Issue Rating Methodology for

Mortgage Pfandbriefe

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1   Introduction

GBB-Rating Gesellschaft für Bonitätsbeurteilung mbH (hereinafter GBB-Rating) forms its opinion on the probability of default of the issue it is assessing systematically and with due professional care.

An issue rating grades an issue according to certain criteria. To some extent a rating is based on uncertain future events and forecasts, and therefore inevitably relies on estimates. It does not establish facts or constitute a recommendation, but expresses an opinion. In particular, ratings produced by GBB-Rating are not recommendations to purchase, sell or hold on to financial instruments.

The rating methodology applied by GBB-Rating for Mortgage Pfandbriefe (singular: Pfandbrief), which are mortgage or covered bonds governed by the German Pfandbrief Act, essentially seeks to assess an issuer's future ability to meet its financial obligations arising from the Mortgage Pfandbrief fully and timely. In particular, an analysis is performed to establish the extent to which the cash flows from the assets in the cover pool are sufficient to service the financial obligations in case of an insolvency of the issuer. It adopts a holistic approach giving consideration to all available information that is deemed relevant. GBB-Rating arrives at its conclusions on the basis of this rating methodology, which brings together quantitative and qualitative criteria.

GBB-Rating is a rating agency with special expertise in the financial services sector. It was founded in Cologne in 1996 for its present purpose, namely to assess the credit rating of undertakings – primarily those that engage in the financial services segment. Apart from rating financial institutions, building societies and leasing companies, GBB-Rating also undertakes ratings for small and medium-sized enterprises (SMEs) in other sectors.

When applying its rating methodology and conducting the rating process to produce solicited and unsolicited credit ratings, GBB-Rating pays due regard to the Code of Conduct Fundamentals for Credit Rating Agencies of the International Organization of Securities Commissions (IOSCO).

Pursuant to Regulation (EC) No. 1060/2009 of the European Parliament and of the Council, GBB-Rating was registered with the European Securities and Markets Authority (ESMA) in Paris on 28 July, 2011, and since then has been subject to the European supervisory regime for rating agencies.

The rating methodology, code of conduct, and policy on performing and producing issue ratings are freely accessible on the website of GBB-Rating (www.GBB-Rating.eu).

2 Rating process

The purpose of the rating process is to produce an appropriate and reliable assessment of the probability of default, and of the amount of the potential default, of a Mortgage Pfandbrief, by applying consistent methodology. This entails an approach that seeks to ensure objectivity, quality, impartiality, independence and confidentiality.

This rating methodology is based on the analysis of Mortgage Pfandbriefe pursuant to Art. 1 (1) Sentence 2 No. 1 PfandBG (Pfandbrief Act). Analyzing the credit quality of a Mortgage Pfandbrief entails, among other things, an assessment of the resolution regime, legal framework, risk profile, and markets and macroeconomic environment relevant to the Pfandbrief in question. An analysis is also performed to establish whether, and on what conditions, the expected cash flows are sufficient to meet the maturing payment obligations arising from the issue of a Mortgage Pfandbrief (cover pool analysis).

The starting point for a Mortgage Pfandbrief rating is always the issuer rating, which is referred to as the anchor rating.

The documents required when undertaking a rating predominantly consist of records containing information about the structure of the Pfandbrief and the cover pool and other specific information. Key sources of information include the issue prospectus, the final bond features and a detailed extraction of the cover pool. All the available documents and information that are relevant for rating purposes are examined during the rating procedure for currency, completeness and plausibility.

Ratings are continuously monitored by the lead analyst and a second analyst, and updated at least annually. The lead analyst presents the rating result, including all analyses and evaluations, to an independent rating committee, which adopts final decisions on the following matters:

- determination of the rating
- suspension of a rating
- withdrawal of a rating

In compliance with the regulatory requirements concerning disclosure, ratings are published on the website of GBB-Rating.

Ratings are the result of a process consisting of the stages described hereinafter.

2.1   Examination of assignment and preliminary briefing

Before accepting or resuming each assignment, GBB-Rating examines compliance with its rules governing independence, the existence of any potential conflicts of interest or other assignment-related risks, and the availability of sufficient resources to satisfy the particular requirements of the assignment appropriately. In case of doubt, the assignment is rejected or discontinued. Prior information required to assess the complexity of the transactions are collected, for example, in an initial internal pre-analysis.

Provided that this initial pre-analysis does not give any grounds for rejecting the assignment, the rating process, methodology and conditions are explained to the prospective subject. A further examination is then performed.

GBB-Rating does not produce or give any indication of a rating result or produce a provisional rating result.

