Modeling Mortgage Insurance in Mortgage Portfolio Analyzer (MPA)
Overview

- **Mortgage Insurance (MI):** Insurance that reimburses lender or RMBS trust when a mortgage loan goes into default

- **Benefits of mortgage insurance modeling:**
  - Better modeling of pool losses
  - Potential use of MPA to model mortgage insurer cashflows

- **Goal is to closely mimic MI mechanics**
  - Terms of MI policies are implemented in MPA
  - MI policies rules applied in the simulation on a loan-by-loan and scenario-by-scenario basis

- **Modeling is mechanical, not mathematical, but interesting dynamics result**
Two Types of Mortgage Insurance

MI reimburses the insured for all or part of the loss caused by default of a mortgage loan

- **Primary MI:**
  - Policy that applies to an individual loan
  - Can be paid for by borrower or by lender

- **Pool MI:**
  - Reimburses for losses due to defaults in the pool once pool deductible is exceeded and until stop-loss is reached
  - May be held by RMBS trust or held by lender for portfolio of loans
How Does Primary MI Work?

- The policy pays loss caused by the default (net of proceeds of sale of property) ...
- ... subject to a Cap, calculated as follows:
  - Policy has a Coverage level between 0% and 100%
  - Gross loss equals sum of
    - Unpaid balance at time of default
    - Unpaid interest
    - Other costs less certain deductions
    - Gross loss is total loss incurred if the property is worthless
  - Cap = Gross loss × Coverage level
- Example: Borrower defaults, Gross loss = $200K. Coverage level = 30%
  - If house is sold for $110K, net loss is $90K, insurer pays $60K (= 30% × $200K)
  - If house is sold for $150K, net loss is $50K, insurer pays $50K
- Claim can be rescinded due to fraud, bad servicing, etc.
How Does Primary MI Affect Severity Modeling?

- To some extent, Primary MI shifts the severity distribution of any loan to the left …
  - E.g., 25% coverage level means 30% severity → 5% severity, 40% severity → 15% severity, etc.

- …but the left shift only captures some of the change
  - Max reimbursement not a fixed percentage of initial balance
  - Rescission creates echo of unshifted distribution

- Tail of the distribution is larger than with simple left shift
Single-loan Loss Histogram with and w/o Primary MI (PMI)

occurrences of no default not shown for either data set (34% each)
Single-loan Loss Histogram with different Rescission Assumptions

- No MI
- PMI resc = 0.05
- PMI resc = 0.30

<table>
<thead>
<tr>
<th>Original Balance</th>
<th>$250,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>FICO</td>
<td>605</td>
</tr>
<tr>
<td>State</td>
<td>CA</td>
</tr>
<tr>
<td>Loan Type</td>
<td>IO ARM</td>
</tr>
<tr>
<td>Doc Type</td>
<td>Full income – No assets</td>
</tr>
<tr>
<td>LTV</td>
<td>90</td>
</tr>
</tbody>
</table>

Occurrences of no default not shown for either data set (14% each)
How Does Pool MI Work?

- Policy applies to total unpaid balance of all loans in pool
- Covers losses not covered by Primary MI
- Main parameters are:
  - Pool deductible (% of total initial unpaid balance)
  - Pool stop-loss (% of total initial unpaid balance)
  - Loan-level stop-loss (% of initial principal balance of loan)
- Like protection on a mezzanine tranche of the pool
- Certain loans in the pool may not be covered based on LTV or absence of primary MI
- Rescission:
  - Claim automatically denied if rescinded by primary MI
  - Can also be rescinded for same reasons as primary MI (even if primary MI is still in force)
Simplified Pool MI Example

- Pool consists of a single $100 loan
- Pool deductible: 3%    Pool Stop-loss: 25%    Loan-level stop loss: 20%
- Loan defaults with $90 outstanding
- Property is sold for $50
- Primary MI pays $30
- Remaining loss = $90 − $50 − $30 = $10
  ✔ ... which is less than the loan-level stop loss of $20 (= 20% × $100)
- First $3 of remaining loss is used up by deductible (3% × $100)
- Pool policy pays $7
How Does Pool MI Affect Severity Modeling?

- **At the loan level:**
  - Loan-level stop-loss depends on initial principal balance, not balance at default, so there can be a left shift, but…
  - Defaults outside the “tranche” create echo of unshifted distribution
  - Pool policy reimbursement for any loan depends on order in which defaults occur.
    - Without pool MI, loans can be modeled independently of one another

- **At the pool level:**
  - There is a spike in the distribution (histogram) at the pool-level deductible, but …
  - It is mitigated by the loan-level stop-loss
Single-loan Loss Histogram with Primary and Pool MI

- **Original Balance**: $589,500
- **FICO**: 772
- **State**: CA
- **Loan Type**: IO ARM
- **Doc Type**: No income – Stated assets
- **LTV**: 87%

Occurrences of no default not shown for any data set (76%)
Pool Loss Histogram with different levels of pool MI

In reality there is a huge spectrum of possible parameters.
Concluding Observations

- **Mortgage Insurance affects the shape of the loss distribution and does not merely shift it**
  - No simple change of parameters reflects effects of MI

- **Benefits of mortgage insurance (MI) modeling:**
  - Better modeling of pool losses
  - Analysis of mortgage insurer solvency

- **Directions for further modeling efforts**
  - Solvency of Insurers
  - Timing of reimbursements
  - Rescission rates