How Does Credit Supply Expansion Affect the Real Economy?

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Prior to joining Princeton in 2012 he taught at the University of California, Berkeley and the University of Chicago Booth School of business. Professor Mian's work studies the connections between finance and the macro economy, and has been published in various academic journals. He is also the author of the critically acclaimed book, House of Debt, with Amir Sufi.

AMIR SUFI

Amir Sufi is the Bruce Lindsay Professor of Economics and Public Policy at the University of Chicago Booth School of Business. He is also a Research Associate at the National Bureau of Economic Research. He serves as an associate editor for the American Economic Review, the Journal of Finance, and the Quarterly Journal of Economics.

Professor Sufi's research focuses on finance and macroeconomics. His research on household debt and the economy forms the basis of his book co-authored with Atif Mian: House of Debt: How They (and You) Caused the Great Recession and How We Can Prevent It from Happening Again.

Professor Sufi was awarded the 2017 Fischer Black Prize by the American Finance Association, given biennially to the top financial economics scholar under the age of 40.

EMIL VERNER

Assistant Professor of Finance, Massachusetts Institute of Technology

The Class of 1957 Career Development Professor and an Assistant Professor of Finance. Before joining MIT, I received my PhD in economics from Princeton University in 2018. My research focuses on finance, international economics, and macroeconomics.

Current Research Focus: Verner's current research focuses on the connection between financial markets and economic activity, both in advanced and emerging markets. In several recent studies, he has examined the role of household credit markets in amplifying business cycle fluctuations.

In related work, Verner has also studied the real economic consequences of banking sector distress during financial crises around the world over the past 150 years. Finally, in ongoing research, Verner is currently exploring what role financial distress has played in the recent rise in populism.

Abstract

- Credit supply expansion can affect an economy by increasing productive capacity or by boosting household demand.
- In this study, we develop a test to determine if the household demand channel is present, and we implement the test using both a natural experiment in the U.S. in the 1980s and an international panel of 56 countries over the last several decades.
- Consistent with the importance of the household

demand channel, we find that credit supply expansion boosts nontradable sector employment and the price of nontradable goods, with limited effects on tradable sector employment. Such credit expansions amplify the business cycle and lead to more severe recessions.

Research ideas and framework

This paper develops and empirically implements a test of whether the household demand channel is operative during a credit supply expansion. The basic insight shows that a credit expansion operating through the household demand channel is inflationary in nature and expands employment in the nontradable sector relative to the tradable

sector. In contrast, a credit expansion operating through the productive capacity channel has a negligible effect on the ratio of employment in the nontradable to tradable sectors, and a more ambiguous effect on the relative price of nontradable goods. As a result, empirical evaluation of employment and nominal price patterns across the nontradable and tradable sectors can be used

to highlight the importance of the household demand channel. This study implements the test using both a natural experiment in the U.S. in the 1980s and a broader international panel of 56 countries with data going back to the 1960s.

To test for the presence of the household demand channel, an ideal natural experiment would entail an exogenous shock to credit supply

that could, in theory, boost either household demand or productive capacity. The U.S. in the 1980s provides such a setting. First, there was an aggregate expansion in credit supply. Second, the effect of the aggregate credit supply expansion varied across states based on the extent of deregulation in the state's geographic restrictions on banking activity. Credit growth in early-

deregulation states was broad-based, with large relative increases in the household debt to income ratio, consumer credit, and mortgage applications.

Recent theoretical research suggests that the household demand channel of credit expansion may amplify business cycles by generating a short-term gain at the expense of an eventual bust.

Why was the recession worse in early-

deregulation states? Downward nominal wage rigidity, banking sector problems and household debt overhang help explain the more severe recession in early-deregulation states.

To broaden the scope of our findings, we construct a novel country-year data set covering 56 economies going back to the 1960s.The international evidence and the evidence from the U.S. in the 2000s suggest that the banking deregulation findings from the 1980s hold more broadly.

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I. Data and Summary Statistics

A. 1980s U.S. State-Level Data Set

The primary data set used in this study is 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, residential 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：individual tax return data，HMDA and Call Report data at the state level.

However, each of these sources has certain drawbacks. Accordingly, we construct a household leverage index that is given as the first principal component of the change in the household debt to income ratio, growth in mortgage loan applications, and growth in consumer loans at the state level.

B. International Panel Dataset

We also construct a panel data set for 56 economies going back to the 1960s.

