Moody’s Approach to Rating RMBS Using the MILAN Framework

Summary

This Rating Methodology describes our global¹ approach to rating residential mortgage-backed securities (RMBS). Under our approach, we first perform a portfolio analysis, including a loan-by-loan assessment of the securitized collateral pool. The results of this analysis are the portfolio’s expected losses (Portfolio EL) and Moody’s Individual Loan Analysis Credit Enhancement (MILAN CE). The Portfolio EL captures our expectations of performance considering the current economic outlook, while the MILAN CE captures the loss we expect the portfolio to suffer in the event of a severe recession scenario.

We use the two outputs from our portfolio analysis to determine a probability loss distribution. The probability loss distribution associates a probability with each potential future loss scenario for the portfolio.

In our structural analysis, we use a cash flow model in order to assess the structural features of the RMBS transaction. The structure is assessed using each scenario in the loss distribution. Finally, we assess the counterparty default risk and assess the legal risk to derive the final ratings.

Our ratings on RMBS tranches are based on the expected losses (Tranche EL) posed to investors. The Tranche EL considers both the probability and the severity of credit losses that investors may suffer.

We do not apply this methodology approach rigidly in all circumstances; our rating committees will, where appropriate, consider all other factors that we deem relevant to our analysis, which could affect the rating outcome. As transactions season, some of the methodology criteria, such as the originator assessment, could become less relevant or not relevant to the analysis, while others, such as realized collateral performance, could become more relevant.

¹ Excludes US
When rating RMBS, we first perform a portfolio analysis. The results of the portfolio analysis are the Portfolio EL and the MILAN CE assumptions.

- **Portfolio EL**: captures the expected loss on the portfolio considering our current economic outlook. We carry out a performance analysis to determine the Portfolio EL assumption, incorporating historic performance and expectations of future performance.

- **MILAN CE**: captures the stressed loss we expect the portfolio to suffer in the event of a severe recession scenario. We use the MILAN model to help determine the stressed loss assumption. Under our structural analysis, the MILAN CE defines the credit enhancement consistent with the highest rating achievable in the country.

To help determine the Portfolio EL and MILAN CE, we supplement the portfolio analysis with (1) an originator and servicer assessment; (2) a data quality assessment; and, specifically for the MILAN CE (3) a sovereign risk assessment. Some of these analytical areas, such as originator assessment, could also be less relevant as transactions season and performance data becomes available.

We use the two outputs from our portfolio analysis to determine a probability loss distribution. The probability loss distribution associates a probability with each potential future loss scenario for the portfolio. For RMBS portfolios, we typically assume the loss distribution is lognormal. We use the Portfolio EL and MILAN CE assumptions to define a lognormal loss distribution for the portfolio (see Appendix 2).

Our portfolio analysis assesses the range of possible losses the portfolio will ultimately suffer assuming transaction parties perform as intended. However, a counterparty default may cause additional portfolio losses. We include those additional losses in our counterparty default risk analysis, described in the structural analysis section, below. We also assess the impact of the timing of portfolio losses as part of our structural analysis.
Deriving the MILAN CE

We use the MILAN model to help evaluate the collateral and determine the MILAN CE. MILAN is a scoring model that we use to assess the credit risk of residential mortgage loan portfolios. It involves an assessment of individual loans as well as overall portfolio diversification, estimating the portfolio’s loss in a severe recession scenario. Appendix 1 contains a step-by-step guide of our collateral analysis, which incorporates the MILAN model as one of the main tools to determine the portfolio’s MILAN CE assumption.

The MILAN model relies on country-specific assumptions regarding loan characteristics and their impact on default probability and loss severity in a severe recession scenario. Appendix 4 contains details of these assumptions per country.

The final MILAN CE takes into account the calculated model result and any other qualitative and quantitative aspects of the portfolio analysis.

Deriving the Portfolio EL

We carry out a performance analysis to determine the Portfolio EL assumption, incorporating expectations of future performance considering the current economic outlook, and benchmarking against comparable portfolios.

The analysis of historical performance data allows us to extrapolate portfolio losses into the future. We consider forecasts of economic variables, evaluating how changes in these variables will affect the future performance of various types of loans in the portfolio.

We review the historic performance of the type of loans included in the securitized collateral pool, other performance data from the same or comparable originators/servicers and any other data available in the mortgage market or other comparable markets. The reviewed performance data includes delinquencies, defaults, loss severities and prepayment rates.

Originator Quality

Our originator quality analysis consists of a review of the originator’s past loan performance, and its policies and practices, all of which may affect future loan performance. We typically focus on the following areas:

- loan performance
- originator ability: sales and marketing practices, underwriting policies and procedures, property valuation policies and procedures, closing policies and procedures, and credit risk management
- originator stability: financial stability, quality control and audit, management strength and staff quality, and technology

We use the results of the originator quality analysis to adjust our assumptions when appropriate. Characteristics not addressed elsewhere in the portfolio analysis, along with originator-specific practices, may influence loan performance, positively or negatively. Average originators in a specific country would typically not attract any adjustment. See Appendix 4 for details of our approach to originator assessments in certain countries.
Servicer Quality

Our servicer quality analysis addresses the expected impact that servicer practices will have on the performance of mortgage loans. We separate the analysis of servicing from that of origination, even if both capacities are handled by the same entity. Strong originators are not necessarily good servicers, and vice versa.

We typically assess the quality of servicing with regard to the following servicing function areas:

- Staff, management and strategy
- Loan administration
- Arrears management
- Loss mitigation
- Asset management
- IT systems and reporting
- Financial stability

We use the results of the servicer quality analysis to adjust our assumptions when appropriate. Characteristics not addressed elsewhere in the portfolio analysis, along with servicer-specific practices, may influence loan performance, positively or negatively. Average servicers would typically not attract any adjustment.

Data Quality

A key element of our portfolio analysis is an evaluation of the mortgage loan characteristics. In assessing those characteristics, we typically rely on data provided by the originator of the transaction. Consequently, our assessment depends on the extent to which the data are likely to provide an accurate representation of the asset characteristics. We perform a data quality assessment to evaluate the quality of the data provided, including a review of third-party verification reports and representations and warranties for the transaction.

Sovereign Risk

Sovereign risk is considered in our portfolio analysis by incorporating the country’s maximum achievable rating. When generating our assumed portfolio loss distribution, we define MILAN CE as the credit enhancement consistent with the highest rating achievable in the country (see Appendix 2).

If we consider the jurisdiction of the assets, originator, or transaction SPV to be exposed to country-specific systemic risks, our analysis identifies these risks and factors them into the ratings. We may incorporate such risks into the analysis by, for example, modifying appropriate assumptions, using rating caps, or defining minimum credit enhancement levels required to achieve a particular rating.

Additionally, mortgage loans denominated in a currency that is different from the country’s local currency face redenomination risk. We may put a cap on the maximum rating achievable by notes backed by foreign currency denominated mortgage loans in a particular jurisdiction. In case of the significant depreciation of the local currency, the government may choose to redenominate the foreign currency loans into the local currency. However, the redenomination may occur at unfavourable exchange rates for the transaction, resulting in an immediate significant loss and an ongoing loss associated with the unhedged nature of the transaction.
Structural Analysis

Overview

In our structural analysis of a transaction, we use a cash flow model to assess the impact of the characteristics of the transaction’s assets and liabilities on the potential losses to investors. The model calculates each tranche’s expected loss, which we use in conjunction with the tranche’s average life as the basis for a model-implied assessment. Our final rating adjusts the model-implied assessment, as necessary, to incorporate counterparty default risks that are not explicitly modeled in the cash flow model, as well as the legal risks of the transaction. We also typically consider the sensitivity of the model-implied assessment to alternative Portfolio EL and MILAN CE assumptions.

EXHIBIT 3
Structural Analysis

Source: Moody’s Investors Service

Cash Flow Model

We use a cash flow model to assess the major features of the liability structure of the transaction, as well as various characteristics of the assets, including the possible portfolio loss scenarios described in the derived probability loss distribution. See Appendices 3 and 4 for details of country-specific assumptions that may supplement or replace the typical assumptions described here.

Our ratings on RMBS tranches are based on the expected losses (Tranche EL) posed to investors by the legal final maturity. The Tranche EL considers both the probability and the severity of credit losses that investors may suffer.

To determine the Tranche EL, the cash flow model calculates the loss to investors resulting from each portfolio loss scenario of the lognormal distribution. The model then weights each loss with the corresponding probability of the loss scenario to calculate the tranche’s expected loss. We combine the Tranche EL with an estimate of the average life of the tranche to derive the model-implied assessment from Moody’s Idealized Expected Loss Table. (See Appendix 5).

Asset Cash Flow Modeling

The cash flow model incorporates assumptions regarding assets, such as the following:

» **Loss timing**: The cash flow model includes assumptions on the timing of losses. For each loss scenario on the lognormal curve, derived under the portfolio analysis, the cash flow model allocates the losses over time. While as a base case losses would typically be assumed to peak after three years, we may...
analyze transactions using various loss timing scenarios. For example, we may assume portfolios with significant seasoning will suffer losses earlier.

» **Recovery rate and arrears modeling:** When appropriate, the cash flow model incorporates assumptions regarding the level of arrears that the portfolio will suffer for each unit of loss. The amount of loans assumed to be in arrears at each point in time, along with the ultimate recovery rate, affects the interest and principal receipts on the portfolio.

» **Prepayment rate and amortization:** We use both the scheduled amortization of the portfolio and a prepayment rate assumption in our cash flow modeling.

» **Interest rates and swaps:** In transactions that are not fully hedged, we may stress the interest payable on the notes or haircut the interest payable on the assets. The haircut or stress may be constant over the transaction’s life, or it may be phased in over time to take account of the prepayment of the highest-interest-rate loans or loan-term renegotiations.

» **Substitution:** For substituting transactions, we take into account the length of the substitution period and any anticipated changes to the asset yield, which may result from new assets being added to the pool. If we expect a significant worsening of the quality of the assets as a result of loose substitution criteria, then we may model an increase in assumed losses for the substituted assets.

**Liability Cash Flow Modeling**

The cash flow model incorporates the transaction-specific structural features, such as tranching, priority of payments, performance triggers and servicing fees.

The assessment of certain transaction features may include stressed assumptions to account for potential future deviations from contractual terms. For example, when the servicer in the transaction is not a highly rated entity, we may assume the modeled servicing fee is higher than the actual contracted servicing fee especially if the contractual fee is less than the market rate for servicing that asset. The modeled servicing fee reflects servicing fees observed in the country and may increase further if the portfolio of loans backing the transaction has any unique features, making it difficult or expensive to service if a replacement servicer was necessary.

**Modeling of Counterparty Default Risks**

The cash flow model incorporates assumptions regarding certain risks relating to counterparty default.

» **Set-off:** In certain jurisdictions, set-off risk arises when borrowers have assets with the originator or a related entity. One typical example is deposit set-off risk. When set-off risk cannot be eliminated fully in the transaction structure, we incorporate an additional asset loss in the cash flow modeling, using (1) information provided on the amount of the exposure held by the borrowers, (2) the rating of the counterparty, and (3) an assumed correlation between the probability of default of the counterparty and the losses incurred by the portfolio. We may stress the exposure if we expect it to increase in the future or provide benefit if we expect it to decline.

» **Commingling:** Commingling risk arises when the servicer or collection account bank is declared insolvent and when the money in the collection accounts is temporarily or permanently commingled with the bankruptcy estate. If the commingling is temporary, this may lead to liquidity risk in the transaction, which can be mitigated by liquidity arrangements. A permanent commingling would lead to a credit loss in the transaction.

» **Other counterparty defaults:** For some transactions, rating committees may complement the counterparty default risk assessment (see below) with additional cash flow modeling. Additional modeling may be appropriate in order to assess particularly strong linkage between the rating of the notes and the credit quality of the counterparty.

Risks not considered directly within the cash flow model are separately assessed, as described in the following section.

**Counterparty Default Risk Assessment Applied Outside the Cash Flow Model**

We assess some counterparty default risks outside of the cash flow model. The process may result in adjustments to the model-implied assessment and may include transaction-specific rating caps. The assessment incorporates any associated structural mitigants, such as counterparty replacement triggers.
The key elements of the counterparty default risk assessment relate to swap risk, operational disruption risk and the risk of default on bank accounts.

**Swap Risk**
Our approach to assessing the rating impact of linkage to swap counterparties in structured finance cash flow transactions depends on various factors, including (1) the rating on the counterparty, (2) the rating trigger provisions in the swap documents, (3) the type and tenor of the swap, (4) the amount of credit enhancement supporting the notes, (5) the size of the relevant tranche, and (6) the rating on the notes before accounting for the effect of linkage. Details of how we assess the rating impact of linkage to swap counterparties are contained in the report “Approach to Assessing Swap Counterparties in Structured Finance Cash Flow Transactions”, please refer to Moody's Related Research at the end of this report.

