(5)
Dereg. measure	0.00866**	0.0111**			
	(0.00245)	(0.00248)			
NPL ratio total loans 1990			-2.610**		-3.206**
			(0.332)		(0.882)
NPL ratio HH loans 1990				-1.982*	
				(0.784)	
NPL ratio C&I loans 1990				-0.382	
				(0.595)	
R^2	0.225	0.320	0.532	0.504	0.504
Specification	OLS	OLS	OLS	OLS	IV
Observations	49	49	49	49	49

Notes: This table shows the relation between banking deregulation, non-performing loans in 1990, and employment growth from 1989 to 1992. The NPL ratio of total loans in 1990 is defined as total non-performing loans relative to total loans in 1990, based on the corresponding call report items. The NPL ratio of HH loans in 1990 is the non-performing loans ratio for the aggregate of real estate and individual loans in 1990. The 1990 NPL ratio of total loans in column 5 is instrumented with the deregulation measure. Standard errors in parentheses are heteroscedasticity robust. +,*,** indicates significance at the 0.1, 0.05, 0.01 level, respectively.

Table 13: Household Leverage and the Bust from 1989 to 1992

	Δ_{89-92} Unemployment	Δ_{89-92} Total employment	Δ_{89-92} Real GDP per capita	Δ_{89-92} House prices	Δ_{89-92} Retail sales	Δ_{89-92} Housing unit permits
	(1)	(2)	(3)	(4)	(5)	(6)
			Panel A: Base Case			
Δ_{82-89} HH leverage index	0.889**	-0.0380**	-0.00970	-0.0556**	-0.0393**	-0.265**
	(0.111)	(0.00592)	(0.00580)	(0.0109)	(0.0111)	(0.0402)
R^2	0.575	0.467	0.056	0.357	0.424	0.482
			Panel B: Controls			
Δ_{82-89} HH leverage index	0.861**	-0.0289**	-0.0198*	-0.0582**	-0.0329$^+$	-0.201**
	(0.152)	(0.00693)	(0.00748)	(0.0136)	(0.0183)	(0.0516)
Δ_{82-89} C&I loans	0.0627	-0.0113	-0.0218	-0.0644$^+$	-0.0484	0.0881
	(0.427)	(0.0194)	(0.0209)	(0.0381)	(0.0381)	(0.144)
Δ_{82-89} Housing unit permits	-0.397	0.0121	0.0209	0.0588*	-0.0874$^+$	-0.205$^+$
	(0.318)	(0.0145)	(0.0156)	(0.0284)	(0.0424)	(0.108)
Δ_{82-89} Real GDP per capita	1.673	-0.273**	0.160*	-0.221	0.0192	-0.0918
	(1.600)	(0.0727)	(0.0785)	(0.143)	(0.231)	(0.541)
Δ_{82-89} Unemployment	-0.242*	0.00219	0.00738	-0.00298	-0.0157	0.00165
	(0.0990)	(0.00450)	(0.00486)	(0.00884)	(0.0122)	(0.0335)
Δ_{82-89} Total employment	-1.607	0.247**	-0.0349	0.340*	0.444$^+$	-0.366
	(1.645)	(0.0747)	(0.0807)	(0.147)	(0.211)	(0.556)
R^2	0.655	0.683	0.319	0.564	0.624	0.629
Observations	49	49	49	49	19	49

Notes: The table presents regressions of economic outcomes from 1989 to 1992 on the rise in household leverage and several other predictors from 1982 to 1989. Δ_{82-89} HH leverage index represents the first principal component of Δ_{82-89} Debt-to-income, Δ_{84-89} Loan appl. volume, and Δ_{82-89} Consumer loans. Standard errors in parentheses are heteroscedasticity robust. +,*,** indicates significance at the 0.1, 0.05, 0.01 level, respectively.

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Figure 1: Aggregate Credit Supply: Baa-Aaa Spread and High Yield Share of Corporate Debt Issuance
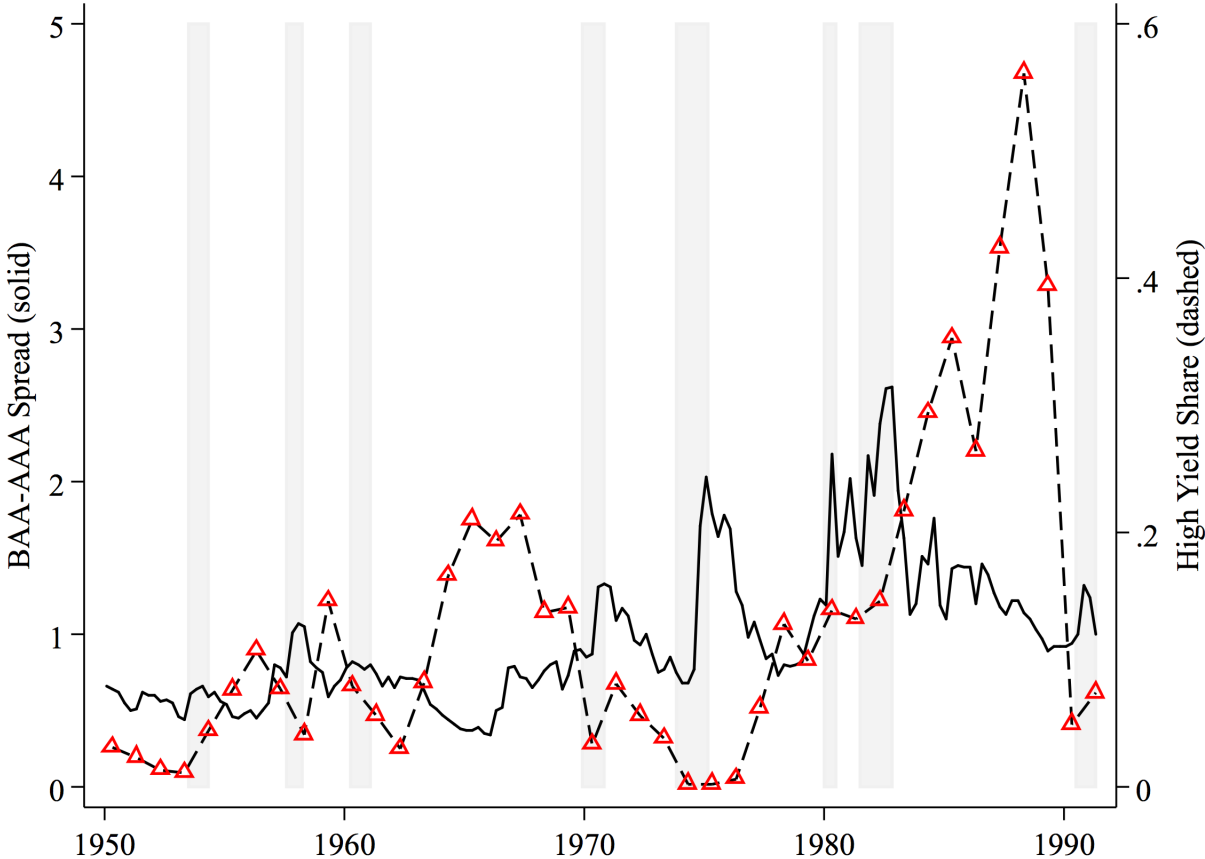
Notes: This figure shows time series plots of the Baa-Aaa spread and the high year share (HYS) of corporate debt issuance from Greenwood and Hanson (2013). Shaded bars represent NBER recession dates.