Table I Summary Statistics

	N	Mean	Median	SD
Panel A: U.S. 1980s State Level Data Set				
Dereg. measure	49	0.00	-0.32	1.00
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(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	0.63	0.61	0.36
Δ_{82-89} ln(Consumer loans)	49	0.70	0.71	0.46
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(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_{82-89} ln(Nontradable employment)	49	0.23	0.24	0.11
Δ_{82-89} ln(Construction employment)	49	0.20	0.30	0.31
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 Nontradables)	25	0.24	0.22	0.06
Panel B: International Panel Data Set				
Δ_3 HH debt to GDP	843	0.05	0.04	0.06
Δ_3 Firm debt to GDP	843	0.04	0.03	0.12
Δ_3 ln(Nontrad./tradable empl.)	843	0.10	0.09	0.07
Δ_3 ln(Nontrad./tradable output)	843	0.03	0.03	0.10
Δ_3 ln(Nontrad./tradable prices)	843	0.02	0.03	0.11
Δ_3 ln(Real GDP)	843	0.09	0.08	0.08

II. Empirical Framework

A. Environment

Consider a small open economy inhabited by a representative household, a tradable production sector, and a nontradable production sector. The household supplies labor to the tradable and nontradable sectors, with total labor supply fixed at n.

the household's period budget constraint is

$$c_T + p_N c_N = \frac{d}{1+r} + w\overline{n} + \Pi.$$

We assume that household borrowing is subject to a borrowing constraint, which can depend on

tradable and nontradable income:

$$d \leq \theta_H(y_T, p_N y_N)$$

A household credit supply expansion, captured by an increase in θH, boosts household borrowing and spending.

Firms in the tradable and nontradable sectors produce output with labor, n, and capital, k. Firms rent capital at a rate r + δ, subject to a collateral constraint:

$$k_i \leq \theta_i, \quad i \in \{T, N\}.$$

In each period, sector i firms solve

$$\max_{k_i, n_i} \; p_i (z_i k_i)^{\phi} n_i^{1-\phi} - w n_i - (r + \delta) k_i \quad \text{s.t. } k_i \leq \theta_i.$$

We assume that the collateral constraint is binding in each period, so that $k_i = \theta_i$. When the constraint is binding, labor demand by sector i is given by

$$n_i = \left(\frac{p_i (1 - \phi)}{w} \right)^{\frac{1}{\phi}} \tilde{\theta}_i, \tag{1}$$

to simplify notation, we define $\tilde{\theta}_i := z_i \theta_i$. A relaxation in the collateral constraint, θi , leads to an increase in labor demand for a given wage.

B. Equilibrium

The ratio of nontradable to tradable labor demand is given by

$$\frac{n_N}{n_T} = \frac{\tilde{\theta}_N}{\tilde{\theta}_T} p_N^{\frac{1}{\phi}}. \tag{2}$$

This equation represents the combinations of the nontradable to tradable employment ratio and the nontradable price that are consistent with firm optimization. We can think of this relation as the economy's supply curve in $\left(\frac{n_N}{n_T}, p_N\right)$ space.

$$\frac{p_N \tilde{\theta}_N^{\phi} n_N^{1-\phi}}{\tilde{\theta}_T^{\phi} n_T^{1-\phi}} = \frac{1-\alpha}{\alpha}[\tilde{\theta}_H + 1]. \tag{3}$$

Equation (3) represents the negative relation between $\frac{n_N}{n_T}$ and p_N that is consistent with nontradable goods market equilibrium. This can be thought of as the economy's demand curve.

We can solve for the equilibrium ratio of nontradable to tradable employment by combining (2) and (3) to obtain

$$\frac{n_N}{n_T} = \frac{1-\alpha}{\alpha}(\tilde{\theta}_H + 1). \tag{4}$$

Substituting (4) back into equation (2) yields the equilibrium price of nontradables:

$$p_N = \left(\frac{1-\alpha}{\alpha}(\tilde{\theta}_H + 1)\right)^{\phi} \left(\frac{\tilde{\theta}_T}{\tilde{\theta}_N}\right)^{\phi}. \quad (5)$$

C. Real Effects of Credit Supply Shocks

RESULT 1 (Nontradable to tradable employment ratio): The nontradable to tradable employment ratio is increasing in θH and independent of θN and θT . Result 1 implies that only a household credit supply expansion boosts the nontradable to tradable employment ratio.

RESULT 2 (Nontradable price): The price of nontradables is increasing in θH and θT , but decreasing in θN . If θT is always proportional to θN , then a credit supply shock can affect the price of nontradables only by shifting θH.

D. Robustness of Comparative Statics

We show that Results 1 and 2 are robust to assuming elastic labor supply. We further show that the results are robust to allowing the production technologies in the tradable and nontradable sectors to differ in both the degree of decreasing returns and their labor intensity.

III. The 1980s Banking Deregulation Natural Experiment

A. First Stage（boom）

$$\Delta_{82,89}Y_s = \alpha^{boom} + \pi^{boom} \cdot DEREG_s + \Gamma^{boom} \cdot Z_s + \epsilon_s^{boom}, \quad (6)$$

where $\Delta_{82,89}Y_s$ is a measure of the growth in credit from 1982 to 1989, DEREGs is our deregulation measure, which captures 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.

