Learning Outcome Statement

After completing this caselet, students and trainees should be able to explain how PSA rates for prepayments are calculated and what ‘seasoning’ means for mortgages. They should know the formulas for single monthly mortality (SMM) and conditional prepayment rates (CPR). They should, also, be able to use The Yield Book Add-in to generate prepayment values and associated balances.

Caselet #50

Renowned Darla Moore School of Business graduate and bond analyst, Ms. Jane Gotzrox, is holding her daily meeting with her intern.

“Sparky,” she says, “it’s time for you to branch out a bit and to do some work on mortgages. Why do investors buy mortgage-backed securities, Sparky?”

“They buy them for the money, Ms. Gotzrox”

“Excellent. And, just how do investors make money with MBSs? she asks”

“One way that investors make money by having realized prepayment speeds differ from the pricing speeds, Ms. Gotzrox.”

“Nicely done, Sparky. Do you want to go for the hat-trick? How do we measure prepayment speeds?”

“We use PSA speeds, Ms. Gotzrox, which take into account predictably low prepayments on new pools of mortgages that then accelerate over time to ‘fully seasoned’ pools.”

“Sparky, answers like that will go a long way toward getting you the job that you covet. Here’s what I want you to do. First, remember the user bond you created in Caselet #5, the MBS that you used to calculate an annuity’s cash flows? Let me remind you.”

“To make your user bond, put the following entries in cells A1:B7 of a new spreadsheet:"

<table>
<thead>
<tr>
<th>cusip</th>
<th>SparkyMtg</th>
</tr>
</thead>
<tbody>
<tr>
<td>sectype</td>
<td>mort</td>
</tr>
<tr>
<td>secsubtype</td>
<td>gold</td>
</tr>
<tr>
<td>outamt</td>
<td>1000</td>
</tr>
<tr>
<td>coup</td>
<td>6</td>
</tr>
<tr>
<td>servfee</td>
<td>0</td>
</tr>
<tr>
<td>remtrmyrs</td>
<td>30</td>
</tr>
</tbody>
</table>
“Once you have those cells entered, go to cell A9 and choose User Data/User Bond/User Bond from The Yield Book Add-in menu. You’ll be asked for a User Bond ID, how about making it the same as the CUSIP? You’ll also be asked for the cell range that includes the needed inputs. Just highlight A1:B7 and you’ll be set. Your user bond is ready to analyze.”

“To find the cash flows, you’ll need Security Analysis/Cash Flow in The Yield Book Add-in. Put the numbers 1 through 360 in Column A, beginning in A12. Notice that to see the cash flows, you must enter a Period Number or Date. Column A gives those period numbers.”

“Now, you are ready to calculate the fraction of a 360-month pool prepaying each month of the pool’s life for any PSA speed. To make those calculations, you are going to need to pass a PSA speed to the Yield Book Add-in. Put the words Prepay Speed in cell D1 and the number 0, for zero prepayments, in cell E1. After the spreadsheet is all built, you will vary the prepayment speed, and you will be able to see how it impacts cash flows.”


“You will get Total Cash Flow from Security Analysis/Total Cash Flow using your User Bond, OutAmt as the Par Amount, the value in E1 as the PSA speed and the value in column A for the period number. Remember, Sparky, all of the values except the period number need to be absolute references.”

“Begin comes from BeginBalance in the Total Cash Flow function. Interest comes from InterestPayment. Principal comes from ScheduledPrincipalPayment. Prepay comes from PrepayPrincipalPayment’. Pmt adds columns D, E and F to check that the Total Cash Flow value in column B is correct. End comes from PrincipalBalance. Check comes from subtracting Principal and Prepay from Begin to make sure it matches the ending balance. Finally, you get to make a real contribution. Find the formulas for single monthly mortality (SMM) and conditional prepayment rate (CPR) and put those calculations in columns J and K. What values do you expect to see for CPR when PSA is 100%, eh, Sparky?”

“Start with a PSA of 0% and populate all ten columns for all 360 rows. You know what to expect for Total Cash Flow, right, Sparky? You saw it in Caselet #5. Then set PSA to 100% to make sure that you are calculating SMM and CPR correctly.”
“To see how prepayments impact cash flows, you need to make some charts. You will have enough of them that it probably makes sense to put them on a separate sheet.”

“Highlight all of the values in column B. The easiest way is to begin in B12 and press ctl-shift-down. Then Insert a Column chart. Cut the graph and paste it on a new sheet labeled ‘Graphs.’ Does the rectangle surprise you, Sparky? It shouldn’t.”

“Make column charts for Interest and Principal the same way and put them on the Graph sheet. Notice that if you add the Interest and Principal payments, you get a constant number, just as you expect.”

“Now, change the PSA rate from 0% to 100%. What happens to the total payments, interest and principal? For clarity, you should make the scale of all three axes the same. Of course, when you change PSA speeds, you may have to re-format the axes, but it is certainly worth your while, to help build your intuition.”

“You will need one last graph, Sparky. Highlight the CPR column and create a line graph. Move it to your graphs sheet. Does it have the correct shape? Correct scale? To make sure that you really understand the prepayment measurement conventions, change the PSA speed to 200%. Can you explain the new CPR graph?”

“There you have it, Sparky. It will take a while, I am sure, but remember mortgages ARE complex to analyze and knowing how to use Yield Book will help a lot if you are trying to break into a mortgage shop. Now, get going!”