

## Understanding the Model

**E**ach individual chapter has focused on explaining one concept of a structured finance model and the mechanics behind implementing that concept in Excel. At this point, the model is mechanically complete and many individual sections have been covered. However, the ability to integrate assumptions into interconnected concepts and produce interpretable results is where the true value of a financial model resides.

So, what happens when asset losses increase? Will the senior bonds receive all of the scheduled interest and principal? What stress scenarios can the transaction handle? All of these questions require an understanding of how each individual component of the model works and how all of those elements work together as a whole.

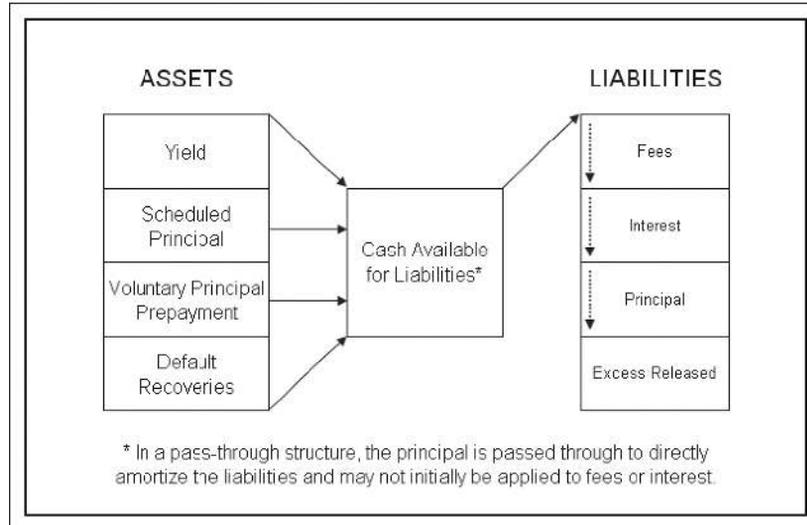
The best method of understanding a model is by changing individual assumptions one by one and evaluating the results. This allows a model operator to witness the cause and effect of each assumption. It is particularly valuable to set the assumptions to reasonable extremes so that result differences are more evident. This section first reviews the model as a whole and then walks through the results of changing each of the major assumptions.

### **THE COMPLETE MODEL IN REVIEW**

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A top-down approach separates the model into two distinct sections: assets and liabilities. On the asset side, cash is generated over time by yield, scheduled amortization, voluntary prepayments, and default recoveries. All of these methods of cash flow generation have assumptions that can vary greatly. However, for every set of assumptions for a scenario there is only a finite amount of cash.

The cash is used to pay for liabilities that set up the deal and fund the assets. Typical liabilities include fees, debt interest, and debt principal, which get paid in very specific orders and amounts depending on the cash flow waterfall. During each period and at the end of the legal final maturity date of the transaction, the finite amount of cash needs to be sufficient to cover all of the liabilities, otherwise parties in the transaction can suffer a loss. The basic model overview is presented in Figure 9.1.



**FIGURE 9.1** In structured transactions cash is typically created and used in a standard order.

Loss is protected against in a number of ways, predominantly through the use of credit enhancement. The top forms of credit enhancement include:

- Excess spread
- Reserve accounts
- Financial guaranties
- Overcollateralization

*Excess spread* is generated by the assets yielding more than the cost of the liabilities. This excess is typically the first form of enhancement used to cover loss. This coverage works in the model by reducing the asset balance by losses and attempting to reduce the debt by a commensurate amount. Since no cash is generated by defaults, the excess is used to maintain the commensurate debt reduction.

If excess spread is not sufficient to cover the liabilities, a *reserve account* can be drawn upon if set up at deal inception. Reserve accounts are either prefunded or grow to certain levels with excess cash. A prefunded reserve account gives comfort since the cash exists and is set aside, however it is an inefficient use of funds. Whenever a need occurs, the cash is withdrawn and typically reimbursed during better times.