2.2   Award of assignment and initiation of rating process

After awarding an assignment in writing, the client is presented with a questionnaire and a list indicating the information and documents required for the rating process. In the course of the rating process, additional information and documents can be requested.

All data and evaluations received by GBB-Rating are treated in confidence. In order to ensure compliance with the rigorous confidentiality requirements, GBB-Rating has installed additional organizational safeguards (e.g. access restrictions, Chinese walls) and adopted appropriate regulations.

The rating is performed by the lead analyst, who also serves as the client's primary point of contact. The work undertaken during the rating process is overseen by an independent second analyst.

Potential conflicts of interest are avoided by rotation alongside other measures. The lead analyst and second analyst are assigned to a different client after no more than four and five years respectively. After managing a client's account for a full term, an analyst cannot resume working for the same client until at least two years have elapsed. In order to ensure consistent assessment practice, the lead and second analysts are generally not rotated at the same time.

It is further ensured that neither the lead analyst nor the second analyst was involved in the original issuer or anchor rating process.

Technical suitability, availability and impartiality are the governing factors when rating assignments are being scheduled and allocated.

2.3 Performing the rating

The analysis is performed with the support of IT-based rating models on the basis of a comprehensive set of criteria. Extensive and detailed internal directives, stipulations and policies are observed when analyzing and evaluating the qualitative and quantitative criteria.

The lead analyst analyzes, assesses and evaluates the relevant factors of the Mortgage Pfandbrief on the basis of qualitative and quantitative evaluation criteria and giving consideration to established internal rules and procedures.

The second rating analyst reviews, checks and verifies the lead rating analyst's credit quality assessment on the basis of internal stipulations and procedures of GBB-Rating.

The lead analyst presents the rating result, including all analyses and evaluations, to an independent rating committee, which adopts the final rating decision.

2.4 Publication of the rating result

As a general rule the rating result consists of a rating grade (AAA through D) and a rating outlook ("stable", "positive", "negative", "indeterminate"). It is reported to the client in writing promptly once finally confirmed by the rating committee ("disclosure").

A reasonable delay is to be observed between informing the client and a possible publication and/or announcement of the rating (hereinafter "publication") to subscribers. The client is to be notified of the rating result at least one full working day (within business hours) before publication, so that an opportunity exists for attention to be drawn to factual errors or ambiguities.

In case of a Mortgage Pfandbrief rating, the client determines whether a rating result is to be published. The publication of rating results by the institution (e.g. in press releases) is to be coordinated with GBB-Rating.

If, in the case of a follow-on rating that has already been published on the website of GBB-Rating, consent to publication has neither been granted unequivocally nor revoked, after a reasonable period the updated rating result is additionally labeled "pending communication" in order to indicate that a current rating campaign remains the subject of conferral with the client. Not later than a further ten working days thereafter, a final decision must be made either to publish or to remove the rating on or from the website. The list of ratings is updated accordingly. A rating that is only withdrawn from publication remains valid in relation to the fee-paying client.

Technical access restrictions are not imposed in connection with publication. Neither the client nor interested third parties are charged in connection with publication (no fee, publication or access charge or similar).

2.5   Monitoring and follow-on rating

Once announced, a rating remains valid for twelve months as a general rule. During this period the economic performance of the issuer, its ability to meet its financial obligations, the development of the industry in which it operates, and the performance of the Mortgage Pfandbrief, including provided collateral, in particular are continuously monitored by the analysts. The aim is to ensure that the opinion expressed by the rating remains current. For this purpose the lead analyst maintains contact with the parties involved in the transaction and evaluates, among other things, information and publications that become available during the year. If events or developments take place in this observation period that could have a material impact on the rating assessment of the Mortgage Pfandbrief, the rating is reviewed and, if necessary, revised.

3   Development, approval and review of rating methodology

The quantitative methods section of GBB-Rating, which is independent of the rating section, is responsible for developing and reviewing the rating methods and thus plays a supervisory role. The methods committee is the approval and final decision-making body as regards the implementation and introduction of adjustments and changes to existing methods.

As necessary, but at least once a year, the rating methodologies are subject to a backtesting/validation procedure.

In case of changes to the rating methodology, the affected clients are notified of the proposed changes and their possible effects during a four-week consultation period. The affected ratings are reviewed within six months.

4   Rating methodology for Mortgage Pfandbriefe

The rating is based on an analysis and evaluation of material quantitative and qualitative aspects of the Mortgage Pfandbrief.

The rating result is assigned to one of 22 grades (AAA through D) and supplemented by a rating outlook (cf. 5).

The Mortgage Pfandbrief rating issued by GBB-Rating reflects the probability of a default of the bond in question and, following such a hypothetical default, the expected cash flows to the creditors.

