Finance and Business Cycles: The Role of Credit Supply Expansion and Household Demand

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Finance and Business Cycles

- Prescott (1986): "Economists have long been puzzled by the observations that during peacetime industrial market economies display recurrent, large fluctuations in output and employment over relatively short time periods."
- Since at least Bernanke and Gertler (and probably before), economists have looked to the financial system as a potential source of fluctuations or at least as an amplification mechanism
- The Great Recession has increased interest in how finance and the real economy are connected, and it has given us important clues into the sources of business cycles

Our Central Thesis

Expansions in credit supply, operating primarily through household demand, are an important source of business cycle fluctuations

Working definition: A **credit supply expansion** is when lenders increase the quantity of credit or decrease the interest rate on credit for reasons unrelated to changes in income or productivity of the borrower

Questions We Try to Answer

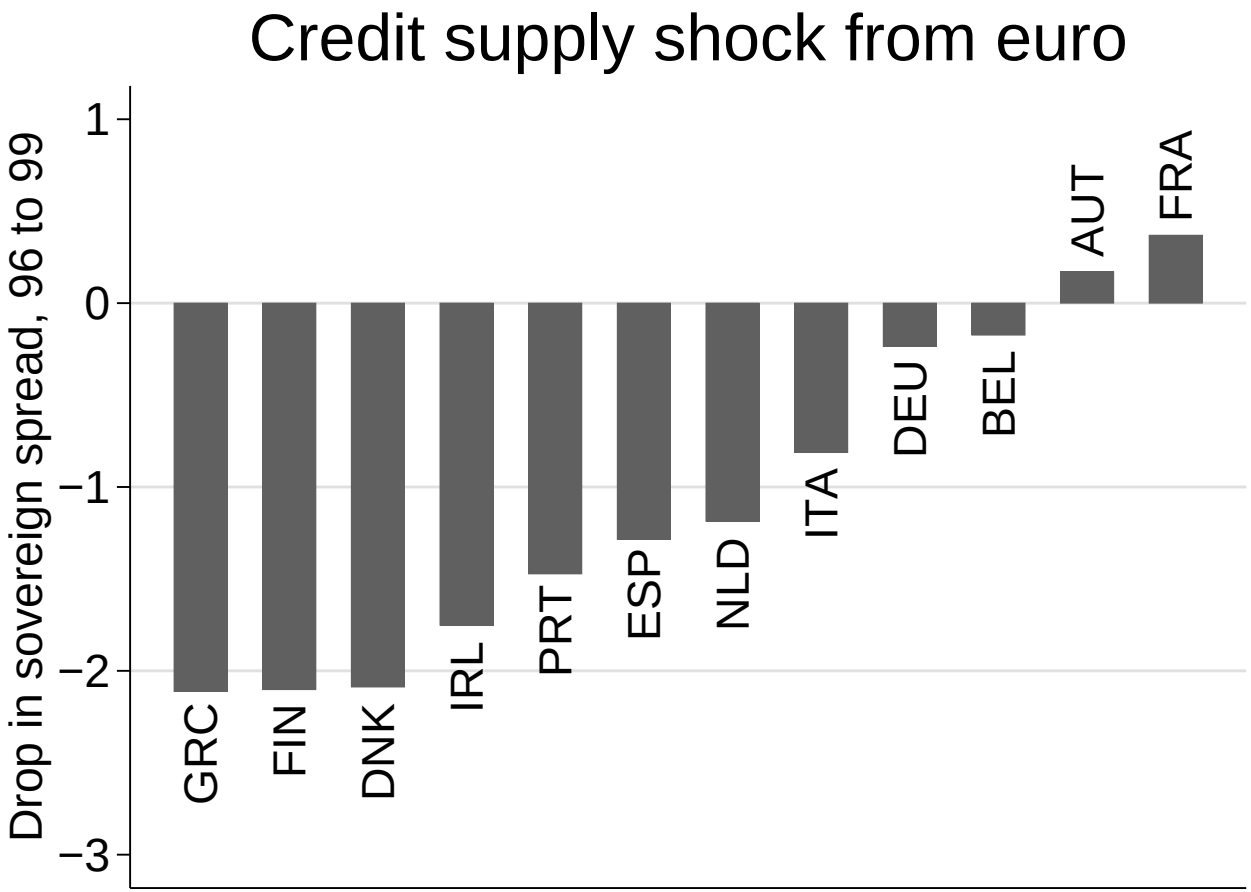
- What is a credit supply expansion from an empirical perspective?
- What is the empirical evidence that they are an important source of business cycle movements?
- What is the empirical evidence that they operate primarily through household demand?
- What is the role of behavioral biases and expectations in generating or amplifying such expansions?
- How do we model all of this?

Evidence

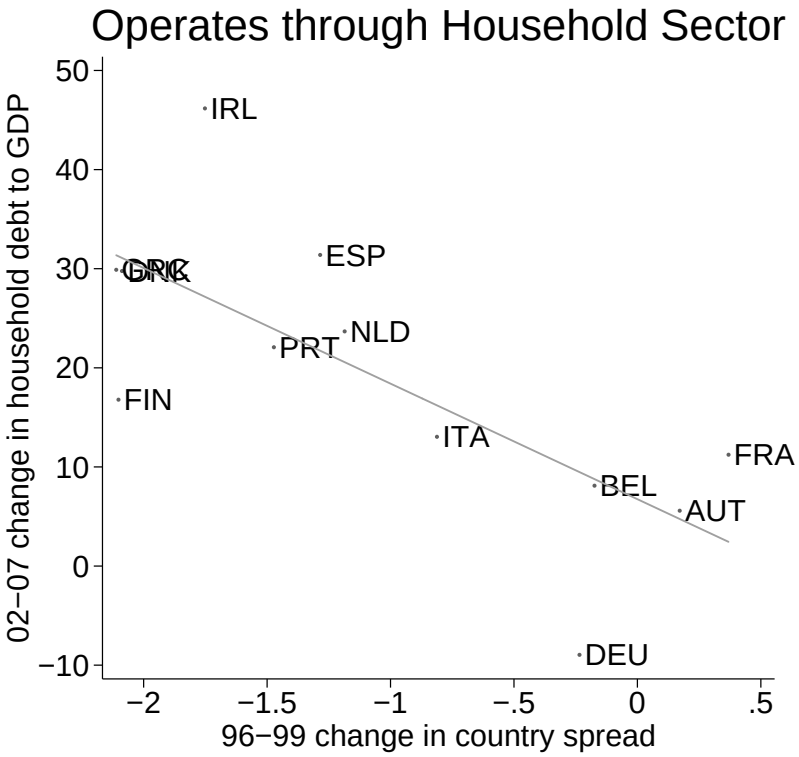
An Example to Fix Ideas: Introduction of euro

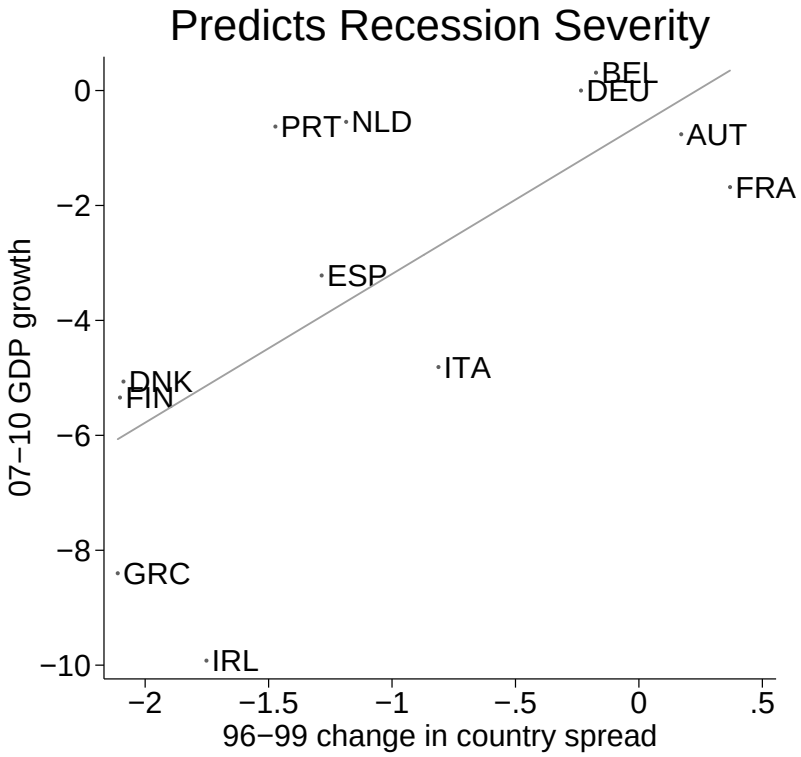
- In the late 1990s, the introduction of euro leads to convergence of sovereign spreads between core and peripheral countries because of decreased currency and other risk premia
- Mian, et al (2017a): six countries in particular saw an average decline in their sovereign spread of 170 basis points in the late 1990s, compared to only 14 basis points for core countries

Measuring an Expansion in Credit Supply



How the Expansion Affects the Economy





Household Channel Appears Dominant

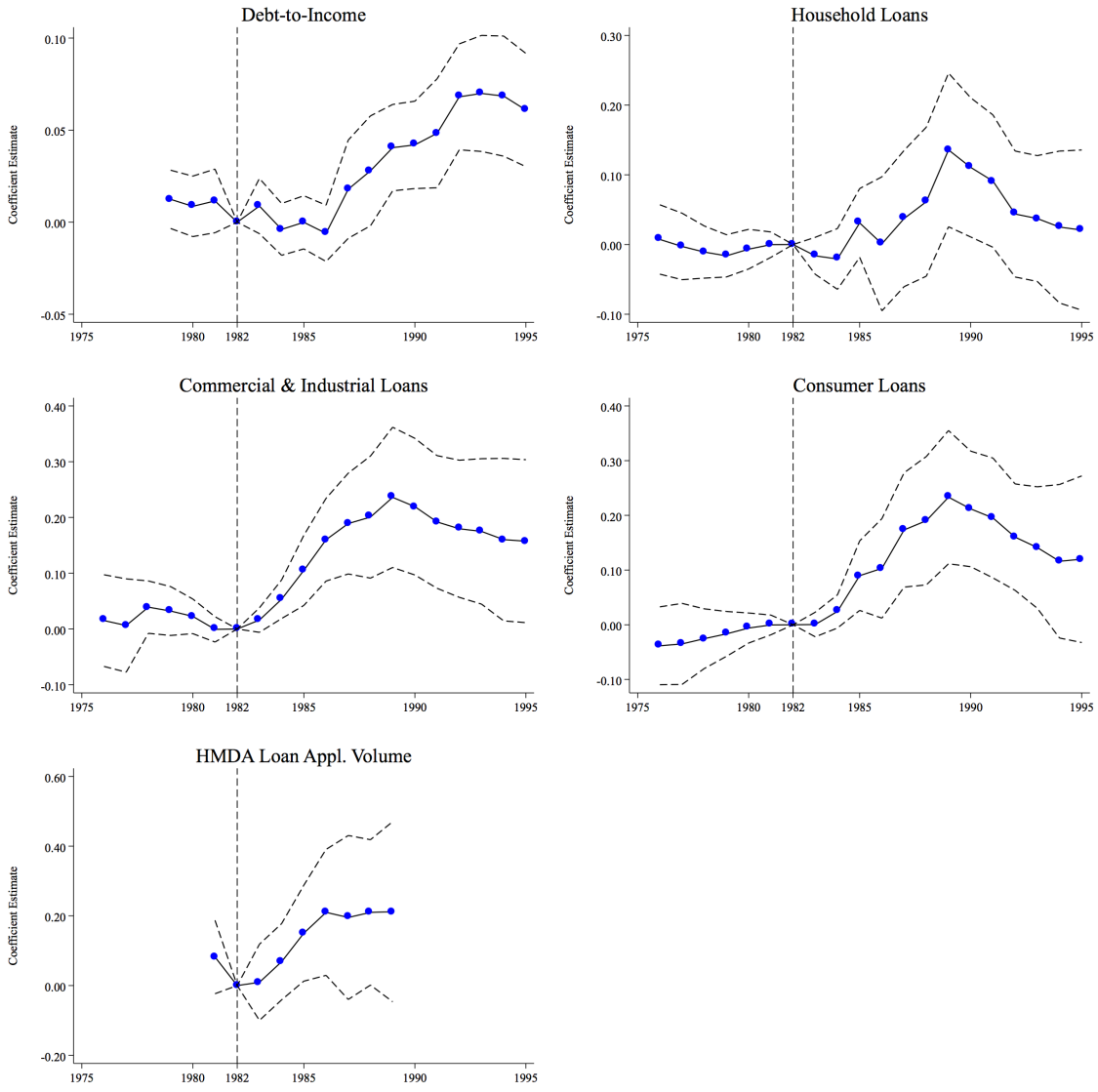
	Small Decline in Spread (N=5)	Large Decline in Spread (N=6)
Sovereign spread change, 1996-99	-0.14	-1.71
Employment growth, 2002-07	4.41	7.80
Tradable empl. growth, 2002-07	-4.62	-6.79
Non-tradable empl. growth, 2002-07	5.47	12.20
Construction empl. growth, 2002-07	5.04	13.38
Inflation, 2002-07	9.86	11.88
Nominal wage growth, 2002-07	12.79	16.84
Employment growth, 2007-10	0.73	-2.63

Notes: This table displays average growth in employment, prices, and wages separately for Eurozone countries with small and large declines in the sovereign spread leading up to the introduction of the euro. The small decline category (first column) includes Austria, Belgium, Germany, France, and Italy, and the large decline group is Denmark (ERM II), Finland, Greece, Netherlands, Spain, and Portugal. Data on employment by industry from the OECD is not available for Ireland.

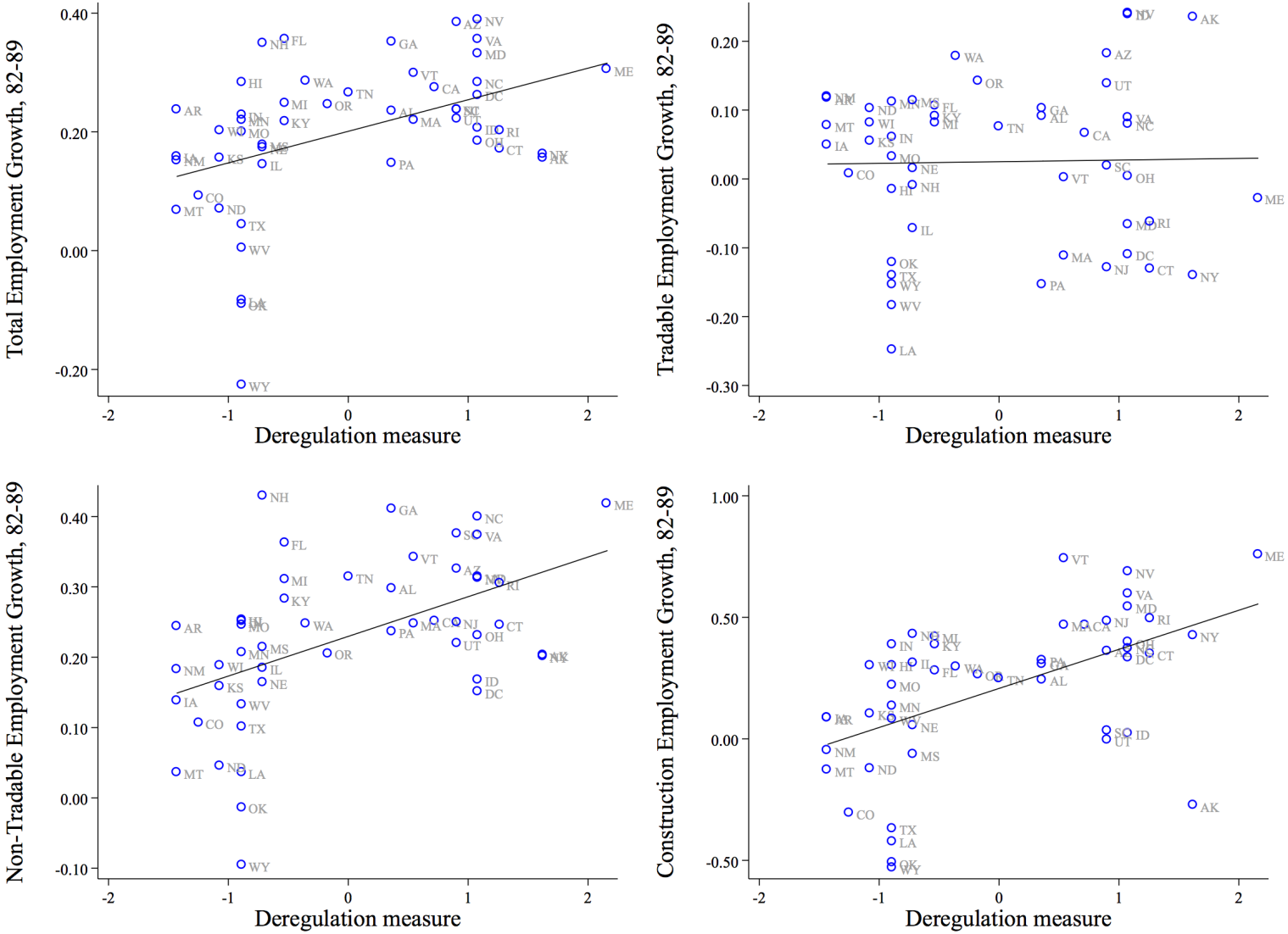
Two Examples using Bank Regulation in United States

- Di Maggio and Kermani (2017): Variation across states in the effect of 2004 federal pre-emption of local laws against predatory lending
- Mian, et al (2017b): Variation in bank branch restrictions across states during the 1982 to 1992 business cycle
- Both papers claim to isolate exogenous variation in credit supply expansion, and both find expansion associated with:
    - larger growth in loans to households
    - larger growth in house prices
    - larger growth in employment, concentrated in non-tradable and construction sectors
    - subsequently worse recession when credit supply shock reverts

Stronger loan growth in early deregulation states



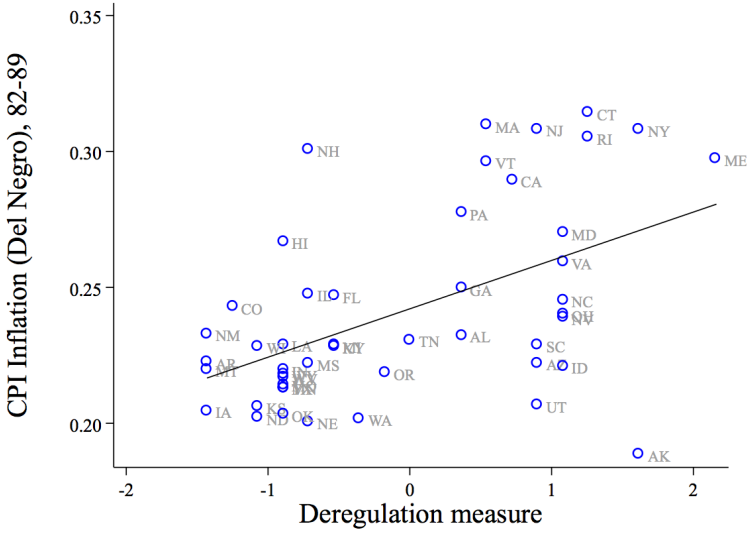
Job gains concentrated in non-tradable sector