A *financial guaranty* mechanically works the same as a reserve account and covers liability shortfalls. The terms of the guaranty are very important because they detail exactly which liabilities are covered, to what degree they are covered, and the priority of reimbursement to the insurer. Many of the monoline insurers that provide financial guaranties insure timely interest and ultimate principal. This

means that if there is ever an interest shortfall during the transaction or a principal shortfall at final maturity then the monoline would cover the difference.

Finally, the concept of *overcollateralization* is the ultimate safeguard to certain investors. Usually the assets are funded by more than one party, one of which assumes a riskier position. The senior party often has structural safeguards that allow for principal repayment priority over the subordinate debt holders. The senior debt holders model their risk by the ability to be repaid by final maturity. They do not care if the subordinate debt holders are repaid. In a stress situation, cash would be directed to the senior holders and typically the subordinate holders would be locked out. This could create a scenario where the senior debt holders are repaid, but the subordinates are not.

Whether or not senior debt holders are repaid largely depends on the percentage of debt relative to the subordinate holder. Any time a senior tranche advances less than 100 percent of the assets, with a subordinate piece making up the difference, the senior tranche is termed *overcollateralized*. In Project Model Builder, the senior debt was initially structured at 95 percent of the assets, with the subordinated debt making up 5 percent. This 95 percent can be considered the amount that the senior debt holders advanced against the assets, otherwise known as the *advance rate*. Because senior debt is often at a lower cost than subordinate debt, many analyses focus on maximizing the senior advance rate. If the senior notes start at \$95,000,000, at least that amount must be generated by the assets through scheduled principal, prepayments, and excess spread. If a scenario models losses at a rate where excess spread and reserve accounts are exhausted and the senior debt is still not repaid, the only other option is to rerun the scenario with a lower advance rate. This process becomes iterative until the optimal advance rate is determined.

## **UNDERSTANDING THE EFFECTS OF INCREASED LOSS**

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To observe the effect that increased loss has on a transaction, a few changes need to be made to the assumptions in Project Model Builder. Use the model under construction or the file *MB9-1.xls* in the Ch09 folder on the CD-ROM for this chapter. Change the gross cumulative loss rate (*pdrCumLoss1*) to 15 percent, the loss stress (*pdrLossStress1*) to 5, the timing scenario (*pdrLossTime1*) to Timing Curve 1, and the recovery rate (*pdrRecovRate1*) to 25 percent. The assumptions should be the same as in Figure 9.2. This is a very stressful scenario where a large amount of credit enhancement is necessary.

The major change that has taken place in this scenario is that the assets are assumed to have a base loss rate of 15 percent, which is stressed five times. The loss is also assumed to be distributed evenly over 360 periods based on timing curve 1. This means that a pool of unseasoned assets would expect to lose 75 percent of its principal to defaults over the life of the transaction. However, take a look at cell I5 on the Output Sheet. Notice that the gross cumulative loss is only 47.42 percent. This is because the assets are completely amortized by period 229 (noticeable in column

PREPAYMENT,DEFAULT,RECOVERY INPUTS						
Gross Cumulative Loss	Loss Stress	Loss Timing Curve	SDA Curves		Recovery Rate	Recovery Lag
15.00%	5	Timing Curve 1			25.00%	5

**FIGURE 9.2** Change the assumptions to produce a very stressful loss scenario.

L of the Cash Flow sheet) and avoid a good portion of the loss curve. Always keep in mind how much loss is actually taken since prepayments and defaults themselves alter assets’ amortization schedules.

The first source of credit enhancement to protect against this loss is excess spread. Notice that the assets are generating 9.00 percent, while the all-in cost of the liabilities is only 7.50 percent (Swap rate of 4.00% + Liability margin & fees of 1.50% + Asset servicing fees of 2.00%). The excess yield generated can make up for some of the lost principal in the transaction. Go to the Cash Flow sheet to cell AZ7. This is the principal due calculation for the senior debt. With no loss, there would be enough principal flowing through the waterfall to exactly meet this amount. However, with the loss amount assumed there is going to be a major shortfall in the next column when the debt is attempted to be paid. This shortfall is mitigated by the excess yield that is flowing through the waterfall and that is part of the Cash Remaining in cell AX7. See Figure 9.3 for more detail.

