MOODY'S INVESTORS SERVICE

RATING METHODOLOGY

Rating Methodology

SME Asset-Backed Securitizations

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This rating methodology replaces the *Moody's Global Approach to Rating SME Balance Sheet Securitizations* methodology published in July 2022. In this update, we have clarified (1) the methodology's scope, and (2) the conditions under which we use the top-down or bottom-up approach. We also have updated the appendix that discusses venture debt securitizations, and we made editorial updates to improve readability and transparency. The updates do not change our methodological approach.

Scope

This methodology applies globally to securitizations backed mainly by loans granted to small and medium-sized enterprises (SMEs) and self-employed individuals.

This methodology does not apply to securitizations backed primarily by loans to public or non-profit organizations, loans to start-up companies (except venture debt[1]), broadly syndicated loans, subordinated loans, preferred stock and/or loans without recourse to an operating company (e.g., real estate project finance and special purpose entities [SPEs]), which require a different analytical approach given the specifics of these obligors/assets.

[1] For more information, see Appendix 13.

Rating approach

Asset overview

This methodology applies to transactions backed primarily by secured and unsecured loans to SMEs for working capital or investment purposes. SMEs are typically defined based on the applicable jurisdiction's guidelines; for example, in Europe those provided by the European Commission. SME transactions typically are driven by funding needs and/or balance sheet considerations of the originator (e.g., managing regulatory capital, risk management). Typically, the originator is a bank, specialized finance company, or even an alternative lender.

Some SME loan securitizations are backed by loans originated for securitization purposes. This methodology applies to these transactions, but additional stress scenarios may be considered, in particular to address potential issues of alignment of interest or adverse selection.

In addition, this methodology applies to Japanese apartment loan securitizations and we describe our approach to rating these transactions in Appendix 11.

The general analytical framework this methodology describes applies to various types of SME ABS transactions; we choose the appropriate technique to derive the pool loss distribution based on the level of diversification in the asset pools and the type and amount of data available.

Key risks

Portfolio credit quality and transaction structure are the two main risk drivers for a typical SME transaction. We discuss other more general transaction risks in the "Other considerations" section.

Portfolio credit quality

The overall credit quality of a portfolio of SME loans is typically driven by (1) the type of contracts securitized (e.g., loans versus short-term facilities, tenor, repayment profile, among others), (2) the credit risk related to the obligors (considering possible group relationships), (3) the portfolio composition in terms of obligor, regional and industry concentrations, as well as (4) the type and amount of collateral (e.g., real estate properties) securing the loans. Furthermore, the originator's specific underwriting and servicing policies, along with the current and forecast macroeconomic environment, may affect the credit profile of the pools.

Transaction structure

Specific features such as cash flow allocations, forms of credit enhancement and cash-trapping mechanisms, have an impact on the expected loss (EL) for each tranche of securities. For transactions with a revolving or prefunding period, the ability to replenish the portfolio with new loans will add some uncertainty to the portfolio composition. When modeling the transaction, we aim to capture the main structural features described in the transaction documentation.

Analysis overview

Our rating analysis of SME securitizations includes both quantitative and qualitative elements. The main drivers of our quantitative analysis are our projections of the future losses on the underlying assets, which depend on the asset default rate and the recovery rate on assets that default. Typically, we project the probabilities of various pool default rates over the life of the transaction, summarized in a "probability distribution" of asset default rates, with a separate analysis of recoveries. Our approach to determine the probabilities of the asset default scenarios depends largely on the data available and the granularity and diversification of the pool.

In assessing pool diversity for SME transactions, we look beyond the nominal number of obligors in a pool to take into account the actual size of the obligors' loans. We express this pool diversity measurement, referred to as the "effective number," in terms of equal-sized exposures. We calculate the effective number for a pool of *n* obligors using the formula in Exhibit 1.

We typically use loan-level information to calculate an effective number of obligors or loans.

Exhibit 1

$$Effective\ Number\ of\ n\ Obligors\ (or\ Loans) = {}^{1}\!/_{\sum_{i=1}^{n}(W_i)^2}$$

Where:

» W_i is the weight of an obligor (or loan) i in the total pool.

Source: Moody's Investors Service

The effective number adjusts the actual number of obligors in the pool by reducing it for any uneven sized exposures to obligors. For pools with equally sized obligors, the effective number is equal to the actual number of obligors. However, the more uneven the distribution of exposures, the smaller the effective number of obligors and the larger the difference between the effective and the actual number of obligors.

We typically consider a pool with an effective number below 250-300 as a concentrated pool that would benefit from an individual asset approach where we derive the credit profile of each obligor in the securitized pool (subject to data availability). Conversely, we view a pool with an effective number higher than 250-300 as granular, suitable for analysis with either a pool approach (assuming pool data are available) or an individual asset approach. If the effective number of a pool is close to this 250-300 range, the rating committee determines the best approach to estimate the future defaults (see Appendix 1 for more information on concentration risk).

The asset-related assumptions, together with the transaction's liability structure, are then aggregated in a cash flow model where we calculate the cash flows that investors would receive in the different scenarios, and weight any shortfalls in investor cash flows (i.e., investor losses) by the probability of occurrence (from the calculated probability distribution). That is, we base our rating on the "expected" (i.e., probability-weighted) loss to investors.

When determining assigned ratings, rating committees will consider, where appropriate, additional qualitative and quantitative factors that they deem relevant. The model outputs derived by our quantitative modeling are important considerations in our rating committee process. However, the ratings assigned by the rating committee incorporate a variety of qualitative factors and may differ from the model output.

Asset-level analysis and related modeling

Deriving a default distribution

The first step in modeling a transaction backed by a portfolio of SME loans is to define the expected default distribution.[2] For granular pools (e.g., pools with an effective number higher than 250-300) that consist of many well-diversified assets of similar size, we may assume that the default distribution is consistent with a statistical distribution law such as a normal inverse (or large homogeneous portfolio approximation). Alternatively, if we have loan-level data, we may use a Monte Carlo simulation approach to determine the default distribution. To do so, for very large portfolios, we might transform the pool into a smaller pool with similar characteristics.

When the securitized pool has significant asset or industry concentrations, however, it is subject to idiosyncratic loss-performance behavior that is generally difficult to predict based on the experience of historical pools. In this case, we typically use a Monte Carlo simulation technique to simulate the default behavior of the individual assets, based on asset-specific characteristics and assumed correlations among the assets. We may use a Monte Carlo simulation model called CDOROM™ to derive default or loss distributions for asset portfolios when we rate certain SME transactions.

In some limited situations, we may use historical pool performance data to analyze a transaction with significant industry concentrations when (a) the historical performance data relate to pools whose industry concentrations are very comparable to those of the securitized pool, and (b) such historical performance data cover at least one full economic cycle.

[2] For more information on certain sub-segments, see Appendices 10, 11 and 13.

Deriving a cumulative default assumption

To determine the cumulative default rate of an SME portfolio, we start with an analysis of the historical performance data of the originator's whole portfolio and/or previously securitized portfolios. When we assess the historical performance data to be both sufficient (i.e., through-the-cycle) and representative of the securitized portfolio, and the pool consists of many well-diversified assets of similar size, we may derive the cumulative default rate directly from the historical data (so-called **bottom-up approach**). In that case, we would either use the resulting default rate as (1) the mean of a probabilistic distribution or (2) the individual asset default equivalent for each obligor in the Monte Carlo simulation.

When the pool is relatively granular but historical data are limited or not representative, and/or securitized pools include some concentrations (e.g., obligor or industry concentrations), we typically use our **top-down approach**, as described in the "Top-down approach" section below. We may complement the analysis with other methods, such as credit estimates or a third party's scoring system,[3] to estimate the default probability of individual obligors as needed.

When a pool is concentrated, historical data analysis and the top-down approach become less relevant and we use instead an **individual asset analysis** (e.g., ratings, credit estimates, third party's scoring system) to estimate the default probability of individual obligors (see the "Estimating single obligor default probability" section).

Historical data analysis

A key element of our analysis - especially for granular and homogeneous pools - is projecting the expected default (or loss), which is the projected amount of cumulative defaults (or losses) on the SME loan pool over the life of the pool. To project those defaults (or losses), when available and relevant, we examine historical performance data from the originator and adjust this data for factors that can drive differing behavior in the future. In some cases, data on defaults and recoveries are not available separately, but are combined in a single asset loss measure. In those cases, we focus our analysis on projecting the probabilities of future scenarios of that asset loss measure.

We consider the historical data (among others, but not limited to, default and recovery information) provided by the originator as well as the performance of previously closed transactions of the respective originator/servicer (as well as, if deemed appropriate, other similar originators), in order to:

1) estimate the expected probability of default or losses of diversified pools when sufficient relevant data is made available.
2) assess the originator/servicer quality and differentiate between originators and/or servicers (this assessment finally affects our adjustments in Step 2.1 of the top-down approach to derive our expected default rate assumption and our servicer quality adjustment when determining our recovery rate assumption).
3) benchmark with our standard assumption on default timing (i.e., constant over the portfolio WAL) and timing of recoveries (jurisdiction specific).
4) compare to the originator's internal default probability estimates over the long term and to our rating factors (over one year) obtained with the top-down approach.

However, to be representative, the historical vintage data should (1) cover a full economic cycle and, ideally, the longest maturity horizon of the securitized product; (2) reflect the underwriting/servicing criteria applied by the originator/servicer for the securitized portfolio; and (3) be granular. Moreover, recovery rate data should cover a full economic/real estate cycle and consider both open positions (i.e., workout process still ongoing) and closed positions (i.e., workout process finalized).[4]

Data type

The data that originators provide cover typically (1) the originator's entire SME portfolio (applying the same selection criteria as used for the securitized portfolio) and (2) a particular set of loans originated during a common period (i.e., vintage or static pool data).

[3] See for more details, Appendix 6.

[4] For more information on specific limitations of recovery rate data, see the "Limitations of historical recovery rate information" section.

Extrapolation

In practice, it is sometimes the case that only some, if any, of an originator's prior static pools may have gone through their entire life cycle. However, even for incomplete pools, data will still contain useful information on likely lifetime defaults based on defaults to date. To use such data in our collateral analysis, we extrapolate defaults to date on the incomplete pool for the remainder of the pool's life. For the missing periods, the extrapolation typically relies on changes in the average cumulative default rate, either on an absolute or percentage basis, in similar pools during those periods (see Appendix 4).

Adjustment for seasoning

We typically consider a pool to be "seasoned" if the weighted average age of the pool since origination is at least twelve months. For a new securitization of a pool of seasoned loans, we typically incorporate another adjustment to historical static pool performance data. We do this because vintage static pool performance is generally presented from the origination of the vintage, while our default projection is concerned with the expected performance only during the remaining life of the securitized pool. Therefore, we make an adjustment to exclude from our projection of lifetime cumulative defaults those defaults that would have occurred while the loans became seasoned prior to the securitization closing (i.e., during the period from origination of the loan until the start of the securitization).

Adjustment for pool characteristics

The credit characteristics of the loans are important determinants of the loans' performance. Therefore, we adjust our historical vintages analysis for any material difference between the credit characteristics of the static pools and those of the pool being securitized. To make those adjustments, we compare the overall characteristics (typically in the form of the average value of the characteristic for the pool, or distributional statistics) of the historical vintages to those of the securitized pool.

In cases where we find significant differences between the historical pools and the pool being securitized, we may eliminate the dissimilar pools from consideration completely. In other cases, we may make qualitative or quantitative adjustments. In particular, when stratified data (i.e., static pool data split by credit characteristics of the pool) is provided, we would project the defaults of the securitized pool based on the performance of the disaggregated buckets, weighted by the bucket-mix of the securitized portfolio.

Top-down approach

In many SME ABS transactions, the underlying pool consists of diversified assets for which we have data on some key characteristics of the individual assets, but we do not have individual credit assessments on each asset. In particular, most of the underlying obligors are usually unrated. In those situations, and when sufficient market data is available, we typically use a top-down approach to estimate the individual asset default equivalent (see Exhibit 2). The analysis does not aim at being accurate on a loan/obligor level but rather aims at deriving a reasonable approximation of the pool default probability. As such, the top-down approach is not suitable for very concentrated pools.

Exhibit 2

SME top-down approach summary (illustrative example)

Roadmap for PD assumption in rating SME securitizations	Potential impact of each step on single loan level	Average impact on standard EMEA portfolio
Step 1: Define Country-Specific Base Assumption for Standard SME	Ba2-Ba3 in EMEA	
Step 2: Portfolio Quality Adjustment	[-4 / +4] notches	[-2 / +1] notches
Step 2.1: Underwriting/origination quality adjustment		
Step 2.2: Portfolio obligor composition adjustment		
Step 2.3: Loan-specific adjustments		
Step 2.4: Past performance/seasoning adjustments		
Step 3: Outlook Adjustment	[-3 / +2] notches	[-2 / +1] notches
Step 3.1: Macro-cycle adjustment		
Step 3.2: Sector-specific cycle adjustment		

Source: Moody's Investors Service

The top-down approach is applied on a loan-level basis. Below is a summary of each step:[5]

Step 1: As a starting point, we assume a country-specific, through-the-cycle rating assumption for standard SMEs within that specific country.

Step 2: The base probability of default (PD) assumption as derived under Step 1 may be adjusted within a range of -4 and +4 notches on a single-loan basis by taking into account the characteristics of the securitized loan. The notching adjustments are indicative and represent aggregated adjustments (i.e., assuming that for a single loan the following adjustments are made for example: -1/+1 notches for originator adjustment, -2/+1 notches for industry sector adjustment, -1/+1 notches for obligor size, +1 notches for short-term credit facilities – see Appendix 5 for more details on specific notching). In specific circumstances, we can decide to increase such adjustments. On average, Step 2 typically results in an overall adjustment to the pool within a range of -2 and +1 notches. A one-notch adjustment would typically represent an increase or decrease in PD of around 30% to 40% for a weighted average life (WAL) of five years.

- **Step 2.1** adjusts for the quality of the underwriting/servicing carried out by the originator/servicer of the portfolio. Among others, to assess the credit culture and risk appetite of the originator, historical data (as available from a representative portfolio of the originator and/or the originator's existing transactions) are benchmarked against the performance data obtained for other originators.
- **Step 2.2** adjusts for certain characteristics of the obligors, such as obligor size and industry.
- **Step 2.3** considers the type of securitized product[6] and other specific loan-level information (e.g., bullet and balloon loans, payment frequencies and loans with a grace period).
- **Step 2.4** considers the past behavior of the obligors. Specifically, we judge positively the seasoning of the loans (especially if they are originated more than five years ago and are still performing). However, we consider delinquent obligors, either with the originator and/or the entire banking system, or renegotiated loans to be riskier.

Step 3: At country level, under Step 3.1, we further extend our quantitative analysis by taking into account the macroeconomic situation for the portfolio's jurisdiction at the transaction's inception (i.e., the current position in the business cycle) as well as our overall forecasts for the main macroeconomic indicators in such jurisdiction over the expected average life of the securitized portfolio. In particular, we may look at data such as GDP history and our GDP forecast over the next few years for a given country due to the pro-cyclicality of the corporate (and SME) default rates.

5 For more information in EMEA, see Appendix 5.

6 For more information, see Appendix 5.

Finally, under Step 3.2 we make sector-specific cycle adjustments to the base PD assumption by including, among others, our industry outlooks or past observed cyclicality of sector-specific delinquency and default rates. These overall adjustments might change the previously adjusted assumption again within a range of -3 to +2 notches at the loan-by-loan level. Step 3 typically results in an overall adjustment to the pool within a range of -2 and +1 notches.

After applying the top-down approach on a loan-level basis, we can determine the loan-specific cumulative default rate equivalent based on the determined individual asset rating equivalent and the loan's WAL, using Moody's Idealized Cumulative Expected Default rates.[7] Finally, our cumulative default rate assumption for the securitized portfolio is the exposure weighted average of the loan-specific cumulative default rate equivalent.[8]

Estimating single obligor default probability

For concentrated pools (or when the securitized pool has some large asset concentrations), we seek data on individual assets in the pool. We use our published ratings to estimate the default probability of rated obligors. For unrated obligors, we may consider using private ratings or credit estimates. Alternatively, we can also analyze the originator's internal estimates for the one-year default probability[9] and/or use our Moody's Analytics RiskCalc™ (RiskCalc)[10] expected default frequencies or other third-party-developed scoring systems to infer the default probability of each obligor in the pool, subject to potential limits.

