Chapter 19
Mortgage-Backed Securities

Concept Questions

1. Mortgage securitization benefits borrowers by reducing interest rates. Interest rates are reduced because securitization increases liquidity in the mortgage market. More liquid mortgages have higher prices and, hence, lower interest rates.

2. It benefits mortgage originators by allowing them to transfer the risk associated with holding mortgages and instead focus on what they do best, originating mortgages. Also, and equally important, by selling mortgages, originators obtain new funds to loan out.

3. For the same rate and original balance, the 15-year mortgage will have higher payments simply because a larger principal payment must be made each month to pay off the loan over a shorter time, even though the interest component may be smaller.

4. Only GNMA is a federal agency, and GNMA securities are backed by the full faith and credit of the U.S. government. The other two, in principle, do not have this backing. As a practical matter, however, the difference is slight.

5. It means that timely payment of both principal and interest is guaranteed.

6. Mortgages are prepaid because the underlying property is sold, interest rates fall, or the owner otherwise wishes to refinance (perhaps to increase the loan balance as a way of obtaining funds for other purposes) or pay off the mortgage. When interest rates fall, prepayments accelerate. Larger drops lead to sharp increases in prepayment rates.

7. The call feature on a bond gives the borrower the right to buy the bond (i.e., pay off the debt) at a fixed price. The right to prepay a mortgage gives the borrower the same right.

8. Prepayments that result purely from interest drops are a risk; the mortgage investor will have to reinvest at a lower rate. However, some mortgages are prepaid for other reasons, such as the sale of the underlying property. This can happen even if interest rates have risen substantially; such a prepayment benefits the mortgage investors. Thus, not all prepayments are bad, just those that result in the need to reinvest at a lower rate.

9. For a fully modified mortgage pool, all cash flows are guaranteed to be paid in a timely manner, meaning that no cash flows will be paid out late. The guarantee does, however, allow cash flows to be paid out early, which occurs in the case of defaults. When a default occurs, the remaining balance on the defaulting mortgage is paid out immediately. Thus to a mortgage pool investor, a default appears as a prepayment since in both cases an early payment of principal is realized.
10. A collateralized mortgage obligation (CMO) is a mortgage-backed security with cash flows that are divided into multiple securities. They exist because they provide a means of altering some of the less desirable characteristics of MBS’s, thereby increasing marketability to a broader class of investors. More fundamentally, they exist because investment banks (the creators and marketers) have found them to be a profitable product! The three best-known CMO structures are interest only and principal only strips, sequential CMOs, and protected amortization class securities.

11. Every mortgage payment has an interest portion and a principal portion. IO and PO strips are very simple CMOs; the interest and principal portions are separated into distinct payments. Holders of IO strips receive all the interest paid; the principal goes to holders of PO strips. If interest rates change, the IO strips—especially the longer dated ones—are vastly more risky. With PO strips, the only uncertainty is when the principal is paid. All PO strips-holders will receive full payment. With an IO strip, however, prepayment means that no future interest payments will be made, so the amount of interest that will be received is unknown.

12. PO strips have greater interest rate risk if we define interest rate risk to mean losses associated with interest rate increases and gains associated with interest rate decreases. When interest rates go up, prepayments slow down, thereby postponing the time until principal is received. In this case, IO strips can actually behave like “inverse floaters.” Their value tends to rise when interest rates increase. The reason is that slowing prepayments increases the interest that will be received by IO strips-holders. However, the value of IO strips fall when interest rates decrease.

13. The A-tranche will essentially receive all of the payments, both principal and interest, until it is fully paid off. The Z-tranche receives nothing until the A-tranche is paid off. After that, the Z-tranche receives everything. The Z-tranche is much riskier because the size and timing of the payment is more uncertain.

14. With a protected amortization class (PAC) CMO, payments are made to one group of investors according to a set schedule. This means that the protected class investors have almost fully predictable cash flows. After protected class investors are paid, all the remaining cash flow goes to non-PAC investors, who hold PAC support or PAC companion bonds. In essence, one group of investors receives fixed payments, the other group absorbs all (or virtually all) the uncertainty created by prepayments.

15. Macaulay duration assumes fixed cash flows. With MBSs and CMOs, the payments depend on prepayments, which in turn depend on interest rates. When prepayments pick up, duration falls, and vice versa. Thus, no single measure is accurate. Effective duration attempts to account for the possibility that mortgage pool cash flows can vary. Effective duration for a mortgage pool will typically be based on a prepayment model that accounts for the effects of changing interest rates on prepayments.

Core Questions

1. \[\frac{\$175,000(0.07/12)}{[1 - (1/(1 + 0.07/12)^{360})]} = $1,164.28\]

2. \[\frac{1,100[1 - (1/(1 + 0.055/12)^{360})] / (0.055/12)} = $193,733.94\]

3. \[\frac{\$210,000(0.064/12)}{[1 - (1/(1 + 0.064/12)^{360})]} = $1,313.56\]
4. \[1,200\{1 - [1/(1 + .068/12)^{360}]\}/.068/12 = \$184,070.20\]

5. \[1 - (1 - .05)^{360} = 0.4265\%\]

6. \[0.00625 = 1 - (1 - \text{CPR})^{360}; \text{CPR} = 7.2475\%\]

7. \$108,320 – 41,564 = \$66,756

8. \[
\text{Payment} = \frac{[\$200,000(.065/12)]\{1 - [1/(1 + .065/12)^{360}]\}}{(.065/12)} = \$1,264.14
\]
The interest in the first month is equal to the original loan amount ($200,000) multiplied by the interest rate, .065/12 = .005417 per month. Thus, the interest amounts to \$1,083.33. The remaining \$1,264.14 – 1,083.33 = \$180.80 is principal. The interest allocation for the second payment is \$1,082.35, and the principal reduction is \$181.78.