The next source of credit enhancement that is available to the senior debt is a reserve account. Check to make sure that the reserve account percentage (RsrvPercent) is set to 1.00 percent. This indicates that a prefunded reserve account was set up at the start of the transaction. Look at cell BC7 on the Cash Flow sheet. There should be amounts that are drawn from the reserve to cover the shortfalls

	AX	AZ	BA	BB	BC	BD	BE
1							
2							
3		<i>Senior Debt Principal</i>					
4	<b>Cash Remaining</b>	<b>Principal Due</b>	<b>Principal Paid</b>	<b>Unpaid</b>	<b>Unpaid Covered by Reserve</b>	<b>Unpaid</b>	<b>Cash Remaining</b>
5							
6							
7	218,502	265,539	218,502	47,037	47,037	-	-
8	235,618	281,589	235,618	45,971	45,971	-	-
9	252,626	252,626	252,626	-	-	-	-
10	269,251	269,251	269,251	-	-	-	-

**FIGURE 9.3** Shortfalls due to loss are first covered by excess spread and then other forms of credit enhancement such as reserve accounts.

created by the loss. Also, go to the reserve account section (columns BG through BL) on the Cash Flow sheet and notice how it is drawn down each period until it is exhausted.

Since there is no financial guaranty modeled in Project Model Builder the only form of credit enhancement left is overcollateralization. The advance rate is set to 95 percent, which means that given the asset size the senior notes initially start at \$95,000,000. With \$100,000,000 of assets the senior notes can have \$5,000,000 lost and still be repaid. The \$5,000,000 would be the nonrepayment of the subordinated notes.

However, even with the excess spread, the reserve account, and the overcollateralization, there is still not enough cash in the structure to pay the senior debt by final maturity. Look at cell CB366 on the Cash Flow sheet. This is the last possible period for the senior notes to receive a payment. At this period there is still a balance of ~\$34.9 million for the senior notes, which will most likely result in a loss to the senior debt holders. If such a scenario is deemed probable, what assumptions can be changed to prevent it from occurring?

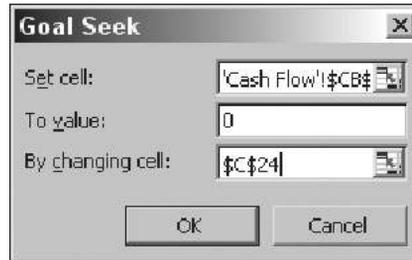
Excess spread is difficult to change. The asset yield can only be increased if the issuer has higher yielding assets that can be added to the pool. However, higher yielding assets are typically more risky and a new static loss analysis should be completed to see if the loss expectation needs to be increased. The liability rates are usually set to market rates which are set by the market. The other fees could possibly be negotiable, but would probably only have a marginal impact.

The reserve account could be increased, but this is an inefficient use of cash. A reserve account locks cash up, typically in *guaranteed investment contracts* (GICs), which earn a low rate of interest. This cash could be better used to create more assets.

In such a loss case, the most often-changed assumption is the overcollateralization amount dictated by the advance rate. Notice the amount due to the senior debt in the final period. Now change the advance rate for the senior debt to 92.5 percent. Because the amount issued by the senior entity is reduced, and the same amount of cash being is still being generated by the assets, the amount due to the senior debt in the final period is reduced. The advance rate can be continuously reduced (86.01 percent in this scenario) until there is no amount due to the senior debt in the final period and the notes are considered to be paid off.

An effective means of finding the optimal advance rate is by using the Goal Seek tool. The “Set cell” should be the final period senior principal balance (cell CB366). It’s “To value” should be 0. Finally, the “By changing cell” should be LiabAdvRate1 from the Inputs sheet. When this is run the advance rate will be minimized until the senior debt balance at the final period is zero. Figure 9.4 shows this in detail.

