

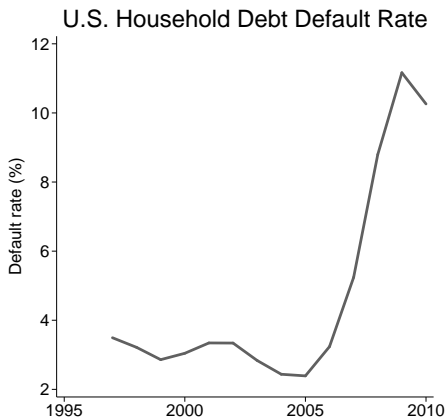
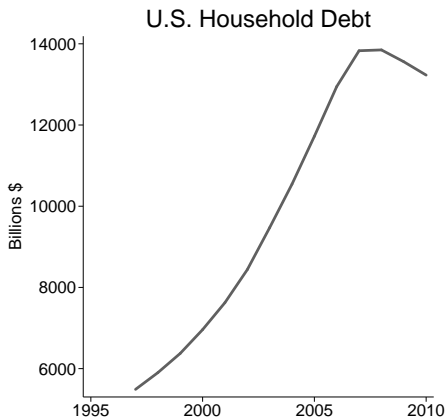
Household Debt and Defaults from 2000 to 2010: The Credit Supply View

Atif Mian
Princeton

Amir Sufi
Chicago Booth

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What are we trying to explain?



Credit supply view (Mian and Sufi (2014))

1. From 2002 to 2005, there was expansion in *supply* of mortgage credit for home purchase toward marginal households who did not see improvements in income, the *extensive margin*
 2. Expansion in supply of mortgage credit increased house prices
 3. Existing homeowners, even at higher points in income and credit score distribution, borrowed aggressively against rise in house prices; this borrowing explains rise in aggregate household debt, the *intensive margin*
 4. Sharp rise in delinquencies in 2007 driven by low credit score individuals living in housing boom zip codes
- ▶ Note: behavioral biases/flawed expectations are compatible with credit supply view, but financial sector role is crucial

Passive credit view

- ▶ Credit played only a *passive* role: it simply followed the housing bubble and had no independent effect
 - ▶ Foote, et al (2012): "... the facts suggest that the expansion occurred simply because people believed that house prices would keep going up—the defining characteristic of an asset bubble. Bubbles do not need securitization, government involvement, or nontraditional lending products to get started."
 - ▶ Adelino, et al (2016): "... these results provide a new picture of the mortgage expansion before 2007 and suggest that cross-sectional distortions in the allocation of credit were not a key driver of the run-up in mortgage markets and the subsequent default crisis. In contrast, our results point to an explanation where house prices increases and drops played a central role during the credit expansion and in the subsequent defaults."
- ▶ Note: in this view, no independent role of financial sector: it is innocent bystander caught up in bubble like everyone else

Why should you care?

1. Did the financial sector play an active role in the housing boom and bust? Should we care about finance at all?
Financial sector irrelevant in passive credit view
2. Theoretical research emerging where credit supply shocks play prominent role in macroeconomic fluctuations; this research lines up closely with the empirical evidence supporting the credit supply view
3. Regulation: Passive credit view holds that there is little regulation can do, and we have little understanding of default crises; credit supply view suggests macro-prudential regulation targeting household debt, more equity financing in the system

Preliminary note

- ▶ In everything we do below, we sort individuals or zip codes by their *ex ante* credit score; or their credit score prior to 2000 when credit boom started
- ▶ As we explain below, sorting individuals on their credit scores during boom leads to mistaken inference
- ▶ In particular, credit scores become endogenous, with the people most likely to default during bust seeing a rise in credit scores during the boom: credit scores after 2000 become an *outcome* variable, not a *sorting* variable

Outline

Credit supply expansion to marginal borrowers

Credit supply increased house prices

Home equity-based borrowing

Who drove the default crisis?

