

Securitization, Screening and Default Models: Evidence from Subprime Loans

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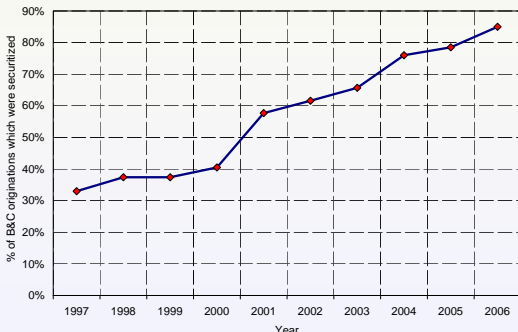
November 4, 2008

The Initiative on Global Markets Credit Crisis Lecture

Background

Securitization...

- ▶ Explosive growth in the last decade or so
 - Involves converting illiquid assets to liquid securities
 - Changes model of financial intermediaries from “risk warehousing” to “originating and distributing”



Background

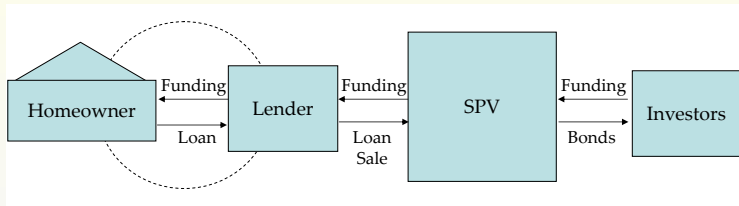
Securitization...

- ▶ Before the crisis: several cited benefits
 - Banks withstand negative shocks better
 - Improved risk sharing lowers cost of capital
- ▶ During the crisis: “Securitization contributed to bad lending” ...Stiglitz [2007]
 - Banks must be given incentives to screen and monitor
 - Illiquidity of loans provides incentives: Diamond and Rajan [2003]
 - Making loans more liquid can reduce incentives
- Proponents argue reputation concerns, regulatory oversight and keeping ‘some’ risk on balance sheet prevented moral hazard

A Simple Empirical Question...

- ▶ Did securitization lead to lax screening by lenders?
 - How large are these effects?
 - Does it affect all assets?

The Process



- ▶ What is lax screening?
- ▶ Relate screening by a lender to securitization
 - Examine quality of loans originated after purging any hard information

Making Causal Inferences Is Difficult

Main Complications

- ▶ Endogeneity of securitization makes causal claims difficult
 - Loans sold may differ systematically on observable risk characteristics from loans kept on balance sheet
- ▶ Conditional on securitization, wide variation possible in loan contracts
 - Necessary to isolate differences in loan outcomes independent of these contract characteristics
- ▶ Inferences based on time-series may be insufficient
 - Macroeconomic factors and policy initiatives may induce compositional differences in mortgage borrowers

Making Causal Inferences Is Difficult

Main Complications

- ▶ Endogeneity of securitization makes causal claims difficult
 - Use adhoc threshold in lending market to generate exogenous variation in securitization likelihood of a loan as compared to another loan with similar risk characteristics

Adhoc Threshold

Background On Credit Scores (FICO)

- ▶ FICO score (350-800) reflects the credit quality of the borrowers
 - A scaled probability score with a higher FICO \Rightarrow borrower with better credit quality
 - Fair Isaac: “FICO gives ranking of potential borrowers by the probability of having some negative credit event in the next two years”
 - Generated via software licensed by Fair Isaac to three independent repositories (TransUnion, Experian, and Equifax)
- ▶ Most reliable measure used by the lender, rating agencies and investors: Gramlich [2007]
 - High predictability even for low income borrowers
 - Median score used by lenders
 - Tend to be sticky (anywhere from 3-6 months to move)

Adhoc Threshold

Threshold of 620 FICO

- ▶ Threshold in mid 1990s by Fannie Mae and Freddie Mac in their guidelines on what loans would be purchased by them
 - Fair Isaac: "... those agencies [Fannie Mae and Freddie Mac], have indicated to lenders that **any consumer with a FICO score above 620 is good...**"
 - Guidelines by Freddie Mac: "... a score below 620 is a strong indication that the borrower's credit reputation is not acceptable..."
- ▶ Confirmed in several papers/ agency lending guidelines/ rating agency guidelines/ articles/ origination matrices of lenders/ anecdotes
- ▶ Since early 2000s, loans around FICO threshold of 620 are predominantly non-agency

