

The Real Effects of Credit Booms and Busts

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Introduction

- **Global Financial Crisis (2008–09):**
 - ▶ Originated in the U.S. housing sector
 - ▶ Paralyzed the world-wide financial system
 - ▶ Real consequences: 3.8 million U.S. foreclosures, 8 million jobs lost ...
- Strong relationship between credit booms and the severity and duration of subsequent economic downturns.
(Reinhart & Rogoff [2011]; Jordà, Schularick & Taylor [2013, 2016]; Mian, Sufi & Verner [2016])

The Role of Credit Supply Shocks?

- Employment decline due almost entirely to the effect of a drop in HP on household demand (Mian & Sufi [2014])
 - ▶ Large effect on employment in **non-tradable** goods sector
 - ▶ No effect on employment in **tradable** goods sector
 - ▶ No effect on local wages
- Credit supply shocks account for less than 1/10 of the employment decline (Duygan et al. [2015]; Greenstone et al. [2015])
- Credit supply shocks account for more than 1/3 of the employment decline (Chodorow-Reich [2014]; Mondragon [2014]; García [2017]; Glancy [2017]; Gertler & Gilchrist [2017])
 - ▶ Losses concentrated among **small** firms (Chodorow-Reich [2014]; Siemer [forthcoming])
 - ▶ Losses concentrated among **young** firms (Haltiwanger & Davis [2016]; Fort et al. [2016]; Siemer [forthcoming])

This Paper

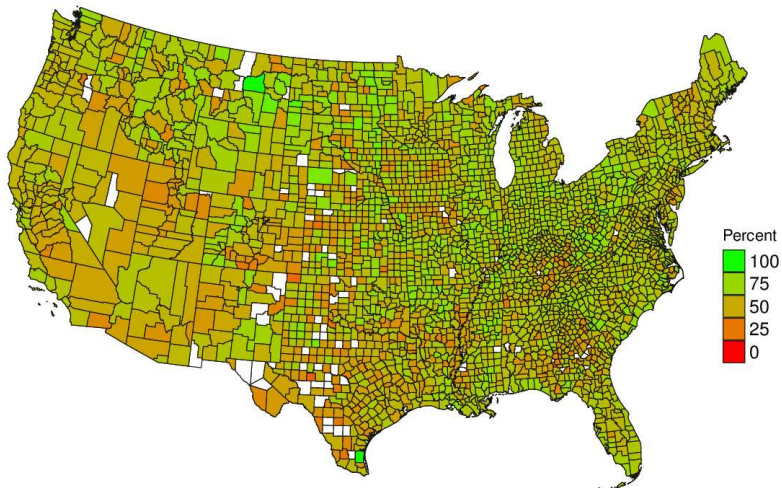
- Empirically investigate the role of credit supply shocks during “boom” (2003–2006 & 2011–2015) and “bust” (2007–2010) periods.
- A new dataset combining geographic data on home mortgages with lender-level regulatory income and balance sheet information.
- New identification strategy:
 - ▶ Exploits the fact that banks originate home mortgages across multiple local markets
 - ▶ Ties the statistical estimates of credit supply shocks to observable indicators of bank health
- Quantify the effect of supply-induced contractions in the availability of bank credit on a wide range of local economic outcomes.

Data Sources

- Merge home mortgage loan originations (HMDA) with banks' income and balance sheet data from regulatory filings.
- Sample selection criteria:
 - ▶ Annual data: 2003–2015
 - ▶ 48 contiguous U.S. states
 - ▶ Home mortgages for single-family home purchases
 - ▶ Banks with at least 1\$ billion in assets
- Local economic area: **county**
(robust to Commuter Zone level of aggregation)
- County-level economic outcomes: home sales, building permits, private employment, unemployment rate, wages, personal income, retail sales, MV registrations

Geographic Coverage – HMDA

Average share of home mortgage loan originations (2003–2015)



