Residential Mortgage-Backed Securities Rating Methodology

Structured Finance

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1. Definitions and applicability

This methodology describes our approach to rating European residential mortgage-backed securities (RMBS) whose collateral consists of granular[1] portfolios of standard mortgage loans to purchase, refinance or refurbish a residential property.

This methodology should be applied to portfolios composed of standard mortgage loans for the relevant country. A portfolio strongly deviating from the standard of the relevant mortgage market may need additional analysis to complement our methodology.

This methodology complements our General Structured Finance Rating Methodology and should be read together with our Rating Methodology for Counterparty Risk in Structured Finance Transactions, available at www.scoperatings.com. This methodology may be selectively applied to mixed portfolios of commercial and residential loans when commercial[2] loans represent a minor proportion of the pool. This methodology may also be selectively applied to RMBS outside Europe when the mortgage loan market and institutional framework are similar.

This methodology presents the analytical framework and key concepts to be applied when rating RMBS, where for each country, our methodology will be complemented by a country addendum that provides additional analytical insights. In the absence of a country addendum detailing the assumptions for such country, our Rating Action Release will describe those.

2. Methodology highlights

Bottom-up and top-down approaches. As part of the credit analysis, we form expectations on how a mortgage portfolio will behave in stress scenarios. Its assumptions for mild or no-stress scenarios are based on the originator's strategy and business model. For severe scenarios, the institutional and macro-economic conditions in the relevant country and the initial strategy of the originator play a key role, with assumptions built using historical case studies since 1920 that address factors such as the dynamics of the unemployment rate and the real estate market. The methodology also explicitly captures sovereign risk through country-specific assumptions.

Comprehensive credit risk framework. This methodology defines a comprehensive analytical framework for analysing the credit risk of a portfolio of mortgage loans. Information we rely on includes i) historical originator performance; ii) loan characteristics assessed through a generic scoring algorithm; iii) originator internal scores or public scores; and iv) peer comparisons. Our approach captures the specificities of the loan portfolio and originator as well as the effect of macro shocks on the mortgage/housing market.

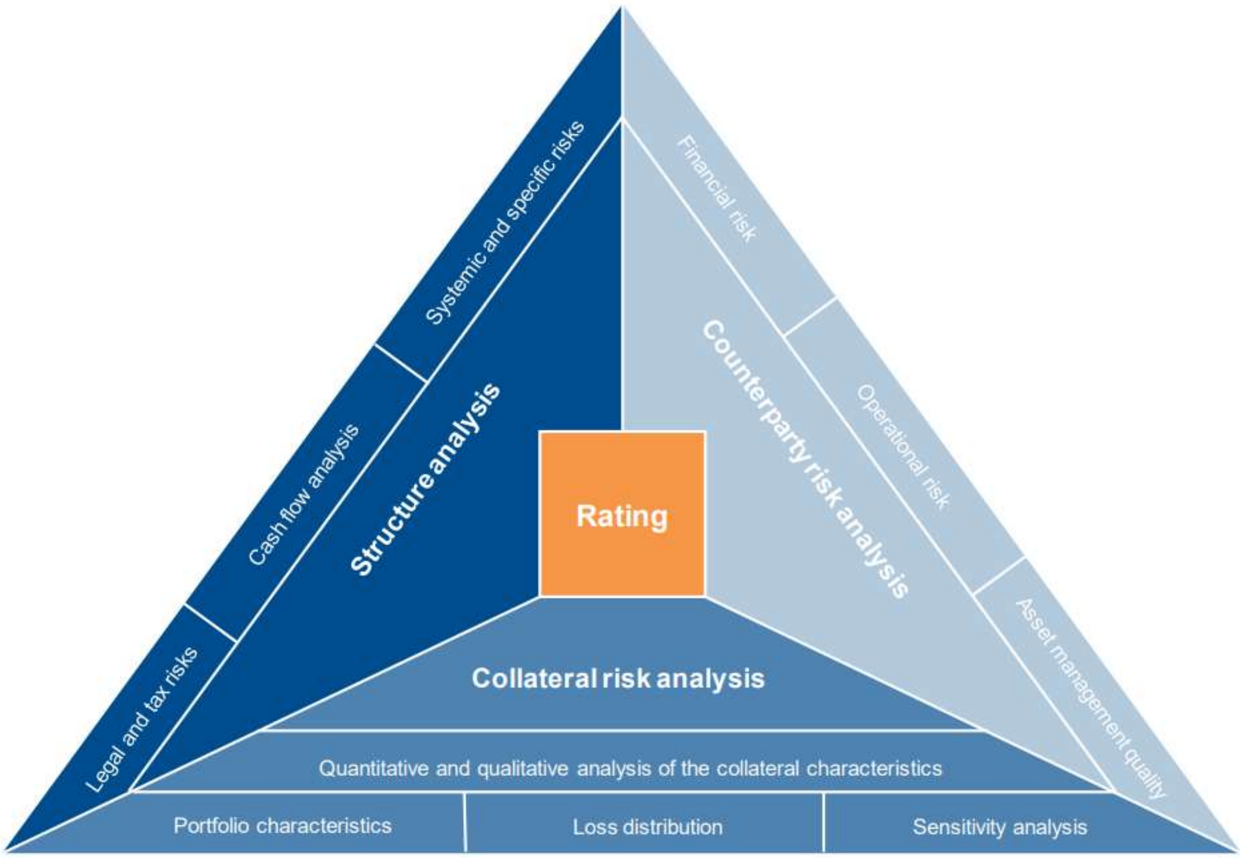
No mechanistic link to sovereign credit quality. As mortgage market specificities are already embedded in our portfolio analysis, there is no reason to mechanistically limit a transaction's maximum achievable rating based on the sovereign credit quality of the country in which the assets are located. Instead, we assess the resilience of each tranche to a mortgage crisis, using distressed default rate assumptions to factor in macroeconomics into the loss distribution. A country addendum integrates our view of the sovereign into the definition of the mortgage default distribution.

Originator/servicer analysis. We leverage on the originator's knowledge of its customers. Its credit view of the assets is based on an analysis of the originator's quality and risk appetite, using factors such as market positioning, product portfolio, origination strategy, risk management and the servicer's monitoring and recovery functions. This assessment has a direct impact on the distribution of default rates and recovery rates.

[1] We measure granularity through the concept of effective number of borrowers, defined as the inverse of the Herfindahl score. The assumptions presented throughout the methodology typically assume a Herfindahl score above 500.
[2] We typically define here commercial loans as loans which: (i) do not have recourse to private individuals and (ii) are dependent upon corporate income.

3. Analytical framework

Figure 1. Scope's three analytical pillars for structured finance transactions



Our analytical framework covers three areas, as shown in Figure 1: (i) the collateral risk analysis (the asset portfolio and its performance), (ii) the structure analysis (cash flow, structure, and legal framework), and (iii) the counterparty risk analysis (the originator, servicer, and other ancillary counterparties).

Our structured finance ratings reflect an investor's expected loss on a securitisation in the context of the cash flow's expected weighted average life. The expected loss accounts for the time value of money at the rate promised to the investor on an instrument. Our General Structured Finance Rating Methodology provides more detail on how we implement the expected loss framework into our ratings.

To model portfolio defaults, we assume an inverse Gaussian distribution in line with our General Structured Finance Rating Methodology, and we apply a fully stochastic recovery rate distribution dependent on the default rates, with the combination of both creating the loss distribution of the portfolio. In addition, our cash flow analysis incorporates key assumptions such as portfolio amortisation, prepayment rates, cure rates, default timing and interest rates.

The final rating reflects our view on the key risks of the transaction, incorporating quantitative and qualitative inputs.

