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Introduction
This guide introduces the reader to the Morningstar CMBS Subordination Model. It starts out with a description of the basic concepts underlying the model and details its primary features.

As with any model, ours utilizes a number of assumptions. We endeavor to base these assumptions on empirical data whenever robust data is available and default to industry experience and intuition when it is not. This paper discusses the concept behind the assumptions.

Section 1–Basic Concept
The Morningstar CMBS Subordination Model derives the credit support levels needed at each rating for a portfolio of commercial real estate loans collateralizing the CMBS transaction. These credit support levels are driven by the combination of Morningstar’s assessment of each property and its corresponding loan and our view of the relationship between certain loan- and portfolio-level characteristics with the portfolio’s overall probability of default (PD) and prospects for recoveries given loan default. Morningstar’s approach in developing this model:

- Employs an intuitive and easily-understandable methodology to facilitate model transparency;
- Maximizes the use of available and sufficiently robust relevant empirical data; and
- Accounts for various portfolio-level characteristics and concentration risks that result in justifiable differentiation in credit support across heterogeneous portfolios.

The first step of Morningstar’s rating process is the analysis of a representative sample of the loans that collateralize the transaction. This assessment determines the sustainablenet cash flow (NCF) and typically values each property using the direct capitalization methodology. It then derives the sustainable debt-service coverage ratio (DSCR) and beginning and ending loan-to-value ratios (BLTV, ELTV) for each corresponding loan. A comprehensive description of Morningstar’s loan analysis approach is beyond the scope of this paper.

Morningstar typically does not analyze every loan in the portfolio. For those loans not analyzed, Morningstar applies a stress assumption to the loan originator’s underwritten NCF to arrive at an estimation of the sustainable NCF.

Morningstar’s sustainable NCF and cap rate for each property, along with the corresponding loan characteristics, are then subjected to defined sets of base stresses in the CMBS model to derive the required credit support at each rating category. Each set of stresses gauges the likelihood of loans to default during the term period and at the balloon date commensurate with economic environments represented by the rating categories.

Each set of stresses includes:

- NCF declines during the term of the loan and at the balloon date that reflect worsening economic conditions,
- Cap rate increases that reflect deteriorating demand for CRE investments,
- Balloon loan constants to reflect restrictive lending conditions when the existing loan needs to get re-financed,
Time to default assumptions that limit the credit to loans which amortize,
Loan liquidation time assumptions that impact the aggregate special servicer fees and accrued interest on P&I advances, and
Interest rate assumptions on interest due the servicer for P&I advances.

Each of these stresses are tiered by rating category with the most onerous commensurate with the highest rating category to reflect extremely stressed economic, CRE market and lending environments. The stresses associated with the lowest rating category, while substantially less painful than that at the highest rating level, still reflect declines. The model, therefore, discounts the positive performances observed in the empirical data. Several of the stresses also differ across property types.

The model also penalizes loans that comprise a substantial proportion of the portfolio, as measured by the outstanding principal balance, with an additional NCF haircut. The magnitude of this penalty increases non-linearly with the proportion. For example, all else being equal, the additional NCF reduction applied to a loan that represents 20% of the portfolio is substantially more than twice the reduction applied to a loan that represents 10% of the portfolio.

Section 2–Determining Probability of Default and Loss Severity
Morningstar’s CMBS Subordination Model derives the required credit support level at each rating level by computing the probability of default (“PD”) and loss severity for each loan to arrive at the expected loss. This is performed separately for term and balloon default events. A conditional formula based on the logic that term default occurs before balloon default is then used to arrive at the overall expected loss for each loan.

We discuss the model’s treatment of these two potential default events separately.

