Payment Size, Negative Equity, and Mortgage Default

Paul Willen, Federal Reserve Bank of Boston
- With Andreas Fuster (FRB NY)

FDIC Consumer Research Symposium
October 17, 2013
Disclaimer

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  - or the Federal Reserve System

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Economists are split. “There’s no question that in many cases, [principal forgiveness] is the only way to assure people will stay in the house,” says Kenneth Rosen of the University of California, Berkeley. Others say what really matters to borrowers is an affordable monthly payment. “If people have a huge debt burden but the mortgage is not the problem, why are we reducing the mortgage?” asks Thomas Lawler, an independent housing economist in Leesburg, Va.

(“How Forgiveness Fits in Housing-Fix Toolkit,” WSJ, July 30, 2012)

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- We study a sample of hybrid ARMs originated in 2005–06 that experienced large **downward** rate resets over 2008–11
  - Compare likelihood of delinquency and cures of loans that have reset lower with that of loans that have not (yet) reset
  - Argue that better identification than from upward resets or loan modifications, where selection effects important
- Our dataset (LP) contains updated CLTV ("TrueLTV") so can compare effects of rates to effects of negative equity
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- Interest rate reductions strongly reduce likelihood of delinquency
  - ...and increase likelihood of cures of delinquent mortgages (cf. paper)
- This holds true even for borrowers that are deeply underwater
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Strong theoretical prior that payment size should matter for default

- both in frictionless and more realistic (double trigger) models

Yet difficult to measure empirically

- No randomized experiments
- Fixed differences across borrowers clearly won’t do
  ⇒ need within-borrower variation

Loan modifications: selection problem because servicers choose to whom they offer mods and at what terms

What about resets?
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What about resets?
Resets

A.R.M. WRESTLING

MORTGAGE RATE SPIKES

Resets

Empirical Analysis

Discussion

October 17, 2013
Upward resets and selection

- Subprime “2/28” ARMs, originated in Q1 2005
- Large increase in default hazard at reset
- but huge selection as well.
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![Default Hazard Chart](chart.png)
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Selection in 2005

- Hazard relative to loans that didn’t reset
  - Reset leads to big increase in relative hazard
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Diagram: Relative Default Hazard vs. Months since origination.
Selection in 2005

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![Graph showing relative default hazard and relative survival probability over months since origination.]
Selection in 2005

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- But the main driver of this is falling denominator.

Note: *number* of defaults stays relatively flat across reset
Our experiment

- All the resets are *down*
  - No incentive to refinance
- *And* most borrowers were underwater
  - Non-agency loans not eligible for HARP.
- No meaningful prepayments at the reset
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The Second Wave of Resets
221K Alt-A interest-only (IO) hybrid ARMs (reset after 3, 5, 7, or 10 years) originated between Jan 2005 and June 2006
- From CoreLogic LoanPerformance dataset
- Track interest rate, delinquency status monthly
- Updated estimate of CLTV – “TrueLTV”

3/1s and 5/1s have reset; 7/1s and 10/1s have not

Why Alt-A?
- Subprime loans almost all had “floors” at initial rate
- Prime (LPS): studied by Tracy and Wright (2012) who also find significant effects of rate reductions

Why IO? Interest rate changes directly translate into payment changes

Why Jan 05 – June 06 range? Index rates low since early 08; want sufficient post-reset data for 5/1s.
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Index rates

Willen (Boston Fed)
Interest rates of Alt-A ARMs originated in 2005/6

The graph shows the interest rates (in %) over months since origination. The rates are categorized based on reset periods: reset after 5 years, reset after 7 or 10 years, and reset after 3 years. The means are indicated on the graph.
60-day delinquency hazard of same loans

![Graph showing the 60-day delinquency hazard of same loans over months since origination. The graph includes three lines:
- Black line: reset after 5 yrs
- Green dashed line: reset after 7 or 10 yrs
- Blue dotted line: reset after 3 yrs

Months since Origination range from 0 to 70, with the monthly hazard ranging from 0 to 0.025. The resets at 5, 7, and 3 years are indicated by vertical red lines.]
Relative hazard of 5/1 and 7/1 ARMS at 60 months
Econometric analysis