3.1 Collateral risk analysis

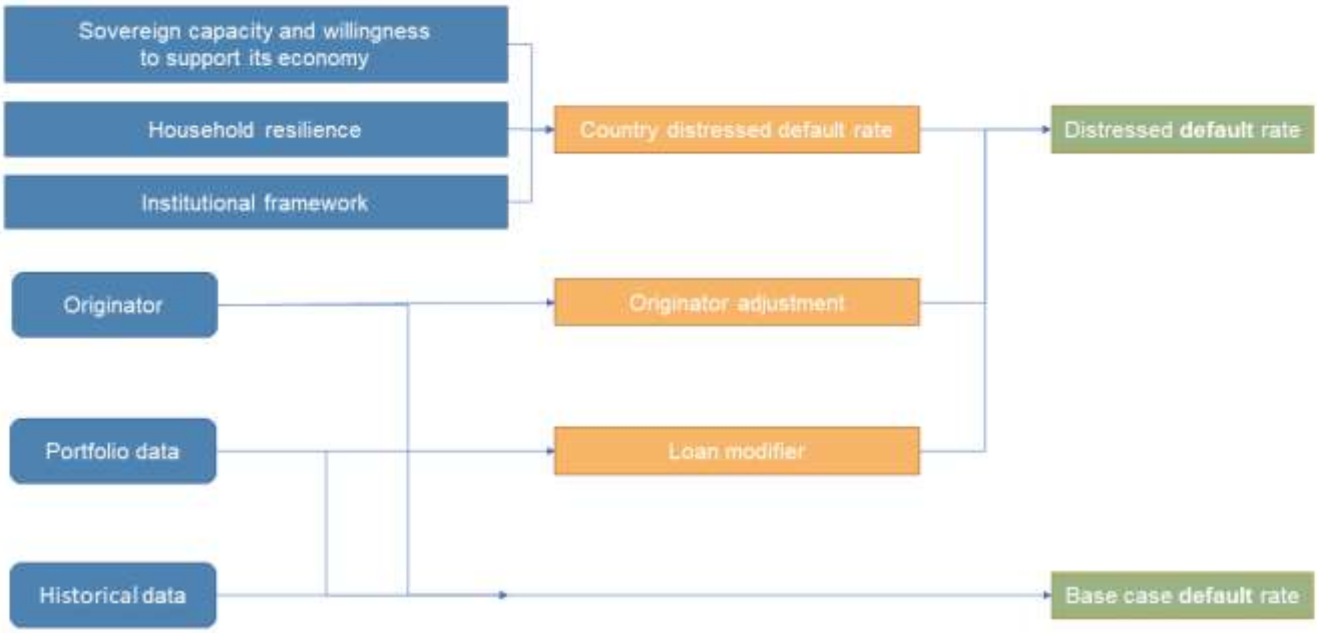
Our modelling of future asset performance is specific to each country. We incorporate an expected view based on recent historical information and a view on potential evolution of asset performance, capturing features and trends of the mortgage market. This approach allows identification of both: (i) the expected loan behaviour, our base case default rate, and (ii) the portfolio behaviour under severe stress, our distressed default rate.

3.1.1 Portfolio default risk assumptions

Our approach to define the asset default risk assumptions relies on two pillars:

- The expected behaviour of the portfolio, captured by the base case default rate, which we derive based on asset performance data.
- The behaviour under stress of the portfolio, captured by the portfolio distressed default rate, which we derive using: (i) a country-specific distressed default rate[3], (ii) related modifiers capturing some of the loan characteristics (which may be different from the characteristics driving the expected behaviour) and (iii) our assessment of the risk appetite of the originator.

Figure 2. Interaction of the key concept to define the default rate



3.1.1.1 Expected behaviour of the portfolio – base case default rate

Our approach to analyse the expected behaviour of the portfolio captures the specificities of the originator without losing consistency across transactions. To derive our assumption of the base case default rate, we can consider: (i) historical performance data of the originator, (ii) a generic scoring algorithm[4] considering the line-by-line loan characteristics, (iii) originator internal scoring or public scoring and/or (iv) benchmarks with country-specific data and other representative transactions (using our usual approach as described in Appendix II and III).

The country addendums detail the required information needed according to the asset class[5] and specific country. Additionally, we assess the representativeness of the available information during the rating process.

Expected behaviour from historical performance

We analyse performance data provided by the originator/servicer on a representative sample of assets with similar characteristics to those of the securitised assets. The originator could provide us with: (i) loan-by-loan historical performance, (ii) cohort historical performance, or (iii) time series of delinquencies or default rates.

[3] Country specific distressed default rate are described in the Country Addendum as described in Appendix V.
[4] As described further in the relevant Country Addendum.
[5] RMBS, or other structured finance market segments.

The determination of the base case default rate from the historical performance will consider: (i) the origination standards (the cohort effect), (ii) the occurrence of a macroeconomic crisis (the period effect) and (iii) the seasoning of the loans (the age effect). Appendix II describes the relevant analytical steps to compute such default rate from raw data for cohort data, whereas Appendix III outlines our analysis when provided with time series of delinquency or default rates. When loan-by-loan historical performance is available, Appendices II or III are still applicable.

Finally, if the portfolio exhibits heterogeneous characteristics, we may split the portfolio into segments, comprising loans with similar characteristics and derive a base case default rate for each.

To derive the base case default rate, we only consider historical data representative of the portfolio being securitised, taking into consideration: (i) the proximity of loan characteristics between historical sample and securitised portfolio and (ii) the duration of available historical data.

Expected behaviour from our generic scoring algorithm

We may apply a country-specific regression algorithm based on loan characteristics to derive an expected loan lifetime default rate for each loan. The respective country addendum describes our generic scoring algorithm, defined using both data from the transaction repository and historical performance data. The mathematical framework of our generic scoring algorithm is built from a logistic regression using key collateral characteristics according to each country. The algorithm does not incorporate the specificities of the originator, which are considered through a qualitative adjustment of the resulting default rates.

Expected behaviour from internal/public scoring

We see potential value in existing scoring systems with a proven track record and regulatory usage. If we assess scores used by the originator to be an adequate predictor of the portfolio behaviour under normal conditions, we will use such scores to define our base case default rate assumption. In addition to the internal scores of credit institutions, there are public scores created and maintained either by private parties (FICO, Experian, etc.) or by public institutions (UC-Score in Sweden, etc.) which we can use.

Appendix III describes the relevant analytical steps to compute such default rate from the score knowledge.

3.1.1.2 Estimating the behaviour under stress of the portfolio – distressed default rate

Scenarios for defaults are used in our cash-flow engine[6] to test the transaction structure versus several potential future default evolutions exploring both expected default behaviour and behaviour under stress. Our base case default rate, as defined in accordance with section 3.1.1.1, represents our expectation with regards to most likely future lifetime default rate, whereas we capture the extreme scenario, occurring in the right tail of the statistical distribution with low frequency but high severity, through the introduction of a distressed default rate.

We derive a distressed default rate starting with: (i) a country-specific distressed default rate, adjusted by (ii) modifiers capturing some of the loan characteristics and (iii) our assessment of the risk appetite of the originator.

Our country-specific distressed default rates capture: (i) the country specificities regarding the capacity and willingness of the sovereign to support its economy, including inter alia our macroeconomic expectations, (ii) the households' resilience to crisis and (iii) the strength of the institutional framework governing the mortgage market. In that sense, our distressed default rates are derived following a top-down approach where the macroeconomic characteristics of the sovereign, its institutions and households define the starting point.

Portfolio Concentrations

The existence of very high portfolio concentration will lead to a commensurate increase of the country-specific distressed default rate, with regards to:

- Borrower concentration if any borrower has an exposure above 2% of the outstanding pool balance, irrespective of the country,
- Regional concentration if any region has an exposure concentration materially diverging from the population distribution.

[6] Scope's cash flow model (Scope CFM), as further described in section 3.3.1 and in our General Structured Finance Rating Methodology.

