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

$\Rightarrow$ expansion of subprime credit viewed as a leading cause for the crisis

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$\Rightarrow$ expansion of subprime credit viewed as a leading cause for the crisis

- Mechanism: Defaults&foreclosures $\rightarrow$ Drop in house prices
  $\rightarrow$ Contraction in credit&consumption
  $\rightarrow$ Recession

  (Berger & al. 2015, Lorenzoni & Guerreri 2015, Kehoe, Midrigan & Pastorino 2014, Mian & Sufi 2014, Midrigan & Philippon 2016)

Our Work

- Study behavior of household credit and delinquency, 1999-2013
  - leading up and following the 2007-09 financial crisis
- Large administrative panel: FRBNY CCP/Equifax data
  - debt positions, delinquencies, credit scores

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1. Credit growth during boom and defaults during the crisis concentrated at mid/top of credit score distribution for all debt categories
   - challenges prevailing narrative (consistent with Adelino, Shoar, Severino (2015) findings for home debt)
2. Also true within zip codes, including those with large subprime population
   - Geographical aggregation distorts evidence on distribution of debt and defaults, overstates role of subprime debt

Data

- Federal Reserve Bank of New York Consumer Credit Panel/Equifax Data
  - quarterly, 1999:Q1-2013:Q4
  - all individuals with an Equifax credit report (anonymous)
- Use 1% sample – about 2.5 million individuals each quarter
- Over 600 variables
  - all aspects of financial liabilities:
    by type of account, balances, numbers
  - delinquent behavior: by severity, type of debt
  - public record items: court judgements, collections, etc.
  - credit score, age, ZIP code
- For 2009, matched to payroll data

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- Findings:
  - credit growth during boom concentrated in prime segment
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  - share of new delinquencies and foreclosures to subprime drops during crisis; rises for higher credit scores

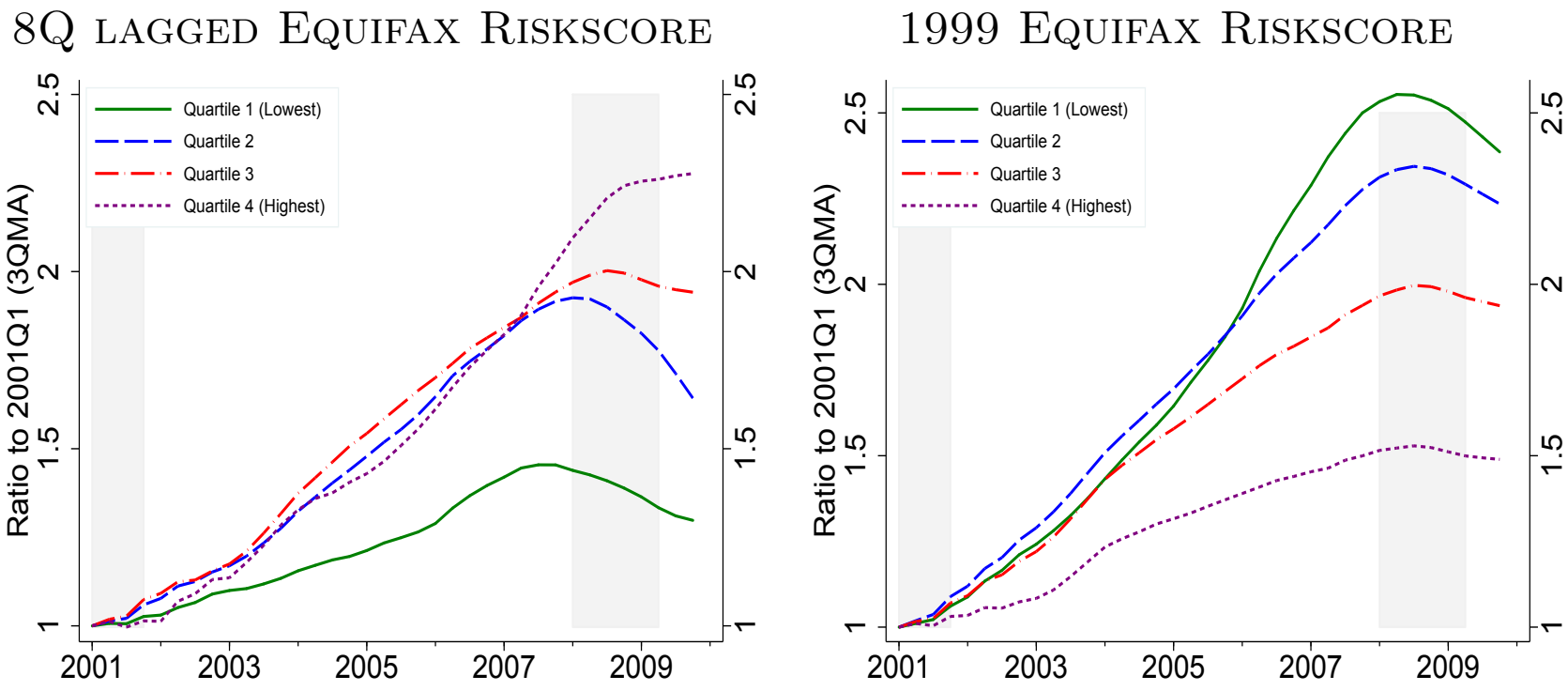
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  - share of new delinquencies and foreclosures to subprime drops during crisis; rises for higher credit scores
- Role of subprime segment magnified by ranking with initial credit scores 1996 (Mian & Sufi 2009) and 1997 (Mian & Sufi 2015)
  - discrepancy between rankings mostly explained by life cycle

Debt: Total Debt Balances

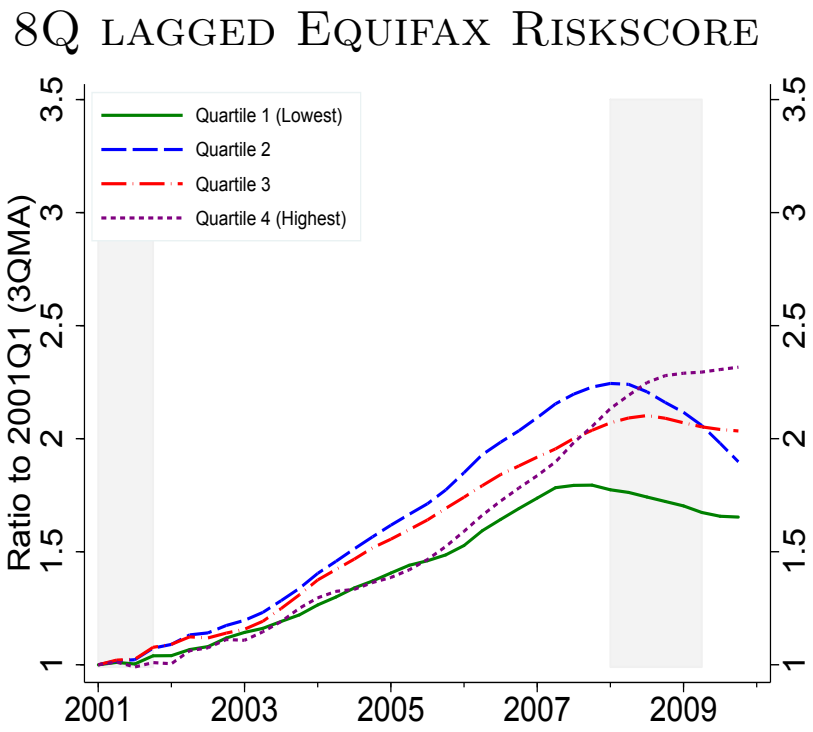
- 1999 ranking overstates debt growth for first quartile (subprime)

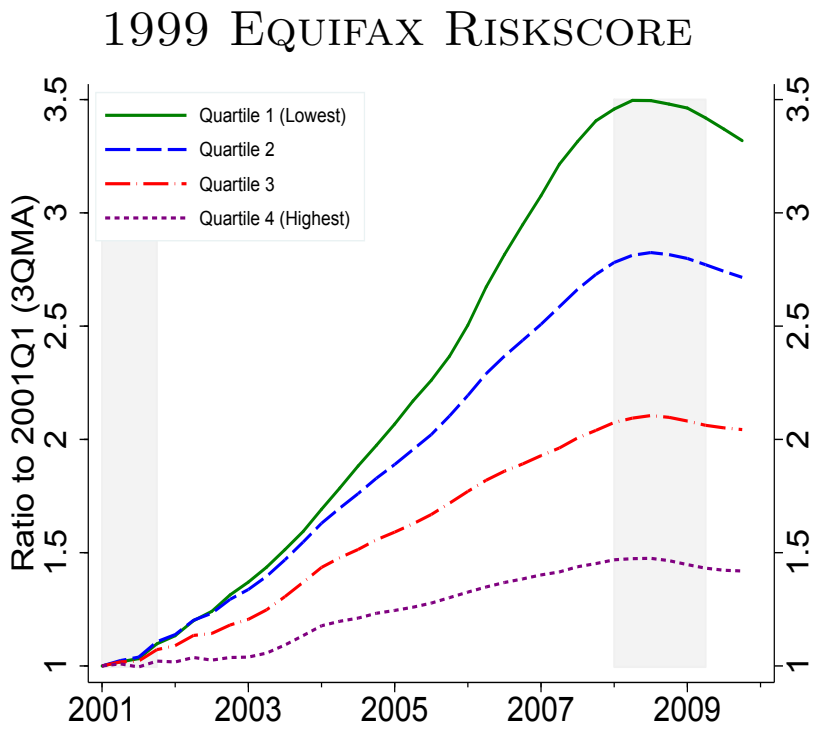


Total debt balances by Equifax Riskscore quartile. Ratio to 2001Q1.
Source: Authors' calculations based on FRBNY CCP/Equifax Data.