For large single-obligor concentrations (i.e., a single obligor accounts for more than 3% of the total portfolio), we would typically use either our rating (if the entity is rated) or a credit estimate[11] to assess the obligor's probability of default. If insufficient individual obligor data is available on a small portion of the pool, we may assume a conservative default probability (e.g., assume the probability to be consistent with the low B to Caa-rating category) for such obligors.

Moreover, and especially if the effective number[12] at obligor and/or obligor group level is small, we investigate whether an adverse selection has taken place when the securitized portfolio was selected. In particular, we compare the securitized portfolio with the overall SME loan book of the originator with regard to the distribution of, for instance, internal ratings, industries, obligor size or WAL.

For large investor properties loans where the obligor is typically an SPE, the loan probability of default will usually be property-driven rather than obligor-driven. In that case, the approach is close to the one used in our CMBS analysis.[13]

Standard deviation, coefficient of variation (CoV) and correlation

For transactions modeled with a statistical distribution law, the standard deviation of the distribution may be inferred from historical data analysis or from benchmarking.

Inferring the standard deviation from expected loss and credit enhancement levels

In situations where there is a sufficiently large set of comparable rated transactions in the country (or in comparable countries), we may infer an estimation of the variability of pool losses from (1) our expected loss estimate and (2) the level of credit enhancement that the rating committee would deem to be consistent with a Aaa (sf) rating for a security (or the highest achievable rating for a security in the country, i.e., the local currency ceiling [LCC] - or in certain cases the foreign currency ceiling [FCC] – if such LCC [or FCC] is below Aaa) with a simple and sequential cash flow structure backed by the given pool (i.e., the "portfolio credit enhancement"). The estimation is done by "solving" for the standard deviation of the probability distribution that produces an expected loss that is commensurate with a

7 For more information, see the discussion of Idealized Probabilities of Default and Expected Losses in *Rating Symbols and Definitions.* A link can be found in the "Moody's related publications" section.

8 For more information on the three steps to determine our default rate assumption in EMEA, see Appendix 5.

9 For more information, see Appendix 6.

10 For more information, see our approach to rating collateralized loan obligations. A link to a list of our sector and cross-sector methodologies can be found in the "Moody's related publications" section.

11 For more information, see our approach to the usage of credit estimates in rated transactions. A link to a list of our sector and cross-sector methodologies can be found in the "Moody's related publications" section.

12 For more information, see the "Pool size" section.

13 For some US small balance commercial loans, see Appendix 10 for more information.

Aaa rating (or the highest achievable rating in the country if the LCC is below Aaa) when the credit support for the security is set equal to the portfolio credit enhancement.

We derive the portfolio credit enhancement from (1) credit enhancement levels of the existing comparable transactions, and (2) judgmental adjustments to account for differences between the given pool and the comparable transactions in the factors affecting variability. Such factors could include expected default levels, the quality, quantity and relevance of the historical data, as well as originator and servicer experience or pool characteristics. For a given loss estimate, the higher the portfolio credit enhancement, the higher the implicit variability of the loss distribution.

For transactions modeled with a Monte Carlo simulation approach,[14] the pool default distribution will depend on the default assumptions of the underlying SME obligors as well as the correlation framework. The coefficient of variation (CoV) and standard deviation of the resulting pool default distribution can then be calculated. A higher CoV implies a "fatter tail" of the distribution (i.e., a higher likelihood of extreme default scenarios materializing). Additionally, especially for granular and diversified portfolios, we also benchmark the obtained results taking into account (1) the implied asset correlation, (2) the standard deviation from historical vintage data (if available), and (3) the "portfolio credit enhancement"[15] applicable to this portfolio.

Our correlation framework for an SME portfolio (typically concentrated in one country and a single originator) is characterized by:

» an inter-industry asset correlation assumption of a three-point distribution with the following values:
   – for investment-grade credits, inter-industry correlations are {5%, 10%, 20%} with probabilities equal to {70%, 20%, 10%}, respectively
   – for Ba-rated credits, inter-industry correlation are {3%, 9%, 12%} with probabilities equal to {70%, 20%, 10%}, respectively
   – for B-rated credits and below, inter-industry correlation are {3%, 7%, 10%} with probabilities equal to {70%, 20%, 10%}, respectively[16]

» an intra-industry asset correlation of 12% is added on top to the inter-industry correlation if such obligors are active in the same sector

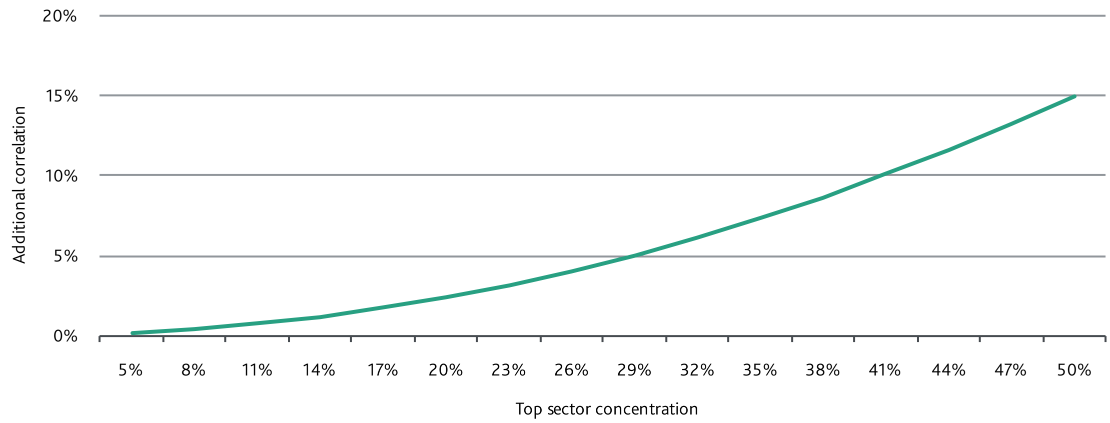
» the pairwise correlation is stressed further depending on (1) the overall portion of obligors active in a given industry sector and (2) the expected cyclicality of the sector. For example, we may apply increased correlation assumptions to the real estate sector in transactions backed by real estate collateralized SME loans, considering the historical cyclicality of such sector. As a result, a maximum additional asset correlation of 15% is usually applied to SME portfolios where one sector represents almost 50% of the total portfolio and is very cyclical. For an SME portfolio with a single-industry concentration of above 50%, the correlation framework is decided on a case-by-case basis (see Exhibit 3).

14 For more details, see the "Deriving a cumulative default assumption" section.

15 See the "Monitoring" section and Appendix 9 for information on the incorporation of country risk in the calibration of the loss distribution.

16 In line with the assumptions described in our methodology for rating corporate synthetic collateralized debt obligations. A link to a list of our sector and cross-sector methodologies can be found in the "Moody's related publications" section.

Exhibit 3
Indicative over-concentration stress for portfolios of SME loans



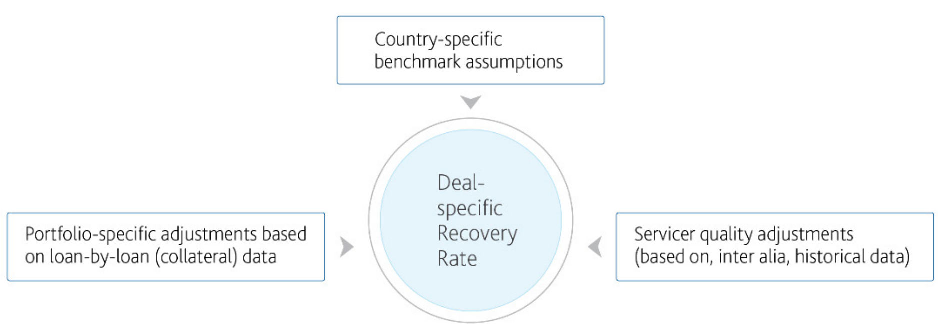
Source: Moody's Investors Service

Recovery rate assumptions

Most SME term loans are secured by collateral (e.g., mortgages, pledges on financial instruments or other assets). We use collateral-specific and related loan-level information (including originator Loss Given Default estimates, if available) as well as historical recovery data (as provided by the originator) to determine our recovery rate assumption. Specifically, we evaluate the collateralization ratio of the securitized portfolio, the type of security backing the loans, the originator's valuation guidelines and the eligibility criteria for new loans with regard to these aspects (ensuring that the same, and not a lower, standard applies). Additionally, we assess the servicer's general recovery procedures.

To determine our recovery rate assumption for a granular SME portfolio, we analyze in detail any real estate collateral securing (a certain portion of) the loans included in the portfolio. Note that all real estate properties that may collateralize the SME loans are completed. As such, the loans included in SME transactions are typically not exposed to construction risk. Loans secured by other types of collateral are usually treated similarly to unsecured loans, as described below (see Exhibit 4).

Exhibit 4
Factors considered in determining our recovery rate assumptions



Source: Moody's Investors Service

We usually consider some of the following factors to determine our recovery rate assumptions:

» Country-specific factors that may influence the recovery rate and that are external to the obligors, such as the bankruptcy regimes in each jurisdiction (which also impact the asset foreclosure costs) and the macroeconomic environment.

» Portfolio loan-level analysis (when available) to better understand the collateral characteristics of the securitized portfolio, such as the economic lien, the type of collateral, the region in which the property is located, the property value, the Loss Given Default estimations, and the loan balance.[17] We typically assume a higher stress on the valuation of commercial real estate properties given their higher cyclicality compared to residential assets. We also treat second (or higher) lien mortgage loans, undeveloped urban land, and loans guaranteed by personal guarantee in a similar way to unsecured loans, for which we usually assume a limited recovery rate. Our CLO recovery rate assumptions (which vary by type of loan) can also provide a helpful benchmark.[18] The portfolio's stressed recovery rate is the weighted average of the stressed recovery rates of the single loans in the portfolio, weighted by the outstanding amount of each loan.

» Originator/servicer's past performance and overall quality assessment (e.g., considering inter-alia workout procedures that are applied to non-performing loans, property valuation standards, servicer's strategy through the real estate cycle, etc.).

The recovery rate assumption is also a function of the specific transaction's default definition, which generally varies across jurisdictions. For instance, a shorter definition of default (e.g., 90 days past due) would typically be associated with a higher recovery rate, as opposed to a longer definition of default (e.g., 18 months past due or internally written-off loans). "Early defaults" may indeed be driven by temporary payment disruptions (often caused by obligors' temporary liquidity shortfalls), and the defaulted loans may return to performing again, or the servicer may effectively recover the position through debt restructuring. This is less likely for "late delinquent loans."

Fixed or stochastic recovery rate assumption

We either use our stressed recovery assumption as a fixed recovery rate in our modeling or model stochastic recoveries, particularly when using a Monte Carlo simulation to simulate a pool-specific default distribution. In that case, we derive the recovery rate distribution using the expected recovery rate, estimates of the variability of recovery rates, correlations across recovery rates, and an assumption about the general shape of the distribution (typically a "normal" distribution).

When modeling stochastic recoveries, we typically calibrate the normal distribution for the portfolio recovery rate with a 20% standard deviation and a correlation of 10% between recovery rates (this assumption may evolve over time should more empirical evidence on SME recovery behavior become available). In addition, we typically use a correlation of 5% between defaults and recoveries for SME portfolios that are well diversified in terms of industry, whereas we generally use a correlation of 10%-15% for SME portfolios that are highly exposed to a single sector, such as the real estate market.

Stochastic recoveries reflect the range of possible recoveries given the various types of collateral in an SME ABS transaction. The two approaches are similar in the sense that a fixed recovery rate assumption represents a certainty-equivalent to the recovery distribution. Thus, the stressed recovery rate assumption is typically lower than the mean of the recovery rate distribution for high target ratings.

Recovery lag

We consider the amount of time needed to realize the assumed recovery rate ("recovery lag"), which is typically determined based on various factors such as the transaction-specific default definition, the country tiers, the assumptions used for comparable collateral,[19] and the historical data provided by the originator. For loans to SMEs backed by real estate assets, we typically assume an average recovery lag of a minimum of 18 months to 5 years (typically distributed over several years). These values are adjusted on a case-by-case basis by taking into account (1) historical data (e.g., the performance of previous transactions), (2) vintage recovery rate data split by the source of cash flow (e.g., reperforming loans, out-of-court settlements and legal proceeds), and (3) country-specific aspects (e.g., typical length of insolvency proceedings).

[17] This loan-level and collateral-specific analysis has some similarities with the stressed house prices framework that we apply when analyzing RMBS transactions. For more information, see our methodology for rating residential mortgage-backed securities. A link to a list of our sector and cross-sector methodologies can be found in the "Moody's related publications" section.

[18] For more information, see our methodology for rating collateralized loan obligations. A link to a list of our sector and cross-sector methodologies can be found in the "Moody's related publications" section.

[19] For more information, see our time to foreclosure assumptions in the various country settings of our RMBS methodology. A link to a list of our sector and cross-sector methodologies can be found in the "Moody's related publications" section.

Limitations of historical recovery rate information

Similar to historical default information, we typically receive historical performance data in the form of cumulative recovery ratios by vintage of entry into default for each securitized (sub-) portfolio. However, historical recovery data (both, vintage data related to the originator's overall loan book and recovery performance data observed in previously closed SME transactions of the same originator) may have some limitations, e.g., the default definition used in the historical data might differ from the default definition used in the transaction; data might not cover a full economic cycle or not capture files where the recovery process is still ongoing; full recovery might be assigned to cured loans although payments may be still ongoing; and low granularity of the vintages. Because of these potential limitations, we also consider other factors such as portfolio-specific collateral characteristics and comparable transaction benchmarks to derive our recovery rate assumption.

Structural analysis and liability modeling

Model purpose and typical structural features

SME transaction structures vary across countries. A typical transaction has the following structural features:

» risk transfer via true sale or a synthetic transaction

» monthly, quarterly or semi-annually paying securities with fixed or variable interest rates

» two distinct waterfalls (interest and principal) with sequential allocation of cash flows and the involvement of a spread capture mechanism or a combined interest and principal waterfall (some structures may contemplate a pro-rata payment feature, which would revert into sequential structure upon portfolio performance deterioration).

» a cash reserve to ensure a liquidity buffer and/or credit support

» hedging mechanism to cover for potential interest rate (and seldom currency) mismatches

More specifically, differing structural features within an SME transaction can have a significant effect on the ratings of the issued securities and/or the level of credit enhancement that supports a certain target rating. Structural features that typically have a significant rating impact include:

» replenishable portfolios versus static portfolios

» availability of excess spread

» spread capture mechanism

» structural mitigants for set-off and/or commingling risks (if any)

Replenishable versus static portfolios

Many SME loans have a relatively short-term horizon (i.e., typically up to five years). As a result, and depending on the originator's motivation, certain SME transactions may have a replenishment period of 12-36 months, during which incoming principal collections are used to purchase new receivables rather than to amortize the securities.

Adding new receivables to the pool can result in portfolio credit deterioration if riskier assets are added. The replenishment period usually starts on the closing date and lasts for a predefined time horizon unless the occurrence of certain events triggers an early termination of such a replenishment period. Additionally, a transaction might face negative carry issues if the originator does not use its replenishment option, but rather holds the cash (that results from the amortization of the underlying portfolio assets) in an account while the securities' principal balance remains unchanged.