Loan Modifiers

Several historical housing crises have highlighted loan characteristics which have an impact on default probabilities in a period of stress. However, not all loan characteristics will play a role in a very severe crisis, only a subset of the usual mortgage default drivers will be differentiating factors. Five characteristics will modify for each loan the country-specific distressed default rate pertaining to their country:

- The original LTV, defining a multiplicative modifier ($MMod_{LTV}$) depending on the deviation of the loan LTV versus the mortgage market average, where the relationship between the adjustment and the original LTV is defined through a log-linear function;
- The seasoning of the loan if the loan is amortising, aka neither bullet nor balloon, where we assume a decrease of the distressed default rate, noted $Haircut_{Seasoning}$,directly proportional to the seasoning with a potential cap;
- The usage of the underlying property, commercial or investment (buy-to-let) will exhibit a higher default rate than standard residential, owner-occupied properties, where we would use a relative modifier, denoted Mod_{Usage}, increasing the distressed default rate;
- A loan which previously defaulted, depending on its reperformance history, will be assumed to be defaulted for the sake of computation of the distressed default rate;
- The interest rate type, fixed versus floating interest rate[7], where we would penalise in proportion to the excess of floating interest rate loans versus the country mortgage market share using a relative modifier, denoted $Mod_{InterestType}$, increasing the distressed default rate depending on the country.

The modifiers are country-specific and the country addendums contain indicative levels of those modifiers.

Originator Adjustment

Finally, we apply an adjustment, denoted $Adj_{Originator}$, to all loans from the same originator capturing our originator assessment as described in Table 1. Such an originator assessment is capturing for example the origination channel, the type of mortgage product offered if different from the standard mortgage, the targeted type of borrowers, minimum affordability or more generally any specificity of the originator.

This is a key element because past mortgage crises have evidenced a clear differentiation between originators in the affected countries. Such adjustments could be either negative or positive, as example 100% when e.g. the originator has very lax lending standards, weak risk management or its loan book performance has shown larger sensitivity to the occurrence of a crisis versus its peers, or zero (no adjustment) when the originator does correspond to the country mortgage market standard.

The distressed default rate of the portfolio is defined with the following formula:

$$Distressed\ default\ rate = \sum_{i=1}^{n} Balance_i * \ Country\ Specific\ AAA\ Default\ Rate * \ MMod_{LTV} * \left(1 + Mod_{InterestType} + Mod_{Usage}\right) * \left(1 - Haircut_{Seasoning}\right) * \left(1 + Adj_{Originator}\right)$$

The formula for distressed default rate can also be applied in case with multiple originators.

3.1.2 Originator and servicer analysis

The quality and risk appetite of the originator and the servicer, including amongst other their business strategies, experience and track record in the industry are highly important for the assets' performance. Our approach to determine the asset risk assumptions considers the idiosyncrasies of both originator and servicer. Our credit view on the securitised assets considers market positioning, product types, origination strategy, risk management (see Table 1) and recovery practices (see Table 2). Our assessment of the originator has a direct impact on the distribution of stressed default rates as outlined in section 3.1, whereas our servicer assessment will be captured in our recovery rate assumptions.

[7] Floating rates typically include all interest rate types that are not fixed rate for life.

Table 1 and Table 2 provide an indicative list of the areas covered in our analysis of the two main parties of the transaction: the originator(s) and the servicer.

Table 1: Indicative risk appetite and quality assessment of the originator

Theme		Examples
Market positioning and strategy	We analyse the strategy and its stability over time: whether products and obligor segments are time-tested, who are the competitors, what is the stability of market share and what are the distribution channels used. We use past data on originated volumes and the originator's performance to form a view on the stability of the originator's business model and of the assets' performance.	Governance Business model and its riskiness Credit risk of the originator Origination volume and its evolution Proportion of NPL or reperforming versus peers
Risk appetite	The risk appetite of the originator defines the type of borrowers/loans targeted. Prime or sub-prime borrowers represent the two extremes. Apart from the definition of the targeted borrowers, we will also look at the level of control of the origination channel and the level of aggressiveness of the selling.	Mortgage loan characteristics Non-standard product offering Specialised lender Broker/third-party origination
Staff, systems, and processes	We review the originator's operational competence, capacity, and expertise in managing the types of assets in the transaction. Staff numbers, team turnover and training are also reviewed.	Adequateness of staff compared to originated volume Strength and independence of the risk function Automation of processes Internal control function
Underwriting standards	Understanding the underlying conditions of the typical mortgage contract offered by the originator is a key factor in our assessment of the originator and its underwriting standards. We will also consider historical changes of those standards. Finally, we assess the originator's internal auditing standards, documentation and processes, as well as the independence of the risk function.	Strength of the institutional/regulatory framework for origination under which the originator operates Evolution in the originator underwriting criteria
Origination stability and performance	We compare the assets' origination trends and credit performance with the volume and credit performance of the entire market and/or of peer originators. This peer comparison helps us position the originator versus its peers.	Pillar 3 (as per EBA requirements) reporting on defaults and recoveries Historical performance and its volatility
Credit-scoring systems and risk models	An originator with sound, stable and predictive credit scoring may be subject to lower default volatility. Our review of the originator's underwriting processes incorporates elements such as the use of external and/or internally developed credit scoring and the quality of data sources. We also assess the frequency and the methods used to validate and review credit-scoring systems.	Usage of F-IRB[8] versus A-IRB[9] approach for mortgages Back testing results showing robustness/predictability of the internal model
Fraud prevention	We review measures to prevent and monitor fraud (e.g. identity theft, loan stacking, fraudulent payslip). The robustness and stability of processes related to borrower selection and loan application validation are important in reducing the volatility of loan portfolios. We consider documentation and investigations surrounding loan applications and approvals.	Case studies Automated checks of documentation Know your customer (KYC) regulations Past scandals and their management
Alignment of interests	We examine the alignment of interests between any third party involved in the origination process and the originator. We also analyse how and to what extent the interests of the originator are aligned with those of investors in the securitisation.	Relevance of covered bond or securitisation in the financing of the originator: duration, stability Existence of "Skin in the game" mechanism

[8] Foundation Internal Ratings-Based
[9] Advanced Internal Ratings-Based

Table 2: Indicative dimensions of assessment of the servicer

Theme		Examples
Alignment of interests	We examine the alignment of interests between any third party involved in the servicing process and the servicer. We also analyse how and to what extent the interests of the servicer are aligned with those of investors in the securitisation.	Credit risk of the servicer Servicer's fee structure Importance and volume of recovered defaulted loans
Staff, systems, and processes	We review the servicer's operational competence, capacity, and expertise in managing delinquent and defaulting loans. Timeline of actions to resolve cases following a missed payment, and corresponding cure rates are analysed. Staff numbers, teams turnover and training, are also reviewed.	Resources allocated to the recovery process Seniority of the staff Efficiency of IT systems tracking recovery process
Monitoring and recovery strategy	We review the servicer's processes, from early delinquency strategies to loss mitigation for defaulted loans, which should be reflected in roll rates and recovery vintage data. Proactive servicing generally limits the number of delinquent loans rolling into default and increases recoveries.	Early arrears management Timeline of recovery strategy Out-of-court versus judicial proceedings Outsourcing/Automation Historical recovery performance and its volatility

3.1.3 Default rate distribution

By deriving the base case default rate and the distressed default rate, we are able to define the default rate distribution:

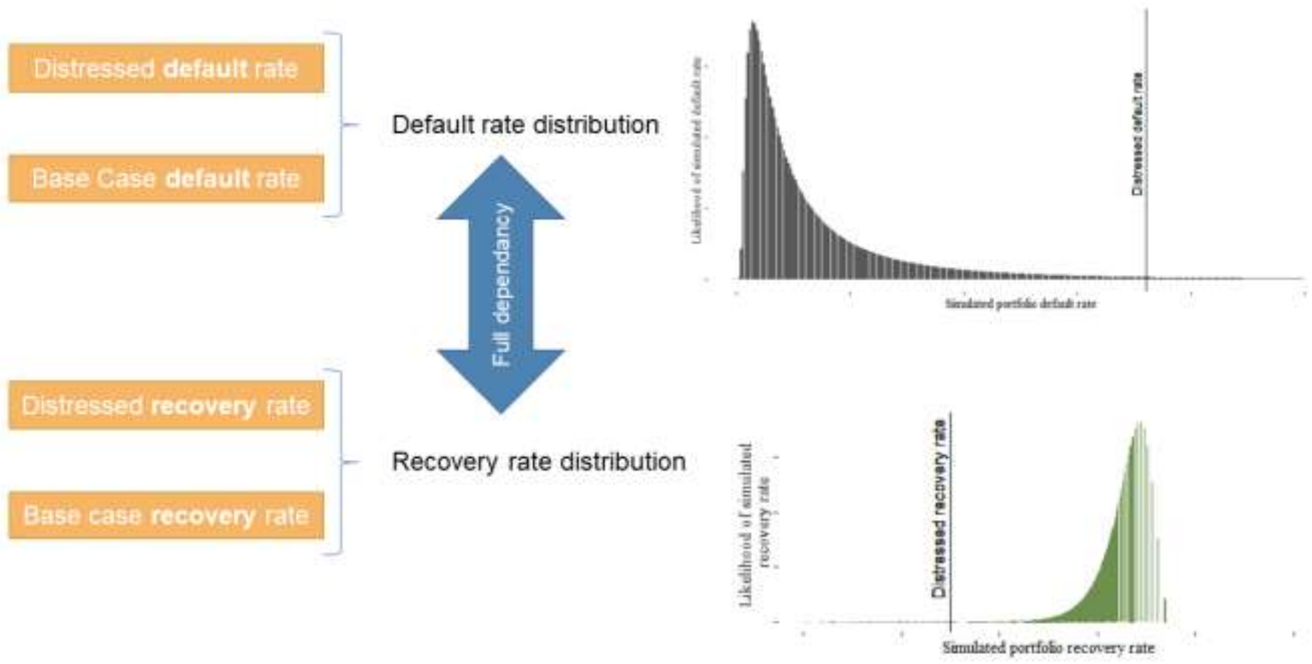
- The base case default rate defines the mean of the inverse Gaussian distribution used;
- The distressed default rate is considered to have a probability of exceedance equal to the ten years idealised probability of default of a AAA.

Having defined these two points of the statistical default distribution, we can then infer the implied standard deviation (or coefficient of variation – CoV[10]) of the default rate. The default rate distribution will then cover multiple intermediate scenarios.

Figure 3 presents in schematic terms the definition of the default rate distribution from two elements of the distribution, the definition of the recovery rate distribution and their interaction.

[10] Defined as the ratio between: (i) the standard deviation and (ii) mean of the distribution.

Figure 3. Default/Recovery rate distribution definition and their interaction



3.1.4 Default timing

We derive a default timing assumption specific to the transaction, considering the characteristics of the securitised assets. We apply a front-loaded default timing, reflecting a constant default intensity that follows the portfolio's amortisation. We also test more front-loaded or back-loaded default timings to assess the impact on the transaction of different paths of this variable.

3.1.5 Recovery rate analysis

To derive our recovery rate assumptions, we can consider either: (i) a statistical analysis of historical data or (ii) a fundamental analysis of the loan portfolio.

In the former case, our base case recovery rate is derived from the statistical analysis of the historical data and to define the distressed recovery rate we apply a country specific haircut to the base case recovery rate.

In the latter case, both our base case and distressed recovery rate are defined using the relevant market value decline within our fundamental approach, as outlined in our General Structured Finance Rating Methodology.

Country addendums provide details on the level of the haircut or the typical ranges of market value decline. The approach applied will vary according to asset class[5] and countries.

In the cash flow analysis, the instrument's expected loss is determined via a numerical integration of the losses under different simulations, weighted with their respective probability. For each simulated scenario, single assumptions for both a default rate and a corresponding recovery rate are defined. This incorporates a perfect dependency between default and recovery rates, where we implicitly apply decreasing recovery rate assumptions as the default rate becomes higher.

We assume recovery rates follow a beta distribution whose parameters are defined such that:

- The base case recovery rate defines the mean of the beta distribution used;
- The distressed recovery rate is the recovery rate such that the probability of recoveries being below this rate is equal to the ten years idealised probability of default of a AAA.

Appendix IV provides more details on the recovery rate distribution and its relationship to the default rate distribution.

3.1.6 Timing of recoveries

We derive recovery-timing assumptions from historical data. However, when choosing the timing of recoveries for a servicer, we will be mindful of the specific recovery processes and strategy put in place (see Table 2), all within the umbrella of a country-specific legal framework. Our experience and data with regards to NPL transactions may be an additional reference point.

Each country addendum provides our country-specific base assumptions for mortgage loans' recovery timing, which we could modify based on our assessment of the servicer capabilities.

3.1.7 Prepayment assumptions

Prepayments are mostly driven by loan refinancing or property sales (due to divorce, moving, etc.). Expansionary monetary policy or increased bank competition[11] may result in a decrease of the refinancing costs favouring prepayments. In addition, regulatory changes and country-specific laws or market practices lead to changes in prepayment penalties, costs which, in some cases, are zero even for fixed-rate mortgage loans.

We assume a central and constant prepayment rate for the full duration of the transaction as our base case. We also test higher and lower prepayment assumptions. Each country addendum gives our country-specific low/high mortgage loan prepayment assumptions.

We expect that during a mortgage crisis period, prepayment rates will be lower than the base case. The calibration of our central prepayment rate assumption is mainly based on historical prepayment rates from the originator and from its competitors if their mortgage products are comparable.

The impact of prepayments on expected cash flows may vary depending on the transaction structure and on the level of excess spread[12] at closing and its potential volatility during the life of the transaction. Prepayment rates may become a key analytical variable if high or low prepayment scenarios result in significant deviations of expected cash flows compared to the base case assumption. Further transaction-specific analysis would be done in such case.

3.2 Structure analysis

3.2.1 Cash flow analysis

We calculate losses on each note class by projecting the cash flow generated by the securitised portfolio, accounting for the transaction's structural features. For the asset side, section 3.1 outlines our main quantitative inputs, complemented by asset amortisation and portfolio yield assumptions. For the liability side, the main inputs are the priorities of payments, the size of the notes, expected coupons, transaction fees and expenses, any reserves covering liquidity or credit risk, any interest rate or currency hedging, any transaction triggers and, in some instances, a quantification of certain, identified counterparty risks.

We assume an aggregate of the level of senior costs, senior to the rated instruments, consistent with the standard within each country. Our analysis assumes **increased senior costs** versus the initial contractual arrangements, particularly to address servicer replacement at market-level fees. We generally assume that senior fees are a percentage of the outstanding portfolio amount, with a certain Euro amount floor. Each country addendum describes our assumptions regarding senior fees.

Our quantitative analysis determines the cash flows available for the tranches in each simulated scenario as well as the associated probability of that scenario. We then calculate the expected loss rate and weighted average life for each class of note, which are mapped to our expected loss tables to determine the corresponding ratings as explained in our General Structured Finance Rating Methodology.

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[11] Increased bank competition in an environment of easing bank lending standards would drive prepayment rates higher.
[12] Credit enhancement provided by the difference between the portfolio yield and the notes' coupons as well as any other item paid senior to it.

3.2.2 Liquidity risk

The risk that portfolio interest collections cannot cover the transaction's senior fees and the notes' coupons is generally mitigated by structural protection provided by cash reserves, or the ability to use principal collections. Further details are to be found in the General Structured Finance Methodology.

3.2.3 Exposure to interest rate risk

Interest rate risk is the risk that the interest rate payable on the rated instruments differs from the interest rate on the securitised assets. Such risk may stem from: (i) basis risk, where both the portfolio and the notes have a floating rate, but they are linked to different reference rates, (ii) fixed-floating risk where the portfolio pays a fixed rate, whereas the rated instruments pay a floating rate (or vice versa), and (iii) reset date mismatch, where both the portfolio and the rated instruments have floating rates linked to the same reference rate, but the reset dates are different.