Debt: Mortgage Balances

- 1999 ranking overstates debt growth for first quartile (subprime)

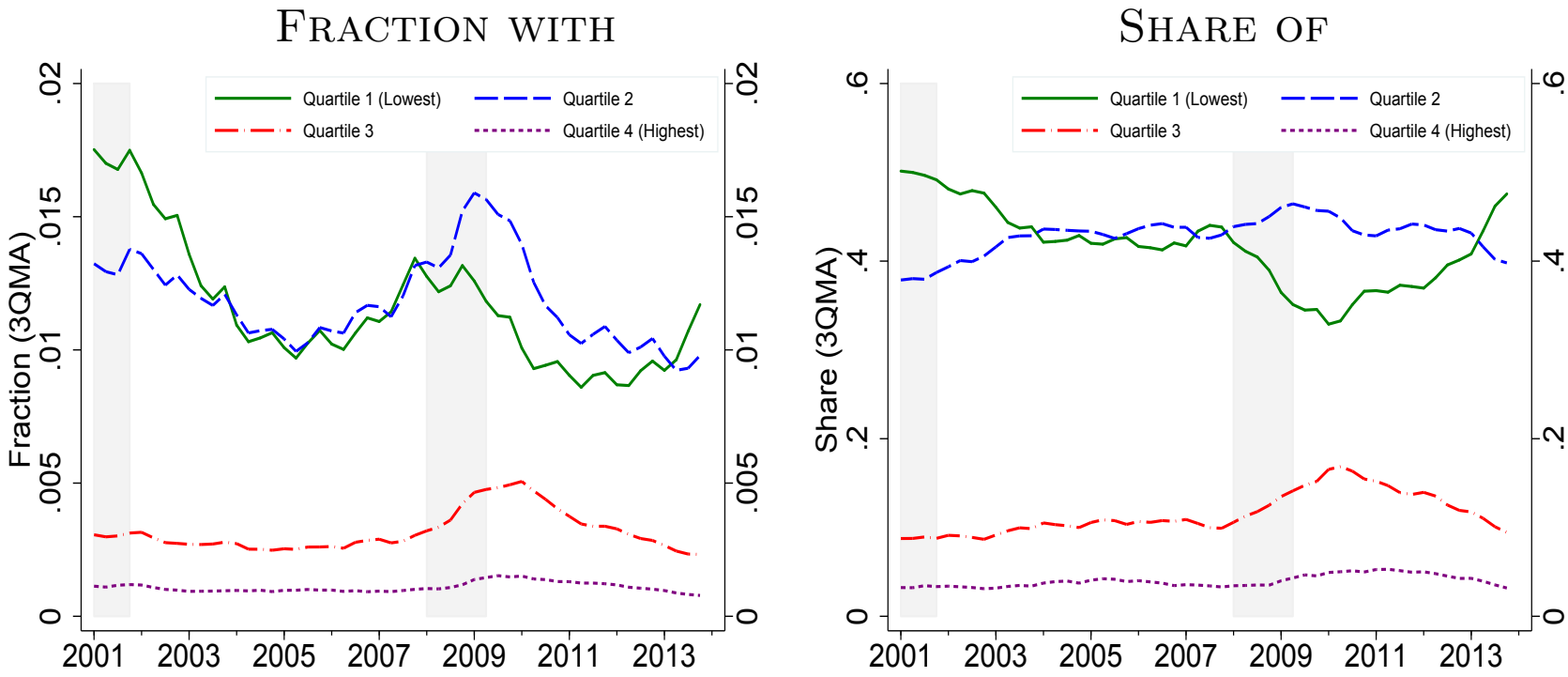




Mortgage balances. Ratio to 2001Q1.
Source: Authors' calculations based on FRBNY CCP/Equifax Data.

Defaults: Delinquencies

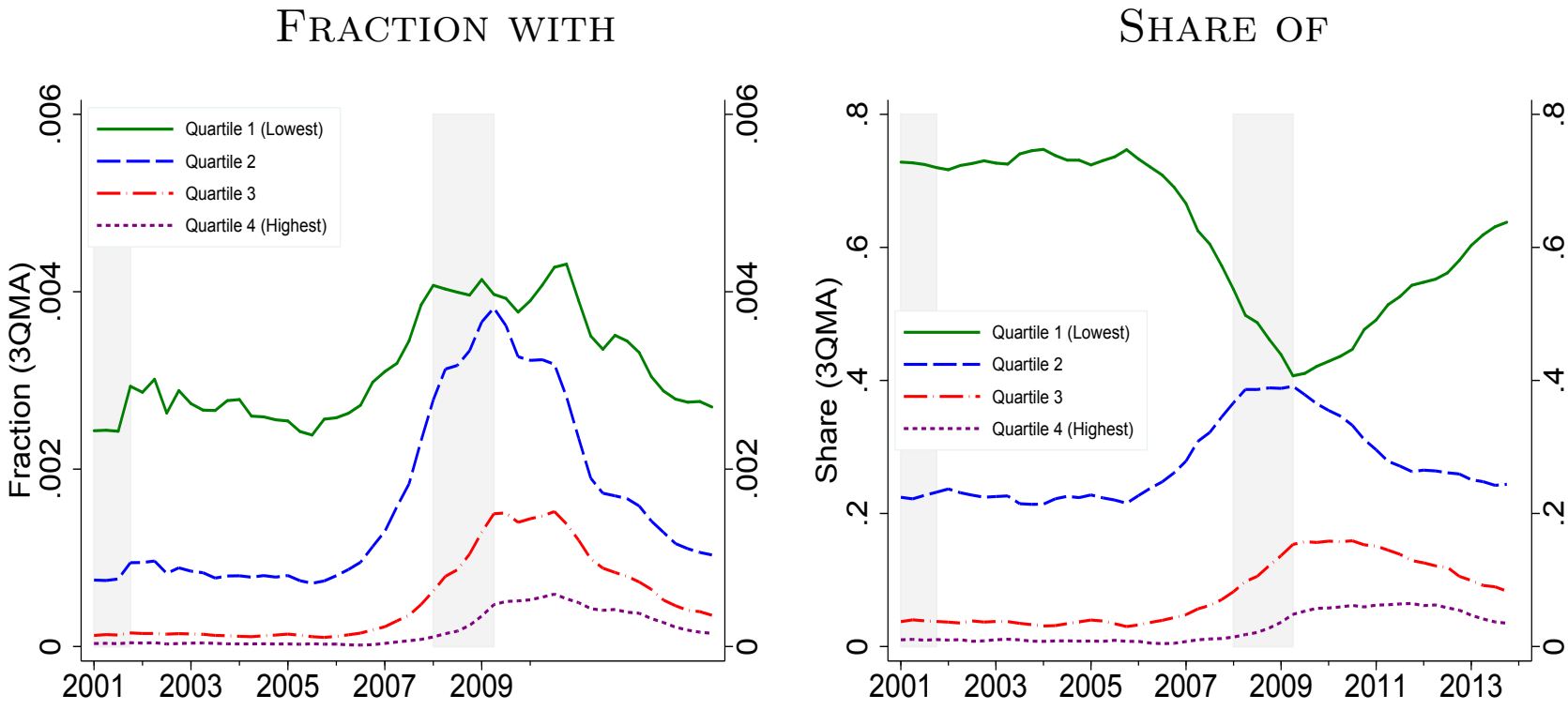
- Share of new delinquencies to 1st quartile drops during crisis; share of 3rd quartile rises



New delinquencies (90 days+late) by credit score quartile, 8Q lagged Equifax Riskscore.
Source: Authors' calculations based on FRBNY CCP/Equifax Data.

Defaults: New Foreclosures

- Share of new foreclosures to 1st quartile drops during crisis; share of 2nd and 3rd quartile rises



New foreclosures by credit score quartile, 8Q lagged Equifax Riskscore.
Source: Authors' calculations based on FRBNY CCP/Equifax Data.

Summary

- Initial credit score ranking overstates credit growth for low credit scores

  Also applies to credit card and auto balances, originations

- Using recent credit score ranking:
  - Credit growth during boom concentrated in prime quartiles
  - Rise in defaults concentrated in middle of credit score distribution
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    rise in foreclosures would be 50% lower with no rise for prime borrowers

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    rise in foreclosures would be 50% lower with no rise for prime borrowers
- Recent credit score
  - better assessment of individual default risk at time of borrowing
  - closely related to income at time of borrowing
  - 4-12Q lag avoids joint endogeneity

Role of Life Cycle

- What accounts for discrepancy between recent and initial ranking?

Role of Life Cycle

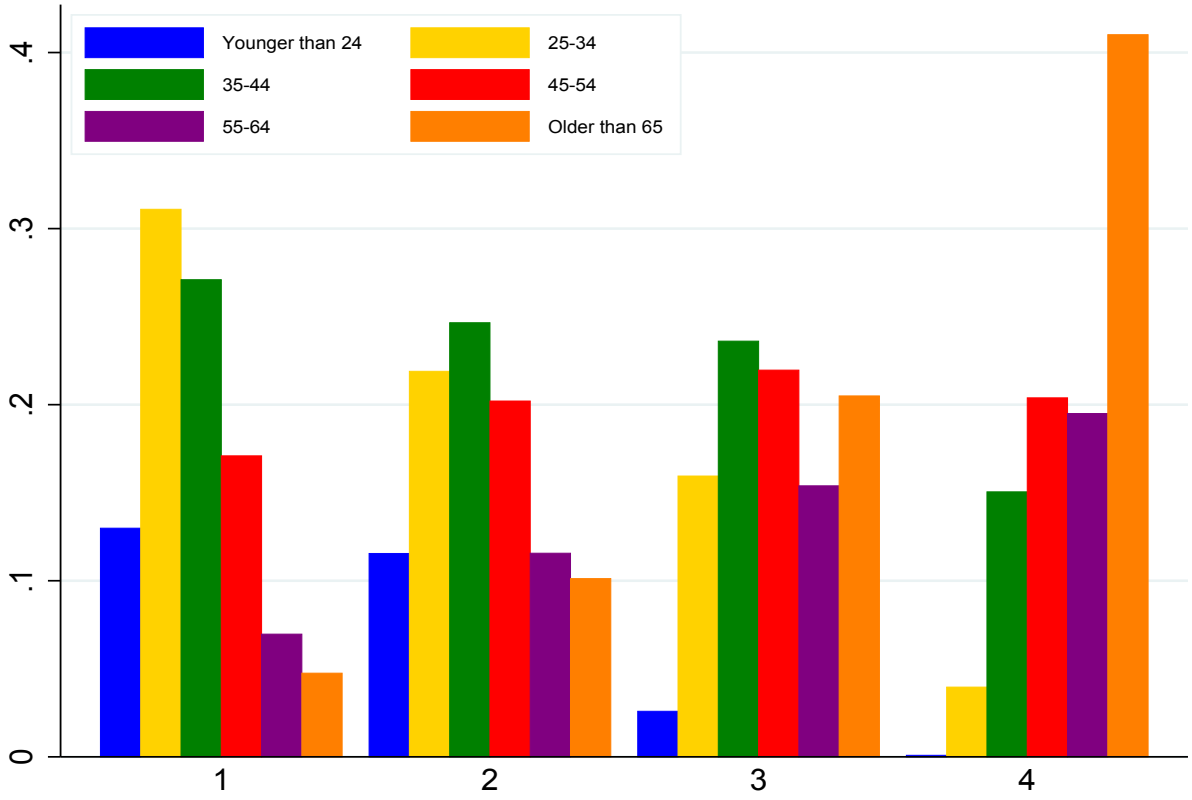
- What accounts for discrepancy between recent and initial ranking?
- Low credit score individuals disproportionately young
  - young experience future credit growth due to life cycle
  - life cycle credit growth related to life cycle income growth
  - credit score at time of borrowing higher than when young