There are instances where the Goal Seek tool finds a solution that does not seem optimal. This may be because the maximum number of iterations is set too low. The option for the number of iterations that Goal Seek runs is controlled with the



**FIGURE 9.4** The Goal Seek tool can be used to find the optimal advance rate.

following steps. On the Excel menu bar, click **Tools** and **Options**. Then click the **Calculations** tab and select the **Iterations** option and, if necessary, in the Maximum iterations box enter 100.

## VARYING PRINCIPAL ALLOCATION METHODOLOGIES

Recall that there were two options for principal amortization built into the model: sequential and pro rata pay. The previous scenario assumes a pro rata pay scenario where the senior debt receives a pro rata share of the asset principal. This is less advantageous than a sequential pay scenario, because in such a scenario principal is paid to the senior debt first, until the senior debt is amortized. Observe the difference by changing the Principal Allocation Type on the Inputs sheet from pro rata to sequential—and remember to change the advance rate back to 95 percent. Now, instead of the senior debt having a balance of ~\$34.9 million, the debt has a balance of ~\$34.8 million. This difference is very slight; but this is largely due to the existing triggers that are set up in the model to direct cash to the senior notes. Try taking the triggers out to see how much of an effect the principal allocation method has on the amortization of the senior debt.

The difference is caused by the calculation and release of cash to pay the subordinated debt on a pro rata basis. The senior debt's periodic principal due is less than it would be under a sequential pay structure. Since the senior note pays down slower there is a higher interest cost and a higher balance in the final period. Also, until a trigger is breached, cash flows to pay the subordinated interest and principal.

A trigger is breached in both scenarios. Aside from the trigger that is preset to rapidly amortize the deal in period three, go to column AC on the Cash Flow sheet and look at period 25 (row 31). In that period, the default trigger turns on. This is caused by the cumulative defaults exceeding the amount set up on the Inputs sheet (Trigger\_Def). When the trigger is tripped, all cash that remains up to the senior principal payment is used to amortize the senior principal. Notice that cell AZ31

on the Cash Flow sheet calculates the senior principal due amount as everything that is remaining (AX31). If the trigger amount were decreased from 5.00 percent to anything lower, the trigger would trip earlier and direct more cash to the senior debt faster.

### Varying Prepayment Rates

The importance of prepayments is particularly heightened during times of increased loss. Prepayments can have a dual effect in a high stress scenario. On one hand they can help avoid parts of the loss curve by accelerating the amortization of the assets. While on the other hand the loans that are expected to prepay are the better credits who can switch to a lower interest rate, thereby decreasing excess spread and creating a higher concentration of poorer performing loans.

In the high loss example currently set up in Project Model Builder enter a 1% SMM for all periods in column N on the Vectors sheet. Set the prepayment curve on the Inputs sheet to SMM 2. Make sure the assumptions are the same as in Figure 9.5.

Now check the senior debt’s final period balance. Instead of ~\$34.9 million at the end there is now only ~\$14.4 million. This is primarily caused by avoiding the tail of the projected loss curve. Notice that the sum of all of the new defaults is ~\$34.6 million in the high prepay scenario. Previously the sum was ~\$47.4 million. Also contributing to the reduction in debt balance is a savings in senior debt interest due to the faster amortization of the debt. Compare the two scenarios total debt interest to notice the difference.

The opposite effect is possible in a more granular analysis. If the model were set up using a loan level analysis, certain obligors would be expected to prepay over others. Obligor with high interest rates and good credit would have an increased propensity to prepay than lower interest rate loans. This causes a decrease in the average yield of the assets termed *weighted average coupon deterioration* (WAC deterioration). With a decrease in asset yield over time, excess spread is reduced and sometimes a greater level of credit enhancement is necessary to make a transaction work.