We expect the notes issued not to be materially exposed to interest rate risk. To mitigate interest rate risks, the issuer may enter into a hedging agreement. We assess the main terms of the hedging agreement to determine how effectively the risk is mitigated. Unless fully covered, structurally or hedged, we would analyse the sensitivity of the transaction to extreme changes (upward or downward) in interest rates throughout the transaction life.

3.2.4 Legal risk analysis

Legal risks can arise from three main sources: i) the assets and the transfer of these assets to the special purpose vehicle; ii) the special purpose vehicle issuing the rated debt and its legal structure (e.g. bankruptcy remoteness); and iii) the transaction parties. We review legal opinions to gain comfort on assumptions regarding relevant legal issues.

For RMBS transactions specifically, we focus additionally on: i) borrower protection statutes under laws governing the contracts; and ii) the validity of rights assigned to the issuer in an event of the originator's liquidation.

Further details can be found in our General Structured Finance Rating Methodology.

3.3 Counterparty risk analysis

We evaluate how risks are linked between the rated instruments and the various parties to the transaction.

The primary counterparties to an RMBS transaction are the mortgage loans' originator and servicer. As described in the section pertaining to our collateral risk analysis, the assessment of those counterparties has a direct impact on our collateral risk assumptions.

There are generally other relevant counterparties in an RMBS transaction, such as the account bank, the hedging counterparty, etc. For each of the counterparties involved, we assess the materiality of a counterparty exposure as excessive, material, or immaterial. We distinguish financial risk from operational risk and assess the transaction's ability to mitigate or reduce counterparty risk. For more information refer to our Methodology for Counterparty Risk in Structured Finance.

3.3.1 Servicer commingling risk

Servicer commingling risk is the risk that moneys of the issuer held by the servicer are commingled with the insolvency estate of a defaulted servicer. The materiality of this risk depends on: (i) the servicer's credit quality; (ii) the legal framework under which the servicer performs its functions; (iii) depending on the jurisdiction, the existence of pledged or dedicated accounts, such as escrow accounts; iv) the ease of redirecting collections from obligors upon a servicer event (e.g. direct debit collections); v) provisions in place to instruct debtors to redirect payments into an account in the issuer's name; vi) the payment method used by the borrowers (e.g. wire, cheque, direct debit); vii) the frequency with which the servicer's funds are transferred into an account in the issuer's name; and, generally, viii) receivables characteristics which determine the amount and potential clustering of collections around certain dates.

We consider whether structural protection features, such as a dedicated commingling reserve or guarantees, are effective at mitigating the risk, assuming obligors' payments can be redirected rapidly. For example, we deem a commingling reserve held in the issuer's name that fully covers collections over a stressed servicer-holding period to be effective at delinking a transaction from servicer commingling losses.

If commingling risk cannot be fully mitigated, our analysis incorporates any uncovered exposure to the servicer by considering both the servicer's default likelihood and the amount of collections at risk. For more detail, refer to our Methodology for Counterparty Risk in Structured Finance.

3.3.2 Set-off risk

Set-off may be invoked by a debtor that holds a monetary cross-claim against the seller or originator. In this case, the debtor may be absolved from honouring the creditor's claim up to the amount of the cross-claim.

Regarding RMBS transactions, set-off risk typically arises when the originator holds the obligors' deposits. These obligors may exercise set-off rights if they lose access to their deposits (for example, upon the originator's insolvency), which could substantially reduce or cancel out the enforceable claim, i.e. the proceeds payable to the issuer, creating a loss for the transaction.

As set-off risk can vary significantly by jurisdiction, we analyse jurisdiction-specific laws. We generally consider the following factors to determine the extent of set-off risk: (i) the probability of the originator becoming insolvent, (ii) the structural protections in place, such as a dedicated reserve or an undertaking by the originator not to open accounts with the securitised debtors, (iii) the existence of country deposit-scheme guarantees, (iv) whether the notice of assignment of the portfolio transfer to the issuer 'crystallises' the amount an obligor may set off against the issuer (equal to the amount that was credited to the debtor's bank account at the time of such notice), and (v) extensive cross-selling of financial products could create linked contracts with the loan. Borrowers may set off losses incurred in cross-sold products against amounts owed on their loans. We assess whether borrowers can legally set off amounts due on their mortgage loans and analyse structural features in place to mitigate this risk, such as set-off reserves.

For additional detail, refer to our Methodology for Counterparty Risk in Structured Finance.

4. Rating sensitivity

Our analytical framework for structured finance transactions is designed to result in rating stability for high investment grade ratings. Two mechanisms enable this: i) an asset default and recovery distribution representing a through-the-cycle view for the key drivers of credit risk (default and recovery); and/or ii) rating-conditional stresses for other drivers.

Our Rating Action Release illustrate the stability of ratings when shocks are applied to relevant analytical assumptions. Sensitivity to shifts in the mean default rate and expected recovery rate illustrate to what extent and in which direction ratings depend on quantitative assumptions. Sensitivity test scenarios should not be interpreted as likely or expected scenarios for the transactions.

Figure 3 shows the typical scenarios in the rating sensitivity test. Upon excessive sensitivity to key analytical assumptions, we may decide to lower a rating to increase its stability.

Figure 3. Typical sensitivity tests considered during the analysis

Analytical assumption tested	Shifts considered
Default rate distribution	Parallel shift by +50% of the base default rate
Recovery rate distribution	Parallel shift by -10 percentage point

We also consider in our analysis the maximum default rate at which no loss is seen for a given tranche (break-even default rates). This information provides investors with another perspective on the resilience of the rated tranches.

5. Data adequacy

As outlined in our approach to define default and recovery rate distribution, representative data is key to our approach.

Our data requirements will differ according to the standards of disclosure of the country and asset class of the issuance. We assess the adequacy of the information received to meet this objective.

5.1 A standard portfolio data template

We do not use a proprietary portfolio template for RMBS portfolios and welcome data that adheres to portfolio reporting standards set by the European Central Bank taxonomy and adopted by the European DataWarehouse (EDW) or the Bank of England template

– as long as the information is relevant for analysing the assets' risk characteristics. We can also work with templates that allow a comparison between the credit characteristics of portfolio assets and those in the originator's entire book.

5.2 Data checks

We judge the plausibility of the information we receive from the originators and other sources, even if we consider these to be reliable and accurate. We may request additional information or clarification from an issuer or its agents if the information conflicts with our assessments. These 'sanity checks' do not, however, verify the reliability and accuracy of information used in the rating analysis.

Agreed-upon procedures performed by reputable, independent auditors can highlight any differences between the data provided by the originator/seller that we use for our rating analysis and the original documents or computer files containing such data.

We believe that the reliability of information increases with the degree of the originator's alignment of interests with noteholders, and/or the independence, experience, and financial strength of the parties providing information. For example, independent legal opinions generally support our legal analysis, whereas representations by an affected party would not be deemed robust.

Conference calls and operational review visits also provide us with more details on the information received. We may review files to gain insight into the processes presented during the operational review visit or the assets being securitised.

6. Monitoring

We monitor RMBS transactions using performance reports such as those produced by the management company, the trustee, or the servicer. Standards performance reports include data on the key risk metrics. When available, we also use EDW reporting. The ratings are monitored on an ongoing basis and are reviewed once a year, or earlier if warranted by events.

7. Integration of ESG factors into our analysis

We do integrate environmental, social and governance (ESG) factors into our credit analysis. We incorporate the risks arising from a transaction's exposure to ESG factors as part of the analytical approach reflected in this rating methodology.
Environmental factors are incorporated as per the description given in Appendix I.
In addition, the main governance factors pertaining to the originator are captured by the originator assessment required by this methodology.