The starting point for a Mortgage Pfandbrief rating is always the issuer rating, which is referred to as the anchor rating. This rating is determined on the basis of our currently applicable rating methodology for banks and building societies.

If no GBB issuer rating exists, an issuer rating issued by another rating agency supervised by ESMA or registered with ESMA may be used as anchor rating with reference to Art. 8 (4) of Regulation (EC) No. 1060/2009 of the European Parliament and of the Council. In addition, the other agency must have proven expertise in the financial services sector. The transfer of issuer ratings of other agencies is based on a mapping procedure.

Mortgage Pfandbriefe are characterized by the dual protection against default they offer to investors. On the one hand, the issuing financial institution is liable for the Mortgage Pfandbrief, and, on the other hand, the creditors are protected against losses in case of the issuer's insolvency by a portfolio of collateral ("double recourse"). In the case of Mortgage Pfandbriefe this collateral or cover pool predominantly consists of mortgages or similar claims secured by a charge on property. From the perspective of GBB-Rating, therefore, a Mortgage Pfandbrief cannot be rated lower than the issuer. Within the rating methodology for Mortgage Pfandbriefe, the anchor rating accordingly represents a rating floor.

In view of the double recourse, the default risk of a Mortgage Pfandbrief is, as a general rule, substantially lower than the risk of an issuer default. For this reason, the rating result determined for a Mortgage Pfandbrief can be significantly higher than the anchor or issuer rating.

From the starting point of the anchor rating, the resolution regime in Germany, the specific legal framework governing the bond, the risk profile, and the markets and macroeconomic environment relevant to the Pfandbrief in question are analyzed. The results of this primarily qualitative analysis are applied to the issuer rating with graduated uplifts; the maximum uplift of the issuer rating is nine notches.

Alongside the qualitative analysis, a quantitative analysis of the cover pool is performed, largely on the basis of a (stressed) cash flow model. This analysis can likewise increment the score represented by the issuer rating by up to nine notches.

The Mortgage Pfandbrief rating is determined upon completion of the full analysis by applying the lower of the qualitative and quantitative uplifts to the anchor rating. In consequence, therefore, the Mortgage Pfandbrief rating can be up to nine notches higher than the issuer rating. In exceptional cases, however, this policy can be disapplied (see 4.5 Additional rating factors).
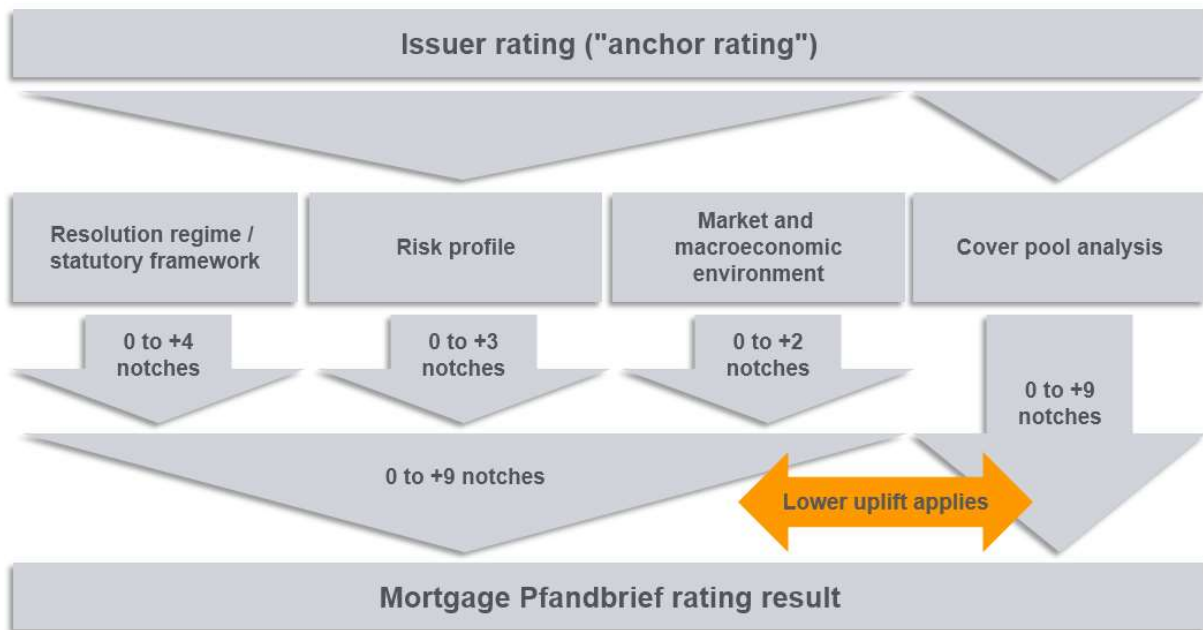
4.1 Resolution regime/statutory framework

In the European Union the Bank Recovery and Resolution Directive (BRRD) establishes a harmonized framework for the recovery and resolution of credit institutions. The BRRD applies a preferential ranking to liabilities, but variances can be provided in the relevant national legislation adopted within the EU. In Germany the BRRD is implemented by the Act on the Recovery and Resolution of Institutions and Financial Groups (SAG). According to BRRD and SAG, German Mortgage Pfandbriefe are excluded from a bail-in as a matter of principle.