Tight eligibility criteria and concentration limits

Tight eligibility criteria and concentration limits may partly mitigate the additional risk resulting from replenishable portfolios by ensuring that the quality of the portfolio remains in line with that of the original portfolio. Among others, they may (1) exclude the addition of delinquent receivables; (2) stipulate limits to obligor, industry and/or geographical concentrations (including concentrations on the originator's lowest internal rating categories), and remaining term; and/or (3) ensure a certain proportion of secured loans, minimum seasoning, and criteria for the weighted average rating (when available) of the portfolio. For example, (a) the weighted-average rating of the portfolio after replenishment must be equal to or better than the weighted-average rating of the portfolio at closing, (b) the weighted-average rating of the replenished portfolio must be equal to or better than the weighted-average rating of the portfolio at closing, and (c) the weighted-average rating of the portfolio after replenishment must be equal to or better than the weighted-average rating of the portfolio before replenishment. Criterion (a) is the strongest in avoiding the adverse selection for the replenished portfolio and negative rating migration during a deteriorating economic period.

The tighter the eligibility criteria and portfolio limits are defined, the lower the originator's flexibility to change important portfolio characteristics during the replenishment period. We address potential changes in the portfolio quality by either modeling replenished portfolios separately from the initial portfolio (i.e., by assuming different default and recovery distributions for initial and replenished portfolios) or stressing the initial portfolio based on the eligibility criteria in place in the transaction. We apply specific default assumptions that are derived based on the worst possible portfolio compositions for the replenished pools.

Early amortization triggers

Early amortization triggers terminate the replenishment period upon a trigger breach and hence may mitigate investors' exposure to certain risks resulting from the replenishment period. Most effective triggers are usually net excess spread triggers, unpaid PDL triggers, and triggers linked to arrears levels. Typical triggers relate to performance (such as maximum cumulative default levels and/or delinquency levels), events affecting the originator's credit standing (such as rating triggers), and portfolio-related triggers (such as breach of concentration limits).

Excess Spread

Excess spread is typically calculated and modeled as interest collections net of senior expenses (e.g., servicing fees and bank account fees) and interest paid on the securities. Excess spread is often an important source of credit enhancement, whereby the level of excess spread varies across transactions and depends on the underlying portfolio but might also be subject to changes during the transaction's lifetime, resulting from, e.g., renegotiations agreed with obligors and changing interest rate risk in the transaction. In certain transactions, excess spread is guaranteed via specific interest rate swap mechanisms.

The benefit to investors provided by excess spread will vary depending on the modeled timing of defaults. To test the robustness of ratings, we typically run model sensitivities with different timings of default.

Spread capture mechanism

In securitizations with a spread capture mechanism (also called a principal deficiency ledger mechanism) built into the structure (either implicitly by having a single waterfall or explicitly in the case of two separate priorities of payments), defaults experienced on the principal portion of the portfolio (which would potentially reduce repayment amounts to the investors) could be offset by excess spread collected via the interest collections of the portfolio. In contrast, in transactions without such spread capture mechanism, excess spread may leak out of the structure despite the fact that defaults have occurred. The spread capture mechanism can be structured for the entire transaction or separately for each class of securities. In the latter case, the more senior-ranking classes are more protected because the excess spread available at each level includes potential interest amounts to be paid on the more junior-ranking classes of securities.

Specific risks in synthetic SME transactions

When the credit risk is transferred synthetically (e.g., through credit default swaps), we focus our analysis on:

1) The specific credit event definition, such as failure to pay, bankruptcy and some restricted restructuring or loss definitions. A definition may be considered tighter or looser depending on the number and type of contingencies that trigger a protection payment and on the level of subjectivity in their quantification.

2) The counterparty risk associated with the originator as credit protection buyer (typically mitigated by advance payments depending on the originator's creditworthiness).

3) The loss allocation mechanism. The loss amount is generally defined as the credit protection payment (i.e., the payment made by the issuer/seller to the originator/buyer that is triggered by the occurrence of a credit event). Securities to which losses are allocated are partially written down in the amount of such loss amount.

4) The synthetic excess spread mechanism, if any. Typically, the excess spread is either available on (i) a use-it-or-lose-it basis (i.e., at a fixed amount, generally a percentage of the non-written-off security balance or the performing portfolio) for a given period (generally one quarter or one year), making it sensitive to the timing of defaults; or (ii) a trapped basis (i.e., at a fixed amount, generally a percentage of the non-written-off securities or the performing portfolio). In each period, to the extent not used before, excess spread is accumulated in a specific ledger.

5) Potential moral hazard problems resulting from the reliance on the credit protection buyer to (a) provide notification of a credit event (as public information is usually not available) and (b) calculate the loss amounts in its capacity as calculation agent (typically mitigated by a verification process performed by an independent third party).[20]

Integrating the default distribution and other asset parameters

Default timing

In our cash flow analysis, we typically assume a timing of default curve that is either (1) constant (i.e., equally distributed) over the life of the portfolio, (2) derived from historical data (if sufficient relevant data is available), or (3) in the absence of adequate data from the sponsor, derived from historical industry data. We usually also perform sensitivities with regards to different default timings, such as default timing curve implied by Moody's Idealized Cumulative Expected Default rates or derived from historical static cohort default data.

Prepayment rate and asset yield

The constant prepayment rate (CPR) assumption is derived from the originator's historical dynamic prepayment data on its total SME portfolio and/or (if available) from specific prepayment data on previous SME loan receivable securitizations of that originator. If neither of these is available, we use a country-specific average SME prepayment rate based on a benchmarking approach.

High levels of prepayments may depress the yield received in a transaction (and hence decrease available excess spread), especially if higher-yielding loans prepay first. In our view, debtors of high interest rate loans have greater incentives to prepay because of their elevated debt burden or competitors offering less expensive financing options. The higher the dispersion of interest rates in the portfolio, the higher the impact of high-yielding loan prepayments on the available excess spread. Therefore, we typically stress the available excess spread in transactions, particularly if the portfolio has a widely dispersed interest profile. However, prepayments also have a positive credit effect. For example, obligors who prepay their debt in full cannot default any longer. In any case, we take into account any specificity of the market under analysis.

Typically, we are provided with an initial portfolio yield vector based on the portfolio's scheduled amortization. To account for the yield compression from prepayments, we examine the dispersion of interest rates within the pool and assume that prepayments result from the highest yielding assets. If the highest yielding assets prepay first, the yield on the remaining portfolio will decrease. Hence, we determine a haircut reflecting the potential yield reduction due to prepayments and reduce the yield vector accordingly. Because of the assumed stressed yield vector, we stress the available excess spread. For replenishable transactions, whose eligibility criteria require a minimum level of yield on purchasable receivables, we may use this minimum level of yield as input for the cash flow model.

The yield vector might be stressed further for, among others, the following aspects:

[20] For more information, see our approach to assessing counterparty risks in structured finance and our approach to rating corporate synthetic obligations. A link to a list of our sector and cross-sector methodologies can be found in the "Moody's related publications" section.

» (partially) unhedged transactions

» potential changes in the yield vector because of renegotiation options allowed on the loans during the transaction's lifetime

Similar to the default timing, the yield vector and CPR assumption are particularly relevant if structural features (e.g., principal deficiency ledgers, excess spread and any type of performance-related triggers) are in place. Hence, we also run some sensitivity analysis on these factors during the rating process.

Portfolio scheduled amortization

The final asset-based key model input is the portfolio amortization profile. The initial portfolio amortization schedule is provided by the originator and modeled accordingly. If subsequent portfolios are sold, we may either use the same amortization profile as per the initial pool or simulate different amortization schedules based on eligibility criteria. These vectors determine the principal cash flows to be received by the issuer in the absence of defaults and prepayments.

Legal final maturity of the transaction is given by the issuer. It usually falls some years after the scheduled maturity date of the longest maturing loan depending on the assumed recovery timing.

Other input parameters

Once we have determined the asset-side modeling assumptions, other transaction-specific inputs should be inserted into the cash flow model.

Transaction expenses: These include (1) fees to be paid to transaction parties such as the trustee, cash manager and servicer; and (2) note coupons. We stress the charged servicing fee upwards if the level is not in line with market rates, and we generally use a minimum servicing fee assumption. This is to ensure that the transaction can withstand paying a market rate servicing fee, if the original (and less expensive) servicing contract were to be terminated over the life of the transaction.

Hedging: Swaps and risks associated with swap counterparties are assessed, as relevant, and may impact our yield, excess spread assumptions and rating considerations.[21]

In the absence of hedging agreements, a transaction may be exposed to interest rate risks and, less frequently, to cross-currency risks during its lifetime. We would then incorporate these additional risks imposed on investors into our analysis.

Triggers: A transaction might incorporate several triggers, which are usually formulated as performance-based (i.e., asset related) triggers or counterparty- (mainly, servicer or originator) related triggers. In our modeling, we concentrate on the performance-based triggers, specifically, where the triggers are linked to variables that are included in our cash flow model (e.g., defaults, securities outstanding amount or reserve fund levels). When breached, these portfolio performance-based triggers usually result in (1) the termination of the replenishment period and early amortization of the securities, (2) a stop of the reserve fund amortization, (3) an alteration of the priority of payments (such as the issuer's payment priorities changing from a pro-rata to a sequential payment structure), or (4) the deferral of interest payments on the junior securities.

Expected loss approach and use of model output

We typically use a comprehensive cash flow model, ABSROM™, which enables us to model transaction cash flows derived from portfolios of loans to SMEs and the associated liability structure. The model produces a series of default and loss scenarios, with outputs for each security that include the expected loss, weighted average life and default probability.

In addition, we identify the default scenario, under the current modeling assumptions, under which each rated tranche suffers its first loss. An illustrative example is shown below.

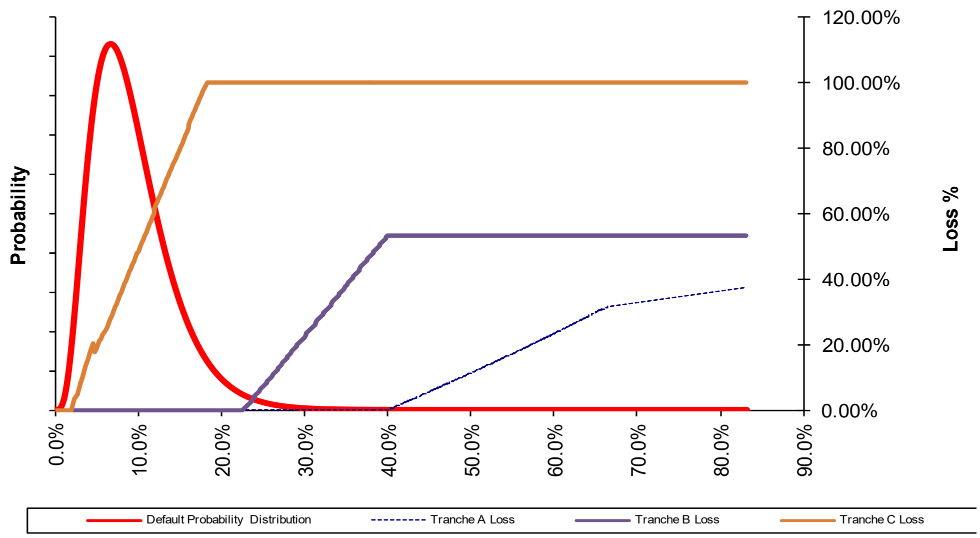
[21] For more information, see our cross-sector methodology for assessing counterparty risks in structured finance, including swap counterparty related risks. A link to a list of our sector and cross-sector methodologies can be found in the "Moody's related publications" section.

Exhibit 5
First loss suffered by each tranche

The rating of each class of securities indicates the expected loss level for the relevant class of securities over the WAL life of the securities.

As a further step, it is useful to ascertain the lowest default scenario in which each class of securities suffers its first loss, as well as at what speed the loss increases in each subsequent default scenario. This can be illustrated in the chart below, which associates the default scenario with the level of losses of each class of rated securities.

Chart: Default distribution and expected loss level for each tranche



Source: Moody's Investors Service

We usually run sensitivities to a variety of key asset inputs (e.g., expected PD, CoV, recoveries and prepayments) and structural features (e.g., turning triggers on and off) in order to test the sensitivities of securities' ratings.

Loss benchmarks

In evaluating the model output for SME securitizations,[22] we select the loss benchmarks referencing the Idealized Expected Loss table[23] using the Standard Asymmetric Range, in which the lower-bound of loss consistent with a given rating category is computed as an 80/20 weighted average on a logarithmic scale of the Idealized Expected Loss of the next higher rating category and the Idealized Expected Loss of the given rating category, respectively. For initial ratings and upgrade rating actions, the upper-bound of loss consistent with a given rating category is computed as an 80/20 weighted average on a logarithmic scale of the Idealized Expected Loss of the given rating category and the Idealized Expected Loss of the next lower rating category, respectively. When monitoring a rating for downgrade, the upper-bound of loss is computed as a 50/50 weighted average on a logarithmic scale. That is, the benchmark boundaries of loss appropriate for evaluating rating category R are given by the formulas in Exhibit 6:

[22] The analysis of SBCRE securitizations originated in the US on or before 2011 does not rely on a model. For more information, see Appendix 10.

[23] For more information, see the discussion of Idealized Probabilities of Default and Expected Losses in *Rating Symbols and Definitions.* A link can be found in the "Moody's related publications" section.

Exhibit 6

Standard Asymmetric loss benchmark boundaries

$$[1]\ Rating\ Lower\ Bound_R = exp\{0.8 \cdot log(Idealized\ Expected\ Loss_{R-1}) + 0.2 \cdot log(Idealized\ Expected\ Loss_R)\}$$

$$[2]\ Initial\ Rating\ Upper\ Bound_R = exp\{0.8 \cdot log(Idealized\ Expected\ Loss_R) + 0.2 \cdot log(Idealized\ Expected\ Loss_{R+1})\}$$

$$[3]\ Current\ Rating\ Upper\ Bound_R = exp\{0.5 \cdot log(Idealized\ Expected\ Loss_R) + 0.5 \cdot log(Idealized\ Expected\ Loss_{R+1})\}$$

Where:

» *Rating Lower Bound$_R$* means the lowest Idealized Expected Loss associated with rating *R* and the expected loss range of rating *R* is inclusive of the *Rating Lower Bound$_R$*.

» *Initial Rating Upper Bound$_R$* means the highest Idealized Expected Loss associated with rating *R* that is either initially assigned or upgraded and the expected loss range of rating *R* is exclusive of the *Rating Upper Bound$_R$*.

» *Current Rating Upper Bound$_R$* means the highest Idealized Expected Loss associated with rating *R* that is currently outstanding and the expected loss range of rating *R* is exclusive of the *Rating Upper Bound$_R$*.

» *R-1* means the rating just above *R*.

» *R+1* means the rating just below *R*.

» The Rating Lower Bound for Aaa is 0% and the Rating Upper Bound for C is 100%. These are not derived using the formula.

Source: Moody's Investors Service

Determining the assigned rating

The output indicated by our quantitative modeling is an important input to our rating committee process. However, the ratings the committee assigns incorporate numerous other factors, including the result of sensitivity analyses to default and recovery timing assumptions, and qualitative analysis relating to factors such as:

» idiosyncratic structural features that are not explicitly modeled

» underwriting and servicing practices

» the incentives of key third parties to the transaction to perform as specified in the transaction documents

» the risk of disruption in the transaction's cash flows that could result from a disruption in a key third party's operations (operational risk)

» counterparty risk

» legal considerations

» sovereign-related risk

Some of these qualitative factors are further detailed below.

Other considerations

Counterparty risks

We consider various counterparty-related risks at different stages throughout our credit analysis. More specifically, the risks we consider include hedge counterparties, operational risks, commingling risk, account banks and set-off risk.[24] Based on our review, we may adjust our assumptions, inputs or model results. If information is limited, we may also adjust the rating level.

24 For more information, see our methodology for assessing counterparty risks in structured finance transactions. A link to a list of our sector and cross-sector methodologies can be found in the "Moody's related publications" section.

Hedge counterparties

We analyze the rating impact of exposures to hedge counterparties including assessing the probability of a transaction becoming unhedged and deriving additional potential losses. As part of our analysis, we may conclude that we adjust the ratings to reflect the linkage and additional loss.