**Operational Disruption Risk**
The strength of a securitization depends not only on the creditworthiness of the underlying pool of assets but also on the effective performance of transaction parties such as the servicer, cash manager, and trustee. A disruption of servicing may result in a weakening of collections activities, leading to increased delinquencies, lower recoveries, and ultimately higher losses on the securitized pool. Alternatively, disruption of the operations of a cash manager or trustee could result in a payment default despite adequate collections. Details of how we assess operational disruption risk are contained in the report “Global Structured Finance Operational Risk Guidelines”, please refer to Moody's Related Research at the end of this report.

**Bank Accounts**
Transactions in which a bank holds or has invested a substantial amount of the transactions' cash relative to the bond liabilities are potentially subject to ratings volatility if the bank or eligible investment defaults. The cash or the investments would not be recoverable quickly, with ultimate recoveries uncertain, and credit enhancement could decline substantially or even fully disappear. Guidelines for the temporary investment of cash in structured finance transaction accounts, including rating standards for banks holding such accounts, are outlined in the report “The Temporary Use of Cash in Structured Finance Transactions: Eligible Investment and Bank Guidelines”, please refer to Moody's Related Research at the end of this report.

**Legal Risk**
Our analysis of the legal aspects of the transaction ensures that assumptions regarding asset quality and transaction structure are appropriately reflected in the transaction documentation. As part of the legal analysis, we also review legal opinions to ensure that they adequately address any concerns regarding the assignment of the assets to the special purpose vehicle (SPV), bankruptcy remoteness of the SPV, or other jurisdiction-specific issues.

**Ongoing Surveillance & Small Residual Pools**
We will generally apply the key components of the approach described in this report when monitoring transactions, except for those elements of the methodology that could be less relevant over time (for example originator assessments, some elements of legal risk and certain representations and warranties).

A material change in any transaction feature prompts a reassessment of the transaction. Absent any material change we typically reassess each transaction annually.

For the portfolio analysis, we usually receive extensive data on transaction-specific performance that we use to help revise our Portfolio EL assumption during the life of the transaction. In the early months of a transaction’s life, we normally maintain our initial Portfolio EL assumption unless we observe immediate signs of a material deviation in transaction’s performance, like for example early payment defaults. We generally give more weight to the performance data as the transaction seasons because this becomes a better indicator of a transaction’s future performance. When significant transaction-specific performance data is available, the portfolio’s payment patterns can be more reliable performance predictors than loan-level or portfolio characteristics, in particular when forecasting future defaults considering our baseline projected economic outlook for the country where the assets were originated.

For the performing part of the portfolio, we analyze the performance data to help extrapolate future defaults. For loans that are delinquent or have been delinquent in the recent past we calculate the
probability of default on the delinquent loans by applying roll rates (probabilities of default) to the loans based on their delinquency status: the more severe the loan’s delinquency status, the higher the probability of default. We then obtain the loss estimates by multiplying the total probability of default by our loss severity expectation considering transaction specific data. We estimate future defaults, roll rates, loss severity and loss timing, prepayment rates and timing, and where applicable, modification adjustments, by taking into account projections from our Macroeconomic Board and other available sources. The final future loss estimate is a combination of both the performing and delinquent loans analysis. We will typically maintain2 our existing Portfolio EL assumption if the future loss estimate does not deviate3 significantly.

We typically expect the MILAN CE stressed loss assumption to remain unchanged over time, absent any material changes in portfolio composition, e.g. through prepayments, or material deterioration in performance. When we reassess a transaction, normally on an annual basis, we consider the MILAN model result4 when reliable and updated loan-level information is available. For loans that are delinquent or have been delinquent in the recent past, the MILAN CE assumption incorporates a delinquent loan analysis similar to that described above. When performance deviates significantly from our expectations, there is a higher likelihood that the expected loss multiples approach, outlined in Appendix 1 below, will apply and drive the MILAN CE.

For the structural analysis, we typically reassess the cashflow model result using the updated capital structure. However the monitoring of certain transactions may not always warrant updated cashflow model analysis. For example, model results would not normally change if the portfolio analysis is in line and the transaction’s capital structure has not materially deleveraged. Alternatively, if the transaction’s bond ratings are limited to the lowest rating levels, due to very weak performance or sovereign risk for instance, we may instead perform a more bespoke analysis comparing our Portfolio EL assumption to each bond’s total credit enhancement.

In addition, during the life of the transaction, as pool sizes decrease to a small fraction of their initial sizes, credit risk exposure to individual borrowers may increase significantly. As part of our continuous monitoring of RMBS transactions, we track the evolution of borrower concentration risk and verify that the amount of credit enhancement under a given class of notes always protects this class from the risk of a default by the largest borrowers. If we estimate that the exposure of notes to the largest borrowers is not consistent with their ratings, we will downgrade these ratings accordingly and may withdraw them. The concentration section under Appendix 1 contains details of our approach to small residual pools.
### Appendix 1: Deriving the MILAN CE

**EXHIBIT 4**

*Deriving the MILAN CE in detail: a step-by-step guide*

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Source: Moody’s Investors Service
Overview

We use the MILAN model to help evaluate the collateral. MILAN is a scoring model assessing the credit risk of residential mortgage loan portfolios. It is an assessment of individual loans as well as overall portfolio diversification, estimating the portfolio’s loss in a severe recession scenario.

The MILAN model relies on assumptions regarding the performance of country-specific benchmark loans and how deviations from these benchmarks may affect default probability and loss severity. Similarly, the model assumes that deviations in overall portfolio diversification from a country-specific benchmark RMBS portfolio affect performance (see Appendix 4 for details of these assumptions per country).

Going forward, we will update certain assumptions and input parameters, including the house price indices, population density figures, classifications of provinces and regions, and the house price stress rates. Additionally, we will incorporate new mortgage products that are emerging in some countries.

Finally, we will periodically review all assumptions used in MILAN and, if needed, revise them according to market developments and new research and information.

Country-Specific Benchmark Loan – Step 1

A country-specific benchmark loan is defined for each country. The benchmark loan has market-standard features with regard to its property, loan and borrower characteristics.

The only features of a benchmark loan that vary are the standard market features, which are also seen as the key drivers of default probability and loss severity within a market. For most countries, we assume one of the key drivers to be the loan-to-value (LTV) ratio. Moreover, certain countries consider variations in other market-standard features, such as the debt-to-income (DTI) ratio or the borrower’s credit score (e.g., FICO), in the benchmark loan definition.

Base Benchmark Credit Enhancement – Steps 2 and 3

The Base Benchmark CE is the loss on a benchmark loan occurring during a severe recession scenario. The loss is split into two components:

» default frequency
» loss severity

Flexible Loans

In some countries, borrowers are allowed to make further drawings up to a limit stated at the origination of the mortgage loan or to redraw prepayments made on the loan.

Generally, a redraw of prepayments or other further drawings are subject to the lender’s credit review and approval. We typically determine the default frequency and severity based on the maximum drawable amount defined by the loan product, rather than the actual current balance.

Default Frequency – Step 2

A MILAN default frequency curve is defined for the benchmark loan features, which vary in each country. For example, in most countries, the main feature is the loan’s LTV ratio. In this case, the curve assigns an assumed default frequency to each LTV level.

To determine the LTV, the current balances of all loans that are secured by the same property are aggregated. Therefore, all prior and equal ranking claims on the property, regardless of whether they are securitized or not, are taken into account. For claims where the current balance is unknown, we typically consider the original loan balance.

We calculate the LTV ratio by using the original property valuation rather than the current indexed valuation.
Loss Severity – Step 3
The main drivers of loss severity are property value, aggregated loan balance, house price stress rate (HPSR), foreclosure costs, time to foreclosure and accrued interest.

We first determine a stressed property value\(^6\) to calculate a loan’s loss severity. We do this by applying a HPSR assumption. The HPSR is our assumption of how far the current property value will fall as a result of a severe recession scenario. The HPSR can be different for each region within a specific country. In order to obtain the current property value, we typically index the last valuation provided using country- and region-specific house price indices.

\[
P_{\text{Stressed}} = P_{\text{Unstressed}} \times (1 - \text{HPSR}_{\text{Region}})
\]

Whereby:

- \(P_{\text{Stressed}}\) = Stressed property value
- \(P_{\text{Unstressed}}\) = Current, indexed, property value
- \(\text{HPSR}_{\text{Region}}\) = Region-specific house price stress rate

The loss severity of a particular loan is then derived from the following formula (see Exhibit 5).

\[
L_i = \text{Max}(0, -P_{\text{Stressed}} + C + (PR_i + PR_i \times I \times FP) + (CB_i + PP_i + (CB_i + PP_i) \times I \times FP))
\]

Whereby:

- \(L_i\) = Loss of Loan \(i\)
- \(CB_i\) = Current balance of Loan \(i\)
- \(C\) = Foreclosure costs on the property
- \(PR_i\) = Current balance of loans ranking senior to Loan \(i\)
- \(PP_i\) = Current balance of loans ranking pari passu with Loan \(i\)
- \(I\) = Interest rate per annum
- \(FP\) = Foreclosure period in years
HPSR: Loss severity is dependent on the house price evolution. For each country, the MILAN approach includes an assessment of how far house prices will fall in response to a severe recession scenario; this assessment leads to the HPSR. The HPSR takes into account a forced sale haircut based on the assumption that, in a stressed scenario, all properties sold are distressed sales. Appendix 1a outlines our approach to deriving the HPSR assumption.

Foreclosure costs: We have estimated the costs associated with the legal proceedings and the auction sale for each country. In some countries, these costs will vary by region.

Time to foreclosure: We use historical information to determine the time to foreclosure in each country. In some countries, time to foreclosure will vary by region.

Accrued interest: Interest accrued during the foreclosure period influences the severity of losses.

Realized Loss Definition in Synthetic Transactions

As can be seen from the loss severity formula described above, excluding foreclosure costs and accrued interest can decrease the severity substantially. This is especially relevant in the case of synthetic transactions, in which the realized loss definition could exclude either interest or foreclosure costs or both.

For true sale transactions, which are the most common type of RMBS transactions that we publicly rate, severity is capped at 100% of the current loan balance plus accrued interest. For synthetic transactions, the cap is transaction specific and may be different from the cap used in true sale deals.

Property value haircuts: In certain cases, we may apply a haircut to the property value either for the severity calculation or for the LTV calculation we use to determine the default frequency of the loan. For example, if the valuation provided is not a full valuation, but rather a valuation obtained through indexing or an automated valuation model (AVM), we typically apply a haircut. We determine the haircut through the analysis of the accuracy of such models and how frequently they are updated.

Finally, we may apply a property haircut for the severity calculation when additional mortgage loans may arise during the life of the transaction and reduce the claim of the securitized loan against the property. The size of the haircut in this case would depend on the expected size of additional exposure and any mitigants designed to limit any additional claims or to ensure that the issuer has prior ranking claim to the property.
**Base Benchmark Credit Enhancement – Step 4**

We define the Base Benchmark CE for any loan included in the pool as the product of default frequency and severity, subject to a country-specific Minimum Loan CE.

**FORMULA 3**

\[ \text{Base Benchmark CE}_i = \max(\text{MinCE}, \text{DefFreq} \times \frac{L_i}{CB_i}) \]

Whereby:

- \( \text{Base Benchmark CE}_i \) = Base Benchmark Credit Enhancement for Loan i
- \( \text{MinCE} \) = Minimum Loan CE
- \( \text{DefFreq} \) = Default frequency
- \( L_i \) = Loss of Loan i
- \( CB_i \) = Current balance of Loan i

**Why Ranking of Loans Matters**

Given a property value of 100 and a current loan balance of 100, the LTV is 100%. Given a house price decrease of 40%, the severity upon default is 40 (not considering foreclosure costs and accrued interest). As a percentage of the current loan balance, the loss is 40%.

Given the same property value as before and a current loan balance of 50, but subordinated to prior ranks of 50, the LTV again is 100%. Hence, the default frequency in both cases is equal. Given a house price decline of 40%, the total loss on the property is again 40. The property value is used to first pay back the prior ranks, which results in a loss for the securitized loan of 40. As a percentage of the current loan balance, the loss is 80%. This higher severity will increase the Base Benchmark CE for this loan, compared with the loan in the first example.

The Minimum Loan CE, which is set at a percentage of the current mortgage loan balance, depending on the specific country, covers certain risks that are not captured anywhere else in MILAN. These risks are:

- sovereign risk
- uninsurable natural risk
- possible weaknesses of legal and regulatory system
- credit culture of borrowers

In synthetic transactions or transactions based on specified (guaranteed) mortgage products, the Minimum Loan CE is transaction specific and may deviate from the country-specific Minimum Loan CE.

**Borrower Credit Profile - Step 5**

In certain countries, we apply an adjustment for the borrower’s credit profile. The adjustment is dependent on the country-specific characteristics of a borrower’s credit profile. Such as county court judgments (CCJ) in the UK or Bureau Krediet Registratie (BKR) codes in the Netherlands. Based on the type of credit profile information, and for some countries the number and amount of adverse credit registrations, we make adjustments to the Base Benchmark CE. By applying the Borrower Credit Profile adjustment after the Minimum Loan CE is applied in the Base Benchmark CE, we ensure that we captured any potential risk layering.
The Benchmark CE is an aggregation of the Base Benchmark CE and the Borrower Credit Profile adjustment. All the other loan level adjustments outlined below will be multiplied by the Benchmark CE for that individual loan. The aggregation enables a greater differentiation between different mortgage loan products targeted at borrowers with varying credit profiles by capturing the resulting risk layering.