From the perspective of GBB-Rating, the BRRD and SAG constitute an unequivocal, transparent and predictable legal framework, so that a progressive **resolution regime** applies in Germany. This evaluation exerts a favorable influence on the assessment of a Mortgage Pfandbrief.

(Mortgage) Pfandbriefe are also subject to the **specific statutory requirements** of the Pfandbrief Act (PfandBG). Given the multiplicity of its statutorily defined minimum standards, we regard PfandBG, from the viewpoint of creditor protection, as a key quality attribute of Mortgage Pfandbriefe. Mortgage Pfandbriefe are, for example, overseen by the Federal Financial Supervisory Authority (BaFin), and a credit institution has to satisfy certain minimum requirements (including as regards both maintaining a minimum capital base and risk management) in order to obtain a license to conduct Pfandbrief business. Another positive factor is the con-

sistency of PfandBG with general insolvency and consumer protection law, and with supervisory regulations such as the Capital Requirements Regulation (CRR). Like the BRRD and SAG, PfandBG is regarded by GBB-Rating as unequivocal, transparent and predictable.

In the case of Mortgage Pfandbriefe, according to PfandBG the cover pool predominantly consists of mortgages or similar claims secured by a charge on property, in respect of which certain geographical restrictions apply. The stipulation of Art. 14 PfandBG, which rules that these loans can be used as cover for only up to 60% of the mortgage lending value, represents a conservative valuation provision and is to be seen in a positive light from the perspective of creditor protection. The principle of prudent valuation is likewise reflected in the provisions of PfandBG governing the assessment of the mortgage lending value (Art. 16), which rule that it must be determined by way of a prudent assessment and cannot exceed the market value. Other assets can be used as cover as well (claims against suitable credit institutions, up to 10%; claims under derivative transactions, up to 12%; public cover assets), whereas the original mortgage cover assets must represent at least 80% of the cover pool.

According to the Pfandbrief Net Present Value Regulation, in order to maintain matching cover the issuer must ensure that the net present value of the Pfandbrief cover assets exceeds the net present value of the liabilities by at least 2%, including in case of a stress scenario. PfandBG further requires that liquidity for the next 180 days is safeguarded at all times.

In the context of this criterion, further analysis is necessary to determine the extent to which the legal principles are capable of averting the default of a Mortgage Pfandbrief in case of the issuer's default, and whether adequate protection is provided for the uninterrupted service of payments due and payable on the issue. GBB-Rating must therefore be satisfied that the cover pool is efficiently managed so as to protect creditors both before, and in particular after, a possible insolvency of the issuer.

PfandBG requires that each issuer appoint a cover pool monitor, who shall ensure that proper cover, as per the regulations, exists for the Mortgage Pfandbriefe, and that the cover assets are recorded in the relevant cover register. This cover pool monitor can be regarded as an independent supervisor because he is not bound to follow any instructions issued by the bank, the national supervisory authority, or the Mortgage Pfandbrief creditors.

The cover pool of a Mortgage Pfandbrief, including the statutory over-collateralization, provides resistance against insolvency; in other words, if the issuer becomes insolvent, the cover assets are excluded from the insolvency proceedings and remain available for satisfying the Pfandbrief creditors' claims. In case of the issuer's insolvency, a cover pool administrator represents the creditors' interests and is responsible for managing the cover pool and servicing the outstanding liabilities.

A maximum possible uplift of the anchor rating by four notches is applied if two conditions are met. First, the bond must be excluded from a bail-in on the basis of an unambiguously and transparently formulated resolution regime. Second, the relevant clearly and unambiguously formulated, specific statutory provisions must satisfy the characteristics expected by GBB-Rating and be capable of averting the default of a Mortgage Pfandbrief in case of the issuer's default, and provide adequate protection for the uninterrupted service of payments due and payable on the issue.

In our view, the rules and laws currently applicable to Mortgage Pfandbriefe in Germany satisfy the forenamed requirements. GBB-Rating is satisfied that the cover pool is efficiently managed so as to protect creditors both before, and in particular after, an insolvency of the issuer. In case of material changes to the underlying resolution regime or specific statutory framework, GBB-Rating promptly monitors the situation and reviews the extent of the uplift applied to the anchor rating.