Empirical Design

Using adhoc cutoff as a measure of ease of securitization

- ▶ How does the lender screen on either side of the threshold?
 - Make inferences by comparing performance of loans to borrowers with scores of 619 (620-) vs. 621 (620+)
 - Unconditional probability of securitization higher at 621:
$$\left\{ \frac{N_s}{N_p} \right\}_{620+} > \left\{ \frac{N_s}{N_p} \right\}_{620-}$$
 - Assumption: Underlying demand for mortgage loans at a given price same for potential 620⁻ or 620⁺ borrowers
 - $\{N_p\}_{620+} \approx \{N_p\}_{620-}$

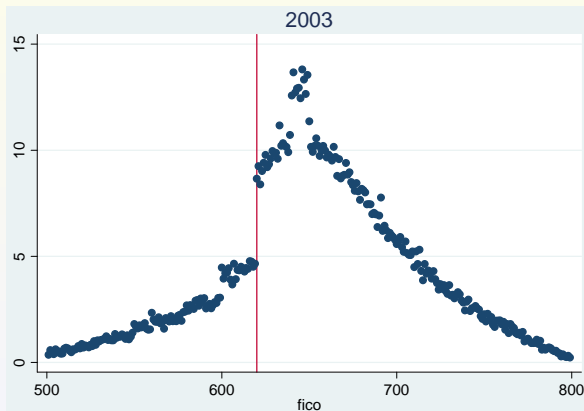
Empirical Design

Main Complications

- ▶ Endogeneity of securitization makes causal claims difficult
 - Use adhoc threshold in lending market to generate exogenous variation in securitization likelihood of a loan as compared to another loan with similar risk characteristics
- ▶ Conditional on securitization, wide variation possible in loan contracts
 - Use detailed data on subprime loans contracts to control for various loan characteristics
- ▶ Inferences based on time-series may be insufficient
 - Estimation relies on cross-sectional differences

Adhoc Rule in Lending

Number of Loans (in'00) at each FICO score: Low Documentation

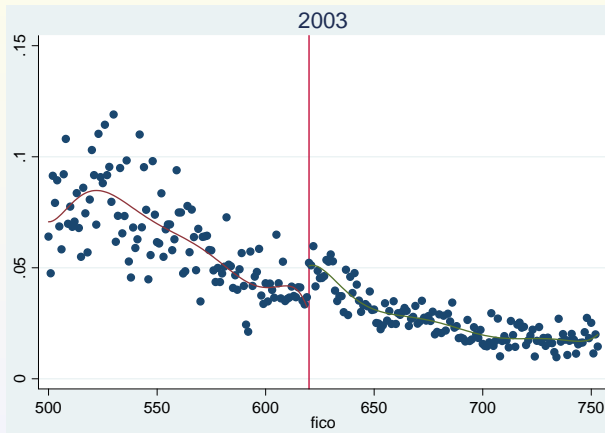


► Large jump in number of loans at 620

- $\left\{ \frac{N_p}{N_p} \right\}_{620+} > \left\{ \frac{N_p}{N_p} \right\}_{620-}$