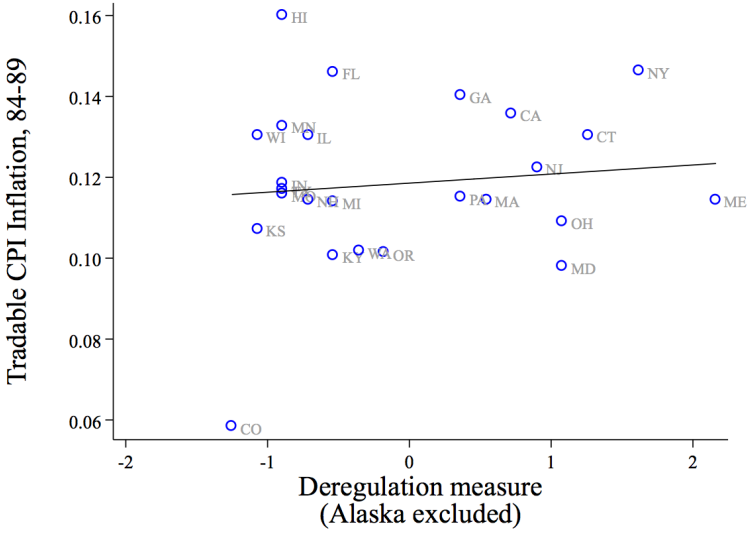


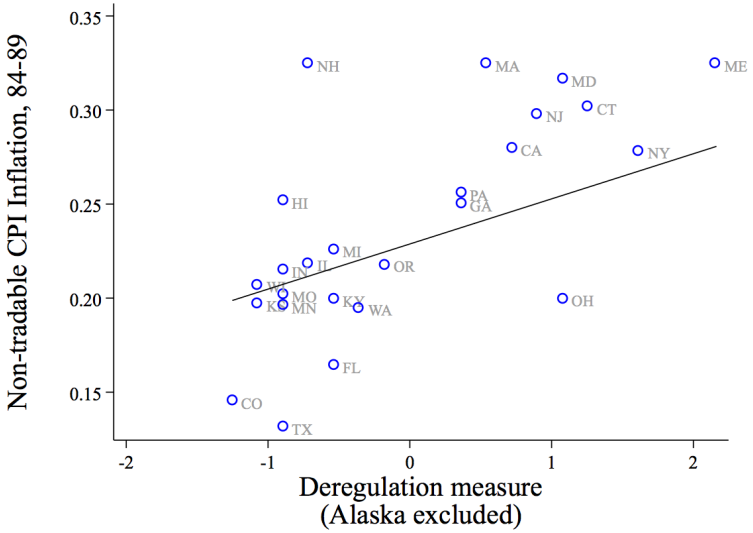
Job growth by industry and by extent of deregulation

	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

Real exchange rate appreciation



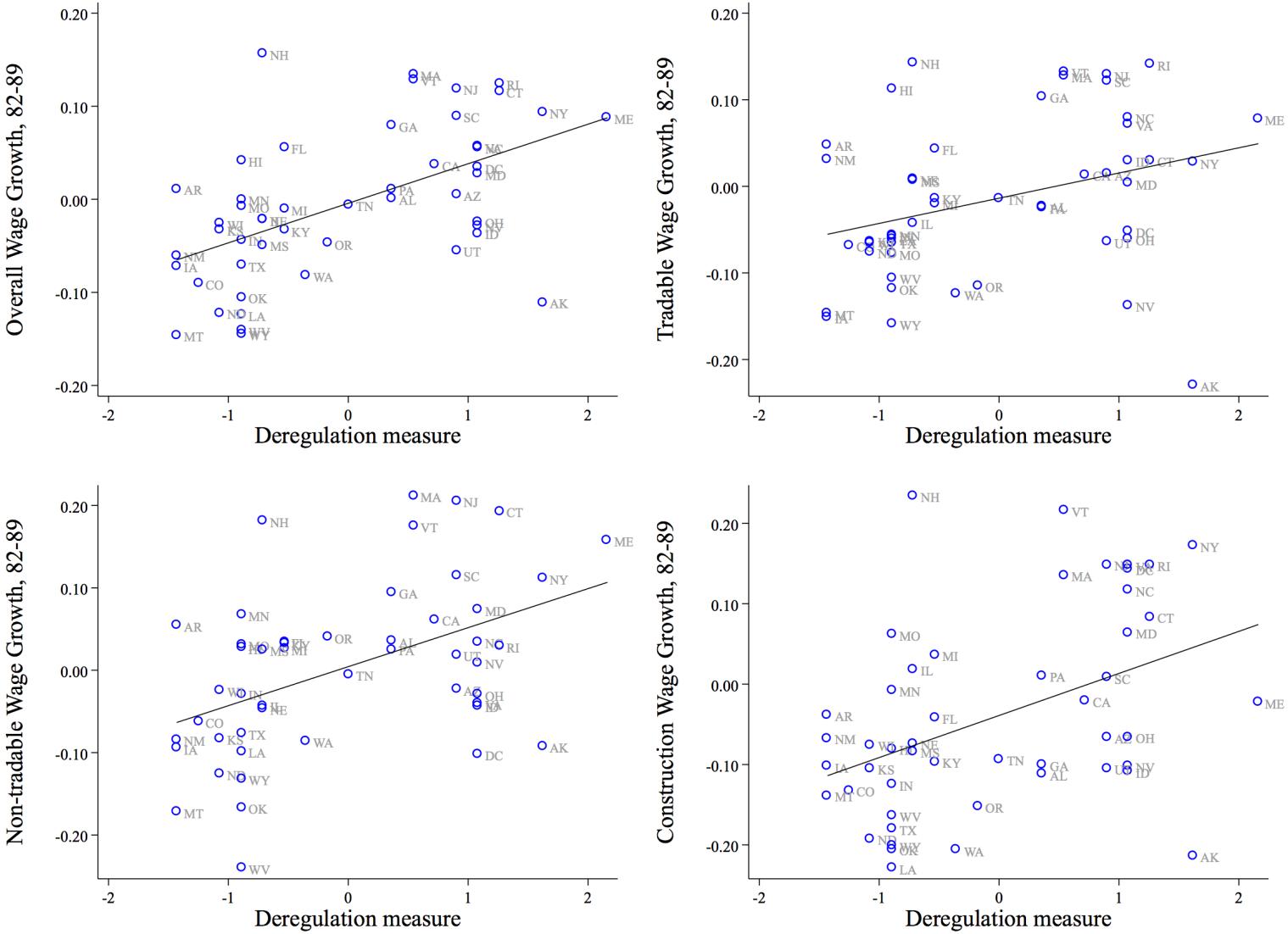




RER appreciation in early deregulation states

			Special Aggregates		
	(1) Δ_{82-89} All items (Del Negro)	(2) Δ_{84-89} All items	(3) Δ_{84-89} Non-tradables	(4) Δ_{84-89} Tradables	(5) Δ_{84-89} Non-tradables or Tradables
Dereg. measure	1.780**	2.334**	4.017**	0.303	0.303
	(0.482)	(0.513)	(0.777)	(0.459)	(0.463)
Dereg. measure × 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 × NT-T
Observations	48	25	25	25	50

Wages rise in early deregulation states in all sectors

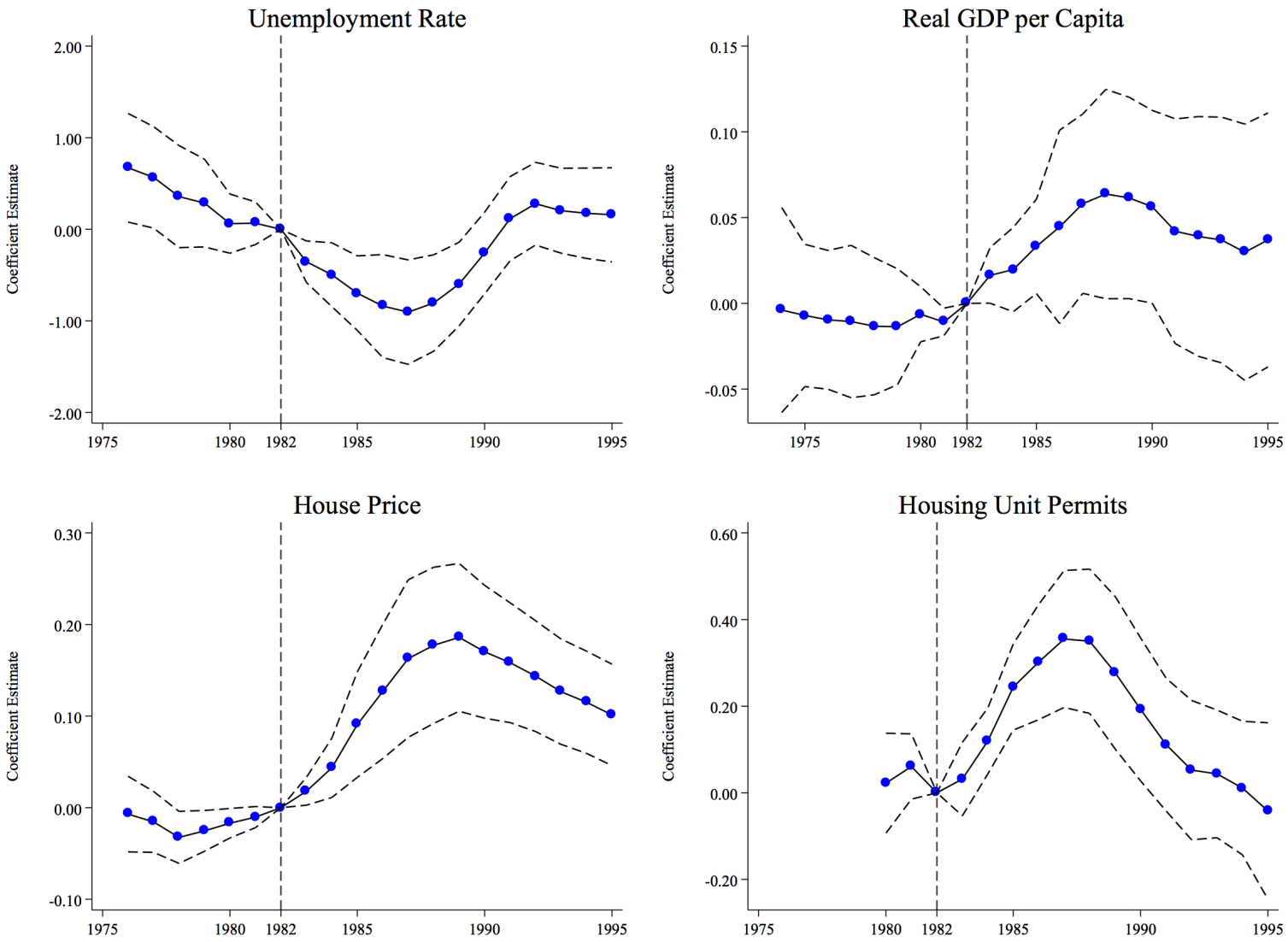


Placebo tests

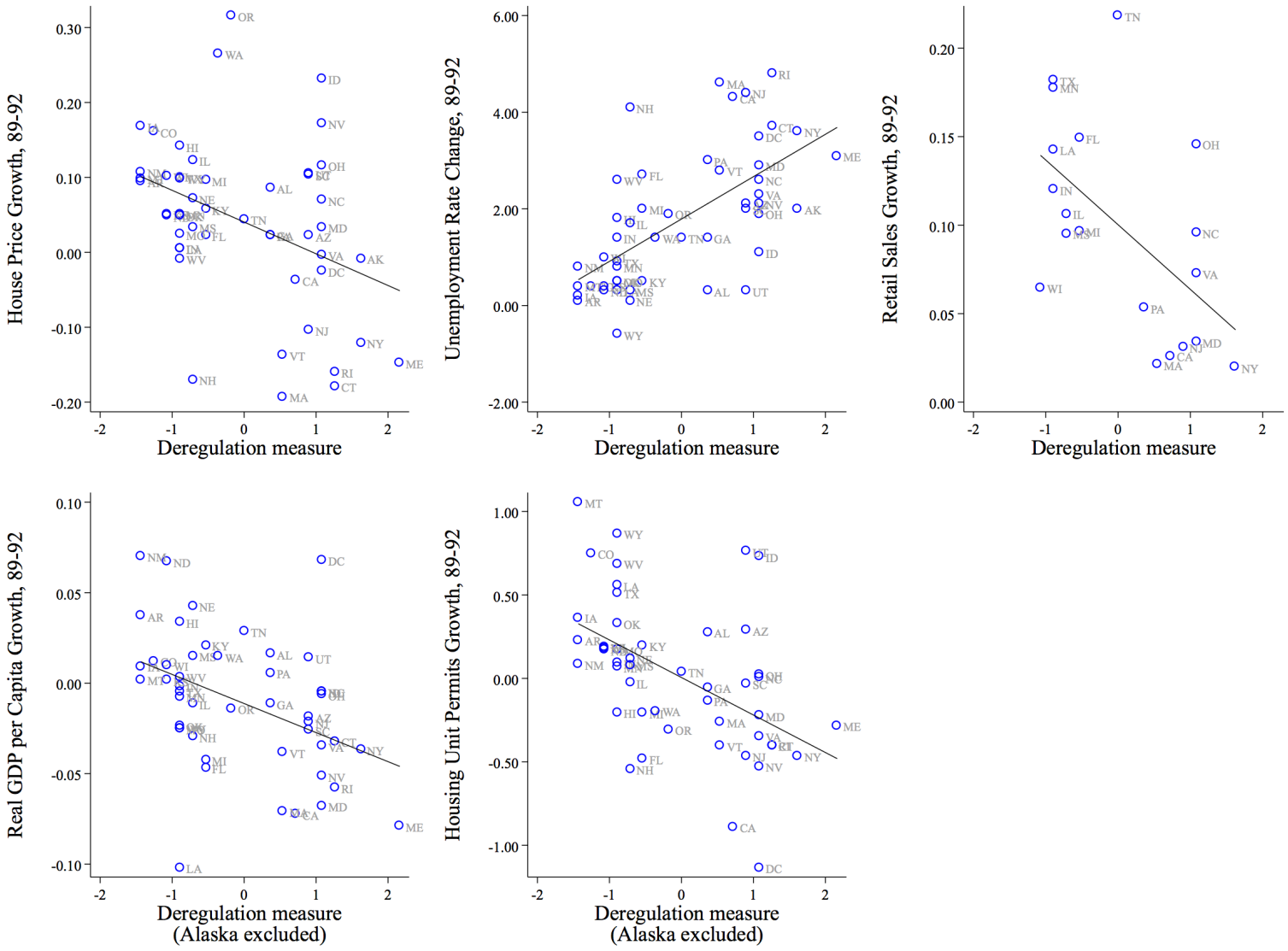
	(1) Δ Total loans	(2) Δ C&I loans	(3) Δ HH loans	(4) Δ Con. loans	(5) Δ CPI (Del Negro)	(6) Δ Empl. tradables	(7) Δ Empl. non-tradables	(8) Δ Empl. construction
Panel A: Boom Period 1975-1979								
Dereg. measure	-0.00109	0.000888	-0.00172	0.00138	-0.00817**	-0.00832	-0.0128	-0.0743*
	(0.000724)	(0.00143)	(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

Business Cycle Amplification

Amplified business cycle in early deregulation states



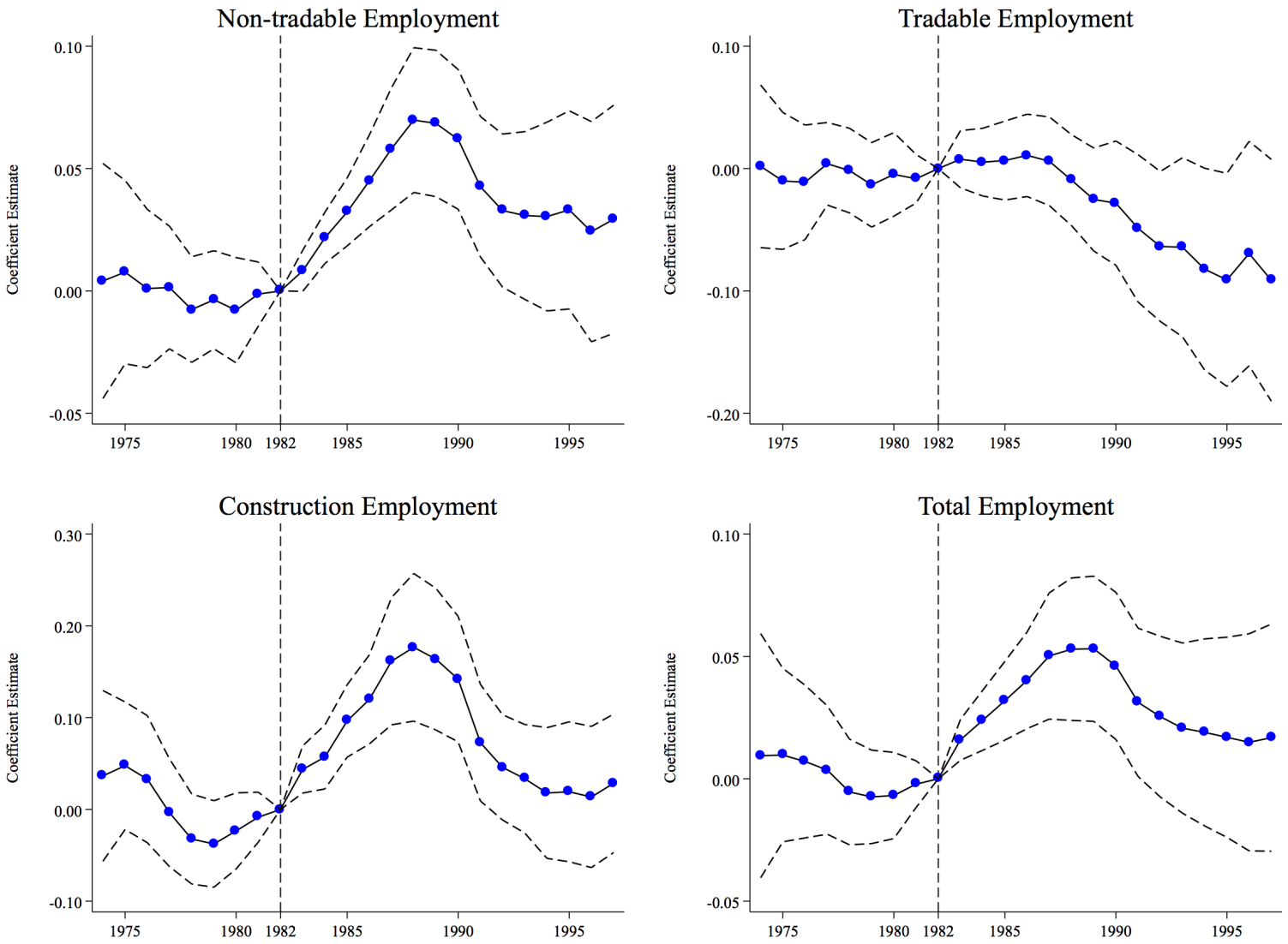
Worse recession in early deregulation states