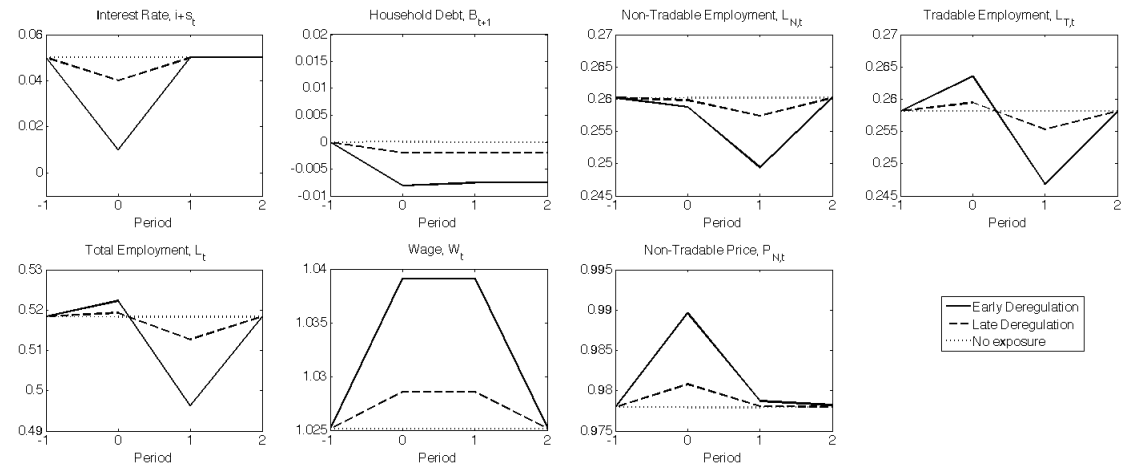Figure 2: Model Predictions

$$\theta_H = 1, \quad \theta_T = 0, \quad \theta_N = 0$$
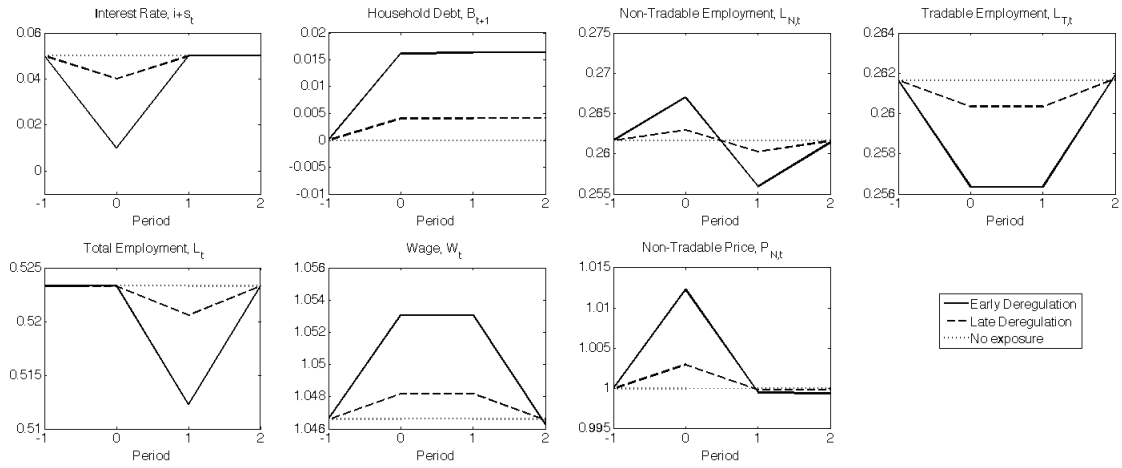
(a) Credit Supply Shock through Local Demand, $\theta_H > 0$, $\theta_T = \theta_N = 0$

$$\theta_H = 0, \quad \theta_T = 0, \quad \theta_N = 0.5$$
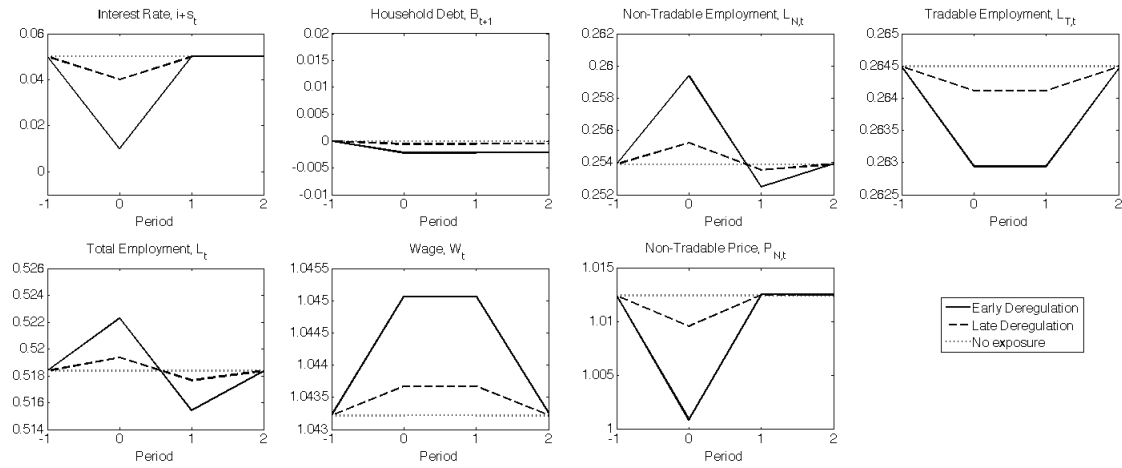
(b) Credit Supply Shock through Non-Tradable Supply, $\theta_N > 0$, $\theta_H = \theta_T = 0$

$$\theta_H = 0, \quad \theta_T = 0.5, \quad \theta_N = 0$$

(c) Credit Supply Shock through Tradable Supply, $\theta_T > 0$, $\theta_H = \theta_N = 0$