4.2 Risk profile

PfandBG applies strict outline conditions concerning the structure of the risk management systems adopted by Pfandbrief banks. Regulations governing refinancing and liquidity management, and the structure of the cover pool, apply as well. Evaluating the risk profile entails an assessment of the actual structure, quality and effectiveness of the three forenamed aspects. PfandBG serves as the evaluation benchmark. Key sources of information for evaluating the risk profile include the report on the most recent audit of cover assets and the transparency reports pursuant to Arts. 27 and 28 PfandBG.

The uplift applied to the original issuer rating within the framework of this evaluation criterion depends on the amount of risk associated with the Pfandbrief issue and the extent to which the specific contractual structure and the implemented risk management measures adequately mitigate the risks from the creditors' perspective. If the identified risks are negligible, or the extent of over-collateralization is so great that a liquidity gap can be ruled out and/or risks arising from identified quality defects in the cover pool are minimized, the maximum possible uplift of three notches can be applied.

Risk management

Risk management pertaining to the issuer, and in particular to the cover pool, is a crucial factor from the perspective of creditor protection. Given that risks associated with the Mortgage Pfandbrief business can differ from those associated with the general banking business, PfandBG imposes specific requirements on the management of risk by a Pfandbrief bank. The extensive stipulations of PfandBG concerning (Mortgage) Pfandbriefe are examined above

under "Resolution regime/statutory framework". In the context of this sub-criterion of risk management, the subject of examination is the extent to which the issuer is complying with the stipulations.

The risk management system must ensure that all risks associated with the Pfandbrief business, such as default, interest rate and currency risks, as well as operational and liquidity risks, are appropriately identified, evaluated, managed and monitored. PfandBG requires that any concentration of risk is confined by way of a limit system, and that a suitable effective procedure is adopted for reducing the risk and alerting the relevant decision-makers early in case of elevated risks. In addition, the risk management system must be revised promptly in response to changing circumstances, and be reviewed at least annually. Finally, the risk management system must be documented in a lucid manner, and a risk report must be presented to the board of directors at least quarterly.

Refinancing and liquidity management

From the perspective of GBB-Rating, the instruments for managing both refinancing and liquidity are especially significant. In this context as well, PfandBG establishes standards for matching cover and the minimum cover requirements outlined above. In addition, every Pfandbrief bank must keep a refinancing register and a cover register complying with the relevant regulation or order.

In the case of Pfandbriefe, liquidity risks can arise in particular in the form of refinancing gaps. A refinancing risk exists above all when the maturities of the cover assets do not coincide with those of the outstanding Mortgage Pfandbriefe. Refinancing risks can also arise from interest rate and currency differences. If, for example, the receivables in the cover pool (predominantly) have variable interest rates and the coupons of the Mortgage Pfandbriefe are fixed, there is a danger in case of an interest rate downturn that the interest income generated by the cover pool is no longer sufficient to cover the coupon payments due to the Pfandbrief creditors. The stipulations of PfandBG concerning the calculation of cover at net present value (giving consideration to stress scenarios) serve the purpose of avoiding/minimizing these risks.

On the other hand, PfandBG currently rules out a postponement of redemption for Pfandbriefe ("hard-bullet structure"). Unlike some other covered bond types, therefore, the redemption date cannot be deferred in order to reduce potential liquidity risks ("soft-bullet structure").

Notwithstanding the statutory safeguarding measures, liquidity risks cannot be ruled out, especially in case of extreme market scenarios. From the creditors' perspective, a risk of a portion of the cover assets having to be sold in an unfavorable market can arise in a crisis situation in which the issuer is unable to procure liquidity from the financial/capital market. The greater the

over-collateralization or maintained liquidity buffer, the lower the probability of the creditors' claims not being serviceable because of a liquidity squeeze.

In addition, the analysis of liquidity management focuses in particular on a comparison of maturity structures, of the cover pool on the one hand, and of the Mortgage Pfandbriefe on the other. The more similar the maturity structures, the lower the underlying liquidity risks as a general rule. Another factor giving rise to a positive assessment is a concurring interest rate/coupon structure (fixed or variable) for the cover pool and the Pfandbriefe. In addition, the amount of assets denominated in foreign currency is to be determined in order to establish the extent of possible currency risks. In this context it is to be examined whether corresponding hedging instruments exist.

An overview of the maturity structure of the outstanding Pfandbriefe, the proportion of fixed-interest cover assets, and the foreign currency items in the cover pool is to be obtained by consulting the transparency reports that are to be published quarterly as per Art. 28 PfandBG. Further detailed analyses are facilitated by internal assessments of the cover pool as prepared by the quantitative methods unit.