Three channels for the worse recession

- **Nominal downward rigidity**, as in Schmitt-Grohé and Uribe (2016); also evidence of a decline in long-run competitiveness in the tradable sector
- **Banking sector losses**: help explain why even tradable employment falls in early deregulation states
- **Household debt overhang**: very strong correlation across states between the rise in household debt during expansion and recession severity during contraction

Deregulation and employment over the full cycle

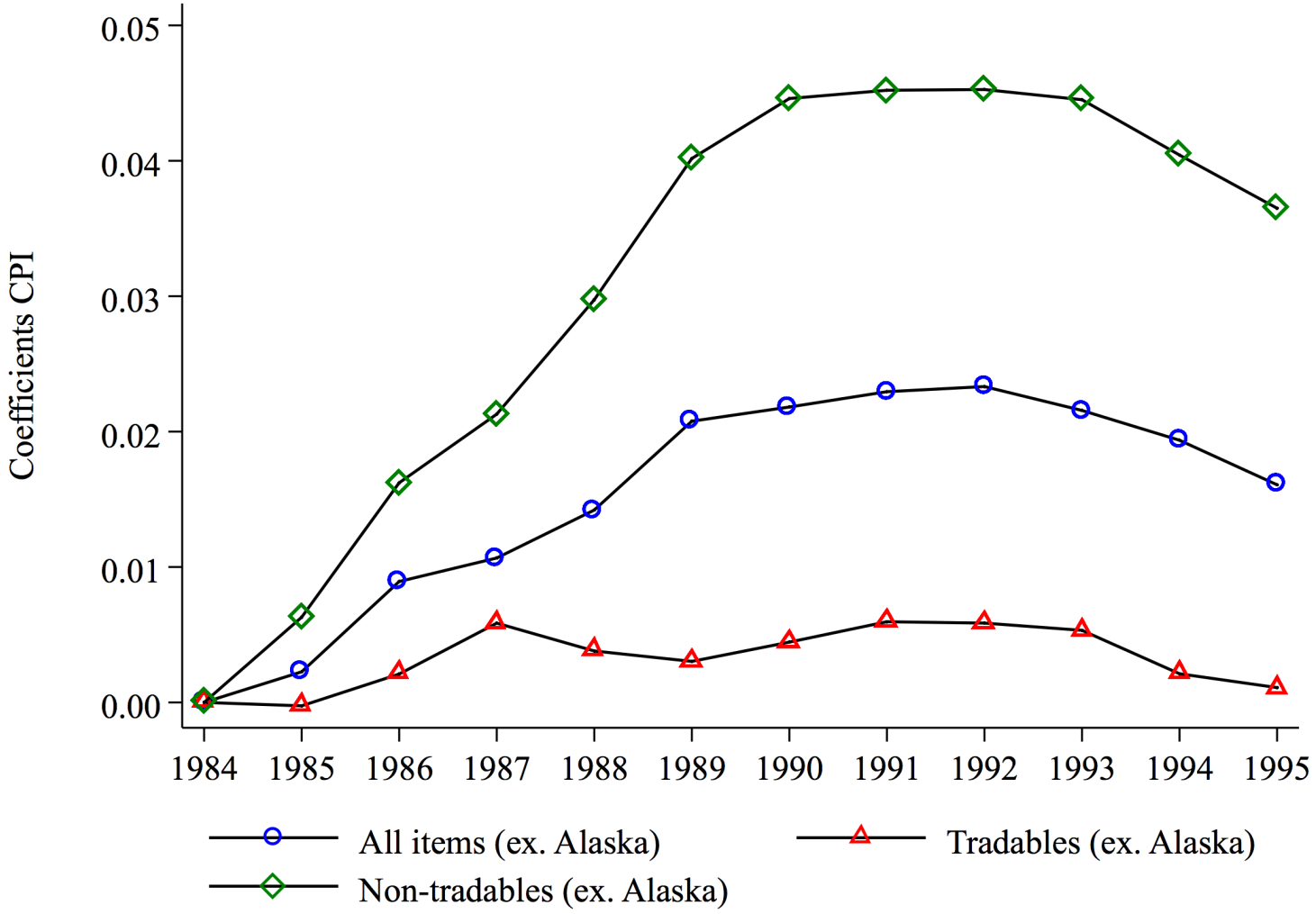


Deregulation and employment during the recession

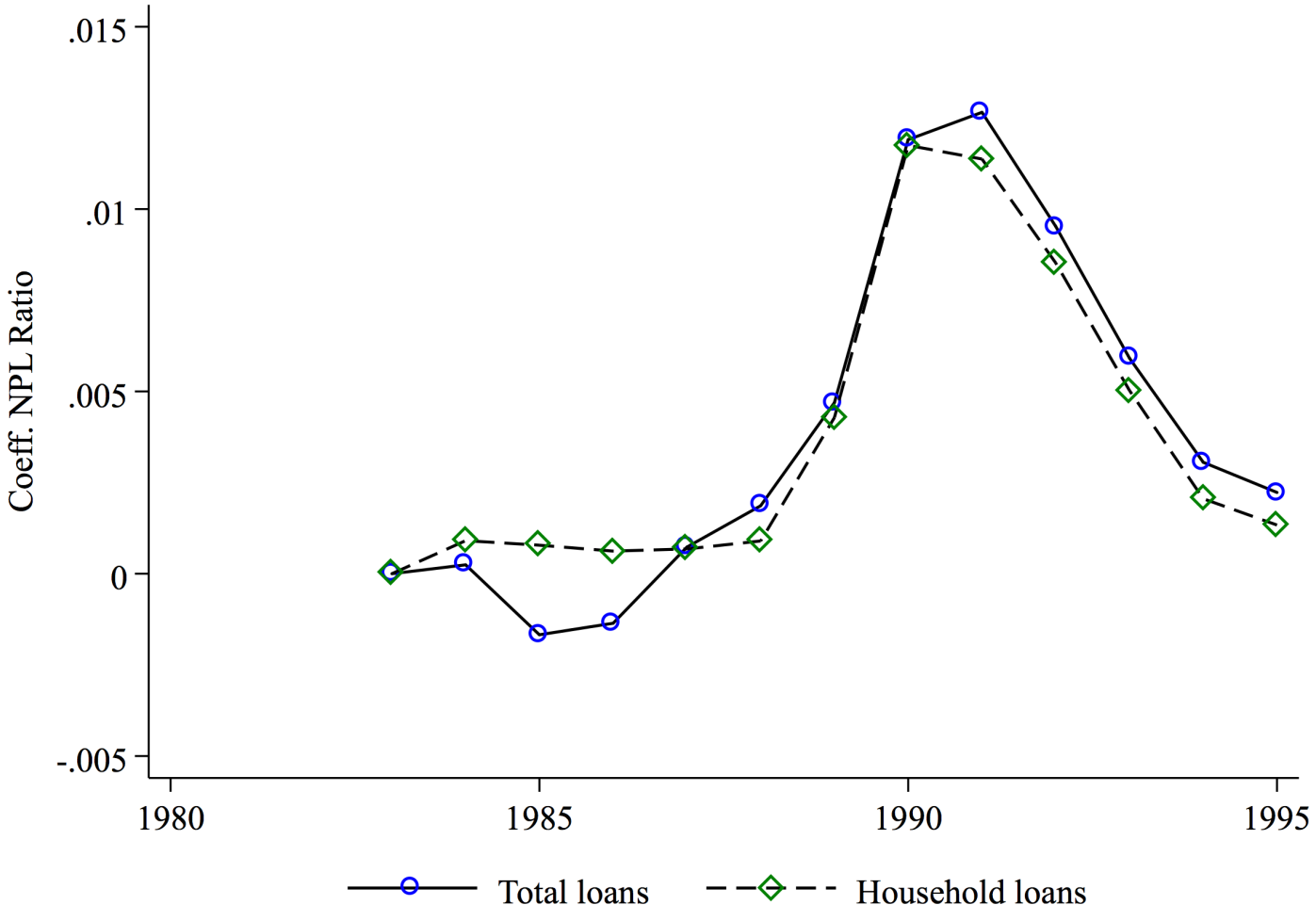
	Δ_{89-92} Total employment	Δ_{89-92} Empl. tradables	Δ_{89-92} Empl. non-tradables	Δ_{89-92} Empl. construction	Δ_{89-92} Industry-level employment			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dereg. measure	-0.0278**	-0.0322*	-0.0313*	-0.128**	-0.0435*	-0.0438*	-0.0422*	-
	(0.00970)	(0.0140)	(0.0116)	(0.0329)	(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

Deregulation and wages over the full cycle

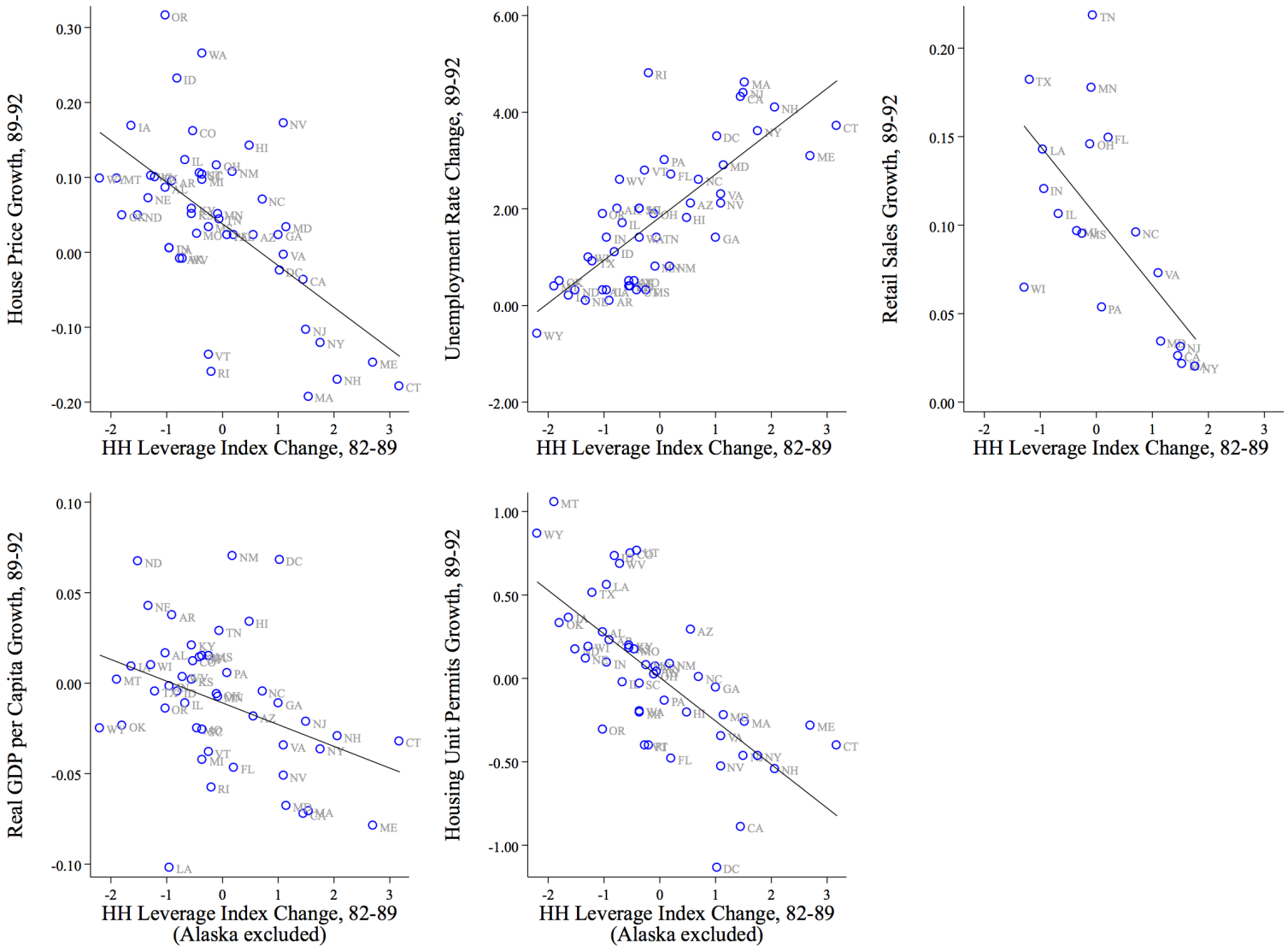
Deregulation and consumer prices over the full cycle



Banking sector losses elevated in early deregulation states



Household leverage and the recession of 1990 to 1991



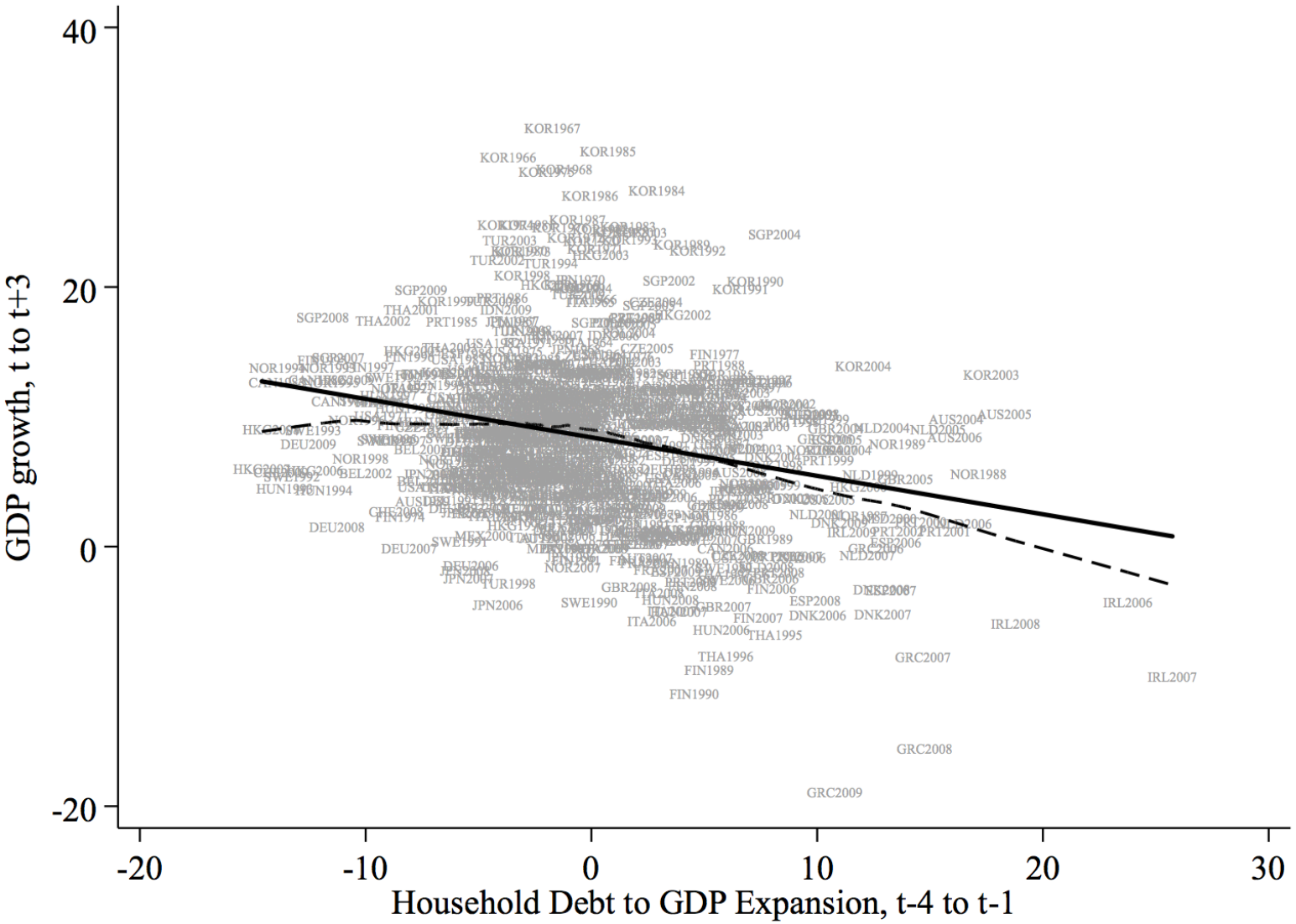
Conclusion

- During the credit expansion of the 1980s, states with a more deregulated banking sector witness larger household debt growth, employment growth in the non-tradable sector, non-tradable price growth, but a similar growth in employment in the tradable sector
- These results highlight the importance of the demand channel over the labor productivity channel of financial deregulation
- Early deregulation states see an amplified business cycle, and the worse recession is related to downward nominal rigidity, banking sector losses, and household debt overhang
- Our results suggest that credit supply shocks on net have a bigger effect by amplifying demand as opposed to improving productivity of firms