Table II Deregulation and the Rise in Leverage from 1982 to 1989

	Δ_{82-89} Debt to income (1)	Δ_{84-89} Loan app. volume (2)	Δ_{84-89} Loan app. number (3)	Δ_{82-89} Total loans (4)	Δ_{82-89} C&I loans (5)	Δ_{82-89} HH loans (6)	Δ_{82-89} Con. loans (7)	Δ_{82-89} HH lev. index (8)
Panel A: Baseline								
Dereg. meas.	0.041**	0.42*	0.20*	0.19**	0.24**	0.14*	0.24**	0.75**
	(0.012)	(0.16)	(0.089)	(0.059)	(0.063)	(0.054)	(0.061)	(0.15)
R^2	0.210	0.182	0.128	0.217	0.250	0.144	0.269	0.398
Panel B: Lagged Dependent Variable Controls								
Dereg. meas.	0.030**			0.19**	0.17*	0.13+	0.22**	
	(0.010)			(0.049)	(0.063)	(0.063)	(0.058)	
R^2	0.477			0.439	0.425	0.197	0.375	
Panel C: Placebo Test on 1975 to 1979 Expansion								
Dereg. meas.				-0.017	0.017	-0.025	0.022	
				(0.011)	(0.027)	(0.017)	(0.021)	
R^2				0.035	0.012	0.036	0.031	
Observations	49	49	49	49	49	49	49	49

To shed light on the exact timing of the relative growth in credit in early-deregulation states, Figure 1 plots estimates of βq from

$$Y_{st} = \alpha_s + \gamma_t + \sum_{q \neq 1982} \mathbb{1}_{t=q} \cdot DEREG_s \cdot \beta_q + \epsilon_{st}. \quad (7)$$