Operational risks

Operational risks can arise from various potential sources, including disruption to cash flows caused by the financial distress of a service provider to the SME transaction. As part of our analysis, we consider the financial disruption risk and the roles of servicers, cash managers, calculations agents, trustees and similar parties.

Commingling risk

In SME transactions, funds owed to investors may be "commingled" with funds of another transaction party prior to the funds' transfer to the issuer's account. If that other party becomes bankrupt, it may be difficult to determine the source and ownership of the commingled funds, resulting in an additional loss for investors. Our analysis captures whether commingling risk exists in a transaction, determines the credit quality of the party and the exposure, and incorporates the additional loss.

In our commingling risk analysis, we consider various structural mitigants, such as (1) frequent transfers from the collection account to the issuer account (typically with a highly rated bank) and (2) rating or financial performance triggers that would lead to notification of the obligors and transfer of collection accounts from the servicer to a higher-rated institution prior to a servicer bankruptcy.[25]

Account banks and investments

Generally, our analysis of account banks and temporary investments consists of three steps: (1) we assess the "rating uplift" to the account bank's rating to obtain an "adjusted" rating; (2) if the adjusted rating is below a certain threshold, we assess the exposure of the transaction and categorize the risk into either "standard" exposure or "strong" exposure; and (3) we determine rating caps to the transaction ratings subject to other quantitative and qualitative factors.

Set-off risk

In SME ABS transactions, set-off could, for example, arise when an obligor sets off a deposit balance against an outstanding loan amount following a default of the originating bank. The risk is typically small in instances of retail deposits covered by a deposit insurance mechanism. However, the risk can be larger in jurisdictions that do not have deposit insurance systems and for corporate and public sector obligors.

SME ABS transactions could be exposed to set-off risk arising from contractual claims other than deposits. In such cases, we will also evaluate mitigating factors and, if considered insufficient, determine any expected incremental loss from set-off.[26]

Legal risks

We assess legal risks that may affect the expected losses posed to investors. In particular, we consider the potential legal consequences of whether the issuer is bankruptcy remote. We review legal opinions at closing to inform our views on the key legal risks identified in a transaction.

Bankruptcy of the originator

With regard to the potential bankruptcy of an originator, we consider whether:

» the originator has actually sold the receivables, known as "true sale"

[25] For more information, see our cross-sector methodology for assessing counterparty risks in structured finance, including commingling risk. A link to a list of our sector and cross-sector methodologies can be found in the "Moody's related publications" section.

[26] For more information, see our cross-sector methodology for assessing counterparty risks in structured finance, including set-off risks. A link to a list of our sector and cross-sector methodologies can be found in the "Moody's related publications" section.

» in the event of the sponsor's bankruptcy, a court would consolidate the owner of the assets and the securitization trust with the sponsor, known as "substantive consolidation"

» the securitization trustee can enforce its ownership or security interest in the collateral once the originator has filed for bankruptcy protection ("perfection")

We also consider jurisdiction and applicable securitization laws.

Local currency ceiling considerations

The country in which the transaction's assets, originator, or issuer is located could introduce systemic economic, legal or political risks to the transaction that could affect its ability to pay investors as promised. We usually incorporate such risks into the analysis by applying our local currency ceilings (LCC).[27] In particular, when generating our assumed portfolio loss distribution, we typically define the portfolio credit enhancement consistent with the highest rating achievable in the country (i.e., the LCC).

Environmental, social and governance considerations

Environmental, social and governance (ESG) considerations may affect the ratings of securities backed by a portfolio of loans granted to SMEs. For information about our approach to assessing ESG issues, please see our methodology that describes our general principles for assessing these risks.[28]

Monitoring

We 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, such as originator assessments, underwriting standards for static pools or review of the legal structure.

Transaction performance

We typically receive periodic data on transaction-specific performance which we use to monitor transactions. We may give more weight to performance information for seasoned transactions, in particular when defaults and losses are higher or lower than expected. When monitoring the performance of outstanding SME transactions, we track the characteristics and performance of the underlying collateral, any material developments regarding the originator, servicer and other participants in the transaction, the amount and form of credit enhancement, and factors that may significantly affect the integrity of the legal structure. The starting point is typically the monitoring of the collateral performance relative to our initial expectations.

The key performance metrics we track are the transaction's delinquency rate and the cumulative net loss rate, or the cumulative default and recovery rates. When loan portfolios are secured over commercial properties as collateral, we may also look for additional information such as vacancy rates or rent levels.[29] We combine the loss rate with the issuer's history of losses to update our estimate of the ultimate lifetime net loss rate on the SME pool.

Updated individual loan data, when available, also allows us to derive updated estimates of individual asset defaults or losses. Such loan-level data is particularly important when the pool has concentrations. In addition, we consider any material changes in the macroeconomic environment that could affect future performance. If, by using this approach, we conclude that the current transaction's ratings need to be reviewed, we would then use a similar approach to the one used to assign the initial ratings (assuming

[27] For more information, see our cross-sector methodology for assessing local currency country ceilings. A link to a list of our sector and cross-sector methodologies can be found in the "Moody's related publications" section.

[28] A link to a list of our sector and cross-sector methodologies can be found in the "Moody's related publications" section.

[29] See for example the approach on "Japanese apartment loan securitizations" discussed in Appendix 11.

similar ongoing data is received on the pool). We also review the evolution of the portfolio composition in terms of obligor concentration and may run sensitivity scenarios based on credit enhancement coverage of largest obligors in the pool.[30]

With regard to counterparty risk, our monitoring analysis also includes an assessment of the stability of the originator, servicer, swap counterparties and credit support providers. If these entities become unable to fulfill their obligations to the transaction, the risk of a decline in the cash flows to investors increases. Thus, changes to the financial stability of an entity that has a weight in the rating of the securities can result in a rating action on the securities.

When the sovereign risk component changes over the life of an SME transaction, we will assess the impact on the rating of securities following the approach described in Appendix 9. We will adjust the maximum achievable rating based on the then-current LCC and may adjust the key collateral assumptions to reflect the change in the sovereign risk. In some instances, the maximum achievable rating for the most senior outstanding securities may be lower than the local currency ceiling if, for example, operational or counterparty-related risks limit the securities' ratings.

Pool size

During the life of the transaction, as pool sizes decrease to a small fraction of their initial sizes, credit risk exposure to individual obligors may increase significantly. As part of our monitoring of SME transactions, we track the evolution of obligor concentration risk and verify that the amount of credit enhancement under a given class of securities always protects this class from the risk of a default by the largest obligors. More specifically, information about the remaining loans and obligors[31] such as updated loan-level data covering industry sectors and nature of the loans (e.g., secured/unsecured) becomes important for us to assess whether the pool concentrations are in line with the rating of the securities. As the number of obligors decline significantly and the securities exposure to the pool's concentrations increases, we may overlay our parameters with an additional stress.

Unless we have detailed information on at least 95% of the obligors (by loan balance) (for example, ratings, credit estimates, using the mapping approach), we do not assign nor maintain ratings on securities backed by SME transactions with the following characteristics: [32]

» Transactions without support mechanisms, such as a credit enhancement floor or reserve fund floor, when the underlying pool has decreased to an effective number of obligors or loans of 50 or below. If we cannot obtain the effective number, we will use a threshold of 90 instead.

» Transactions with a reserve fund or credit enhancement floor, which partially compensates for the increased exposure to single obligors, when the underlying pool has decreased to an effective number of obligors or loans of 30 or below. If we cannot obtain the effective number, we will use a threshold of 45 instead.

  However, we 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 pool or security level,[33] or for securities that benefit from full cash collateralization.

30 For example, in methodologies where models are used, modeling is not relevant when it is determined that (1) a transaction is still revolving and performance has not changed from expectations, or (2) all tranches are at the highest achievable ratings and performance is at or better than expected performance, or (3) key model inputs are viewed as not having materially changed to the extent it would change outputs since the previous time a model was run, or (4) no new relevant information is available such that a model cannot be run in order to inform the rating, or (5) our analysis is limited to asset coverage ratios for transactions with undercollateralized tranches, or (6) a transaction has few remaining performing assets.

31 For more information, see our cross-sector methodology for evaluating global structured finance data quality. A link to a list of our sector and cross-sector methodologies can be found in the "Moody's related publications" section.

32 This does not apply to transactions where we receive frequently updated and detailed property-level cash flows and valuations such as Japanese apartment loan securitizations (see Appendix 11) or venture debt securitizations (see Appendix 13).

33 For more information, see our rating methodology for assessing transactions based on a credit substitution approach. A link to a list of our sector and cross-sector methodologies can be found in "Moody's related publication" section.

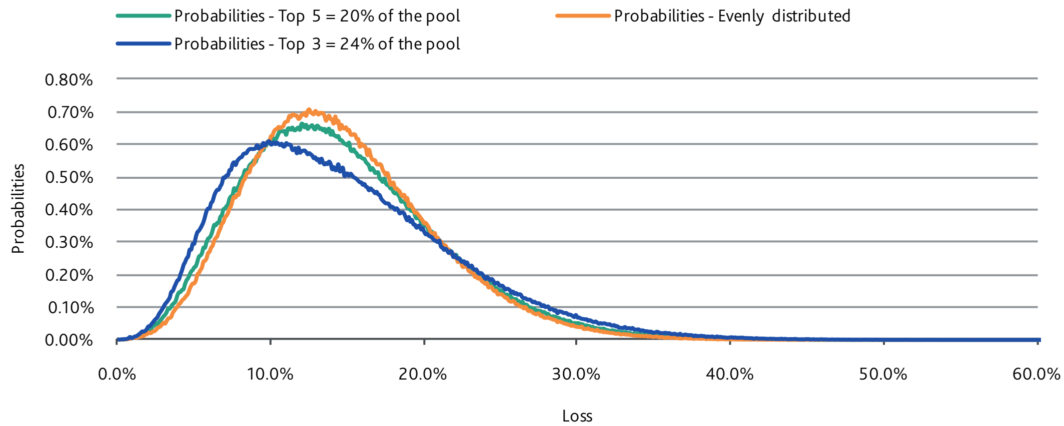
Appendix 1: Concentration risk

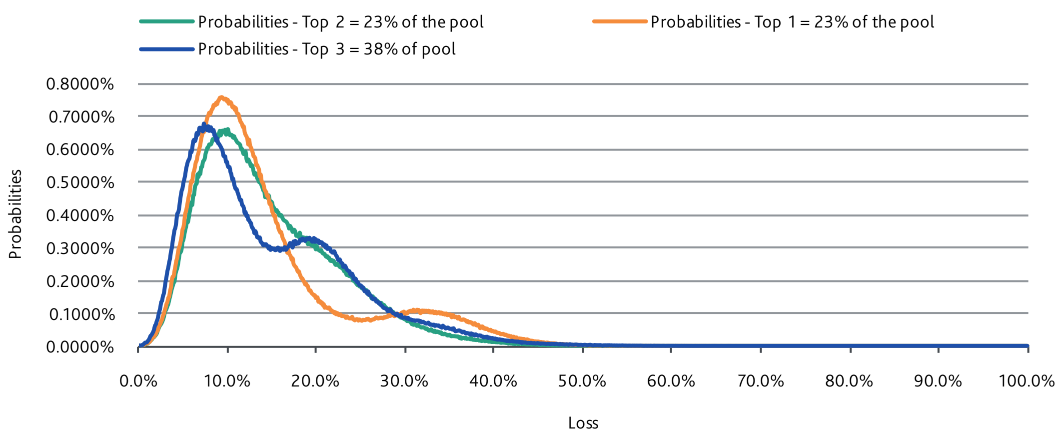
SME pools range from very granular pools to much more concentrated pools. Asset concentrations, including disproportionately large individual assets, and regional and industry concentrations, directly influence the shape of the asset pool default curve. As a result, the analytical approach we choose to rate a particular transaction depends heavily on how well it addresses the level of concentration in the pool.

Obligor concentration

Exhibit 7 shows the impact of various top obligor concentrations on the shape of the pool default distribution.

Exhibit 7
Impact of obligor concentration on portfolio default distribution
Monte Carlo simulation results for a pool of 100 B-rated obligors in a single country (the pool is well diversified across industries; the obligors are evenly distributed in terms of size, with the exception of the top 1, 2, 3 or 5 obligors respectively):





Source: Moody's Investors Service

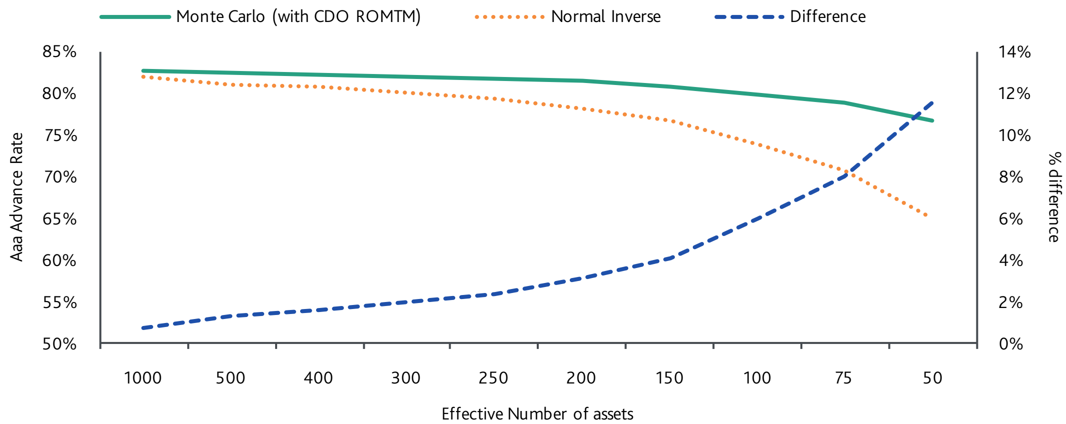
Concentrated vs. Granular Pools

We typically consider a pool with an effective number below 250-300 as a concentrated pool that would benefit from an individual asset approach. Conversely, we view a pool with an effective number higher than 250-300 as granular, suitable for analysis with either a pool approach (assuming pool data are available) or an individual asset approach. This 250-300 cut-off is based on the following analysis.

Exhibit 8 shows the impact of lowering the effective number of obligors on the Aaa advance rate using (1) a Monte Carlo simulation and (2) an approximation of the Monte Carlo simulation via a normal inverse distribution. In both approaches, the Aaa advance rate starts decreasing (i.e., the Aaa levels of enhancement start increasing) exponentially when the effective number falls below the 250-300 range. At the same time, the Aaa levels of enhancement for each approach start to diverge more significantly when the effective number falls below the 250-300 range, even if the expected loss and variance in the two approaches are equal. The reason for the divergence is that the normal inverse then loses accuracy as it does not adequately account for the idiosyncratic risks associated with concentrated pools. Note, however, that the distribution from the Monte Carlo simulation (using our CDOROM) produces a lower senior securities credit enhancement than the normal inverse (assuming the mean and the standard deviations of the two distributions are identical), so the approximation of the Monte Carlo distribution (via CDOROM) by a normal inverse is a conservative one.

Exhibit 8

Impact of lowering the effective number on the Aaa (sf) advance rate: Monte Carlo simulation vs. statistical approach (using a normal inverse (ni))*



* The chart shows the impact of the effective number on the tranching based on a purely homogenous portfolio (2% mean DP, 10% asset correlation, 0% RR). The moments of the normal inverse distribution are matched to those of the Monte Carlo simulated distribution (i.e., the mean and the standard deviations of the two distributions are identical).

Source: Moody's Investors Service

Industry concentration

Obligors involved in similar businesses are to some extent subject to the same positive and negative factors and could all suffer concurrently from a single negative factor, which would result in substantial losses in the asset pool. Industry concentration tends to vary widely in SME securitizations, although material concentrations in specific sectors (such as building and real estate) are common.