Sources of disagreement

Concluding Remarks

Expansion in quantity of subprime mortgage originations (Levitin and Wachter)

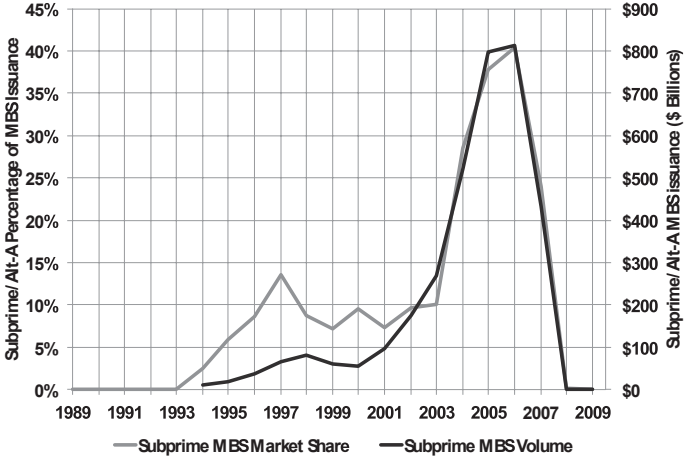
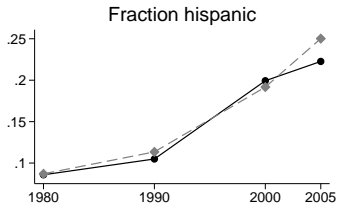
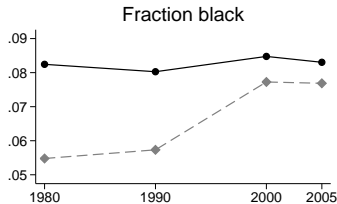
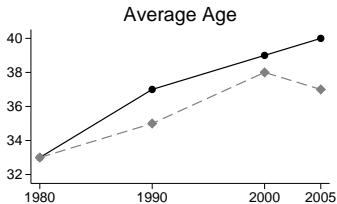
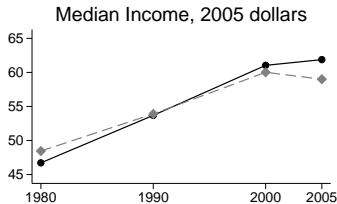


Figure 2. Annual Market Share and Volume of Subprime/Alt-A MBS Issuance⁵²

Simultaneous *decline* in subprime mortgage interest rates

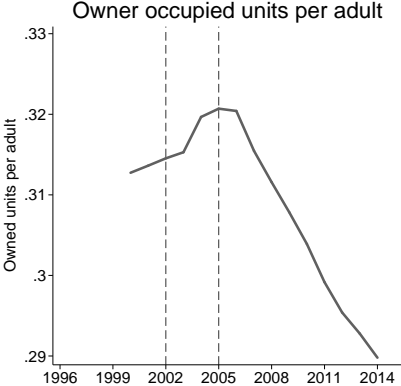
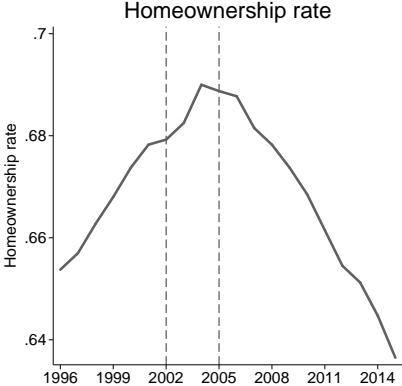
- ▶ Demyanyk and Van Hemert (2011): “The downward trend ... indicates that the subprime-prime spread, after adjusting for differences in observed loan and borrower characteristics, declined between 2001 and 2007 ... and the adjusted riskiness of loans rose. Therefore, on a per-unit-of-risk bases, the subprime-prime mortgage spread decreased more than the level of the spread.”
- ▶ See also Justiniano, Primiceri, and Tambalotti (2016), “The Mortgage Rate Conundrum,” who also show sharp decline in mortgage interest rates during 2002 to 2005 period
- ▶ Expansion in quantity of credit and decline in interest rate classic signal of outward shift in credit supply curve

Marginal buyers of homes younger, poorer (ACS)