The aggregation produces a Benchmark CE for each loan in the pool. We calculate the Benchmark CE, which is subject to the Minimum Loan CE, with the formula below.

**FORMULA 5**

\[
\text{Benchmark CE}_i = \max(\text{Base Benchmark CE}_i + \text{Credit Profile Adj}_i, \text{MinCE})
\]

Whereby:

- **Benchmark CE** = Benchmark Credit Enhancement for Loan \(i\)
- **Base Benchmark CE** = Base Benchmark Credit Enhancement for Loan \(i\)
- **Credit Profile Adj** = Borrower Credit Profile Adjustment for Loan \(i\)
- **MinCE** = Minimum Loan CE

**Adjustments on Single Loan Level – Steps 7 to 11**

We adjust the Benchmark CE for each loan to account for higher- or lower-risk features as compared with the benchmark loan. Most adjustments address a different default frequency from that of the benchmark loan. Others, however, address a different loss severity. Unless indicated otherwise, we define adjustments to a loan’s Benchmark CE with the following formula:

**FORMULA 6**

\[
\text{Adjustment}_{k, i} = \text{Benchmark CE}_i \times \text{Adjustment Factor}_k
\]

Whereby:

- **Adjustment** = Adjustment type \(k\) to Loan \(i\)
- **Adjustment Factor** = Adjustment factor for characteristic \(k\)

The characteristics we consider and our assumptions regarding the impact of deviations from the benchmark loan on risk assessment vary from country to country. Below are some of the typical characteristics that lead to adjustments in MILAN. Appendix 4 contains details of the characteristics and related assumptions per country.

**Property-Related Adjustments — Step 7**

We adjust the Benchmark CE according to property type, occupancy type, property valuation type and property value.

**Loan-Related Adjustments — Step 8**

We adjust the Benchmark CE according to loan purpose, interest rate type, interest and principal frequency, currency of the loan, loan region, loan amounts and origination channel.
Borrower-Related Adjustments — Step 9
We adjust the Benchmark CE according to employment type, borrower type, nationality and multiple borrowers.

Performance-Related Adjustments — Step 10
We adjust the Benchmark CE according to seasoning/months current and arrears status.

Months-current data indicates the number of months since the loan was last in arrears. To account for a loan’s historical payment performance, we give credit for seasoning if the monthly payment has been made consistently. However, there will be limited benefit if the loan has previously been in arrears, depending on the period since the loan was last in arrears up to the cut-off date.

For loans that are not in arrears, we calculate the seasoning benefit on the Benchmark CE but not on any increase due to Borrower Credit Profile or to any of the other penalties applied.

We apply a scaling factor to performance-related adjustments to ensure the MILAN CE remains a more stable measure of risk through the cycle. This takes into account the other adjustments on each particular loan. A loan with more risky characteristics than the benchmark receives more credit for good historical performance but attracts a lower penalty if it is in arrears or has recently been in arrears. Similarly, a loan with less risky characteristics than the benchmark receives less credit for good historical performance but attracts a higher penalty if it is in arrears or has recently been in arrears. We calculate the scaling factor with one of the formulas below and use it to scale up or down the performance-related adjustment factor.

For credits with regard to seasoning/months current and arrears:

**FORMULA 7**

\[
\text{ScalingFactor}_i = \frac{\text{Max}(\text{Benchmark CE}_i + \text{all adjustments}_i, \text{MinCE})}{\text{Benchmark CE}_i}
\]

Whereby:

\[
\text{All adjustments}_i = \text{the aggregation of the Single Loan Level adjustments for Loan i described above in steps 7-9}.
\]

\[
\text{ScalingFactor}_i = \text{Scaling factor used to scale up or down the performance-related adjustment factor for Loan i}.
\]

For penalties with regard to seasoning/months current and arrears:

**FORMULA 8**

\[
\text{ScalingFactor}_i = \frac{\text{Benchmark CE}_i}{\text{Max}(\text{Benchmark CE}_i + \text{all adjustments}_i, \text{MinCE})}
\]

When loans in arrears are included in the pool at closing, we will analyze them individually, taking into account assumed roll rates from arrears into default and ultimate loss severity levels. In such cases, we do not consider the standard benchmark loan features to be the major driver for default frequency. Consequently, roll rates and severity levels become more important. For loans in early-stage arrears (typically under 30 days) in the countries where such loans were found to have high probability of default, we assume a minimum default frequency for such loans. This default frequency is then the minimum used together with the loss severity (calculated as described above) to determine the Benchmark CE for such loan.

We will also investigate the level of loan modifications in the pool and the lender’s general approach to loan modifications. Depending on the results, we may apply an additional case-by-case penalty.
Originator and Servicer Adjustments — Step 11

The final Single Loan Level adjustments in MILAN are related to the quality of origination and servicing. These adjustments are applied to the aggregation of Benchmark CE and all the Single Loan Level adjustments described above in steps 7-10.

**FORMULA 9**

\[
\text{Adjustment}_{\text{Originator/Servicer}, i} = \max(\text{Benchmark CE}_i + \text{all adjustments}_i, \text{MinCE}) \times \text{Adjustment Factor}_{\text{Originator/Servicer}}
\]

Whereby:

\[
\text{All adjustments}_i = \text{the aggregation of the Single Loan Level adjustments for Loan } i \text{ described above in steps 7-10.}
\]

**MILAN CE Single Loan – Step 12**

After we make all Single Loan Level adjustments, we calculate the total MILAN CE for a single loan as the sum of the Benchmark CE plus all adjustments.\(^7\) We re-apply the Minimum Loan CE to this sum to ensure that the CE for each loan is at least the country-specific minimum.

**FORMULA 10**

\[
\text{MILAN CE Single Loan}_i = \max(\text{Benchmark CE}_i + \sum \text{Adjustment}_k, \text{MinCE})
\]

**Adjustments on the Portfolio Level – Steps 13 and 14**

We make further adjustments at the portfolio level. These are dependent on regional diversification and borrower concentration in the portfolio as compared with the country-specific benchmark RMBS portfolio.

We may make further adjustments, on a case by case basis, to account for other portfolio concentrations such as a large exposure to a single employer or industry or to particular regions which lack economic diversity.

Both portfolio level adjustments are applied multiplicatively to the aggregated MILAN CE for each loan in the portfolio.

**FORMULA 11**

\[
\text{Aggregated loan MILAN CE} = \sum (\text{Loan MILAN CE}_i \times W_i)
\]

Whereby:

\[
\text{Aggregated loan MILAN CE} = \text{Aggregated MILAN CE for each loan in the portfolio}
\]

\[
\text{Loan MILAN CE}_i = \text{Benchmark CE plus all adjustments for loan } i
\]

\[
W_i = \text{Weight of the total exposure to loan } i \text{ in the portfolio}
\]

**Regional Concentration Adjustment — Step 13**

We compare the regional diversification of the portfolio with the property density for the country-specific benchmark RMBS portfolio. For some countries, property density data may not be available. In these cases, we use either population density or GDP data as a proxy for the benchmark portfolio. We generally allow for 10%-20% excess concentration within each of the regions in a specific country. The sum of concentration above that excess concentration threshold bears a country-specific adjustment for concentration on the portfolio.
Borrower Concentration Adjustment – Step 14

We address a portfolio’s lack of diversification by using the borrower concentration adjustment. RMBS portfolios are typically highly diversified in terms of borrowers and single loan sizes. However, a low average loan size could be the result of an extreme portfolio, with a few large and many small loans. Or, a few borrowers may have many small loans resulting in less diversification.

We assess borrower or loan concentration by calculating the effective number of borrowers in the portfolio. The calculation uses an adjusted Hirschman Herfindahl Index based on the aggregated borrower exposure and can be interpreted as the number of equally weighted borrowers in a hypothetical portfolio. For example, we assume a pool with 500 borrowers and an effective number of 300 borrowers has the same borrower concentration risk as a pool with 300 borrowers that all have the same amount outstanding. The benchmark RMBS portfolio typically has an effective number of borrowers of 3,000, which is equivalent to a 0.033% exposure to each borrower.

**FORMULA 13**

$$\text{Effective Borrowers} = \frac{1}{\sum (W_m)^2}$$

Whereby:

- **Effective Borrowers** = Effective number of borrowers for the portfolio
- **W_m** = Weight of the total exposure to borrower m in the pool

As can be seen in the formula above, larger borrower concentrations result in a lower effective number of borrowers, indicating less diversity.

**FORMULA 14**

$$\text{Borrower Adjustment} = \frac{(\text{Borrower Adj Factor} \times \max(0, \ln(\text{Benchmark Borrowers}) - \ln(\text{Effective Borrowers})))}{\text{Aggregated Loan MILAN CE}}$$

Whereby:

- **Borrower Adj Factor** = Adjustment factor for borrower concentration
- **Benchmark Borrowers** = The effective number of borrowers for the benchmark RMBS portfolio
For small portfolios with significant borrower and/or regional concentration, we may determine that the regional and/or borrower concentration risk cannot be mitigated through credit enhancement. In this case, we may decide to cap the ratings of the transaction below the maximum rating achievable in the country.

In addition, during the life of the transaction, as pool sizes decrease to a small fraction of their initial size, credit risk exposure to large borrowers may increase significantly. This may happen when the amortization of loans to large borrowers is slower than that of the pool as a whole. A significant borrower concentration build-up is typically offset by a commensurate CE build-up, so that rated notes remain at all times protected against the default risk of the largest borrowers in the pool. Structural features, such as sequential amortization and reserve fund floors, are generally designed to build such credit enhancement cushions against residual borrower concentration risk.

As part of our continuous monitoring of RMBS transactions, we track the evolution of borrower concentration risk and verify that the amount of credit enhancement under a given class of notes always protects this class from the risk of a default by the largest borrowers. In the absence of borrower-level information allowing the largest borrower exposures to be accurately tracked, we may withdraw our ratings on notes backed by pools that have amortized to a small fraction of their initial size. If we estimate that the exposure of notes to the largest borrowers is not consistent with their ratings, we will downgrade these ratings accordingly and may withdraw them.

We will not assign or maintain ratings on the following types of RMBS transactions:

- transactions that do not have support mechanisms, such as credit enhancement floors or reserve fund floors, when the underlying pool has decreased to an effective number of borrowers of 30 or below
- transactions with reserve fund or credit enhancement floors that partially compensate for the increased exposure to single borrowers, when the underlying pool has decreased to an effective number of borrowers of 15 or below

However, we will make exceptions for securities with ratings that do not rely on our assessment of individual obligor creditworthiness, such as those that benefit from a full and unconditional third-party guarantee, whether at the pool or note level, or securities that benefit from full cash collateralization.

**Model-Driven MILAN CE – Step 15**

To determine the MILAN CE for a portfolio, we aggregate all calculations made within MILAN and adjust for regional and borrower portfolio concentrations:

\[
\text{Model Driven MILAN CE} = \text{Aggregated Loan MILAN CE} \times \text{Regional Adjustment} \times \text{Borrower Adjustment}
\]

The model-driven MILAN CE is expressed as a percentage of total portfolio balance.

**MILAN CE Is Subject to a Floor – Step 16**

The model-driven MILAN CE is subject to a floor, namely the Minimum Expected Loss Multiple. For countries where the availability of information limits the predictability of severe stress scenarios, the model-driven MILAN CE may be subject to a further floor, the Minimum Portfolio MILAN CE.

For all countries, if the standard analytical approach produces MILAN CE levels below 4%-5%, we will further assess the specific pool and the appropriate application of this methodology and, if applicable, make qualitative adjustments to reflect our view of the full extent of the risk.

We apply a **Minimum Expected Loss Multiple** for all countries to ensure that extreme loss scenarios have an adequate probability of occurrence in our analysis. It is applicable when the Portfolio EL is assigned or updated. It is determined as a multiple of the Portfolio EL to ensure that the minimum level of difference is maintained between the Portfolio EL and the MILAN CE. This allows for a minimum coefficient of variation to be maintained by the lognormal distribution used to simulate losses incurred by the securitized portfolio.
This is particularly important for high Portfolio EL assumptions or where there is an expectation of adverse performance, which is not yet reflected by the arrears performance of the collateral portfolio, but is already qualitatively incorporated into the Portfolio EL assumption. Using a multiple of the Portfolio EL to determine a floor for the MILAN CE ensures the stability of the highest ratings achievable in the country in various economic environments. The multiples differ based on the level of the Portfolio EL assumed and varies between 3x (for high Portfolio EL assumptions) and 5x (for low Portfolio EL assumptions). Multiples in the range of 3x-5x apply for most RMBS transactions.\(^\text{11}\)

We generally use the **Minimum Portfolio MILAN CE**\(^\text{12}\) levels for each country as a function of the potential deterioration arising from macroeconomic, social or political events that would affect all portfolios originated in a particular jurisdiction, regardless of (1) the strength of the origination and underwriting processes of an originator; (2) the type of borrowers in a portfolio; or (3) the characteristics of the underlying security that the borrowers provide. We will set the Minimum Portfolio MILAN CE at different levels for each affected country. The following factors influence the magnitude of the deterioration and the minimum credit enhancement:

- country-specific factors such as our expectation of the level of increased unemployment rates, consumer leverage levels and economic development
- country-specific effects of banking system disruptions or macroeconomic stresses either preceding or following a country default
- effects of possible adverse changes to the legal and institutional environment in the country

We will apply such Minimum Portfolio MILAN CE levels for as long as we assume these conditions to prevail.