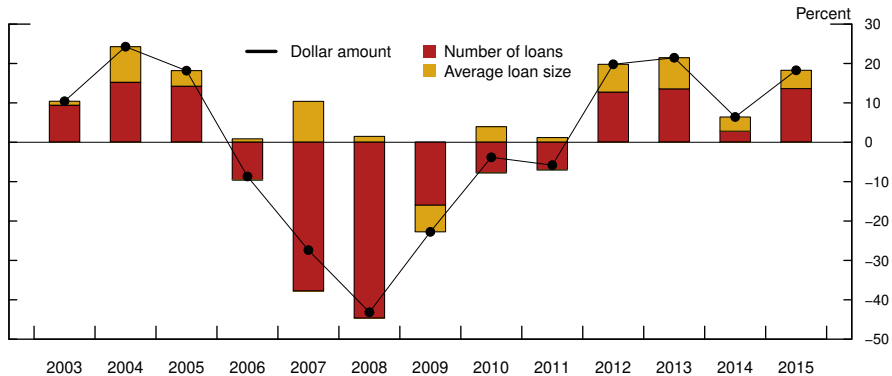
Local Economic Outcomes: Boom vs. Bust

Population-weighted moments

Variable	Boom: 2003–2006, 2011–2015		Bust: 2007–2010	
	Mean	StdDev	Mean	StdDev
Home mortgage lending (% Δ)	10.01	16.83	-23.49	22.25
Home prices (% Δ)	4.79	5.92	-6.67	7.26
Home sales per capita (% Δ)	2.97	34.84	-22.30	37.96
Bldg. permits per capita (% Δ)	2.63	31.69	-28.53	42.55
Employment-population ratio (% Δ)	1.00	2.59	-3.16	3.17
Unemployment rate (Δ)	-0.76	0.60	1.68	1.60
Wages per employee (% Δ)	2.78	4.04	1.63	5.01
Income per capita (% Δ)	3.85	2.98	0.57	4.65
Rtl. sales per capita (% Δ)	4.01	3.68	-2.21	7.85
Rtl. sales (ex. MV) per capita (% Δ)	3.71	4.17	-0.73	6.85
MV registrations per capita (% Δ)	5.26	8.80	-13.31	17.87

Home Mortgage Lending

Intensive vs. extensive margin



Identification of Credit Supply Shocks

- Statistical decomposition of the growth in the **number** of home mortgage originations between year $t - 1$ and t :

(Khwaja & Mian [2008]; Schnabl [2012]; Jiménez et al. [2014]; Greenstone et al. [2015])

$$\Delta \ln N_{j,k,t} = \mu_t + S_{j,t} + D_{k,t} + \epsilon_{j,k,t}$$

- ▶ WLS estimation
- Interpretation:
 - ▶ $S_{j,t}$ = bank fixed effect \Rightarrow bank-specific **credit supply** shock
 - ▶ $D_{k,t}$ = county fixed effect \Rightarrow county-specific **credit demand** shock
 - ▶ Aggregation: $\widehat{S}_{k,t} = \sum_{j \in \mathcal{B}_{k,t-1}} b_{j,k,t-1} \times \widehat{S}_{j,t}$

Identification of Credit Supply Shocks (cont.)

- Estimate a panel regression (2003–2015):

$$\widehat{S}_{j,t} = \beta \text{BankHealth}_{j,t} + \eta_j + \lambda_t + \epsilon_{j,t}$$

- Component of $\widehat{S}_{j,t}$ due to bank health: $\widehat{S}_{j,t}^* = \widehat{\beta} \text{BankHealth}_{j,t}$
 - Aggregate to county-level $\Rightarrow \widehat{S}_{k,t}^* = \sum_{j \in \mathcal{B}_{k,t-1}} b_{j,k,t-1} \times \widehat{S}_{j,t}^*$
- Orthogonalize $\widehat{S}_{k,t}^*$ w.r.t. county-level demand shocks (2003–2015):

$$\widehat{S}_{k,t}^* = \theta_1 \widehat{D}_{k,t}^{(I)} + \theta_2 \widehat{D}_{k,t}^{(E)} + \delta_k + \gamma_t + \zeta_{k,t}$$

- $\widehat{\zeta}_{k,t}$ captures variation in credit supply across counties due to changes in bank health and is orthogonal to changes in local credit demand