Risk structure of cover pool

Among the core constituents of this assessment criterion is a qualitative and descriptive analysis of the cover pool, and of the risks associated with a Pfandbrief investment from the creditor's perspective (in particular the counterparty risks).

The amount of over-collateralization is also to be examined. From the perspective of creditor protection, high over-collateralization (beyond the legally binding stipulations of PfandBG) can also compensate for any weaknesses in the cover pool identified by the structural analysis of same.

In relation to the resistance against insolvency afforded by this "voluntary" over-collateralization, it is to be noted that the insolvency administrator can insist pursuant to Art. 30 (4) PfandBG that assets which are "obviously not required" for satisfying the Pfandbrief creditors be surrendered to the insolvency estate. On the other hand, the burden of demonstration and proof indicating that the voluntary over-collateralization is not required to cover future risks arising from all outstanding Pfandbriefe, for the duration of all maturities, rests with the insolvency administrator.

An initial overview of the cover pool is provided by the transparency reports that are to be published quarterly according to Art. 28 PfandBG, which among other things indicate the volume of the other cover assets, the states in which the cover assets are located, the total amount of payments in arrears for at least 90 days, and a distribution by size of the amounts

provided as cover. More detailed and far-reaching analyses are facilitated by internal assessments of the cover pool as prepared by the quantitative methods unit.

This unit initially performs a descriptive analysis of the cover pool data and previews the cash flow and liquidity situation over the coming years against the backdrop of a normal scenario. The descriptions and results are forwarded to the analysts for evaluation. The analysts also have the opportunity to ask for further data analyses.

On the basis of all this information, the credit quality of the debtors has to be analyzed (e.g. by way of external ratings, distribution according to the banks' internal risk categories, assessment of historical and/or current default rates of the loan portfolio). Within the framework of this evaluation, the extent to which concentrations of risk exist (size and sector-related concentrations, concentration on certain property types, country risks) within the cover pool is also examined. A granular cover pool without any noteworthy concentration risks is to be assessed more favorably than a cover pool containing risk clusters. The proportion of other cover assets (claims against public sector bodies, central banks or suitable credit institutions, derivative hedging instruments) must be analyzed as well.

When evaluating the cover pool, the analyst is assisted by a series of indicators, including the debt service coverage ratio (DSCR) and loan-to-value ratio (LTVR).

4.3   The market and macroeconomic environment

Disregarding the resolution regime, this criterion assesses the probability of public sector or other market actors providing support in case of the issuer suffering economic distress.

In view of its history in the market, the German Mortgage Pfandbrief is a highly significant refinancing instrument. It has proven resilient even in times of crisis and attracts a customer base that has grown over time. In addition, the good functional capabilities of the German money and capital markets are generally acknowledged. The Association of German Pfandbrief Banks (vdp) is an engaged domestic interest group that proactively monitors market developments, underpins confidence in the Pfandbrief market, and influences the regulatory and statutory framework in the interests of the market participants. From an overall perspective there is systemic depth to the market and, as a matter of principle, sovereign support measures are highly likely to be adopted if necessary. Recent examples of non-governmental rescue/support measures, for fairly small issuers of Mortgage Pfandbriefe lacking systemic importance, highlight the systemic significance of (Mortgage) Pfandbriefe and the willingness of relevant market actors to provide assistance for the good of the (Mortgage) Pfandbrief market. A typical trigger for sovereign intervention would be the threat of a fire sale – the disposal of

the underlying assets – or other situations that could give rise to a liquidity squeeze on the markets.

An assessment is also undertaken to establish the extent to which the German state, based on current macroeconomic conditions, would be able to intervene in case of a crisis. Country ratings are a key source of information in this context. As regards the German Mortgage Pfandbrief market, the German state currently has the highest possible credit quality ratings.

In our estimation, the cover assets primarily used for Mortgage Pfandbriefe, namely loans secured by charges on property, such as mortgages and other security interests in real property, play a significant role in the financial and banking sector. As a general rule, therefore, support measures are to be deemed highly likely.

In consequence, the analysis performed in the context of this criterion can prompt a maximum possible uplift of the original issuer rating by two notches. In the view of GBB-Rating, the characteristics of the German Mortgage Pfandbrief market fundamentally warrant the award of the maximum possible uplift. The market and the macroeconomic outline conditions are the subject of continuous monitoring, moreover, so that the uplift can be adjusted at any time if necessary.