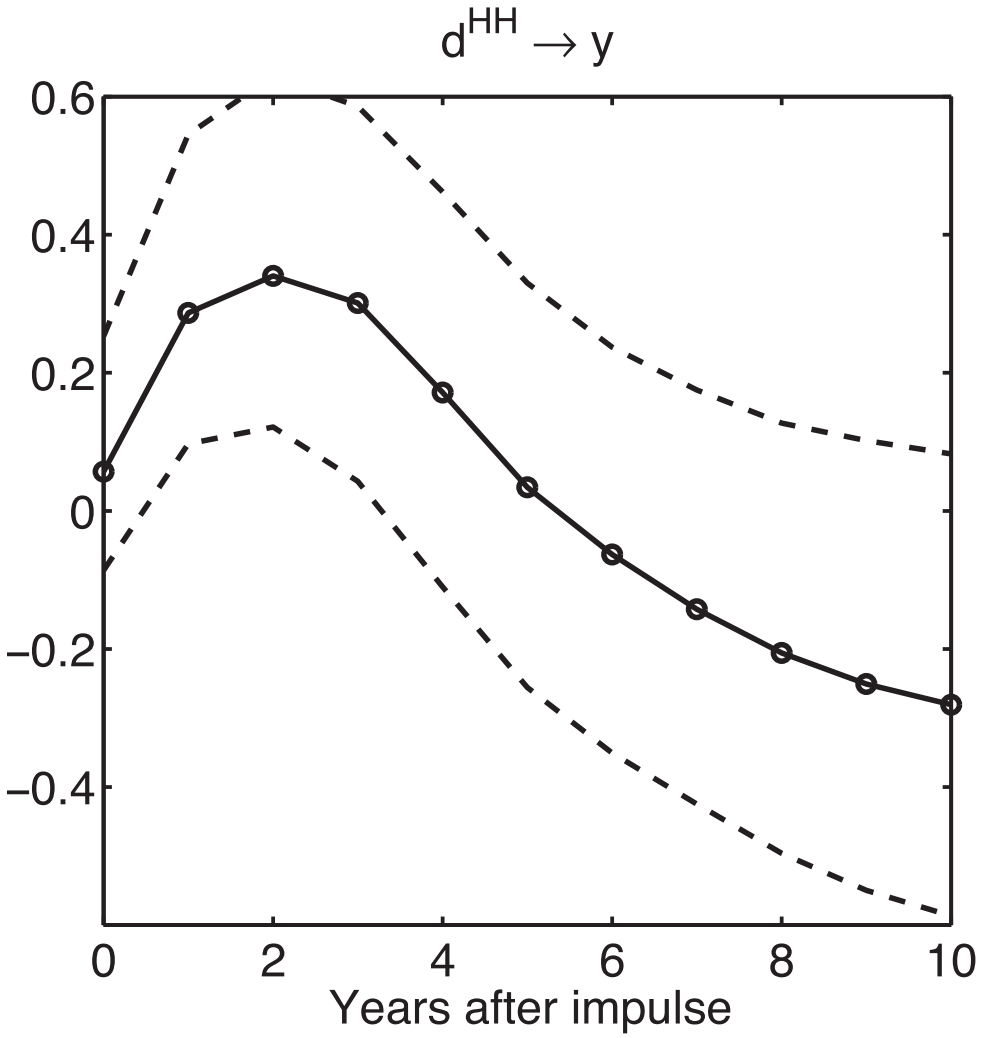
International Historical Evidence

- Mian, et al (2017a): 30 countries over 40 years
  - 3 to 4 year increases in household debt to GDP ratio predict subsequent decline in GDP growth
  - Credit supply expansion: Proxy-SVAR using low mortgage interest spreads as an instrument for rise in household debt
  - Boom and bust pattern unique to household debt (not firm or government), bust missed by economic forecasters
- Jordà, et al (2015): 17 countries over 140 years
  - Mortgage credit and house price booms post-WW2 are closely connected to subsequent financial crises
  - Credit supply expansion effect demonstrated using an instrument for interest rates based on exogenous monetary policy movements for pegged countries

Increase in Household Debt Predicts Lower Growth



Proxy-SVAR with Low Interest Spreads as Instrument



JST Local Projections using Interest Rate Instrument

Ò. Jordà et al. / Journal of International Economics 96 (2015) S2–S18

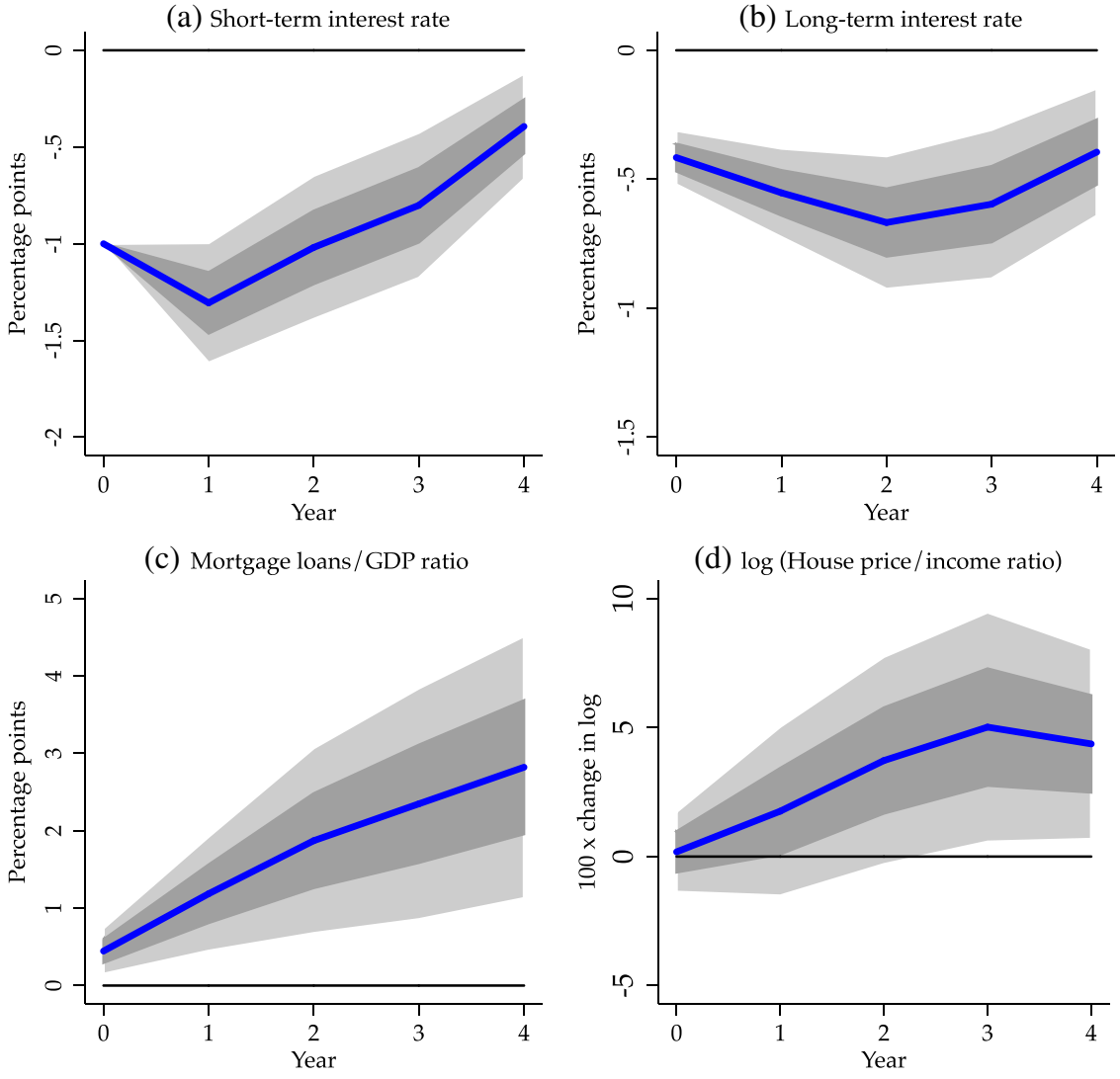


Fig. 8. LP-IV responses for an exogenous shock to the short-term interest rate.

Summary of Evidence

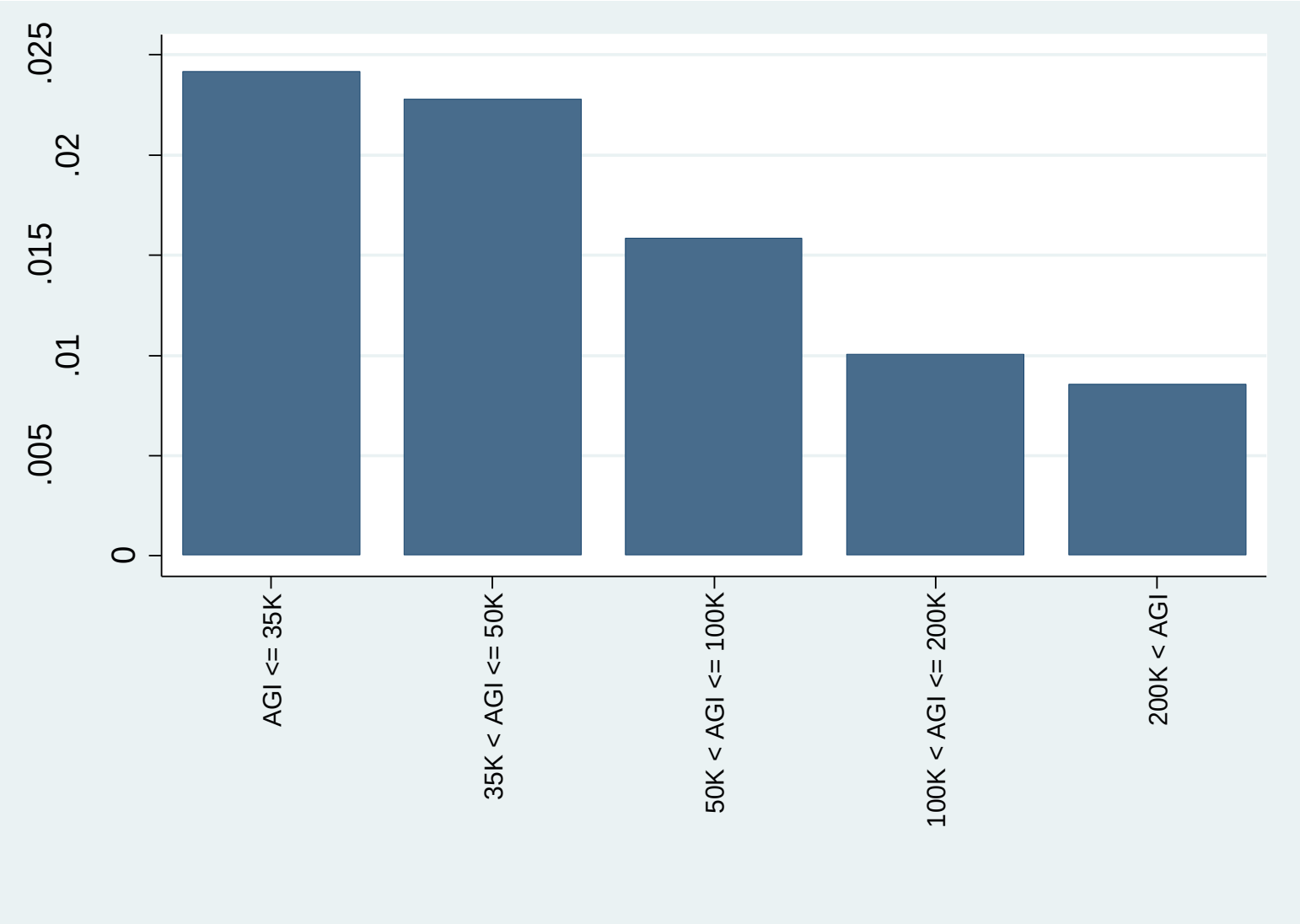
- An expansion in credit supply–an "exogenous" decline in interest rates, a relaxation of banking regulation, or a decline in currency risk premia–generates a boom and bust cycle in the real economy
  - Note: given credit rationing, credit supply expansion may show up in shifts in credit to low credit quality households or firms (Mian and Sufi 2009; Greenwood and Hanson 2013)
- Shifts in household demand appear to be transmission mechanism
- The bust is predictable, hinting at the importance of flawed expectations formation

Other "Clean" Examples of Credit Supply Expansions

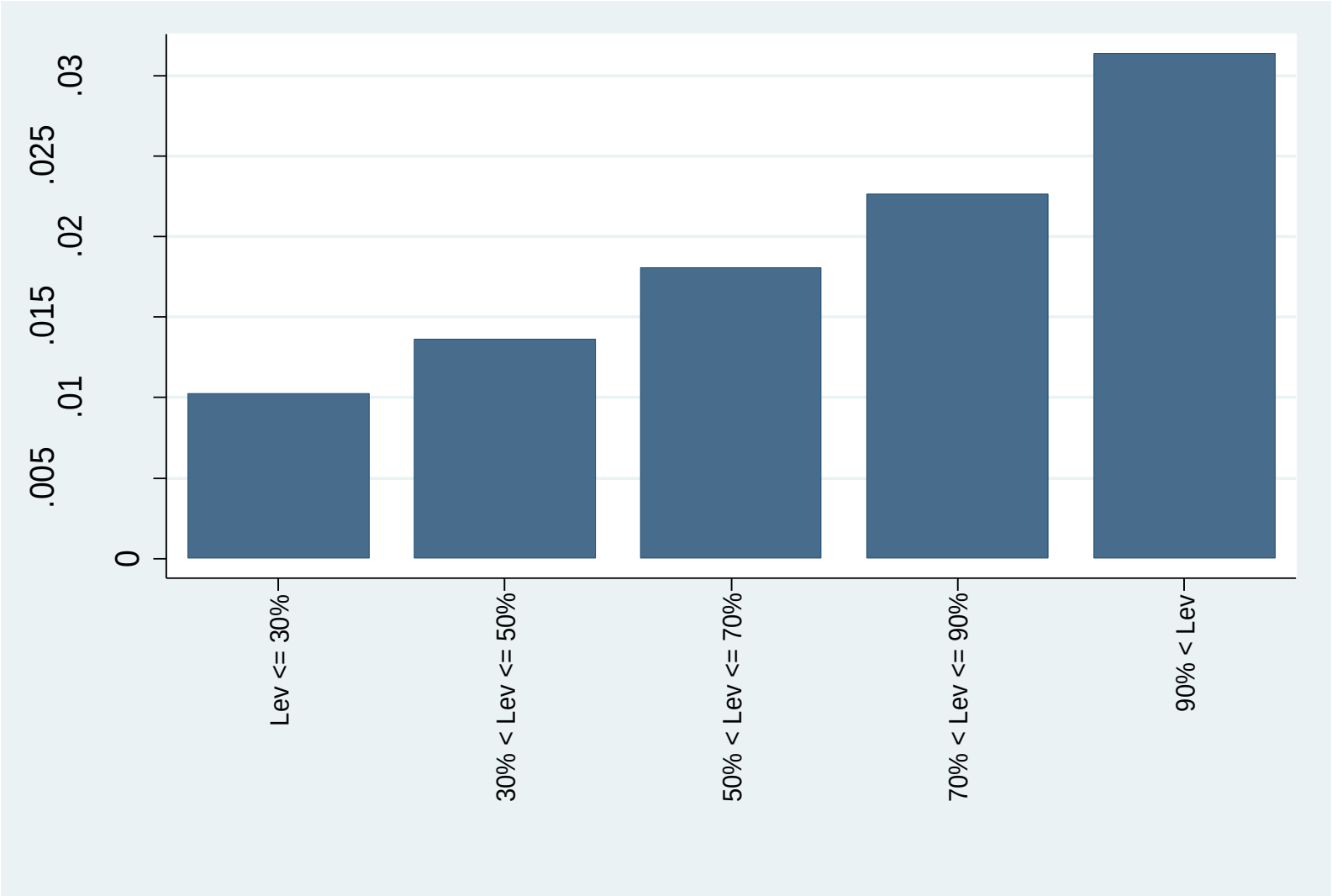
- Cleanest "exogenous" credit supply expansions in empirical macro come from small open economy literature:
  - Baskaya, et al (17): VIX as instrument for capital inflows for Turkey
  - Ioannidou, et al (15): Exposure of Bolivia to U.S. monetary policy
  - Jimenez, et al (12, 14): Exposure of Spain to ECB monetary policy
- Given data availability, these studies focus exclusively on bank loans to firms – bank loans to households should also be studied

Marginal propensity to consumer by income

(Figure 7)