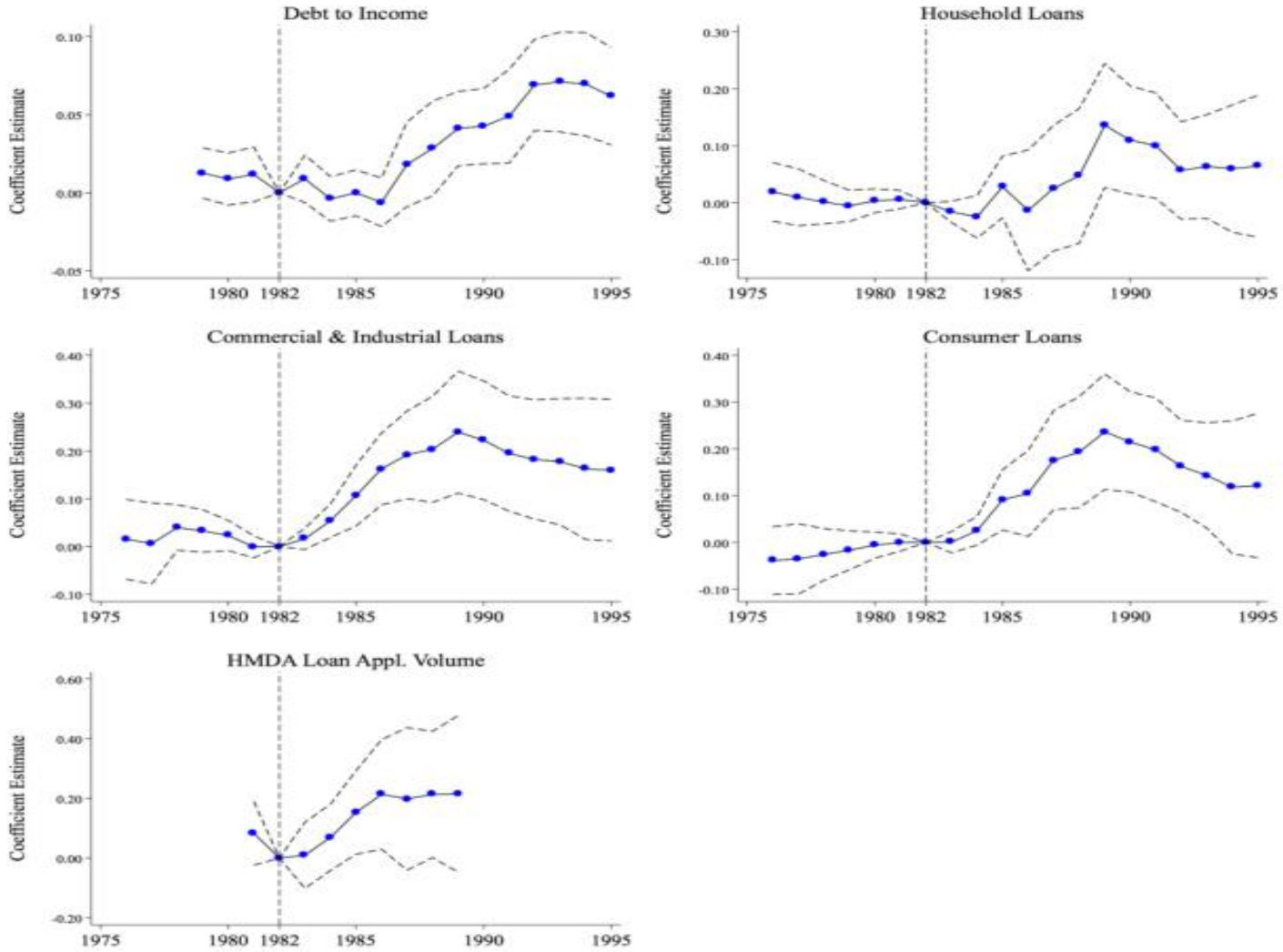


Figure 1. Credit growth and deregulation.

B. Exclusion Restriction (Placebo Test)

One concern with using deregulation timing to generate credit supply shocks is that such timing may be spuriously correlated with other sources of business cycle variation.

Panel C of Table II presents specifications similar to equation 6, but using credit growth from 1975 to 1979 instead of 1982 to 1989.

The results indicate that states that deregulated their banking sectors earlier in the 1980s did not see differentially large credit growth during the previous economic expansion.

IV. Evidence of the Household Demand Channel

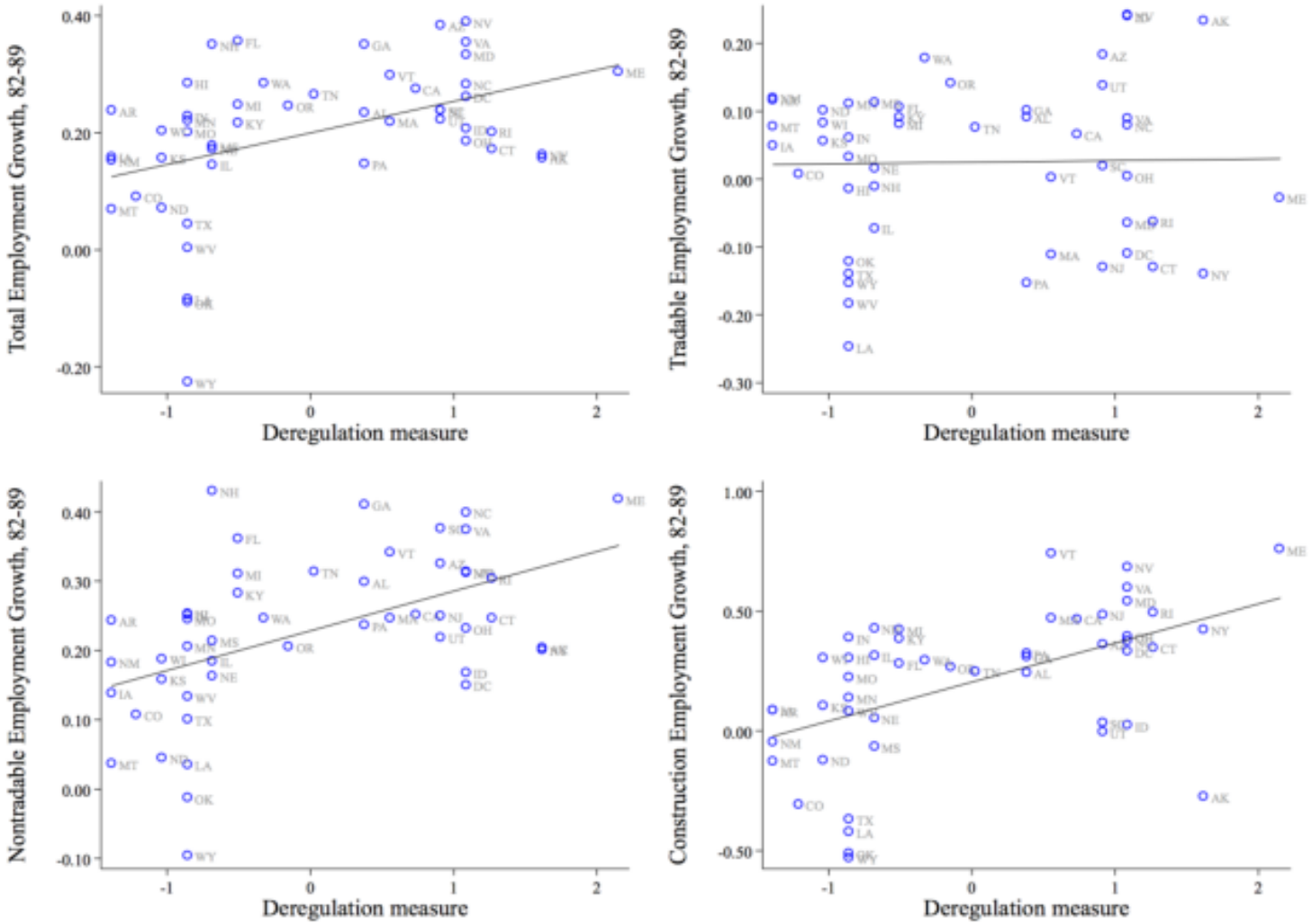


Figure 2. Deregulation and employment growth, 1982-1989.