Term Default
The model determines the likelihood of a term default for each loan by:

1. First subjecting Morningstar’s sustainable NCF for the loan to a NCF haircut that simulates the potential decline in net effective rent over the term of the loan. The magnitude of this decline represents the maximum assumed decline in NCF on the property during the term of the loan.
2. The Morningstar sustainable NCF is then further reduced by a loan concentration haircut that penalizes loans that comprise a substantial portion of the portfolio.
3. Next, the resultant NCF is further reduced by a property type concentration haircut that penalizes loans backed by property types that comprise a high proportion of the overall portfolio.
4. The resultant NCF is then further reduced by a geographic concentration haircut that penalizes loans backed by properties located in regions that comprise a high proportion of the overall portfolio.
5. The resultant stressed NCF and the terms of the loan are then used to determine the loan’s stressed DSCR. This DSCR is the lowest coverage ratio projected by the model for the subject rating category.
6. The loan’s probability of default during the term of the loan is then derived by translating this “low-point” DSCR into a PD based on a Morningstar empirical study of the correlation between DSCR and PD.

This approach assigns a probability of default to each loan that will be greater than zero, but less than 100%. In other words, loans with very high DSCR will still have some, albeit low, likelihood of defaulting. Conversely, low DSCR loans won’t always default though the likelihood is quite high.

The other component in computing the expected loss during the term of the loan is loss severity. It consists of two sources — Lost Principal and Special Servicer Costs. In practice, a special servicer has a number of tactics to maximize the recoveries on problem loans, including modifying the terms of the loan, foreclosing on the loan, selling the loan, etc. The model simplifies these actions by assuming that the special servicer forecloses on all loans which experience a term default. We believe this is a conservative assumption that leads to higher projected principal losses.

Lost principal is calculated as the difference between the outstanding loan balance at the time of default and the stressed property value. The model computes the loan balance based on empirically based time-to-default assumptions and the terms of the loan. The stressed property value is arrived at using the stressed NCF and a ratings-adjusted cap rate.

Special servicer costs include the fees earned by the special servicer while the loan is being specially-serviced, interest on any P&I advances that the servicer makes, and the liquidation fees due the special servicer for selling the foreclosed property. The special servicer fee is dependent upon the period of time the loan is specially serviced. The model uses assumptions of this time period tiered by rating category. The expected loss for a loan during the term of the loan is then calculated as the product of its probability of default and the loss severity.

**Balloon Default**

The overwhelming majority of loans backing CMBS deals to date do not fully amortize by the loan’s maturity date. As such, most loans have a balloon date. Borrowers are required to secure take-out financing for the remaining principal balance by this date. Failure to do so triggers a default event and the loan becomes specially-serviced. Balloon default is therefore a binary event.

The model tests the ability of each loan to get refinanced at its balloon date by comparing the loan’s stressed refinance DSCR and LTV to assumed refinancing threshold requirements. Morningstar stresses the sustainable NCF and cap rate, and then applies a stressed refinance loan constant to arrive at the loan’s refinance DSCR and LTV ratios. If these DSCR and LTV metrics pass this test, the loan is projected to be re-financed (PD equals zero and there is no loss).

If they do not, the model assumes that the loan becomes specially serviced and the special servicer takes one of two actions. Note that the model conservatively assumes the borrower is either unable or unwilling to infuse equity at the refinance date.
If the existing loan’s DSCR is greater than an assumed special servicer loan extension threshold, the model assumes that the special servicer extends the loan for up to two years. Otherwise the model assumes the special servicer will initiate foreclosure proceedings and the property is eventually sold. An assumed timeframe from the balloon date to the date of liquidation is used for calculating the special servicer fees incurred. This timeframe is tiered by rating category. The model also calculates any needed P&I advances and the liquidation fee. The liquidation price is the stressed value calculated for the property commensurate with the rating category. In this scenario, the model assumes that there is no change in property value from the balloon date to date of liquidation. Morningstar believes this is a conservative assumption because the stressed value used in testing balloon defaults are based on a study of net effective rent movements that focused solely on declines.

If the existing loan’s DSCR is indeed greater than the assumed special servicer loan extension threshold, then over the loan extension period, the model may assume some growth in NCF generated by the property, better loan conditions and an improved CRE market as manifested in a lower refinance loan constant and cap rate, respectively. Morningstar believes these are reasonable assumptions since the balloon date stresses are quite onerous and empirical data at the national level exhibit no incidences of NCF declines over 15 year periods. However, in instances where the loan term is less than 10 years, the benefits of improvement during the extension period may be partially or fully eliminated.