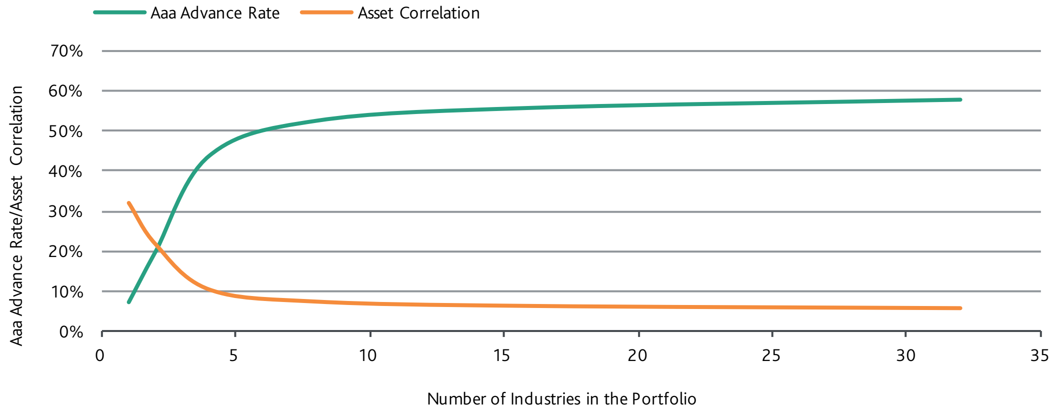
In Exhibit 9 below, we generated in CDOROM a portfolio of 480 identical assets, all rated B1 with a WAL of five years. We then split the portfolio evenly among 32, 16, 8, 4, 2, and 1 industries (i.e., in the case of 32 industries, we had 15 assets in each industry, in the case of 16 industries, 30 assets in each industry, etc.). We then extracted the default distribution in each case and tested the Aaa issuance amount. Asset correlations and covariance levels tend to increase exponentially once we are left with four industries or fewer, and the Aaa advance rate then reduces significantly.

In general, we find that the volatility of the asset default distribution (which we can measure by the asset correlation or the CoV of the default distribution) tends to increase exponentially when the concentration in a specific industry reaches levels close to 25%-30% (i.e., asset correlations higher than 10% or a coefficient of variation higher than 50%, levels that are rare in historical data).

Exhibit 9

Aaa advance rate as a function of industries in the portfolio

(Monte Carlo simulation)



Source: Moody's Investors Service

Exhibit 10 shows the implied asset correlation (based on the mean and standard deviation of a default distribution derived for a specific portfolio composition) as a function of pool granularity and the largest single-industry concentration. In each of the scenarios in the Monte Carlo simulation, we vary the effective number as well as the largest single-industry concentration. We keep the mean probability of default for the assumed portfolio at 15.1%, and the second-largest industry sector, constant at approximately 10%; we also assume a global inter-industry correlation is 5%. Hence, the variation in the implied asset correlations is driven mainly by the variation of the overall portfolio concentration or the single-industry concentration. The table shows the negative impact of sector concentrations on the implied asset correlation.

Exhibit 10

Implied asset correlation* as a function of granularity and single industry concentration for a sample portfolio**

		Top single industry concentration in % of the total pool		
		21%	32%	45%
Overall portfolio concentration measured by Effective Number (EN)	Pool with 900 EN, smallest obligor accounts for 0.02% of pool	6.50%	8.20%	11.70%
	Pool with 617 EN, smallest obligor accounts for 0.1% of pool	6.80%	8.50%	12.00%
	Pool with 353 EN, smallest obligor accounts for 0.25% of pool	7.10%	8.80%	12.50%
	Pool with 170 EN, smallest obligor accounts for 0.6% of pool	7.70%	9.50%	15.10%

* Implied asset correlation is the correlation implied by a normal-inverse default distribution as defined by its mean and the standard deviation. Equation (2) describes this relationship and can be solved for "ρ", which represents the implied asset correlation.

** In order to create the scenarios, only the number of obligors was varied to reduce the EN (base case = 900 EN), while only the industry sectors were varied to increase single industry sector concentration (base case = 21% top industry sector). Consequently, overall mean PD rate is the same in all scenarios.

Source: Moody's Investors Service

Appendix 2: Information for rating SME securitizations

Loan description

We generally receive a detailed description of the loan contracts underlying the securitized loans. This description not only details specific features (such as tenor, nature of amortization or payment frequency), but ideally also explains the origination channels.

Information on actual portfolio

Because of the limited homogeneity of the underlying SME loan portfolios, we typically obtain a loan-level data template listing each single asset included in the (initial) portfolio in order to assess the actual credit quality of that portfolio. As some information may not be provided on a loan-level basis, we look for the following additional information to model credit quality of the assets:

- obligor-level information regarding deposits, securities and derivative contracts for the set-off risk analysis
- amortization profile of the portfolio/master amortization schedule
- yield vector of (initial) portfolio (i.e., development of weighted-average portfolio spread over the course of the transaction) separately for fixed and floating-rate paying loans

In case a mapping approach is taken to determine the default rate of the securitized portfolio on top of the rating or score for each obligor, we look for the description of the rating system and the validation results (e.g., migration matrices).[34]

[34] For more information, see Appendix 6.

Appendix 3: Moody's industry classifications

We group obligors in the following industries based on their main sector of activity (e.g., Statistical Classification of Economic Activities (NACE) Revision 2 in Europe, or North American Industry Classification System (NAICS) in US or Standardized Industrial Classification in Japan).

Industry classifications

1) Aerospace & Defense
2) Automotive
3) Banking, Finance, Insurance & Real Estate
4) Beverage, Food & Tobacco
5) Capital Equipment
6) Chemicals, Plastics & Rubber
7) Construction & Building
8) Consumer Goods - Durable
9) Consumer Goods - Non-durable
10) Containers, Packaging & Glass
11) Energy - Electricity
12) Energy - Oil & Gas
13) Environmental Industries
14) Forest Products & Paper
15) Healthcare & Pharmaceuticals
16) High Tech Industries
17) Hotel, Gaming & Leisure
18) Media - Advertising, Printing & Publishing
19) Media - Broadcasting & Subscription
20) Media - Diversified & Production
21) Metals & Mining
22) Retail
23) Services - Business
24) Services - Consumer
25) Sovereign & Public Finance
26) Telecommunications
27) Transportation - Cargo
28) Transportation - Consumer
29) Utilities - Electric
30) Utilities - Oil & Gas
31) Utilities - Water
32) Wholesale

Appendix 4: Historical data extrapolation

We generally use the growth rate extrapolation approach to extrapolate vintage data series when available. We use this approach consistently across a market or country to allow for a better comparison between SME transactions.

Growth rate extrapolation

For a given vintage, we can derive the historical cumulative default (or loss curve) representing the cumulative amount of defaulted loans over time divided by the aggregate original outstanding amount of the loans included in the vintage. For recently originated vintages that do not offer extensive historical data, we extrapolate default rates following the historical pattern observed on older vintages.

We calculate the growth rate of the average cumulative defaults observed during prior periods. If we consider the percentage increase in average cumulative defaults from period to period after origination (using a comparable amount of data points), we can estimate future growth rates of cumulative defaults for each period. We obtain extrapolated default data by multiplying the last historical data point of a specific vintage by one plus the growth rate of the average cumulative defaults of the specific period (and so on with the subsequent growth rates and the resulting extrapolated data).

When the period with historical data is shorter than the average loan maturity, we may extend the observed default curves to capture the impact of potential defaults after the observation period and build a full default curve. To derive unobserved defaults, one approach is to extrapolate the default rate of the longest observed period to the weighted average maturity of each vintage, at a rate equal to the last actually observed growth rate.

We may exclude younger or older vintages or may make other changes to data or results capturing additional qualitative considerations including seasoning, trends or macroeconomic environments. We also derive additional results including the distribution of cumulative defaults.

Delta net loss timing curve method

The starting point is to create a loss timing curve for the originator. The loss timing curve provides the percentage of the overall lifetime losses the receivables are likely to incur at various intervals of the pool's life. We can use the loss timing curve to extrapolate the cumulative losses on a static pool of receivables from its current level to the expected level at maturity.

We frequently use the “delta” loss curve method to construct the loss curve (see Exhibit 11). In this method, we use an increment (delta) of each vintage’s cumulative loss rates to calculate the average incremental loss rates across vintages for each period (the average delta loss rate). Next, we calculate the cumulative average “delta” loss rate for each period by adding the incremental delta loss rates up through that period (cumulative delta loss).

If the static pool performance history does not include pools that have paid down in full, the static pools will incur losses over their remaining lives. Therefore, to apply the cumulative average delta loss to pools that we need to extrapolate, we determine the "anchor" or terminal value of the cumulative delta loss curve. We can use a number of methods to forecast the anchor value; one is to analyze the trend line of six-month deltas to determine the projected six-month deltas over the remaining life. We add these projections to the life-to-date losses to determine the anchor or terminal loss.

We create the loss curve by calculating the percentage of the total cumulative delta loss incurred in each period after origination. We can then use the loss timing curve to project the cumulative loss for each of the vintages with an incomplete history by dividing the life-to-date loss for any vintage by the corresponding value of the loss timing curve.

Exhibit 11

"Delta" loss curve method

Column	(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)
Originations (in $000')	25,216	26,878	27,815	27,327	26,943	28,433				
Pool Factor	0.01%	0.31%	1.92%	10.56%	25.38%	48.76%				

Year	1	2	3	4	5	6			Loss Curve
1	0.68%	0.86%	0.94%	0.76%	0.74%	0.72%			24.28%
2	1.73%	1.84%	2.32%	1.96%	1.74%	1.71%			58.38%
3	2.26%	2.57%	2.64%	2.39%	2.18%				73.57%
4	2.49%	3.28%	2.91%	2.75%					85.74%
5	2.59%	3.50%	3.46%						94.73%
6	2.66%	3.75%							99.69%
7	2.67%								100.00%
Projected Lifetime Loss	2.67%	3.76%	3.65%	3.21%	2.96%	2.93%			

(5) Projected lifetime loss calculation: 2.18/73.57=2.96%

(1) Delta calculation: 2.26-1.73=0.53

Incremental static pool losses

(3) Cumulative calculation: 0.78+1.1=1.88

(2) Average delta loss calculation: Year 1 average=0.78

								Average Delta Loss	Cumulative Delta Loss	Loss Curve
1	0.68%	0.86%	0.94%	0.76%	0.74%	0.72%		0.78%	0.78%	24.28%
2	1.05%	0.98%	1.38%	1.20%	1.00%	0.99%		1.10%	1.88%	58.38%
3	0.53%	0.73%	0.32%	0.43%	0.44%			0.49%	2.37%	73.57%
4	0.23%	0.71%	0.27%	0.36%				0.39%	2.77%	85.74%
5	0.10%	0.22%	0.55%					0.29%	3.06%	94.73%
6	0.07%	0.25%						0.16%	3.22%	99.69%
7	0.01%							0.01%	3.23%	100.00%

(4) Loss curve calculation: 3.06/3.23=94.73%

Source: Moody's Investors Service

Appendix 5: SME top-down approach to determine the expected default rate: EMEA settings

Exhibit 12
SME top-down approach summary (EMEA)

Roadmap for PD assumption in rating SME securitizations	EMEA typical settings
Step 1: Define country-specific base assumption for standard SME	In the mid- to low-Ba range. (The country-specific base assumption may be lower for certain EMEA countries, e.g., Greece, Turkiye).
Step 2: Portfolio quality adjustment	
Step 2.1: Underwriting/origination quality adjustment	+1 notch/-1 notch
Step 2.2: Portfolio obligor composition adjustment	Size of company: + 1 notch for large corporate, - 1 notch for micro-SMEs. Sector of companies: see below.
Step 2.3: Loan-specific adjustments	Short-term facilities: see below. Bullet and Balloon loans: see below. Payment frequency: we penalize loans paying semi-annually or less frequently (typically 5% extra PD stress). Interest and/or principal grace period: we penalize such loans (typically with 10% extra PD stress).
Step 2.4: Past performance/seasoning adjustments	Delinquent loans: we typically penalize loans in arrears by more than 30 days depending on the transaction's default definition and the numbers of days in arrears (up to 3 rating notches). Seasoning: we apply a benefit to those performing amortizing loans depending on when the origination took place (e.g., more than 5 years ago) and the sector of activities of the obligor (up to 2 rating notches benefit).
Step 3: Outlook adjustment	
Step 3.1: Macro-cycle adjustment	
Step 3.2: Sector-specific cycle adjustment	

Source: Moody's Investors Service

Portfolio obligor composition adjustment: focus on industry sectors (Step 2.2)

Using our RiskCalc models, in particular, the latest available average 5-year financial statement only (FSO) expected default frequency by country and sector, and historical information covering at least one business cycle (e.g., country-specific bankruptcy, insolvency and non-performing loans statistics, and the past performance of SME transactions), we have identified certain industry sectors that are performing (in terms of default rates) independently of the prevailing economic situations (i.e., much better or worse than the economy on average). Based on this research, we have, for example, identified that industry sectors such as Construction and Development or Real Estate Developers are generally performing worse than the economy on average. Therefore, when assessing Step 2.2 under our top-down approach, we may adjust the PD assumption for obligors in these sectors by up to -2 notches, in particular in certain countries such as Spain and Italy.

Special risks and treatment of short-term credit facilities (Step 2.3)

Typically, receivables resulting from securitized short-term credit facilities share the following characteristics:

1) They have a contractual maturity horizon of one year or (significantly) less.
2) They are typically fully drawn upon transfer to the issuer and typically do not involve an option for re-drawing.[35]
3) They are due for repayment at their contractual maturity date (i.e., bullet repayment) and might also have an option for earlier (partial) repayment.

[35] In exceptional cases, re-drawings (or drawings of undrawn amounts) under the underlying credit facility could take place after the receivables transfer to the issuer either thanks to a replenishment mechanism or a dedicated cash reserve funded at closing. In synthetic securitizations, the reference amount (i.e., the risk protection amount) is typically defined as the sum of the drawn and undrawn amount of the underlying (revolving) credit facility and re-drawings are allowed.

4) They result from "uncommitted" credit facilities, i.e., allowing the originator to terminate the underlying credit facility relatively quickly, if needed (and as soon as repaid by the obligor).

Given the bullet nature of these facilities, the major element driving the credit risk is whether the obligor can repay at maturity. Typically, the actual repayment at maturity date is achieved via a rollover into a new loan granted by the originator. Hence, the repayment at maturity depends on a obligor's credit quality as well as an originator's funding situation.

We differentiate between two scenarios in our analysis of the credit risk embedded in short-term credit facilities, whereby the probabilities for each scenario occurring are linked to the originator's current rating:

1) If the originator has access to funding and is comfortable with the obligor's credit quality, the rollover will most likely take place. The fact that for short-term loans an originator reviews more frequently the credit exposure (and if needed, can reduce or cancel the relevant exposure) compared to loans with longer maturity horizon explains the better historical performance observed for a one-year loan facility renewed five times compared to a five-year term loan. Consequently, in our analysis, we typically grant a one notch benefit in Step 2 for short-term loans. Additionally, when translating the individual asset default equivalent into a cumulative default rate, the actual short WAL of the receivable is generally applied (because originators have the option to withdraw the short-term credit facilities at the contractual maturity date.)

2) If the originator faces funding problems (e.g., due to a deterioration of its own creditworthiness), fewer facilities will be rolled-over. In this scenario, the obligor needs either to have sufficient own funds or to obtain a new facility from another originator at short notice. Hence, it is likely that some obligors will not be able to refinance or repay in a timely way the expiring short-term loan. Typically, in SME securitizations such cliff risk (usually a low probability, but high severity scenario) is structurally mitigated by:

   a) not having a replenishment period during which expiring short-term loans could be replaced with new short-term loans (i.e., this limits the risk horizon for the cliff risk to the relatively short maturity horizon of the respective portfolio as of closing) or,

   b) an early amortization trigger/stop replenishment trigger linked to the originator's credit quality in the case of replenishable structures, to ensure that all securitized short-term loans have expired and repaid before a potential default of the originator.

