CREDIT GROWTH AND THE FINANCIAL CRISIS: A NEW NARRATIVE

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Introduction

- Prevailing narrative about the financial crisis:

  credit growth during boom concentrated in subprime segment
  defaults during financial crisis also concentrated in this segment

→ expansion of subprime credit leading cause for the crisis
**Introduction**

- Prevailing narrative about the financial crisis:
  
  credit growth during boom concentrated in subprime segment
  defaults during financial crisis also concentrated in this segment
  
  → expansion of subprime credit leading cause for the crisis

- Mechanism:

  mortgage defaults → drop in house prices
  
  → contraction in credit for high MPC households
  
  → drop in consumption and employment

Our Contribution

- Study household debt and delinquency in 1999-2013:
  based on large administrative panel of credit report data
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- Study **household debt and delinquency in 1999-2013**: based on large administrative panel of **credit report data**

Findings:

I. Credit growth during boom primarily for mid-high credit score borrowers (consistent with Adelino, Shoar & Severino 2015, Ferreira & Guyourko 2015 and Foote, Loewenstein & Willen 2016)

II. Larger rise in defaults for mid-high credit score borrowers during crisis

III. High credit score defaults driven by real estate investors

Lessons:

- Reassessment of role of subprime credit
- Critical role of real estate investors in foreclosure crisis
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- Critical role of real estate investors in foreclosure crisis
Data

- FRBNY Consumer Credit Panel/Equifax Data

  1% of all individuals with an Equifax credit report
  (2.5 mil borrowers per quarter)

  quarterly, 1999:Q1-2013:Q4

- Information

  all consumer debt except pay day loans
  delinquent behavior
  public record items
  credit score, age, ZIP code

  matched to payroll data for 2009
Prevailing Narrative

- Initial credit score used to assess borrower quality
  (Mian&Sufi 2009 and 2017)
**Prevailing Narrative**

- Initial credit score used to assess borrower quality  
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**Individuals by Initial Credit Score**

Real per capita real mortgage balances, ratio to 2001Q3. (FRBNY CCP/Equifax Data.)
Prevailing Narrative

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Real per capita real mortgage balances, ratio to 2001Q3. (FRBNY CCP/Equifax Data.)
**Prevailing Narrative**

- Initial credit score used to assess borrower quality
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→ Stronger mortgage debt growth for subprime borrowers

---

**Individuals by Initial Credit Score**

**Zip Codes by Initial Subprime Share**

Real per capita real mortgage balances, ratio to 2001Q3. (FRBNY CCP/Equifax Data.)
Problems with Initial Credit Score Ranking

- Low credit score borrowers disproportionately young

Median Age

<table>
<thead>
<tr>
<th>Quartile 1: 39</th>
<th>Quartile 2: 44</th>
<th>Quartile 3: 48</th>
<th>Quartile 4: 58</th>
</tr>
</thead>
</table>

Age distribution by credit score quartile, 2004-2012 average. (Experian Data.)
Problems with Initial Credit Score Ranking

- Low credit score borrowers disproportionately young
- Young experience life cycle debt and credit score growth

Credit Score

Debt

Estimated age effects. (FRBNY CCP/Equifax Data.)
**Problems with Initial Credit Score Ranking**

- Low credit score borrowers disproportionately **young**

- Young experience **life cycle** debt and credit score growth

→ Initial credit score lower than **at time of borrowing**
Problems with Initial Credit Score Ranking

- Low credit score borrowers disproportionately young

- Young experience life cycle debt and credit score growth

→ Initial credit score lower than at time of borrowing

- Life cycle growth of credit scores and debt driven by income growth
Life Cycle Credit Scores, Debt and Income

- Credit score and debt growth for young in 1999 rise with 2009 income

25-34 year olds in 1999 by income quintile in 2009

Credit Score

Mortgage Balances

Difference with 2001 (credit score) and ratio to 2001 (mortgage balances).

