Lender Behavior During Credit Cycles

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The views expressed in this presentation are those of the author and do not necessarily represent those of the *IMF*. 
Mortgage Boom and Crisis

- Mortgage market grew fast but has now been in a crisis for over 2 years
  - Loan originations tripled between 2000 and 2006
  - Apparent relationship between delinquencies and credit growth
  - Significant changes in market structure and financial innovation
  - Reports of downward pressure on credit standards by aggressive nationwide lenders (Countrywide etc.)
Main Questions

- Can we link the decline in loan quality to the credit expansion?

- How did local market conditions affect lenders in their decisions on whether or not to grant a loan?

- How did changes in local market structure and entry of national players affect local lenders?

- Did better-capitalized banks apply more stringent standards (higher denial rates)?
Related Literature

- **Empirical work on subprime crisis:**
  - Links lending standards to securitization (Mian-Sufi, 2007, Loutskina and Strahan, 2007, Keys et al., 2008)

- **Theoretical work on credit cycles/booms:**
  - Classical papers linking business cycle with agency problems (Bernanke-Gertler, 1989, Kiyotaki-Moore, 1997)
  - Link with lending standards or credit quality (Rukes, 2004, Dell’Ariccia-Marquez, 2006, Gorton-He, 2008)
“Financial accelerators” (Kiyotaki and Moore, JPE 1997): an increase in value of collateralizable goods releases credit constraints. Boom fuels further wealth effects etc. Negative shocks inverts cycle, leaving banking system overexposed.

“Institutional memory” (Berger and Udell, JFI 2004): in periods of fast credit expansion banks find it difficult to recruit enough experienced loan officers (especially if there has not been a crisis for a while). This leads to a deterioration of loan portfolios.

“Informational capital and adverse selection” (Dell’Ariccia and Marquez, JF 2006, Gorton and He, RFS 2008): during expansions, adverse selection is less severe and banks find it optimal to trade quality for market share, increasing crisis probability.
Some Guidance from Theory

- Banks should become less choosy:
  - When economic prospects are better
  - During fast market expansions (adverse selection stories)
  - When they are less capitalized
  - When they securitize more (moral hazard)
  - During housing booms (collateral effect)
  - When threatened by entry of lower cost lenders
Empirical Model

- Investigate how local market conditions and institution-specific characteristics affect how lenders grant loans

- Regressions based on panel 10 years, thousands of lenders, and over 300 metropolitan areas (but starting from aggregating individual loan applications)

- Dependent variable: application denial rate (a proxy for lending standards)

- Main variables of interest: number of applications (at each lender and competitors), number of competitors, entry variables, regulatory capital
Data Sources

- Loan application data: Home Mortgage Disclosure Act (HMDA)
- Subprime delinquency rate: LoanPerformance
- Economic and social indicators: Bureau of Economic Analysis, Bureau of Labor Statistics, Census Bureau, Office of Federal Housing Enterprise Oversight
Data: HMDA

- Millions of loan applications / Coverage from 1996 to 2007 (essentially the universe of mortgage applications)
- Depository and non-depository institutions issuing mortgages in a metropolitan statistical area (MSA)
- Both prime and subprime loans
- Aggregate information in a three-dimensional panel (MSA, Lender, Year)
Data: Limitations

- **Identifying subprime loans**
  - Subprime lenders identified using list by Dept. of Housing and Urban Development (HUD)
  - Robustness using interest rate data after 2004

- **Multiple applications**

- **No loan-to-value and FICO score information**
Other Control Variables

- **Macro variables**
  - Income growth, unemployment rate, population, self-employment rate

- **Market structure variables**
  - Number of competing lenders
  - Proportion of new entrants; Proportion of new large (top 20) national players; Market share of entrants

- **Other sectoral variables**
  - House price appreciation (endogeneity issues here)
  - Percentage of loans sold
Denial Rates and Lending Standards

- Did banks become less choosy during the boom?
- We focus on the denial rate of mortgage applications at the MSA-lender level
- Somewhat of a proxy for lending standards
- Need to control for variables that would affect decision to grant a loan
Regress denial rate of applications at MSA-lender level on:

1. Measures of market expansion (boom)
2. Controls for market structure and entry
3. CAMEL variables
4. Loan sales (securitization) and house price dynamics
5. Macro and local variables controlling for economic conditions (including time and MSA fixed effects)
Baseline Methodology