Figure 3: Bank Credit Indices 1980-1992
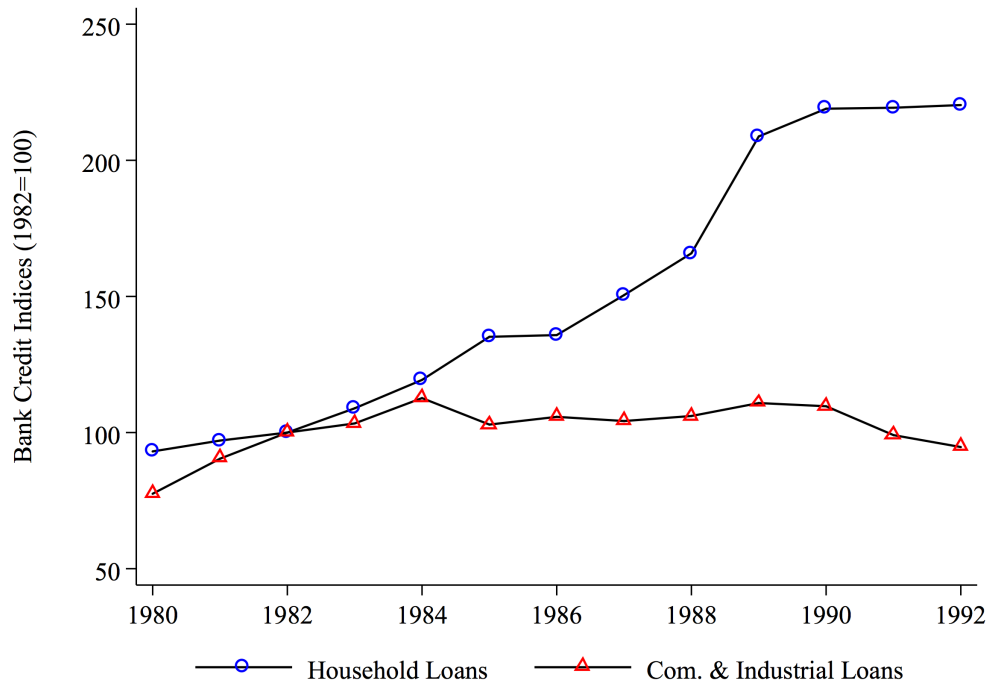
Notes: Household loans comprise the call report items "Real Estate Loans" and "Loans to Individuals". Commercial and industrial loans follow the definition of the corresponding call report item. Both time series are normalized to 100 in 1982.

Figure 4: Credit Growth and Deregulation
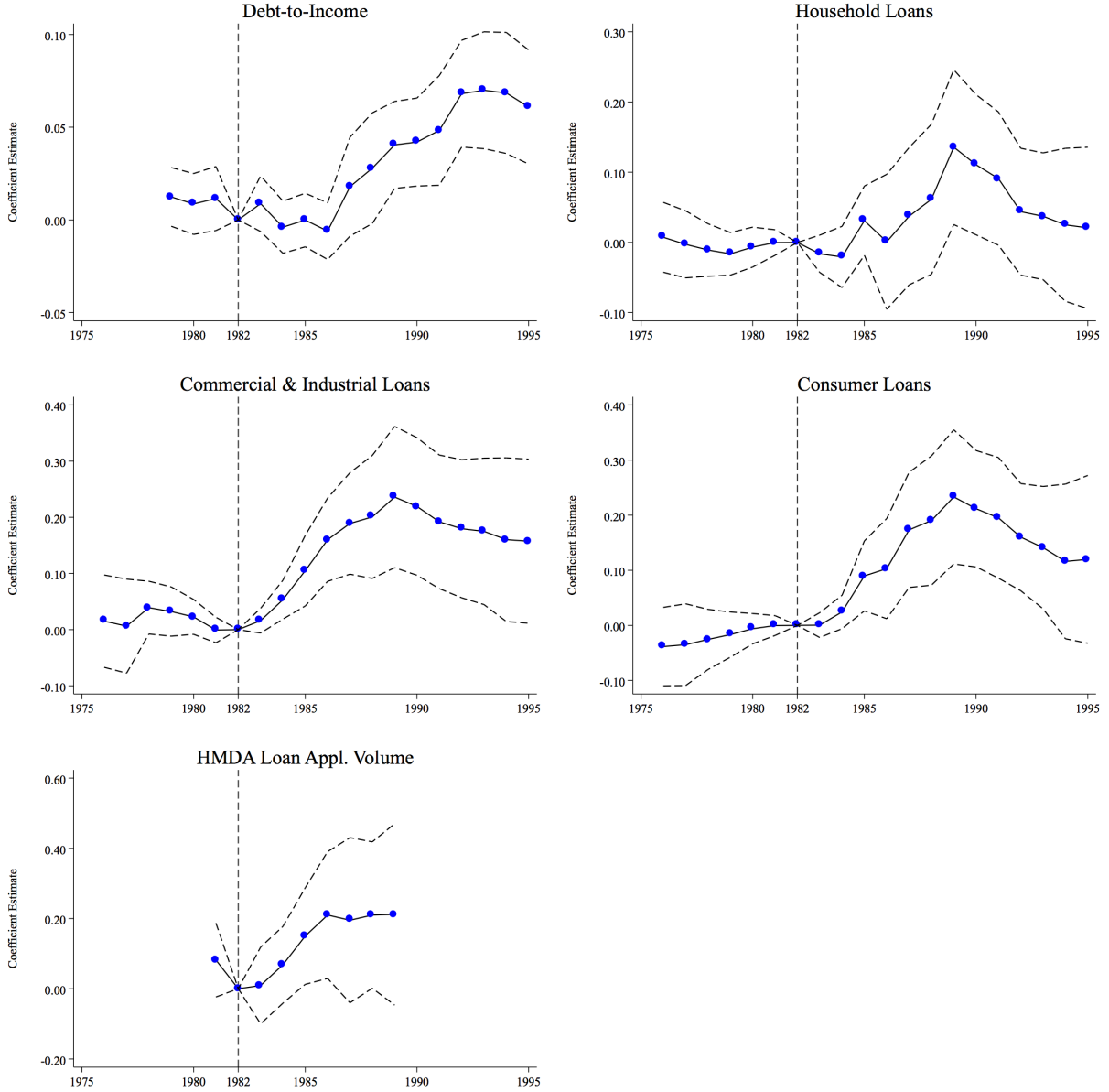
Notes: This figure presents estimates of $\{\beta_y\}$ from $y_{st} = \alpha_s + \alpha_t + \sum_{y \neq 1982} \mathbb{1}_{t=y} d_s \beta_y + \epsilon_{st}$, where d_s is the deregulation measure. Dashed lines represent 95% confidence intervals from standard errors clustered at the state level. Household loans is based on the call report item "Loans to Individuals" and "Real Estate Loans". Commercial and industrial loans are based on the call report item "Commercial and Industrial Loan". Consumer loans are based on the call report item "Loans to Individuals" and subsume home-equity loans starting in 1987.