Appendix I – Energy efficiency, climate risk and mortgage credit risk

Climate risk is now a known risk to any investments, either because of the direct consequences of a more volatile climate on physical assets or because of the associated regulatory framework.

Transitional Risk

Climate change has required governments and regulators worldwide to find tools to reduce energy consumption. Buildings represent a large part of the overall energy consumption. A European research initiative, the Energy efficiency Data Protocol and Portal (European Mortgage Federation), has been set-up to raise awareness of the importance and benefits of mortgages on energy-efficient buildings.

The Energy Performance of Buildings Directive (EPBD) requires that the energy performance of a building be expressed by means of a primary energy consumption indicator. Energy performance certificates (EPCs) are issued on residential properties to be sold, let, or constructed. EPC labels range from A to G.

There has been increasing focus on the relationship between mortgaged property energy efficiency and default rates. Studies in different countries show that defaults are less frequent on mortgages against energy efficient properties, even when controlling for key variables such as loan-to-income ratios and borrower income. Potential explanations for this relationship could be either: (i) a positive selection on borrowers valuing the energy efficiency of properties or (ii) potential savings linked to energy efficiency that become available to service mortgage loans.

Scope considers in the analysis information on property energy efficiency, when available. The following example illustrates how energy efficiency could be incorporated into the analysis. Let us assume that the market proportion of properties with A or B EPCs is 30%, while this proportion within the securitised portfolio is 45%, so that there is a 15% excess of properties in the upper range of energy efficiency labels. We would then reduce our portfolio expected default rates in proportion to such excess. The magnitude of the reduction would depend, inter alia, on: (i) originator historical performance data by energy efficiency, (ii) market performance data, or (iii) third-party studies.

Physical Risk

Weather risk and climate change leading to catastrophic events, such as floods, earthquakes, and wildfire may cause severe property damages, leading to loss of property value, lower mortgage borrowers' affordability, and thus negatively impact performance of securitisations.

First, Scope will assess the natural catastrophe risk to which the portfolio is exposed based upon both: (i) the geographical distribution of the underlying properties and (ii) public databases of known natural catastrophe risks (storms, earthquake, floods, volcanoes, wildfire, etc.). Second the potential mitigants will be considered such as insurance coverage or limited concentration in the riskier areas.

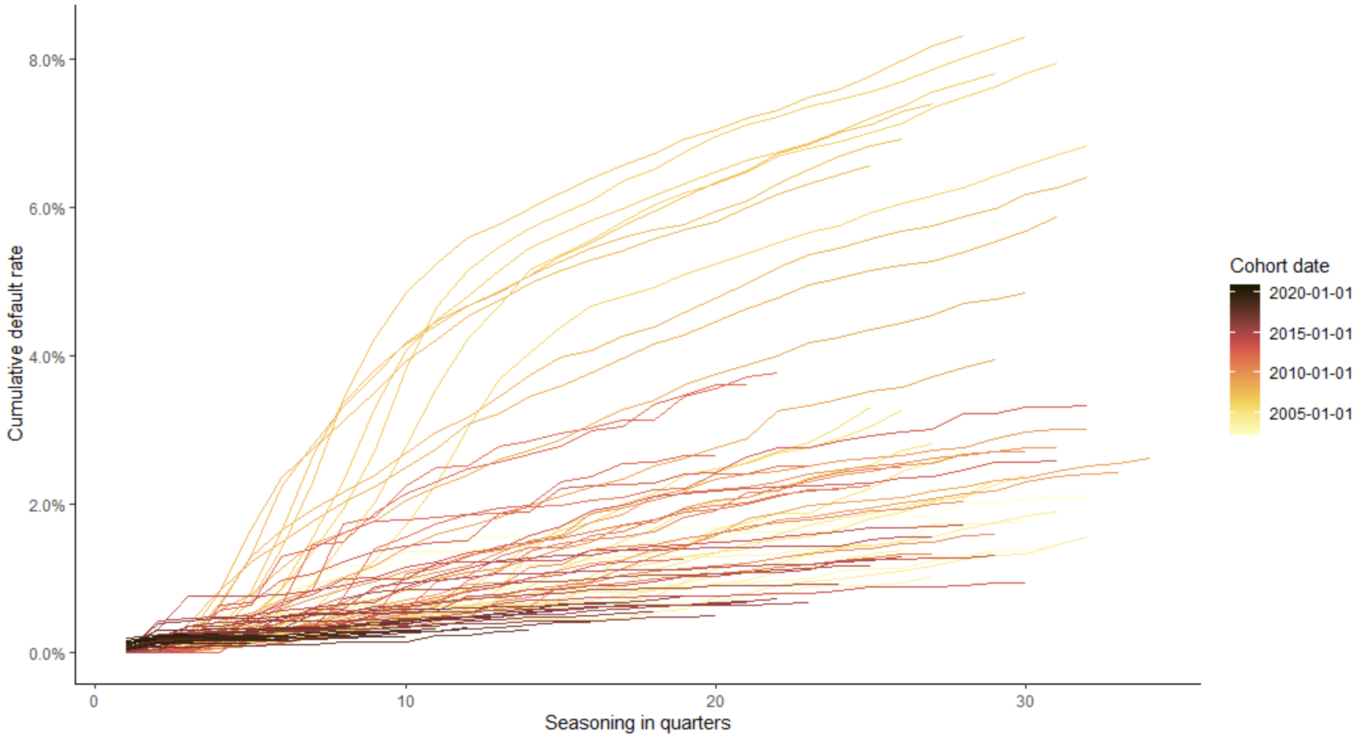
According to both the exposure and the quality of the mitigants, the climate risk may have an impact on the rating analysis.

Appendix II – Vintage data analysis

We use vintage data analysis to derive the expected default rate for the cohorts being part of the securitised pool. Such analysis entail: (i) an extrapolation of the incomplete cohort performance, (ii) an assessment of the representativeness of each of the past cohorts and (iii) a rebasing of the cohort cumulative default rate to account for their seasoning.

Figure 4 presents an example of the evolution of several cumulative default rate for cohorts of loans originated between 2004 and 2020.

Figure 4. Example of vintage data



Extrapolation of the cohorts

We use the cumulative default rate for a set of loan contracts, usually called a cohort, grouped by their origination date (by year, semester, or quarter generally). The cumulative default rate of each cohort is then decomposed along the three axis of age (seasoning effect), period (crisis effect) and cohort (origination effect) through the usage of marginal default rate, computed considering the estimated amortisation of the loans, if any.

The extrapolation of the cumulative default rate to the expected weighted average life of the pool is done using a marginal growth rate defined considering one of the following extrapolation methods:

1. The average marginal default rate per seasoning;
2. The average marginal default rate per cohort;
3. The marginal default rates extrapolated from both: (i) loan age, (ii) loan cohort and (iii) the period.

The analyst will assess the relative importance of the factors explaining the historical performance to choose the best method of extrapolation. For RMBS, we use mainly extrapolation methods 1 and 2. If cohorts have not shown similar performance, the extrapolation will use age-driven marginal default rates (method 1), if irrespective of their seasoning, loans have not shown too dissimilar performance, the extrapolation will use cohort-driven marginal default rates (method 2). For more complex cases, marginal default rates will be computed through the usage of all dimensions (method 3).