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  - credit score at time of borrowing higher than when young
- Credit growth for subprime individuals in 1999 driven by life cycle demand

Credit Score and Age

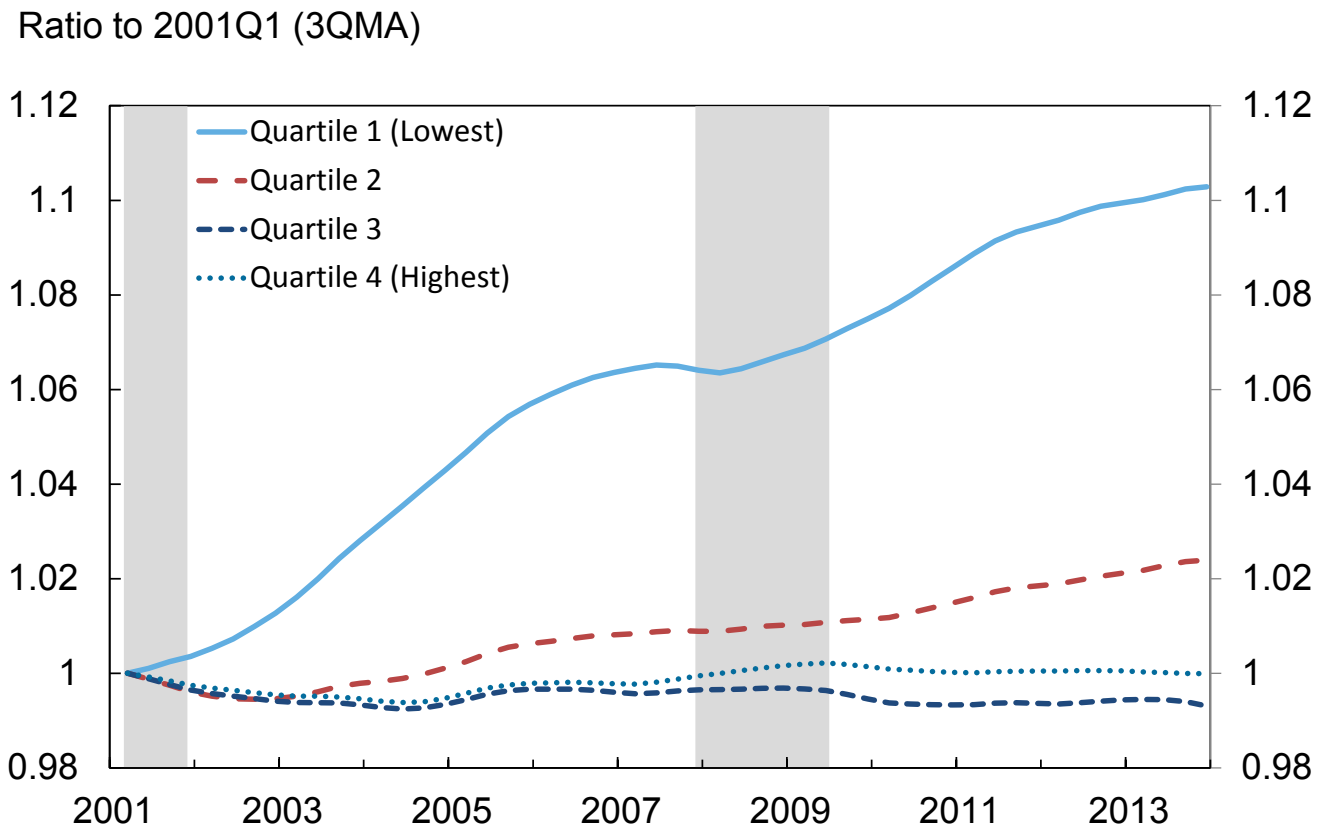
- Low credit score individuals disproportionately young



Fraction in each age bin in 1999 by Equifax Riskscore quartile in 1999.
Source: Authors' calculations based on FRBNY CCP/Equifax Data.

Credit Score and Age

- Low credit score individuals in 1999 exhibit credit score growth over time

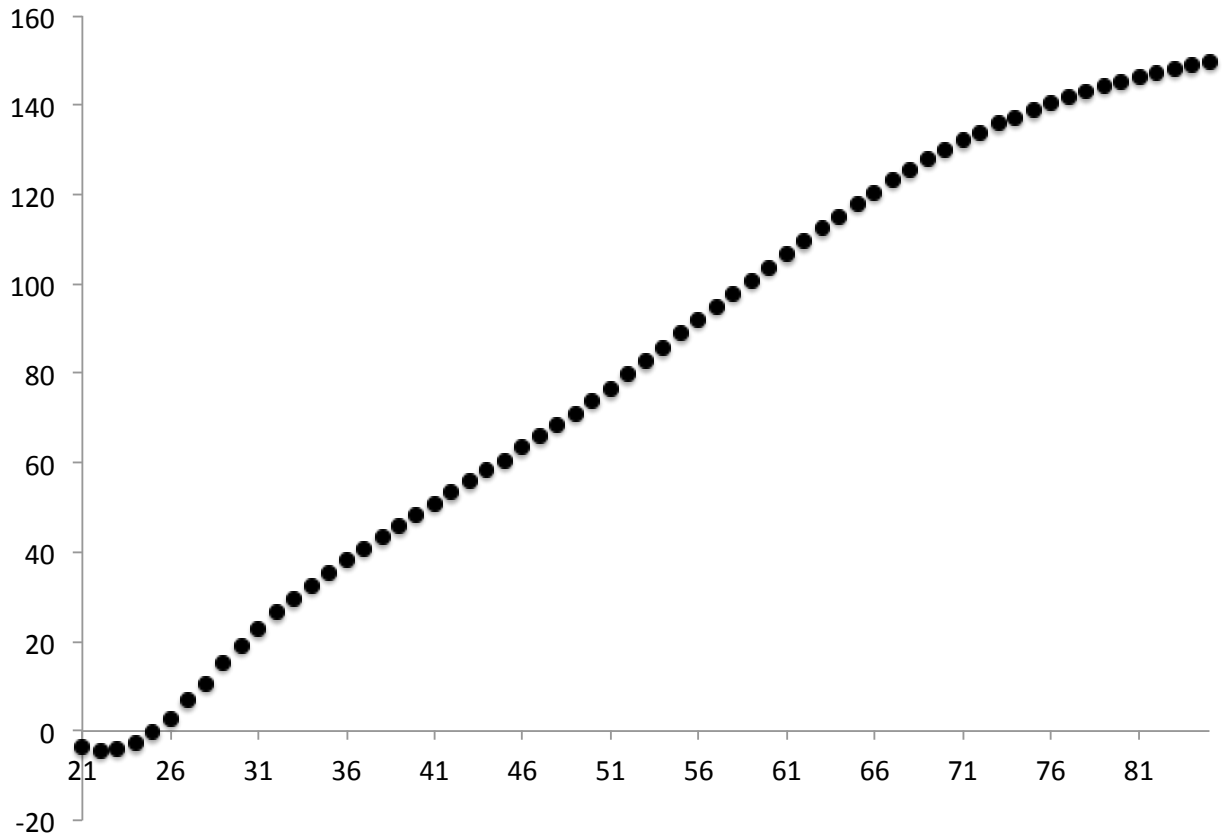


Current credit score as ratio to 1999, by Equifax Riskscore quartile in 1999.
Source: Authors' calculations based on FRBNY CCP/Equifax Data.