Bank Health and Credit Supply Shocks

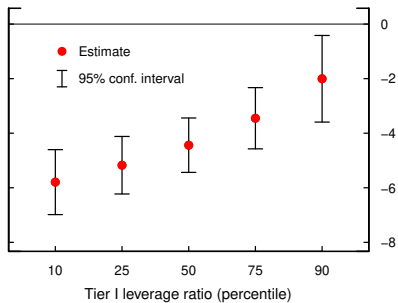
Sample period: 2003–2015

Explanatory Variables	Dep. Variable: $\widehat{S}_{j,t}$	
	(1)	(2)
RE-CHG $_{j,t}$	-4.530 (0.511)	-10.404 (1.586)
T1LEV $_{j,t-1}$	0.469 (0.181)	0.188 (0.193)
RE-CHG $_{j,t} \times$ T1LEV $_{j,t-1}$.	0.650 (0.165)
RE-SHR $_{j,t-1}$	-0.070 (0.020)	-0.070 (0.020)
$\ln A_{j,t-1}$	-0.125 (0.012)	-0.124 (0.0122)
Pr > W_γ	<.001	<.001
R^2	0.173	0.174
No. of banks		4,725
Observations		31,918

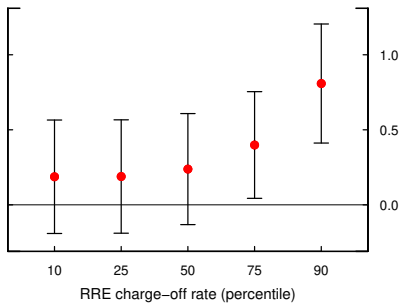
NOTE: Bank-clustered standard errors in parentheses.

Marginal Effects

With respect to charge-offs

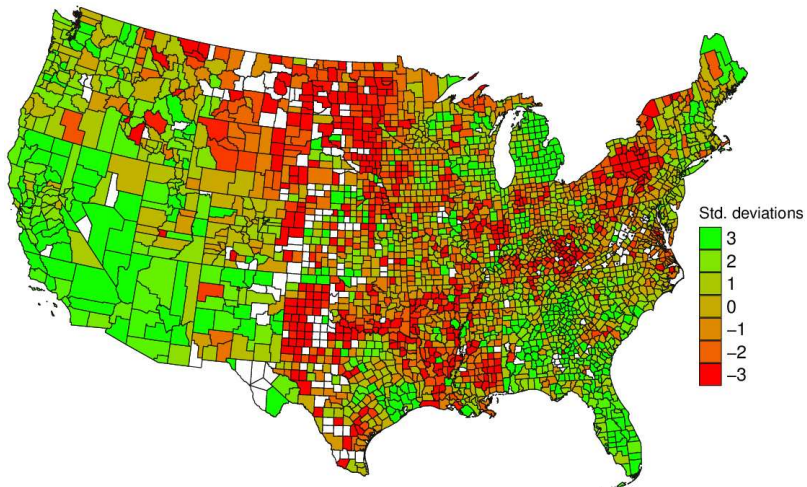


With respect to capital



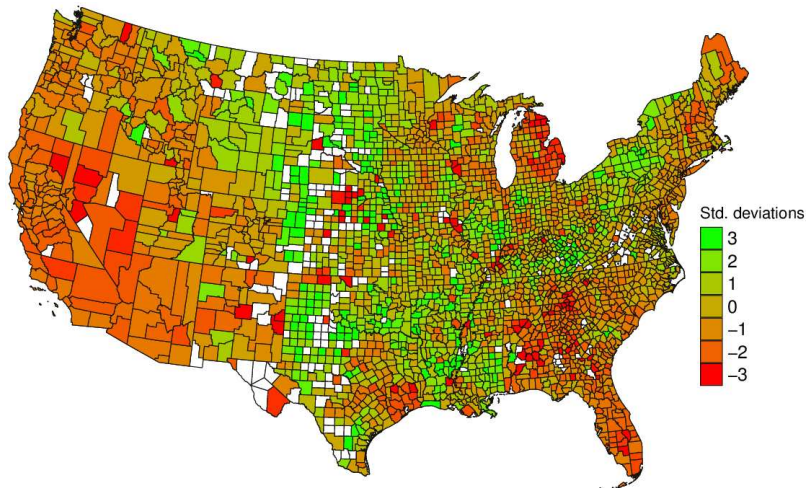
Mortgage Credit Supply Effects – Boom

Sample period: 2003–2006



Mortgage Credit Supply Effects – Bust

Sample period: 2007–2010



Estimation

- Baseline specification:

$$\Delta_2 Y_{k,t} = \beta \Delta_2 \ln \text{HP}_{k,t} + \gamma' \mathbf{X}_{k,t-3} + \delta_t + \epsilon_{k,t}$$