At the conclusion of the extension period, the model again tests whether or not the loan gets re-financed. The improved DSCR and LTV ratios are compared to the assumed takeout financing threshold requirements. If this test is passed, then the loan is taken out in whole. There is no principal loss but losses in the form of special servicer costs (special servicer fee and interest on P&I advances) are incurred.

If the loan is still not able to get refinancing, the model assumes the special servicer initiates foreclosure proceedings and the property is eventually sold. Losses in this scenario include a likely principal loss along with special servicer costs (special servicer fee, interest on P&I advances and liquidation fee).

**Section 3—Details on the Model Assumptions**

In this section, we cover each of the model’s primary concepts and features. These include:

- NCF Reduction Stresses
- Cap Rate Adjustments
- Loan Concentration Adjustments
- Property Type Concentration Adjustments
- Geographic Concentration Adjustments
- Translating DSCR to Probability of Default
- Differentiating across Loan Terms
- Time to Default Assumptions
- Refinance Loan Constant
- Liquidation Period
- Special Servicing Costs
- Overall Expected Loss
This section should provide the reader with a clearer and more detailed understanding of the underpinnings of the model and the assumptions used in arriving at the credit support levels.

(a) NCF Reduction

The NCF stresses are based on empirical data of average annual vacancy rates and effective rents for different property types in the United States at the national level. We also used regional and MSA level performance for guidance into how much worse future performance could get. In many instances, the data goes as far back as 1980 and ends in 2007. Morningstar’s analysis of this data looked at the annual Net Effective Rent which is the product of occupancy rate and effective rent. Since our focus is on determining the magnitude of NCF stress at the various rating levels, we concentrated on the periods of falling Net Effective Rent.

Our approach takes the observed net effective rent declines and applies it as tiered base NCF stresses at each rating category. The “AAA” rating, representing the most stressful economic environment, utilizes a base NCF stress that is well in excess of the worst observed declines at the national level. Conversely, the “B” rating, representing a mildly stressful economic environment, is stressed with an NCF decline that is a fraction of the worst observed event.

The empirical data shows that certain property types experienced greater NCF volatility than others. This is reflected in the model. It should be noted, however, that the NCF stresses are not solely based on empirical data. Much consideration was also given to possibility of unprecedented future events. For instance, though retail properties at the national level have only experienced three very minor net effective rent drops over any 10-year window spanning 1980 to 2007 (the largest was -1.1%), the model’s base NCF stresses reflect our view that changes in consumer spending behavior will negatively impact retail performance more than evidenced in the data.

We utilize two distinct sets of base NCF stresses—one for defaults during the term of the loan and the other for defaults at the loan balloon payment date. The stresses for term default are more severe than those for balloon default. Details of these approaches follow.

It should be noted that there was no data for self-storage, healthcare and other more esoteric property types. Self-storage and other were given the same stresses as industrial properties. Healthcare properties were stressed at levels in excess of that applied to the most volatile observed property type (office) to reflect our view of its relative riskiness.

Furthermore, the empirical data used do not differentiate between property subtypes (e.g., regional malls and neighborhood shopping centers, CBD office and suburban office). Given these restraints, the model currently differentiates base NCF stresses at the property types but not at the sub-property level.

**Term Default NCF Stress**

The NCF decline assumptions for term default are based on the worst drops in net effective rents at the national level from the peak of the market to bottom in the period analyzed. Since the majority of deals have 10 year maturities, we limited the period of decline to 10 years or less. In many instances, the largest observed declines occurred over a few years. Thus, the peak-to-trough declines are often markedly more severe than declines over full 10 year spans.
The empirical data also show that certain property types have demonstrated a propensity for greater negative NCF volatility than others. Of the more traditional property types, office and hospitality properties have experienced substantially greater NCF declines than retail and multi-family properties. Accordingly, the model applies base NCF declines by property type to reflect this observed distinction.

By using these severe and often short-term drops as the NCF stress, the model projects how low the DSCR for each loan could get in each rating category and translates this into the loan’s probability of default.