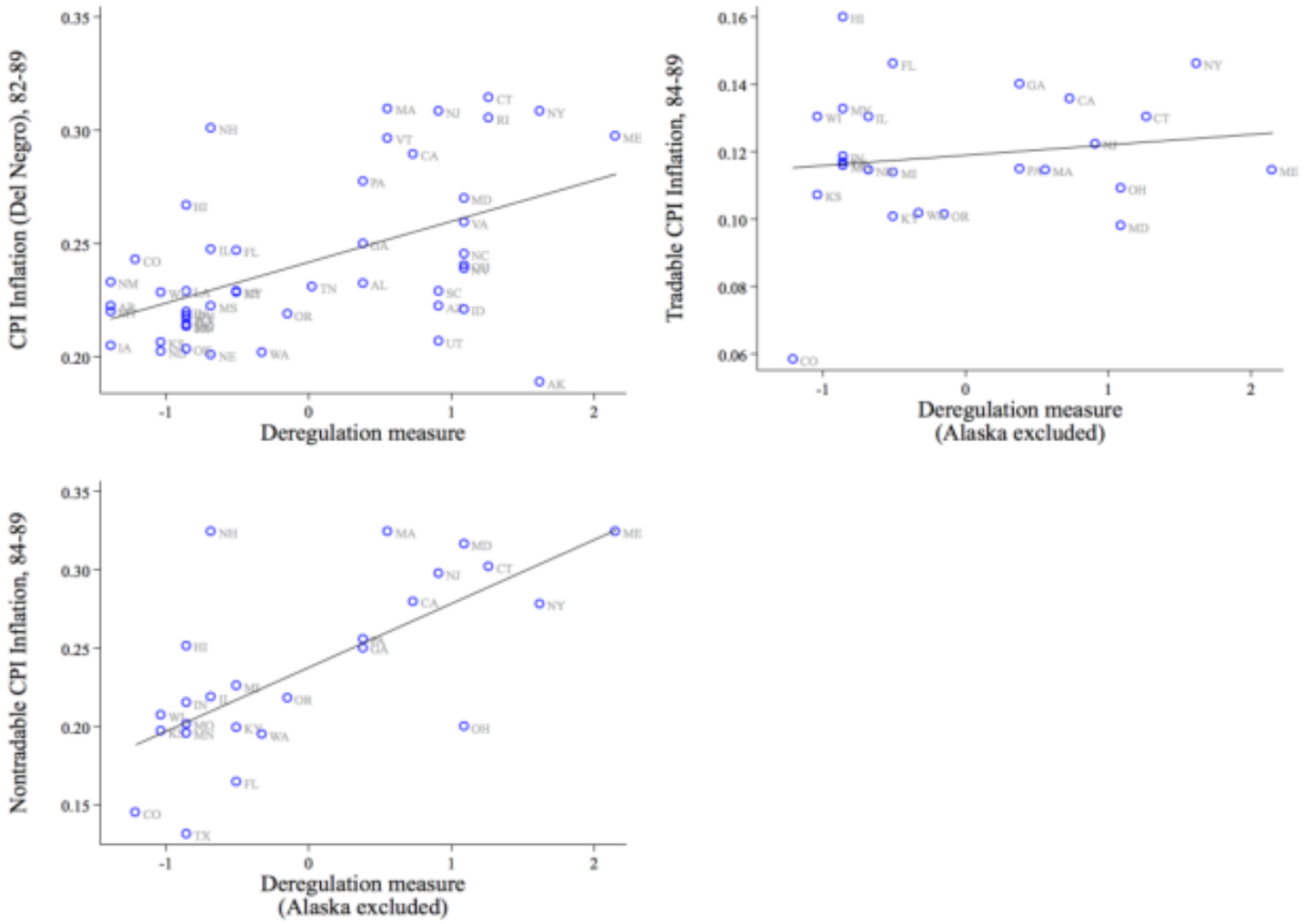


Figure 3. Inflation and deregulation.