**Rating Committee Approval of MILAN CE – Step 17**

The rating committee approves the MILAN CE taking into account the calculated model result and any other qualitative and quantitative aspects of the portfolio.

For example, since MILAN assesses the risk of a static portfolio, transactions with revolving periods and/or prefunding require further adjustments on the MILAN CE to reflect the expected pool composition over time. Also, if further advances, product switches and/or loans conversions are allowed, additional adjustments are required depending on the transaction-specific criteria. Depending on the criteria, we may apply the adjustment either via a defined percentage increase of the MILAN CE or via modeling a certain level of substitution in the portfolio.

The result, which is obtained after we have applied all adjustments to the model-driven MILAN CE, is the MILAN CE for the portfolio.
Appendix 1a – Deriving the HPSR Assumption

The HPSR assumption has two distinct components: (1) a fixed floor and (2) a variable element dependent on the sustainability of previous house price developments.

We compound the two factors, applying the fixed element to the level of house prices after the unsustainable portion of recent house price growth has been lost.

**FORMULA A**

\[
HPSR_{Region} = HPSR_{Variable} + (1 - HPSR_{Variable}) \times HPSR_{Fixed}
\]

Whereby:

- \( HPSR_{Region} \) = Region-Specific House Price Stress Rate
- \( HPSR_{Variable} \) = House Price Stress Rate Variable Factor
- \( HPSR_{Fixed} \) = House Price Stress Rate Fixed Factor

**VARIABLE FACTOR: TO WHAT EXTENT HAVE CURRENT HOUSE PRICES DEPARTED FROM CURRENT FUNDAMENTALS?**

- The variable factor assumes a portion of the medium-term house price growth will be lost in response to a severe economic shock.
- For countries that have seen a greater departure from fundamentals, we assume a larger proportion of the medium-term growth is lost. We will reassess this proportion periodically based on the following fundamental demand and supply drivers:
  - Demand drivers include:
    - the past 10 years of growth in household disposable income
    - the past 10 years of growth in the number of households
  - Supply drivers include:
    - the past 10 years of growth in housing stocks
- We then compare the increase in house prices over the last 10 years with the historic drivers above to assess how much the house price growth is not justified by fundamentals. We make a qualitative assessment as to whether the growth in house prices has outstripped fundamentals. We express our assessment on a scale of 1-5, where 1 is the lowest and, though there is no upper bound, 5 is typically the highest.
- We take a final qualitative adjustment based on the ratio of house prices to household disposable income per capita, a simple measure of house price affordability that does not depend on the medium-term trends.¹³
- The variable factor updates dynamically since it is based on a rolling window of medium-term, typically 10-year, house price growth. Therefore, all else being equal, strong growth in prices will automatically lead to an increased HPSR assumption.
FORMULA B

\[ \text{HPSR}_{\text{variable}} = \text{VFM} \times \text{HPC}_{\text{Region}} \]

Whereby:

\( \text{VFM} \) = The variable factor multiplier, which is the proportion of medium-term house price growth that we assume is lost following an economic shock. We convert the score described above to the percentage of house price growth that we assume is lost during an economic shock. The exhibit below provides a guide that converts the assigned scores into the VFM we use in the variable factor.

\( \text{HPC}_{\text{Region}} \) = The component of today’s house price which is derived from medium-term growth in regional prices (e.g., if prices have doubled, then this component is 50% since half of today’s price is made up of medium-term house price growth). This will update dynamically based on a rolling window of medium-term house price growth.

### Exhibit 6

**Variable Factor Score to VFM Guidance**

<table>
<thead>
<tr>
<th>Score</th>
<th>Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-2</td>
<td>0%-30%</td>
</tr>
<tr>
<td>3</td>
<td>35%</td>
</tr>
<tr>
<td>4</td>
<td>40%</td>
</tr>
<tr>
<td>5+</td>
<td>50%+</td>
</tr>
</tbody>
</table>

Source: Moody’s Investors Service

**Fixed Factor: To what extent will structural features of the economy contribute to declines in house prices?**

- The fixed factor assumes house prices will fall by an additional fixed percentage. It is based on a qualitative assessment of how each country’s structural features will contribute to a housing market downturn following an economic shock.

- Our qualitative assessment made under the fixed factor is based on the following four sub-factors. We score each of the sub-factors separately and take a weighted average (according to the weights shown in parentheses): 14

  a. How vulnerable is the consumer to the economic shock? (weight 35%)

  Higher household debt leverage will leave consumers more vulnerable to the economic shock. We look at various available measures of household leverage and savings rates to assess this question.

  In the case of countries where GDP, disposable income and savings may be affected as a result of current or expected economic contraction, we will take a forward-looking view of these measures.

  b. How large is the structural surplus of houses? (weight 35%)

  Countries with more spare housing capacity will fare worse because there is structural surplus that puts downward pressure on prices. As a proxy for the structural surplus of houses, we primarily look at how many more dwellings there are than households. This part of the fixed factor is different than the change in housing supply assessed in the variable factor, because it looks at the stock of unused housing rather than the flow of new housing.

  In some countries where second homes are common, this number looks large, even though many houses are not truly vacant. However, in the context of a severe economic shock, many households will sell their second homes and the tourism industry may also be acutely affected. As a sense check, we also look at the reported vacancy rates, although this data is usually not timely, because they date to the last census conducted in the country. Also, the reporting convention in each country is not always comparable, because some countries include second homes and others do not.
c. Does the lack of automatic stabilisers amplify the shock? (weight 20%)

Countries with freely moving exchange rates and control over their monetary policy will fare better, for example, asymmetric economic shocks in eurozone countries may mean that some countries will have a harder time lifting out of the recession and housing slump because the interest rate and exchange rate may not be accommodating for them.

d. How large could a ‘second-round’ impact be? (weight 10%)

Higher unemployment and slower growth may result from a softening in the housing market. Countries with a higher degree of reliance on the residential construction sector in terms of employment and contribution to output are likely to be more affected by the initial decrease in house prices assessed in the variable component.

We convert the weighted average fixed factor score described above to a fixed factor house price stress. The exhibit below provides a guide that converts the scores assigned into the fixed factor:

<table>
<thead>
<tr>
<th>Score</th>
<th>Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-3</td>
<td>25.0%-27.5%</td>
</tr>
<tr>
<td>3-4</td>
<td>30.0%</td>
</tr>
<tr>
<td>4-5</td>
<td>35.0%</td>
</tr>
<tr>
<td>5+</td>
<td>40.0%+</td>
</tr>
</tbody>
</table>

Source: Moody’s Investors Service
Appendix 2 - Lognormal Distribution

We use the two outputs from our portfolio analysis to determine a probability loss distribution. The probability loss distribution associates a probability with each potential future loss scenario for the portfolio. For RMBS portfolios, we typically assume the probability loss distribution is lognormal. We use three parameters to determine the lognormal loss distribution:

- Portfolio EL: assumed as the median of the lognormal loss distribution
- MILAN CE: defined as the subordination of a theoretical senior tranche targeting the highest rating achievable in the country
- expected average life: of the theoretical senior tranche

We can define a lognormal loss distribution if we know its median loss and standard deviation. We use the Portfolio EL assumption as the median loss. To determine the shape of the lognormal loss distribution, we estimate the standard deviation of the losses associated with the MILAN CE assumption. We estimate the standard deviation using a methodology similar to value at risk (VAR) theory. In VAR theory, the distribution is known and the risk at a certain quantile is searched for. However, under our methodology, we know the risk and quantile and search for the standard deviation that will define the distribution.

We first establish a theoretical single senior tranche with only note subordination as credit enhancement equal to the MILAN CE assumption. Given the portfolio features, we determine the expected average life of this tranche. Using this average life and the highest rating level achievable in the country, we define the risk as the expected loss from our idealized expected loss tables (see Appendix 5). Finally, we can derive the quantile using the expected loss and the theoretical note subordination in order to search for a standard deviation for the portfolio’s loss distribution.

EXHIBIT 8
General Shape of the Lognormal Loss Distribution

Source: Moody’s Investors Service
Appendix 3 – Approach to Assessing Certain Specific Features of RMBS

Appendix 3a – EMEA RMBS/ABS SME Mortgage Loan Portfolios Mixed-Pool Analysis

In Europe, the Middle East and Africa (EMEA), we use a unified approach to analyzing a ‘mixed-pool’ portfolio, which is a portfolio with two sub-pools of mortgage loans made to individuals and to small and medium-sized enterprises (SMEs). Our approach combines the standard EMEA rating methodologies for assessing RMBS and ABS SME loan portfolios.

We split the portfolio into sub-components, and analyze each sub-pool using the standard EMEA methodologies for individuals and SMEs. We then merge the loss distributions associated with the two sub-pools. This appendix describes our method for merging the two loss distributions. In instances where one of the pools is very small (typically less than 5% of the total portfolio), we may adopt a simpler approach, whereby we will apply only the standard methodology of the main asset type.

Splitting the Portfolio Between Individuals and SMEs

We divide the portfolio of mortgage loans in the pool by borrower and property type to create the two sub-pools.

RMBS sub-pool: The first sub-pool includes loans to individual borrowers or small unlimited liability companies that have taken out a mortgage loan to purchase/renovate a residential property. In cases where these borrowers are companies, they are generally artisans and self-employed professionals who are purchasing their house, typically as a primary residence, with full recourse to the shareholders. We capture the increased risk that these self-employed borrowers pose through our standard RMBS approach.

SME sub-pool: The second sub-pool includes (1) loans to limited liability companies (no recourse to the shareholders) with mortgage loans on either a residential or commercial property, and (2) loans to small unlimited liability companies with a mortgage loan on a commercial property or residential property to finance the business activity of the borrower.

Merging the Loss Distributions of the Portfolios – Single-Rated Tranche Transactions

Once we have determined the loss distributions on a standalone basis of the ABS SME and RMBS sub-pools, we merge the loss distributions of the two sub-portfolios. The approach we use to merge the two distributions has two properties:

1. The resulting loss distribution follows a lognormal distribution.
2. The approach is relatively simple so that we can determine the key parameters for rating and monitoring the portfolios.

For ABS SME pools, we generally use a normal inverse (or transaction-specific) distribution, whereas for RMBS pools we typically use a lognormal distribution.

To determine the loss distribution of the mixed portfolio in a single-rated tranche transaction, we follow these steps:

1. We determine the loss distribution of the RMBS sub-portfolio by using a lognormal distribution.
2. We determine the loss distribution of the SME sub-portfolio. Depending on the granularity of the sub-portfolio, we either use a Monte Carlo simulation approach or assume a normal inverse distribution.\(^ {17}\)
3. Based on the country’s maximum achievable rating and the SME’s sub-pool weighted average life, we determine the expected loss of such maximum achievable rating using Moody’s Idealized Expected Loss tables (see Appendix 5).
4. We derive the percentile on the SME loss distribution (Equivalent MILAN number) so that the area under the distribution curve on the right hand of this percentile number equals the expected loss calculated in step 2 (see Exhibit 9, area beyond the green line until the Equivalent MILAN number).
5. We fix the mean of the SME lognormal matched distribution to the distribution derived in step 1.
6. We fix the standard deviation of the SME lognormal matched distribution, so that the expected loss of the area under the distribution curve on the right hand of the Equivalent MILAN number matches the one calculated in step 2.

EXHIBIT 9

Tails of the Transaction-Specific Default Distribution and “Matched” Lognormal

Source: Moody’s Investors Service

7. We merge the two loss distributions assuming a 100% correlation.

8. We use the combined loss distribution in our cash flow analysis.

Exhibit 9 shows an example of a manual default distribution determined using Monte Carlo simulation and of a “matched” lognormal distribution. In the example, we assume a maximum achievable rating of Aaa and a weighted average life of five years to derive the “matched” lognormal distribution.

Merging the Loss Distributions of the Portfolios – Multi-rated Tranche Transactions

For transactions with more than one tranche rated across the capital structure, our procedure is:

1. We determine the loss distribution of the SME sub-portfolio, either using a Monte Carlo simulation approach or assuming a normal inverse default distribution.

