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

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Princeton

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• 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
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.
Drop in sovereign spread, 96 to 99

Credit supply shock from euro

GRC FIN DNK IRL PRT ESP NLD ITA DEU BEL AUT FRA
How the Expansion Affects the Economy

Operates through Household Sector

Predicts Recession Severity
Household Channel Appears Dominant

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

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
- 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

<table>
<thead>
<tr>
<th></th>
<th>$\Delta_{82-89}$ Total employment</th>
<th>$\Delta_{82-89}$ Empl. tradables</th>
<th>$\Delta_{82-89}$ Empl. non-tradables</th>
<th>$\Delta_{82-89}$ Empl. construction</th>
<th>$\Delta_{82-89}$ Industry-level employment</th>
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<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
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<td>(5)</td>
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<tr>
<td>Dereg. measure</td>
<td>0.0531**</td>
<td>0.00237</td>
<td>0.0564**</td>
<td>0.161**</td>
<td>0.0378*</td>
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<tr>
<td></td>
<td>(0.0147)</td>
<td>(0.0174)</td>
<td>(0.0134)</td>
<td>(0.0404)</td>
<td>(0.0155)</td>
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<tr>
<td></td>
<td>Dereg. measure x non-tradables</td>
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<tr>
<td></td>
<td>0.0715**</td>
<td>0.0676**</td>
<td>0.0687**</td>
<td>0.0874**</td>
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<tr>
<td></td>
<td>(0.0231)</td>
<td>(0.0229)</td>
<td>(0.0226)</td>
<td>(0.0232)</td>
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<tr>
<td></td>
<td>Dereg. measure x construction</td>
<td></td>
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<tr>
<td></td>
<td>0.0890**</td>
<td>0.0866**</td>
<td>0.0874**</td>
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<td></td>
<td>(0.0238)</td>
<td>(0.0235)</td>
<td>(0.0232)</td>
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<tr>
<td></td>
<td>Dereg. measure x other</td>
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<tr>
<td></td>
<td>0.184**</td>
<td>0.182**</td>
<td>0.183**</td>
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<tr>
<td></td>
<td>(0.0395)</td>
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<td>Unit of Obs. State</td>
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<td>State</td>
<td>State</td>
<td>State x 2 digit Ind.</td>
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<td>2 Digit Ind. FE State FE</td>
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<td></td>
<td>State x 2 digit Ind.</td>
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<td></td>
<td>$R^2$</td>
<td>0.193</td>
<td>0.000</td>
<td>0.256</td>
<td>State x 2 digit Ind.</td>
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<td>Observations</td>
<td>49</td>
<td>49</td>
<td>49</td>
<td>State x 2 digit Ind.</td>
</tr>
</tbody>
</table>

**Note:** The table above shows the job growth by industry and by extent of deregulation. The variables are as follows:

- **Dereg. measure**: The extent of deregulation.
- **Empl. tradables**: Employment in tradable industries.
- **Empl. non-tradables**: Employment in non-tradable industries.
- **Empl. construction**: Employment in the construction industry.
- **Industry-level employment**: Total employment change adjusted for industry-level factors.

The table includes coefficients with their standard errors, and the significance levels are indicated by asterisks: ** for p < 0.01, * for p < 0.05. The unit of observation is state, and the analysis includes fixed effects (FE) to control for state-specific effects.
Real exchange rate appreciation

(CPI Inflation (Dol Negro), 82-89)
RER appreciation in early deregulation states

<table>
<thead>
<tr>
<th></th>
<th>(1) $\Delta_{82-89}$ All items (Del Negro)</th>
<th>(2) $\Delta_{84-89}$ All items</th>
<th>(3) $\Delta_{84-89}$ Non-tradables</th>
<th>(4) $\Delta_{84-89}$ Tradables</th>
<th>(5) $\Delta_{84-89}$ Non-tradables or Tradables</th>
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<tbody>
<tr>
<td>Dereg. measure</td>
<td>1.780** (0.482)</td>
<td>2.334** (0.513)</td>
<td>4.017** (0.777)</td>
<td>0.303 (0.459)</td>
<td>0.303 (0.463)</td>
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<tr>
<td>Dereg. measure $\times$ NT</td>
<td></td>
<td></td>
<td>3.714** (0.821)</td>
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<tr>
<td>Dummy Non-tradables</td>
<td></td>
<td></td>
<td></td>
<td>11.94** (0.878)</td>
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<tr>
<td>$R^2$</td>
<td>0.261 State</td>
<td>0.434 State</td>
<td>0.476 State</td>
<td>0.021 State</td>
<td>0.807 State $\times$ NT-T</td>
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<tr>
<td>Unit of obs.</td>
<td>48 State</td>
<td>25 State</td>
<td>25 State</td>
<td>25 State</td>
<td>50 State $\times$ NT-T</td>
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</table>
Wages rise in early deregulation states in all sectors
### Placebo tests