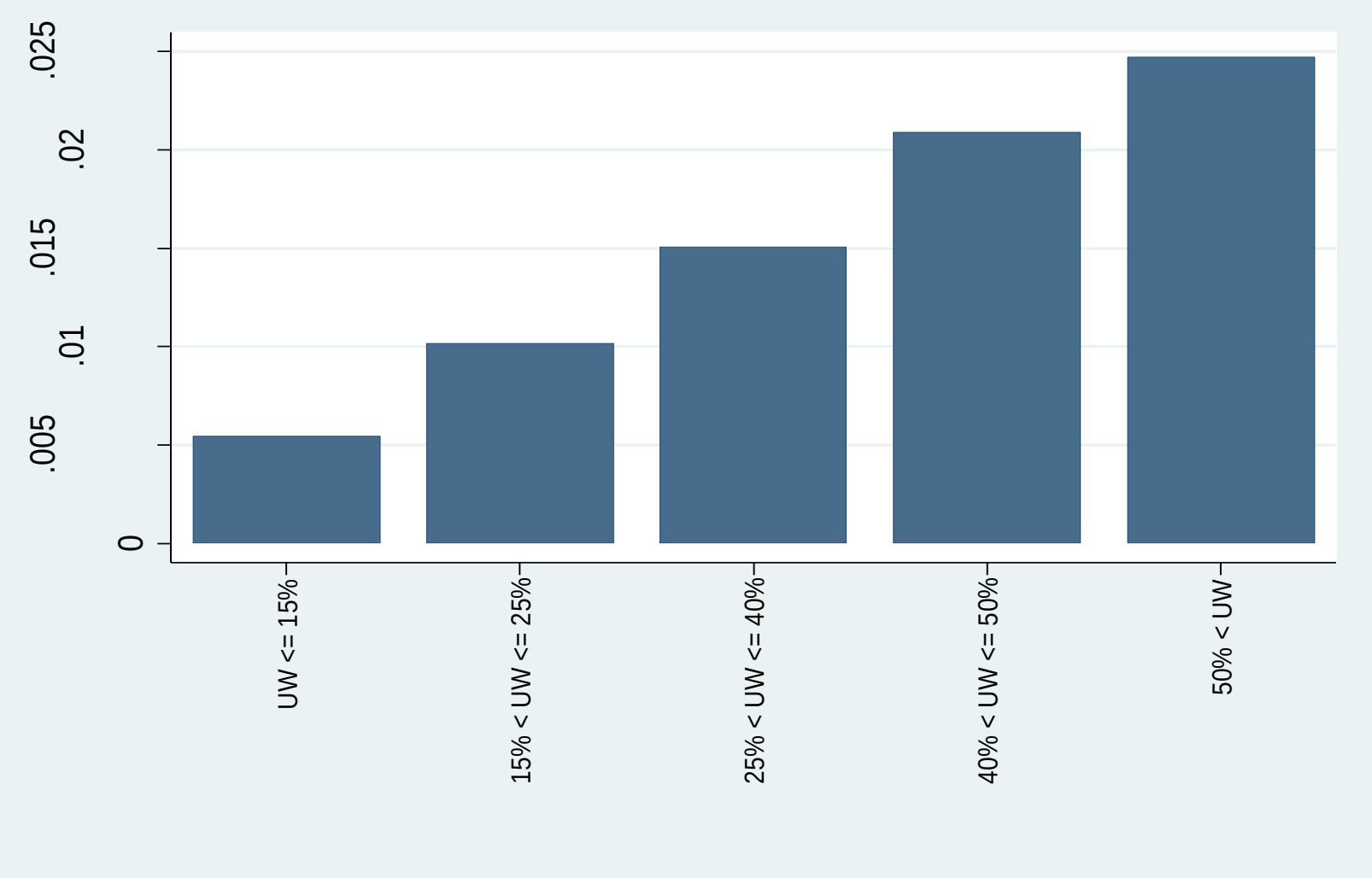


Marginal propensity to consume by leverage



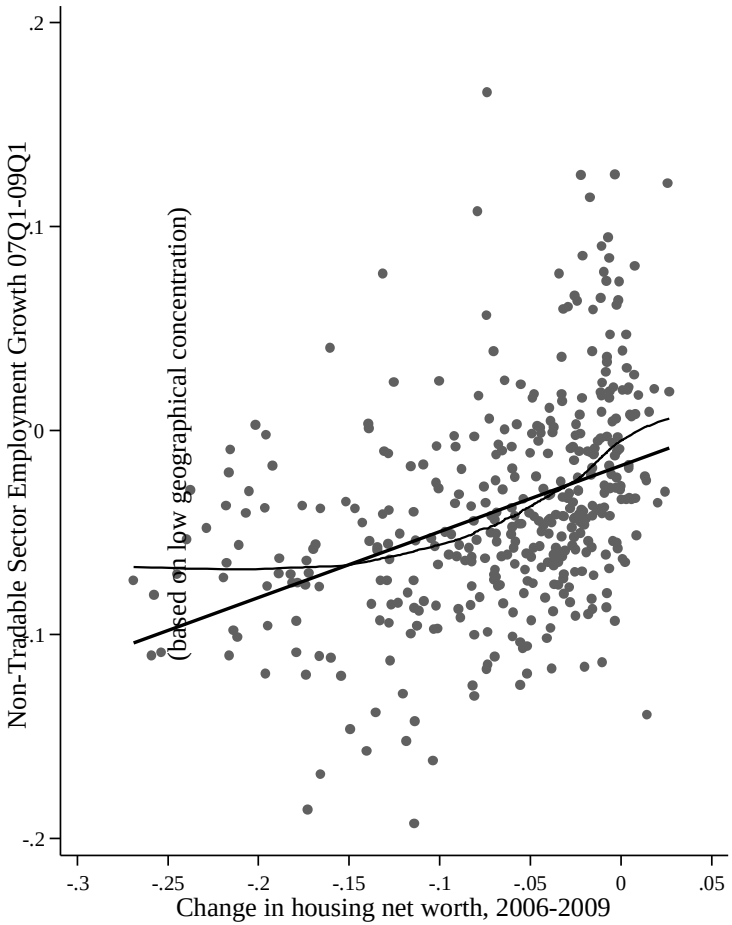
Marginal propensity to consume by underwater homeowner fraction

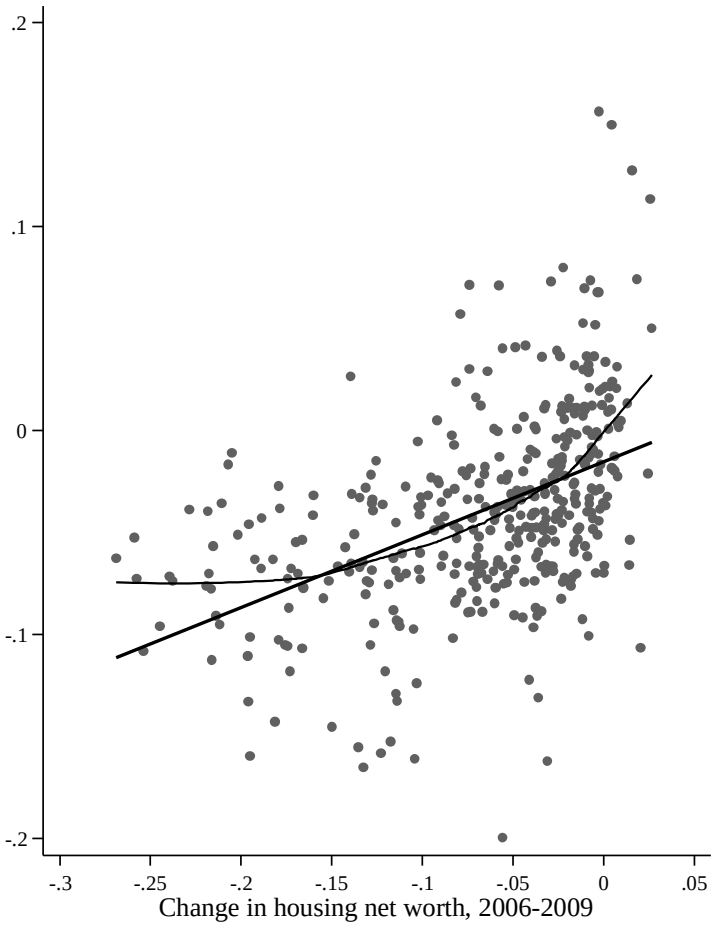
(Figure 8)



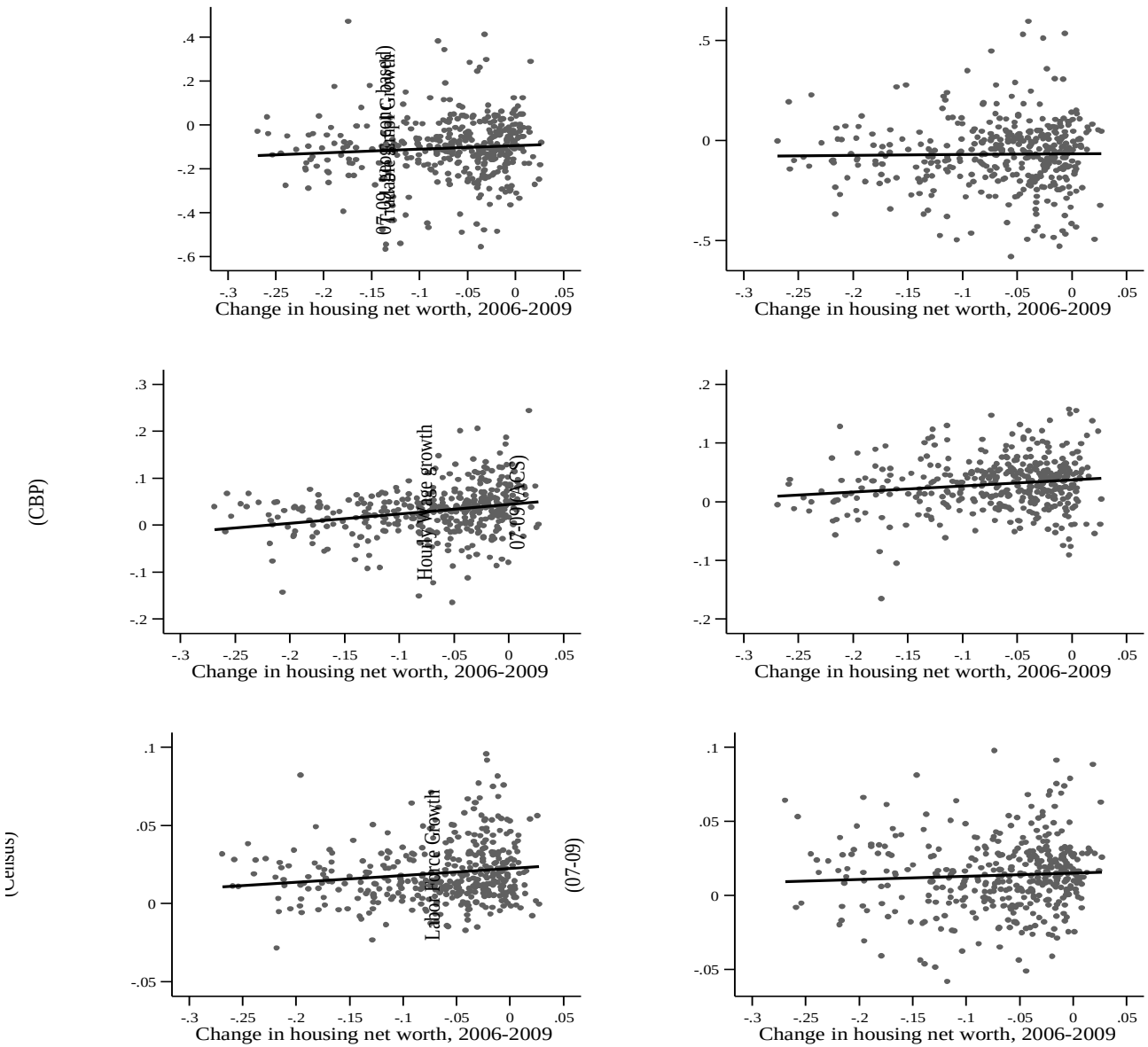
Employment Growth: Non-Tradable

(Figure 4)





Employment Growth: Tradable Industries:



Bigger Picture, but Less Precise Identification

1. Credit supply and the U.S. economic cycle of 2000 to 2010:

   Mayer, et al (2009); Mian and Sufi (2009, 2014); Keys, et al (2010); Demyanyk and Van Hemert (2011); Levitin and Wachter (2012, 2013); Landvoigt, et al (2015); Justiniano, et al (2017)

2. International historical evidence using debt to GDP ratios:

   Dell'Ariccia, et al (2012); Schularick and Taylor (2012); Jordà, et al (2013, 2015, 2016); Mian, et al (2017a); Drehmann, et al (2017)

U.S. Credit Supply Expansion (1/3)

Levitin and Wachter (2012)

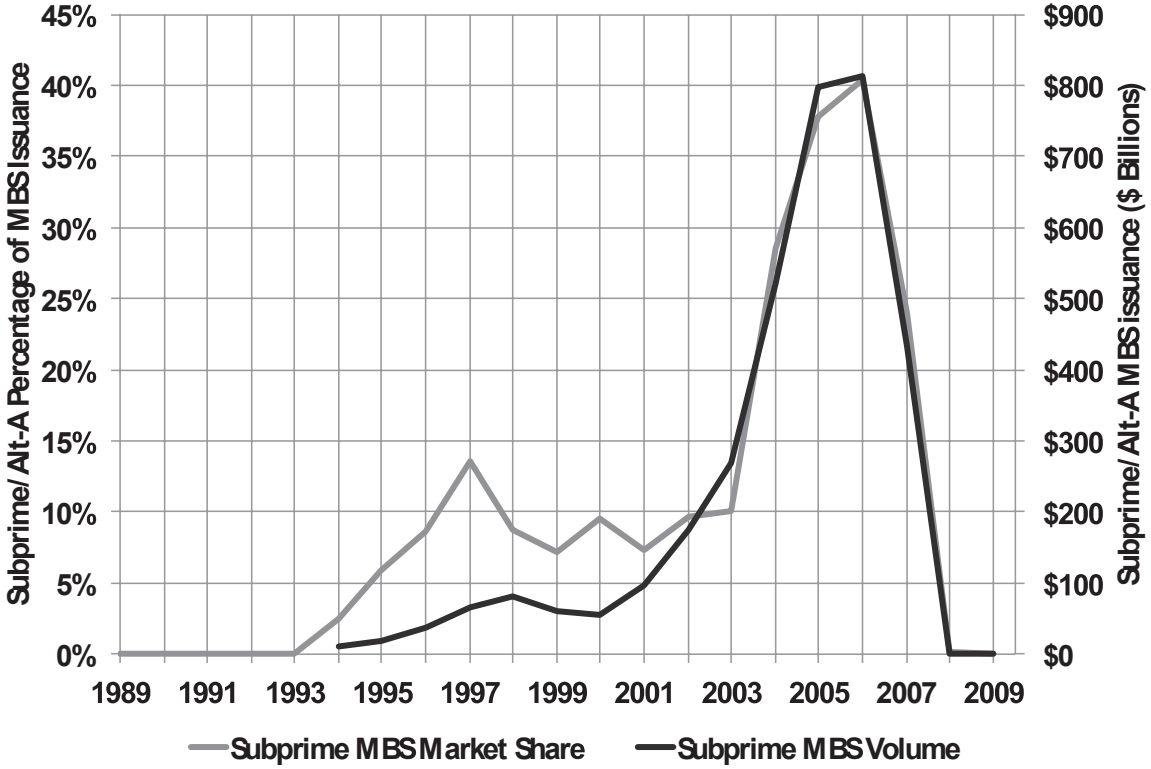


Figure 2. Annual Market Share and Volume of Subprime/Alt-A MBS Issuance[52]

U.S. Credit Supply Expansion (2/3)

Justiniano, et al (2017)

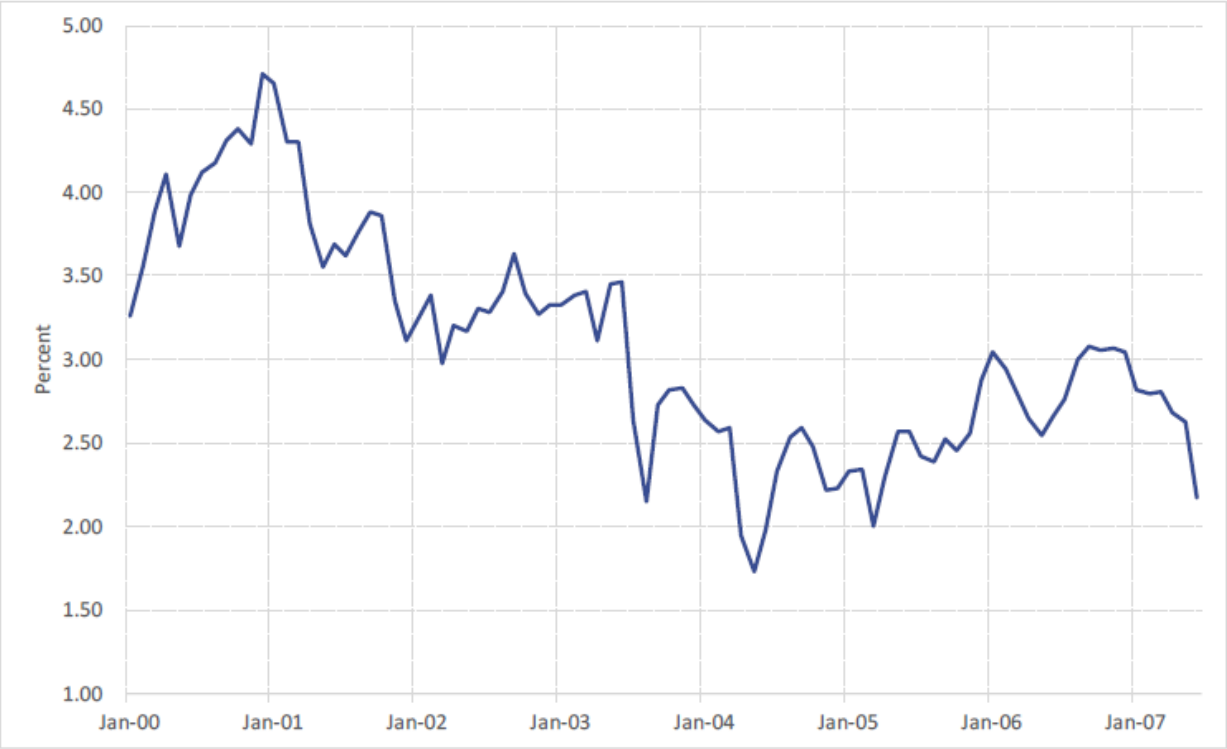


FIGURE 3.1. Spread between the average mortgage rate in the PLSD and the 10-year Treasury yield.

U.S. Credit Supply Expansion (3/3)