- ▶ $\Delta_2 Y_{k,t}$ = annualized 2-year growth (or change) in an indicator of economic conditions in county k from year $t - 2$ to year t
 - ▶ $\Delta_2 \ln \text{HP}_{k,t}$ = annualized 2-year growth of home prices (Nakamura & Steinsson [2014])
 - ▶ $\mathbf{X}_{k,t-3}$ = vector of pre-determined county characteristics
- **Instruments:** $(\hat{\xi}_{k,t-1}, \hat{\xi}_{k,t})$ – orthogonalized bank-health credit supply shocks in years $t - 1$ and t
- Sample periods:
 - ▶ **Boom:** 2003–2015, excluding the bust period and 2006
 - ▶ **Bust:** 2007–2010

Home Prices and the Labor Market (LS)

Dependent variable: $\Delta_2 Y_{k,t}$

Explanatory Variables	Emp-to-pop ratio	Unemployment rate	Payroll per employee
<i>A. Boom</i>			
$\Delta_2 \ln HP_{k,t}$	0.049 (0.009)	-0.019 (0.003)	0.057 (0.012)
R^2	0.085	0.591	0.273
Observations	19,680	22,148	19,675
<i>B. Bust</i>			
$\Delta_2 \ln HP_{k,t}$	0.116 (0.014)	-0.071 (0.004)	0.061 (0.016)
R^2	0.337	0.754	0.179
Observations	7,433	7,445	7,423

NOTE: Clustered standard errors in parentheses.

First-Stage Results

Boom vs. Bust

Explanatory Variables	Mortgage Lending	Home Prices
<i>A. Boom</i>		
$\hat{\zeta}_{k,t}$	2.726 (0.454)	1.911 (0.312)
$\hat{\zeta}_{k,t-1}$	0.039 (0.367)	1.197 (0.163)
R^2	0.411	0.663
Observations	23,374	22,080
<i>B. Bust</i>		
$\hat{\zeta}_{k,t}$	1.931 (0.596)	1.193 (0.209)
$\hat{\zeta}_{k,t-1}$	-0.928 (0.497)	0.419 (0.332)
R^2	0.416	0.425
Observations	7,849	7,446

NOTE: Clustered standard errors in parentheses.

Home Prices and the Labor Market (IV)

Controlling for unobserved heterogeneity

Explanatory Variables	Emp-to-pop ratio	Unemployment rate	Payroll per employee
<i>A. 2003–2015</i>			
$\Delta_2 \ln HP_{k,t}$	0.105 (0.019)	-0.070 (0.010)	0.106 (0.018)
County FE	N	N	N
Pr > J	0.002	0.000	0.550
Observations	29,538	31,982	29,532
<i>B. 2003–2015</i>			
$\Delta_2 \ln HP_{k,t}$	0.113 (0.020)	-0.073 (0.012)	0.094 (0.020)
County FE	Y	Y	Y
Pr > J	0.010	0.003	0.578
Observations	29,538	31,982	29,532

NOTE: Clustered standard errors in parentheses.

Home Prices and the Labor Market (IV)

Boom vs. Bust

Explanatory Variables	Emp-to-pop ratio	Unemployment rate	Payroll per employee
<i>A. Boom</i>			
$\Delta_2 \ln \text{HP}_{k,t}$	0.046 (0.022)	-0.014 (0.009)	0.143 (0.026)
$\text{Pr} > J$	0.872	0.000	0.653
Observations	19,639	22,068	19,634
<i>B. Bust</i>			
$\Delta_2 \ln \text{HP}_{k,t}$	0.197 (0.036)	-0.147 (0.019)	0.115 (0.040)
$\text{Pr} > J$	0.418	0.111	0.948
Observations	7,428	7,440	7,427

NOTE: Clustered standard errors in parentheses.

Taking Stock

- During the boom:
 - ▶ Relatively little systematic relationship between fluctuations in the supply of home mortgage credit and labor market outcomes
- During the bust:
 - ▶ Home mortgage credit supply shocks have significant effects on labor market outcomes

What Is the Mechanism?