2. We determine the loss distribution of the RMBS sub-portfolio by using a lognormal distribution.

3. We merge the two loss distributions using a non-parametric approach. For each given probability scenario across the two loss distributions, we take the weighted average of each loss scenario based on the contribution of each sub-pool.
Analysis of the Individuals Sub-pool
For the “individuals” part of a mixed pool, we use our RMBS rating methodology.

Analysis of the SME Sub-pool
For the SME pool, we use “Moody’s Global Approach to Rating SME Balance Sheet Securitizations”, please refer to Moody’s Related Research at the end of this report.
Appendix 3b – Automated Valuation Models in UK RMBS

This appendix outlines the framework we use to quantify the risk associated with automated valuation models (AVMs) as an alternative method to surveyors’ valuation in UK RMBS transactions.

For mortgage loans where an AVM has been used to value a property, the potential risk is sized in a twofold approach:

- **Property value haircut**: Firstly, a haircut is applied to the AVM valuation, effectively increasing the loans’ LTV ratio for all calculations in our collateral analysis.

- **MILAN Property Valuation Type Penalty**: Secondly, a property valuation type penalty is applied under the Single Loan Level adjustments of the MILAN model. In addition, we will review the manner in which the lender uses AVMs in its underwriting, in order to ensure they are used in a prudent manner. If not, we may apply additional penalties.

We primarily analyze test data supplied by each provider to review its respective AVM. The analysis focuses on the AVMs’ ability to accurately estimate the property value within each of their stated confidence levels. We statistically quantify the estimation error between the AVM valuation and test data from independent surveyor valuations.

**Property Value Haircut**

The haircut we apply to the AVM property valuation is sized to capture two concerns:

- **Time lag**: Based upon a qualitative assessment of the AVM providers’ procedures, we apply a haircut to account for the time lag between actual real-estate market movements and the time it takes for these movements to be reflected in updates to the AVM.

- **Median estimation error**: Our concern is not only the estimation error associated with AVM valuations, but also any consistency in over-estimation of the property value. If applicable, we further reduce the AVM valuation with a haircut equal to the median value of the estimation error distribution if the AVM consistently overvalues. We derive the haircut separately for each AVM’s stated confidence level.

**MILAN Property Valuation Type Penalty**

A property valuation type penalty is derived for each the AVM’s stated confidence levels. The penalty is applied within the Single Loan Level adjustments of the MILAN model.

The penalty is set equal to the censored standard deviation of the estimation errors. The part of the estimation error distribution that represents AVM valuations lower than the surveyor valuation is calculated and censored; this statistical approach enables the derivation of volatility in AVM and surveyor valuations in instances where the AVM overvalues. The volatility is measured by the standard deviation of this distribution. A separate standard deviation of the censored distribution is calculated per confidence level employed by the AVM provider.

**Maximum Property Values**

Due to the extra volatility observed for larger property values. We will assess AVM valuations over a certain threshold on a transaction-specific basis. The thresholds will be reviewed on a periodic basis using updated data from the providers.
Appendix 3c - NHG Mortgage Loans in Dutch RMBS

A borrower may obtain a Nationale Hypotheek Garantie (NHG Guarantee) for a mortgage loan that is or will be occupied by the owner. The guarantee covers loss to the lender after the end of the foreclosure process for a defaulted borrower subject to a loss coverage formula. NHG loans are only granted if certain strict eligibility conditions on the loan, borrower and property are met. Such conditions also apply to the eventual claim made by the lender regarding the origination and servicing process. The Homeownership Guarantee Fund (Stichting Waarborgfonds Eigen Woningen, WEW^[21]), a foundation set up by the Dutch government and the municipalities represented by the Association of Dutch Municipalities (Vereniging Nederlandse Gemeenten), grants the guarantees.

The benefit of such guarantees may reduce substantially the severity of loss upon a borrower default. However, in our approach, we assume the NHG Guarantee will not cover all losses as a result of borrower default for two main reasons:^[22]

» **Guarantee mismatch**: The coverage level of the NHG Guarantee is not necessarily 100%. In our loan loss severity analysis, we take into account any mismatch between the actual outstanding mortgage loan balance and the NHG guarantee.

» **Rescissions**: The full check for whether a loan is compliant with NHG criteria is only performed when a loss arises and the claim is made to WEW. It is therefore not certain in advance that the loan is compliant and the guarantee will pay out as expected.

**Guarantee Mismatch**

We adjust the loss severity calculation in the MILAN model to account for the assumed mismatch between the actual outstanding mortgage loan balance and the NHG guarantee. The NHG underwriting conditions relating to coverage levels are occasionally amended for new mortgage loan originations. The size of the potential mismatch may therefore vary depending on when the loan was originated. In our analysis, the coverage level for each loan is individually assessed, taking into account the specific NHG conditions that apply.

Should the conditions specify how the guarantee amortizes overtime, this may not necessarily match the actual loan amortization. Since the coverage level may change, the timing of default for NHG borrowers becomes an important assumption. In the specific case of NHG loans whose conditions specify guarantee amortization, we assume the default timing to be 48 quarters. Taking into account the default timing, we are able to calculate the mismatch between the actual outstanding mortgage loan and the NHG guarantee.

In addition to the principal losses after foreclosure, lenders can typically claim accrued interest and foreclosure costs with WEW. The guarantee mismatch does not typically affect this part of the claim. Subject to the specific NHG conditions as they apply to each loan, we disregard the guarantee mismatch when assessing the impact of accrued interest and foreclosure costs in the loss severity calculation.

**Rescissions^[23]**

Due to a number of reasons, WEW will not always pay the full claim to the originator and may instead fully or partially rescind the claim. The most common reason for rescissions is the mistakes made during the underwriting or servicing process. We use the historical rescission rates provided by each originator and servicer as a starting point for deriving the assumed rescission rates in our analysis. As the historic rescission rates vary, we will use a different rescission rate per originator or servicer.

We stress the historic rescission rates to account for potential increases during recession scenarios. We believe that WEW is likely to be more critical toward the application of its originating and servicing criteria when the number of claims and the possible payout increase. We adjust the loss severity calculation in the MILAN model to account for the assumed rescission rate. We apply the adjustment by reducing the calculated benefit of NHG claims in proportion to the rescission rate. We apply this reduction to the full claims, including costs and accrued interest.
Appendix 3d – UK RMBS Master Trust Cash Flow Analysis

Due to the complexity and flexibility of the UK RMBS master trust structures, we perform a variety of cash flow scenarios in our structural analysis. The cash flow scenarios include (1) variations in the loss timing; (2) the time lag between default and loss realization; (3) variations in the principal payment rate (PPRs), (4) substitutions, (5) and servicer downgrade and servicer default.

**Cash Flow Scenarios**

The scenarios in the summary exhibit below are not exhaustive, but are an example of the types of scenario that we will review. Circumstances specific to a particular transaction may involve running additional scenarios.

**EXHIBIT 10**

Summary of Our Cash Flow Scenarios

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Loss Timing</th>
<th>Losses Time Lag (mths)</th>
<th>PPR</th>
<th>Substitution Period (mths)</th>
<th>Substitution Amount</th>
<th>Servicer Downgrade</th>
<th>Servicer Default</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Auto</td>
<td>12</td>
<td>Auto</td>
<td>0</td>
<td>N/A</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
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<td>12</td>
<td>Auto</td>
<td>60</td>
<td>Initial Trust Size</td>
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<td>No</td>
</tr>
<tr>
<td>3</td>
<td>Auto</td>
<td>12</td>
<td>Auto</td>
<td>60</td>
<td>Minimum Trust Size</td>
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<td>No</td>
</tr>
<tr>
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<td>Auto</td>
<td>30</td>
<td>Initial Trust Size</td>
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<td>No</td>
</tr>
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<td>5</td>
<td>Auto</td>
<td>12</td>
<td>Auto</td>
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<td>Minimum Trust Size</td>
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<td>No</td>
</tr>
<tr>
<td>6</td>
<td>3</td>
<td>12</td>
<td>Auto</td>
<td>0</td>
<td>N/A</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>7</td>
<td>3</td>
<td>12</td>
<td>Auto</td>
<td>60</td>
<td>Initial Trust Size</td>
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<td>No</td>
</tr>
<tr>
<td>8</td>
<td>3</td>
<td>12</td>
<td>Auto</td>
<td>60</td>
<td>Minimum Trust Size</td>
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<td>No</td>
</tr>
<tr>
<td>9</td>
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<td>Auto</td>
<td>10%</td>
<td>0</td>
<td>N/A</td>
<td>No</td>
</tr>
<tr>
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<td>Auto</td>
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<td>10%</td>
<td>60</td>
<td>Initial Trust Size</td>
<td>No</td>
</tr>
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<td>Auto</td>
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<td>Auto</td>
<td>10%</td>
<td>60</td>
<td>Minimum Trust Size</td>
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<td>Auto</td>
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<td>Auto</td>
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<td>No</td>
</tr>
<tr>
<td>13</td>
<td>Auto</td>
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<td>60</td>
<td>Initial Trust Size</td>
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<tr>
<td>14</td>
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<td>Auto</td>
<td>40%</td>
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<td>Minimum Trust Size</td>
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</tr>
<tr>
<td>15</td>
<td>Auto</td>
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<td>Auto</td>
<td>10%</td>
<td>0</td>
<td>N/A</td>
<td>No</td>
</tr>
<tr>
<td>16</td>
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<td>Auto</td>
<td>12</td>
<td>Initial Trust Size</td>
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<td>Yes</td>
</tr>
<tr>
<td>17</td>
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<td>Auto</td>
<td>12</td>
<td>Minimum Trust Size</td>
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<td>Yes</td>
</tr>
<tr>
<td>18</td>
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<td>12</td>
<td>Initial Trust Size</td>
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<td>No</td>
</tr>
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<td>Auto</td>
<td>10%</td>
<td>12</td>
<td>Initial Trust Size</td>
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</tr>
<tr>
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<td>Auto</td>
<td>24</td>
<td>Auto</td>
<td>60</td>
<td>Minimum Trust Size</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>21</td>
<td>Auto</td>
<td>24</td>
<td>Auto</td>
<td>60</td>
<td>Initial Trust Size</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>22</td>
<td>Auto</td>
<td>24</td>
<td>Auto</td>
<td>0</td>
<td>N/A</td>
<td>No</td>
<td>No</td>
</tr>
</tbody>
</table>

Source: Moody’s Investors Service

We typically review 22 main scenarios as part of the master trust cash flow analysis. However, in some cases, we may consider additional scenarios to analyze additional circumstances particular to a transaction. Scenarios 1, 2, and 3 represent the key scenarios, which we use to assess the ratings on the notes. In addition, the following are the general criteria for the ratings on the notes in the non-key scenarios 4-22:

- **Aaa (sf) rated notes**: should remain in the Aaa range in all scenarios
- **Aa (sf) rated notes**: should fail by no more than one to two notches in the non-key scenarios
- **A (sf) rated notes**: should fail by no more than two to three notches in the non-key scenarios
- **Baa (sf) rated notes**: should fail by no more than three notches in the non-key scenarios

However, we analyze every material failed rating in more detail to ensure it is not caused by an unusual structural weakness of the master trust.
Loss Timing

In most scenarios, we assume the timing of losses varies dynamically depending on the size of the loss point being considered in the cash flow model. These scenarios are labeled as “Auto” in the exhibit above. Specifically, for low loss points, we assume the losses are distributed over 10 years with a decreasing rate over time. For higher-loss scenarios, we assume the loss timing is more front loaded and the loss allocation is more concentrated. These assumptions ensure that the most stressful loss allocation is applied to the most stressful loss scenario to verify that the ratings of the notes can withstand this combined stress. This is particularly relevant for the senior notes, which usually have shorter average lives and, as a result, are more affected by front-loaded losses. In addition, front-loaded losses generally represent a conservative assumption for all notes because excess spread available in the future is decreased by the losses incurred by the pool. Certain scenarios assume a fixed loss timing in order to test sensitivity.

The loss timings we typically assume are summarized in the exhibit below. Loss timing 1 will generally be used for loss points less than 2%, loss timing 2 for loss points between 2% and 4%, and loss timing 3 for loss points above 4%.

### EXHIBIT 11

**Loss Timings**

<table>
<thead>
<tr>
<th>Year</th>
<th>Loss Timing 1</th>
<th>Loss Timing 2</th>
<th>Loss Timing 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
</tr>
<tr>
<td>1</td>
<td>10.0%</td>
<td>19.5%</td>
<td>25.0%</td>
</tr>
<tr>
<td>2</td>
<td>12.0%</td>
<td>18.8%</td>
<td>25.0%</td>
</tr>
<tr>
<td>3</td>
<td>12.0%</td>
<td>17.3%</td>
<td>25.0%</td>
</tr>
<tr>
<td>4</td>
<td>12.0%</td>
<td>15.2%</td>
<td>25.0%</td>
</tr>
<tr>
<td>5</td>
<td>12.0%</td>
<td>12.4%</td>
<td>0.0%</td>
</tr>
<tr>
<td>6</td>
<td>12.0%</td>
<td>9.2%</td>
<td>0.0%</td>
</tr>
<tr>
<td>7</td>
<td>9.0%</td>
<td>5.7%</td>
<td>0.0%</td>
</tr>
<tr>
<td>8</td>
<td>8.0%</td>
<td>1.9%</td>
<td>0.0%</td>
</tr>
<tr>
<td>9</td>
<td>7.0%</td>
<td>0.0%</td>
<td>0.0%</td>
</tr>
<tr>
<td>10</td>
<td>6.0%</td>
<td>0.0%</td>
<td>0.0%</td>
</tr>
<tr>
<td>11</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
</tr>
<tr>
<td>Total</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
</tbody>
</table>

Source: Moody’s Investors Service

For the various loss timings, we assume the losses are distributed evenly throughout the year.