Figure 5: Deregulation and Employment Growth, 1982-1989
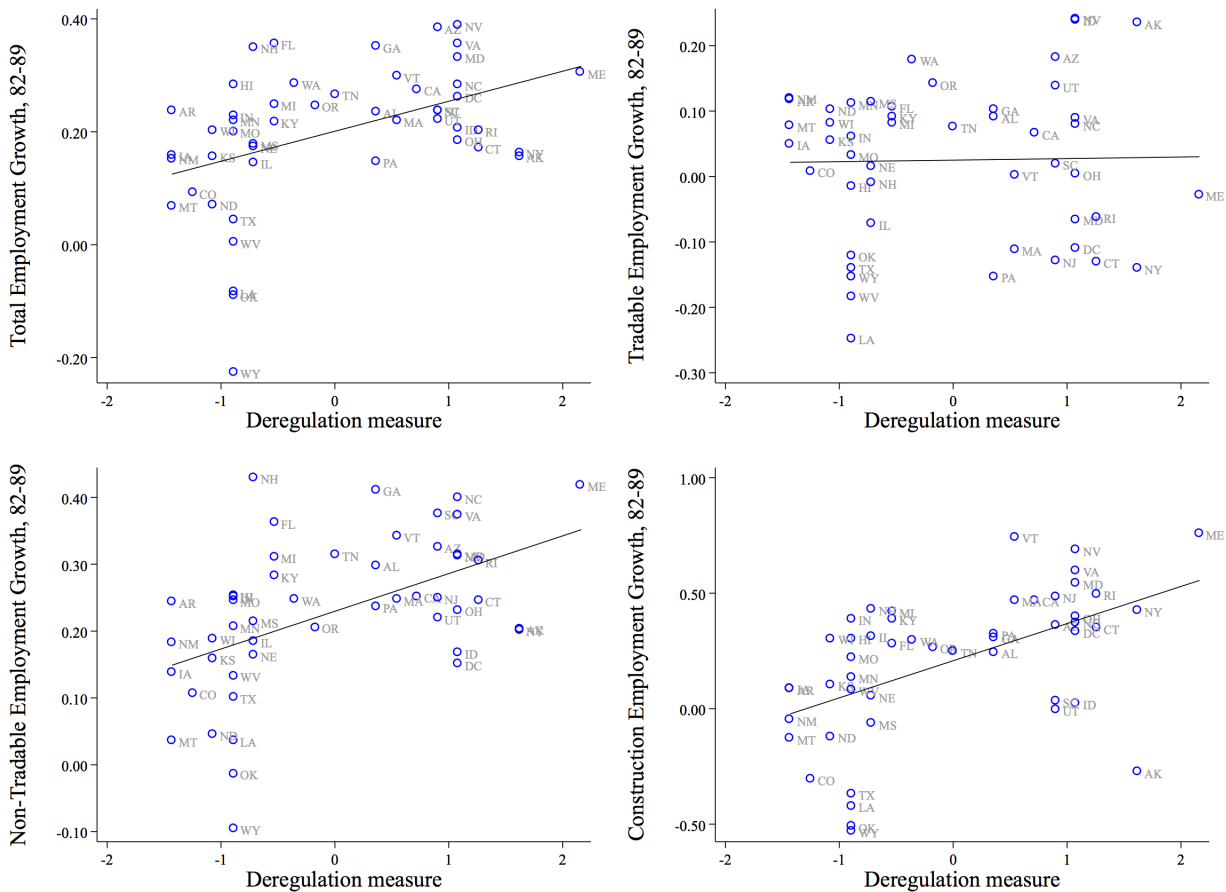
Notes: This figure presents scatterplots of the deregulation measure on employment growth by industry from 1982 to 1989.

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Figure 6: Inflation and Deregulation
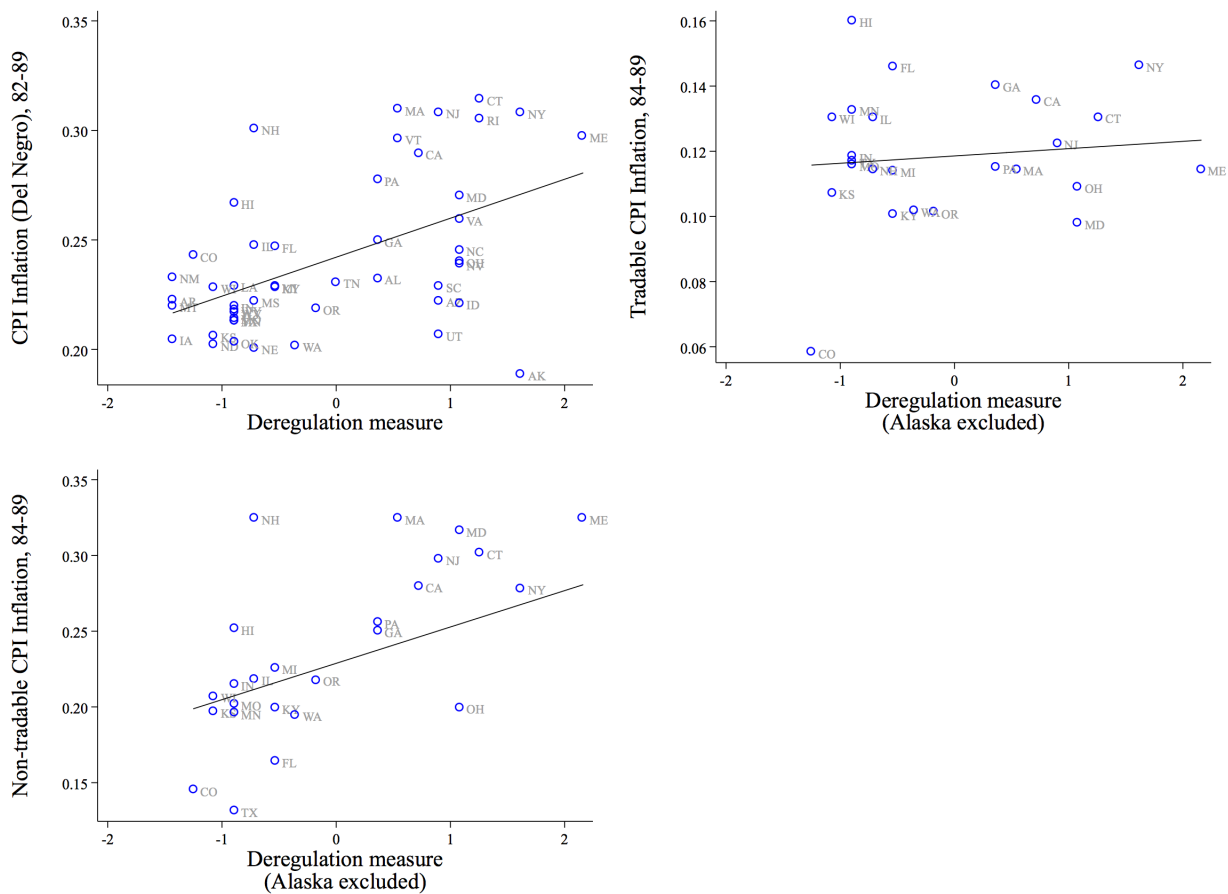
*Notes*: This figure presents scatter plots of the CPI inflation from 1982 (1984) to 1989 on the deregulation measure. The top-right and bottom-left panels show inflation for tradables ("Commodities") and non-tradables ("Services") for 25 states for which this measure is available (excluding Alaska).