4.4 Cover pool analysis

4.4.1 Data requirements

A detailed quantitative analysis of the cover pool relies on knowledge of the payment particulars of the Pfandbriefe (coupon, volume, maturities etc.), and in particular of all the available cover pool data (approved loan, residual value, assignment to cover pool (nominal/present value) term start date, due date, interest rate, type of loan etc.). As a general rule, the key information on the mortgage loans is to be provided by the issuer in a format that facilitates further data processing. Apart from examining the data quality (completeness; extent to which a worksheet or file is filled with data; formats etc.) and, if necessary, requesting additional information/data, the analysis entails data editing, processing and modeling.

The information required for the subsequent stress testing of the cover pool includes the mortgage lending value and market value of the individual properties, and the probability of default and (internal) risk classification of the borrowers. In addition, further cover pool-specific information on the properties (property type, location, date of calculation of the Beleihungswert, purchase price, prior charges, type of use, tenant information, rental income, operating costs, etc.) is included in the stress tests.

If the cover pool contains derivatives alongside mortgage loans, their performance is modeled by applying stochastic methods, based on the current market situation. In consequence, the models outlined below are augmented by this variable and thus become more complex.

4.4.2 Fundamental model assumptions

According to the law of total probability, the probability of a default A can be expressed as

$$P(A) = P(A|E) \cdot P(E) + P(A|\bar{E}) \cdot P(\bar{E}),$$

where E is the event of the issuer's default, and $\bar{E}$ is the complementary event (the issuer does not default). Probability $P(E)$ is the probability of default determined by way of the issuer rating. We assume that a default of the cover pool is impossible, provided that the issuer does not default, because the issuer can take action in order to provide the necessary liquidity. It accordingly follows that

$$P(A) = P(A|E) \cdot P(E).$$

The probability of default of the cover pool therefore depends on the probability of default of the issuer, and on the conditional probability of a default on the condition that the issuer has already defaulted. From this point we presume a static cover pool because no further new business can be generated.

The purpose of the quantitative analyses is to estimate the conditional probability $P(A|E)$. For this reason they are always performed on the assumption that the issuer has already defaulted.

Let T be the date of final maturity of all loans and Pfandbriefe, t_0 be the current date, N_D be the number of loan agreements, n_i be the term of the loan i, $A_t^{(i)}$ be the incoming payment arising from the agreement i in period (month) t, and $t = t_0, t_0 + 1, \dots, n_i, i = 1, 2, \dots, N_D$. Where $n_i < T$, in order to simplify the formulas, the sequence of payments can be continued with the value 0 to T. Likewise, the payments arising from loans with non-monthly payments can be depicted as monthly payments by inserting the value 0. Excluding derivatives, the cash flow to the cover pool in period $t \in [t_0, T] \cap \text{IN}$ is $\sum_{i=1}^{N_D} A_t^{(i)}$. In this connection, $A_t^{(i)}$ are interpreted as random variables representing the amounts actually paid by the borrowers. In case of a defaulting customer, the due amount is paid only partially or not at all.

On the basis of the cover pool, let N_P Pfandbriefe have been issued. For Pfandbrief j, payment $B_t^{(j)}$ is made in period (month) t. In total, therefore, in a period $t \in [t_0, T] \cap \text{IN}$, payments $\sum_{j=1}^{N_P} B_t^{(j)}$ are due, which in each case can include premature repayments as well.

A cover pool default is now deemed to have occurred if, in at least one future month in the period to T, the incoming payments are not sufficient to service the payment obligations arising

from the Pfandbriefe, or the over-collateralization required by law is not maintained. Modeling this second case calls for a net present value approach, which is explained further in section 4.4.4. The variables $A_t^{(i)}$ and $B_t^{(j)}$ are calculated as explained in the section below.

4.4.3 Cash flow modeling

The cash flow consists of the incoming payments from the loan agreements belonging to the cover pool, the payments to be made by the institution to the bond holders, incoming and outgoing payments in respect of derivatives (if applicable) and other cover assets (securities, claims against credit institutions). If the cover pool contains derivatives as well, their performance is modeled by applying stochastic methods, based on the current market situation. In consequence, the models outlined below are augmented by this variable and become more complex.

Modeling interest payments and principal repayments arising from loan agreements

For each client and agreement, the residual debt and remaining payments (including interest) at the time of the rating are calculated on the basis of the available information. Let the variables be as follows:

K_0: Loan amount

Z_t: Interest payment in period t

T_t: Repayment of principal in period t

a_t: Debt service for period t

z_t: Interest rate (in period t)

n: Term

The following equation holds:

$$a_t = Z_t + T_t.$$

As a general rule, therefore, the payables consist of principal repayments and interest payments. The residual debt K_t at the end of period t increases in the amount of the interest payable and decreases in the amount of debt service, therefore

$$K_t = (1 + z_t) \cdot K_{t-1} - a_t = K_{t-1} - T_t.$$

At the end of the term, the loan has been completely repaid, therefore

$$T_1 + \cdots + T_n = K_0.$$

For modeling purposes a distinction is made between three types of repayment. The applicable type is determined by consulting the loan particulars:

- Repayment by annuities
- End-of-term repayment
- Repayment by installments

A further distinction is made between fixed and variable interest rates. The payment frequency is another factor that is to be given consideration.