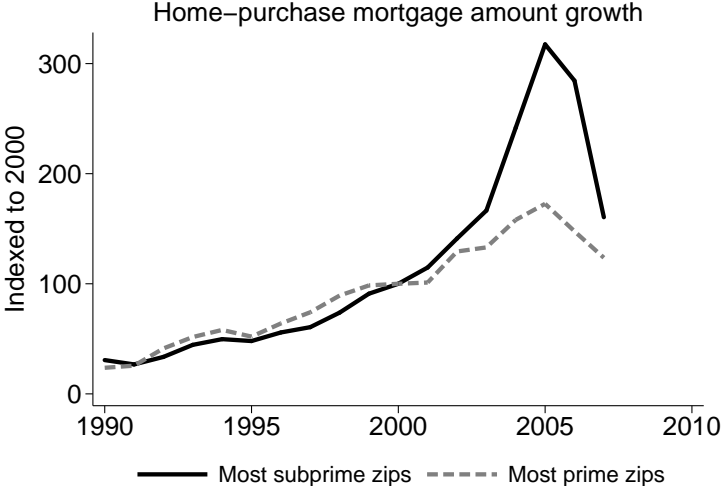


—●— All homeowners - -◆- - Recent homebuyers with mortgage

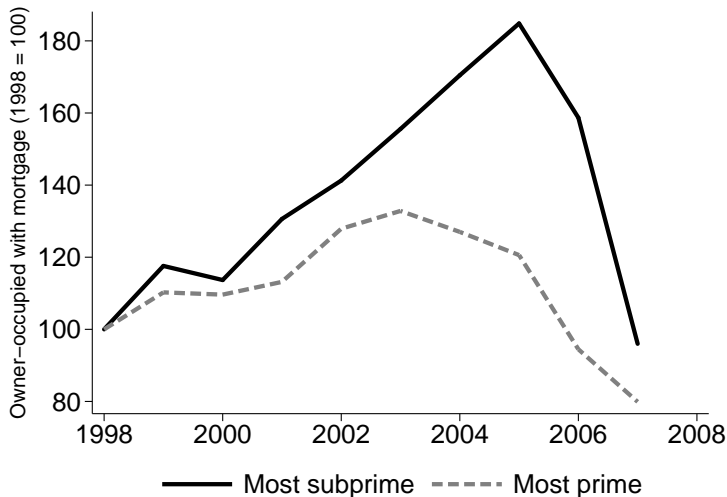
Homeownership rate increased



Increase in purchase originations in marginal zip codes



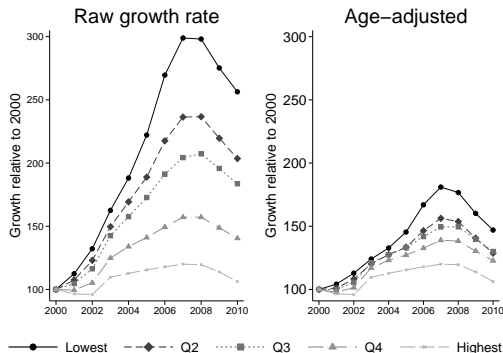
Same result using DataQuick data for owner-occupied transactions with mortgage



Increase in mortgages in marginal zips not driven by investors (from DataQuick)

	Δ Investor share 2002 to 2005, street		Δ Investor share 2002 to 2005, zip code	
	(1)	(2)	(3)	(4)
Fraction subprime borrowers, 1996	-0.078* (0.030)	-0.052** (0.017)	-0.018 (0.027)	-0.012 (0.015)
Constant	0.042** (0.010)	0.034** (0.006)	0.025** (0.009)	0.023** (0.005)
County FE?	No	Yes	No	Yes
Observations	1923	1923	1925	1925
R ²	0.003	0.778	0.000	0.779

Stronger debt growth of low credit score individuals shows up in individual level data, not driven by age differences



- ▶ This is individual-level data and right panel fully controls for age differences: it compares two individuals same age but different 1997 credit score bins – controlling for age, low credit score individual sees stronger credit growth

Other research supporting outward shift in credit supply

- ▶ Mayer, Pence, and Sherlund (2011): “lending to risky borrowers grew rapidly in the 2000s; underwriting deteriorated along several dimensions”
- ▶ Levitin and Wachter (2012): “the bubble was caused by excessive supply of housing finance”
- ▶ Demyanyk and Van Hemert (2011): “a classic lending boom-bust scenario, in which unsustainable growth leads to a collapse of the market”
- ▶ Justiniano, Primiceri, Tambalotti (2015): Confirms Mian and Sufi (2009) findings using FRBNY consumer credit panel, argues results most consistent with credit supply shift
- ▶ Anenberg, Hizmo, Kung, and Malloy (2016): “striking” increase in credit supply from 2001 to 2005 using a frontier estimation approach