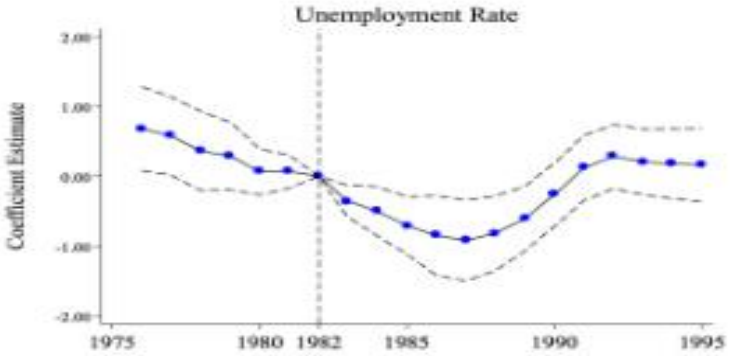
V. Credit Expansion and Business Cycle Amplification

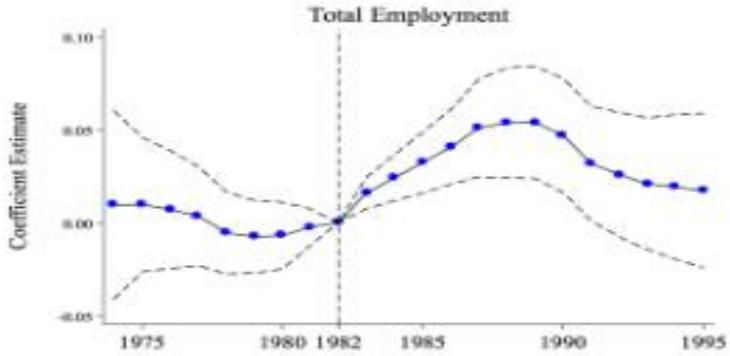
A. Business Cycle Amplification

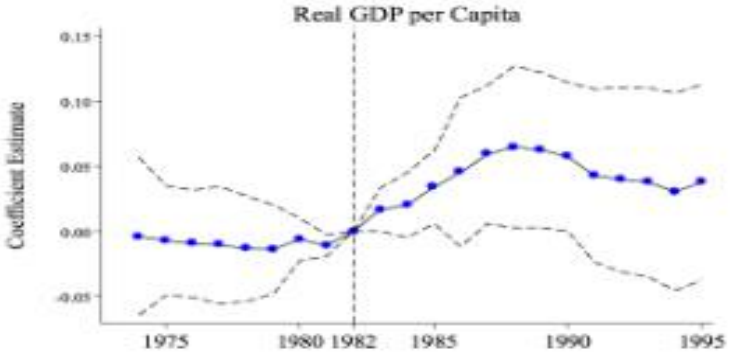
To shed light on the exact timing of the relative growth in credit in early-deregulation states, Figure 4 plots estimates of βq from equation (7)

$$Y_{st} = \alpha_s + \gamma_t + \sum_{q \neq 1982} \mathbb{1}_{t=q} \cdot DEREG_s \cdot \beta_q + \epsilon_{st}. \quad (7)$$

Figure 4. Deregulation and unemployment, real GDP per capita, house prices, and housing units.


Unemployment Rate
Coefficient Estimate
2.00
1.00
0.00
-1.00
-2.00
1975
1980
1982
1985
1990
1995


Total Employment
Coefficient Estimate
0.10
0.05
0.00
-0.05
1975
1980
1982
1985
1990
1995


Real GDP per Capita
Coefficient Estimate
0.15
0.10
0.05
0.00
-0.05
1975
1980
1982
1985
1990
1995


House Price
Coefficient Estimate
0.30
0.20
0.10
0.00
-0.10
1975
1980
1982
1985
1990
1995


Housing Unit Permits
Coefficient Estimate
0.60
0.40
0.20
0.00
-0.20
1975
1980
1982
1985
1990
1995

Estimates of equation (6) and a similar equation for the bust:

$$\Delta_{89,92} Y_s = \alpha^{bust} + \pi^{bust} \cdot DEREG_s + \Gamma^{bust} \cdot Z_s + \epsilon_s^{bust}. \qquad (8)$$