Figure 7: Wage Growth and Deregulation
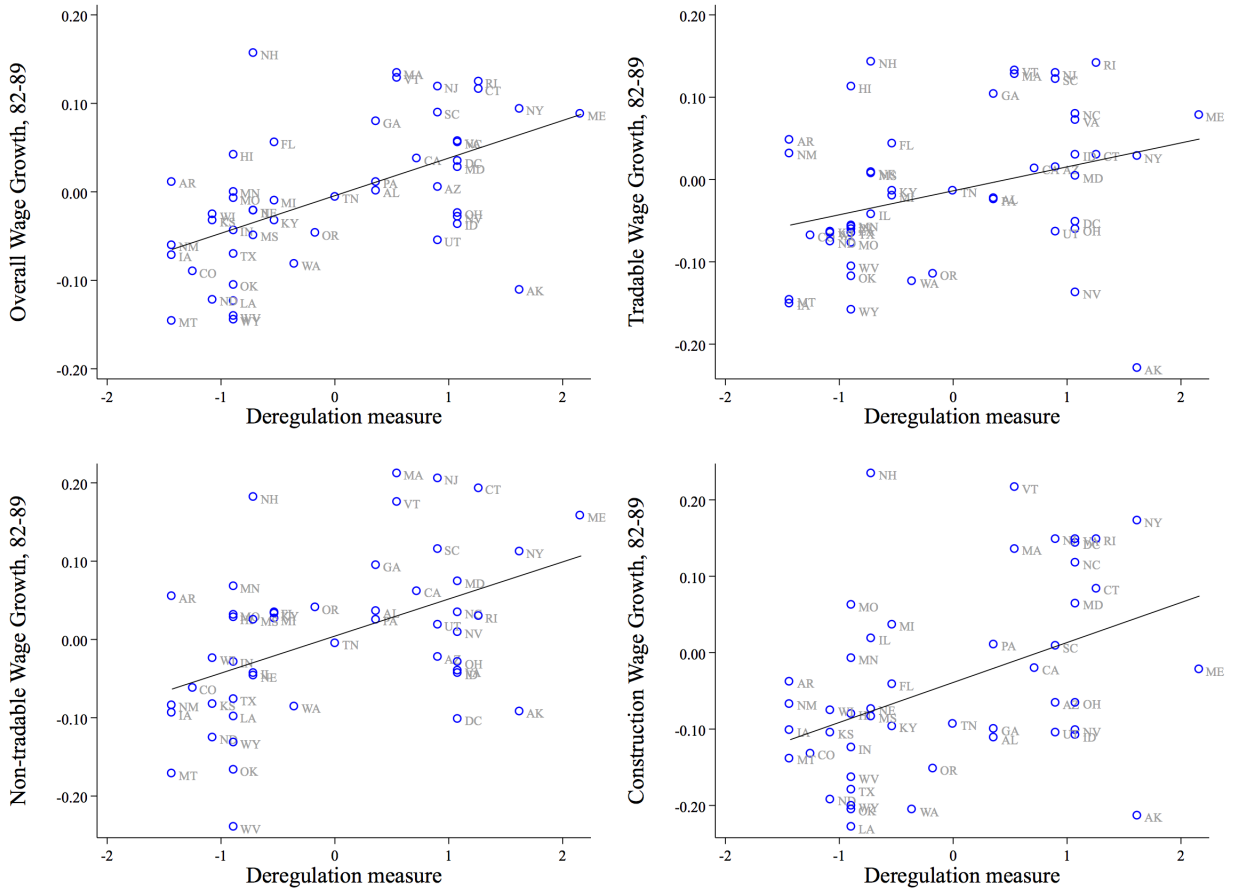
Notes: This figure presents scatter plots of wage growth from 1982 to 1989 against the deregulation measure. Wages are deflated by the aggregate CPI-U-RS (but not by state price indexes).

Figure 8: Deregulation and Unemployment, Real GDP per Capita, House Prices, and Housing Units
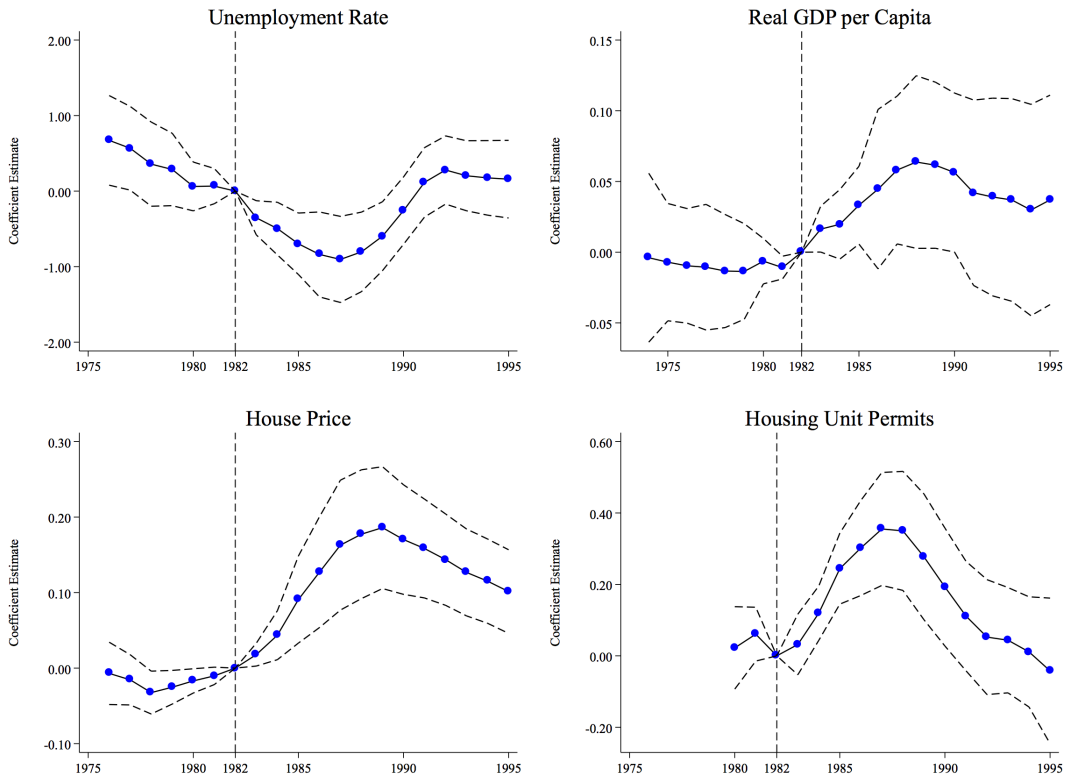
Notes: This figure presents estimates of $\{\beta_y\}$ from $y_{st} = \alpha_s + \alpha_t + \sum_{y \neq 1982} \mathbb{1}_{t=y} d_s \beta_y + \epsilon_{st}$, where d_s is the deregulation measure and y_{st} is the state unemployment rate, log real GDP per capita, log house prices, or log housing units. Dashed lines represent 95% confidence intervals from standard errors clustered at the state level.