- Consumption response?
- Sectoral employment response: construction, tradables, non-tradables, or other sectors?
- Small vs. large firms or young vs. old firms?

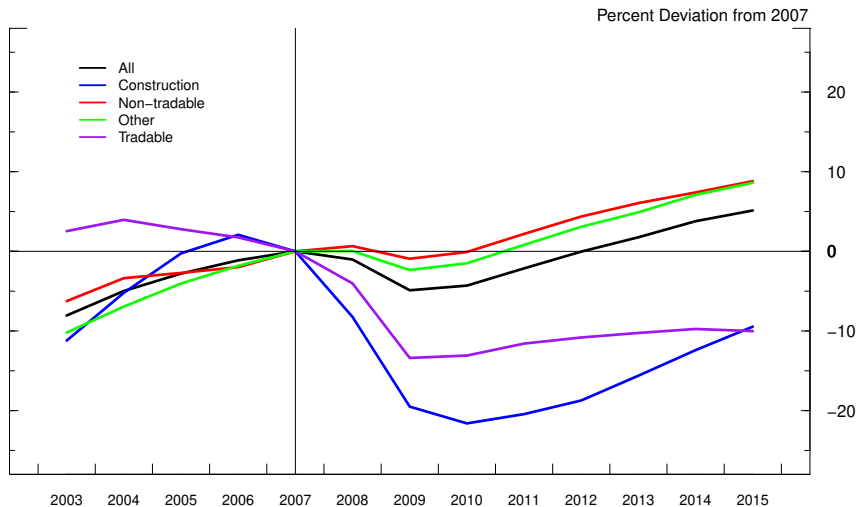
Home Prices, Income, and Consumption (IV)

Boom vs. Bust

Explanatory Variables	Income per capita	Rtl. sales per capita	MV sales per capita	Bldg. Permits per capita
A. Boom				
$\Delta_2 \ln HP_{k,t}$	0.175 (0.029)	0.117 (0.031)	0.228 (0.097)	-0.190 (0.266)
Pr > J	0.01	0.46	0.21	0.01
Observations	22,080	22,080	19,660	22,884
B. Bust				
$\Delta_2 \ln HP_{k,t}$	0.165 (0.047)	0.136 (0.052)	0.487 (0.150)	3.142 (0.481)
Pr > J	0.582	0.489	0.449	0.033
Observations	7,446	7,446	7,434	7,060

NOTE: Clustered standard errors in parentheses.

Employment Trends by Sector



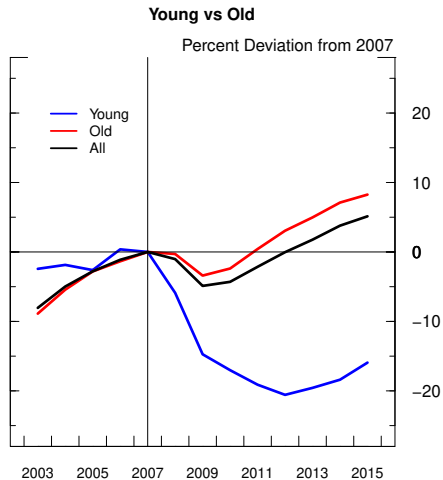
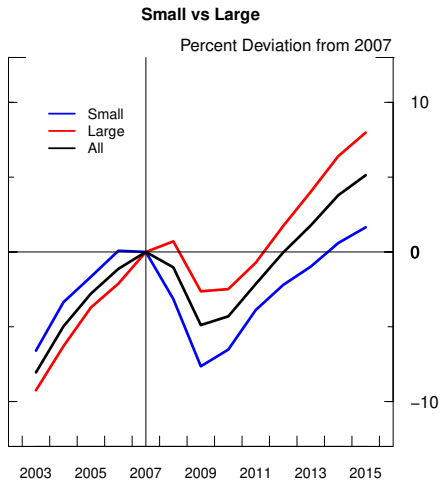
Home Prices and Sectoral Employment (IV)

Boom vs. Bust

Explanatory Variables	Construction	Tradable	Non-tradable	Other
<i>A. Boom</i>				
$\Delta_2 \ln HP_{k,t}$	0.361 (0.075)	-0.066 (0.075)	-0.009 (0.028)	-0.013 (0.030)
Pr > J	0.651	0.330	0.555	0.056
Observations	17,183	17,177	17,183	17,183
<i>B. Bust</i>				
$\Delta_2 \ln HP_{k,t}$	0.336 (0.100)	0.196 (0.122)	0.092 (0.049)	0.187 (0.043)
Pr > J	0.955	0.106	0.000	0.641
Observations	7,428	7,428	7,428	7,428

NOTE: Clustered standard errors in parentheses.