Delinquencies of Loans

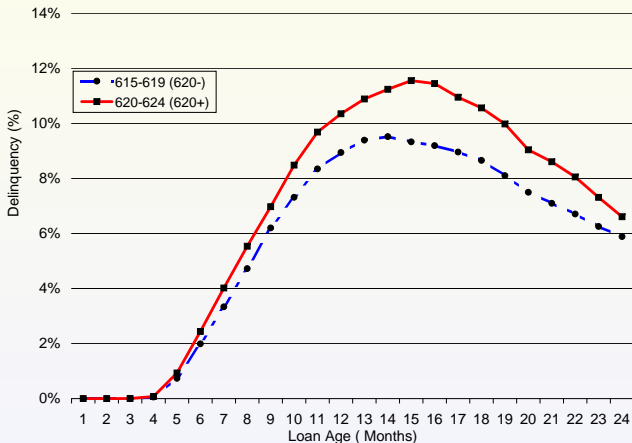
Delinquencies: Low Documentation



- ▶ Default rates jump around the 620 threshold

Performance of Loans Around Thresholds

60+ Delinquency: Low Documentation



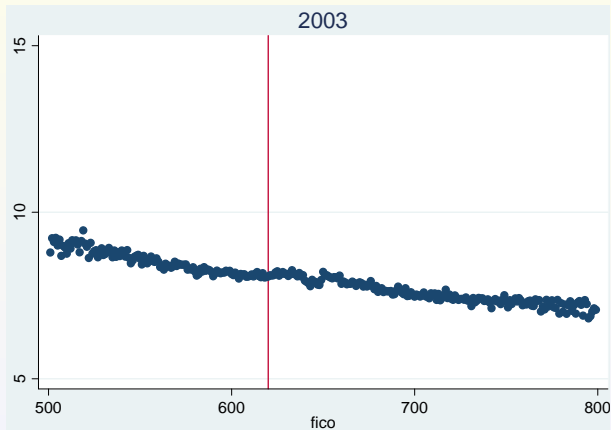
▶ Loans at 620⁺ default more relative to loans at 620⁻

Alternative Explanations

- ▶ Contract terms different?
 - Attract safer borrowers below 620?

Loan Characteristics Around Thresholds

Interest Rates: Low Documentation



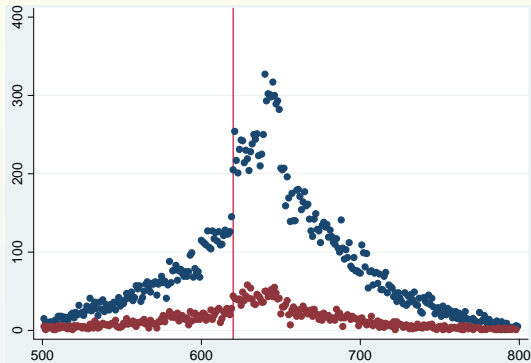
- ▶ No jump in interest rates at 620.

Alternative Explanations

- ▶ Rule of thumb unrelated to securitization?

A Natural Experiment

Number of Loans: Low Documentation



- ▶ Predatory laws passed in Georgia and New Jersey (Oct 2002)
- ▶ Subsequently reversed Georgia (April 2003) and New Jersey (May 2004)

How Large Are These Effects?

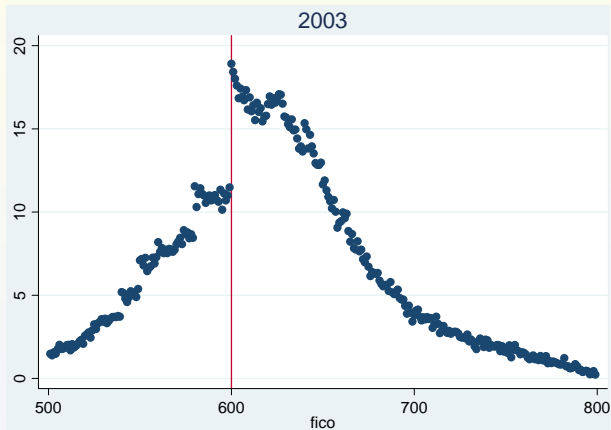
- ▶ Large magnitudes relative to mean default rates
 - Around 20% more defaults for 1 point FICO increase

All Assets?

- ▶ More severe in assets with soft information
 - Effects attenuate with more hard information (for full doc loans)

Another Adhoc Rule

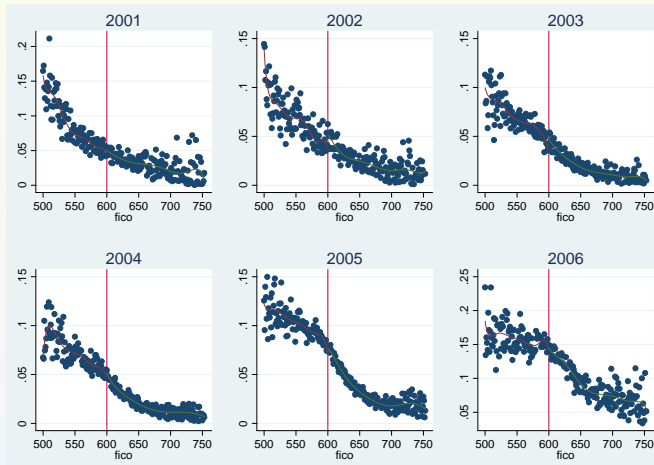
Number of Loans at each FICO score: Full Documentation



- ▶ Large jump in number of loans at 600

Delinquencies of Loans

Delinquencies: Full Documentation



Securitization and Screening: Two Broad Implications

- ▶ Implications in general for defaults models and regulation through models
 - Are default models invariant to strategic behavior of participants?
- ▶ Implications on what works in the securitization market
 - Should we regulate more?