Loss Time Lag

As can be seen from the exhibit above, we assume that losses start to occur one year after closing. This assumption takes into account the foreclosure period, and so we assume loans that become delinquent generate losses approximately one year after. In addition, we review the scenarios in which losses start in year 2 in order to test the ratings using back-loaded losses. The loss timing starts at year 2 and ends at year 11. While monitoring, or for existing master trust structures, we may shorten the loss time lag to reflect the current performance of the pool.

Principal Payment Rate

In most scenarios, we assume the timing of losses varies dynamically depending on the size of the loss point being considered in the cash flow model. These scenarios are labeled as “Auto” in the summary exhibit above.

The PPR rates we typically assume are summarized in the exhibit below. The PPR rates reflect both scheduled and unscheduled amortization of the pool; the scheduled amortization vector is not included separately in the model, because we assume that a master trust pool is continuously substituting and that the amortization vector obtained from the closing pool may thus not be reflective of the actual amortization of the pool after substitution.
### Principal Payment Rates

<table>
<thead>
<tr>
<th>Loss Point</th>
<th>&gt;=0% &amp; &lt;=1%</th>
<th>&gt;1% &amp; &lt;=3%</th>
<th>&gt;3% &amp; &lt;= 6%</th>
<th>&gt;6%</th>
</tr>
</thead>
<tbody>
<tr>
<td>PPR</td>
<td>35%</td>
<td>25%</td>
<td>20%</td>
<td>15%</td>
</tr>
</tbody>
</table>

Source: Moody’s Investors Service

We convert the annual PPR rates shown to monthly equivalents and apply them to the performing principal balance at the beginning of each month. If the amortization of the portfolio would result in some losses not being allocated to the pool, the amortization of the portfolio is delayed in order to allow all losses to be allocated to the trust. This may arise if the pool would ordinarily amortize before all losses are incurred as defined by the loss timing vector.

### Substitutions

In the cash flow analysis, we assume each new batch of loans added to the pool would generate its own losses following its own loss pattern from the day these loans are placed into the trust. The same loss pattern is used for the new loans and for the original loans, but the loss pattern for the new loans starts from the date they are added to the trust.

In addition, the cash flow analysis examines scenarios with different levels of substitution, such as:

- **substitution to the initial trust size**: the amount of loans added to the pool is such that the performing balance of the pool stays constant. The total pool balance during the substitution period is decreased only by the losses incurred by the pool and not by the prepayments.
- **substitution to the minimum trust size**: the total trust size would not fall below the minimum trust size, if applicable, and/or the seller share would not fall below the minimum seller share. The minimum trust size and/or minimum seller share are usually defined to be lower than the initial trust size and seller share. Therefore, the scenario would result in a lower amount of substitutions and hence a lower amount of additional losses. These scenarios in particular help assess the cash flows whilst avoiding triggers related to breaches in minimum trust size and/or minimum seller.

We also perform scenario analysis in relation to the length of the substitution period as outlined in the summary scenario exhibit above.

### Servicer Downgrade and Default

The modeling includes a scenario to simulate a downgrade of the originator/servicer at a certain point in time of the transaction, in order to incorporate the breach of any rating-based triggers. A rating trigger breach would typically have various consequences in the cash flows of the transaction, such as trapping of principal receipts to build up a liquidity reserve and stopping substitution. We typically assume the downgrade will occur one year after closing.

We also include servicer default in the scenario analysis. A servicer default is typically one of 'non-asset trigger' conditions resulting in a change in the cash flow allocations of the transaction. In addition, following a servicer default, we assume the servicing fee will increase to a stressed level. Lastly, following a servicer default, we assume the arrears multiple will increase to a higher level and the loss timing distribution for the remaining losses will become more front loaded. This allows us to simulate the disruption, which we expect will be associated with the servicer default and lead to higher delinquencies and possibly higher losses while the servicing transfer is taking place. We assume the default will occur two years after the downgrade.
Other Cash Flow Assumptions

Evolution of Asset Yield

We use three inputs to define the evolution of the yield on assets over time in the transaction: the initial yield, the minimum yield for the substitution period, and the post-substitution yield. We define the yield as the margin received by the issuer on the assets through the associated swaps over the floating swap base rate (usually LIBOR). We calculate the initial yield level from the closing pool. While substitution continues, we typically assume the yield will decrease continuously over one year to the minimum margin defined in the documentation for the master trust. It then stays at this level until substitution stops. Once substitution stops, we assume that fixed and discounted mortgages reset over time, which leads to an increase in the asset yield of the pool to an assumed level determined on a case-by-case basis per master trust.

Arrears

In the master trust cash flow model, we back-calculate arrears from losses by applying an arrears multiple to the loss amount a certain period before the loss is modeled to occur. This calculation simulates loans going into arrears prior to generating a loss and accounts for the fact that a certain proportion of loans in arrears will become current instead of defaulting. For example, if the cash flow analysis assumes the arrears multiple of two, this would mean that, for each £1 of loss, £2 of assets go into arrears 12 months before this loss is incurred. The arrears multiple can also vary dynamically in the cash flow analysis to account for sudden spikes in arrears due to, for example, servicer default.

Once a loan goes into arrears, no interest would be collected on this loan. Thus, a high arrears multiple has a negative impact on liquidity and excess spread. If the loan becomes re-performing, we assume the interest accrued on the loan will recover fully; however, the interest on a defaulted loan, which results in a loss, is ignored and is not recovered.

We typically ignore any arrears triggers in our cash flow analysis. Such triggers typically modify the transaction waterfall or cause the reserve fund to build up after a certain arrears level has been breached. They are ignored due to the uncertainties and inconsistencies in arrears reporting by different originators that make it difficult to predict exactly when the arrears trigger would be breached.

Bullet Test

To ensure that the bullet notes can be repaid as scheduled, even under adverse performance scenarios, we use a separate Bullet Test, which assumes a high PPR, typically 30%, up to the beginning of the accumulation period of the note and a low PPR, typically 7%, during the accumulation period. This simulates the lowest possible principal collections received during the accumulation period because the master trust size is decreased by the high PPR prior to accumulation, which is then dramatically lowered for the duration of accumulation period.
Appendix 3e – Global Approach to Lender’s Mortgage Insurance

This appendix describes how we evaluate lender’s mortgage insurance (LMI) when rating RMBS. LMI can play a critical role because it provides the first layer of credit protection in RMBS transactions. If a borrower defaults, and a loss occurs after the sale of the security property, the lender may file a claim under the LMI policy for the loss amount. The policy typically covers 100% of the principal, accrued interest and reasonable expenses incurred in the enforcement of the mortgage.

LMI policies do not generally constitute guarantees. They are normally subject to terms and conditions that include, among others, a lender’s compliance with agreed underwriting policies and the relevant procedures and loans management process. While mortgage insurers must pay valid claims, they have the right to reduce or deny claims that breach the terms and conditions under the policy.

A summary of our approach follows.

Overview of LMI Benefit

The LMI benefit is the measure by which the presence of LMI results in a transaction needing less credit enhancement from other sources in order to achieve a target rating.

The LMI benefit is primarily a function of (1) the insurer’s claim-paying ability, which we express as its IFSR, and (2) a discount to account for loan losses that the insurers will not cover (the discount is the loss adjustment rate (LAR)). To address the risk of loss adjustments, we typically use a LAR in the range of 10%-25%. We determine a LAR on an RMBS program or transaction basis.

LMI Benefit for Senior Aaa(sf) Notes

Exhibit 13 details the LMI benefit for senior notes with Aaa (sf) ratings. We calculate the benefit as a percentage of the MILAN CE. We incorporate the benefit into our cash flow analysis to arrive at a credit enhancement commensurate with the target Aaa (sf) rating on the notes.

<table>
<thead>
<tr>
<th>Mortgage Insurer IFSR Rating</th>
<th>Claim-Paying Ability Benefit</th>
<th>Overall Benefit after LAR of 10%-25%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aa1</td>
<td>70%</td>
<td>63%-53%</td>
</tr>
<tr>
<td>Aa2</td>
<td>60%</td>
<td>54%-45%</td>
</tr>
<tr>
<td>Aa3</td>
<td>50%</td>
<td>45%-38%</td>
</tr>
<tr>
<td>A1</td>
<td>40%</td>
<td>36%-30%</td>
</tr>
<tr>
<td>A2</td>
<td>35%</td>
<td>32%-26%</td>
</tr>
<tr>
<td>A3</td>
<td>30%</td>
<td>27%-23%</td>
</tr>
<tr>
<td>Baa1</td>
<td>20%</td>
<td>18%-15%</td>
</tr>
<tr>
<td>Baa2</td>
<td>10%</td>
<td>9%-8%</td>
</tr>
<tr>
<td>Baa3</td>
<td>5%</td>
<td>5%-4%</td>
</tr>
</tbody>
</table>

Source: Moody’s Investors Service

LMI Benefit for Non-Aaa(sf) Senior Notes

Exhibit 14 details the LMI benefit for senior notes whose rating is below Aaa (sf).
EXHIBIT 14
Claim-Paying Ability Benefit for Non-Aaa (sf) Senior Notes

We may reduce the LMI benefit below to account for LAR. LAR is typically in the range of 10% to 25%.

<table>
<thead>
<tr>
<th>Mortgage Insurer’s IFSR Rating</th>
<th>Note Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Aa1(sf)</td>
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<tr>
<td>Aa1</td>
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</tr>
<tr>
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<td>60%</td>
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<td>45%</td>
</tr>
<tr>
<td>A3</td>
<td>40%</td>
</tr>
<tr>
<td>Baa1</td>
<td>30%</td>
</tr>
<tr>
<td>Baa2</td>
<td>15%</td>
</tr>
<tr>
<td>Baa3</td>
<td>10%</td>
</tr>
<tr>
<td>Ba1</td>
<td>5%</td>
</tr>
<tr>
<td>Ba2</td>
<td>-</td>
</tr>
<tr>
<td>Ba3</td>
<td>-</td>
</tr>
<tr>
<td>B1</td>
<td>-</td>
</tr>
<tr>
<td>B2</td>
<td>-</td>
</tr>
</tbody>
</table>

Source: Moody’s Investors Service

Impact of LMI on Junior Notes

The rating on the junior notes will correspond to the IFSR of the lowest rated mortgage insurer in the transaction, if structural protections, other than non-retainable excess spread, are in place to cover loss adjustments.

Junior notes lacking structural protections are exposed to losses not covered by the LMI. We measure the probability of incurring a loss on these junior notes by taking into account, among other factors, 1) the credit quality and performance to date of the underlying mortgage pool; and 2) the LAR in our cash flow analysis.

Claim-Paying Ability Benefit

The claim-paying ability benefit is based on the mortgage insurer’s IFSR. The level of benefit depends on the notes’ target rating relative to the mortgage insurer’s IFSR. The benefit takes into account:

1. **Correlation**: The high correlation between the performance of the mortgage market, RMBS portfolios and the financial strength of the LMIs. The correlation between mortgage insurers and RMBS portfolios is usually very high because both are exposed to the local mortgage market. In addition, insuring RMBS portfolios usually constitutes a material proportion of the mortgage insurers’ business. The claim-paying resources and financial strength of the mortgage insurers will be challenged in an event of material losses arising in RMBS portfolios and in the non-securitized segment of the mortgage market covered by mortgage insurance.

2. **Timing of loss uncertainty**: A mortgage insurer’s claim-paying resources are available to cover losses on its entire portfolio, and can be used on a “first-in, first-served” basis. As such, there is uncertainty about the timing of losses on the mortgage insurer’s overall portfolio relative to a specific portfolio of mortgages, whether they are securitized or not. This could mean that in a stressed scenario, a mortgage insurer’s claim-paying resources could be substantially depleted prior to losses materializing in a specific securitized pool.
Loss Adjustment Rates

We may reduce the LMI benefit to account for LAR if we believe that there is a risk of the mortgage insurer rescinding claims. Our LAR assumption is typically in the range of 10% to 25%. We determine a LAR on an RMBS program or transaction basis.

We incorporate loss adjustments into our analysis because the benefit of LMI in RMBS can be substantially diluted if there is a material level of loss adjustments.

Loss adjustments encompass any LMI claim adjustments, such as claim reductions, or denials or rescissions of non-claimable amounts.