PREPAYMENT/DEFAULT/RECOVERY INPUTS									
Description	Prepay Curve	Frangy Stress	Gross Cumulative Loss	Loss Stress	Loss Timing Curve	SDA Curves		Recovery Rate	Recovery Leg
Asset Pool 1	SMM 2	1	15.00%	5	Timing Curve 1			25.00%	5

LIABILITY INPUTS								
Debt Description	Advance Rate	Liability Interest Type	Floating Rate Curve	Fixed Rate	Loan Margin	Fees	Reserve Active	Prin Allocation Type
Senior Debt 1	95.00%	Floating	1-Month LIBOR		1.00%	0.50%	Yes	Pro Rata
Sub Loan	5.00%	Floating	Custom 1		0.00%	0.00%	No	Pro Rata

**FIGURE 9.5** Make sure all of the assumptions on the Model Builder are the same as in the figure.

## **VARYING LOSS TIMING**

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Project Model Builder was built with five possible loss timing scenarios. In general, there are three patterns that a transaction should be tested against: base case losses, front-loaded losses, and back-loaded losses. In Project Model Builder, Timing Curve 3 is clearly the front-loaded case and Timing Curve 5 is the back-loaded case. Assume that Timing Curve 1 is the base case.

Continuing with the assumptions from Figure 9.5, change the Loss Timing Curve (pdrLossTime1) to Timing Curve 3. Now take a look at the final period senior debt balance. It jumps to ~\$66.9 million! This is because less of the loss curve is being avoided by the faster amortization of the assets. If Timing Curve 1 is used a large part of the default curve is avoided because the assets amortize by period 229. Also, the upfront defaults deteriorate the assets from the start, which prevents excess spread from generating early in the transaction. With unseasoned assets most front-loaded loss curves will be very damaging to a transaction.

Now switch the Loss Timing Curve to Timing Curve 5. The final period senior debt balance falls to zero. A major reason for this is that the assets have amortized prior to taking the most strenuous part of the loss curve. Notice that the assets are amortized by period 265, but according to Timing Curve 5 one would only expect to have taken less than 30 percent of the loss curve through that timeframe. With ~70 percent of the loss curve avoided the gross cumulative loss is greatly reduced.

Loss timing is very important for the periodic flow of cash. Triggers can be tripped in certain timing scenarios, leading to changes in debt amortization methods. Reserve accounts can be emptied earlier or later. Total interest can be higher or lower. All of these effects can alter the weighted average life of the debt, vary the overall debt yield, and possibly cause debt holder loss.

## **VARYING RECOVERY RATE AND LAG**

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The most observable mitigant to loss is recovery. For structured finance transactions, recovery is a source of cash that is dependent on rates and time. Put the loss timing back to Timing Scenario 1 and change the recovery rate from 25 percent to 75 percent. It is clear from the TEST section of the Inputs page that the debt is paid off by maturity. (Not that the Inputs cell L6 switches from ERROR to OK) By increasing the recovery rate there is additional cash in the transaction. Recovery cash is purely for the benefit of the transaction and can be thought of as additional yield since it does not reduce the asset balance.

The other component of recovery is the amount of time it takes to receive the cash. This is important because as the recovery lag increases, the recovery benefit to the transaction diminishes. Change the recovery lag from 5 to 40. By doing this, the TEST section shows that the senior debt balance is not paid off by final maturity. With a longer recovery lag the debt is paid down slower and accrues more interest than with a shorter lag.

## **THE VALUE OF A SWAP**

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Project Model Builder was created with a swap in place that fixed the liabilities to a 4 percent interest rate. Without such a hedge the interest rate on the notes would be subjected to the floating rate curve, which in the example is much higher than 4 percent. Keeping the 75 percent recovery rate, set the recovery lag back to 5 so that the senior debt pays off and then turn the Swap Active cell (Swap\_Active) on the Inputs sheet to No. By doing this, the TEST section shows that the senior debt no longer pays off by maturity because of the increased interest cost without a swap.

## **ADDITIONAL TESTING**

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Every assumption that has been created in Project Model Builder has an effect on the results. Try changing each assumption, check the TEST and Output sheet to see the result, and then go over the Cash Flow sheet in detail to see how each section has changed. It is extremely important to understand cause-and-effect relationships because when actual transactions are modeled often times a result is returned that can be unexpected. These unanticipated results need explanations, which can only be done by going backward through the process to understand what assumptions caused the result.