Employment Trends by Firm Type



Home Prices and Employment by Firm Type (IV)

Boom vs. Bust

Explanatory Variables	By Firm Size		By Firm Age	
	Small	Large	Young	Old
<i>A. Boom</i>				
$\Delta_2 \ln HP_{k,t}$	0.105 (0.044)	0.130 (0.037)	0.055 (0.094)	0.119 (0.032)
$\Pr > J$	0.125	0.904	0.272	0.195
Observations	19,839	19,835	21,634	21,634
<i>B. Bust</i>				
$\Delta_2 \ln HP_{k,t}$	0.261 (0.046)	0.089 (0.074)	0.410 (0.115)	0.118 (0.039)
$\Pr > J$	0.120	0.083	0.172	0.129
Observations	6,770	6,770	7,404	7,404

NOTE: Cluster-robust standard errors in parentheses.

Interpretation

- Are employment effects due to the firms' inability to access credit or a decline in household demand?
- Control for household demand using motor MV sales:
 - ▶ MVs are a tradable goods, so there should be no local price effects
- Examine the within-industry response in the non-tradable good sector.

Home Prices and Employment by Firm Type (IV)

Boom vs. bust; controlling for local demand

Explanatory Variables	By Firm Size		By Firm Age	
	Small	Large	Young	Old
<i>A. Boom</i>				
$\Delta_2 \ln \text{HP}_{k,t}$	0.076 (0.040)	0.105 (0.037)	0.042 (0.083)	0.081 (0.032)
$\Delta_2 \ln \text{MV}_{k,t}$	0.085 (0.011)	0.034 (0.012)	0.051 (0.024)	0.061 (0.011)
<i>B. Bust</i>				
$\Delta_2 \ln \text{HP}_{k,t}$	0.227 (0.048)	0.042 (0.088)	0.365 (0.134)	0.079 (0.047)
$\Delta_2 \ln \text{MV}_{k,t}$	0.074 (0.011)	0.080 (0.012)	0.089 (0.024)	0.069 (0.011)

NOTE: Clustered standard errors in parentheses.

Home Prices and Non-Tradable-Sector Employment by Firm Type (IV)

Boom vs. bust; controlling for local demand

Explanatory Variables	By Firm Size		By Firm Age	
	Small	Large	Young	Old
<i>A. Boom</i>				
$\Delta_2 \ln HP_{k,t}$	0.036 (0.045)	0.002 (0.052)	0.095 (0.131)	-0.008 (0.040)
$\Delta_2 \ln MV_{k,t}$	0.041 (0.013)	0.010 (0.015)	-0.014 (0.031)	0.035 (0.015)
<i>B. Bust</i>				
$\Delta_2 \ln HP_{k,t}$	0.149 (0.070)	0.088 (0.121)	0.594 (0.193)	0.078 (0.069)
$\Delta_2 \ln MV_{k,t}$	0.081 (0.028)	0.049 (0.036)	0.004 (0.066)	0.056 (0.021)

NOTE: Clustered standard errors in parentheses.

Summary

- Credit-supply induced movements in home prices have modest effect on local economic outcomes in a boom, but strong effects during a bust—employment response increases by a factor of 4!
- During a bust, credit-supply induced movements in home prices:
 - ▶ have large effects on consumer spending on durables and housing
 - ▶ affect employment in all sectors
 - ▶ especially affect employment at small and young firms
- Differences in employment dynamics at small/large young/old firms:
 - ▶ account for all of the differences in employment outcomes between a boom and a bust
 - ▶ occur within sectors
 - ▶ robust to controlling for local demand
- **Bottom line:** a significant component of credit supply effects on employment during the bust are attributable to a direct effect of the firms' loss of access to credit, rather than to a decline in household demand.