The base NCF decline assumptions are tiered by rating category with the worst observed peak-to-trough decline used as the baseline for the single-A rating stress. In this way, the stresses used for the double-A and triple-A rating categories are more onerous than the events observed to date.

**Balloon Default NCF Stress**
The base NCF stress assumptions used in the model’s balloon default projections are based on the worst observed drops in net effective rents over ten year periods in the period analyzed. As stated earlier, these stresses are often less onerous than those applied in the model’s term default projections.

As in the case with the peak-to-trough observations, empirical data support the view that certain property types have a propensity for greater negative NCF volatility than others over 10-year periods. This too is reflected in the model’s base assumptions for balloon default NCF stresses.

The base NCF decline assumptions for balloon default projections are tiered also by rating category with the worst observed peak-to-trough decline used as the baseline for the single-A rating stress.

For loans with terms less than 10 years, the stresses may be adjusted to reflect the relevant time exposure.

**(b) Cap Rate Adjustments**
Morningstar’s loan analysis process includes the valuation of each property using a cap rate that takes into account the current CRE environment. The model stresses this cap rate at each rating category to reflect Morningstar’s belief that the balance between sellers and buyers in the commercial real estate market shifts along with the economic environments. Accordingly, higher rating categories are stressed with a higher base cap rate adjustment to reflect more restrictive property transaction environments.

This adjustment results in more severe principal losses at the higher rating categories since such losses are computed as the difference between the outstanding loan balance and Morningstar’s stressed value.
(c) Loan Concentration Adjustment
While the presence of 60+ loans in a typical fusion/conduit transaction provides diversity benefits that lessen the effects of one or a few loan defaults, the inclusion of large balance loans introduces event risks that can have heightened negative impact on the transaction. Morningstar addresses this risk by further adjusting the NCF downward on each property using a sliding scale tied to the loan’s beginning balance as a percentage of the aggregate portfolio beginning balance. Under this approach, the base NCF adjustment on a single loan that accounts for 20% of the portfolio is greater than the collective adjustments on two loans that each represent 10% of the portfolio.

A non-linear equation is used to size the NCF adjustment to provide increasingly punitive adjustments as the loan concentration increases. In contrast to a linear function, it applies very small reductions on the NCF of smaller loans and much higher reductions on loans that represent substantial portions of the portfolio. Contrasted with an exponential function, it imposes slightly larger reductions on smaller loans but the increase in penalty on larger loans does not increase as rapidly.

The non-linear equation applies adjustments on loans that represent more than 0.25% of the portfolio balance. Examples of the adjustment amount are provided below:

**Loan Concentration Adjustment**
Formula is \( f(x) = a' \times x^b \), where \( x \) is the loan size as a percentage of the portfolio balance and the coefficients are:

<table>
<thead>
<tr>
<th>Coefficients</th>
<th>Values</th>
<th>Examples:</th>
<th>X</th>
<th>Haircut</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>1.0110</td>
<td>1.0</td>
<td>5.4</td>
<td></td>
</tr>
<tr>
<td>b</td>
<td>0.6342</td>
<td>5.0</td>
<td>15.1</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>10.0</td>
<td>23.5</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>20.0</td>
<td>36.4</td>
<td></td>
</tr>
</tbody>
</table>

It is important to point out that this loan concentration adjustment is applied as a percentage of the NCF reduction. For instance, if the NCF reduction is 45% and the loan concentration adjustment is 5%, then the reduction to the unstressed NCF is 5% of 45%, or 2.25%. On a property with a Morningstar sustainable NCF of $10 million, this loan concentration reduction is $225,000.

By tying the loan concentration adjustment to the NCF reduction rather than directly to the unstressed NCF amount, the model is able to tier the adjustment across property types and rating categories. Less stable property types, such as hotels, are impacted more and the adjustment at the higher rating categories is greater.

(d) Property Type Concentration Adjustment
Economic factors and world events affect the performance of each property type to different degrees. For instance, the combination of the dot-com recession and 9/11 terrorist attack generally had a substantially greater impact on hospitality properties than on multi-family...
properties. High concentrations of any property type in a deal would thus subject the deal’s performance to additional risks.