If the cliff risk is not structurally mitigated, we size an additional expected loss assuming that a significant portion of loans will not be refinanced on time and, hence, default. The portion of loans defaulting as well as the expected recovery on such defaults (e.g., deriving from refinancing with other originators) is affected by various factors (e.g., a country's banking landscape and macroeconomic environment) and, hence, will be determined on a case-by-case basis.

Treatment of bullet and balloon loans (Step 2.3)

Non-amortizing loans (i.e., "bullet loans") and loans with limited amortization (i.e., "balloon loans") entail a higher risk, because their risk exposure does not diminish over time. They are also highly exposed to refinancing risk, especially if the economic conditions are, or expected to be, depressed or distressed upon the loans' maturity. For instance, SME loans to obligors active in the building and real estate (B&RE) sector and/or collateralized by real estate are often bullet loans.

Hence, for European SME, we typically assume higher default rates for all bullet loans. We typically add to each bullet loan the higher of (1) the one-year default probability (i.e., the idealized cumulative default rate over a tenor of one year) using the obligor's individual asset default equivalent obtained after Step 2.2 or (2) a default probability using the originator's rating over the maturity horizon of the loan. Typically, (1) is higher than (2). However, (2) allows us to better consider whether the originator is able to refinance the loan. Additionally, we consider on a case-by-case basis an extra stress for bullet loans (granted to obligors active in the B&RE sector) when the loan-to-value (LTV) ratio is above 90% (although this is rarely the case). For highly rated obligors domiciled in EMEA, however, the obligor's individual asset default equivalent (for that purpose) will be on a case-by-case basis substituted with a determined rating, currently typically equivalent to B1. This allows us to introduce a minimum stress for refinancing risk, for instance, for large corporates active in less risky sectors (i.e., with low rating factors).

This approach captures the near-term refinancing risk related to shorter tenor (i.e., one to three years) bullet loans. With the described stress for bullet loans, the cumulative default probability of a bullet loan maturing in one year of a obligor rated B1 would be doubled, whereas the cumulative default probability of bullet loans maturing in five years for the same obligor would be increased by only 30%. We will review the need for an adjustment of the stress applied depending on the credit cycle at the time of the transaction closing and on the average life of the transaction. If we expect a decreased refinancing risk at the time the bullet loans are maturing, the bullet stress might be adjusted accordingly. More precisely, instead of doubling the PD, we may decide to add a stress of 25% or 50% to the one-year PD.

Appendix 6: Mapping ratings and scores provided by third-party entities

Overview

In this appendix, we describe our approach for mapping ratings and scores from third-party entities, such as banks and specialized rating or score providers, to Moody's rating factors. We map third-party ratings for unrated assets included in e.g., certain collateralized loan obligations (CLOs) such as balance sheet CLOs or transactions backed by loans to SMEs. Our mapping approach incorporates both qualitative and quantitative elements and is determined and periodically reviewed by rating committees.

A mapping is a correspondence between a third-party rating category (or class) and our rating factor as per Moody's Idealized Cumulative Expected Default rates. The rating factor that results from the mapping allows us to associate a default probability with an asset that does not have a Moody's rating or a credit estimate. Rating factors are not equivalent to and do not represent traditional Moody's credit ratings. If we conducted an analysis commensurate with a full credit rating, the result may be significantly different.

Furthermore, we may seek a credit estimate for any unrated individual asset that accounts for more than approximately 3% of the portfolio, rather than using a mapping for the asset.

Qualitative analysis

Our qualitative mapping analysis determines whether we can achieve a mapping that is sufficiently reliable for use in a transaction. We cover the key qualitative elements of the rating system during an operational review. More specifically, our operational review of the third party includes an assessment of the entity's rating system methodology and associated processes, including the credit approval process, credit and loan personnel and systems. We also review the independence of its ratings assignments from its processes for both loan origination and the selection of assets for inclusion in the structured finance transaction. When the rating is provided by a specialized provider, the operational review will cover the specialized provider with respect e.g., to the rating system methodology and rating assignment process and the originator with respect e.g., to the use of the ratings.

Operational review

During the operational review, we seek to understand the expertise and experience of the individuals who are responsible for assigning the ratings, the adequacy of staffing levels at the rating provider, and detailed information on the third-party rating process. If the rating provider is a bank, we also obtain an overview of its loan underwriting standards. The operational review also includes a discussion of the roles of the rating provider's relevant staff, any models, methodologies and systems involved and the set of procedures applicable to the assignment of an internal rating.

We will also seek information related to the rating provider's monitoring process, including the standard frequency of review of ratings, the circumstances which may prompt an unscheduled review and the placement of credits "on watch" for further attention. Another factor we consider is the stability of the rating process itself.

Finally, we will review whether the rating provider is regulated and the applicable regulations governing the provider. If regulated, we will assess the frequency and extent to which the provider's ratings process is audited by an internal audit function and evaluated by an external regulator(s). Both the frequency of such reviews and the findings are relevant. For a bank's rating system, an important aspect is whether it has been approved for the advanced approach under the Basel II framework (or any subsequent revision thereof). We consider mappings of these types of rating systems to be generally more reliable because of: (1) the close scrutiny bank regulators apply to assess a bank's internal credit processes, and (2) their acknowledged experience and expertise in assessing the credit risk of their customers and counterparties. Strong bank supervision and implementation of robust risk management processes greatly increase the likelihood that a bank will maintain consistent credit policies across time, as well as across obligors in different regions and sectors.

If we believe the entity's rating system is not sufficiently complete or robust, we may apply more conservative assumptions or adjustments when determining a mapping or we may conclude that a mapping process is not feasible.

Quantitative analysis

In general, to determine the correspondence between a third party's rating and Moody's rating factor, two approaches are possible:

1) If the rating provider's overall portfolio contains a sufficiently large sample of obligors with monitored Moody's ratings and the sample is representative of the securitized portfolio, we perform a statistical analysis, comparing the third-party ratings to Moody's monitored ratings.[36] We call this the *rating matching approach*.

2) If the rating provider's overall portfolio contains an insufficient sample of obligors with monitored Moody's ratings, we establish a mapping by comparing:

   a) The long-run average probabilities of default ("target PDs") assigned to each rating grade within the provider's rating system to Moody's Idealized Cumulative Expected Default rates of the same time horizon; or

   b) If the third party's rating system does not include target PDs, the performance (e.g., historical default rates) of the provider's rating system with the performance of Moody's monitored ratings over a similar time horizon.

Mapping approach 2.a. may be complemented by an analysis of performance data commensurate with the approach described under 2.b. We call this the *default rate matching approach*.

Regardless of the type of mapping approach, for each third-party rating category, the best possible individual asset default equivalent will be the one corresponding to the third party's expected default rates (i.e., based on its master scale if they have a master scale). This ensures that the resulting rating factors are no better than the third party's expected ones.

We may adjust the results of this quantitative analysis based on the qualitative analysis we describe above. These adjustments may affect the entire portfolio or only a fraction of it (e.g., an 'x'-notch adjustment is applied to the mapping only for assets originated in a particular country).

Rating matching approach

To establish a mapping between the third party's ratings (TPR) and our rating factors, we use a sample of obligors with both a TPR and a Moody's rating and we establish a mapping function between the two by performing a regression of the TPR on Moody's rating, i.e., the dependent variable, adjusted to account for the number of observations available for each TPR.

We start with a frequency distributions table of Moody's ratings for the obligors in the sample that have been assigned the TPR (see Exhibit 13).

36 We may also rely on RiskCalc to generate one-year expected default frequencies (EDFs) that may be compared to the provider's internal ratings and can be directly translated by using our Idealized Default Probability table. For more information, see *Rating Symbols and Definitions*. A link can be found in the "Moody's related publications" section.

Exhibit 13

Sample frequency distributions of third-party ratings (TPRs) and Moody's ratings

	Moody's ratings																				
TPR	Aaa	Aa1	Aa2	Aa3	A1	A2	A3	Baa1	Baa2	Baa3	Ba1	Ba2	Ba3	B1	B2	B3	Caa1	Caa2	Caa3	CA	Grand Total
1	16.7%	22.2%	16.7%	16.7%	5.6%	11.1%	5.6%	5.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
2	0.0%	6.5%	9.7%	9.7%	16.1%	16.1%	29.0%	12.9%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
3	0.0%	0.0%	4.0%	8.0%	18.0%	28.0%	20.0%	18.0%	4.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
4	3.0%	1.0%	3.0%	4.0%	12.1%	24.2%	16.2%	24.2%	7.1%	5.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
5	0.0%	1.5%	0.0%	1.5%	4.6%	13.8%	20.0%	20.0%	23.1%	13.8%	1.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
6	0.0%	2.2%	0.0%	0.0%	2.2%	6.5%	8.7%	26.1%	39.1%	13.0%	2.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
7	0.0%	0.0%	0.0%	0.0%	0.0%	7.1%	7.1%	32.1%	39.3%	14.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
8	2.9%	0.0%	0.0%	0.0%	2.9%	5.7%	17.1%	22.9%	17.1%	14.3%	8.6%	8.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
9	0.0%	0.0%	0.0%	0.0%	4.2%	12.5%	0.0%	4.2%	37.5%	25.0%	4.2%	4.2%	8.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
10	0.0%	0.0%	0.0%	0.0%	0.0%	3.4%	3.4%	13.8%	13.8%	37.9%	10.3%	6.9%	6.9%	3.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
11	0.0%	0.0%	0.0%	0.0%	0.0%	7.1%	0.0%	7.1%	14.3%	14.3%	28.6%	7.1%	14.3%	7.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
12	0.0%	0.0%	0.0%	0.0%	0.0%	5.4%	2.7%	5.4%	13.5%	18.9%	10.8%	10.8%	13.5%	10.8%	2.7%	2.7%	2.7%	0.0%	0.0%	0.0%	100.0%
13	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	9.1%	18.2%	0.0%	9.1%	0.0%	9.1%	27.3%	9.1%	18.2%	0.0%	0.0%	0.0%	0.0%	100.0%
14	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	5.9%	0.0%	11.8%	23.5%	5.9%	23.5%	11.8%	11.8%	0.0%	5.9%	0.0%	0.0%	0.0%	100.0%
15	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	16.7%	0.0%	16.7%	16.7%	0.0%	16.7%	16.7%	16.7%	0.0%	0.0%	0.0%	100.0%
16	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	5.0%	5.0%	5.0%	10.0%	5.0%	15.0%	0.0%	30.0%	20.0%	5.0%	0.0%	0.0%	100.0%
17	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	25.0%	0.0%	25.0%	12.5%	0.0%	12.5%	0.0%	12.5%	0.0%	12.5%	0.0%	100.0%
18	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	33.3%	0.0%	0.0%	33.3%	0.0%	0.0%	33.3%	0.0%	0.0%	100.0%
19	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	50.0%	50.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
20	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	20.0%	20.0%	0.0%	20.0%	20.0%	20.0%	0.0%	0.0%	0.0%	100.0%

Source: Moody's Investors Service

Our objective is to dderive a mapping function taking into account that for some TPRs, many observations (in terms of monitored Moody's ratings) are available while for others there are only few.

We consider three different statistical models: linear, exponential and second order polynomial, to explain the relationship between the monitored Moody's rating (dependent variable) and the TPR (independent variable) by fitting a curve between the percentile levels (the z%-tiles) of each TPR-specific frequency distribution of monitored Moody's ratings and the TPR. To find the optimal parameters for each model, we minimize the sum of weighted least-squares. For each TPR category, we take into account the number of observations available.

We then implement a constraint that the rating factor that the statistical model generates for the TPR representing the lowest credit risk must be equal to or worse than the respective z%-tile Moody's rating.

When choosing a certain percentile (the z%-tile), we typically conduct a sensitivity analysis by deriving alternative mapping functions using a slightly higher and/or lower percentile. We may complement our analysis by carrying out a scenario analysis for a larger number of different percentile levels where in a first step, we determine the level of credit enhancement necessary for a theoretical senior-most liability tranche with a Aaa target rating and using a portfolio mapped using the given z%-tile. Next, we calculate the rating impact (through Moody's Metric, MM[37]) of adjusting the percentile to a higher level, using the same credit enhancement level. By repeating this exercise up to the 100th percentile and using the same incremental step size when adjusting the percentile, we can calculate the expected MM by weighting the respective percentiles by their probabilities of occurrence. The expected MM must lie within a predetermined tolerance level, which we generally take to be two rating subcategories. If the tolerance is exceeded, then either the starting point of the mapping must be more conservative (i.e., a higher percentile), or a larger sample must be gathered to reduce statistical uncertainty.

Default rate matching approach

To establish a mapping between the third party's ratings (TPRs) and our rating factors using the default rate matching approach, we compare Moody's Idealized Cumulative Expected Default rates at the same time horizon and the third party's long-run average probabilities of default for each third-party rating category. If the third party's system does not include this information, we compare

[37] For more information, see Moody's CDOROM™ User Guide on www.moodys.com.

the performance of the provider's rating system, expressed for example by historical default rates, with the historical performance of Moody's monitored ratings over a similar time horizon.

The rating factors we derive from this approach need to be supported by the validation results, both in terms of discriminatory power and if applicable, calibration level over a full economic cycle.

Data quality

While reviewing the third-party rating system in our operational review as we describe above, we also assess the sample and quality of the data provided to establish the mapping. We typically review a number of key factors:

» **Rating system**: We review the rating system concept, such as the default definition (and how it differs from our default definition[38] and the securitization's default definition), the time horizon (i.e., point-in-time vs. through-the-cycle), the main components (e.g., financial, behavioral and qualitative) and the sources of the inputs.

» **Backtesting and historical data**: We look for data supporting the third party's rating scale, including default rates and rating transitions, preferably covering at least the previous five years or a full economic cycle, including a recession. We may also request to evaluate a smaller "control" sample of unrated names which have been analyzed through Moody's Analytics CreditEdge® and/or RiskCalc models or which have been assigned credit estimates as a further test.

Typically, to create a mapping relationship between a sample of the third party's ratings and our rating factors, the sample comprises the entire universe of assets of the type that will be securitized (i.e., the sample should be representative of the securitized portfolio). The data sample may also be tailored to match the characteristics of the portfolio that will be securitized, with assets' attributes such as industry, country, obligor size and credit quality in similar proportions.

Monitoring

When monitoring a transaction where the credit quality of the portfolio is determined using a mapping, we monitor the mapping by looking for the following information:

» Reported overall delinquency and default rates in the portfolio are in line with what we would expect from the average mapped quality of the portfolio, and whether defaulted assets exhibit unusual behavior.

» Third-party rating provider to confirm that there has been no significant change in their rating process or approach since the mapping was established. In case we obtain limited or insufficient confirmation, we may apply an additional default probability stress to the mapped rating factors.

We periodically refresh our mapping analysis given that the relationships between the third party's rating and our rating factors may drift over time. Our refreshing of existing mappings is generally similar to the approach we use to assign initial mappings, incorporating both an updated operational review and quantitative analysis.

Other events such as significant, unexplained credit deterioration in the portfolio as well as material changes in the third-party rating process or approach may prompt a refreshing of our mapping. All mappings which are older than two years are subject to an additional default probability stress when used in our monitoring analysis. When the remaining number of mapped assets has reduced over the transaction life, we may subject the mapped assets to a default probability stress given that the mapping becomes less statistically robust the smaller the number of assets in the transaction portfolio.

[38] Moody's definition of default is (1) a failure to pay interest of principal when due, (2) the filing for bankruptcy or a similar insolvency/receivership event, or (3) a restructuring or distressed exchange that has the effect of diminishing the present value of the creditor's obligation or postponing default. For more information on Moody's definition of default, see *Rating Symbols and Definitions*. A link can be found in the "Moody's related publications" section.

Appendix 7: European recovery rate approach in detail

Roadmap for stressed recovery value

Exhibit 14 is setting forward the roadmap for stressed recovery value assumptions in European SME ABS transactions.