Credit Score and Age

$$\text{credit score at t} = \text{age FE} + \text{time FE} + \text{state FE}$$

- Estimated age effects

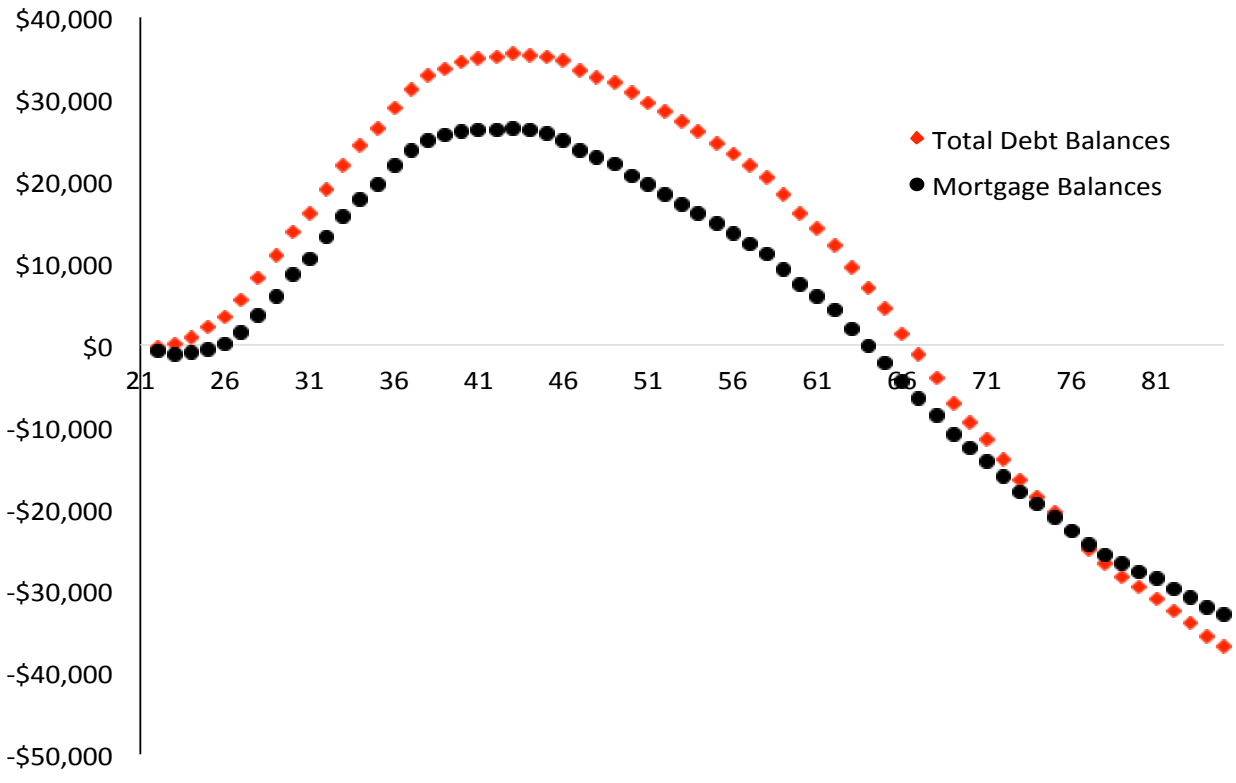


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Debt Balances and Age

$$\text{balances at t} = \text{age FE} + \text{time FE} + \text{state FE}$$

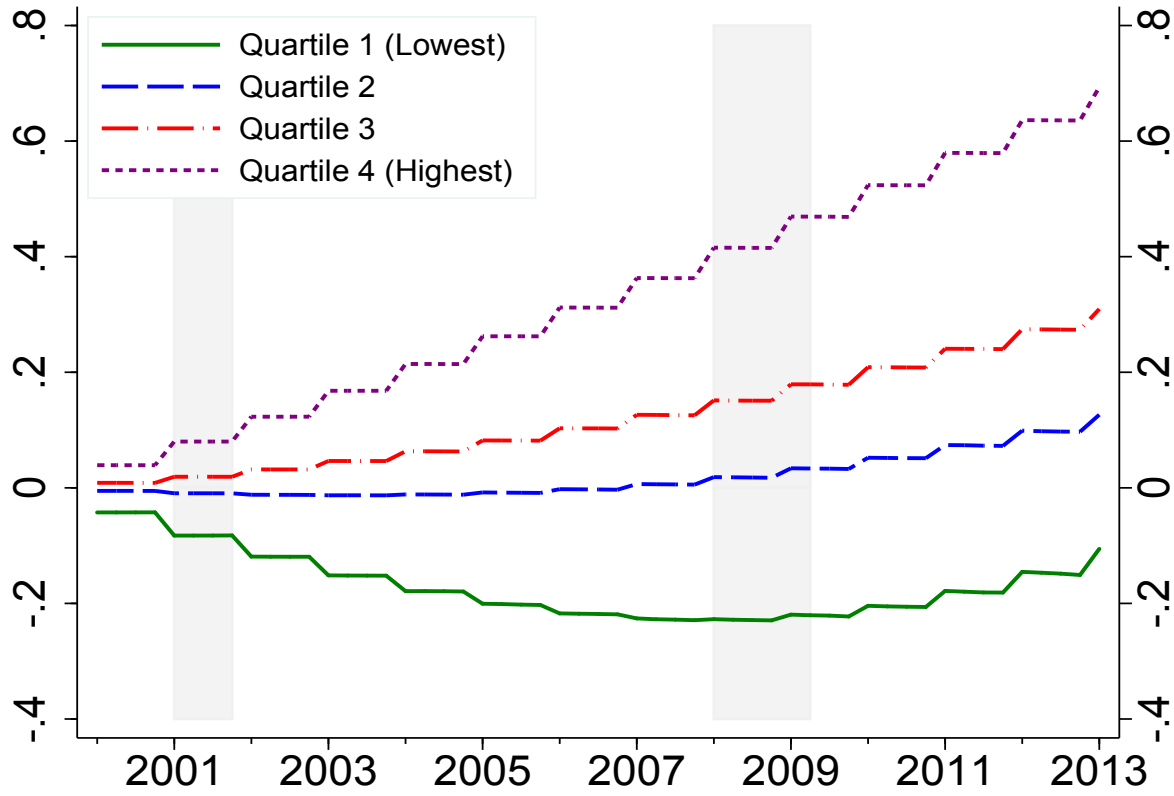
- Estimated age effects



Source: Authors' calculations based on FRBNY CCP/Equifax Data.

Debt Balances and Age

- Change in credit growth from removing age effects by 1999 CS quartile

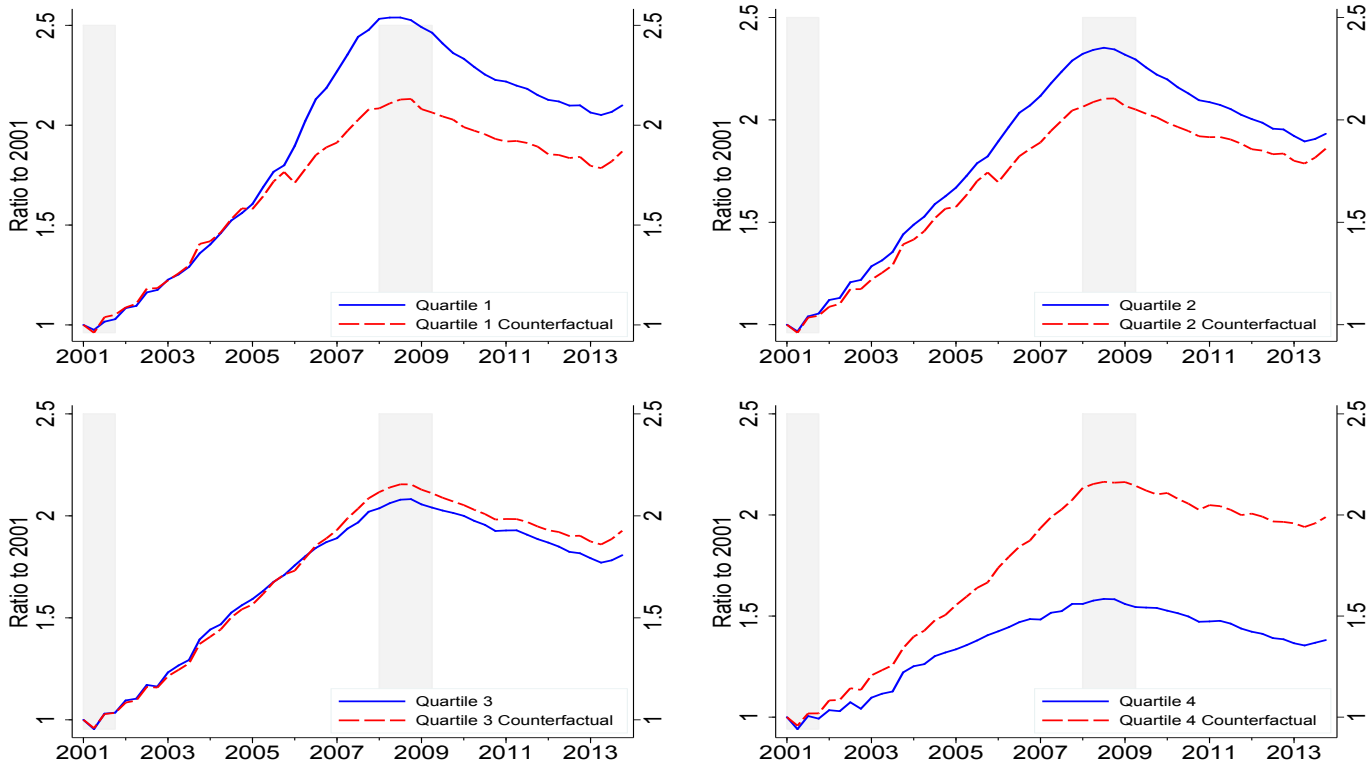


Source: Authors' calculations based on FRBNY CCP/Equifax Data.

Life Cycle and Credit Demand

- Counterfactual total balances removing life cycle effects

  Absent age effects, peak credit growth 50pp lower for first quartile, 80pp higher for fourth quartile



Total debt balances by 1999 Equifax Riskscore quartile. Counterfactual assigns to each 1999 age bin, in each quarter, debt balances of those who currently are in that age bin.
Source: Authors' calculations based on FRBNY CCP/Equifax Data.

Credit Scores and Income

- Why are recent credit scores better indicators of default risk?

  Variation in recent credit scores mostly accounted for by variation in income, conditional on age

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- Use supplementary payroll data for 2009, merged with Equifax CCP
  - 11k observations, comparable with CPS, ACS

Percentile	10%	25%	50%	75%	90%	Mean	St. Dev.
Riskscore	519	602	700	775	808	680	112
Income	16,640	22,880	39,520	64,100	99,840	49,728	35,057

Distribution of 8Q lagged Equifax Riskscore and 2009 Worknumber total annual labor income. Source: Authors' calculations based on FRBNY CCP/Equifax Data.

Credit Scores and Income

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  Variation in recent credit scores mostly accounted for by variation in income, conditional on age

- Use supplementary payroll data for 2009, merged with Equifax CCP
  - 11k observations, comparable with CPS, ACS
  - Change from 25th to 75th income percentile increases 8Q lagged credit score by 120 points after controlling for age

    69% of change from 25th to 75th percentile

Credit and Income Over the Life Cycle

- How do credit scores and borrowing by age in 1999 vary with income in 2009?