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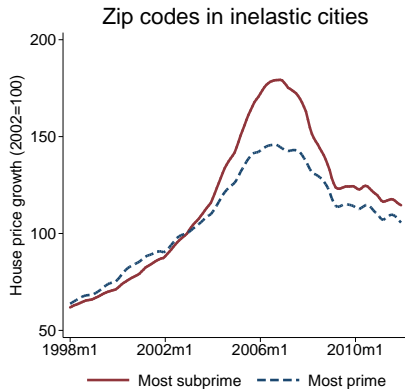
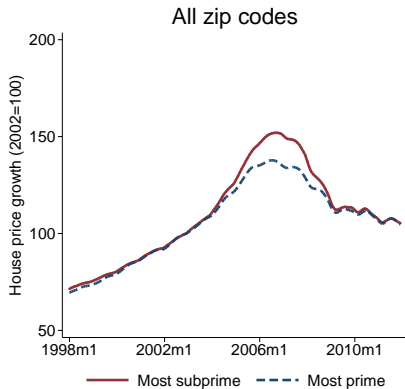
Sources of disagreement

Concluding Remarks

Reviewing evidence from Mian and Sufi (2009)

- ▶ House prices grew most in marginal zip codes in inelastic housing supply cities, despite declining relative and absolute income in these neighborhoods
- ▶ To break chicken and egg problem, we focused on very elastic housing supply cities where there was no house price growth – even there, we see expansion in credit supply to marginal zip codes
- ▶ As far as we know, neither of these results has been challenged
- ▶ Why should more marginal zip codes see higher house price growth in pure bubble story where credit plays passive role?
- ▶ Our explanation is simple: credit pushed up house prices in low credit score zip codes

House prices grew more in marginal zip codes



A robust fact: expansion of credit pushed up house prices

- ▶ Tons of evidence that credit supply increased house prices
 - ▶ DiMaggio and Kermani (2015)
 - ▶ Landvoigt, Piazzesi, and Schneider (2015)
 - ▶ Favara and Imbs (2015)
 - ▶ Adelino, Schoar, and Severino (2014)
 - ▶ Anenberg, Hizmo, Kung, and Malloy (2016)
- ▶ This is not to say that credit is the only explanation: see research on importance of investors in fueling house price growth by Chinco and Mayer (2012), Nathanson and Zwick (2015), and Gao, Sockin, and Xiong (2016)
- ▶ But argument that house price growth was independent of credit supply expansion is soundly rejected in the data

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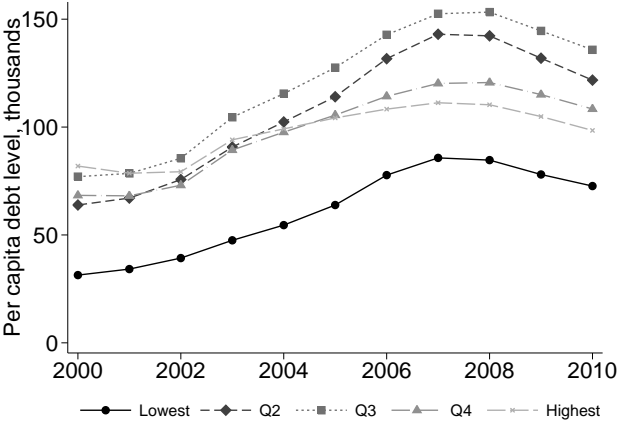
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Home-equity based borrowing: the rise in debt levels



Home-equity based borrowing present in all but top quintile of credit score distribution

Credit Score Quintile	Share of population, 1999 (%)				
	lt 40%	House Price Growth Category			gt 130%
		40-75%	75-105%	105-130%	
1	3.7	3.2	3.7	3.7	5.4
2	3.8	3.8	4.0	3.6	4.8
3	3.9	4.2	4.1	3.5	4.1
4	4.0	4.8	4.4	3.5	3.5
5	3.7	5.1	4.5	3.7	3.4

Credit Score Quintile	Debt level, 2000 (thousands)				
	lt 40%	House Price Growth Category			gt 130%
		40-75%	75-105%	105-130%	
1	32.3	34.0	32.4	33.9	28.9
2	63.6	69.0	65.4	68.8	59.5
3	75.4	84.2	76.8	82.1	73.8
4	65.2	78.0	66.3	68.7	64.0
5	76.0	90.1	77.1	84.0	76.3

Credit Score Quintile	Share of Debt Increase, 2000 to 2007 (%)				
	lt 40%	House Price Growth Category			gt 130%
		40-75%	75-105%	105-130%	
1	2.2	3.2	3.6	4.1	5.6
2	3.3	5.7	5.9	5.7	6.9
3	3.7	6.2	5.4	5.1	5.6
4	2.8	4.5	3.8	3.3	3.4
5	1.6	3.0	1.9	1.9	1.7