Exhibit 14

Roadmap for stressed recovery value assumption in rating SME securitizations in Europe

Country-specific recovery rate for secured loans	Jurisdiction specific
Portfolio-specific quality adjustment	**Valuation of commercial real estate (CRE) property**: Due to often incomplete information on CRE prices, the regional specific house price stress rate (HPSR) as defined for residential real estate properties is typically increased by 1.2 times for CRE prices. **Unsecured loans**: RR of 25%. **Expected foreclose costs**: at 5%-10% for residential properties (depending on jurisdiction) and applying a stress factor of 1.05 to 1.1 times for the commercial properties due to lack of specific data.
Servicer quality adjustments	-5% - +5% depending on the ranking of the servicer.
Final result:	**Stressed recovery rate transformed into a stochastic recovery rate**: + 5%-10% on the stressed recovery rate.

Source: Moody's Investors Service

Country-specific recovery rate for secured loans

There are significant differences between bankruptcy regimes in European jurisdictions, which clearly impact the final realization proceeds and the timing of recoveries (i.e., the recovery lag). We classified European countries in four tiers depending on the creditor-friendliness of the bankruptcy regimes and the security package.

These tiers reflect the predictability of the length and outcome of the legal processes and the degree to which competing interests of creditors and other parties are addressed in a balanced manner under the laws of that jurisdiction.

To determine the expected recovery rate for a senior fully secured loan in a given country, we assess the prevailing stage in the credit and real estate cycle and analyze national residential and commercial real estate prices.

Portfolio quality adjustment

To reflect the portfolio quality of an SME loan portfolio that is collateralized (at least partially) by real estate properties, we apply a loan-level stressed recovery rate approach similar to the one used for rating RMBS transactions[39] (assuming sufficient collateral data is provided). This approach allows us to consider in our analysis on a loan-level basis the following aspects in detail:

» economic lien (typically first economic lien)

» degree of collateralization of the portfolio (e.g., the portion of unsecured loans and loans backed by land, percentage of loans backed by mortgages)

» property value versus loan balance at closing (i.e., the LTV)

» type and location of property provided as collateral (e.g., residential versus commercial property)

Specifically, the differences in the legal framework highlighted are reflected in our country specific assumptions on the foreclosure costs, the time to foreclosure, the level of interest accrued and the property price stress rates applied to each loan, depending on the location of the property.

[39] For more information, see our methodology for rating residential mortgage-backed securities. A link to a list of our sector and cross-sector methodologies can be found in the "Moody's related publications" section.

This approach also enables us to account for the pro-cyclicality of the collateral requirements by the originators. An update of the HPSR for a specific country prompts an update of the values used to determine our recovery rate in such country.

To determine our stressed recovery value for a specific portfolio, we apply on a loan-level basis a fixed recovery rate assumption of 25% for unsecured loans and the above approach used for RMBS with the following portfolio specific adjustments for collateralized loans:

1) The HPSR for commercial real estate properties is typically derived by stressing 1.2 times the HPSR defined for residential real estate properties. This is based on the price corrections of commercial properties shown during previous real estate crises, such as those seen at the beginning of the 1990s or between 2007 and 2009 in the UK.
2) Loans secured by undeveloped urban land are considered to be unsecured loans to account for the high volatility experienced by prices for urbanized land. For loans backed by rural land, a decision is taken on a case-by-case basis.
3) Second (or higher) economic lien mortgage loans are typically treated as unsecured loans, as first economic lien information is typically unavailable to us and, hence, the value of the higher lien mortgage cannot be determined.
4) The foreclosure costs applied to commercial properties are derived by increasing upwards by 5% to 10% the foreclosure costs assumed for residential properties to account for the complexity of the legal proceedings when liquidating a commercial property.
5) The market value of the properties might be adjusted up or downward on a case-by-case basis depending on the type of property valuation conducted by the originator (desktop versus external valuation, liquidation versus market value) and on the country-specific development of the real estate prices since their valuation (indexation).

With this approach, we obtain a stressed recovery value on a loan-level basis (i.e., a recovery value expected by applying the HPSR to the property's market value, if any). The recovery cash flows are not discounted in the cash flow model when the timing of recoveries is considered directly in the cash flow model. This is also benchmark with the exposure weighted-average downturn LGD estimated by the originating banks that adopt the advanced internal rating-based approach under Basel II. However, LGD estimates need to be treated cautiously because the integration of downturn effects in LGD estimates is challenging due to the limited data available. Therefore, we will review in detail the validation results of the internal estimates.

Servicer quality adjustment

Our final recovery rate assumption also takes into account the quality of the underwriting/servicing carried out by the originator/servicer of the portfolio, because the servicing standards for the management of late delinquent and defaulted loans have a large impact on the ultimate recovery rates.

Appendix 8: European SME securitizations with high real estate exposure

Overview

SME portfolios may have exposure to fluctuations in the real estate market in two main ways:

Obligor activity: The obligor can directly operate in, or be strongly linked to, the B&RE sector. This sector is heterogeneous and comprises (1) companies developing, trading or holding land or real estate properties (e.g., real estate developers, REDs); (2) building material companies; and (3) construction companies that generate the majority of their total revenues as general contractors or subcontractors of the construction or refurbishment of buildings used for residential, commercial or public purposes, civil infrastructure and industrial infrastructures (including dams or oil and gas facilities).

In EMEA, the importance of the construction sector (without the RED activities) varies considerably among European countries, depending on the development of the real estate market over the past two decades. This is also reflected in the composition of the securitized SME loan portfolios.

Type of collateral: Unlike loans to large corporates, loans to SMEs are often collateralized by real estate properties including:

1) **Owner-occupied commercial real estate properties**: The majority of loans to SMEs are collateralized by the premises of the debtor, such as commercial real estate properties occupied directly by the SMEs (e.g., industrial buildings, offices, warehouses, retail stores and hotels).

2) **Residential or mixed properties**: Loans to microenterprises are sometimes collateralized by residential (or mixed) properties (i.e., the house of the owner or a building with both residential and business premises). This is because there is typically no real distinction between the wealth of the owner and the assets of the company (often an individual enterprise).

3) **Income-producing real estate properties** (both residential and commercial): SME loans can be taken out for investment purposes by all SMEs, not only by SMEs active in the B&RE sector. The loan purpose is usually "buy-to-let" and the collateral can be residential (e.g., for a homebuilder) or commercial real estate. The default probability of the loan is also related to the sustainable cash flow generated by the purchased properties. However, the main source of reimbursement still remains the total obligor's cash flow from the operating company. This is different from loans in CMBS transactions, where the obligor is typically a bankruptcy-remote vehicle with the real estate properties as its only assets.

4) **Land**: Loans to REDs are sometimes only collateralized by land because the purchase of land is the first step in the development of a building project.

In EMEA, all real estate properties collateralizing the SME loans are completed and, as such, the loans included in SME transactions are typically not exposed to construction risk. All properties used as collateral have an "occupancy license" if the property is residential, or a "start of activity" license if the property is commercial. This is also valid for loans to REDs, whose purpose is to develop a real estate project. REDs frequently use existing properties as collateral to obtain new loans.

Special risks and treatment of loans exposed to construction risk

SME loans to obligors active in B&RE, especially when involved in RED activities and/or collateralized by real estate properties, are often bullet loans with a maturity of one to two years. This reflects the nature of the real estate business. These loans are typically repaid in a lump sum using proceeds from the sale of the mortgaged properties or proceeds from a refinancing loan. If the property has not been sold by the expected maturity date, the obligor will have to renew the loan or refinance it with a new loan provided by other financial institutions. If neither course is possible, the obligor will have to use its own funds to repay the loan.

Construction risk may include the risk of (1) postponing of the termination date of the construction due to, for instance, technical or administrative issues (e.g., the discovery of geographic obstacles or denial of the occupancy license due to non-compliance with the regulations), or adverse weather conditions; and (2) jeopardizing the project's economic viability due to adverse market development for the construction costs.

Appendix 9: Sovereign risk

Loss distribution curve accounts for changes in the probability of high loss scenarios

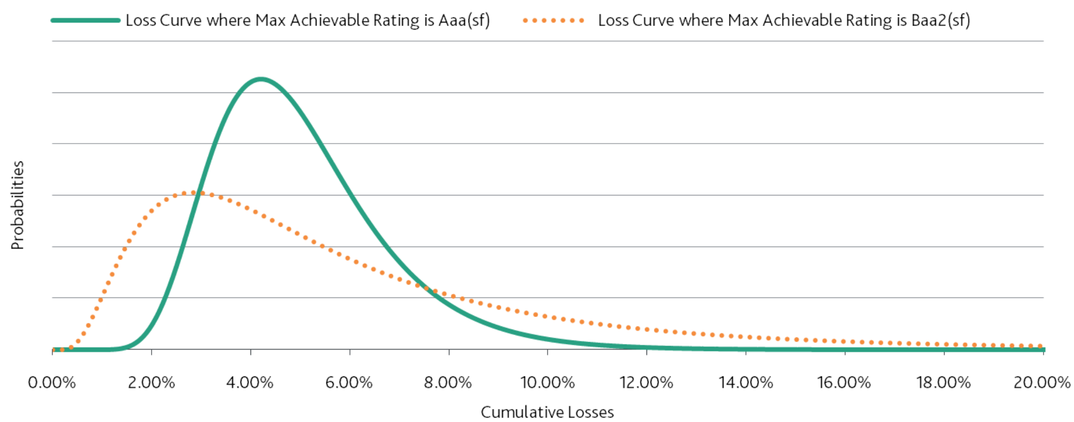
The modeling approach for SME ABS transactions usually takes into account a country's local currency country ceiling (LCC) when calibrating the portfolio loss curve, which we use to generate portfolio losses. In particular, we typically define the portfolio credit enhancement as the credit enhancement consistent with the highest rating achievable in the country (i.e., the LCC). Under certain circumstances, in particular for low ceilings, we might consider alternative loss distribution assumptions or might not adjust our loss distribution assumptions in light of the LCC.

As Exhibit 15 shows, two loss distributions reflecting the same amount of credit enhancement (CE) but different maximum achievable ratings will have markedly different shapes, meaning the losses and their associated probabilities differ markedly. The loss distribution for a maximum achievable rating of Aaa (sf) has a lower probability of very high loss scenarios than the loss distribution for a maximum achievable rating of Baa2 (sf).

Exhibit 15

Calibration of credit enhancement to Aaa (sf) vs. Baa2 (sf)

Same portfolio credit enhancement for different country ceiling levels (granular portfolio)



Source: Moody's Investors Service

Under this approach, if we lower the maximum achievable rating for structured finance transactions in a country, we will not necessarily lower the amount of CE necessary. For example, if a maximum achievable rating of Aaa (sf) previously corresponded to 10% CE, a new maximum achievable rating of Baa2 (sf) may also correspond to 10% CE, to account for the risk of a higher probability of high loss.

Calculating the loss distribution using the same enhancement amount but a lower rating results in a fatter tail on this curve, which takes into account the higher probability of high losses on the rated tranche in a country with a lower ceiling.

This approach provides for a consistent stress across the capital structure, from the senior to the junior classes. The revised loss distribution captures a change in the level of country risk and resulting changes in the maximum achievable rating or the relevant CE (for junior securities).

When we use the top-down approach to assess the expected default probability of individual obligors in a pool, we usually already incorporate a macro-cycle adjustment and a sector-specific adjustment.[40] Such adjustments are typically calibrated based on sovereign-related considerations in the respective country. In that case, we may consider modifying appropriate assumptions to derive the portfolio CE in order to avoid overestimating sovereign risk in a transaction.

[40] For more information, see the "Top-down approach" section, and specifically steps 3.1 and 3.2.

Minimum portfolio credit enhancement

Furthermore, for transactions issued in countries where the availability of information limits the predictability of severe stress, our analysis will also consider additional features. Specifically, we may subject the CE consistent with the highest rating achievable in a given market to a floor, the minimum portfolio CE. This minimum portfolio CE mitigates general market factors such as system-wide event risk and asset correlation, which could lead to high losses in the pool in the event of extreme stress despite overall good asset quality. We will set the minimum portfolio credit enhancement level at different levels for each affected country and asset class to reflect the underlying economic uncertainty of the asset class in the specific market.

We generally determine the minimum portfolio CE 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 (a) the strength of the origination and underwriting processes of an originator, (b) the type of obligors in a portfolio, or (c) the characteristics of the underlying security the obligors provide.

We apply such minimum portfolio credit enhancement levels as long as we assume that those conditions will prevail.

Appendix 10: Monitoring US SME securitizations backed by commercial real estate loans

In this appendix, we describe our approach for monitoring US SME securitizations backed by small balance commercial real estate (SBCRE) loans, which were closed in or before 2011. We do not run a model as part of this approach. Instead, we perform a loss coverage analysis.

Analysis of small balance commercial real estate loans

Roll rate method for US SBCRE loans

This approach evaluates historical roll rate behavior of loans and extrapolates these roll rates forward to determine an expected gross loss on the pool. We evaluate historical roll rate behavior by looking at the rate at which loans pay in full or move through delinquency to default over a specified period of time. Historical roll rates are applied to the pool as a starting point going forward, with adjustments to those assumed roll rates to account for future expected improvement or deterioration in economic conditions and, therefore, pool performance, to arrive at an expected gross loss. Additionally, adjustments to the roll rates for certain loan characteristics, such as balloon payments or previous modifications, are used. To determine the expected net loss, recovery rates are applied. We then compare the net loss number with the credit enhancement available under the rated securities (loss coverage analysis).

Appendix 11: Japanese apartment loan securitizations

In Japan, an apartment loan is a financing instrument for high-net-worth individuals or small business obligors who want to build or purchase apartments for rental. Monthly rents are used to repay the apartment loan. Upon a loan default, the underlying apartment building is usually liquidated. We take the following transaction characteristics into consideration in our analysis.

Characteristics of apartment loan-backed securities

» There are two types of obligors in apartment loans: the landowner and the investment owner. Landowners take out apartment loans to obtain tax deduction or to make better use of their land. Investment owners take on debt to purchase land and an apartment building to realize income gains.

» Most obligors hire a property management firm – typically the company that will put up the apartment building – or an affiliate or master lessee as property manager.

» The maximum loan amount is usually around JPY200~300 million but varies according to the originator and the value of the apartment (or building). The typical maturity of an apartment loan is around 30 years. The apartments are generally scattered around Japan.

» Most initial LTV levels are around 70%-80% based on external valuations. External values are typically calculated based on the land value and the building construction cost.

» Apartment loans are classified as either recourse or non-recourse loans. A non-recourse loan is secured by collateral for which the obligor is not personally liable. The main source of the loan payments will be rents, the stability of which will depend on the property characteristics – which will significantly affect the performance of a loan.

» The number of obligors for securities backed by apartment loans is typically several hundred at closing.

» Payment to investors is typically made either on a sequential basis (sequential payment structure) or based on target redemption amounts (target redemption payment structure), although other structures can be considered.

» Servicers are mostly the originating banks or third-party servicers.

Cumulative default rate

To determine a cumulative default rate estimate, we review the historical performance of the portfolio and of comparable outstanding transactions. We examine obligor attributes, loan and property attributes, and any non-recourse provisions to estimate the cumulative default rate in a pool. Generally, the main source of periodic loan repayments will be the rent, to which our default estimate is sensitive.

As such, we consider the debt service coverage ratio (DSCR) when determining default rates at closing. DSCR represents the profitability of the property and is calculated based mainly on rents, vacancy rates, operating expenses, taxes, repair costs, and loan payment amounts. Each property attribute – location, submarket, real estate market trends, type of construction, and age – is taken into account. We do not give credit to rental guarantees in our analysis for high target ratings, because the credit qualities of the master lessee or rental guarantors are either unknown or insufficient for a high rating. Therefore, in our analysis, rents are dependent solely on the quality of the property.

Additionally, we assume that, when the DSCR is under pressure, the default probability of an apartment loan is further impacted by the type of recourse, the building purpose and the obligor's financial strength. We expect obligors who build apartments for tax benefit purpose have a high incentive to maintain payments to avoid default regardless of recourse provisions, because they are usually high-net-worth individuals being landowners or business owners that are well-known in their respective area. In that scenario, our estimated default probability of obligors will not differ significantly between recourse and non-recourse loans. On the other hand, for obligors who build apartments for investment purposes, recourse provisions may positively incentivize them to maintain payment when the property cash flows are under stress.