The majority of fusion/conduit transactions are typically well diversified across most or all of the major property types. Some deals, however, might have more concentration in one or more types and are therefore more exposed to property type concentration risk. This is particularly the case in large loan transactions.

The type of property with an excessive concentration also matters. For instance, we view a pool comprised of 70% office properties as riskier than one with 70% multi-family properties.

Morningstar addresses the risks inherent in portfolios with high property type concentrations in two ways:

- First, the model’s base NCF stresses differ across property types. When a portfolio contains a high concentration of the more volatile property types (e.g., office, hospitality), the differences in NCF stresses results in higher credit support requirements.
- Second, a property type concentration adjustment is applied to further stress the NCF of those properties with high concentrations. This affects both concentrations in the more-volatile and less-volatile property types.

The magnitude of the property type concentration adjustment increases as the overall exposure to the property type increases via a linear function. For instance, each property of the type that represents 50% of a portfolio would be stressed harder than if the type represented only 35% of the overall balance. The adjustment is applied to all loans backed by properties with high concentrations, not just the incremental excess above the threshold.

As in the case of the loan concentration adjustment, the property type concentration adjustment is applied as a percentage of the NCF reduction. This has the effect of tiering the adjustment by property type and rating category. Relatively volatile property types (i.e., office, hospitality, healthcare) are adjusted downwards further than the less volatile types (i.e., multi-family, retail, industrial).

(e) Geographic Concentration Adjustment
Empirical data of the revenue generating performance of each property type clearly show variances in declines at the regional levels during the times of economic stress. Properties in certain regions have performed markedly worse than the national average.

The model’s base NCF stresses are based on historical declines at the national level. Geographic concentrations therefore introduce additional risk. Morningstar addresses this risk by applying a geographic concentration adjustment to the stressed NCF of the properties in highly concentrated regions.

The geographic concentration adjustment is applied to those properties in regions with high concentrations. The magnitude of the adjustment is the same for each region and grows as the degree of concentration increases. Again, as in the case of the Loan Concentration Adjustment, the geographic concentration adjustment is applied as a percentage of the NCF reduction.
Morningstar breaks up the United States into ten regions: New England, Mid-Atlantic, Southern Atlantic, Southern East Coast, Southern West Coast, Midwest-Eastern, Midwest-Western, Northwestern, West-Mountain and Western-South Pacific.

(f) Translating DSCR to Probability of Default
After all the relevant NCF adjustments have been applied to the Morningstar sustainable NCF in the term default analysis, the model calculates the DSCR for each loan and uses this to determine the loan’s probability of default. In the case of partial IO loans, the DSCR ratio is calculated based on the loan’s amortization phase.

Once the DSCR has been computed, the model translates this ratio into a probability of default for the loan using an equation derived from an internal regression analysis of loans in conduit/fusion CMBS transactions issued between 1999 and 2007 tracked by Morningstar. The analysis allows us to quantify the correlation between the DSCR on a loan and its default probability, by property type. Two loans with identical DSCR ratios will have different probabilities of default if they are backed by different property types. Morningstar may periodically update the regression analysis and update the model if deemed appropriate.

A loan with a strong DSCR ratio still has a probability of default. Conversely, the model does not automatically default a loan with a DSCR lower than 1.00x.

(g) Differentiating across Loan Terms (Amortizing vs IO Loans)
The model takes each loan’s financing terms into account thereby differentiating between amortizing loans, IO loans and partial IO loans. This directly impacts the calculations that lead up to loss severity for both term and balloon defaults.

Amortizing loans get credit for the reduced loan balance up to an assumed time of default in the term default computations. Since loss severity (in dollar terms) is the amount by which the loan balance exceeds the property value, with all else being equal, amortizing loans experience lower losses following default.

Conversely, due to the lower debt service payments, the model gives favorable treatment to IO loans in the probability of default calculation for term default. This could partly counterbalance the higher loss severity. This is however, not the case in balloon default analysis since the model assumes that at the balloon date, the IO loan is refinanced by an amortizing loan, often at a higher loan constant.