  Highest growth for young in 1999 with high income in 2009

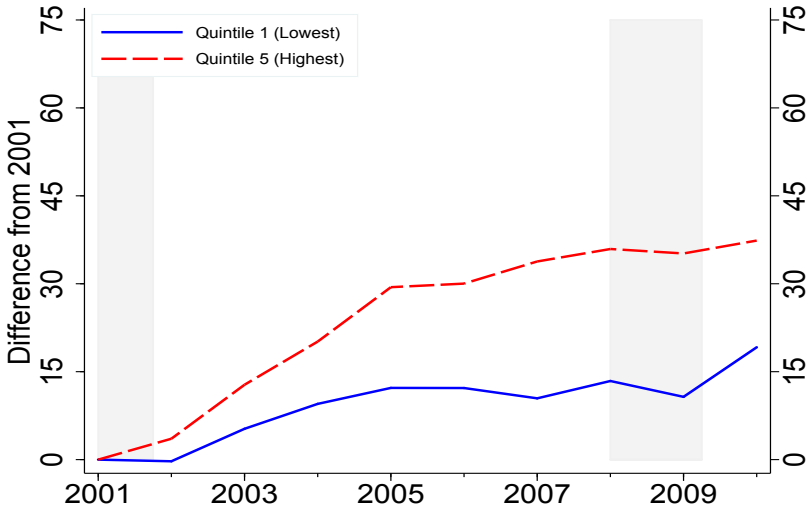
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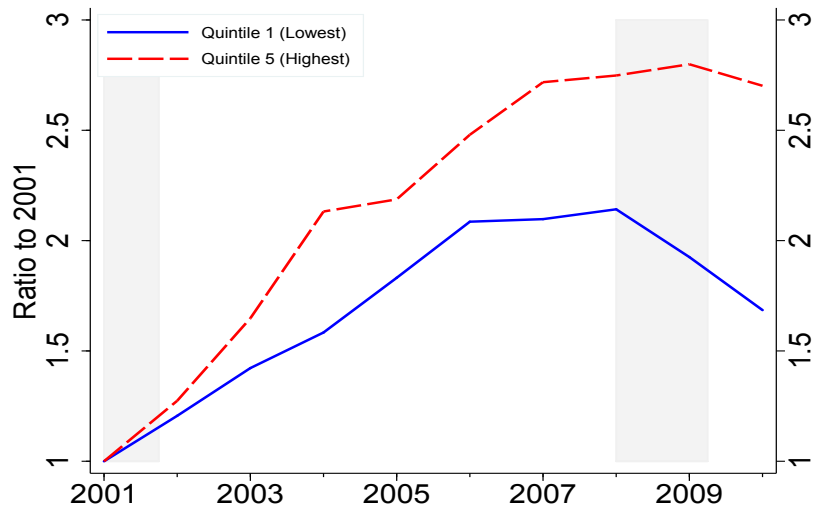
  Highest growth for young in 1999 with high income in 2009

- 25-34 yo in 1999 by their income quintile in 2009

Credit score



Total debt balances



Equifax Riskscore and total debt balances for 25-34 yo in 1999 by their 2009 Worknumber total annual labor income quantile. Difference with 2001 (credit score) and ratio to 2001 (balances). Source: Authors' calculations based on FRBNY CCP/Equifax Data.

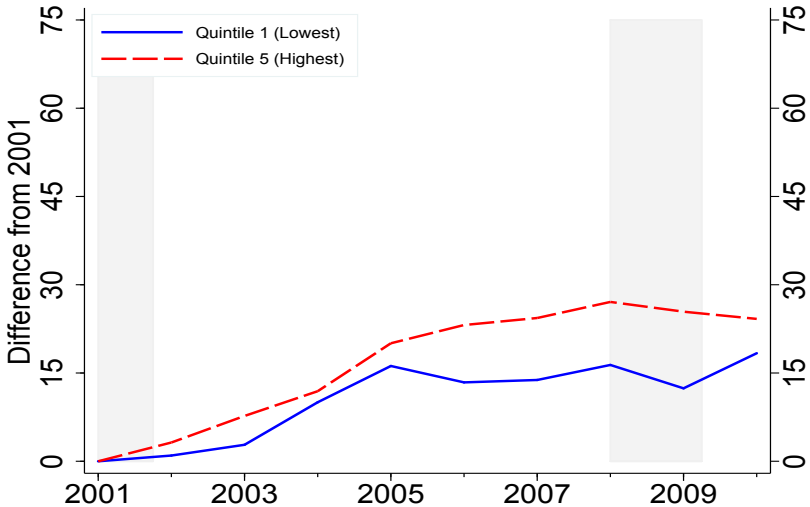
Credit and Income Over the Life Cycle

- How do credit scores and borrowing for the young in 1999 vary with income in 2009?

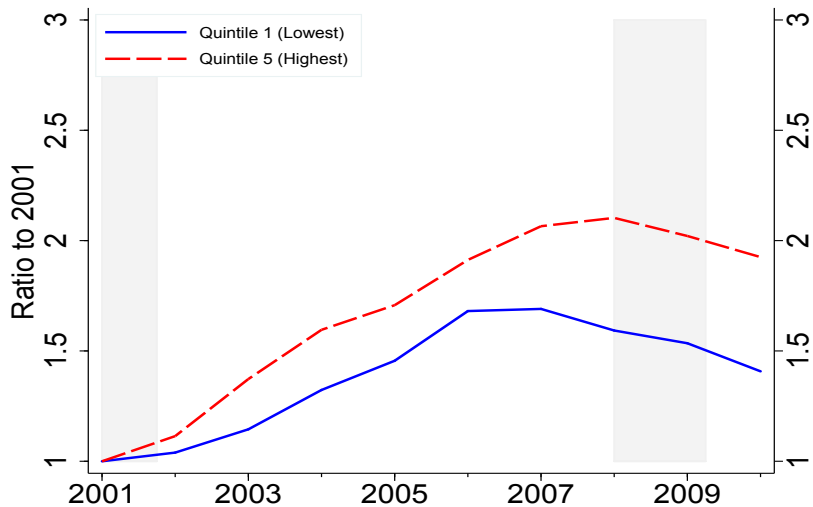
  Highest growth for young in 1999 with high income in 2009

- 35-44 yo in 1999 by their income quintile in 2009

Credit score



Total debt balances



Equifax Riskscore and total debt balances for 35-44 yo in 1999 by their 2009 Worknumber total annual labor income quantile. Difference with 2001 (credit score) and ratio to 2001 (balances). Source: Authors' calculations based on FRBNY CCP/Equifax Data.

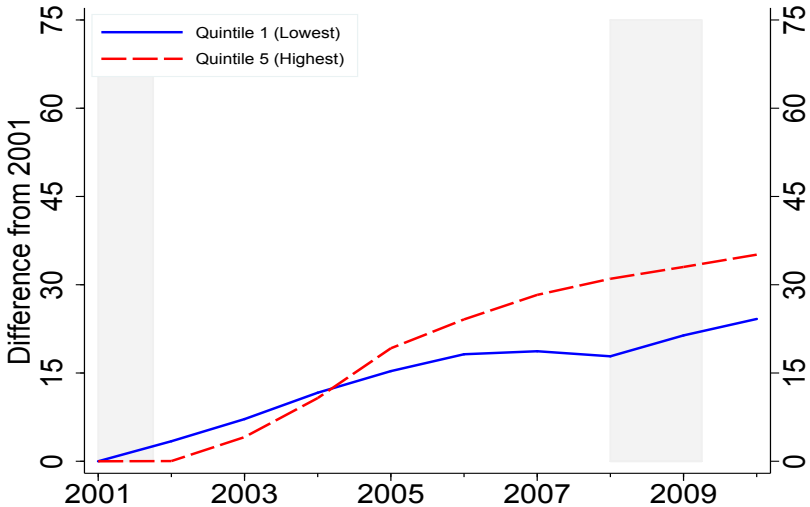
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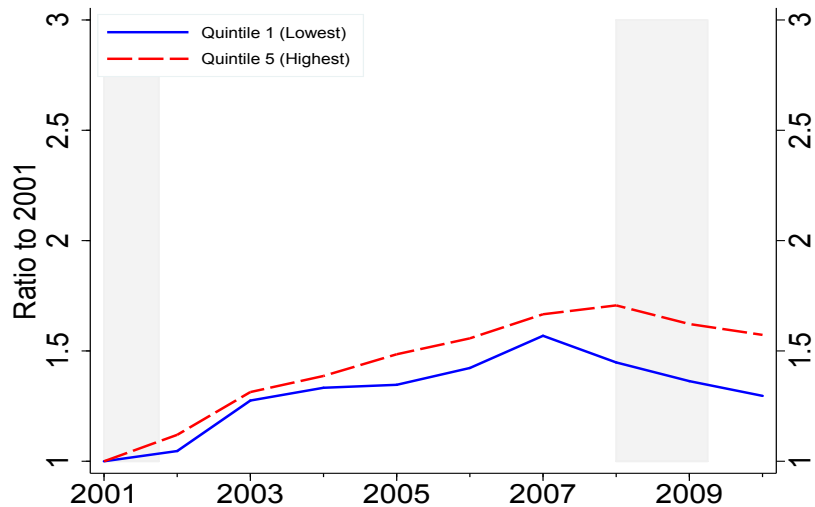
  Highest growth for young in 1999 with high income in 2009

- 45-54 yo in 1999 by their income quintile in 2009

Credit score



Total debt balances



Equifax Riskscore and total debt balances for 45-54 yo in 1999 by their 2009 Worknumber total annual labor income quantile. Difference with 2001 (credit score) and ratio to 2001 (balances). Source: Authors' calculations based on FRBNY CCP/Equifax Data.

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Credit and Income Over the Life Cycle

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- Older individuals in 1999 exhibit lower subsequent credit score and debt growth, still positively related to their income in 2009

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- Role of lifecycle in credit score and debt growth during the credit boom related to the **evolution of income**

  Consistent with PSID analysis on relation between income and borrowing

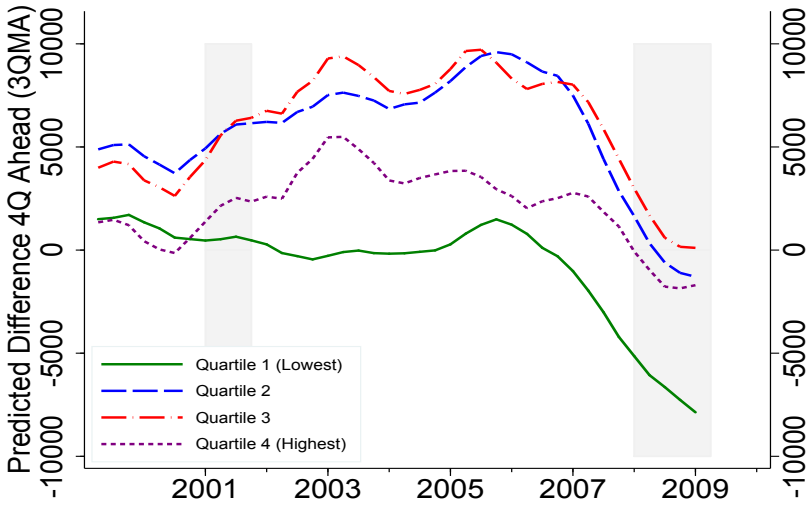
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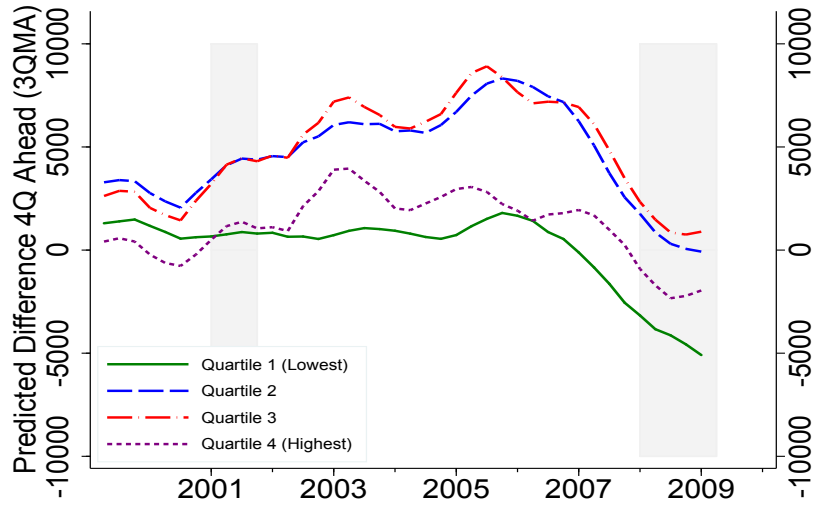
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- How does credit growth vary with credit scores at time of borrowing?
- Predicted 4Q ahead change in balances on 1Q lagged credit score
  No growth for subprime (quartile 1) **during boom**