We usually determine a transaction-specific default distribution by using a Monte Carlo simulation approach. We may also verify that the amount of credit enhancement under a given class of securities is sufficient to protect this class from the risk of a default by the largest obligors.

The assumed timing of default varies also, with a concentration of defaults expected after the first 10 years of the loan, as it becomes more difficult to find new tenants while properties deteriorate over time and newly built apartments come to the market.

Recovery rate

Whether a loan is recourse or non-recourse, recoveries upon obligor default will depend mainly on the liquidation proceeds of the property. This means that the collateral value, i.e., land and apartment building, is a key factor in estimating the recovery rate for apartment-loan securitizations. The recovery rate is calculated as the stressed property value (Moody's stressed value) over the outstanding loan balance.

We use two alternative approaches to determine the recovery rate upon loan default. The main approach assumes a variable recovery rate that depends on the timing of a potential default. In that scenario, we assume that the property value remains at the original Moody's stressed value for an initial period before decreasing over time down to a floor value that relates to the land value (see following section for more details). We may also use a constant recovery rate (calculated as a fixed percentage of outstanding loan balance), irrespective of the timing of a potential default. The assumed future value of the property, in this case, is directly proportional to the outstanding loan balance. We expect that the first approach provides a better recovery rate estimate. However, estimating future property value curves requires individual property analysis based on detailed information on collateral properties, which is not always available.

Time-series evaluation of collateral value

The amounts recovered from the sale of property vary according to the valuation approach, for example, whether income or cost or combination of both. We use multiple valuation methods for individual properties in light of the property characteristics and age.

The length of time – as a portion of the loan term, for example – to be used to determine a property's value will depend on the age of the property. For example, on a 30-year apartment loan for a new apartment building, we will evaluate each 10-year period using a different approach, as described below, because an income approach may not be appropriate over the full term of the loan for typical apartment buildings whose value could depreciate in a much shorter time.

Exhibit 16

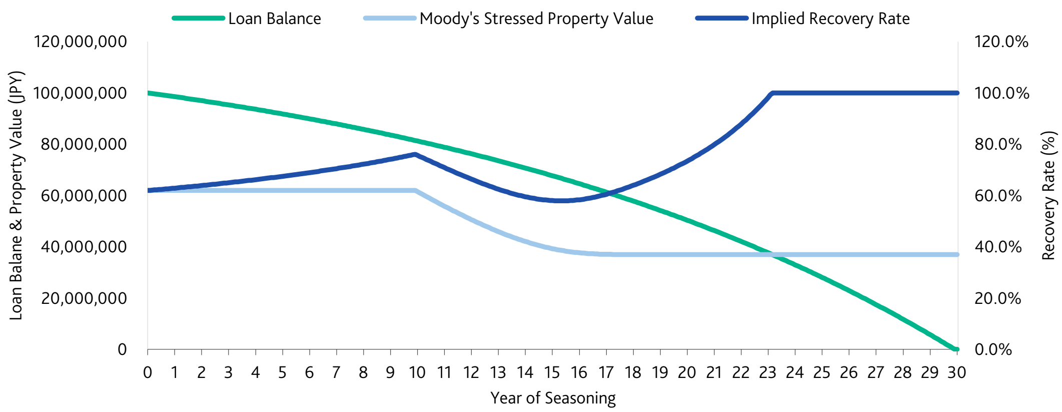
Collateral value over time

First 10 years:	We evaluate the initial collateral value (Moody's value) based on an income approach (i.e., a net cash flow value, assuming sustainable rents, vacancy rates, expenses and cap rates). We then haircut that value to arrive at a Moody's stressed value.
Next 10 years:	We link the values for years 10 to 20 with a bow-shaped line.
Last 10 years:	We estimate that the life span of an apartment building is 20 years and that its value will equal its current rosenka land value estimate (as appraised by the National Tax Administration Agency) for the remaining 10 years of the loan.

Source: Moody's Investors Service

Exhibit 17

Example of Moody's expected collateral value and related recovery rate over time



Source: Moody's Investors Service

Expected loss approach

Once the asset-side modeling assumptions and transaction-specific inputs are implemented, a cash flow model produces a series of default scenarios. In each default scenario, the corresponding loss for each class of securities is calculated given the incoming cash flows from the assets and the outgoing payments to third parties and investors. The expected loss for each tranche is the sum product of the probability of occurrence of each default scenario and the loss expected in each default scenario for each tranche.[41]

We usually run sensitivities to a variety of key asset inputs (e.g., expected PD, prepayments) and structural features (e.g., triggers if any) in order to test the sensitivities of security ratings.

[41] For more information, see the discussion of Idealized Probabilities of Default and Expected Losses in *Rating Symbols and Definitions* (a link can be found in the "Moody's related publications" section) and in the "Loss benchmarks" section.

Appendix 12: Normal inverse distribution and Monte Carlo simulated default distribution

Modeling defaults of a granular portfolio via a normal inverse distribution (also known as the Large Homogeneous Portfolio Approximation) is the extension of the factor model concept to an infinite portfolio of identical assets because the normal inverse distribution is the limit of the default probability distribution for a portfolio with an infinite number of assets, which are homogeneous in size and default probability and whose default behavior is driven by a single-factor model with the same pair-wise correlation. Hence, the consistency of the analysis across the full spectrum of portfolios is ensured: less granular portfolios are modeled based on the Gaussian copula concept with the use of Monte Carlo simulations like CDOROM, while granular pools can be modeled based on the Gaussian copula concept via a normal inverse distribution.

The normal inverse distribution is determined using two parameters: the mean and standard deviation.

On a cumulative basis, the normal inverse distribution is given by the following formula (Φ being the cumulative standard normal distribution describing the probability that the random variable D (representing actual defaults) is not greater than a cumulative default rate of q):

(1) $P(D \leq q) = \Phi[\frac{\sqrt{(1-\rho)} * \Phi^{-1}(q) - \Phi^{-1}(p)}{\sqrt{\rho}}$, where p is the mean and ρ is the asset correlation

Interestingly, an explicit relationship exists between ρ and the standard deviation of the distribution, which is given by the following formula:

(2) $\sigma(D) = \sqrt{N_2(\Phi^{-1}(p), \Phi^{-1}(p), \rho) - p^2}$, where N_2 is the standard bivariate normal cumulative distribution function.

Formula (2) thus links the level of standard deviation with the level of asset correlation in a normal inverse distribution. As a result, when we benchmark portfolios, we might convert the level of standard deviation into asset correlation using formula (2). In this case, we refer to the resulting level of correlation as “implied asset correlation” since it represents the single level of asset correlation implied by a given level of standard deviation.

Appendix 13: Venture debt securitizations

Transaction overview

This appendix provides an overview of venture debt securitizations, which are typically backed primarily by pools of senior-secured term loans to developmental-stage growth companies in which venture capital firms invest. Transactions may include other types of debt such as real estate loans, working capital loans, equipment loans and equipment leases. These pools typically consist of less than 100 obligors and are concentrated in a few industries.

Developmental-stage growth companies typically have short operating histories with low or no revenue, but generally are supported by venture capital firms and considered to have high growth prospects. Typically, the obligors' products or services are in their early stages, with limited or unknown market value. Other obligors might be public companies that need customized financing for marketable products.

The underlying loans could be secured by either a first or second lien on the obligor's assets. Nearly all the loans are secured by 100% of the obligor's assets, which include physical equipment and either a positive or negative pledge of intellectual property that often has significant value for other industry participants long before the product or service has been fully developed. A negative pledge prohibits an obligor from pledging its intellectual property to others, but still allows the obligor to license the intellectual property, leaving open the potential for the obligor to realize revenue prior to final product development.

The combined weighted average loan-to-value (LTV) for a pool is typically in the low to mid-teens, and original loan maturities typically range from two to five years. They are also generally fully amortizing (a small percentage amortize partially or are balloon loans) after a six- to 12-month interest-only period, which reduces principal risk over time and implies a relatively short weighted average life for rated securities. Additional or other indebtedness is strictly limited, but additional tranches can be added if the obligor reaches agreed-upon milestones.

The originator's lien on the obligor's key assets, including intellectual property and patents, plus the low combined LTV and loan amortization, serve to align the interests of the venture capital equity investors with those of the originators, who need the company to repay the loan in order to realize returns or recoup their equity investments.

The obligors are generally in high-growth industries in which venture capital firms typically invest, such as life sciences or technology. Examples of life sciences firms are companies that develop biotechnological, pharmaceutical products, diagnostics, therapeutics or medical devices which are. in the early to late phase of testing or may have already been approved by the US Food and Drug Administration. Examples of technology firms are companies that develop internet services, clean technology, communications and networking, software, media and information services. In most cases, the source of cash flow is subsequent rounds of venture capital equity, raised based on the companies' reaching their product development milestones rather than on their generating product revenues. Therefore, their ability to meet debt service obligations generally depends on reaching the milestones as well as market liquidity for the sector.

The diverse pursuits of obligors in these portfolios therefore imply a low risk of correlated defaults for pure business (as opposed to refinancing) reasons. However, a pullback or general shortage of funding liquidity in the venture capital industry could hamper companies' from obtaining subsequent rounds of equity financing, which they might need to continue meeting their debt service obligations. This risk may increase default correlation in the performance of the loans in a venture debt transaction.

Asset Analysis

Obligors

When analyzing venture debt securitizations, we typically follow the individual asset approach where we assess each obligor in the securitized pool (subject to data availability). From this analysis we derive the obligors' expected default probabilities and recovery rates. We may run sensitivity analysis around such assumptions given the limited financial data that may be available on the obligors. In addition, we consider the possible default correlations between obligors as well as the correlation between defaults and recoveries.

We start our portfolio credit quality analysis by evaluating the credit quality of the pool based on the creditworthiness of the underlying obligors. We perform our analysis on an obligor level because venture debt pools typically are not granular. We may consider several factors that affect the credit quality of the obligors and loans including:

» cash on the balance sheet
» cash flows and cash burn rate
» future loan commitments
» lines of business
» plan of development and future equity raises
» venture capital ownership and percentage
» combined loan-to-value (LTV)
» lien position

Next, we generally examine the development status of the companies, with a focus on:

» underlying intellectual properties
» amount of equity raised
» any relationships with co-originators
» product revenues
» debt service

These criteria help us determine an obligor's stage in the development process and its potential viability.

Based on this analysis, we may infer a probability of default for the obligors in the pool. Given that companies are typically in development stage, we generally expect a low creditworthiness and related high probability of default for this type of obligor.

We also consider the expected recovery rate in case of default. Originator/servicer data typically show that recovery rates on defaulted loans vary considerably. Although venture debt has a very low combined LTV ratio initially, the recovery data that we have analyzed show that upon default, low LTVs do not provide sufficient protection against losses. One reason is that when a company is in distress, its value drops and no longer provides the high protection initially expected. Given the often-illiquid nature of the assets backing the loans, we assume very low recovery rates, typically between 0% and 20%. We also assume that any recoveries will be realized a year after default to reflect the illiquid nature of the collateral, which generally includes intellectual property.

In CDOROM, we account for the underlying venture debt by modeling each of the scheduled principal payments as bullet loans to the same obligor. We do not model prepayments resulting from venture debt market dynamics such as refinancing, mergers and acquisitions, or initial public offering because the loan substitution feature typical in venture debt transactions potentially allows the sponsor to substitute for loans that will prepay.

Servicer quality

We review the servicer's surveillance processes which are designed to identify risks early on. The servicer typically monitors the portfolio of companies to determine whether they are meeting their financing criteria and business plan objectives. The servicer's management team closely monitors the business status and financial performance of each individual company through contact with the company's management team and its financial sponsors. The servicer, as the originator, can use its lien position and its control of the obligor's cash accounts as leverage over both the obligor and the venture capital firms to facilitate debt restructuring or full loan repayment from an at-risk obligor even before default. As a result, obligors rarely default because their loans are typically modified or restructured before a payment default can occur.

Upon a delinquency or default, the servicer will typically establish an action plan to pursue the highest possible recovery. They may advise companies on internal controls, recruiting, financing, mergers and acquisitions, strategic planning, and manufacturing and procurement, and may also help with loan refinancing when appropriate.

Under limited circumstances, the servicer can sell or substitute loans in the pool. Loan substitution is a structural feature often used to minimize reduction in a transaction's weighted average life by substituting new loans for loans that plan to prepay. A criterion for substitution is that the substituted contract does not materially affect the portfolio characteristics. A material substitution percentage could affect or impair the legal true sale of the collateral and could therefore weaken the credit profile of the venture debt transaction. The substitution feature is typically credit negative because it may eliminate the benefits of prepayments (through refinancing, merger, acquisition or initial public offering takeout) and also introduce the risk that the new loans are of lower credit quality than the substituted loans.

Structural analysis

Cash flow simulation

Given the lack of the granularity of these pools, we determine a transaction-specific default (or loss) distribution by using a Monte Carlo simulation approach. We simulate obligor defaults (and recoveries) in the pool using CDOROM and run the results through a cash flow model that reflects the transaction's structure. While our modeling incorporates the same correlation framework stated in this methodology by using CDOROM to simulate defaults (or losses), we usually apply different correlation assumptions for venture debt transactions. This is to reflect a higher expected default correlation among obligors as well as a potentially higher correlation between defaults and recoveries. In that context, we typically assume a stressed liquidity environment that reflects venture capital cycles in which obligors find new rounds of equity financing difficult to obtain and weak operating performance, resulting in a rise in defaults among the obligors.

Modeling the transaction structure

Venture debt transactions typically incorporate several standard credit protections, such as overcollateralization, a reserve fund (providing both credit enhancement and liquidity) and excess spread, which we account for in a cash flow model in conjunction with CDOROM. Other structural features typically found in venture debt transactions are:

Concentration limits

Venture debt transaction pools typically consist of fewer than a hundred obligors and thus could be subject to the risk of default of a single or small group of obligors. As the securities pay down and the venture debt pool amortizes, concentration risk typically increases. To address this risk, the transaction typically incorporates obligor concentration limits. In the event of a breach of these limits, the transaction will divert cash flows to the investors until the concentrations fall below the prescribed limits and thus increase the over-collateralization necessary to reduce tail risk in a highly concentrated pool.

Rapid amortization

Some transactions are structured to allocate all available cash flows to pay down the rated securities upon the transaction closing. Other transactions rely on performance-based triggers to cause an acceleration of cash flows to investors. These performance-based triggers, known as rapid amortization triggers, are usually based on prescribed thresholds such as delinquency and default rates, as well as over-collateralization levels and concentration limits. Typically, an event of default is also an early amortization trigger.

Legal risks

The legal risk analysis for venture debt transactions is similar to the analysis described in the "Other considerations" section of this methodology. We focus primarily on the risk of bankruptcy of the transaction sponsor and the securitization entity, and whether either is bankruptcy remote. In both cases, the risk to investors is either that creditors outside the securitization will make a claim on the securitization assets, or that the cash flows intended for ABS investors will be subject to an automatic stay and be delayed by the bankruptcy process.

Monitoring

In monitoring the ratings of outstanding venture debt transactions, we generally consider the same key variables that we use to assign the initial ratings.

We track the amount and form of credit enhancement, and incorporate analyses of the key risks we considered in the primary rating process, such as loan modifications and delinquencies as well as amortization of the assets relative to the scheduled balances established at the inception of the transaction.

When performance trends are not in line with our expectations, we model the remaining cash flows and credit enhancement to further assess the credit risk posed to each rated security.

Moody's related publications

Credit ratings are primarily determined through the application of sector credit rating methodologies. Certain broad methodological considerations (described in one or more cross-sector rating methodologies) may also be relevant to the determination of credit ratings of issuers and instruments. A list of sector and cross-sector credit rating methodologies can be found here.

For data summarizing the historical robustness and predictive power of credit ratings, please click here.

For further information, please refer to *Rating Symbols and Definitions,* which includes a discussion of Moody's Idealized Probabilities of Default and Expected Losses, and which is available here.

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