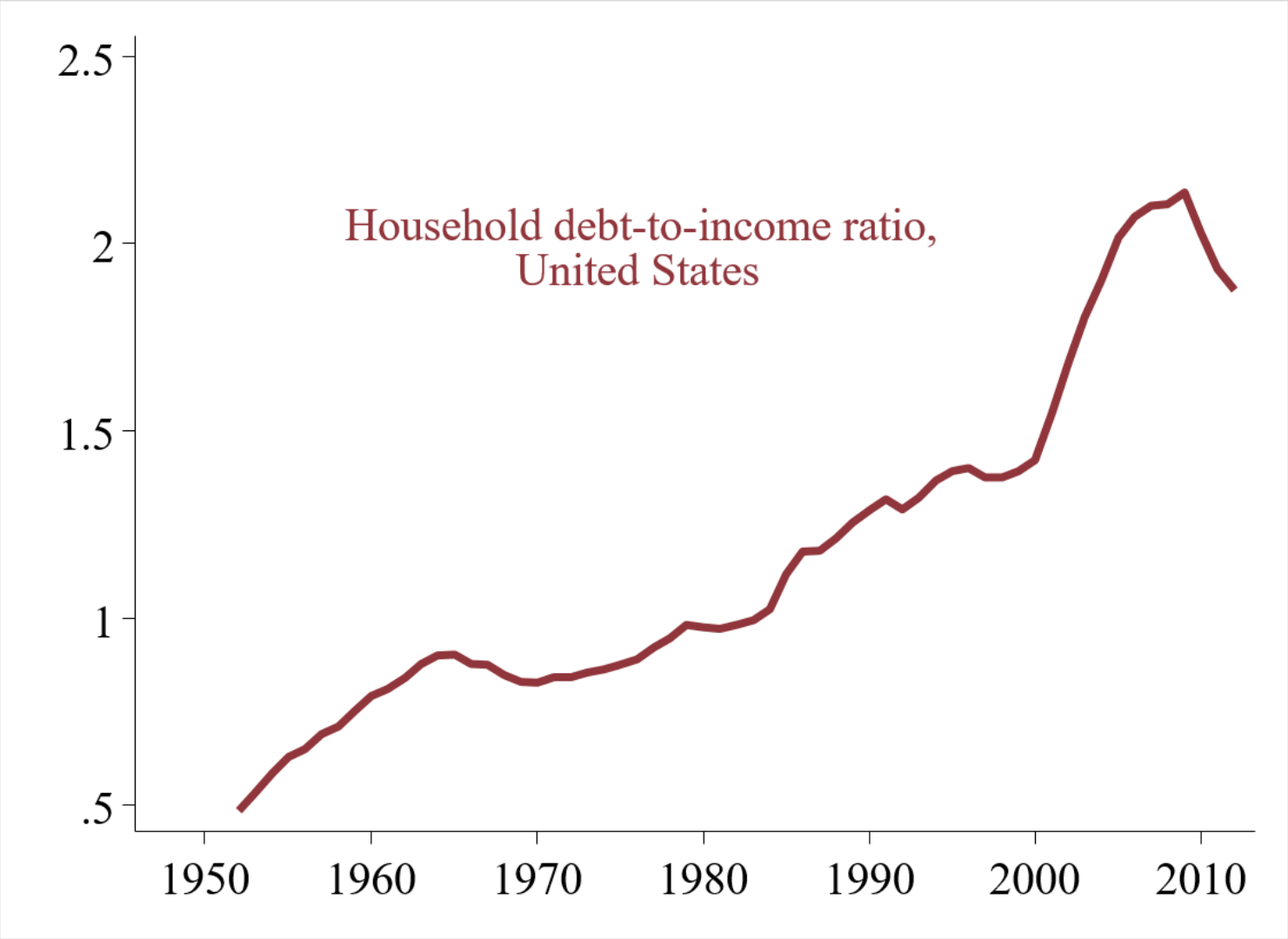
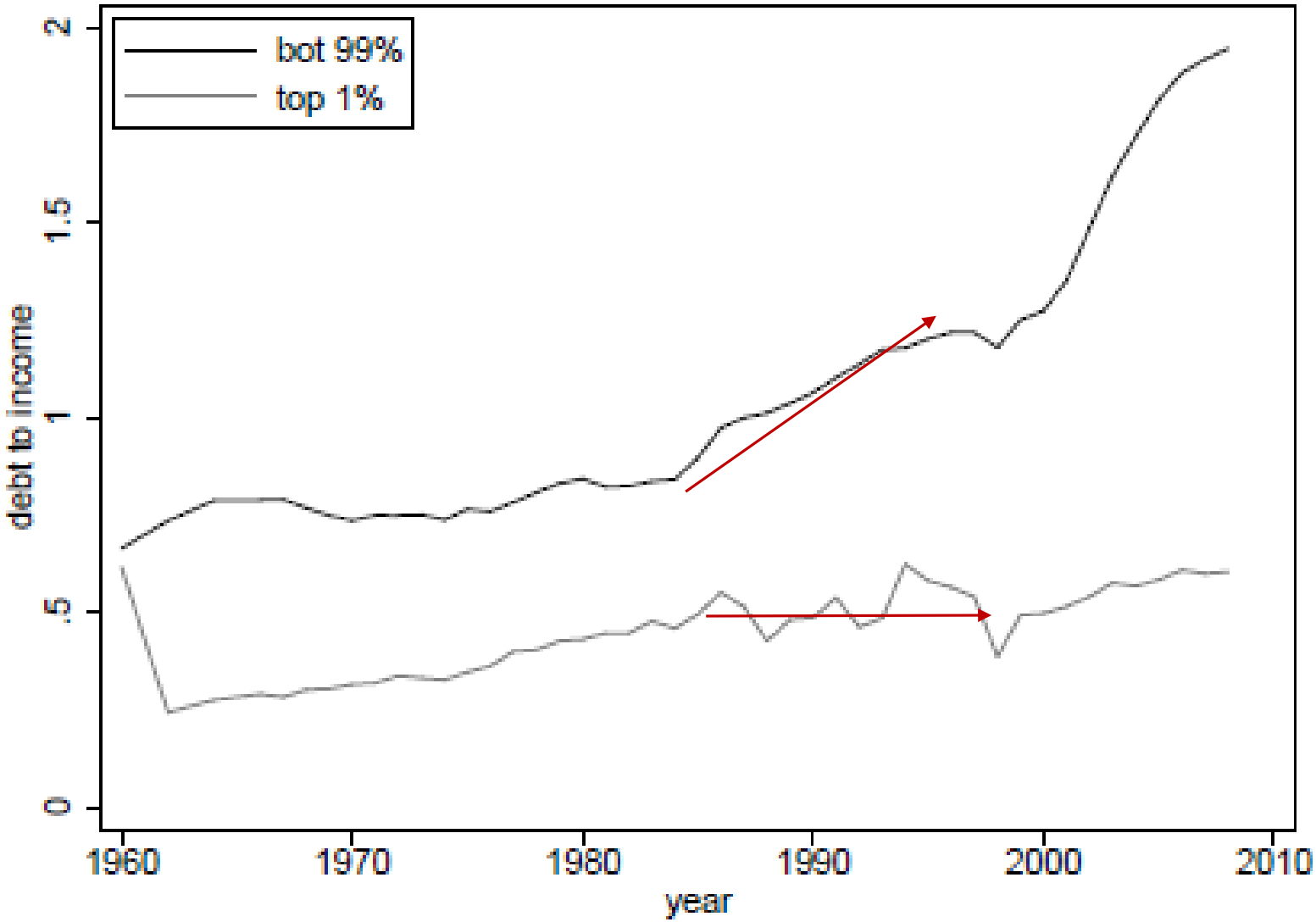
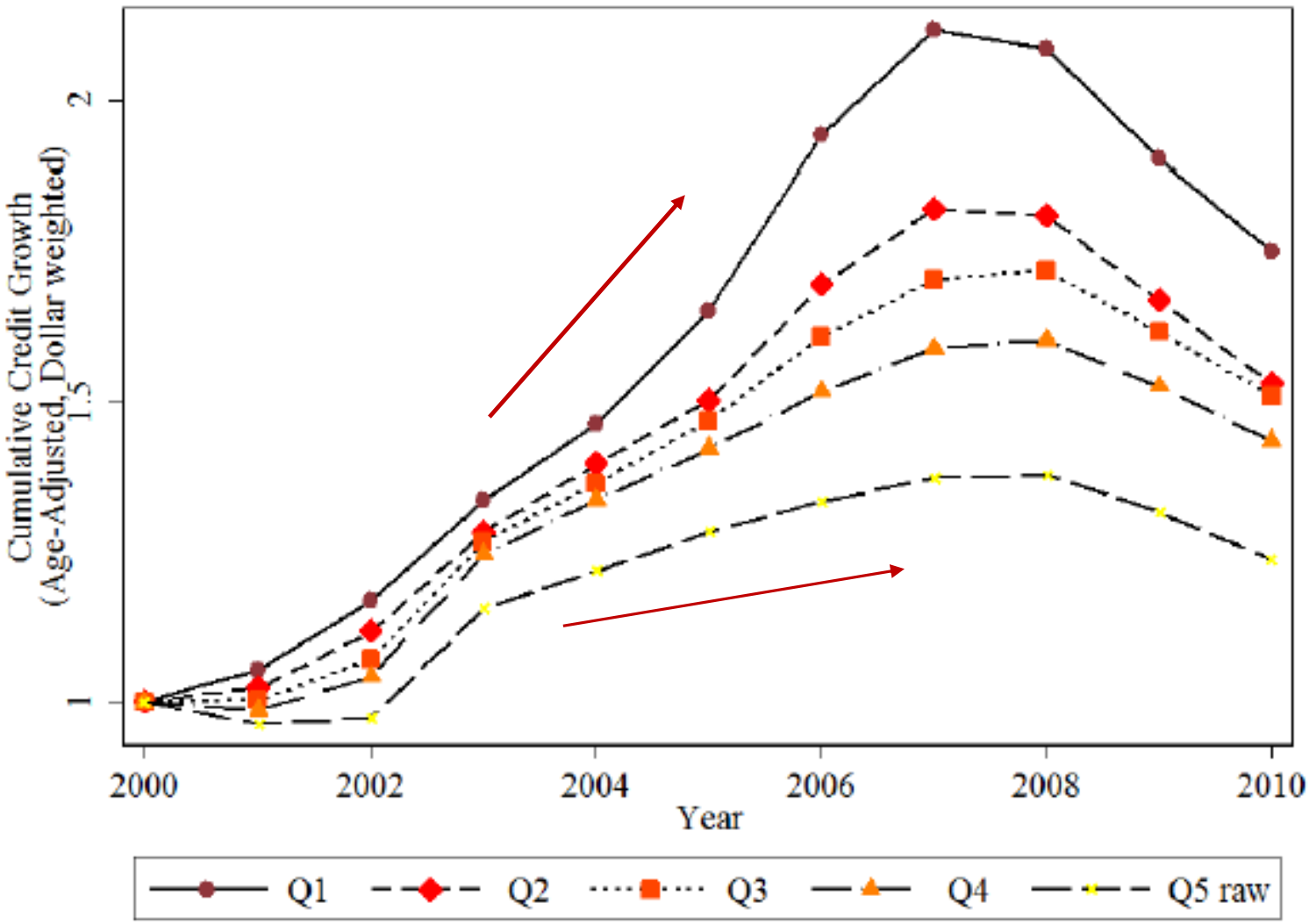


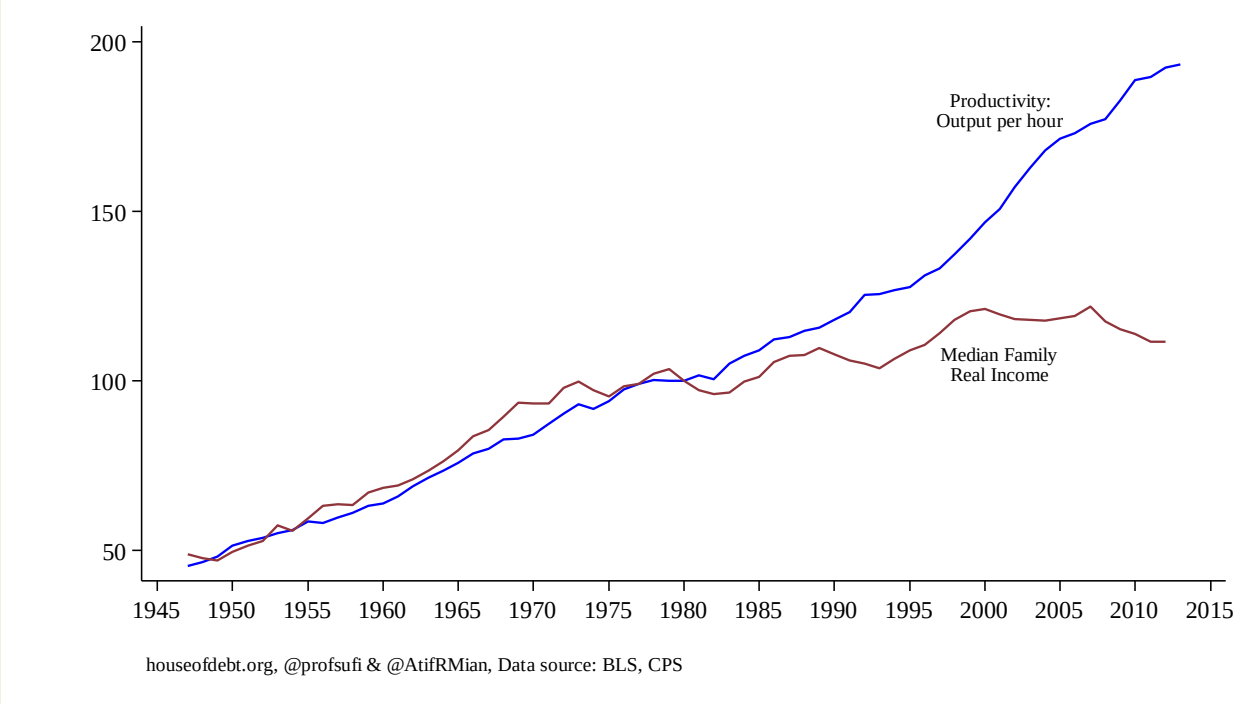
Figure 1: 1% vs. 99%

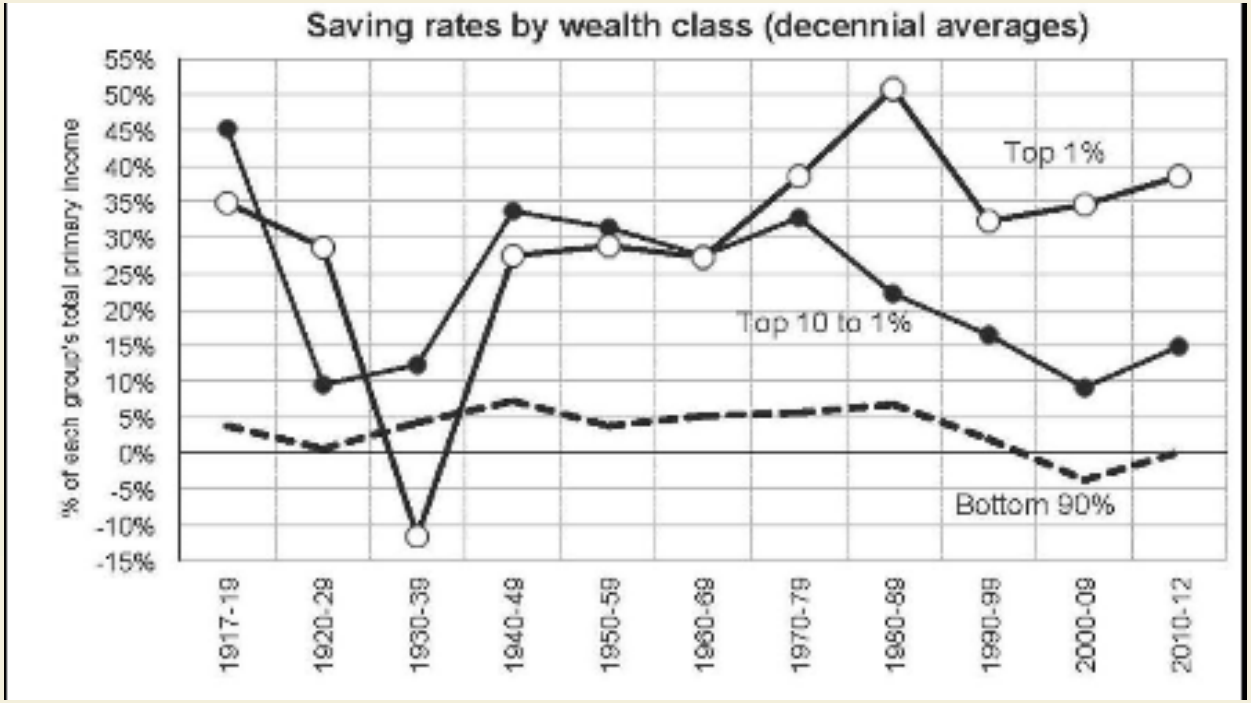



Cumulative Credit Growth
(Age-Adjusted, Dollar weighted)
2
1.5
1
2000
2002
2004
2006
2008
2010
Year
Q1
Q2
Q3
Q4
Q5 raw

What Was Source of Credit Supply Expansion?

- Changes in mortgage origination process: "The primary cause of the housing bubble was the shift from regulated, government-sponsored securitization to unregulated, private securitization as the principal method of funding mortgage loans." (Levitin and Wachter 2012)
- Global imbalances, global savings glut (Bernanke 2005; Cabellero, et al 2006)
- Flawed lender beliefs (Landvoigt 2016)
- Rising wealth inequality (Kumhof, et al 2015)

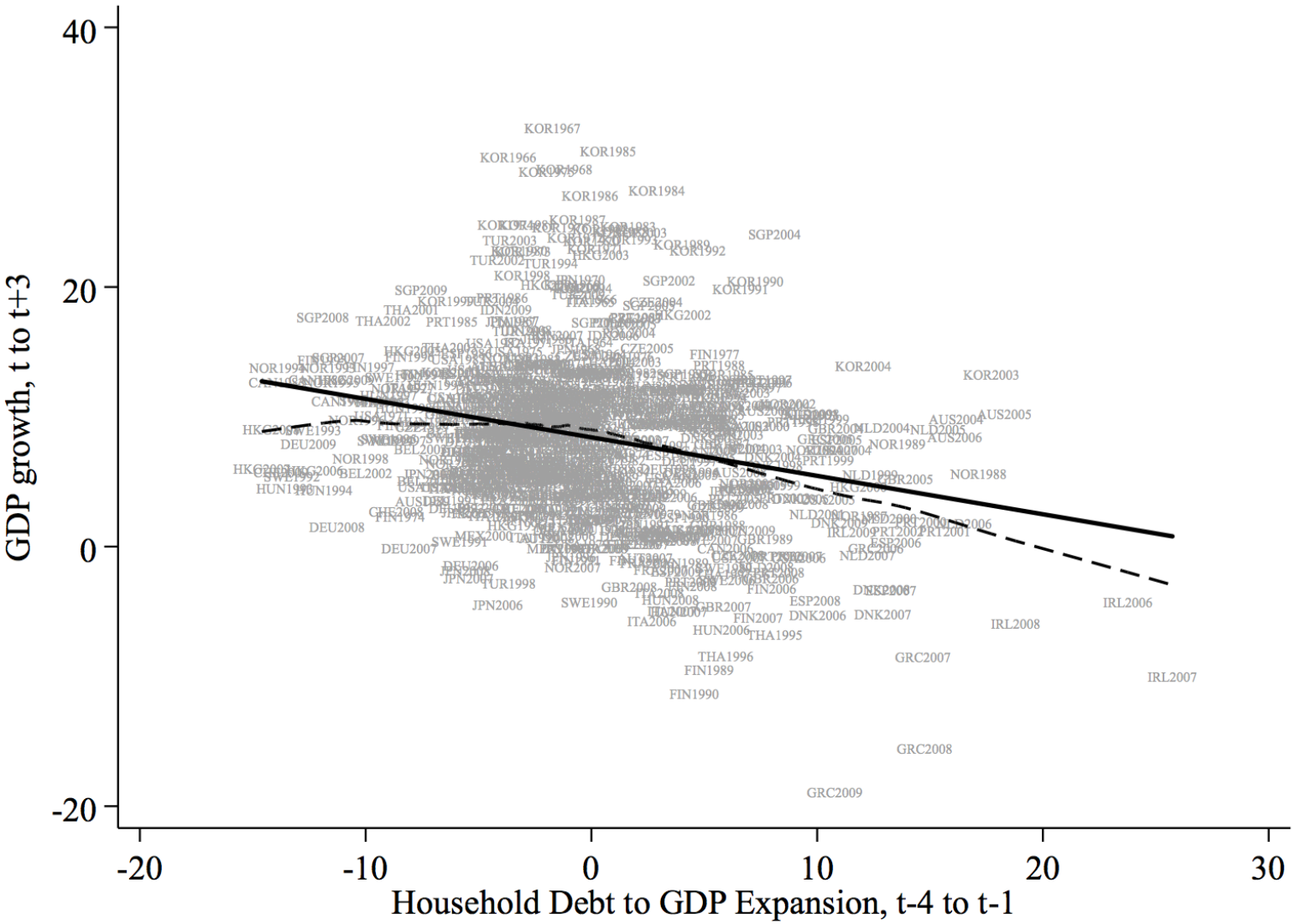

200
150
100
50
1945
1950
1955
1960
1965
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
Productivity:
Output per hour
Median Family
Real Income
houseofdebt.org, @profsufi & @AtifRMian, Data source: BLS, CPS