Total debt balances



Mortgage balances

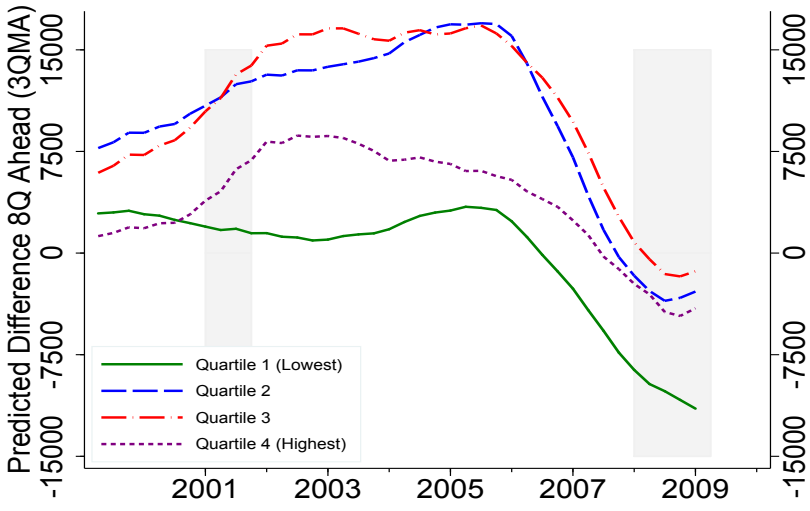


Predicted 4Q ahead change in total and mortgage balances by 1Q lagged Equifax Riskscore. Regressors include time effects, 1Q lagged credit score quartile effects, their interaction, age, age^2. Source: Authors' calculations based on FRBNY CCP/Equifax Data.

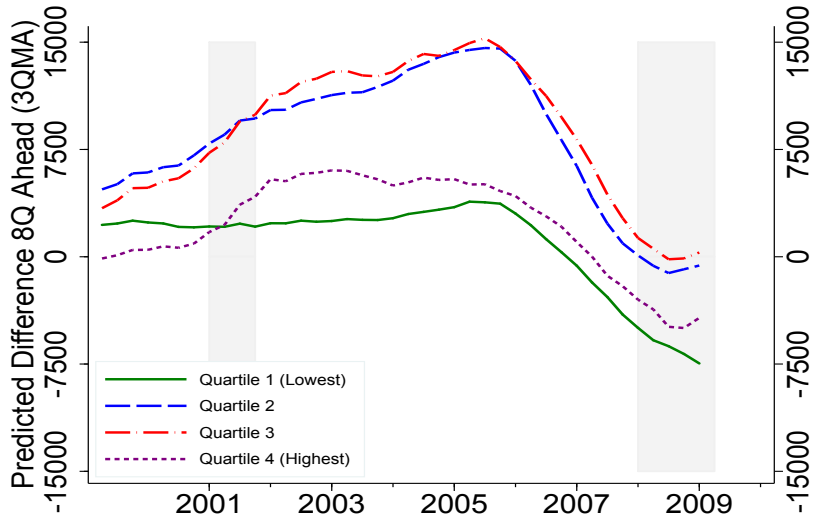
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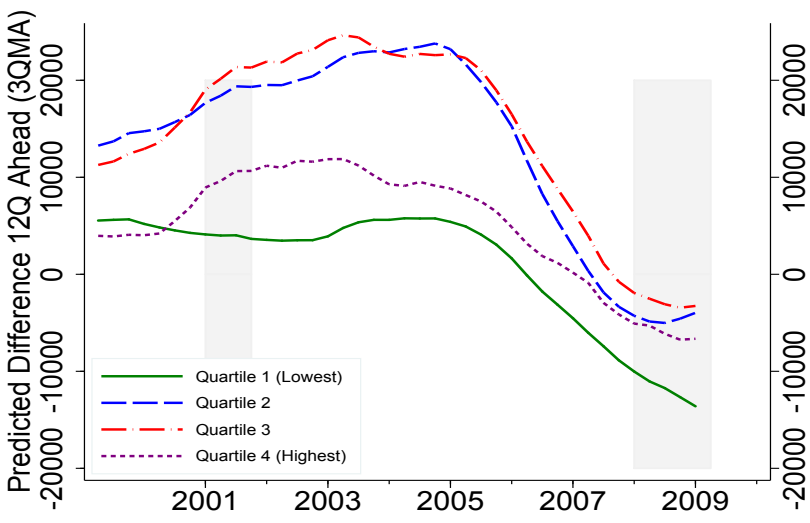


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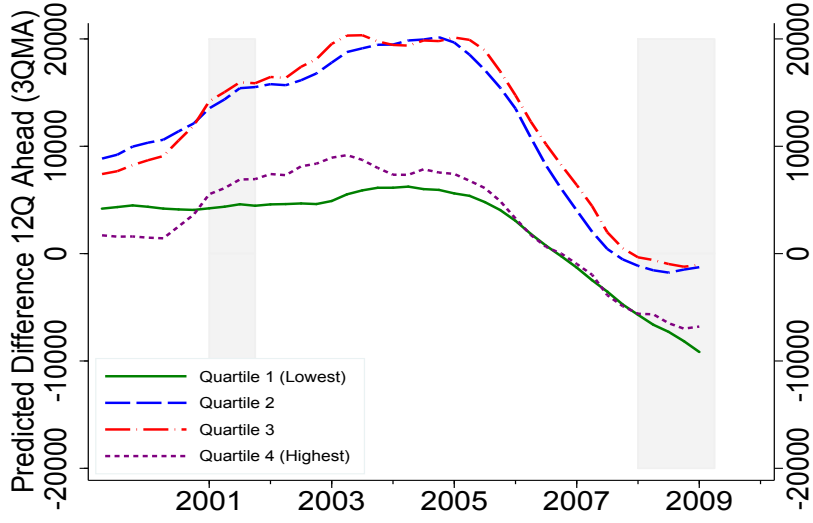
Credit Growth and Defaults by Credit Score

- How does credit growth vary with credit scores at time of borrowing?
- Predicted 12Q ahead change in balances on 1Q lagged credit score
  No growth for subprime (quartile 1) **during boom**

Total debt balances



Mortgage balances



Predicted 12Q ahead change in total and mortgage balances by 1Q lagged Equifax Riskscore. Regressors include time effects, 1Q lagged credit score quartile effects, their interaction, age, age^2. Source: Authors' calculations based on FRBNY CCP/Equifax Data.

Credit Growth and Defaults by Credit Score

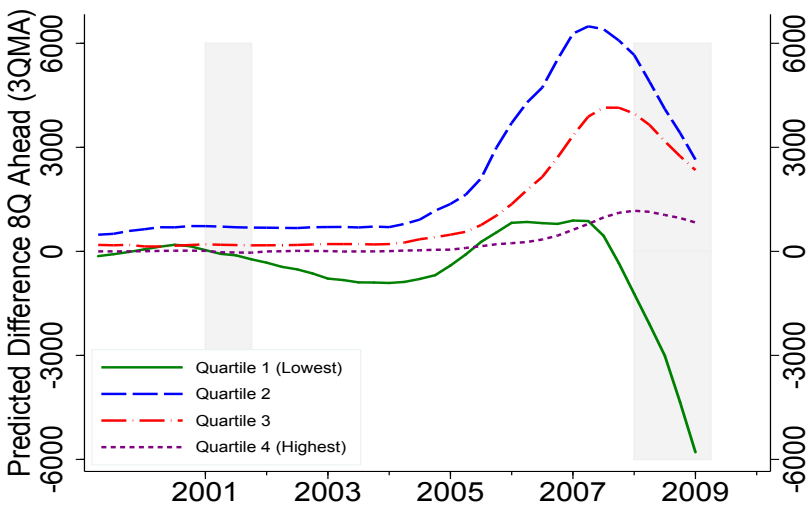
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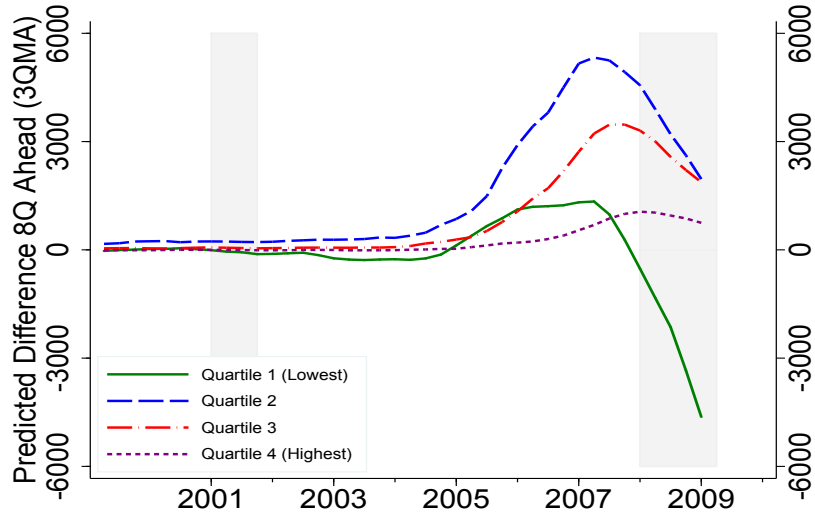
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- Predicted 8Q ahead change in delinquent balances by 1Q lagged credit score; similar for 4Q ahead

Total delinquent balances



Delinquent mortgage balances



Predicted 8Q ahead change in total and mortgage delinquent balances by 1Q lagged Equifax Riskscore. Regressors include time effects, 1Q lagged credit score quartile effects, their interaction, age, age^2. Source: Authors' calculations based on FRBNY CCP/Equifax Data.