(FRBNY CCP/Equifax Data.)
Life Cycle and Borrowing by Initial Credit Score

I. Removing differences in age distribution

(FRBNY CCP/Equifax Data.)
Life Cycle and Borrowing by Initial Credit Score

I. Removing differences in age distribution

Differences in debt growth across initial credit scores attenuated

Per Capita 2001Q3-2007Q4 Real Mortgage Balance Growth

<table>
<thead>
<tr>
<th>Difference with Quartile 4 Explained by Age Distribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quartile 1</td>
</tr>
<tr>
<td>25%</td>
</tr>
</tbody>
</table>

Borrowers ranked by 1999 Equifax Risk Score. (FRBNY CCP/Equifax Data.)
II. Removing life cycle effects

Real per capita mortgage balances by 1999 Equifax Risk Score, ratio to 2001. Life cycle effects removed by assigning to each 1999 age bin balances of borrowers in that age bin in current quarter. (FRBNY CCP/Equifax Data.)
Life Cycle and Borrowing by Initial Credit Score

II. Removing life cycle effects

→ Differences in debt growth by initial credit score mostly eliminated

Real per capita mortgage balances by 1999 Equifax Risk Score, ratio to 2001. Life cycle effects removed by assigning to each 1999 age bin balances of borrowers in that age bin in current quarter. (FRBNY CCP/Equifax Data.)
Credit Scores, Debt and Defaults

- Alternative to initial credit score? RECENT CREDIT SCORE
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- Alternative to initial credit score? **RECENT CREDIT SCORE**
  → Strongly positively related to income, given age

Predicted relation between credit score and total labor income by age in 2009.
(FRBNY CCP/Equifax Data.)
Debt and Defaults by Recent Credit Score

- Analysis from lender’s perspective
Debt and Defaults by Recent Credit Score

- Analysis from lender’s perspective

**Regression Specification**

Dependent variable:

future change in balances (4-12 quarter ahead)
DEBT AND DEFAULTS BY RECENT CREDIT SCORE

- Analysis from lender’s perspective

REGRESSION SPECIFICATION

Dependent variable:
  future change in balances (4-12 quarter ahead)

Explanatory variables:
  1 quarter lagged credit score quartile
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**Regression Specification**

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Explanatory variables:

1 quarter lagged credit score quartile
lagged change in credit score (4-8 quarter change)
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Regression Specification

Dependent variable:
- future change in balances (4-12 quarter ahead)

Explanatory variables:
- 1 quarter lagged credit score quartile
- lagged change in credit score (4-8 quarter change)
- time effects, age effects
- time and age effects interacted with 1 quarter lagged credit score

Findings:
Strongest growth in debt and defaults for mid-high credit score borrowers
Debt and Defaults by Recent Credit Score

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time and age effects interacted with 1 quarter lagged credit score

- Findings:

   Strongest growth in debt and defaults for mid-high credit score borrowers
Debt by Recent Credit Score: Mortgage Balances

- Growth strongest for quartiles 2-3 during boom

Predicted 8 quarter ahead change in mortgage balances

Age adjusted, by 1Q lagged Equifax Risk Score quartile, USD. (FRBNY CCP/Equifax Data.)
Debt by Recent Credit Score: Mortgage Balances

- Sizable estimated age effects only for quartiles 2-4

Age effects for 8 quarter ahead change in mortgage balances

By 1Q lagged Equifax Risk Score quartile, USD. (FRBNY CCP/Equifax Data.)
Credit Growth by Credit Score: More Evidence

- No growth in new originations for quartile 1

(FRBNY CCP/Equifax Data.)
Credit Growth by Credit Score: More Evidence

- No growth in new originations for quartile 1
- No growth in fraction with first mortgages for quartile 1

Fraction with First Mortgages

By 8Q lagged Equifax Risk Score quartile. Quartile cutoffs: 615, 720, 791, 840. (FRBNY CCP/Equifax Data.)
Defaults by Recent Credit Score: Balances