Figure 9: Deregulation and Subsequent Recession
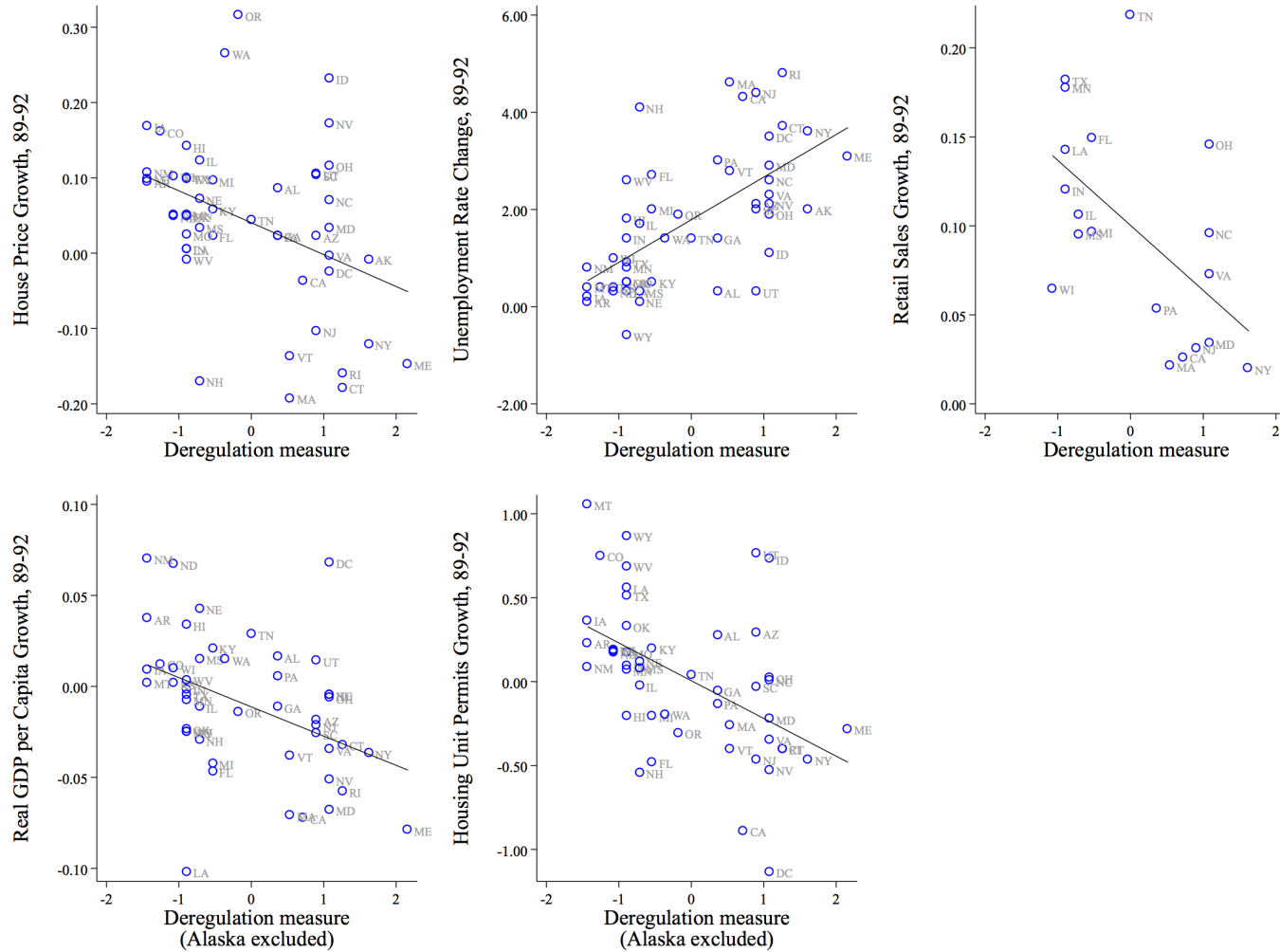
Notes: This figure presents scatter plots of various outcomes from 1989 to 1992 against the state deregulation measure.

Figure 10: Deregulation and Employment by Industry over the Full Cycle
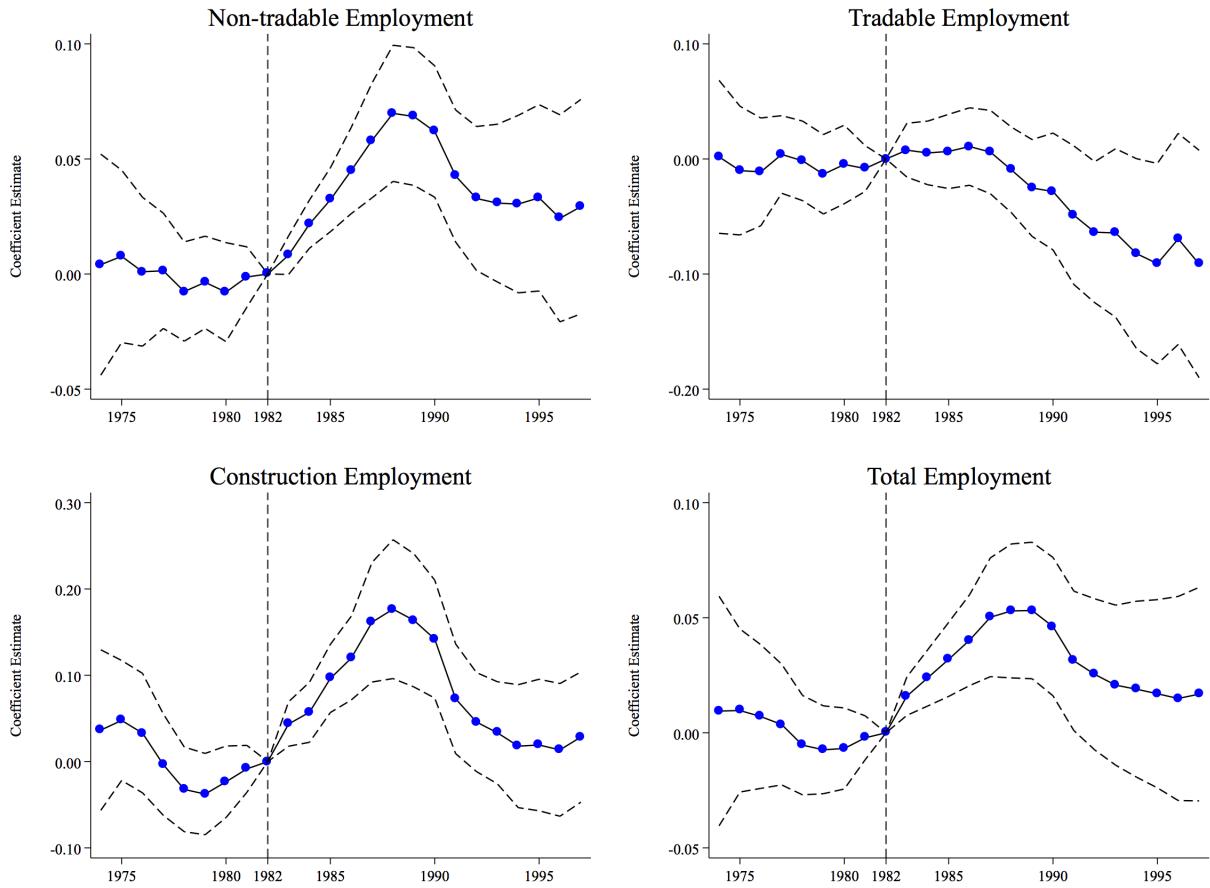
Notes: This figure presents estimates of $\{\beta_y\}$ from $e_{st} = \alpha_s + \alpha_t + \sum_{y \neq 1982} \mathbb{1}_{t=y} d_s \beta_y + \epsilon_{st}$, where d_s is the deregulation measure and e_{st} is log non-tradable, tradable, construction, or total employment. Dashed lines represent 95% confidence intervals from standard errors clustered at the state level.