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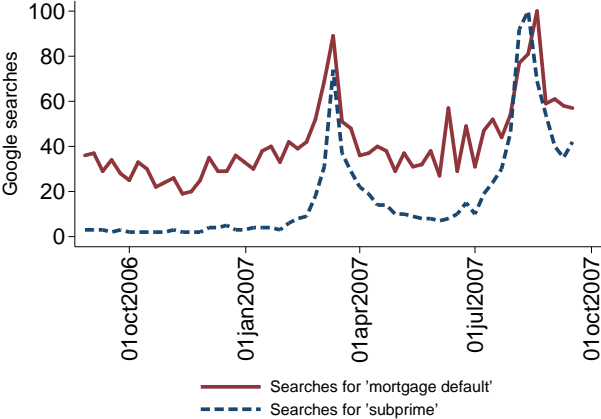
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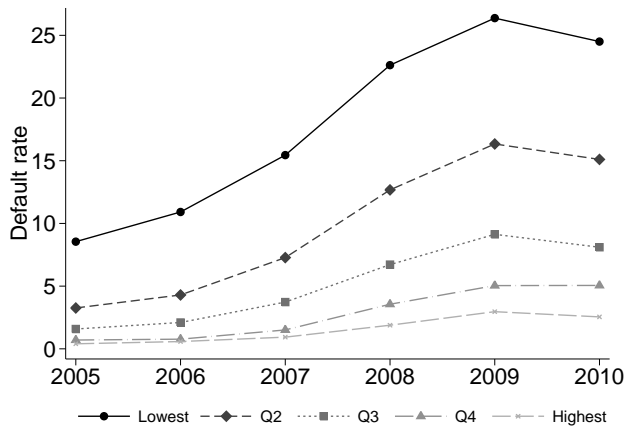
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Initial default shock in 2007 clearly related to subprime

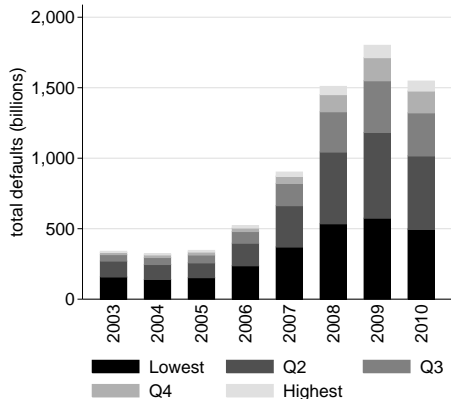


Default rates much higher for low credit score individuals

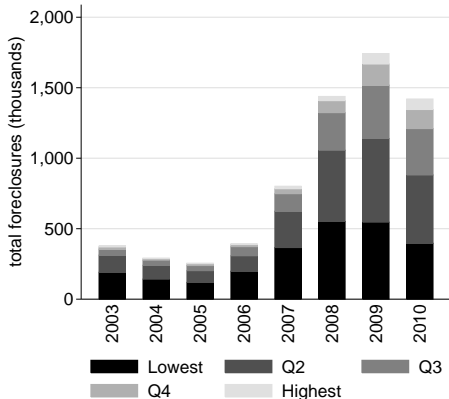


Amount in default driven by low credit score individuals

Total defaults



Total foreclosures



Low credit score individuals in housing boom zips drove defaults

Credit Score Quintile	Share of delinquent debt, 2007 (%)				
	House Price Growth Category				
	lt 40%	40-75%	75-105%	105-130%	gt 130%
1	5.6	6.8	7.6	7.9	12.8
2	4.5	5.8	6.7	6.6	9.7
3	2.3	3.5	3.3	3.8	4.6
4	1.0	1.4	0.9	1.1	1.2
5	0.4	0.9	0.5	0.3	0.8

- ▶ Top right 4 cells make up 17% of individuals, 37% of defaults

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Why different results?