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

<table>
<thead>
<tr>
<th></th>
<th>Δ_{89-92} Total employment</th>
<th>Δ_{89-92} Empl. tradables</th>
<th>Δ_{89-92} Empl. non-tradables</th>
<th>Δ_{89-92} Empl. construction</th>
<th>Δ_{89-92} Industry-level employment</th>
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<td></td>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
<td>(4)</td>
<td>(5)</td>
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<tr>
<td>Dereg. measure</td>
<td>-0.0278**</td>
<td>-0.0322*</td>
<td>-0.0313*</td>
<td>-0.128**</td>
<td>-0.0435*</td>
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<td></td>
<td>(0.00970)</td>
<td>(0.0140)</td>
<td>(0.0116)</td>
<td>(0.0329)</td>
<td>(0.0162)</td>
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<td>Dereg. measure x non-tradables</td>
<td>0.00386</td>
<td>0.00135</td>
<td>0.000297</td>
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<td>(0.0192)</td>
<td>(0.0190)</td>
<td>(0.0187)</td>
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<tr>
<td>Dereg. measure x construction</td>
<td>0.00814</td>
<td>0.00654</td>
<td>0.00612</td>
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<td>(0.0140)</td>
<td>(0.0136)</td>
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<td>Dereg. measure x other</td>
<td>-0.0742**</td>
<td>-0.0758**</td>
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<td>(0.0253)</td>
<td>(0.0250)</td>
<td>(0.0244)</td>
<td>(0.0244)</td>
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**Unit of Obs.**
- State x 2 Digit Ind.
- State x 2 Digit Ind. FE
- State x 2 Digit Ind. FE

**State FE**
- ✓
- ✓
- ✓
- ✓

**R²**
- 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

Overall Wages

Non-tradable Sector Wages

 Tradable Sector Wages

Construction Sector Wages
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

  - 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
Figure IV

Impulse Responses to a Household Debt Shock Identified with the Mortgage Lending Spread in a Proxy SVAR

This figure shows impulse responses to a household debt shock identified using an indicator variable for whether the standardized mortgage spread is below the median as an external instrument in a proxy SVAR. The reduced-form VAR coefficient estimates are corrected for Nickell bias using an iterative bootstrap procedure. Dashed lines represent 95% confidence intervals that account for contemporaneous cross-country residual correlation and are computed by resampling cross-sections of residuals using the wild bootstrap.

Output then rises for two periods, before reversing and falling sharply for several periods. The general shape of the output response from the proxy SVAR mirrors the response using the Cholesky scheme shown in Section III. In particular, a low MS spread induced rise in household debt is followed by a growth slowdown in the medium run. An increase in household debt driven by an increase in credit supply is associated with lower subsequent GDP growth.

V.B. Cross-Sectional Analysis

In this section, we examine the experience of the eurozone and countries prior to the Great Recession to show in a cross-sectional setting the relation between the interest spreads, household debt changes, and economic growth. We first show that the decline in the sovereign spread relative to U.S. Treasuries can be a useful proxy of a credit supply shock for the eurozone in the years leading up to the Great Recession. The introduction of the euro led to a convergence of sovereign spreads between the eurozone core and peripheral countries because of decreased currency and other...
JST Local Projections using Interest Rate Instrument


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

(a) Short-term interest rate

(b) Long-term interest rate

(c) Mortgage loans/GDP ratio

(d) log (House price/income ratio)
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
  - 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

- Lev <= 30%
- 30% < Lev <= 50%
- 50% < Lev <= 70%
- 70% < Lev <= 90%
- 90% < Lev

![Bar chart showing marginal propensity to consume by leverage](chart.png)
Marginal propensity to consume by underwater homeowner fraction

(Figure 8)
Employment Growth: Non-Tradable
(Figure 4)

Change in housing net worth, 2006-2009

Non-Tradable Sector Employment Growth (based on low geographical concentration)
Employment Growth: Tradable Industries:

Change in housing net worth, 2006-2009

Wage growth 07Q1-09Q1
Hourly Wage growth 07-09 (ACS)

Change in housing net worth, 2006-2009

Labor Force Growth (07-09)

Change in housing net worth, 2006-2009

Population Growth 07-09 (Census)

Change in housing net worth, 2006-2009
Bigger Picture, but Less Precise Identification

1. Credit supply and the U.S. economic cycle of 2000 to 2010:
   Demyanyk and Van Hemert (2011); Levitin and Wachter (2012, 2013);

2. International historical evidence using debt to GDP ratios:
U.S. Credit Supply Expansion (1/3)

Levitin and Wachter (2012)

Figure 1. Share of MBS Issuance by Securitization Type

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

51. See id.
52. See id.
Figure 3.1. Spread between the average mortgage rate in the PLSD and the 10-year Treasury yield.
Household debt-to-income ratio, United States
Figure 1: 1% vs. 99%

The graph shows the trend in debt to income for the bottom 99% and the top 1% over the years from 1960 to 2010. The bottom 99% (bot 99%) has shown a steady increase, while the top 1% (top 1%) has seen a significant increase, especially after 1990.
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)
Productivity:
Output per hour
Median Family
Real Income

U.S. Productivity and Median Family Income (1980=100)

houseofdebt.org, @profsufi & @AtifRMian, Data source: BLS, CPS
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
This figure shows impulse responses to a household debt shock identified using an indicator variable for whether the standardized mortgage spread is below the median as an external instrument in a proxy SVAR. The reduced-form VAR coefficient estimates are corrected for Nickell bias using an iterative bootstrap procedure. Dashed lines represent 95% confidence intervals that account for contemporaneous cross-country residual correlation and are computed by resampling cross-sections of residuals using the wild bootstrap.

Output then rises for two periods, before reversing and falling sharply for several periods. The general shape of the output response from the proxy SVAR mirrors the response using the Cholesky scheme shown in Section III. In particular, a low MS spread induced rise in household debt is followed by a growth slowdown in the medium run. An increase in household debt driven by an increase in credit supply is associated with lower subsequent GDP growth.

V.B. Cross-Sectional Analysis

In this section, we examine the experience of the eurozone and countries prior to the Great Recession to show in a cross-sectional setting the relation between the interest spreads, household debt changes, and economic growth. We first show that the decline in the sovereign spread relative to U.S. Treasuries can be a useful proxy of a credit supply shock for the eurozone in the years leading up to the Great Recession. The introduction of the euro led to a convergence of sovereign spreads between the eurozone core and peripheral countries because of decreased currency and other

25. In experiments using the raw MS spread and other cutoffs for a “low” MS spread indicator, we find that the shape and level of the IRF are generally similar to the results shown in Figure IV.
JST Local Projections using Interest Rate Instrument

In the final days of Bretton Woods, it was the turn of the U.S. to fall under exchange rate pressure, but in the dead of the night the German government withdrew its support, allowing the dollar to fall against the mark, a decision that was later justified by Chancellor Schmidt with an appeal to the arcane legal doctrine \textit{ultra posse nemo obligatur}.

The same problem of cooperation under fixed exchange rates resurfaced in the 1992 ERM crisis when, at the September 5 meeting in Bath, the German Finance Minister Theo Waigel replied to the repeated pleas of his British counterpart, Norman Lamont, for the Bundesbank to loosen monetary policy: “My dear Lamont, you have asked that question four times... if you ask again, I will get our helicopter ready to take us back.”

Still today the recurrent mutterings about currency wars in recent years tell the same story: when considering not just the plight of unilateral dollarizers such as Panama, Ecuador, or El Salvador, but even the general spillovers from U.S. monetary policy to the quasi–“dollar bloc” of emerging economies, especially India and China, players on all sides harbor few illusions that the Fed will shape its interest rate policies to suit conditions in far away countries.

In sum, to peg is to sacrifice monetary policy autonomy, at least to some degree. Given this understanding of the key constraints in past and present international monetary regimes it is natural for us to treat the term $z_{it} = [PEG_{it} \times KOPEN_{it} \times \Delta r_{it}^\ast]$ on the right-hand side of Eq. (1) as an exogenous influence on local monetary conditions in the home economy, notwithstanding other effects captured by the rest of the terms in the equation. Thus $z_{it}$ will serve in what follows as the IV for changes in home interest rates, and will permit us to identify causal relationships from rates to mortgage credit and to house prices.