- Cox proportional hazard framework:

\[ h(t|X_{it}) = h_0(t) \cdot \exp(X_{it}\beta) \]

where \( X_{it} \) contains

- Origination characteristics (don’t vary with \( t \)): e.g. FICO, initial rate
- Macro variables (don’t vary with \( i \)): e.g. unemployment
- Calendar quarter \( \times \) loan category dummies
- Time-varying mortgage characteristics: e.g. CLTV (bins)
- Main variable of interest: \( \text{rate}_{it} \) relative to \( \text{rate}_{i0} \) (bins)

- Let baseline hazard \( h_0(t) \) vary by origination quarter
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60-day delinquency hazard — baseline results

![Graph showing the 60-day delinquency hazard ratio against the effect of rate change. The x-axis represents the effect of rate change, with a range from 0 to 4, and the y-axis represents the hazard ratio, ranging from 0.3 to 1.0. The line graph illustrates a decreasing trend in the hazard ratio as the effect of rate change increases.]
60-day delinquency hazard — baseline results

![Chart showing the relationship between CLTV and hazard ratio, with a downward trend indicating a decrease in delinquency risk with higher CLTV and rate changes.](chart-image)
Do deeply underwater borrowers react to resets?

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<td>&gt; 4</td>
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Results also robust when restricting to other subsamples (e.g. only Willen (Boston Fed) Payment Size & Mortgage Default).
Do deeply underwater borrowers react to resets?

![Graph showing hazard ratio vs. rate reduction](image)

- **Sample with CLTV > 140**
- **Baseline**

Hazard Ratio

Rate Reduction

Results also robust when restricting to other subsamples (e.g. only Willen (Boston Fed): Payment Size & Mortgage Default)
Timing of effects of rate reductions

- In results shown so far, have assumed that only contemporaneous rate matters for delinquency.
  - in fact, lag rate by 2 periods (rate of month 61 affects delinquency status in month 63 only).
  - e.g. reset on June 1:
    - rate determined by LIBOR of May 1
    - payment due on July 1
    - affects delinquency in August

- However, theory would predict that if borrower unconstrained and forward-looking, reset should matter long before it occurs.

- To test, put in forward-looking interest rate changes, assuming rates follow a random walk:
  - two-periods-ahead rate always known
  - receive notification the month before the reset (e.g. May)
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  - receive notification the month before the reset (e.g. May)
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Do borrowers anticipate the reset?

![Graph showing the relationship between months before reset and hazard ratio with 95% confidence interval. The graph indicates that as the months before reset decrease, the hazard ratio decreases, suggesting that borrowers may anticipate the reset and adjust their behavior accordingly.](image-url)
Discussion – Policy implications

- Lowering required monthly payment strongly reduces $Pr(\text{delinquency})$
- Suggest that programs such as HARP, HAMP can be effective at reducing defaults
- Principal reductions clearly also very effective (reduce CLTV and payment)
  - Do not attempt cost/benefit analysis here
- More broadly: with ARMs, monetary policy can be a powerful tool to reduce delinquencies
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  - Though keep in mind that rates can go back up as well
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Upward resets and selection

- Subprime 2/28s, originated < 2005.
- Big increase in defaults at reset (relative to loans that didn’t reset)
- but huge selection as well.
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Note: number of defaults stays relatively flat across reset
## Descriptive statistics at origination