9. \[
\text{Payment} = \frac{[\$250,000(.078/12)]\{1 - [1/(1 + .078/12)^{300}]\}}{(.078/12)} = \$1,975.80
\]
Balance = \$1,975.80 \{1 - [1/(1 + .069/12)^{240}]\}/(.069/12) = \$256,828.33

**Intermediate Questions**

11. \[
\text{Original payment} = \frac{[\$160,000(.08/12)]\{1 - [1/(1 + .08/12)^{360}]\}}{(.08/12)} = \$1,174.02
\]
Balance = \$1,174.02 \{1 - [1/(1 + .06/12)^{288}]\}/(.06/12) = \$140,359.53
New payment = \$140,359.53 \{1 - [1/(1 + .06/12)^{240}]\}/(.06/12) = \$1,005.58
Savings = \$1,174.02 – 1,005.58 = \$168.44

12. \[
\text{Original payment} = \frac{[\$110,000(.09/12)]\{1 - [1/(1 + .09/12)^{360}]\}}{(.09/12)} = \$1,115.69
\]
Balance = \$1,115.69 \{1 - [1/(1 + .06/12)^{240}]\}/(.06/12) = \$69,344.76
New payment = \$69,344.76 \{1 - [1/(1 + .06/12)^{240}]\}/(.06/12) = \$1,013.03
Savings = \$1,115.69 – 1,013.03 = \$102.67

13. \[
\text{Original payment} = \frac{[\$150,000(.06375/12)]\{1 - [1/(1 + .06375/12)^{360}]\}}{(.06375/12)} = \$935.80
\]
Balance = \$935.80 \{1 - [1/(1 + .06/12)^{240}]\}/(.06375/12) = \$140,212.87
New payment = \$141,712.87 \{1 - [1/(1 + .06/12)^{240}]\}/(.06/12) = \$913.06
Savings = \$935.80 – 913.06 = \$22.75

14. \[
\text{Original payment} = \frac{[\$175,000(.074/12)]\{1 - [1/(1 + .074/12)^{360}]\}}{(.074/12)} = \$1,211.66
\]
Balance = \$1,211.66 \{1 - [1/(1 + .06/12)^{288}]\}/(.074/12) = \$163,036.37
\$167,036.37 = \$1,211.66\{\text{PVIFA}_{.05,.288}\}; \ R = 0.5934\%; \ APR = 7.12\%

15. \[
\text{Original payment} = \frac{[\$205,000(.0815/12)]\{1 - [1/(1 + .0815/12)^{360}]\}}{(.0815/12)} = \$1,525.71
\]
Balance = \$1,525.71 \{1 - [1/(1 + .06/12)^{288}]\}/(.0815/12) = \$107,345.72
\$110,345.72 = \$1,525.71\{\text{PVIFA}_{.05,.96}\}; \ R = 0.6155\%; \ APR = 7.39\%
16. For a seasoned 100 PSA mortgage, the CPR is 6 percent per year.
   PSA 50: CPR = (50/100)(.06) = 3.00%
   PSA 200: CPR = (200/100)(.06) = 12.00%
   PSA 400: CPR = (400/100)(.06) = 24.00%
   These CPRs have two, more or less equivalent interpretations. They are an estimate of the probability that any given mortgage in the pool will prepay in a given year. A more useful interpretation is that they are an estimate of the percentage of outstanding principal that will be prepaid in a given year. In other words, if the odds of prepayment are 6 percent for any given mortgage, then we expect that 6 percent of all mortgages will prepay, meaning that 6 percent of the principal in a mortgage pool will be prepaid per year.

17. PSA 50: SMM = 1 – (1 – .03)\(^{1/12}\) = 0.2535%
    PSA 200: SMM = 1 – (1 – .12)\(^{1/12}\) = 1.0596%
    PSA 400: SMM = 1 – (1 – .24)\(^{1/12}\) = 2.2610%
    Notice that the 400 PSA is not simply double the 200; there’s a compound interest-type effect in the calculation. The SMM estimates the probability of prepayment in a given month. Thus, with 50 PSA, it is estimated that .254 percent of mortgages will prepay in a given month.

Spreadsheet Problems

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td><strong>Chapter 19</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>Question 18</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>Input Area:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td></td>
<td># of years</td>
<td>30</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td></td>
<td>Original balance</td>
<td>$180,000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td></td>
<td>Rate</td>
<td>6.25%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td></td>
<td>Output Area:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td></td>
<td>Payment</td>
<td><strong>$1,108.29</strong> =PMT(D8/12,D7*12,-D8,0)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>