The formal definition of the IV $z_{it}$ consists of multiplying the change in relevant base country short-term interest rate $\Delta r_{it}^\ast$ by the product of $PEG_{it}$ and of $KOPEN_{it}$. The peg indicator equals 1 when the home country is pegged to the base country in both year $t$ and year $t-1$. For the sample of countries we study, a description of the relevant base countries in each historical era is presented in Table 2. Prior to WW2, peg codings are taken from Obstfeld et al. (2004, 2005). After WW2 they are gleaned from Ilzetzki et al. (2008) and updates thereto. Prior to 1914 we treat the U.K. as the base for everyone, and after 1945 we treat the U.S. as the base for everyone, with the exception of EMS/ERM/Eurozone countries for which Germany is the base after 1973. In the interwar period, the choice of a suitable base country is more challenging and subjective given the instability of the interwar gold standard period; we follow Obstfeld et al. (2004) in using a hybrid “gold center” short-term interest rate, which is an average of U.S., U.K., and French short term rates depending on which of the three countries was pegged to gold in a particular year; our results are not sensitive to this choice and we replicate our findings using any one of these three countries as the sole interwar base as in Obstfeld et al. (2004). The capital mobility indicator is based on the index (from 0 to 100) in Quinn et al. (2011). We use a continuous version of their index rescaled to the unit interval, with 0 meaning fully closed and 1 fully open.

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:**

• **House prices and household debt:**

• **Behavioral:**
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
Korinek and Simsek (2016)

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

Each household type \(h \in (l, b)\) has the same per-period utility \(u(c^h_t)\), but differs in its discount rate \(\beta^h\), 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,

\[
y_t = \min(\bar{y}, \frac{(c^l_t + c^b_t)}{2})
\]  

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

Impatient households borrow an amount $d_t \left( \frac{1}{1+r_t} \right)$ 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 $\phi$.

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.
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”.
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 up to their limit $\phi$ 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 $c^{b}_{t} = \bar{y} - \phi(1 - \beta^l)$, and $c^{l}_{t} = \bar{y} + \phi(1 - \beta^l)$.

The response of economy in period 2 to the fully anticipated $\phi$ shock depends on how much it borrowed in period 1.
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 $\phi$ and given by, 

$$c^b_2 = y_2(D_1) - d_1 + \frac{\phi}{1+r_2}.$$ 

Lender’s Euler equation determines $r_2$, 

$$\frac{u'(c^l_2)}{\beta^l u'(c^l_3)} = 1 + r_2.$$ 

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

Thus consumption of lending households is bounded from above with $c^l_2 \leq \bar{c}^l_2$, where $u'(\bar{c}^l_2) = \beta^l u'(\bar{y} + \phi(1 - \beta))$. 

If $c^b_2$ is low enough due to forced deleveraging of borrowing hh, interest rates cannot fall enough to raise $c^l_2$ and there is a recession.
HH borrowing with AD externality & macro frictions

If \((d_1 - \phi) > \bar{c}_2 - \bar{y}\), the economy becomes demand constrained and dips into a recession with \(y_2(D_1) = \bar{c}_2 + \phi - d_1 < \bar{y}\).
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).
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, $c^b_1 = \bar{y} - d_0 + \frac{d_1}{1+r_1}$, and $c^l_1 = \bar{y} + d_0 - \frac{d_1}{1+r_1}$.

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

$$\frac{u'(c^b_1)}{\beta^b u'(c^b_2)} = \frac{u'(c^l_1)}{\beta^l u'(c^l_2)} = 1 + r_1$$

(7)

We can solve for $d_1$ and $r_1$ using (7) and the expressions for $c^b_1$, $c^b_2$, $c^l_1$ and $c^l_2$ 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. $\beta^b$ 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.
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)
Schmitt-Grohé and Uribe (2016)

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

$$E_0 \sum_{t=0}^{\infty} \beta^t u(c_t)$$  \hspace{1cm} (8)

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

$$c_t = A(c_t^T, c_t^N)$$  \hspace{1cm} (9)
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 $d_{t+1} < \bar{d}$. 
\[ P_t^T = E_t, \] 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
\[ w_t = \frac{W_t}{P_t} = \frac{W_t}{E_t} \] 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.
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, $\Phi$.

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

(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 $\Phi$. 
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?