Loss adjustments also cover any loss amounts that are not submitted to a mortgage insurer. In some cases, lenders voluntarily do not submit loss amounts, partial or full, if they know that the amounts would not constitute a valid claim. However, it is still important to consider such a loss amount as it represents an economic loss to the RMBS.

Historical LAR Range for RMBS Can Vary

For each RMBS program, we calculate the observed LAR as the amount of all claim adjustments, plus loss amounts not submitted as claims, divided by the total loss amount after the sale of security property (i.e., losses incurred prior to submitting LMI claims).

Increases in claims lead to higher claim scrutiny and adjustments. Increases in the frequency and magnitude of LMI claims will lead to greater scrutiny by mortgage insurers of the claim process, leading to a higher risk of claim adjustment.

Reasons for loss adjustments vary. Loss adjustments generally occur when the lender fails to comply with the terms and conditions of the LMI policy, or the type of loss incurred is not covered by the policy.

Determining LAR

In determining the LAR for each lender/servicer, we take into account, among other factors, the following:

Contractual arrangement for the Insurance Agreement

We consider the contractual arrangements and whether the insurance agreement allows for rescission, and under what criteria. In some markets, the determination of compliance is made ex ante, and as such limits the ability for the insurer to rescind a claim made against it. Furthermore, the specific contractual arrangement may not insure all losses incurred.

Originator’s Underwriting Arrangements with Mortgage Insurers

Underwriting arrangements generally fall into three categories:

Category 1: Full underwriting by mortgage insurers. This type of underwriting substantially reduces the risk of claim adjustment caused by irregularities in loan underwriting or misrepresentations. Mortgage insurers typically review all information necessary to underwrite the loan, including income verifications, valuations, evidence of serviceability calculations, and credit bureau checks. In some jurisdictions, the insurer may only review a sample of the loans in the pool however the subsequent contractual arrangements exclude rescission for non-compliance for all loans in the insured pool. We will typically assign a lower LAR under this category, provided other criteria are satisfactory.

Category 2: Delegated underwriting authority (DUA). Lenders themselves underwrite mortgage loan insurance policies under DUAs issued by the mortgage insurers. The mortgage loans must be underwritten in line with the criteria agreed with the mortgage insurers. The risk of claim adjustments under such an arrangement is typically higher than in Category 1, because it leaves the mortgage insurers with grounds to adjust the claims on the basis of deficiencies in underwriting practices.

Category 3: Pool insurance. Pool insurance is normally taken out at the time of securitization. The risk of claim adjustment under such arrangements is higher than in the case of the other two types, because the mortgage insurers rely heavily on lenders’ underwriting processes and because any deficiency may lead to claim denials.
Under Categories 2 and 3, the mortgage insurers typically audit a sample of loans to ensure that they have been underwritten in line with agreed criteria. While the audits help the mortgage insurers to mitigate the risk of deficiency in the underwriting processes of lenders, the risk remains because the mortgage insurers carry out the audits themselves and are not independent parties. The timing and scope of the audits are also set by the mortgage insurers at their own discretion.

**Lenders’ Underwriting Controls**

Tight underwriting standards are crucial to minimize the risk of loss adjustments. We will assign a higher LAR if a lender falls short of the underwriting criteria, which include:

» A clear separation between loan origination/sales and loan approvals  
» Verification of critical information, such as employment and income, is not delegated to brokers or staff involved in the loan origination/sales process  
» Settlement review process is in place to ensure all relevant loan assessment information is obtained  
» Lenders perform comprehensive hindsight reviews to ensure loans are underwritten in line with their underwriting policies

**Historical LAR Experience**

LARs vary by lender, and provide an important insight into an individual lender’s underwriting controls and its ability to efficiently manage the foreclosure process.

We will generally consider historical loss rates as a floor for our assumptions on stressed loss adjustment rates for each lender/servicer.

If a lender’s historical claim adjustments are mainly caused by foreclosure expenses above the limits specified in the LMI policy, we will consider a LAR of 10% or 15% as appropriate, assuming other criteria are satisfactory.

Historical LARs due to excessive foreclosure expenses are typically below 5% when calculated as total loss adjustments divided by the total amount of loss experienced after the sale of the security property (i.e., amount of loss prior to submitting any claim to mortgage insurers).

If historical experience shows loss adjustments because of misrepresentation by a lender or deficiencies in the underwriting process, we will apply a LAR of at least 20%.

We assume a higher claim adjustment rate if a lender fails to provide us with reliable historical data on LARs, but there are historical losses on its RMBS portfolio, or if it is a new issuer.

**Scale of Servicing Operations and Servicer’s Financial Strength**

We apply a higher LAR if a lender’s servicing capacity is limited by its scale and/or financial strength. Efficient servicing of mortgages through the foreclosure process is critical to minimizing claim adjustments, particularly in times of economic stress.

**Alignment of Interest**

We apply a higher LAR if the lender’s interest is inadequately positioned to mitigate risks during the origination and servicing process.

Most bank lenders originate loans on their balance sheets, and only securitize a small proportion of the loans. Since the majority of the risk remains on their balance sheets, the incentives of these lenders are generally well aligned with the need to maintain robust origination and servicing practices.

In cases where the origination model is predominantly for the purposes of securitization, we may apply higher LARs. However, we will consider low historical LARs as a positive factor.

Based on the factors outlined, LARs are typically 15% or 20% for most lenders. Refer to Exhibit 15 below for a summary of the above factors.
Representations and Warranties
Additionally, we may reduce assumed LARs for some programs in the context of junior notes, depending on the representation and warranties provided by the lender regarding compliance of the mortgages with the terms and conditions of the LMI policies. We will consider giving any benefit to such representations and warranties if:

» they are tightly construed
» adequate and timely indemnities are in place in case of any loss to the transaction caused by a breach of representation and warranties
» the lender is rated investment grade

EXHIBIT 15
Loss Adjustment Rate Guidance

<table>
<thead>
<tr>
<th>LAR</th>
<th>Guidance</th>
</tr>
</thead>
</table>
| 10% | Loans are underwritten by mortgage insurers themselves.  
In case of pool insurance, the lender obtains an external audit covering whether underwriting is in line with underwriters’ policies and procedures.  
Negligible historical loss adjustment rates are mainly caused by foreclosure expenses exceeding a mortgage insurer’s allowable limit.  
Lender has strong internal and external underwriting controls.  
Servicer has adequate operational capacity. |
| 15% | Lender has DUA subject to regular audits (in the context of rewriting loans) by mortgage insurers.  
Median historical loss adjustment rates are below 5% and are mainly caused by foreclosure expenses exceeding a mortgage insurer’s allowable limit.  
Lender has adequate internal and external underwriting controls.  
Servicer has adequate operational capacity. |
| 20% | Lender has DUA, which is subject to regular audits (in the context of rewriting a loan) by mortgage insurers.  
Median historical loss adjustment rates are 5%-10%, and some are caused by deficiencies in the underwriting process or misrepresentations.  
Lender has strong internal and external underwriting controls.  
Servicer has adequate operational capacity. |
| 25% | Lender has DUA, which is subject to regular audits (in the context of rewriting a loan) by mortgage insurers.  
Median historical loss adjustment rates are above 10%, or are mainly caused by deficiencies in the underwriting process or misrepresentations.  
Verification of critical information, such as employment and income, is delegated to brokers/staff involved in the loan origination/sales process.  
Financially weak servicer.  
Lender’s interest is inadequately positioned to mitigate risk during the origination and servicing process, and this is reflected in high claim adjustment rates. |
| > 25% | There are systematic issues with the underwriting/high level of claim reductions emerging. |

Source: Moody’s Investors Service
Appendix 3f – Tail Risk in Australian RMBS that Pay Principal Pro-rata

This appendix describes our monitoring approach to 1) evaluating tail risk in Australian RMBS that pay principal to the securities on a pro-rata basis; and 2) assessing the sufficiency of the credit enhancement and liquidity available to the rated securities. Tail risk is the risk of a disproportionately large loss on the underlying pool at the end of a transaction’s term when few loans remain in the pool and credit enhancement, though high in percentage terms, is low in dollar terms.

We will use this approach to monitor senior and mezzanine securities with Aaa (sf)–A (sf) ratings from pro-rata pay transactions that do not have compensating mechanisms of support, such as credit enhancement and liquidity floors. Pools of mortgages with LMI back these senior and mezzanine securities.

In general, so long as the senior and mezzanine securities do not incur losses under the stress scenario, we will cap their ratings at 1) the relevant mortgage insurer’s rating\(^27\) if the transaction has sufficient liquidity to cover the collection shortfall during the insurance claim period; or 2) one notch below the relevant mortgage insurer’s rating if the transaction has insufficient liquidity to cover the shortfall during that period. If the securities do incur losses, their ratings will be commensurate with the losses under that scenario.

**Approach to Assessing Tail Risks**

To assess the vulnerability of senior and mezzanine securities to tail risk, we run an additional stress test, whereby we increase our projection of losses and slow the timing of future defaults:

- **Step 1 Stress Factor:** We first compute a stress factor by analyzing the securitized pool’s LTV distribution and the percentage of low documentation loans. The stress factor ranges between 1.5, for pools with low LTVs and low percentages of low documentation loans, to 2.0 for pools with high LTVs and large percentages of low documentation loans.

- **Step 2 Stressed Expected Loss:** We apply the stress factor to our projection of expected loss on the pool. We subject this stressed loss to a floor equal to the aggregate loss from the default of the five largest loans.

- **Step 3 Default Timing:** Using the stressed loss, we perform a cash flow analysis that employs a stress back-ended loss curve. We distribute the timing of defaults over the next three to 10 years depending on the pool’s LTV and the percentage of loans with long interest-only periods. The higher the LTV or the greater the percentage of loans with long interest-only periods, the further into the future we will push the timing of the majority of defaults.

In addition, we assess the sufficiency of the liquidity facility to cover any collection shortfalls at the end of a transaction. To determine sufficiency, we assume that the largest loans with the longest interest-only periods will remain outstanding. We then determine the collection shortfall from the high delinquency of these loans for a prolonged period and compare it with the available liquidity in the transaction.
Appendix 3G - Revising Assumptions Over the Life of an EMEA RMBS/ABS Transaction

As part of our ongoing surveillance of EMEA RMBS/ABS transactions, we use transaction-specific performance data to help revise our expected default or loss assumptions during the life of the transaction. The transaction specific data we consider generally includes:

- delinquency rates and trends
- observed periodic and cumulative default or loss2 rates
- historical portfolio redemption rates, which can often be separated into scheduled redemption and prepayments

We have two broad approaches to help revise expected default assumptions: a trend analysis and a roll rate analysis. We consider the results of both approaches when revising our assumptions.3 The roll-rate analysis, which uses a more static approach, provides a simpler assessment, compared to the trend analysis. The trend analysis becomes more relevant for seasoned portfolios as it leverages on transaction’s performance data to project future defaults. However, the trend analysis could also produce more volatile results as it is more reactive to temporary changes in performance trends.

In the early months of a transaction’s life, we typically maintain our initial expected default or loss assumption unless we observe signs of material deviation in performance. More weight may be given to the results of these approaches the more the transaction is seasoned. When significant transaction specific performance information is available, the payment patterns exhibited by the portfolio can be better performance predictors than loan level or portfolio characteristics, in particular when forecasting future defaults considering our baseline projected economic outlook.

We also incorporate benchmarking analysis and other qualitative considerations when reassessing our expected default or loss estimates. For example, we may complement our analysis by reviewing performance indicators such as the evolution of the securitized portfolio delinquency trend or the distance between the observed defaults or losses and our expected default or loss assumption for the life of the transaction. In case of significant deviation of observed defaults or losses to our assumed level, we would adjust our expected loss or default assumption considering the two broad approaches described below and may adjust further to acknowledge the observed deviation.

Trend Analysis
Our trend analysis considers two elements: a short-term projection and a long-term projection. The two elements are then added together. We may then convert the projected default rate to a projected loss using a transaction and/or country- specific severity assumption.

Short-term projection
We apply roll rates (probability of default) to the non-performing parts of the portfolio, with higher rates applied to loans in later stages of delinquency. Unlike the roll rate analysis below, the short-term projection for the trend analysis considers only the non-performing part of the portfolio to which it may apply more refined roll-rates.

Long-term projection
We forecast future default frequency rates from recent default trends and extrapolate the future amortisation of the portfolio from recent redemption data. We consider in particular the following:

**Default Frequency Rate (DFR)** of reporting period \(t\) is defined as the balance of the loans that have defaulted4 from reporting date \((t-1)\) to reporting date \(t\), divided by the portfolio balance at the beginning of the period (this is, therefore, a dynamic measure):

\[
\text{DFR}_{t} = \frac{\text{balance of loans that defaulted from } (t-1) \text{ to } t}{\text{portfolio balance at the beginning of the period}}
\]

Sometimes loss rates are reported instead of default rates. The entire approach to revise the expected default assumption that is described in this report also applies to revise the expected loss assumption, although the exact modelling approach is not identical.

For example, we may consider a simple average of the two results or only the roll rate analysis if the trend analysis is resulting in very low projected default rate.