<table>
<thead>
<tr>
<th></th>
<th>3/1s</th>
<th>5/1s</th>
<th>7/1s</th>
<th>10/1s</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Origination amount (000s)</td>
<td>294</td>
<td>272</td>
<td>345</td>
<td>414</td>
<td>306</td>
</tr>
<tr>
<td>LTV on first lien (%)</td>
<td>78</td>
<td>77</td>
<td>77</td>
<td>74</td>
<td>77</td>
</tr>
<tr>
<td>CLTV (TrueLTV; %)</td>
<td>93</td>
<td>94</td>
<td>93</td>
<td>88</td>
<td>93</td>
</tr>
<tr>
<td>Number of Liens</td>
<td>1.7</td>
<td>1.7</td>
<td>1.6</td>
<td>1.5</td>
<td>1.7</td>
</tr>
<tr>
<td>FICO score</td>
<td>714</td>
<td>710</td>
<td>717</td>
<td>721</td>
<td>713</td>
</tr>
<tr>
<td>Initial interest rate (%)</td>
<td>6.2</td>
<td>6.6</td>
<td>6.6</td>
<td>6.3</td>
<td>6.5</td>
</tr>
<tr>
<td>Investor or 2nd home</td>
<td>0.24</td>
<td>0.28</td>
<td>0.19</td>
<td>0.15</td>
<td>0.24</td>
</tr>
<tr>
<td>Low documentation</td>
<td>0.73</td>
<td>0.69</td>
<td>0.63</td>
<td>0.74</td>
<td>0.70</td>
</tr>
<tr>
<td>No documentation</td>
<td>0.04</td>
<td>0.06</td>
<td>0.04</td>
<td>0.06</td>
<td>0.06</td>
</tr>
<tr>
<td>CA, NV, FL, or AZ</td>
<td>0.57</td>
<td>0.52</td>
<td>0.57</td>
<td>0.67</td>
<td>0.56</td>
</tr>
<tr>
<td>Purchase mortgage</td>
<td>0.68</td>
<td>0.70</td>
<td>0.61</td>
<td>0.57</td>
<td>0.67</td>
</tr>
<tr>
<td>Resets every 6 months</td>
<td>0.85</td>
<td>0.79</td>
<td>0.45</td>
<td>0.28</td>
<td>0.69</td>
</tr>
</tbody>
</table>
### Descriptive statistics — CLTVs and outcomes

<table>
<thead>
<tr>
<th></th>
<th>3/1s</th>
<th>5/1s</th>
<th>7/1s</th>
<th>10/1s</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>January 2008</td>
<td>109</td>
<td>108</td>
<td>107</td>
<td>102</td>
<td>107</td>
</tr>
<tr>
<td>January 2010</td>
<td>144</td>
<td>142</td>
<td>139</td>
<td>130</td>
<td>139</td>
</tr>
<tr>
<td>November 2011</td>
<td>150</td>
<td>147</td>
<td>146</td>
<td>137</td>
<td>145</td>
</tr>
</tbody>
</table>

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<thead>
<tr>
<th>Fraction of loans that have ...</th>
<th>3/1s</th>
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<th>7/1s</th>
<th>10/1s</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gone 60+ days delinquent</td>
<td>0.37</td>
<td>0.46</td>
<td>0.45</td>
<td>0.36</td>
<td>0.43</td>
</tr>
<tr>
<td>Ended in foreclosure / short sale</td>
<td>0.30</td>
<td>0.38</td>
<td>0.35</td>
<td>0.26</td>
<td>0.34</td>
</tr>
<tr>
<td>Prepaid voluntarily</td>
<td>0.46</td>
<td>0.36</td>
<td>0.32</td>
<td>0.35</td>
<td>0.37</td>
</tr>
<tr>
<td>Been modified at least once</td>
<td>0.04</td>
<td>0.07</td>
<td>0.08</td>
<td>0.07</td>
<td>0.07</td>
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Distribution of rate changes

The graph shows the cumulative density distribution of interest rate changes for different mortgage products:
- **5/1, first reset**
- **5/1, later resets**
- **3/1, first reset**
- **3/1, later resets**

The x-axis represents the interest rate change, while the y-axis shows the cumulative density.
Effects on prepayments, overall incidence of delinquency, and cures

- Run similar proportional hazard analysis for prepayments
- Rate reductions also strongly reduce prepayments...
- ...as do high CLTV levels.
- Overall prepayment hazard $<<$ delinquency hazard

- Predict cumulative incidence of delinquency for “typical” 5/1s
  - Estimates imply that for $\text{CLTV} \in [130, 140)$, a 3 pp. reduction reduces fraction of defaults from age 63 to 75 by 9 pp., or about 50%

- Also find effects on cures of similar magnitude
  - 3 pp. rate reduction doubles $\Pr(\text{cure})$
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Cure hazard by loan age, newly 60 dpd loans

Cure = become current or pay off mortgage within 3 months of becoming 60 days delinquent.