- Delinquent mortgage balances grow most for quartiles 2-4 during crisis

Predicted 8 quarter ahead change in delinquent mortgage balances

Age adjusted, 90+ day delinquent, by 1Q lagged Equifax Risk Score quartile, USD.
(FRBNY CCP/Equifax Data.)
Defaults by Recent Credit Score

- Quartile 1 share of foreclosures drops during crisis

Foreclosures in the last 4 quarters by 8 quarter lagged Equifax Risk Score quartile.
(FRBNY CCP/Equifax Data)
Explaining High Credit Score Defaults

- Why did borrowers with 'good credit' default during crisis?

  Rise in investors → borrowers with 2 or more first mortgages
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Rise in investors → borrowers with 2 or more first mortgages

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<td>2001Q3-2004Q3 mean</td>
<td>0.063</td>
<td>0.103</td>
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<td>0.196</td>
<td>0.212</td>
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By 8 quarter lagged Equifax Risk Score. (FRBNY CCP/Equifax Data.)
**Explaining High Credit Score Defaults**

- Why did borrowers with 'good credit' default during crisis?

  Rise in investors → borrowers with 2 or more first mortgages

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<tr>
<td>2007Q4 peak</td>
<td>0.082</td>
<td>0.156</td>
<td>0.162</td>
<td>0.142</td>
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<tr>
<td>2007Q4 peak</td>
<td>0.183</td>
<td>0.333</td>
<td>0.350</td>
<td>0.317</td>
</tr>
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By 8 quarter lagged Equifax Risk Score. (FRBNY CCP/Equifax Data.)
High Credit Score Defaults: Role of Investors

- Rise in foreclosure rate more pronounced for investors

Foreclosure rate by 8 quarter lagged Equifax Risk Score, 3QMA.
(FRBNY CCP/Equifax Data.)
High Credit Score Defaults: Role of Investors

- Rise in foreclosure rate more pronounced for investors

→ Rise in investor share of defaults for high credit score borrowers

By quartile of the 8 quarter lagged Equifax Risk Score, 3QMA. (FRBNY CCP/Equifax Data.)
Macroeconomic Implications

- Aggregate consequences of growth in subprime lending

  Mortgage defaults $\rightarrow$ drop in house prices
  $\rightarrow$ contraction in credit for high MPC households
  $\rightarrow$ drop in consumption and employment
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- Causal link identified from geographical variation
  
  (zip code, MSA, county, state)

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  Mortgage defaults $\rightarrow$ drop in house prices
  $\rightarrow$ contraction in credit for high MPC households
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- Causal link identified from geographical variation
  (zip code, MSA, county, state)


  $\rightarrow$ New findings challenge causal mechanism
Growth in Mortgage Balances By Zip Code

- Strongest growth for prime borrowers in all zip codes

Ratio to 2001. (FRBNY CCP/Equifax Data.)
ZIP CODE VARIATION: ROLE OF AGE DISTRIBUTION

- Highest debt growth in high subprime zip codes for all borrowers
### Zip Code Variation: Role of Age Distribution

- Highest debt growth in high subprime zip codes for all borrowers
- More young borrowers in high subprime zip codes

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<tr>
<td>2001 subprime share</td>
<td>19%</td>
<td>32%</td>
<td>44%</td>
<td>60%</td>
</tr>
<tr>
<td>median age</td>
<td>50</td>
<td>49</td>
<td>48</td>
<td>46</td>
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**Fraction in each age bin**

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<tr>
<td>20-34</td>
<td>0.22</td>
<td>0.25</td>
<td>0.28</td>
<td>0.30</td>
</tr>
<tr>
<td>35-54</td>
<td>0.42</td>
<td>0.41</td>
<td>0.41</td>
<td>0.41</td>
</tr>
<tr>
<td>55-85</td>
<td>0.38</td>
<td>0.34</td>
<td>0.32</td>
<td>0.30</td>
</tr>
</tbody>
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By fraction of subprime in 2001. 2001Q1-2013Q4 averages. (FRBNY CCP/Equifax Data.)
ZIP CODE VARIATION: ROLE OF AGE DISTRIBUTION