Figure 5. Average marginal default rate per seasoning

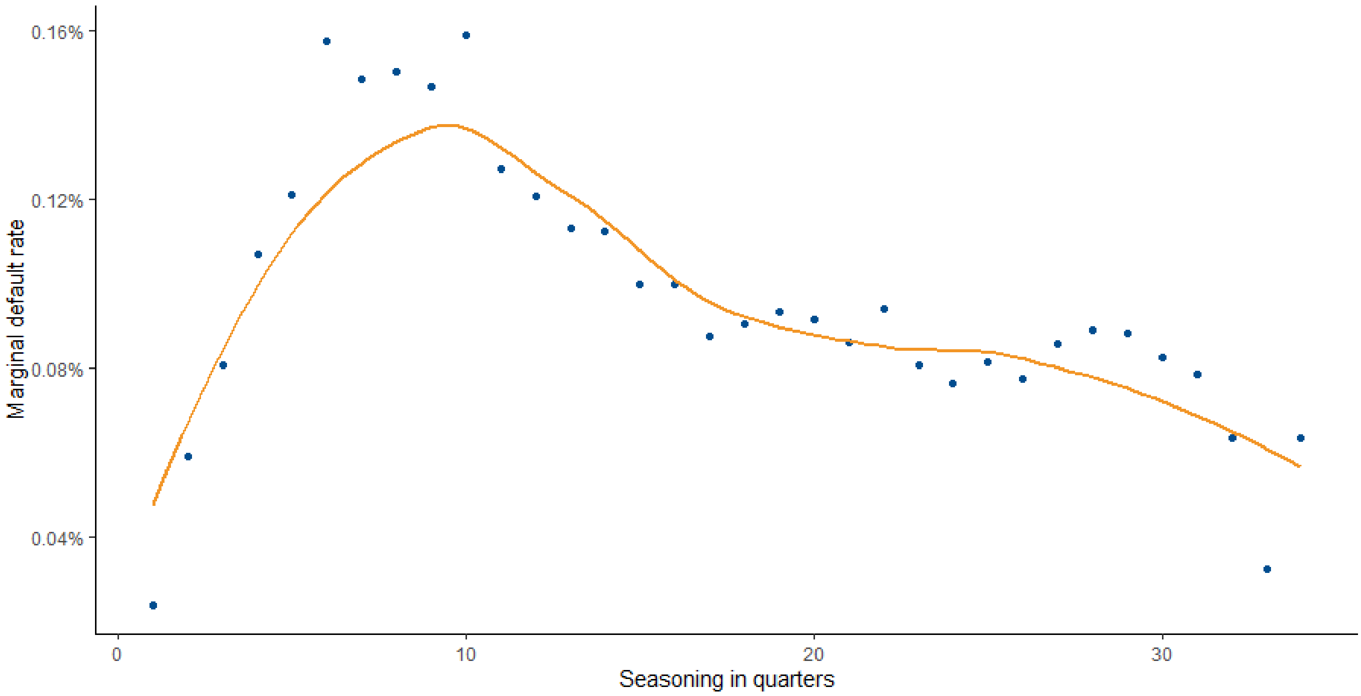


Figure 5 is using the same raw data as Figure 6 whereas the focus is on the influence of seasoning on the default rate and thus on the timing of defaults. The evolution of the marginal default rate is typical of a pool of amortising loans.

Figure 6. Average marginal default rate per origination date

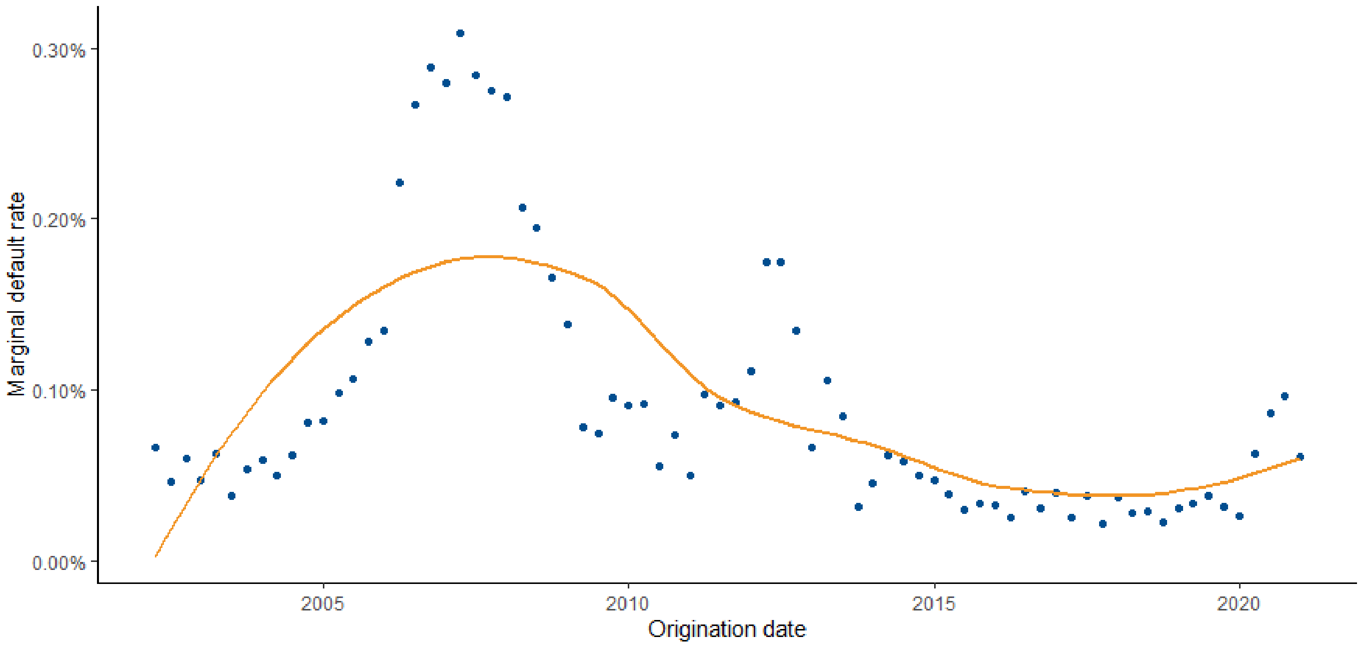


Figure 6 allows us to assess the evolution of the default likelihood depending on the origination date and thus captures the origination conditions.

Representativeness of each cohort

The representativeness of the historical data needs to be assessed by the analyst to check the adequacy of the cohort with the portfolio to be securitised. Such an assessment will potentially modify the weight given to each cohort for the computation of base case default rate defined as the cohorts' weighted average lifetime default rate.

A change in the underwriting criteria by the originator is an example of lack of representativeness of the affected historical cohorts. By analysing the data with the cohort extrapolation, we can assess the impact stemming from such a change and then decide whether we will assign a lower weight or no weight to some vintages in the computation of our base case default rate. An institutional change regarding mortgage regulation could also decrease the relevance of certain cohorts.

Rebasing the cumulative default rate

We may adjust vintage data to capture the effect of seasoning on securitised assets. The loans transferred to the securitisation vehicle may be seasoned and thus not exposed to the **full** lifetime default rate resulting from our historical data analysis. On the other hand, the vintage data usually does not contain information on whether equity really has been built up over time or if the borrowers have refinanced and re-leveraged the loans and, in addition, the vintage data usually does not contain information on whether the borrowers have been paying in time, which is rather included in the loan-by-loan data.

Appendix III – Extrapolating default rates

We may be provided with historical performance information, aggregated across cohorts and seasoning, under the form of realised default rates over a specified horizon. Example of such realized default rates can be found in the originator's Pillar 3 reporting or attached to specific scoring provided by a third party.

We need to transform such marginal default rates, which provide the likelihood of default over a short-term horizon, into a lifetime default rate, to derive our Base Case default rate, as detailed below.