Figure 11: Deregulation and Wages by Industry over the Full Cycle
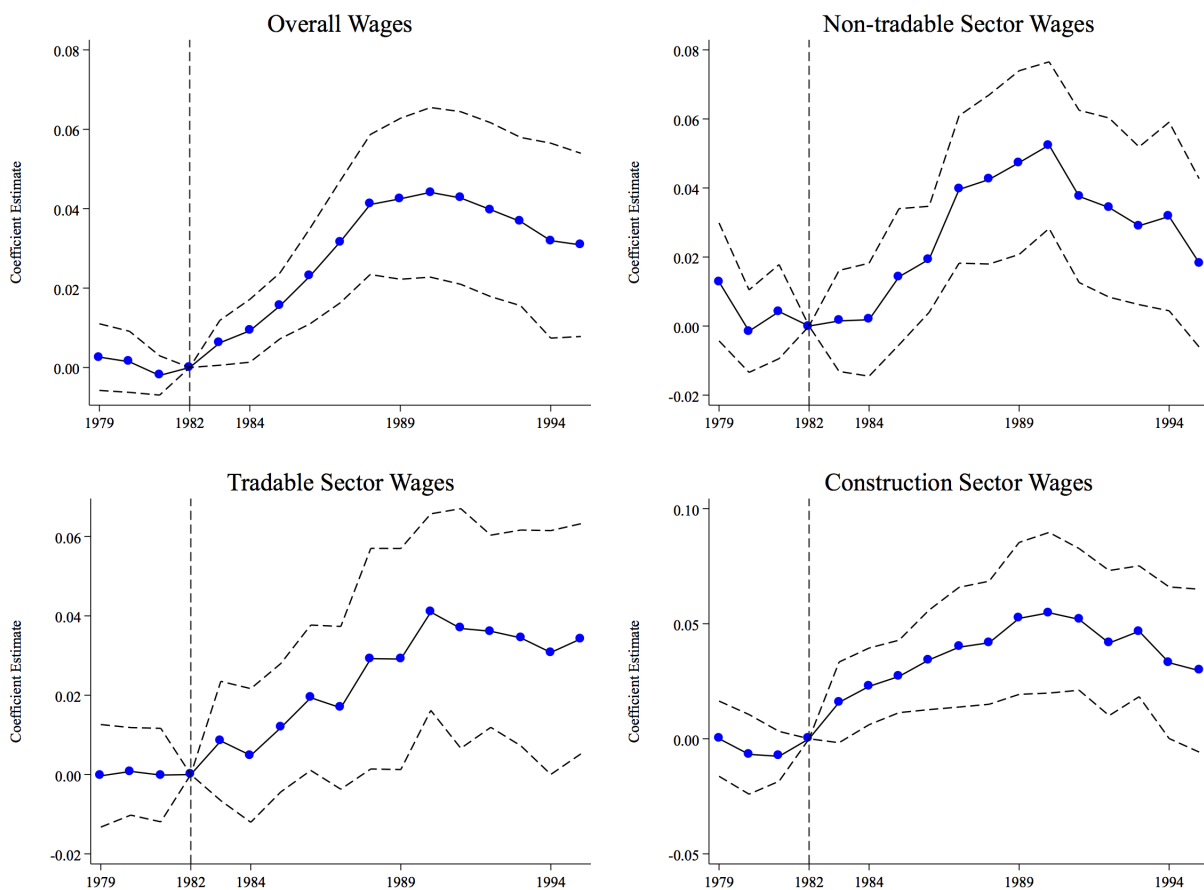
Notes: This figure presents estimates of $\{\beta_y\}$ from $w_{st} = \alpha_s + \alpha_t + \sum_{y \neq 1982} \mathbb{1}_{t=y} d_s \beta_y + \epsilon_{st}$, where d_s is the deregulation measure and w_{st} is log residualized state wages. Dashed lines represent 95% confidence intervals from standard errors clustered at the state level.

Figure 12: Tradable and Non-Tradable Prices over the Full Cycle
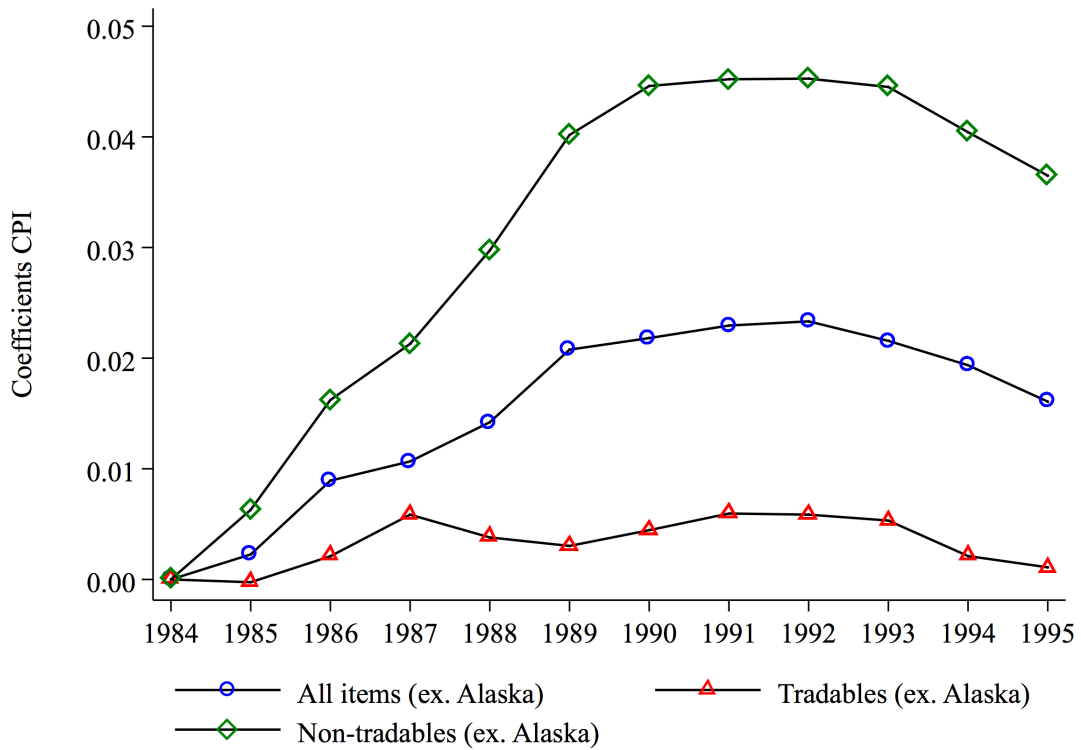
Notes: This figure presents estimates of $\{\beta_y\}$ from $\ln CPI_{st} = \alpha_s + \alpha_t + \sum_{y \neq 1983} \mathbb{1}_{t=y} d_s \beta_y + \epsilon_{st}$, where d_s is the deregulation measure and $\ln CPI$ is the the log of the state CPI for all items, tradables ("Commodities"), or non-tradables ("Services").