Background

Statistical Default Models...

- ▶ Variants of statistical default models used widely
 - To price complex securities: standardization helps create liquid market
 - For regulating capital: integral part of Basel II
- ▶ Central element in these models is estimation of defaults on the underlying collateral (e.g., Standard & Poor's LEVELS[®] 6.1 Model for MBS)
 - Two essential ingredients
 - Calibrate relationship of default likelihood
 - Use large historical data

Background

Performance of Default Models Recently Questioned...

- ▶ Value of subprime loans backed MBSs fell rapidly during the subprime crisis
 - ABX index fell by about 45% over the course of eight months starting in July 2007: Greenlaw, et al. [2008]
 - Genuine surprise among practitioners, regulators and investors
 - “ The foreclosure frequency increased by 350 % [relative to their model]...”
- ▶ Why did the default models fare so poorly?
 - Popular answer: House prices fell and this was not modeled
 - Perhaps...but what about incentive effects?

What Has Securitization Done?

Performance of Default Models...

- ▶ Securitization creates an incentive problem with respect to collecting soft information
 - Price investors offer for a loan (or pool of loans) must depend only on the associated hard information
 - Soft information cannot be verified and perforce uncontractible
 - Moral hazard problem for the lender
 - Lender has incentive to pool borrowers: loans to all borrowers who generate the same hard information signal, though soft information might have improved screening
 - Among borrowers with similar hard information characteristics, the set that receives loans worsens in a fundamental way

What Has Securitization Done?

Performance of Default Models...

- ▶ Statistical Models relied entirely on hard information variables
 - Possible failure to account for change in relationship between observable borrower characteristics and default likelihood caused by a fundamental change in lender behavior: Lucas Critique
 - Defaults systematically increase in set of borrowers for whom soft information is valuable

Do We See More Reliance on Hard Information?

$$r_i = \alpha + \beta_{FICO} \times FICO_i + \beta_{LTV} \times LTV_i + \epsilon_i. \quad (1)$$

	β_{FICO}	β_{LTV}	R ² (in %)	Observations
1997	-0.004*** (.0002)	0.030*** (.0013)	3	24067
1998	-0.007*** (.0001)	0.035*** (.0008)	7	60094
1999	-0.007*** (.0001)	0.020*** (.0005)	8	104847
2000	-0.010*** (.0001)	0.035*** (.0004)	14	116778
2001	-0.012*** (.0001)	0.038*** (.0004)	20	136483
2002	-0.011*** (.0001)	0.071*** (.0001)	18	162501
2003	-0.012*** (.0001)	0.079*** (.0001)	32	318866
2004	-0.010*** (.0001)	0.097*** (.0001)	40	610753
2005	-0.009*** (.0001)	0.110*** (.0001)	48	793725
2006	-0.011*** (.0001)	0.115*** (.0001)	50	614820