Option 1: Constant marginal default rate

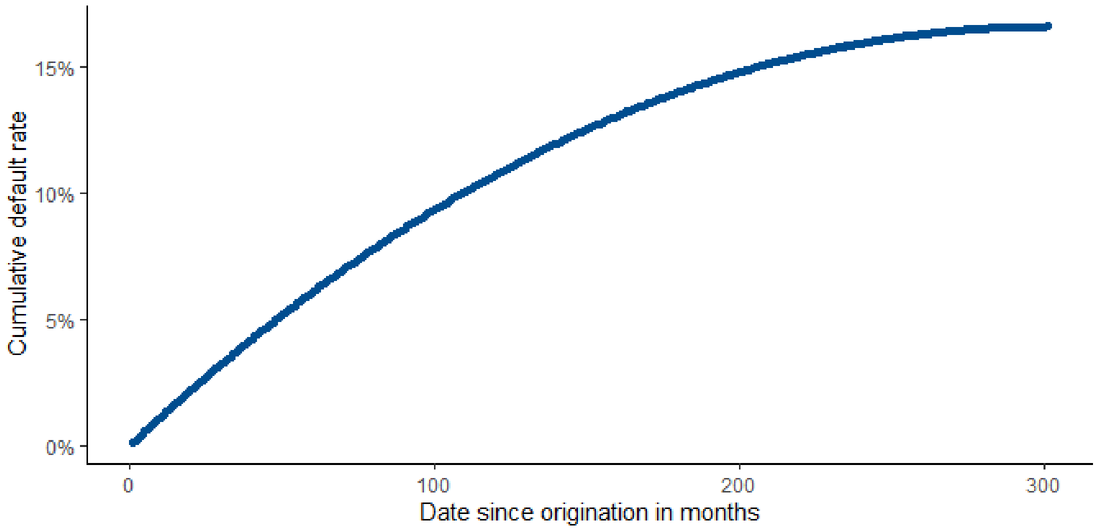
The base case default rate is computed by using a marginal default rate applied recursively to the remaining loan balance of the initial pool considering: (i) scheduled amortisation and (ii) previous defaults, as per the following formula:

$$Lifetime\ Cumulative\ Default\ Rate = \sum_{i=1}^{n} mdp * (1 - mdp)^{i-1} * \ Scheduled\ Remaining\ Balance_{i-1}$$

Where:

- mdp is the default rate over a single period;
- n is the number of periods corresponding to a standard mortgage loan;
- $Scheduled\ Remaining\ Balance_i$ is defined recursively according to the planned amortisation of the mortgage loan.

Figure 7. Example of cumulative default rate computation for French amortising loans



Option 2: Term structure of default rate

The base case default rate is computed by using marginal default rates, depending on the seasoning, applied recursively to the remaining loan balance of the initial pool considering: (i) scheduled amortisation, (ii) previous defaults and (iii) the term structure of default rate, as per the following formula:

$$Lifetime\ Cumulative\ Default\ Rate = \sum_{i=1}^{n} mdp_i * \ Scheduled\ Remaining\ Balance_{i-1} \prod_{k=1}^{i-1}(1 - mdp_k)$$

Where:

- mdp_i is the marginal default rate corresponding to seasoning i;
- n is the number of periods corresponding to a standard mortgage loan;
- $Scheduled\ Remaining\ Balance_i$ is defined recursively according to the planned amortisation of the mortgage loan.

Appendix IV – Recovery rate distribution

Our analysis of a portfolio of mortgage loans is assuming stochastic recovery rates for the defaulted loans. We incorporate within our overall framework a stochastic distribution for the average recovery rate on defaulted loans. The final recovery rate on a specific defaulted loan is exhibiting stochasticity due to either: (i) idiosyncratic risks (the nature of the recovery processes followed, the liquidity of the underlying collateral, etc.) or (ii) systemic risks (pressure on household budgets, rise of unemployment, house price index (HPI) decline).

On granular pools of mortgages, idiosyncratic risks are diluted away whereas systemic risks remain. Such systemic risks are driven by the same determinants as the default rate when in an economic crisis ('tail dependency').

Our proposed approach captures those stylised properties:

- The stochastic distribution of the recovery rate is defined as a beta distribution defined by its mean, being equal to the base case recovery rate and its distressed-quantile[13] defined as the distressed recovery rate;
- There exists full dependency between the recovery rate and the default rate distribution.

Figure 8. Simulated default and recovery rates relationship

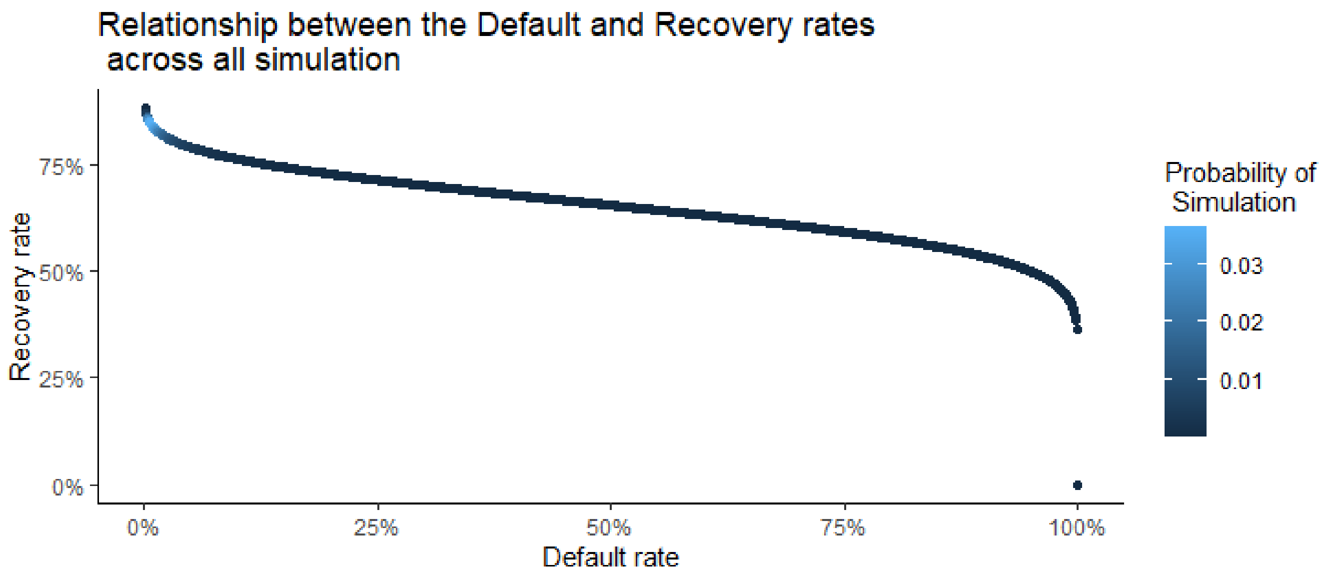


Figure 8 depicts an example of the dependency between default and recovery rates where the negative correlation between the two is evident. The above example assumes: (i) a mean default rate of 3.5% and a distressed default rate of 31% and (ii) a mean recovery rate of 65% and a distressed recovery rate at 39%. Colour is used to represent the probability of occurrence of a specific simulation defined as both (default rate, recovery rate).

[13] The distressed quantile is defined as the recovery rate such that the likelihood of a lower recovery rate is equal to Scope's AAA default probability at ten years.

Appendix V – Country Addendum

To capture accurately the idiosyncrasies of each sovereign jurisdiction regarding its mortgage market, our RMBS Methodology is completed with Country Addendum which provide parametrisation to our overall architecture. We describe here the key building blocks of our parametrisation.

Base case default rate

We define for each country the required set of information needed to define our base case default rate. However, in addition to those specification, we provide the terms and sensitivities of our generic scoring algorithm.

Distressed default rate

This section presents the parameters required to compute the Distressed default rate of a transaction: both the Country specific distressed default rate and the value of the different loan modifiers as presented in section 3.1.1.2. Additional elements pertaining to the mortgage market description (average original LTV and proportion of floating rate mortgage loan) are given here.

Recoveries

To compute the required parameters of the recovery rate distribution, assumptions for both (i) the market value decline for the country and (ii) the Distressed recovery rate haircut are given. In addition, an indicative recovery timing is published.

Prepayment

Annual constant prepayment assumptions are described for our three scenarios of (i) low prepayment, (ii) mid prepayment and (iii) high prepayment speed.

Structural assumptions

Additional parameters relevant for the transaction structural modelling are also published in that dedicated section, like our senior fee assumption.

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