Figure 13: NPL Ratios
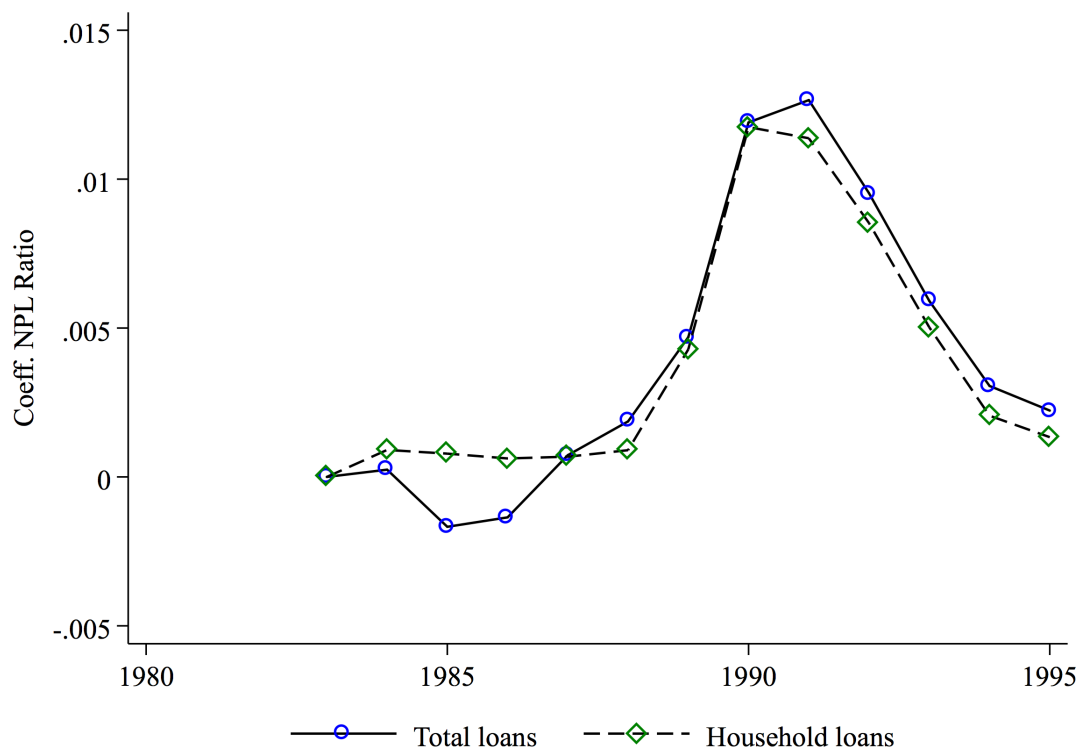
Notes: This figure presents estimates of $\{\beta_y\}$ from $NPL_{st} = \alpha_s + \alpha_t + \sum_{y \neq 1983}[\mathbb{1}_{t=y}d_s\beta_y + \mathbb{1}_{t=y}op_s\gamma_y + \mathbb{1}_{t=y}oe_s\delta_y] + \epsilon_{st}$, where d_s is the deregulation measure, op_s is the oil production of state s as of total oil production adjusted for federal production and population size in 1985, oe_s the employment in the oil sector as a share of total employment in 1982, and NPL_{st} is the non-performing loan ratio for household or total loans.

Figure 14: Household Credit Boom and the Subsequent Recession
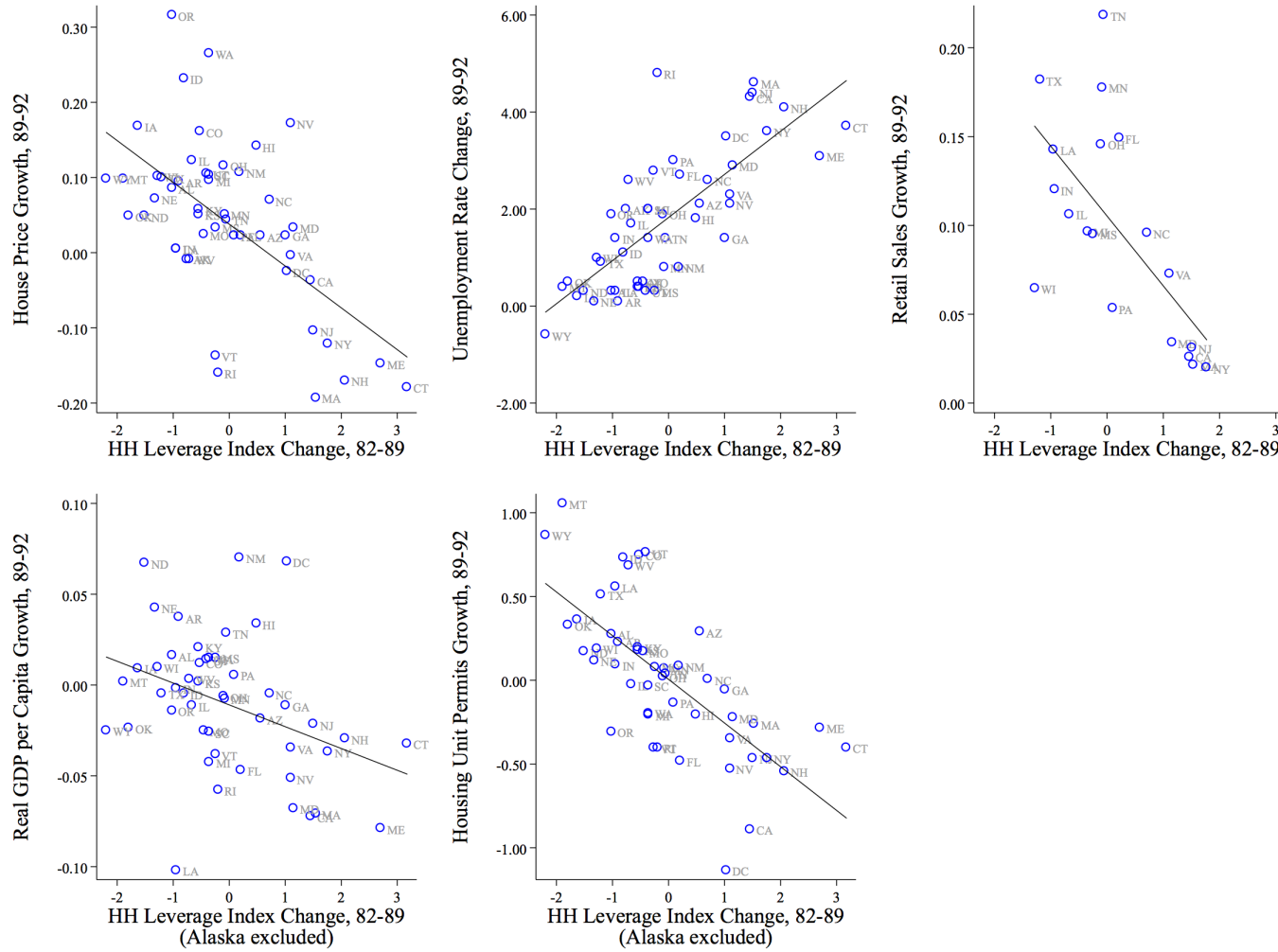
Notes: This figure presents scatter plots of the change in various outcomes from 1989 to 1992 against the Δ_{82-89} HH leverage index.

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