Underperformance of Default Models

- ▶ For 1997–2001 (low securitization regime), estimate

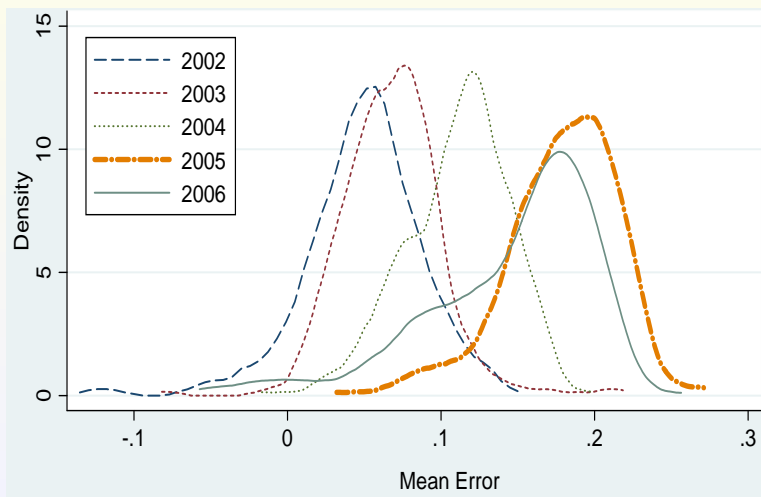
$$Pr(\text{Default}=1) = \Phi \left(\begin{array}{l} \alpha + \beta_{FICO} \times FICO + \beta_{LTV} \times LTV + \\ \beta_r \times r + \beta_{ARM} \times ARM + \\ \beta_{Pre} \times Prepenalty + \gamma^s, \end{array} \right)$$

- Default = 1 if loan defaults within 24 months of origination, zero otherwise.
- ▶ For each year 2002–2006, compute a predicted default probability:

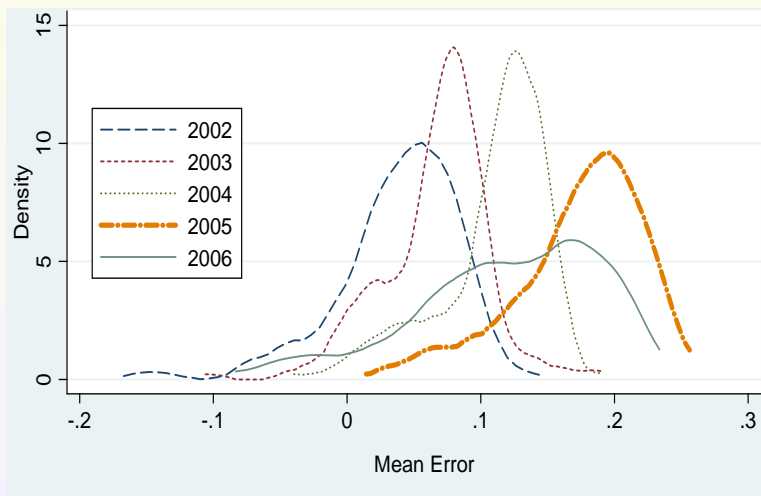
$$Pr(\widehat{\text{Default}}_{i,t+k} = 1) = \Phi(\widehat{\alpha}_{t-n,t} + \widehat{\beta}_{t-n,t} \cdot X_{i,t+k} + \widehat{\gamma}_{t-n,t}^s)$$

	FICO	I	LTV	State F.E	Pseudo R^2	Observations
1997-2001	-0.00702*** (0.0002)	0.19367*** (.01137)	0.14071*** (0.01553)	Yes	9.97%	100873

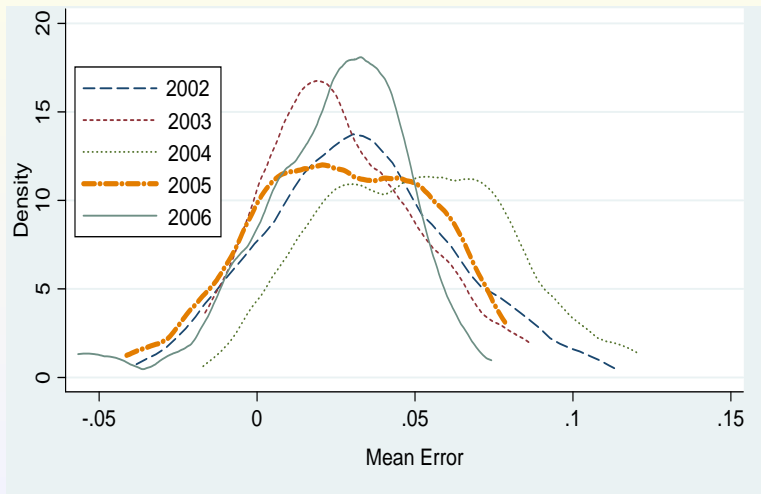
Kernel Density of Mean Prediction Errors, Low Doc Loans