Table III Deregulation and Amplification: First-Difference Specifications

	Boom: Change from 1982 to 1989				Bust: Change from 1989 to 1992			
Controls	None (1)	Lagged Dep. Var. (2)	Oil Shock (3)	Demo. & Forb. (4)	None (5)	Lagged Dep. Var. (6)	Oil Shock (7)	Demog. & Forb. (8)
Panel A: Unemployment								
Dereg. meas.	-0.61*	-0.85**	-0.22	-0.43*	0.89**	0.83**	0.79**	0.78**
	(0.23)	(0.16)	(0.22)	(0.21)	(0.14)	(0.14)	(0.16)	(0.11)
R^2	0.10	0.68	0.42	0.42	0.41	0.44	0.47	0.58
Panel B: Total Employment								
Dereg. meas.	0.054**	0.064**	0.017	0.049**	-0.028**	-0.031**	-0.030**	-0.022+
	(0.015)	(0.016)	(0.011)	(0.017)	(0.010)	(0.009)	(0.009)	(0.011)
R^2	0.19	0.33	0.72	0.21	0.18	0.24	0.36	0.45
Panel C: Real GDP								
Dereg. meas.	0.091**	0.061**	0.059**	0.071*	-0.019*	-0.013	-0.019*	-0.016
	(0.029)	(0.019)	(0.015)	(0.032)	(0.008)	(0.009)	(0.007)	(0.019)
R^2	0.22	0.77	0.80	0.35	0.12	0.43	0.33	0.21
Panel D: Real GDP per Capita								
Dereg. meas.	0.062*	0.038**	0.043**	0.042	-0.023**	-0.020**	-0.020**	-0.021*
	(0.029)	(0.011)	(0.010)	(0.032)	(0.008)	(0.007)	(0.005)	(0.009)
R^2	0.13	0.87	0.86	0.38	0.22	0.47	0.52	0.38
Panel E: House Prices								
Dereg. meas.	0.189**	0.189**	0.151**	0.193**	-0.043**	-0.033*	-0.046**	-0.044*
	(0.040)	(0.038)	(0.048)	(0.050)	(0.013)	(0.013)	(0.016)	(0.018)
R^2	0.32	0.51	0.38	0.47	0.15	0.43	0.15	0.31
Panel F: Housing Unit Permits								
Dereg. meas.	0.277**	0.283**	0.028	0.216*	-0.228**	-0.230**	-0.156*	-0.144*
	(0.0861)	(0.102)	(0.061)	(0.088)	(0.059)	(0.064)	(0.060)	(0.063)
R^2	0.15	0.33	0.67	0.31	0.25	0.31	0.36	0.35
Observations	49	49	49	48	49	49	49	48

B. Why a More Pronounced Downturn?

The increase in household debt is statistically most powerful in predicting recession severity. In addition, downward nominal rigidity and banking sector problems help explain the more severe recession in early-deregulation states.

