Question and Problem Answers
Chapter 20 - Asset Backed Securities

20 - 1:

A. The monthly mortgage payment is $2,306.74

$$\textit{Monthly payment} \quad ' \quad \textit{Principal} \quad (\quad \left[\frac{r \ (1\%r)^{\,m}}{(1\%r)^{\,m} \ \& \ 1} \right]$$

$$' \ \$300{,}000 \quad (\quad \left[\frac{\frac{0.085}{12}\left(1\% \ \frac{0.085}{12}\right)^{360}}{\left(1\% \ \frac{0.085}{12}\right)^{360} \ \& \ 1} \right] \quad ' \quad \$2{,}306.74$$

B. On the first payment $2,125.00 is interest $\left[\$300{,}000 \ (\ \frac{0.085}{12}\right]$ and the remainder, $181.74, is principal.

C. The first payment reduces or pays down the principal by $181.74. This means you still owe $299,818.26 on your mortgage. The second payment will thus include interest of $2123.71 $\left[\$299{,}818.26 \ (\ \frac{0.085}{12}\right]$ and $183.03 principal.

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20 - 2:

If the current mortgage rates are lower than 7.3% (6.8% + 0.5%) then the dealer wants to keep the securities with the lowest probability of prepayment because these mortgages generate a higher than current rate of interest. 250% PSA means that, even when mortgage rates remain steady, this pool will prepay faster than the PSA benchmark pool (perhaps the mortgages are all in Champaign-Urbana where, due to the University, mobility is high). By slipping your colleague the highest %PSA pool he has on his books he reduces his own **prepayment risk exposure**.

When the current mortgage rates are higher than 7.3% then the dealer wants to keep the securities with the highest probability of prepayment because he can reinvest the proceeds at a higher rate. By slipping your colleague the lowest %PSA pools on his book the dealer reduces his **extension risk exposure**.

Naturally, when you place orders with the dealer, you specify the %PSA on the mortgage pool before you buy or sell anything.

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20 - 3:

A. John Q. Investor purchased $100,000 of a $1m pool of mortgages. This means that JQ owns 1/10 of the each mortgage in the pool. If the outstanding principal remaining is $700,000 then JQ's portion is $70,000.

B. The scheduled principal payment in month 31 is $1,600 then JQ's share is 1/10th or $160.00

C. We translate the description on page 311 into mathematics as follows:

$$Rate \text{ ' } PSA \text{ (} 0.06 \text{ (} \min\left(1,\frac{months}{30}\right)$$

For 100% PSA we calculate the expected prepayment rate in month 31 as 6%

$$\begin{aligned} Rate &\text{ ' } PSA \text{ (} 0.06 \text{ (} \min\left(1,\frac{months}{30}\right) \\ &\text{ ' } 1.00 \text{ (} 0.06 \text{ (} \min\left(1,\frac{31}{30}\right) \\ &\text{ ' } 0.06 \end{aligned}$$

D. We calculate the expected prepayment as $359.19

$$\begin{aligned} E[P] &\text{ ' } \left[1 \text{ \& } (1 \text{ \& } Prepayment\ Rate)^{1/12}\right] \text{ (} (Outstanding\ Principal \text{ \& } Scheduled\ Principal\ Payment) \\ &\text{ ' } \left[1 \text{ \& } (1 \text{ \& } 0.06)^{1/12}\right] \text{ (} (\$70{,}000.00 \text{ \& } \$160.00) \\ &\text{ ' } (0.005143013) \text{ (} (\$69{,}840) \\ &\text{ ' } \$359.19 \end{aligned}$$

E. At 80% PSA the prepayment rate is 4.8% instead of 6%

$$\begin{aligned} Rate &\text{ ' } PSA \text{ (} 0.06 \text{ (} \min\left(1,\frac{months}{30}\right) \\ &\text{ ' } 0.80 \text{ (} 0.06 \text{ (} \min\left(1,\frac{31}{30}\right) \\ &\text{ ' } 0.048 \end{aligned}$$

and the expected pre-payment is $285.70 instead of $359.19

$$\begin{aligned} E[P] &\text{ ' } \left[1 \text{ \& } (1 \text{ \& } Prepayment\ Rate)^{1/12}\right] \text{ (} (Outstanding\ Principal \text{ \& } Scheduled\ Principal\ Payment) \\ &\text{ ' } \left[1 \text{ \& } (1 \text{ \& } 0.048)^{1/12}\right] \text{ (} (\$70{,}000.00 \text{ \& } \$160.00) \\ &\text{ ' } (0.004090797) \text{ (} (\$69{,}840) \\ &\text{ ' } \$285.70 \end{aligned}$$

F. At 120% PSA the prepayment rate is 7.2% instead of 6%

$$\begin{aligned} Rate &= PSA \times 0.06 \times \min\left(1, \frac{months}{30}\right) \\ &= 1.20 \times 0.06 \times \min\left(1, \frac{31}{30}\right) \\ &= 0.072 \end{aligned}$$

and the expected pre-payment is \$433.54 instead of \$359.19

$$\begin{aligned} E[P] &= \left[1 - (1 - Prepayment\ Rate)^{1/12}\right] \times (Outstanding\ Principal - Scheduled\ Principal\ Payment) \\ &= \left[1 - (1 - 0.072)^{1/12}\right] \times (\$70{,}000.00 - \$160.00) \\ &= (0.006207615) \times (\$69{,}840) \\ &= \$433.54 \end{aligned}$$

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20 - 4:

(C) Sallie Mae is the Student Loan Marketing Association.

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20 - 5:

(B) The Public Securities Association model is a benchmark of prepayment rates for new mortgage loans.