New Evidence

- Higher credit scores associated with higher future credit growth **during boom** and defaults **during crisis**

  no growth in credit & defaults for first quartile (subprime)

  positive relation between recent credit scores and income, and credit score growth and income growth over the life cycle

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- Why did individuals with 'good credit' experience defaults during crisis?

  Large aggregate shock (decline in house prices, rise in unemployment)

  High leverage (rise in multiple first mortgages&non-conforming loans)

  Risky loans (ARM etc)

Broader Implications

- Consequences of growth in subprime lending:

  Defaults&foreclosures $\rightarrow$ Drop in house prices

  $\rightarrow$ Contraction in credit&consumption

  $\rightarrow$ Recession

- Causal link based on geographical evidence i.e. zip code, MSA, state

  (Mian&Sufi 2014, Mian, Rao & Sufi 2013, Kehoe, Midrigan & Pastorino 2014, Mian, Sufi & Trebbi 2014, Midrigan & Philippon 2016)

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- New findings challenge validity of geographical evidence

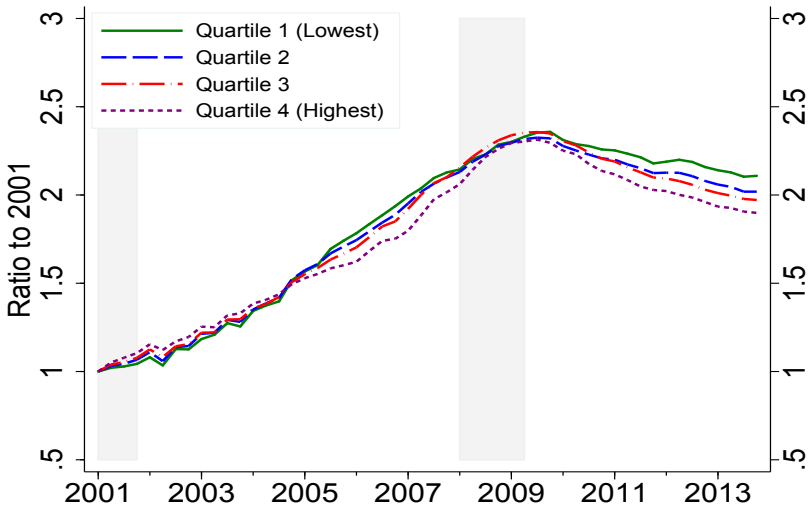
Geographical Variation: Zip Codes

- Credit growth by zip code, ranked by share of subprime individuals in 1999: credit score below 660 considered subprime (Mian & Sufi 2009)

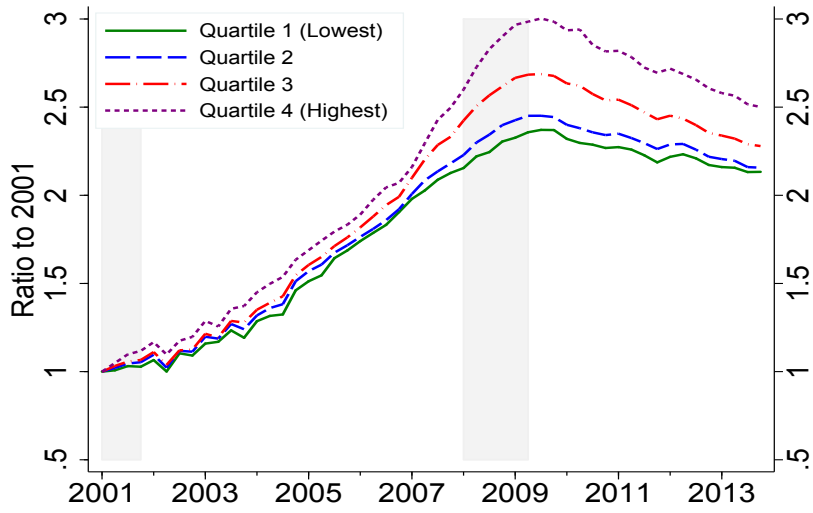
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- Mortgage credit grows more for zip codes with high share of subprime; no difference for total balances

Total Debt Balances



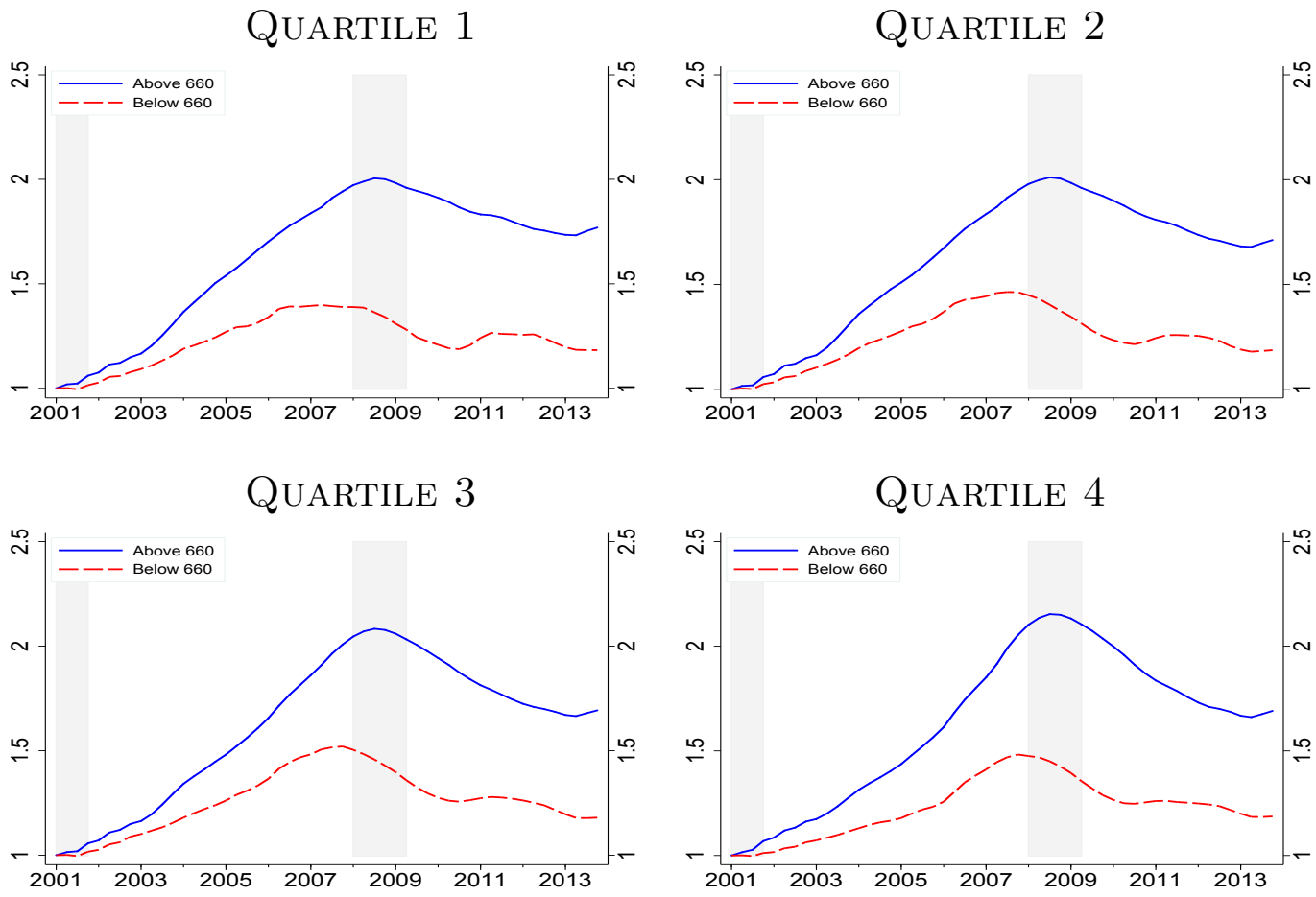
Mortgage Balances



Growth in total and mortgage balances by share of individuals with Equifax Riskscore below 660 in 1999. Source: Authors' calculations based on FRBNY CCP/Equifax Data.