Similarly, if loss rates were reported, Loss Frequency Rate (LFR) would be defined as the losses that have occurred from reporting date \((t-1)\) to reporting date \(t\), divided by the portfolio balance at the beginning of the period.
Total Redemption Rate (TRR) of reporting period \( t \) is defined as the portfolio redemption from reporting date \( t-1 \) to reporting date \( t \), divided by the portfolio balance at the beginning of the period.

Growth Rates (GR_{DFR} and GR_{TRR}) DFRs and TRRs typically slowly increase through at least part of the transaction’s life. Therefore, we apply growth rates to the 12-month average DFR and the 12-month average TRR to project the future expected default frequency rates and the future expected amortisation of the portfolio. Specifically, we will apply different growth rates at different stages of the transaction’s life, separately for DFRs and TRRs.

Delinquency Trend Coefficient (DT_{DFR}) Additionally, as increasing delinquencies often translate (with some lag) into increasing default frequency rates, the 12-month average DFR is also stressed by a delinquency trend coefficient to reflect any possible predictive trend in delinquencies. We compute this coefficient as the average of smoothed ratios calculated separately for each delinquency bucket and reflecting recent trends.

The formulas to determine future DFRs and TRRs are the following:

**FORMULA 1**

\[
DFR_t = (12\text{MonthAverageDFR}) \times DT_{DFR} \times \prod_{i=2}^{t} (1 + GR_{DFR}),
\]

Note that for the first period in the future, the DFR would simply be:

\[
DFR_t = (12\text{MonthAverageDFR}) \times DT_{DFR}
\]

**FORMULA 2**

\[
TRR_t = (12\text{MonthAverageTRR}) \times \prod_{i=2}^{t} (1 + GR_{TRR}),
\]

Total projected long-term defaults are then computed as the sum for all future periods of the product between the default frequency rate and the current portfolio balance.

Outlook adjustment
To account for our market-specific RMBS/ABS outlooks, we make adjustments to our roll rate analysis and trend analysis. Adjustments may be applied to roll rates, severity assumption, as well as to the growth rates applied to future DFRs or TRRs.

For instance, in a negative outlook scenario, the assumptions for the roll rates and the severity could be increased compared with the assumptions corresponding to a stable outlook scenario. The growth rates applied to future DFRs could be increased too, whereas the growth rates applied to future TRRs could be decreased, so that the amortisation of the portfolio would be slower and the DFRs would be applied for a longer time, resulting in a higher long-term defaults projection.

Hypothetical example
This example considers a theoretical seasoned transaction.

For the short-term projection we apply asset class and country-specific roll-rates to the current delinquency rates to project the short-term defaults. Over the short-term the defaulting loans will typically emerge from the loans which are already delinquent.
EXHIBIT 16

**Short-term projection**

<table>
<thead>
<tr>
<th>Delinquency bucket</th>
<th>Proportion of the portfolio</th>
<th>Example roll rates</th>
<th>Projected defaults</th>
</tr>
</thead>
<tbody>
<tr>
<td>31-60 days</td>
<td>3%</td>
<td>25%</td>
<td>0.8%</td>
</tr>
<tr>
<td>61-90 days</td>
<td>2%</td>
<td>50%</td>
<td>1.0%</td>
</tr>
<tr>
<td>90+ days</td>
<td>1%</td>
<td>100%</td>
<td>1.0%</td>
</tr>
<tr>
<td><strong>Total short-term projection</strong></td>
<td></td>
<td></td>
<td><strong>2.8%</strong></td>
</tr>
</tbody>
</table>

For the long-term projection we start with the transaction’s last 12-month average DFR and the last 12-month average TRR. We also apply asset class and country specific growth rates and delinquency trend coefficients.

EXHIBIT 17

**Long-term projection**

<table>
<thead>
<tr>
<th>Future period (t)</th>
<th>Pool Factor P(t)</th>
<th>TRR(t)</th>
<th>DFR(t)</th>
<th>Projected Defaults</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>100%</td>
<td>14.3%</td>
<td>0.8%</td>
<td>n/a - derived in the short term projection⁶</td>
</tr>
<tr>
<td>1</td>
<td>85.5%</td>
<td>14.5%</td>
<td>0.9%</td>
<td>0.8%</td>
</tr>
<tr>
<td></td>
<td>PF₀ x (1 – TRR₁)</td>
<td>TRR₁ x (1 + GRTRR)</td>
<td>DFR₀ x DT₁ x (1 + GRDFR)</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>72.8%</td>
<td>14.8%</td>
<td>0.9%</td>
<td>0.8%</td>
</tr>
<tr>
<td></td>
<td>PF₁ x (1 – TRR₂)</td>
<td>TRR₂ x (1 + GRTRR)</td>
<td>DFR₁ x (1 + GRDFR)</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>61.8%</td>
<td>15.1%</td>
<td>0.9%</td>
<td>0.7%</td>
</tr>
<tr>
<td>4</td>
<td>52.3%</td>
<td>15.4%</td>
<td>0.9%</td>
<td>0.6%</td>
</tr>
<tr>
<td>5</td>
<td>44.0%</td>
<td>15.7%</td>
<td>1.0%</td>
<td>0.5%</td>
</tr>
<tr>
<td>6</td>
<td>37.0%</td>
<td>16.0%</td>
<td>1.0%</td>
<td>0.4%</td>
</tr>
<tr>
<td>7</td>
<td>30.9%</td>
<td>16.4%</td>
<td>1.0%</td>
<td>0.4%</td>
</tr>
<tr>
<td>8</td>
<td>25.8%</td>
<td>16.7%</td>
<td>1.0%</td>
<td>0.3%</td>
</tr>
<tr>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td><strong>Total long-term projection</strong></td>
<td></td>
<td></td>
<td></td>
<td><strong>5.2%</strong></td>
</tr>
</tbody>
</table>

Finally, the short-term and the long-term projections are added together to derive the total expected defaults for the remaining life of the transaction.

EXHIBIT 18

**Combined projection**

<table>
<thead>
<tr>
<th>Projection</th>
<th>Projected Defaults</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short-term projections</td>
<td>2.8%</td>
</tr>
<tr>
<td>Long-term projection</td>
<td>5.2%</td>
</tr>
<tr>
<td><strong>Total future defaults</strong></td>
<td><strong>8.0%</strong></td>
</tr>
</tbody>
</table>

**Roll Rate Analysis**

The roll rate analysis is a simpler static approach which applies probabilities of default for the life of the transaction to the performing pool, early, mid and late stage delinquencies.

We calculate the probability of default on the delinquent loans by applying roll rates to the loans based on their delinquency status: the more severe the loan’s delinquency status, the higher the probability of default.

We also apply a lifetime default rate to the performing part of the portfolio based upon the quality of the pool. A pool of lower credit quality loans will have a higher lifetime default rate applied to the performing loans.

---

⁵ Pool factor relative to the outstanding balance of the portfolio at the date of assessment
⁶ The number of periods included in the short term projection will vary depending on the transaction’s frequency of reporting and default definition
We estimate our standard asset class and country-specific roll-rates and default rates based upon observed historical data for the sectors. If a transaction is sufficiently seasoned, we may estimate transaction-specific roll rates from the past default and delinquency performance of the transaction, replacing our standard estimates.

As described above under the trend analysis, we may also make adjustments to the roll rate and severity assumptions to account for our market-specific RMBS/ABS outlooks.

**EXHIBIT 19**

**Roll Rate Analysis Hypothetical Example**

<table>
<thead>
<tr>
<th>Portfolio Buckets</th>
<th>Proportion of the portfolio</th>
<th>Example roll rates</th>
<th>Projected defaults</th>
</tr>
</thead>
<tbody>
<tr>
<td>31-90 days</td>
<td>5%</td>
<td>50%</td>
<td>2.5%</td>
</tr>
<tr>
<td>90+ days</td>
<td>1%</td>
<td>100%</td>
<td>1.0%</td>
</tr>
<tr>
<td>Performing pool</td>
<td>94%</td>
<td>3.5%</td>
<td>3.3%</td>
</tr>
<tr>
<td><strong>Total future defaults</strong></td>
<td></td>
<td></td>
<td><strong>6.8%</strong></td>
</tr>
</tbody>
</table>

When converting our expected default assumption to an expected loss we also apply a severity assumption derived from transaction- and country-specific data.
Appendix 4 – Settings for Countries Using the MILAN Framework

Please click here to access a list of countries using the MILAN framework, their related settings and, for certain regions, a description of our approach to originator assessments.
Appendix 5 – Idealized Expected Loss Table

Please click here.
Moody's Related Research

The credit ratings assigned in this sector are primarily determined by this credit rating methodology. Certain broad methodological considerations (described in one or more secondary or cross-sector credit rating methodologies) may also be relevant to the determination of credit ratings of issuers and instruments in this sector. Potentially related secondary and cross-sector credit rating methodologies can be found here.

For data summarizing the historical robustness and predictive power of credit ratings assigned using this credit rating methodology, see here.

Please refer to Moody’s Rating Symbols & Definitions, which is available here, for further information.
Also known as revolving transactions in some countries

Maintaining our existing assumption means this specific transaction feature would be considered unchanged as part of our ongoing surveillance.

For example in EMEA RMBS a future loss estimate within a 30% deviation of the current assumption may be considered to be performing within expectations given the volatility of such number.

We may reassess the MILAN model result using (and performing a data quality assessment on) the latest loan-level information for certain key dynamic mortgage loan characteristics; such as current loan balance and arrears status. The majority of the mortgage loan characteristics would typically be considered as static and therefore unchanged from the information provided when initial ratings are assigned.

In some countries, the property value provided is the foreclosure value instead of the market value. For those countries, the property value as provided by the originator is adjusted to derive the market value using a market-specific adjustment factor.

For loans secured on multiple properties, we separately stress each property's value.

MILAN CE requirement for a single loan is subject to a frequency cap of 100% and severity cap of 100% plus accrued interest.

If we cannot obtain the effective number, we will use a threshold of 45 borrowers instead. If we cannot obtain the effective number of borrowers, we will use the effective number of loans instead.

If we cannot obtain the effective number, we will use a threshold of 25 borrowers instead.

However, for structured finance securities with full support from a financial guarantor, if the financial guarantor’s rating is below investment grade, we would expect to withdraw the rating of the security after withdrawing its underlying rating.

For very high Portfolio EL assumptions, the multiple will be assessed case by case.

We will apply the Minimum Portfolio MILAN CE to the RMBS part of the portfolio. For mixed pools, we will assess the non-RMBS portion of the pool separately.

We give more weight to the price-to-income ratio when we observe increasing consumer leverage in a given country. Increasing consumer leverage indicates that medium-term house price growth has been sustained because households were provided with sufficient increases in debt financing. We believe there will be a disruption to this increase in debt financing in an economic shock, which will in turn reduce house prices.

Although we have assigned weights to the sub-components of this component, the method is not formulaic in that the scores assigned to each sub-component is qualitatively assigned using a broad range of information.


The maximum achievable rating in the market typically aligns with the local currency country ceiling. In certain circumstances, depending on the drivers of the local currency country ceiling, we may consider alternative loss distribution assumptions or may not adjust our loss distribution assumptions taking into consideration the local currency country ceiling.

For SME sub-portfolios, we will convert the stochastic recovery distribution, typically used for SME portfolios, into a fixed recovery rate.

The standard deviation of the combined pool will be calculated as the weighted average standard deviation of the SME and RMBS sub pools.

Estimation error = (AVM valuation – Surveyors valuation) / Surveyors valuation. The risk is quantified assuming the estimation error is normally distributed.

Descriptive statistics, such as mean, median and standard deviation, are some of the statistical measures used in the analysis.

As WEW is a Dutch institute providing insurance for Dutch mortgages, there exists some correlation between defaults in the mortgage portfolio and a default of WEW. However, as WEW is guaranteed by the Dutch government, we assume the correlation is low.

We focus on the loss arising from borrower default. We assess other potential sources of loss not covered by NHG, such as set-off risk, separately.

We define rescissions as reduced or denied claims for reasons other than the guarantee mismatch.

Due to ongoing substitution, master trust documentation typically contain criteria to restrict poorer quality assets being added to the pool. We take the criteria into consideration in our portfolio analysis. The criteria may include, loan level eligibility criteria, limits on the portfolio’s LTV distribution or the use of Moody’s Portfolio Variation (MPV) test. The MPV test compares the pool quality at two points in time through a simplified MILAN model.

Bullet redemption notes typically have a short maturity and are redeemable on full on a single date. The payment date is typically preceded by an accumulation period with the aim of trapping sufficient cash to pay the note in full when due.

The methodology is only applicable to private mortgage insurers. Our approach to a highly rated government-owned or government-supported mortgage insurance provider would be different, to account for a much lower correlation between the mortgage market and financial strength of a highly rated government.

The relationship between the rating of the relevant mortgage insurer and the security rating is not one to one. We will analyze the rating impact on the security arising from the rating migration of the mortgage insurer on a case-by-case basis.
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