Saving rates by wealth class (decennial averages)
% of each group's total primary income
55%
50%
45%
40%
35%
30%
25%
20%
15%
10%
5%
0%
-5%
-10%
-15%
Top 1%
Top 10 to 1%
Bottom 90%
1917-19
1920-29
1930-39
1940-49
1950-59
1960-69
1970-79
1980-89
1990-99
2000-09
2010-12

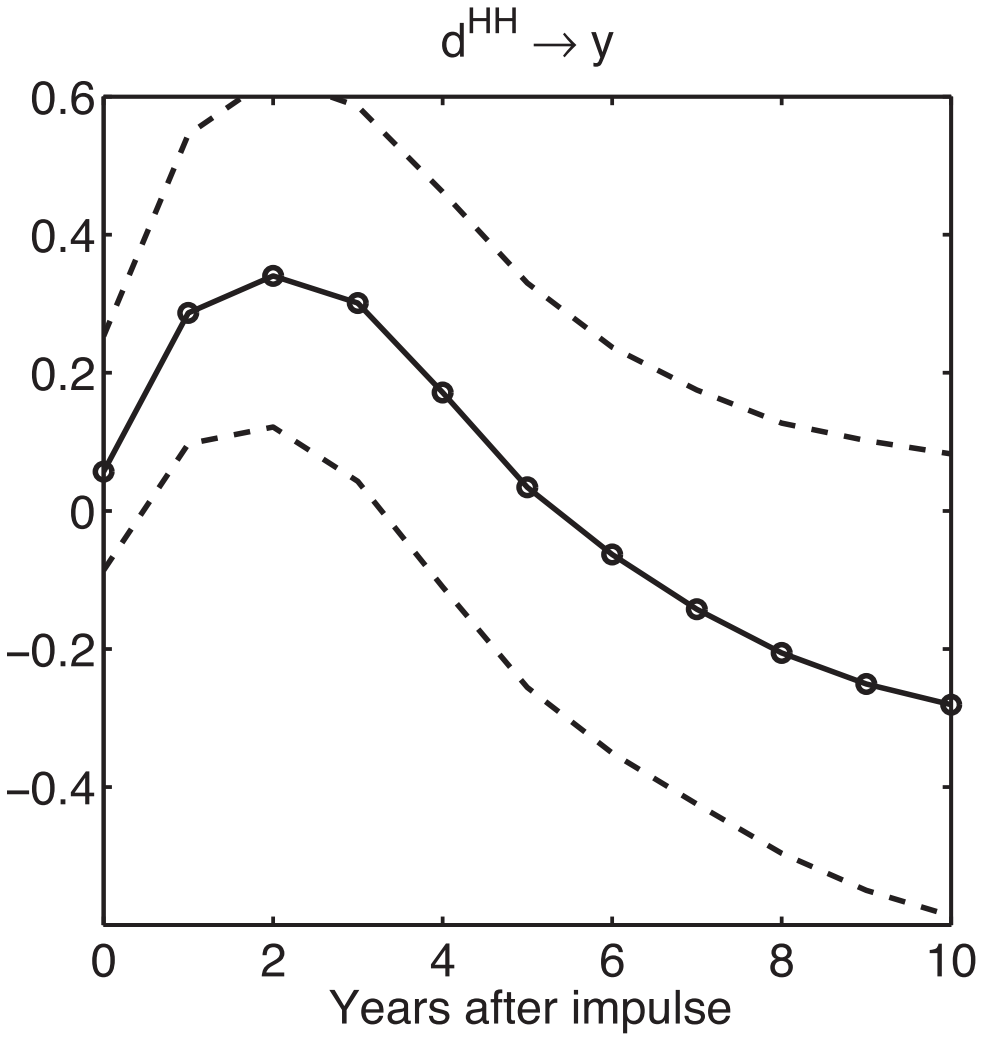
International Historical Evidence

- Mian, et al (2017a): 30 countries over 40 years
  - 3 to 4 year increases in household debt to GDP ratio predict subsequent decline in GDP growth
  - Credit supply expansion: Proxy-SVAR using low mortgage interest spreads as an instrument for rise in household debt
  - Boom and bust pattern unique to household debt (not firm or government), bust missed by economic forecasters
- Jordà, et al (2015): 17 countries over 140 years
  - Mortgage credit and house price booms post-WW2 are closely connected to subsequent financial crises
  - Credit supply expansion effect demonstrated using an instrument for interest rates based on exogenous monetary policy movements for pegged countries

Increase in Household Debt Predicts Lower Growth



Proxy-SVAR with Low Interest Spreads as Instrument



JST Local Projections using Interest Rate Instrument

Ò. Jordà et al. / Journal of International Economics 96 (2015) S2–S18

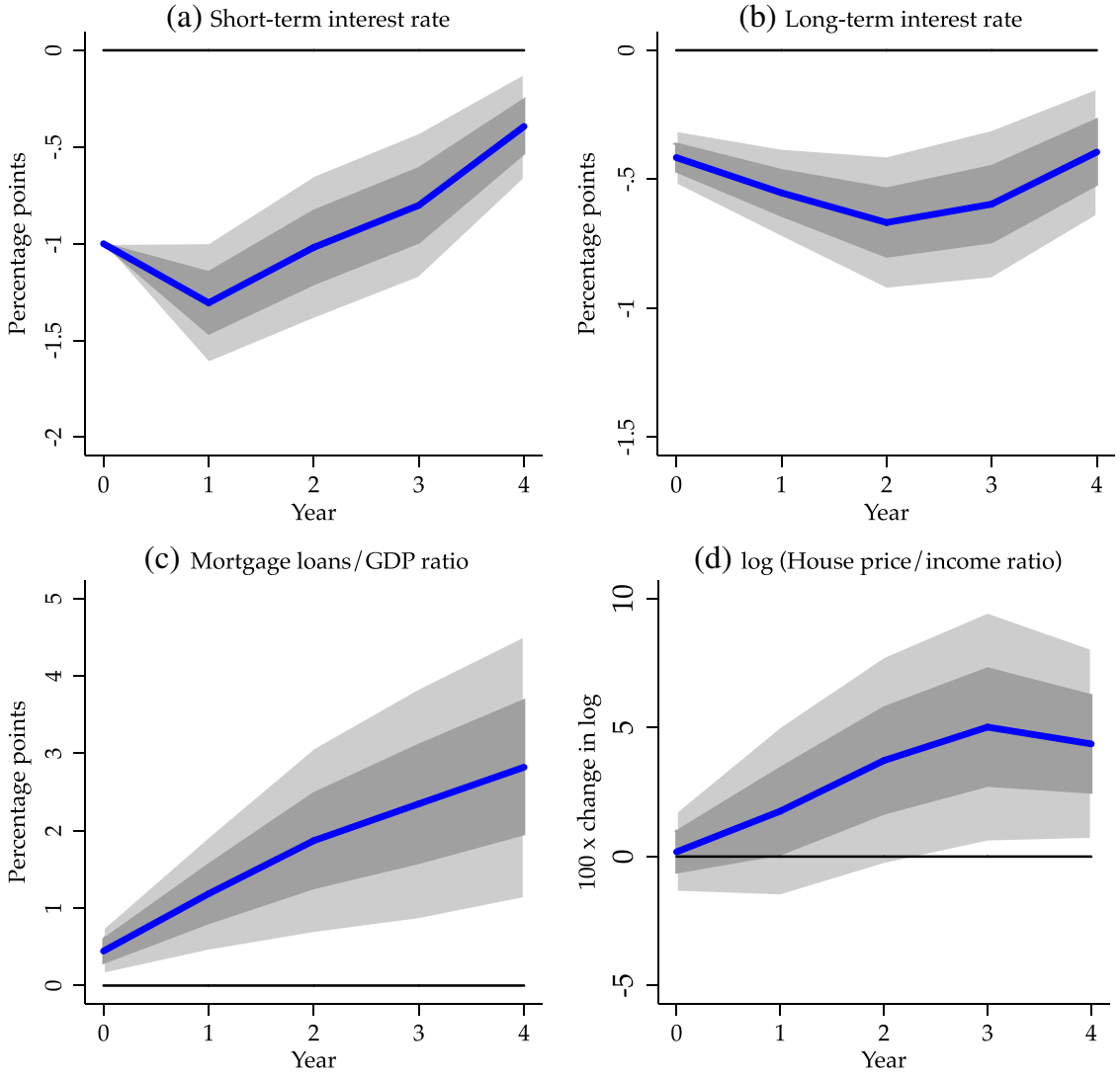


Fig. 8. LP-IV responses for an exogenous shock to the short-term interest rate.

Summary of Evidence

- An expansion in credit supply–an "exogenous" decline in interest rates, a relaxation of banking regulation, or a decline in currency risk premia–generates a boom and bust cycle in the real economy
  - Note: given credit rationing, credit supply expansion may show up in shifts in credit to low credit quality households or firms (Mian and Sufi 2009; Greenwood and Hanson 2013)
- Shifts in household demand appear to be transmission mechanism
- The bust is predictable, hinting at the importance of flawed expectations formation

Contrast with Bernanke-Gertler Inspired Literature

- The BG inspired empirical literature (e.g., work by Gilchrist, others) focuses on the **contractionary shock** in credit supply
- Implicit assumption is that economy prior to crisis is "normal"; crisis phase is how finance affects real economy
- We focus instead on the **expansionary shock**, viewing the contractionary phase as an outcome
- The boom is critical for understanding the bust!

Theory

Potential Sources of Credit Supply Expansions

- Financial excesses, broadly defined
  - Global savings imbalances (Caballero, et al 2008)
  - Wealth inequality (Kumhof, et al 2015)
  - Shifts in monetary policy in core countries (Miranda-Agrippino and Rey 2015)
- Financial liberalization, banking deregulation, decline in currency risk
- Financial innovation
- Behavioral biases (amplification or source?)

Models We Are Studying

- **Finance and Macroeconomic fluctuations:**
  Eggertsson and Krugman (2012); Huo and Ríos-Rull (2013, 2016); Kumhof, et al (2015); Schmitt-Grohé and Uribe (2016); Korinek and Simsek (2016); Farhi and Werning (2016); Midrigan and Philippon (2016); Guerrieri and Lorenzoni (2017)

- **House prices and household debt:**
  Landvoigt, et al (2015); Favilukus, et al (2016); Greenwald (2016); Landvoigt (2016); Justiniano, et al (2017b); Garriga, et al (2017); Kaplan, et al (2017)

- **Behavioral:**
  Barlevy and Fisher (2011); Gennaioli, et al (2012); Greenwood, et al (2016); Burnside, et al (2016); Bordalo, et al (2017)

Some Lessons So Far

- Open economy models can match empirical patterns by assuming exogenous movements in interest rates (e.g., Schmitt-Grohé and Uribe 2016; Mian, et al 2017b)
- Relaxation of an LTV constraint is not a good approximation for the credit supply expansion we have in mind
  - Interest rates go the wrong way (e.g., Justiniano, et al 2017b)
  - Difficult for LTV relaxation to increase house prices in closed economy models (e.g., Kiyotaki, et al 2011)
- Critical aspects of housing make it a unique asset: indivisibility, nontradability of dividends, and differentiation (Landvoigt, et al 2015)
- Models with sudden tightening of borrowing constraint explain bust well, but what about preceding boom?

Behavioral Biases Versus Demand Externalities

- Technically, one can get predictable boom and bust in rational model using aggregate demand externalities (Korinek and Simsek 2016)
- But assumptions are extreme, and difficult to reconcile with stock price predictability and forecast error findings
- Some notion of behavioral biases, especially by lenders, seems critical

HH borrowing with AD externality & macro frictions

Korinek and Simsek (2016)

Consider an infinite horizon economy ($t = 1, 2, 3, ...$) with two types of households – borrowers and lenders.

Each household type $h \in (l, b)$ has the same per-period utility $u(c_t^h)$, but differs in its discount rate β^h, with $\beta^b < \beta^l$.

Households supply up to one unit of labor costlessly that translates into $\bar{y}$ units of output as long as there is sufficient demand. In particular, output per capita is given by,

$$y_t = \min(\bar{y}, \frac{(c_t^l + c_t^b)}{2}) \tag{6}$$

Equation (6) captures the Keynesian idea that output can be "demand constrained".

HH borrowing with AD externality & macro frictions

Impatient households borrow an amount $\frac{d_t}{(1+r_t)}$ from lenders at interest rate r_t.

Period 1 and 2 are the most important periods in this model. At $t = 2$, there is a *perfectly anticipated* shock that sets the borrowing limit to ϕ.

Borrowers face no borrowing constraint in period 1. We can think of period 1 as a time when credit supply (temporarily) expands and lenders relax borrowing constraints.

Borrowing households start period 1 with initial debt d_0 that is due right away, and must decide on the new debt amount d_1 that will be due in full at the beginning of period 2.

HH borrowing with AD externality & macro frictions

What could be the source of relaxing credit constraint from $t = 0$ to $t = 1$?

Some example:

Favilukis et al. (2015) claim that financial liberalization and an infusion of foreign capital led to a reduction in borrowing constraints during the 2000s.

Rey (2015) argues that there is a global financial cycle in capital flows which can potentially drive "excess credit creation." (e.g. due to core-country monetary policy)

López-Salido et al. (2016) and Bordalo et al. (2016) point to sentiments and non-standard "diagnostic expectations".

HH borrowing with AD externality & macro frictions

Will households make borrowing decisions in period 1 that are optimal from a macro perspective?

There is a tension between individual optimality and social optimality. Solve the model in period 3 and work backwards.

Economy in $t \geq 3$ is in steady state. Borrowers borrow upto their limit ϕ and interest rate is determined by lending households Euler equation.

$r_t = \frac{1}{\beta^l} - 1$

Output $y_t = \bar{y}$ and consumption of each household type is $c_t^b = \bar{y} - \phi(1 - \beta^l)$, and $c_t^l = \bar{y} + \phi(1 - \beta^l)$.

The response of economy in period 2 to the fully anticipated ϕ shock depends on how much it borrowed in period 1.

HH borrowing with AD externality & macro frictions

Let D_1 be the total household debt due at the beginning of period 2. $D_1 = d_1$ in equilibrium.

y_2 may be demand-constrained if D_1 is too high as consumption of borrowing households will be constrained by limit ϕ and given by, $c_2^b = y_2(D_1) - d_1 + \frac{\phi}{1+r_2}$.

Lender's Euler equation determines r_2, $\frac{u'(c_2^l)}{\beta^l u'(c_3^l)} = 1 + r_2$.

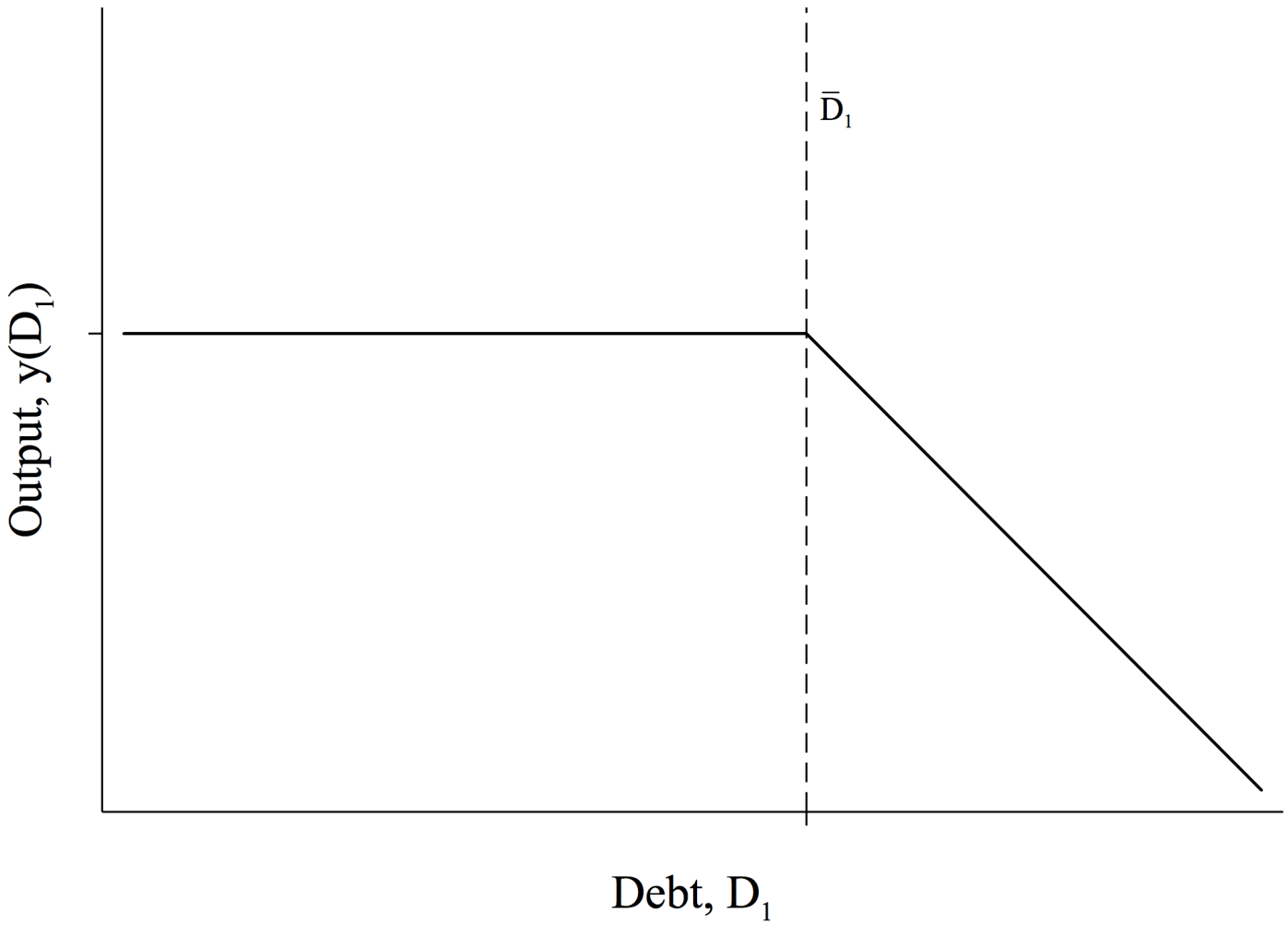
The key macro friction is that $r_2 \geq 0$.

Thus consumption of lending households is bounded from above with $c_2^l \leq \bar{c}_2^l$, where $u'(\bar{c}_2^l) = \beta^l u'(\bar{y} + \phi(1-\beta))$.

If c_2^b is low enough due to forced deleveraging of borrowing hh, interest rates cannot fall enough to raise $c2^l$ and there is a recession.