Geographical Variation: Zip Codes

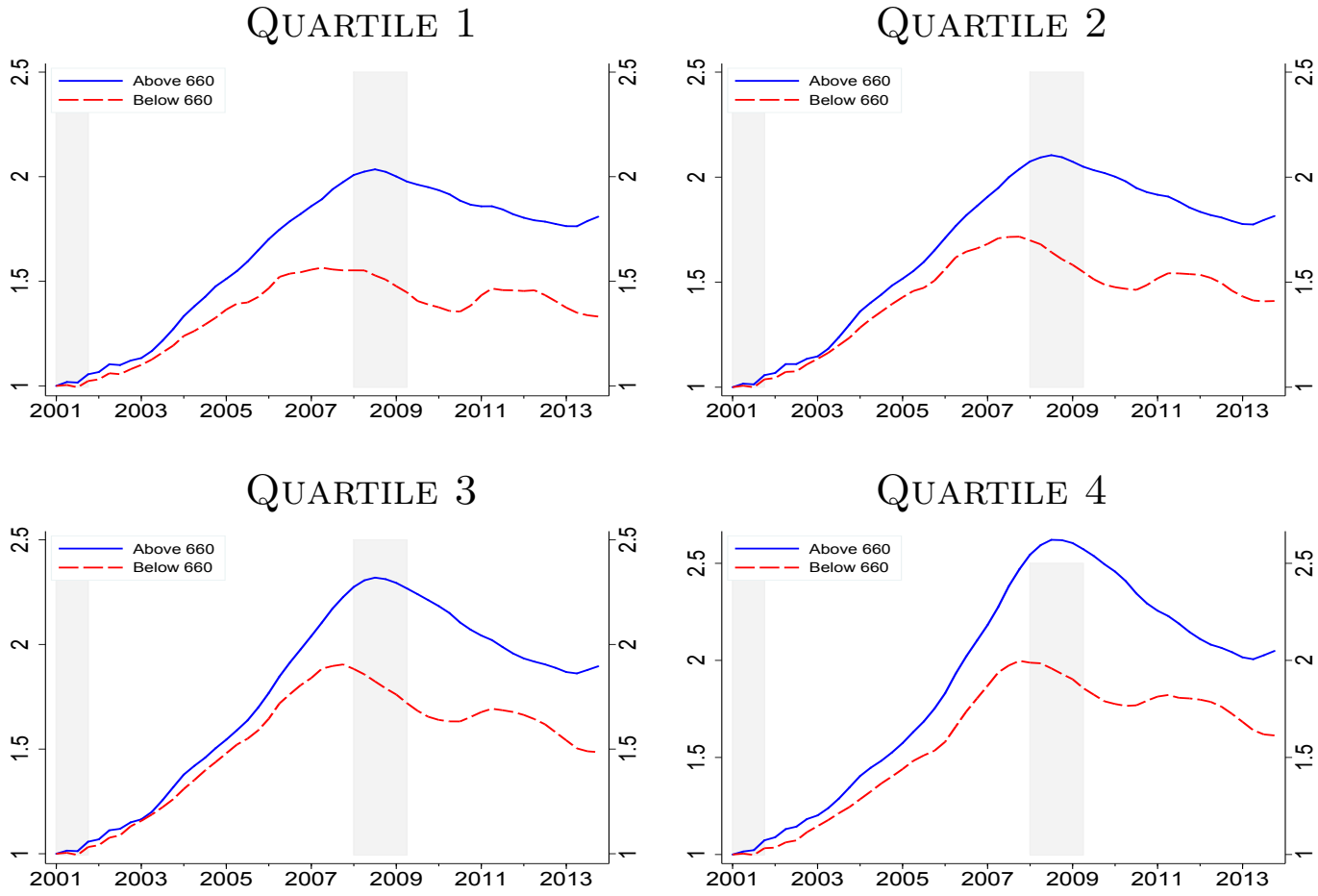
- Higher credit growth in **all** zip codes for prime individuals; total balances



Total debt growth for prime&subprime individuals by quartile of share of subprime in 1999. Based on 8Q lagged individual credit scores. Source: Authors' calculations based on FRBNY CCP/Equifax Data.

Geographical Variation: Zip Codes

- Higher credit growth in **all** zip codes for prime individuals; mortgage balances

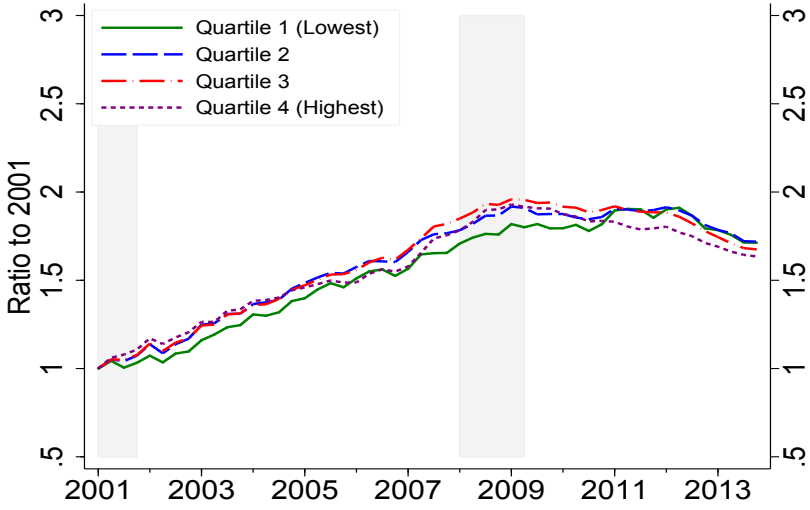


Mortgage debt growth for prime&subprime individuals by quartile of share of subprime in 1999. Based on 8Q lagged individual credit scores. Source: Authors' calculations based on FRBNY CCP/Equifax Data.

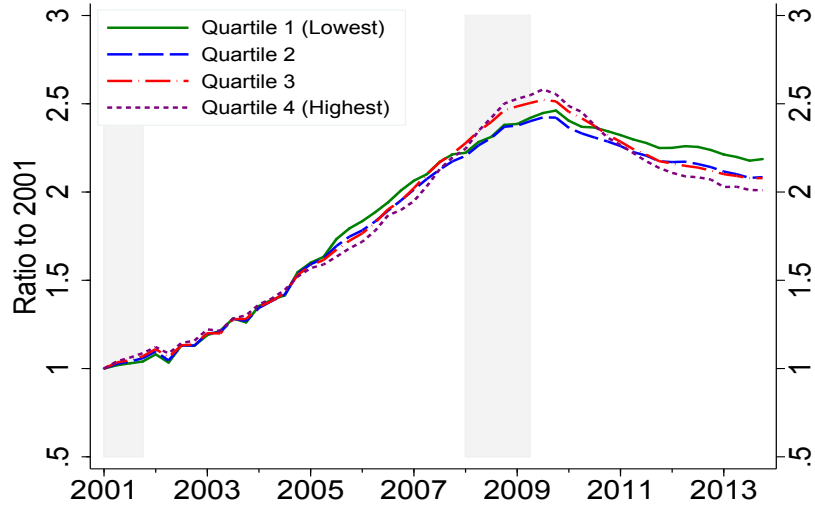
Geographical Variation: Zip Codes

- Counterfactual growth in total balances by share of subprime in 1999: for all individuals, growth set equal to subprime or prime
- Differences in credit growth across prime and subprime individuals, not across zip codes

All Subprime



All Prime

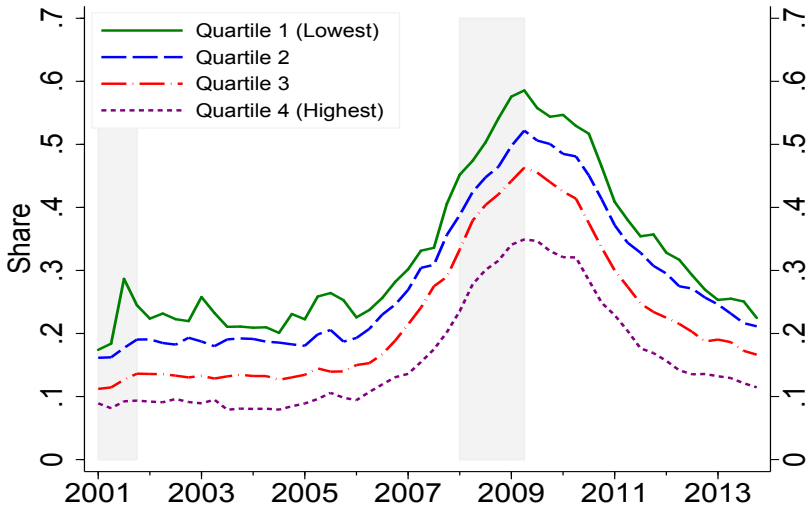


Counterfactual growth in total balances by quartile of subprime share in 1999. For all individuals, growth equated to that of subprime or prime individuals in each quartile. Source: Authors' calculations based on FRBNY CCP/Equifax Data.

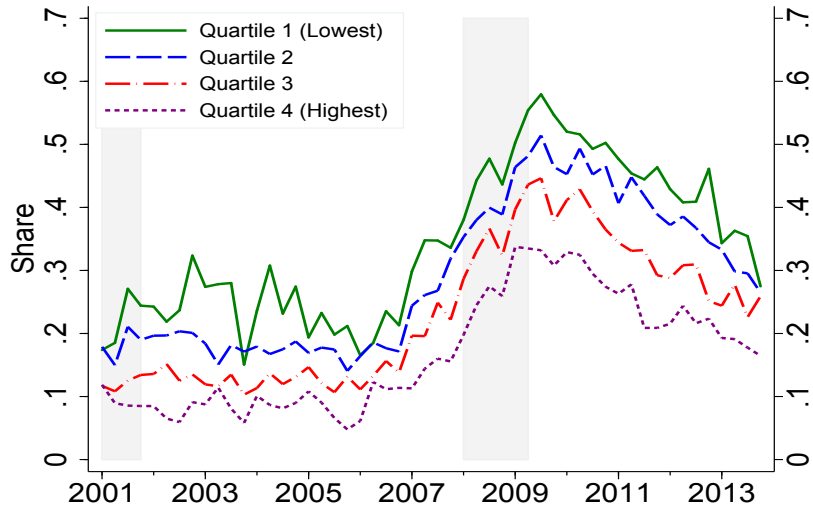
Geographical Variation: Zip Codes

- Prime individuals contribute more to growth in delinquent balances and foreclosures during crisis in **all** zip codes

Delinquent Balances



Foreclosures



Share of 90+ days delinquent balances and new foreclosures for prime individuals, based on 8Q lagged individual credit score. Quartiles of subprime share in 1999.
Source: Authors' calculations based on FRBNY CCP/Equifax Data.

Geographical Variation: Zip Codes

- Why did zip codes with high share of subprime individuals experience more severe Great Recession?

  Economically disadvantaged areas more sensitive to business cycles

  High inequality urban areas (strong HPI growth, low PDI growth)

Table: Economic Indicators

	Quartile 1	Quartile 2	Quartile 3	Quartile 4
Average PDI 2001-2007	\$38,627	\$27,800	\$20,069	\$14,809
Average UR 2001-2007	5.02%	5.15%	5.47%	5.93%
$\frac{\text{Average Income} \geq \$200K}{\text{Average Income}}$	5.5	7	8.6	10.7
HPI Growth 2001-2007	53%	63%	75%	74%
PDI Growth 2001-2007	27%	27%	21%	16%

Quartiles of subprime share in 1999. Equifax Riskscore below 660 is subprime.
Source: Authors' calculations based on FRBNY CCP/Equifax Data, IPUMS, IRS, BLS data.

Discussion and Ongoing Work

- Reassessment of role of subprime credit in the crisis
  - need to rethink driving factors
  - crucial for policy responses and prevention
- Why rise in defaults for individuals with good credit?
  - aggregate shocks, high leverage, risky loan contracts?
  - unrealistic house price and income growth expectations?
  - alternative default risk indicators?
- Ongoing work:
  - further analysis of geographical variation
  - reassessment of collateral channel