- **OLS regressions** with MSA-lender and time fixed effects
- 379 MSAs, over 8,000 lenders, 10 years
- Basic specification:

\[
DR_{ijt} = \alpha_t + \gamma_{ij} + \beta_1 X_{it} + \beta_2 Y_{jt} + \beta_3 Z_{ijt} + \varepsilon_{ijt}
\]
## Baseline Specification

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
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<tbody>
<tr>
<td>House price appreciation, lagged</td>
<td>-4.51***</td>
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<tr>
<td>Average income</td>
<td>0.06</td>
</tr>
<tr>
<td>Income growth</td>
<td>-2.61*</td>
</tr>
<tr>
<td>Unemployment rate</td>
<td>11.79*</td>
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<tr>
<td>Self-employment rate</td>
<td>8.48*</td>
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<tr>
<td>Log population</td>
<td>-3.63**</td>
</tr>
<tr>
<td>Log number of competitors</td>
<td>0.25</td>
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<tr>
<td>Loan-to-income ratio</td>
<td>0.73***</td>
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<tr>
<td><strong>Log number of applications to competing lenders in MSA</strong></td>
<td>-0.57**</td>
</tr>
<tr>
<td>Log number of applications to lender in MSA</td>
<td>0.63***</td>
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<tr>
<td>Proportion of loans sold by lender in MSA</td>
<td>-0.02***</td>
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<td>Market share of lender in MSA (lagged)</td>
<td>-0.07***</td>
</tr>
<tr>
<td>Lender size</td>
<td>-0.24***</td>
</tr>
<tr>
<td>Nationwide denial rate</td>
<td>0.74***</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.33</td>
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The Role of House Prices

- Significant and economically relevant coefficient

- Two possible interpretations:
  - Collateral/Net worth effect
  - Lenders gambling on real estate

- Potential for endogeneity bias:
  - Variable is lagged
  - Instrumented in previous paper
The Role of Boom Dynamics

- Denial rates are affected by number of applications
  - Decrease with applications to competitors
  - Increase with applications to individual lender
  - Much smaller effect than house prices

- Consistent with adverse selection stories
  - Less adverse selection in faster growing markets
  - Yet, ability to become more choosy with higher demand

- Concerns for endogeneity?
  - Limited here (coefficient has wrong sign for that)
  - Instrumented in previous paper
### Effect of CAMEL Variables

<table>
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<th>MSA Variables qualitatively as before</th>
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<td>Lender-MSA Variables qualitatively as before</td>
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<tr>
<td>Capital adequacy ratio (lagged)</td>
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<tr>
<td>Asset quality (lagged)</td>
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<tr>
<td>Efficiency (lagged)</td>
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<tr>
<td>Profitability (lagged)</td>
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<td>Liquidity (lagged)</td>
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<tr>
<td>R-squared</td>
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Effects of Entry

- We do find evidence that entrants have lower denial rates (Countrywide effects)

- But, no robust evidence of effects of entry on incumbent’s denial rates

- Coefficients have the expected sings, but they are very small and not statistically significant (unstable when cropping sample)

- Is there a problem with causality?
  - Entry may occur where denial rates are higher

- Different types of banks may react in different ways
  - Large banks versus small (nationwide)
  - Dominant market share versus marginal (locally)
Much to Do

- Investigate further entry result

- Slice sample across different groups of banks
  - Size
  - Geographical scope
  - Regulator
  - Specialization

- Robustness and identification issues
Summary of Findings

- Evidence that Banks become less choosy:
  - When economic prospects are better 😊
  - During fast market expansions (adverse selection stories) 😊
  - When they are less capitalized 😊
  - When they securitize more (moral hazard) 😊
  - During housing booms (collateral effect) 😊
  - When threatened by entry of lower cost lenders 😞
Conclusions (so far...)

- We find evidence that boom dynamics affected lenders’ denial rates
- Lending standards are likely to change over the cycles beyond what granted by fundamentals
- Capital appears to have had its intended effect
- Findings broadly support view in favor of more anti-cyclical regulatory framework
Market Structure Changed During Boom

[Line graph showing the average number of lenders in MSAs from 1996 to 2007. The graph indicates an overall increase in the number of lenders, with fluctuations from 1996 to 2007.]
Subprime Crisis: A Credit Boom Gone Bad?

Change in Delinquency Rate 2004-2006 (in percent)

Growth of Loan Origination Volume 2000-2004 (in percent)

MSA level data
Where was the boom?
...And where are the delinquencies?

Home loans: 60+ days late
Percent of total loans, November 2007

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