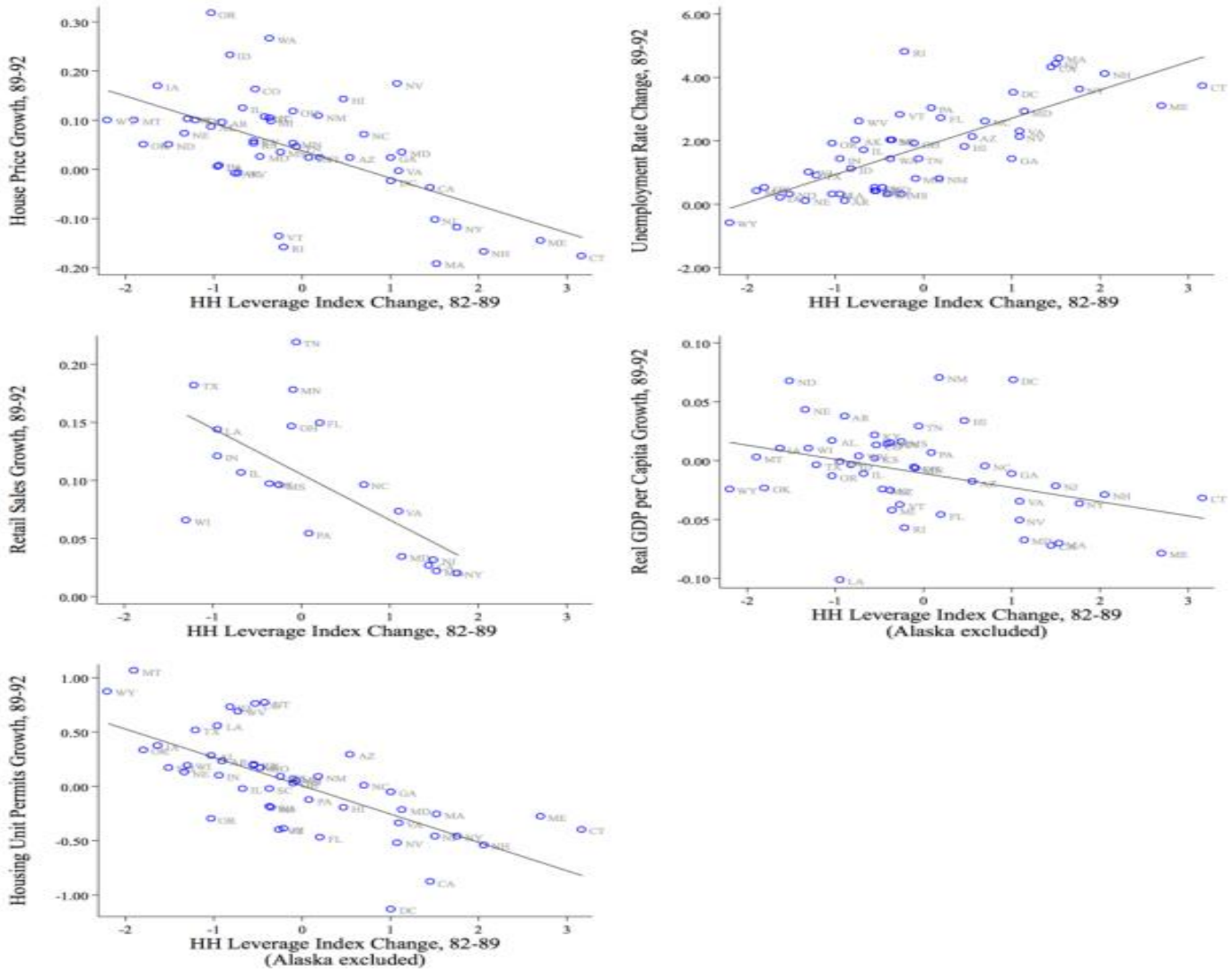


Figure 5. Household credit boom and the subsequent recession.

VI. Contributions and deficiencies

The existing literature typically adopts a difference-in-differences specification:

$$Y_{st} = \alpha_s + \gamma_t + \beta * DEREG_{st} + \epsilon_{st}, \qquad (9)$$

where DEREGst takes a value of zero before a state deregulates and one afterward. This specification also includes state and year fixed effects. The estimated β from this specification reflects the immediate effect of deregulation on Y by comparing states that deregulate in year t with states that have not yet deregulated.

VII. The Household Demand Channel in Broader Settings

The following specification at the country level:

$$\Delta_3 \ln(Emp_{NT}/Emp_T)_{it} = \alpha_i + \beta^P \Delta_3 d_{it}^P + \epsilon_{it}, \qquad (10)$$

where $\Delta_3 \ln(Emp_{NT}/Emp_T)_{it}$ is the three-year change in the log nontradable to tradable employment ratio, α_i is a country fixed effect, and $\Delta_3 d_{it}^P$ is the three-year change in the private debt to GDP ratio. We examine three-year changes based on the result that credit shocks typically lead to an expansion in credit of three to four years.

Table IV Broader Evidence from International Panel Data

	$\Delta_3 \ln\left(\frac{Emp_{NT}}{Emp_T}\right)_{it}$		$\Delta_3 \ln\left(\frac{Y_{NT}}{Y_T}\right)_{it}$		$\Delta_3 \ln\left(\frac{P_{NT}}{P_T}\right)_{it}$		$\Delta_3 y_{it+4}$	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: Private Credit Expansion								
$\Delta_3 d_{it}^P$	0.16**	0.15**	0.23**	0.17**	0.066+	0.043	-0.15**	-0.12**
	(0.017)	(0.029)	(0.014)	(0.022)	(0.039)	(0.035)	(0.024)	(0.020)
R^2	0.13	0.25	0.14	0.27	0.0099	0.12	0.100	0.53
Panel B: Household and Firm Credit Expansion								
$\Delta_3 d_{it}^{HH}$	0.39**	0.37**	0.47**	0.45**	0.31**	0.34*	-0.45**	-0.32**
	(0.064)	(0.049)	(0.048)	(0.066)	(0.11)	(0.13)	(0.085)	(0.029)
$\Delta_3 d_{it}^F$	0.059	0.055	0.12**	0.051	-0.041	-0.082	-0.019	-0.038
	(0.038)	(0.046)	(0.024)	(0.047)	(0.054)	(0.058)	(0.026)	(0.027)
R^2	0.16	0.28	0.16	0.29	0.030	0.14	0.16	0.55
Country FE	✓	✓	✓	✓	✓	✓	✓	✓
Controls		✓		✓		✓		✓
Year FE		✓		✓		✓		✓
Observations	843	843	843	843	843	843	843	843

Table V Broader Evidence: The 2000s Boom

	Δ_{00-07} Empl. Nontrad.	Δ_{00-07} Empl. Tradables	Δ_{00-07} Empl. Constr.	Δ_{00-07} CPI	Δ_{00-07} CPI Nontrad.	Δ_{00-07} CPI Tradables	Δ_{07-09} Total Empl.
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Δ_{00-07} HH DTI	0.22**	-0.16	0.27*	0.069**	0.079*	0.036*	-0.11**
	(0.073)	(0.16)	(0.11)	(0.021)	(0.031)	(0.013)	(0.026)
R^2	0.28	0.037	0.14	0.21	0.16	0.13	0.39
Observations	50	50	50	29	29	29	50

VIII. Conclusion

- The analysis here shows that household demand was an important channel through which banking deregulation affected the real economy. In particular, early-deregulation states experienced a relative increase in household debt and a relative increase in employment in the nontradable sector. In contrast, employment in the tradable sector was similar in early and late deregulation states. Early-deregulation states also witnessed a substantial relative increase in the price of nontradable goods during the expansion.

- Consistent with demand-based models of credit supply cycles, the evidence shows 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 result is explained in part by downward nominal wage rigidity, banking sector losses, and elevated household debt.

Thank you