Mean Prediction Errors, Low Doc Loans, Low FICO scores



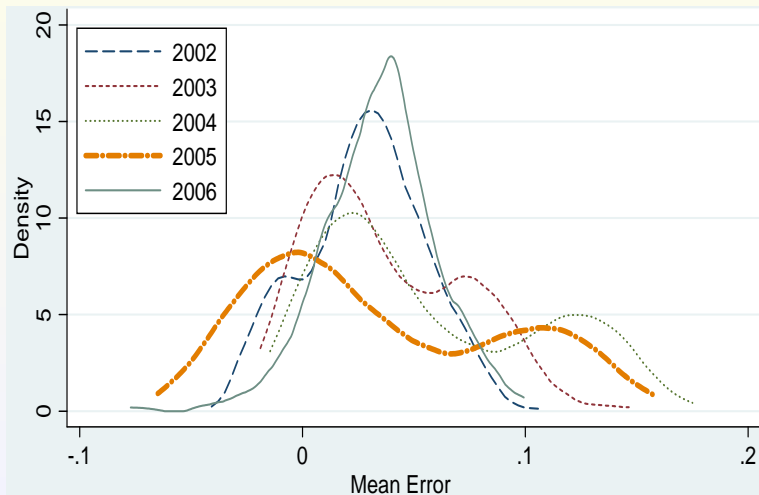
Mean Prediction Errors, Low Doc Loans, High FICO scores



Works Fine For Assets With Hard Information?

- ▶ Repeat earlier exercise on full documentation loans
 - Estimate default model on 1997–2001.
 - Consider default predictions for 2002–2006 loans.

Full Documentation Loans



Statistical Default Models...

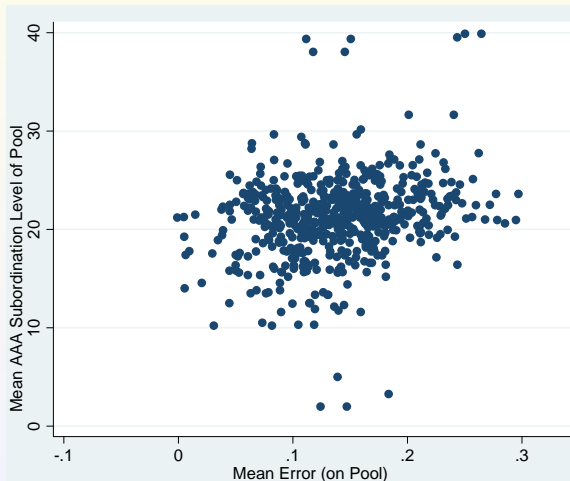
- ▶ Securitization leads to an incentive problem: Lender fails to collect soft information about borrowers
 - Predictable change in quality of loans issued, based on hard information available about borrower
 - Leads to systematic underprediction
- ▶ Use of default models to regulate market participants?
 - Underlying regime shift \implies model risk
 - More historical information into models not necessarily helpful

Statistical Default Models...

- ▶ Only an issue if regulators and investors (blindly) use such a statistical model to price loans
 - Errors in the basic model can amplify across the market
- ▶ Were market participants naïve?
 - S&P (November 2007)
 - “Reducing reliance on FICO as a predictor of default...”
 - “...High LTV loans with low FICO scores worst performers”

2005 Subordination Levels for AAA Tranches

High Low Documentation Proportion



Current Debate

Regulation of what?

- ▶ Call for more supervision and regulation of lenders
 - ...but moral hazard more severe in heavily regulated lenders (banks)
 - Fragility of lender capital structure alleviates moral hazard in lightly regulated lenders
- ▶ Calls for regulations to mandate competition among participants
 - ...but moral hazard reduces in pools when more lenders contribute
 - Sharper relative performance evaluation can mitigate moral hazard to some extent
- ▶ Calls to increase transparency and disclosure
 - ...requiring originators to hold some risk reduces the moral hazard problem
 - Making information on what loans the originator and the securitizer hold available to various market participants

Going Forward...

- ▶ Securitization reduces screening incentives of lenders: trade-off between liquidity and incentives
 - Detected only because liquidity differential around 620 was large enough!
 - Default models not invariant to strategic behavior of participants
- ▶ What should and should not be securitized?
 - Assets with hard vs. soft information
 - Benefits of securitization need to be evaluated with these costs
- ▶ Market forces rather than regulation may have been more effective in mitigating moral hazard in this market