HH borrowing with AD externality & macro frictions

If $(d_1 - \phi) > \bar{c}_2^l - \bar{y}$, the economy becomes demand constrained and dips into a recession with $y_2(D_1) = \bar{c}_2^l + \phi - d_1 < \bar{y}$.



HH borrowing with AD externality & macro frictions

There is a threshold level of debt, such that if $D_1 > \bar{D}_1$, $y_2 < \bar{y}$.

It is thus possible for the economy to become "over-levered" leading to a demand-driven recession.

The model uses ZLB, but other frictions could give similar results.

For example, if borrowers and lenders live in different geographical areas and labor cannot move/adjust across regions and sectors.

Then a fall in spending by borrowers will lead to a fall in the non-tradable sector employment in their region. (see Mian and Sufi (2014) for evidence and Huo and Ríos-Rull (2013) for theory).

HH borrowing with AD externality & macro frictions

Will households recognize the dependence of total output on debt level D_1 and not exceed $\bar{D}_1$ when they are unconstrained?

Consumption for the two types is given by, $c_1^b = \bar{y} - d_0 + \frac{d_1}{1+r_1}$, and $c_1^l = \bar{y} + d_0 - \frac{d_1}{1+r_1}$.

Since borrowing in unconstrained in period 1, both types of households will be on their FOC:

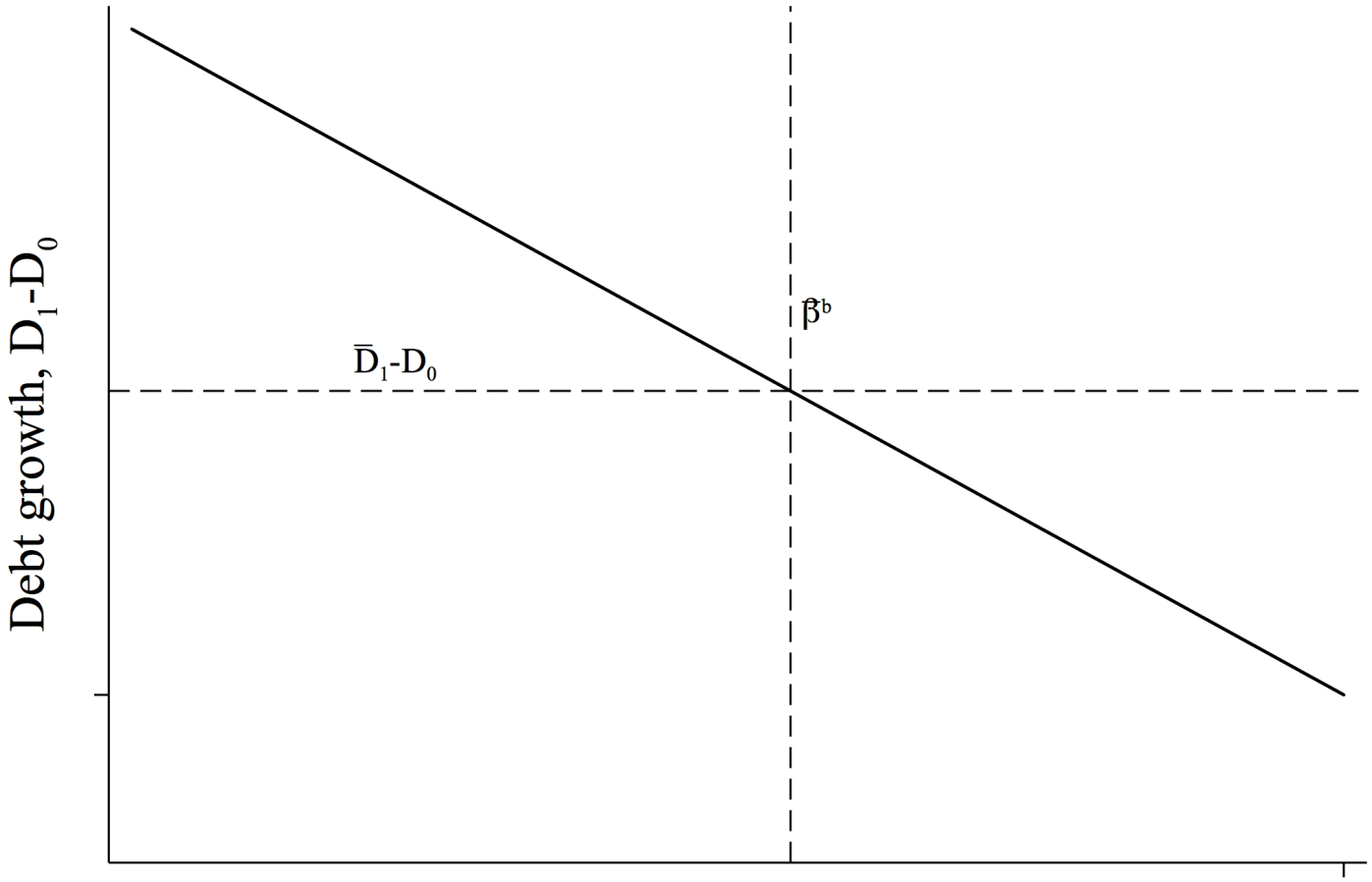
$$\frac{u'(c_1^b)}{\beta^b u'(c_2^b)} = \frac{u'(c_1^l)}{\beta^l u'(c_2^l)} = 1 + r_1 \tag{7}$$

We can solve for d_1 and r_1 using (7) and the expressions for c_1^b, c_2^b, c_1^l and c_2^l derived earlier and get the following result as in Korinek and Simsek (2016)

HH borrowing with AD externality & macro frictions

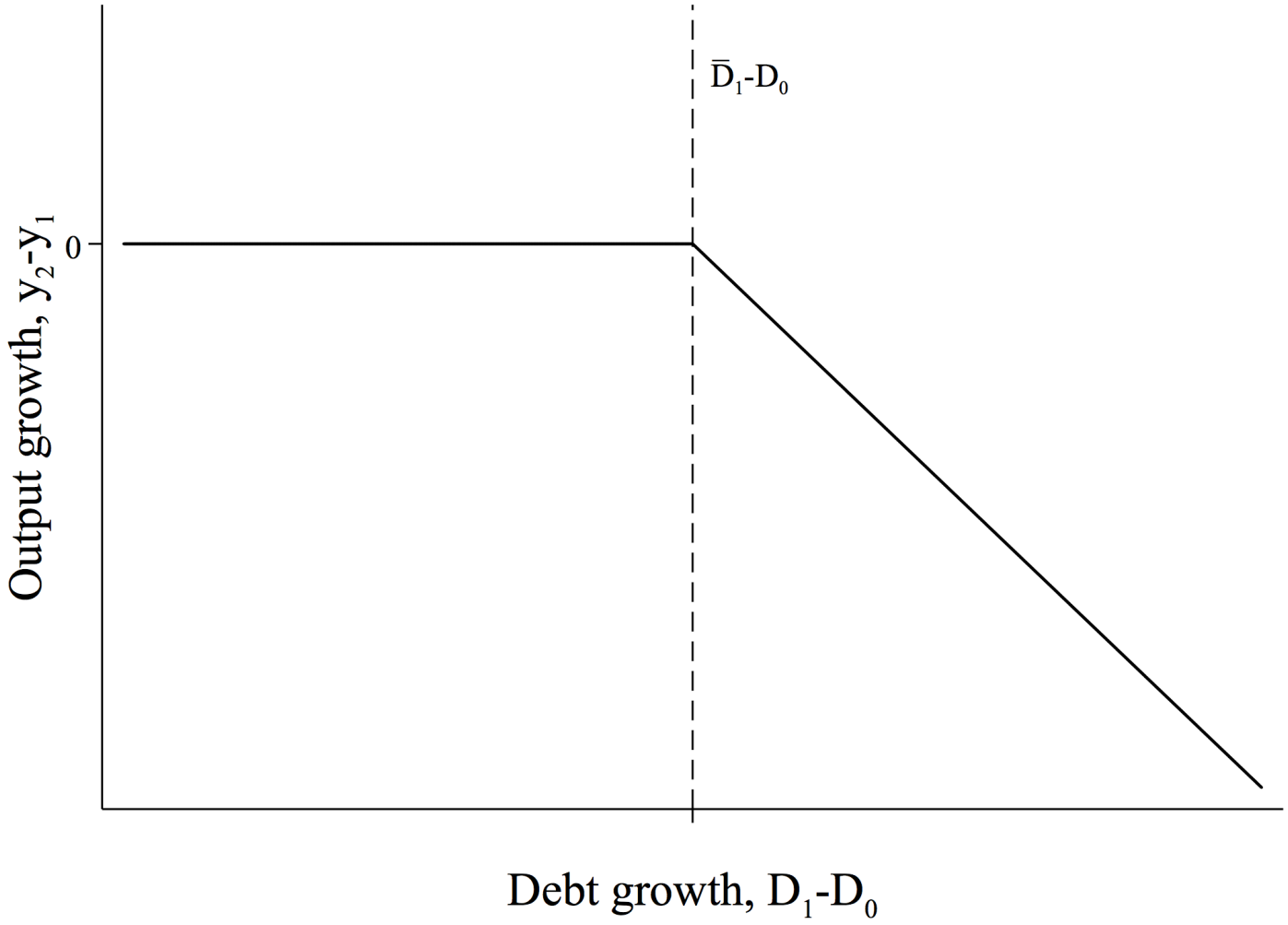
If borrowers are sufficiently impatient (i.e. β^b is low enough), then $d_1 > \bar{D}_1$ and there is recession next period when credit tightens.

See Chen (2013) and Cronqvist and Siegel (2015) for cross-country differences in saving rates driven by "deep" parameters such as language and genetics.



HH borrowing with AD externality & macro frictions

Negative, non-linear relationship between household debt growth and subsequent output growth.



HH borrowing with AD externality & macro frictions

Our focus was on aggregate demand externality

Other behavioral models that also suggest the possibility of a negative forecasting relationship between debt and growth.

If individuals are myopic due to hyperbolic preferences, access to financing could lead to excessive short run consumption at the expense on long run growth (Laibson (1997) and Barro (1999)).

Agents may suffer from "neglected risk" at times (Gennaioli et al. (2012)), or agents have strong differences in beliefs about the fundamental price of collateral Geanakoplos (2010)

SOE with RA but downward wage rigidity

Schmitt-Grohé and Uribe (2016)

Consider a small open economy with a continuum of identical infinitely lived households with utility function,

$$E_0 \sum_{t=0}^{\infty} \beta^t u(c_t) \tag{8}$$

Consumption is an increasing and concave composite of tradable and non-tradable consumption.

$$c_t = A(c_1^T, c_t^N) \tag{9}$$

SOE with RA but downward wage rigidity

One period, state non-contingent bond, d_t is debt assumed in period $(t-1)$ and *due at* t.

r_t is the interest rate between t and $t+1$, and **exogenous**.

Tradable output is **exogenously** given by y_t^T, and non-tradable output, $y_t^N = F(h_t)$ is produced using labor alone, with F increasing and concave. (therefore, $h_t = F^{-1}(y_t^N) = F^{-1}(c_t^N)$ in equilibrium.)

Labor is supplied in fixed total quantity $\bar{h}$.

Wages are downwardly rigid, and hence equilibrium employment $h_t \leq \bar{h}$.

Households are subject to a debt limit $d_{t+1} < \bar{d}$.

SOE with RA but downward wage rigidity

$P_t^T = E_t$, the nominal exchange rate.

Households choose $c_t, c_t^T, c_t^N, d_{t+1}$ to maximize (8) subject to their intertemporal budget and borrowing constraint.

Let, $p_t = \frac{P_t^N}{P_t^T} = \frac{P_t^N}{E_t}$ be the "real" non-traded price, and $w_t = \frac{W_t}{P_t^T} = \frac{W_t}{E_t}$ be real wages.

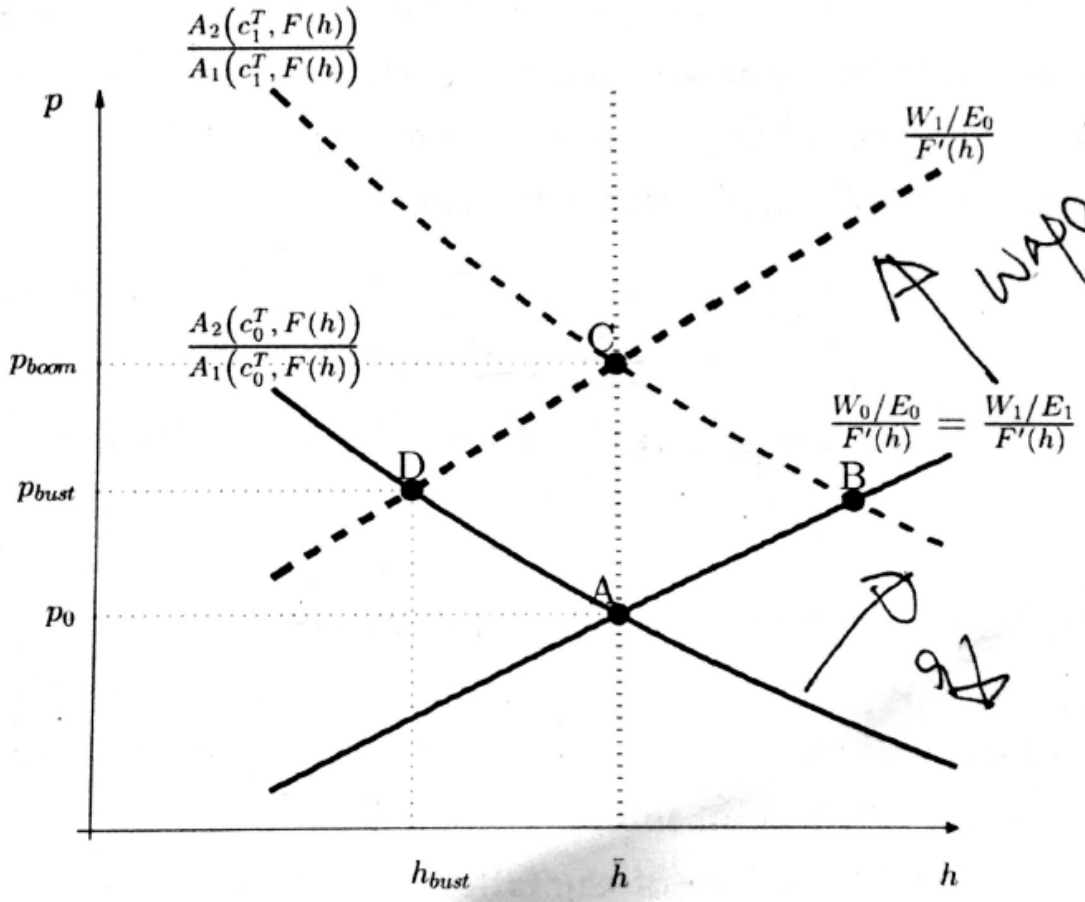
We assume wages are downwardly rigid with $W_t \geq W_{t-1}$.

We also assume for now that exchange rate is pegged, so $\epsilon_t = \frac{E_t}{E_{t-1}} = 1$

SOE with RA but downward wage rigidity

Equilibrium is defined by clearing in the non-tradable sector

Figure 3: Adjustment To A Boom-Bust Episode Under A Currency Peg



Note. The figure is drawn under the assumption that $\gamma = 1$.

SOE with RA but downward wage rigidity

A negative shock to r_t, households will want to borrow from abroad to increase domestic consumption of the tradable good. Since utility depends on the composite good, demand for non-tradable good also increases, thus shifting the demand curve up. In the absence of supply adjustment, there will be over-employment at point B.

Therefore supply curve must adjust to the left due to an increase in real wages (i.e. wage relative to the tradable good price). The new equilibrium point is C, with all of the adjustment happening in the non-tradable price level through wage inflation.

SOE with RA but downward wage rigidity

Now, suppose r_t goes back to its original level. Demand curve falls back to its original position, but supply curve is stuck at its new position! Thus new equilibrium will be D!!. There is a recession due to downward rigid wages.

Externality: Go back to the period when r_t goes down. Will households internalize the effect of wage rigidity and **not** borrow as much? NO! because they take total borrowing in the economy as given - i.e. everyone else's reaction, and hence total domestic absorption of tradable good as given.

Notice that the relationship between GDP (non-tradable output) and debt is the **same** in this model as in the previous model of Korinek and Simsek (2016).

General set up

Representative agent as in first model, but only two periods, t and $t+1$.

Output at $t+1$ contingent on the total household debt, D_t, and macroeconomic frictions, Φ.

$$y_{t+1} = \begin{cases} \bar{y} & \text{if } D_t \leq \bar{D} \\ \bar{y} - f(\frac{D_t}{\bar{D}}, \Phi) & \text{with } f(1,.) = 0, f_1 > 0 \text{ and } f_{12} > 0, \text{ otherwise} \end{cases} \tag{10}$$

If households choose to take on "excessive" debt ($D_t > \bar{D}$), the economy cannot operate at full capacity in period $t+1$. The output shortfall will be larger with higher levels of household debt and more severe macroeconomic frictions Φ.

General set up

The economy enters t with no debt at all, and that there are a continuum of identical households of measure one.

Each household chooses consumption c_t, c_{t+1}, and debt d_t to maximize utility $u(c_t) + \beta u(c_{t+1})$, subject to budget constraints $y_t = c_t - \frac{d_t}{1+r_t}$ and $y_{t+1}(D_t) = c_{t+1} + d_t$.

Each household chooses d_t, taking as given expectation of D_t, giving rise to "demand" externality: households do not internalize that their choice of debt could lead to lower output next period, leading to excessive borrowing relative to the social optimum.

General set up

The demand externality becomes transparent by comparing the *private* Euler equation of each household, in which a household takes D_t as given, with the social planner's Euler equation who internalizes the effect of her choice of d_t on D_t.

Private Euler equation: $\frac{u'(c_t)}{u'(c_{t+1})} = \beta(1 + r_t)$

Social Euler equation is $\frac{u'(c_t)}{u'(c_{t+1})} = \beta(1 + r_t)(1 + f_1 \bar{D}^{-1})$.

Thus private consumption c_t (and hence borrowing d_t) is too high in the decentralized equilibrium relative to the social optimum.

Conclusion

- The role of private credit in driving macroeconomic cycles
  - Credit is a side show: passive variable driven by fundamental factors such as productivity shocks (e.g. PIH models)
  - Financial constraints view: credit expansion is unambiguously positive for growth as it alleviates credit constraints.
  - Minsky view: There is a tradeoff, credit growth may create short term gain, but at the expense of an eventual bust.
    - Credit naturally comes with potential externalities and distortions.
    - Credit expands due to sentiments or behavioral biases and then macro-frictions bind

Policy

Preliminary Thoughts on Policy

- Macro-prudential policy limiting debt booms
- Why monetary policy may be ineffective
- What financial contracts should the government promote?