(h) Time to Default Assumptions
The model’s calculation of a loan’s balance at the time to default is predicated on assumptions of the time lapsed from the CMBS transaction’s origination date to the loan default date. The model affords credit to the amortization on loans based on this timing. IO loans receive no such credit and partial IO loans only receive credit to the extent the interest-only period has lapsed prior to the assumed default date.

The model calculates loss severity as the amount by which the property value falls short of the outstanding loan balance. In the term default analysis, credit given for amortization lowers the
loan balance which, in turn, lowers the lost severity and ultimately culminates in lower credit support requirements.

The assumptions for time to default in the model are based on an internal analysis of defaulted loans in CMBS transactions tracked by Morningstar. This analysis defines loans experiencing 60+ days delinquency as defaulted loans. It uses the CMBS issuance date as the starting point (instead of the loan origination date) and the time the loan first became 60+ days delinquent as the proxy for the default date. The study was broken out by property type and cumulatively recorded loan defaults.

The assumptions used are accordingly segregated by property type and tiered by rating category. This tiering is tied to the percentage of observations that occurred by the assumed timeframe as shown below:

<table>
<thead>
<tr>
<th>Rating Category</th>
<th>% of Observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>AAA</td>
<td>10</td>
</tr>
<tr>
<td>AA</td>
<td>20</td>
</tr>
<tr>
<td>A</td>
<td>25</td>
</tr>
<tr>
<td>BBB</td>
<td>30</td>
</tr>
<tr>
<td>BB</td>
<td>40</td>
</tr>
<tr>
<td>B</td>
<td>50</td>
</tr>
<tr>
<td>B-</td>
<td>50</td>
</tr>
</tbody>
</table>

For example, the AAA assumption for time to default is the number of months within which approximately 10% of the recorded defaults occurred. This assumption is quite conservative since 90% of the time the defaults occurred later and we thereby give minimal credit for amortization. The BBB assumption reflects the number of months within which 30% of the defaults occurred. Here we give more amortization credit.

(i) Refinance Loan Constant
The model assumes that the lending environment at a loan’s balloon date will typically be more restrictive than when the loan was initially originated. This is achieved by tiering loan constants by rating category. These constants are based on an internal study of loan constants on loans in CMBS transactions. Note that there are historical periods where the loan constants were higher than the loan constant used in the model.

(j) Liquidation Period
After the property backing the foreclosed loan becomes an REO property, Remic rules give the special servicer 3 years to sell the property. The model’s assumption for the time it takes to complete the sale is tiered by rating category with 18 months assumed for the triple-A scenario and quicker sales moving down the ratings scale. A longer sales period has the effect of incurring more special servicing fees and interest on any P&I projected advances.
(k) Special Servicing Costs
When a loan experiences a default either during its term or at the balloon date, the model assumes that it is transferred to the special servicer and costs associated with such servicing activities are borne by the trust. The model specifically accounts for three such costs:

- Special Servicing Fee
- Interest on P&I Advances
- Liquidation Fee

The model’s treatment of each cost is detailed separately.

**Special Servicing Fee**
While a loan is classified as a “specially-serviced loan”, a fee is earned by the special servicer. This fee is at an annual rate, as dictated by the deal’s Pooling and Servicing Agreement (PSA), based on the outstanding principal balance. There is often also a minimum monthly fee. The model allows the user to enter the fee rate and the minimum monthly amount. It uses the default event as the time when the loan becomes specially serviced.

The period of time this fee is incurred is driven by the default event, any extension period, and any liquidation period.

- For term defaults, the model assumes the servicer forecloses on the loan and sells the property. The special servicing fee is calculated over an assumed liquidation period commensurate with the rating category.
- For balloon defaults in which the loan is not extended, the model assumes the servicer forecloses on the loan and sells the property. The special servicing fee is calculated over an assumed liquidation period commensurate with the rating category. This is the same treatment as for term defaults.
- For balloon defaults in which the loan is extended and the loan gets refinanced at the end of the extension period, the special servicing fee is calculated over the extension period (up to two years).
- For balloon defaults in which the loan is extended but the special servicer ultimately forecloses on the loan because the borrower is unable to secure refinancing at the end of the extension period, the special servicing fee is calculated over the sum of: (a) the extension period and (b) the assumed liquidation period commensurate with the rating category.

