MORTGAGE BACKED SECURITIES

October 1999
FIGURE 2.1
Size of the Capital Markets
(as of December 1987)

FIGURE 2.2
Composition of the Mortgage Market
(as of December 1987)
<table>
<thead>
<tr>
<th>Feature</th>
<th>GNMA-I</th>
<th>GNMA-II</th>
<th>FHLMC PC</th>
<th>FNMA MBS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collateral</td>
<td>Primarily single-family residential mortgages. Mortgages have FHA, VA, or FmHA default guarantees. Newly issued mortgages (less than two years old)</td>
<td>Same as GNMA-I</td>
<td>Mostly conventional loans (single-family fixed-rate mortgages without government guarantees). New or seasoned mortgages. Some seasoned FHA/VA pools</td>
<td>Similar to FHLMC</td>
</tr>
<tr>
<td>Maximum mortgage amount</td>
<td>$153,200</td>
<td>$153,200</td>
<td>$168,700 (50% more for Alaska, Hawaii, and Guam)</td>
<td>$168,700 (50% more for Alaska, Hawaii, and Guam)</td>
</tr>
<tr>
<td>Original term</td>
<td>15–30 years</td>
<td>15–30 years</td>
<td>10–30 years (wide range of underlying maturities)</td>
<td>10–30 years (wide range of underlying maturities)</td>
</tr>
<tr>
<td>Guarantee</td>
<td>Full faith and credit of U.S. government for timely payment of P&amp;I guaranteed by GNMA</td>
<td>Same as GNMA-I</td>
<td>Timely payment of interest and eventual repayment of principal guaranteed by FHLMC</td>
<td>Timely payment of interest and principal guaranteed by FNMA</td>
</tr>
<tr>
<td>Minimum pool size</td>
<td>$1 million ($500,000 for manufactured housing)</td>
<td>$250,000 multiple-issuer pools</td>
<td>$1 million for Guarantor</td>
<td>$1 million ($250,000 for FNMA Majors)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$1 million level custom pools</td>
<td>$50 million for Cash, $500,000 for ARMs, $250,000 for Baby pools</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>$350,000 manufactured housing custom pools</td>
<td>Cash 200 bp</td>
<td></td>
</tr>
<tr>
<td>Maximum servicing spread (basis points)</td>
<td>50 bp (except manufactured housing and project pools)</td>
<td>50–150 bp</td>
<td>Guarantor 250 bp</td>
<td>230 bp</td>
</tr>
<tr>
<td>Payment delay</td>
<td>Actual: 14 days</td>
<td>19 days</td>
<td>44 days</td>
<td>24 days</td>
</tr>
<tr>
<td></td>
<td>Stated: 45 days</td>
<td>50 days</td>
<td>75 days</td>
<td>55 days</td>
</tr>
<tr>
<td>time</td>
<td>pay</td>
<td>begining</td>
<td>end</td>
<td></td>
</tr>
<tr>
<td>------</td>
<td>--------</td>
<td>----------</td>
<td>----------</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>54.62262</td>
<td>100000</td>
<td>99945.38</td>
<td></td>
</tr>
<tr>
<td>60</td>
<td>84.88496</td>
<td>95965.02</td>
<td>95880.14</td>
<td></td>
</tr>
<tr>
<td>120</td>
<td>132.9028</td>
<td>89562.65</td>
<td>89429.74</td>
<td></td>
</tr>
<tr>
<td>180</td>
<td>208.0834</td>
<td>79538.57</td>
<td>79330.49</td>
<td></td>
</tr>
<tr>
<td>240</td>
<td>325.7922</td>
<td>63844.06</td>
<td>63518.27</td>
<td></td>
</tr>
<tr>
<td>300</td>
<td>510.0866</td>
<td>39271.47</td>
<td>38761.38</td>
<td></td>
</tr>
<tr>
<td>360</td>
<td>798.6329</td>
<td>798.6273</td>
<td>-0.00559</td>
<td></td>
</tr>
</tbody>
</table>
PRICING OF GINNY MAES

STEP 1 Estimate of interest rate paths

(Paths must be arbitrage-free and result in positive interest rates.)
STEP 2 Estimate prepayment at each node

a. Generally use historical data.

b. Prepayment not rational function of interest rate.

1. Bond Rate

2. Relationship between Bond Rate and "New" Mortgage Rate

3. Remaining Maturity

4. Prior Path

5. Season

6. Home Turnovers

c. Note for mortgages not path independent.
STEP 3  Estimate cash flows.

Cash flows include prepayment and principal and interest.