- Highest debt growth in high subprime zip codes for all borrowers
- More young borrowers in high subprime zip codes

→ Quartile 4-Quartile 1 difference mostly explained by age distribution

2001Q1-2007Q4 REAL PER CAPITA MORTGAGE BALANCE GROWTH

<table>
<thead>
<tr>
<th></th>
<th>Quartile 2</th>
<th>Quartile 3</th>
<th>Quartile 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Difference relative to Quartile 1 explained by age distribution</td>
<td>44%</td>
<td>43%</td>
<td>84%</td>
</tr>
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By fraction of subprime in 2001. (FRBNY/CCP Equifax Data.)
Defaults By Zip Code

- Level differences in foreclosure rates, similar rise during crisis

Foreclosure Rate

By fraction of subprime in 2001. (FRBNY CCP/Equifax Data.)
Defaults By Zip Code

- Level differences in foreclosure rates, similar rise during crisis
- Large rise in prime share of defaults in all zip codes during crisis

Prime Share of Foreclosures

By fraction of subprime in 2001. (FRBNY CCP/Equifax Data.)
Defaults By Zip Code

- Level differences in foreclosure rates, similar rise during crisis
- Large rise in prime share of defaults in all zip codes during crisis
  → Higher default rates for prime borrowers in high subprime zip codes

Prime Share of Foreclosures

By fraction of subprime in 2001. (FRBNY CCP/Equifax Data.)
Defaults By Zip Code: Role of Investors

- Larger rise in investors for prime borrowers, similar across zip codes
- More subprime investors in low subprime zip codes

Prime Borrowers

Subprime Borrowers

Fraction with 2+ first mortgages by fraction of subprime borrowers in 2001. Prime status based on 8Q lagged credit score. (FRBNY CCP/Equifax Data.)
Defaults By Zip Code: Role of Investors

- Stronger rise in balances and foreclosures for prime investors in high subprime zip codes

### Prime Borrowers

<table>
<thead>
<tr>
<th>no. first mortgages</th>
<th>Quartile 1</th>
<th>Quartile 2</th>
<th>Quartile 3</th>
<th>Quartile 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>86%</td>
<td>85%</td>
<td>97%</td>
<td>104%</td>
</tr>
<tr>
<td>3</td>
<td>94%</td>
<td>104%</td>
<td>117%</td>
<td>118%</td>
</tr>
<tr>
<td>4+</td>
<td>102%</td>
<td>122%</td>
<td>133%</td>
<td>125%</td>
</tr>
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</table>

2005Q4-2007Q4 change in foreclosure rate

<table>
<thead>
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<th>no. first mortgages</th>
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<tr>
<td>2</td>
<td>0.023</td>
<td>0.027</td>
<td>0.045</td>
<td>0.053</td>
</tr>
<tr>
<td>3</td>
<td>0.040</td>
<td>0.063</td>
<td>0.087</td>
<td>0.115</td>
</tr>
<tr>
<td>4+</td>
<td>0.076</td>
<td>0.096</td>
<td>0.123</td>
<td>0.151</td>
</tr>
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Zip code level investor activity for prime borrowers by fraction of subprime in 2001. (FRBNY CCP/Equifax Data.)
Zip Code Variation: Role of Demographics

- Why did high subprime zip codes experience more severe recession?
Zip Code Variation: Role of Demographics

- Why did high subprime zip codes experience more severe recession?
  Young, low education, high minority share

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<tr>
<th>Zip Code Level Indicators</th>
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<th>Quartile 4</th>
</tr>
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<tbody>
<tr>
<td>Associate+ degree (2012)</td>
<td>45%</td>
<td>31%</td>
<td>23%</td>
<td>17%</td>
</tr>
<tr>
<td>Percent white</td>
<td>93%</td>
<td>90%</td>
<td>83%</td>
<td>63%</td>
</tr>
<tr>
<td>Percent black</td>
<td>1.7%</td>
<td>3.6%</td>
<td>7.6%</td>
<td>24.6%</td>
</tr>
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By fraction of subprime in 2001. PDI in 2012 USD.
(FRBNY CCP/Equifax Data, IPUMS, IRS, ACS.)
**Zip Code Variation: Role of Demographics**

- Why did high subprime zip codes experience more severe recession?
  