For balloon defaults in which the loan is extended but the special servicer ultimately forecloses on the loan because the borrower is unable to secure refinancing at the end of the extension period, the special servicing fee is calculated over the sum of: (a) the extension period and (b) the assumed liquidation period commensurate with the rating category.

The principal balance used in the fee calculation is the outstanding balance at the time the model projects the default event. It does not account for any amortization that may occur after the default event and the fee calculated is likely higher than it should be.

**Interest on P&I Advances**
The servicer is required to advance on any shortfalls on the monthly loan payments that the borrower is not able to cover, subject to a recoverability standard. The model uses the stressed NCF as the amount of funds available to cover loan payments. It assumes that the borrower is unable or unwilling to come out of pocket to cover any shortfalls.
An appraisal reduction is determined as part of the calculation of the amount the servicer advances. The purpose of this reduction is to protect the trust against advances that might not be recoverable. Thus, though there is a loan payment shortfall, the appraised value of the property might be low enough that the servicer would not cover any or a portion of the shortfall.

An appraisal is performed as part of the appraisal reduction. The model uses its calculated stressed value as the appraisal amount. The appraisal reduction is based on a percentage of this appraisal amount. This percentage is dictated by the deal’s PSA and is often consistent with an industry standard. The model applies this industry standard.

There are three scenarios in which the model determines if P&I advances are needed:

- For term defaults. Here the stressed NCF falls short of the loan payment due and the special servicer forecloses on the loan. The advance is made over the assumed liquidation period commensurate with the rating category.
- For balloon defaults where the loan is not extended because the NCF falls short of the loan payment and the special servicer forecloses on the loan. The advance is made over the assumed liquidation period commensurate with the rating category.
- For balloon defaults in which the loan is extended but the special servicer ultimately forecloses on the loan because the borrower is unable to secure refinancing at the end of the extension period. The advance is made over the sum of: (a) the extension period and (b) the assumed liquidation period commensurate with the rating category.

The interest due on the P&I advance accrues at an interest rate dictated by the deal’s PSA. It is typically based on an interest rate index. The model uses assumed interest rates tiered by rating category in its calculation of the interest accrued. The model assumes this interest is paid to the servicer when the loan is liquidated.

**Liquidation Fee**

The special servicer is due a fee for realizing recoveries upon liquidation of the loan or when the loan has been refinanced after it has been specially serviced (loan extension in this instance). This liquidation fee is computed by applying an industry standard rate to the net liquidation proceeds. The model uses the stressed property value determined by the model as the proxy for net liquidation proceeds. This results in a higher calculated fee and partially compensates for liquidation expenses that are not addressed by the model.

The model assumes no change in the value of the property from the time foreclosure is initiated to the time the loan is liquidated. Given the onerous assumptions used in the model leading up to the default event, this assumption is likely conservative.

It should also be noted that deals typically contain a purchase option that allows the holder of this option to purchase the loan. In some situations there is a mezzanine loan on the property and that lender has the option to purchase the loan held in the CMBS trust. If either sale were to occur, the special servicer is not due the liquidation fee. The model ignores this possibility thus making the approach more conservative.
(l) Overall Expected Loss

Having separately calculated expected losses for a loan in the term and balloon default analyses, the model then computes the loan’s overall expected loss. This calculation uses a conditional equation based on the logic that:

- A loan will either experience a term default, a balloon default, or none at all,
- The probability of a loan experiencing a term default or a balloon default are independent of each other, and
- A term default would occur first and a balloon default is possible only if the loan does not experience a term default.
- The conceptual equation is as follows.

\[ EL = ELt + [ELb \times (1-PDt)] \]

Where, 
- \( EL \) is the overall expected loss,
- \( ELt \) is the term expected loss,
- \( ELb \) is the balloon expected loss, and
- \( PDt \) is the term probability of default

The weighting between the term and balloon scenarios might be adjusted if it is determined that the weighting does not properly reflect the overall risk of the loan.