1. Confusion over extensive versus intensive margin: credit supply view *does not* imply that poor or lowest credit score individuals accounted for most of the aggregate rise in debt – home equity-based borrowing was broad
2. Flawed data analysis
 - ▶ Use of fraudulently overstated income on mortgage applications as true income by Adelino, et al (2016) makes it appear that low income buyers had growing income (see Mian and Sufi (2016))
 - ▶ Incorrect calculation of average mortgage size in Adelino, et al (2016) because of second liens
3. We always sort on *ex ante* credit scores – credit scores during the boom become endogenous in a way that makes it appear credit expanding to higher credit score individuals
4. On defaults, others look at how share of defaults evolves over time, whereas we always look at total defaults during crisis

Incorrect mortgage size result in Adelino, et al (2016)

- ▶ Adelino, et al (2016) argue that average mortgage size for home purchase conditional on origination *declined* in low income growth neighborhoods from 2002 to 2005
- ▶ This result is incorrect, because they treat first and second liens as *independent* mortgages, instead of combining them as would be appropriate when assessing total mortgage size
- ▶ Second liens are smaller than first liens, and they increased disproportionately in low income growth neighborhoods from 2002 to 2005, thereby generating artificial decline in average mortgage size in low income growth neighborhoods
- ▶ Properly combining first and second liens yields the opposite result: even average size of mortgage conditional on origination increased in low credit score, low income growth zip codes from 2002 to 2005 (which is even stronger than claim in MS09)

Mortgage size result, properly accounting for second liens

	Amount for home purchase growth 2004-2005	Growth in mortgage size treating second liens as independent 2004-2005	Change in second lien fraction 2004-2005	Growth in average first lien mortgage size 2004-2005	Growth in total mortgage size per housing unit 2004-2005
	(1)	(2)	(3)	(4)	(5)
Fraction subprime borrowers, 1996	0.435** (0.043)	-0.108** (0.017)	0.101** (0.006)	-0.016 (0.017)	0.038* (0.017)
R^2	0.404	0.464	0.449	0.414	0.423
Observations	3014	3014	3014	3014	3014

	Amount for home purchase growth 2004-2005	Growth in mortgage size treating second liens as independent 2004-2005	Change in second lien fraction 2004-2005	Growth in average first lien mortgage size 2004-2005	Growth in total mortgage size per housing unit 2004-2005
	(1)	(2)	(3)	(4)	(5)
IRS income growth 2004-2005	-0.383** (0.077)	0.098** (0.031)	-0.126** (0.011)	0.002 (0.030)	-0.056+ (0.030)
R^2	0.387	0.459	0.419	0.414	0.422
Observations	3014	3014	3014	3014	3014

Sorting on credit scores during boom is problematic

- ▶ Credit scores become endogenous during credit boom
- ▶ In particular, low credit score individuals living in high house price growth areas see an increase in credit scores because they are able to “borrow” their way out of negative shocks using home equity
- ▶ In reality, they are *not improving* on any fundamental dimension such as income (as shown in our previous work) – the housing boom masks their true credit quality
- ▶ Consistent with this argument, the rise in credit scores during the boom is *positively* related to defaults in the bust
- ▶ Dynamically sorting on scores during the boom will (a) understate growth of credit for truly low credit score individuals, and (b) overstate defaults among truly high credit score individuals during bust

Rise in credit score during boom predicts default in bust

	(1) Default in 2008	(2) Default in 2008	(3) Default in 2009	(4) Default in 2010	(5) Default in 2010
Credit score, 2006	-12.527** (0.061)	-13.423** (0.068)	-12.731** (0.069)	-12.153** (0.068)	-12.424** (0.070)
Δ Credit Score, 1998 to 2006		2.318** (0.079)	3.655** (0.084)	3.981** (0.083)	
Δ Credit score, 1998 to 2000					2.279** (0.116)
Δ Credit score, 2000 to 2002					3.653** (0.126)
Δ Credit score, 2002 to 2004					4.775** (0.127)
Δ Credit score, 2004 to 2006					5.717** (0.126)
Constant	114.384** (0.534)	120.476** (0.576)	114.819** (0.580)	109.569** (0.577)	111.899** (0.591)
Observations	245308	244299	244299	244299	240502
R ²	0.213	0.216	0.176	0.161	0.165

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Conclusion

- ▶ Kindleberger: “asset price bubbles depend on the growth in credit”; We have models linking leverage with asset prices (Geanakoplos (2010), Allen and Gale (2000), Simsek (2013))
- ▶ The evidence is inconsistent with the view that credit expansion played no independent role in the mortgage debt boom and subsequent default crisis
- ▶ The debate is impassioned because passive credit view absolves the financial sector of any blame for household debt crisis in Great Recession – we find this unacceptable
- ▶ Where do we need more research? What is source of credit supply shocks? How do behavioral biases interact with leverage? How does leverage affect expectations formation?