  Young, low education, high minority share

  High unemployment, low income, high inequality

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<tbody>
<tr>
<td>Average UR 2001-2007</td>
<td>4.94%</td>
<td>5.19%</td>
<td>5.38%</td>
<td>5.72%</td>
</tr>
<tr>
<td>Average PDI 2001-2007</td>
<td>$41k</td>
<td>$30k</td>
<td>$26k</td>
<td>$21k</td>
</tr>
<tr>
<td>PDI Growth 2001-2007</td>
<td>25%</td>
<td>16%</td>
<td>10%</td>
<td>4%</td>
</tr>
<tr>
<td>Mean Income ≥ $200K</td>
<td>6.4</td>
<td>7.9</td>
<td>9.4</td>
<td>11.8</td>
</tr>
<tr>
<td>Mean Income (2006-11)</td>
<td></td>
<td></td>
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By fraction of subprime in 2001. PDI in 2012 USD.
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Zip Code Variation: Role of Demographics

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  Young, low education, high minority share
  High unemployment, low income, high inequality
  Higher population density, more pronounced housing cycle

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<tr>
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<tr>
<td>Pop per sq mile</td>
<td>1,214</td>
<td>1,380</td>
<td>1,386</td>
<td>2,322</td>
</tr>
<tr>
<td>HPI Growth 2001-2007</td>
<td>29%</td>
<td>37%</td>
<td>42%</td>
<td>47%</td>
</tr>
<tr>
<td>HPI Growth 2007-2010</td>
<td>-21%</td>
<td>-30%</td>
<td>-27%</td>
<td>-36%</td>
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By fraction of subprime in 2001. PDI in 2012 USD.
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ZIP CODE VARIATION: ROLE OF DEMOGRAPHICS

- Why did high subprime zip codes experience more severe recession?
  Young, low education, high minority share
  High unemployment, low income, high inequality
  Higher population density, more pronounced housing cycle

→ Prevalence of business cycle sensitive, high MPC populations
  → stronger impact of recession on employment and consumption
Zip Code Variation: Role of Demographics

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  High unemployment, low income, high inequality
  Higher population density, more pronounced housing cycle

→ Prevalence of business cycle sensitive, high MPC populations
  ⇒ stronger impact of recession on employment and consumption

→ Prevalence of urban areas
  ⇒ accentuated house price cycle
    gentrification (Guerrieri et al. 2013)
    international capital inflows
Conclusions

I. Reassessment of role of subprime credit

II. Important role of real estate investors for foreclosure crisis
Conclusions

I. Reassessment of role of subprime credit

II. Important role of real estate investors for foreclosure crisis
   - drivers of investor activity?
   - alternative default risk indicators?
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   - drivers of investor activity?
   - alternative default risk indicators?

III. Geographical variation
   - larger rise in debt and defaults for prime borrowers everywhere
   - more severe recession in high subprime areas linked to demographics
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II. Important role of real estate investors for foreclosure crisis
   - drivers of investor activity?
   - alternative default risk indicators?

III. Geographical variation
   - larger rise in debt and defaults for prime borrowers everywhere
   - more severe recession in high subprime areas linked to demographics

Why stronger housing cycle and investor activity in high subprime areas?
   - preference for urban locations
   - labor market factors
     rise in initial local income (Ferreira and Gyourko 2012)
     concentration of growing industries (Liebersohn 2017)