STEP 4  Discount at Treasury spot curve

If no spread, this would give average market value. Generally believe spread. Thus discount so that model price fits actual price on average.

\[(1+r+\Delta)\]

\(\Delta\) is OAS

Do so fits on average in order to spot "mispriced bonds."
New Valuation, Duration and Convexity Models

Exhibit 4
Steps Taken in an Options-based Model

Interest Rate Process
- Assumptions:
  - Short-term rate volatility
  - Long-term rate volatility
  - Correlation of short- and long-term rates
- Constraints:
  - Rate movements do not result in negative interest rates
  - Interest rates do not create arbitrage opportunities
- Result:
  Interest rate paths

Prepayment Function
- Estimated from historical data
- Arguments include:
  - Difference between corporate and refinancing rate
  - Lagged response variables to capture homeowner inertia
  - Remaining term (age)
  - Season of year
  - Remaining balance of the MBS
- Result:
  Prepayment rates, which when applied to a particular MBS, produce cash flows for each interest rate path

Price Sensitivity Estimates
- Each rate path is shocked up and down by a small increment
- Two new theoretical prices and probable market prices are obtained
- Price sensitivities are determined from these new prices relative to the initial ones
- Result:
  MBS duration
  MBS convexity

Valuation
- Each path's cash flows are discounted back to present using Treasury rates
- Average of all paths' present values is theoretical price assuming no spread off Treasuries
- Theoretical price equated to market price by adding spread to Treasury discounting rates
- Result:
  Options-adjusted spread to Treasury curve
FOR EMMA 30 Y VR CONV NT ONV. DU ON A

PREPARMEN T RATE VERSUS AGE AND SPREAD
EXHIBIT 5
CASH FLOWS OF A COLLATERALIZED MORTGAGE OBLIGATION

PANEL 5A
The Mortgage Pool With 6 Percent CPR

PANEL 5B
The Class A Tranche

PANEL 5C
The Class B Tranche

PANEL 5D
The Class C Tranche

* WAL Weighted average life

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Figure 1. Prices per $100 principal of an eleven percent twenty-five-year default-free fully amortizing mortgage issued five years ago with ninety percent of its relative principal currently outstanding as a function of the long rate, \( l \), for various prepayment assumptions.
Splitting mortgage payments into more valuable payment patterns

CMO

Simplest CMO splitting into multiple groups by payment

Example 1:

1. $100 million Ginny Mae

2. Split into three tranches

3. A gets all principal payment until $40 million paid

   B gets all principal payment after $40 million paid and before $70 million paid

   C gets remainder

4. All tranches receive same interest rate
Example 2:

Unequal interest payments.

1. $100 million issue paying nine percent

2. B-1 receives 3% interest and principal of $50 million

3. B-2 receives 6% interest and principal of $50 million
Yield of Current Coupon Mortgage (%/Annum B.E.)

Current Coupon Less 40 bp
Yield Assumption:

% from FNMA 8% Graduated Payment MBS
Stipped MBS, 6% Coupon
Exhibit 7

Stripped Mortality – Broken Securities
Exhibit 2

Structure of stripped MBS Class A

From FNMA 11% MBS

Class A.2

6.6% Coupon

1% Principal

0.6% Interest

Class A

5% Coupon

99% Principal

4.96% Interest

11%
Exhibit 17

Stripped MBS, 66.5% Cc pon
Class A-2 from FHM: 11% MBS
Mortgage

Assume for illustration annual payments

1,000,000  principal
4  years
.094626  rate
31,180.86  payment
.50  probability
<table>
<thead>
<tr>
<th>Spot Rates</th>
<th></th>
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<tbody>
<tr>
<td></td>
<td>18.879</td>
</tr>
<tr>
<td></td>
<td>14.624</td>
</tr>
<tr>
<td>11.0999</td>
<td>12.935</td>
</tr>
<tr>
<td>8</td>
<td>8.893</td>
</tr>
<tr>
<td>5.544</td>
<td>7.288</td>
</tr>
<tr>
<td>3.448</td>
<td>1.924</td>
</tr>
<tr>
<td>Mortgage Value</td>
<td>26,229.18</td>
</tr>
<tr>
<td>----------------</td>
<td>-----------</td>
</tr>
<tr>
<td></td>
<td>50,687.58</td>
</tr>
<tr>
<td>75,476.03</td>
<td>27,609.67</td>
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<tr>
<td>102,413</td>
<td>54,656.35</td>
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<tr>
<td>83,374.41</td>
<td>29,062.81</td>
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<tr>
<td>58,687.58</td>
<td>30,592.43</td>
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<tr>
<td>100,000</td>
<td>72,281.73</td>
</tr>
<tr>
<td>54,508.35</td>
<td>28,485.40</td>
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