Repayment by annuities with fixed interest rate

In each period a fixed amount $a_t = a$ is paid, where $z_t = z$ constant. From the generally applicable relations, $q = 1 + z$ gives rise to the formulas

$$T_1 = K_0 \frac{q - 1}{q^n - 1}, T_t = T_1 q^{t-1}, t = 2, \dots, n,$$

$$Z_t = K_0 z - T_1(q^{t-1} - 1), t = 1, 2, \dots, n,$$

$$K_t = K_0 \left(1 - \frac{q^t - 1}{q^n - 1} \right), t = 1, 2, \dots, n,$$

$$a = K_0 q^n \frac{q - 1}{q^n - 1}.$$

Since the cited interest rate is generally the annual rate, it has to be adjusted to match the relevant payment frequency. In case of monthly payments, the interest rate is $\frac{z}{12}$, and in case of quarterly payments it is $\frac{z}{4}$. Quarterly payments are transformed into monthly values by inserting 0. In the absence of a maturity date, the formula

$$-\frac{\ln \left(1 - K_0 \cdot \frac{z}{m \cdot a} \right)}{\ln \left(1 + \frac{z}{m} \right)}$$

can be applied to calculate a hypothetical term, provided that $1 - K_0 \cdot \frac{z}{m \cdot a} > 0$. Here, m has the value 12 in case of monthly payments, and 4 in case of quarterly payments.

End-of-term repayment with fixed interest rate

In the case of end-of-term repayment with a fixed interest rate, only interest is paid at the agreed frequency during the term of the loan agreement. The interest payments are $Z_t = K_0 \cdot \frac{z}{12}$ in case of monthly installments and $Z_t = K_0 \cdot \frac{z}{4}$ in case of quarterly installments. The loan principal is repaid in full as a lump sum upon the ending of the agreement.

Repayment by installments with fixed interest rate

In each period a fixed amount of the principal $T_t = \frac{K_0}{n}$ is repaid, with $z_t = z$ constant. The annuity is calculated thus:

$$a_t = \frac{K_0}{n}\left(1 + (n - t + 1) \cdot z\right).$$

Variable interest rates

Different formulas apply for variable interest rates since the interest rates for different payment periods can no longer be aggregated because of the time dependency. Interest rate curves are used in order to forecast future interest rates.

Modeling coupon and redemption payments arising from bonds

The coupon and redemption payments to the bond holders are calculated by consulting the bond particulars. For calculation purposes, redemption upon maturity, an annual coupon payment and a fixed coupon are presumed. On each payment date, coupon payments for a bond tranche are therefore due in the amount of $V \cdot z$, where V is the volume and z is the agreed coupon. In the month when the bond matures, the volume (aggregated principals) is redeemable as well.

4.4.4 Nominal and net present values and definition of default

Assuming the issuer's insolvency, it is to be examined whether the cover pool is sufficient, with the generation of new business now being impossible, for the satisfaction of all payment obligations. For this purpose, the problem is investigated from both a nominal value and a net present value (NPV) perspective.

On a monthly basis, the sum of all payments received from borrowers is measured against the sum of all payments to be made to bond holders in the same month. This practice reflects a nominal value approach. A default occurs if, by the final payment date of a month, the income from loans is not sufficient to cover the contractually agreed outgoing payments. Adopting the notations from section 2, a default occurs therefore if there is a month $t \in [t_0, T] \cap \text{IN}$ for which the inequality

$$\sum_{i=1}^{N_D} \sum_{s=t_0}^{t} A_s^{(i)} < \sum_{j=1}^{N_P} \sum_{s=t_0}^{t} B_s^{(j)}$$

holds. This formula already takes into account that the amount by which income exceeds expenditure can be carried forward as a reserve to subsequent months.

The incoming and outgoing payments are also assessed from a net present value perspective. For this purpose, the payments D_t expected to occur in month t are discounted back to their present value by applying the formula

$$V_{t_0,t} = \frac{D_t}{(1+q_t)^{t-t_0}}.$$

In this context q_t is the interest rate calculated from the yield curve at the time point t. The sum of all present values of a loan agreement i at the point in time t_0 is therefore

$$\sum_{t=t_0}^{n_i} \frac{A_t^{(i)}}{(1+q_t)^{t-t_0}}.$$

A similar procedure is applied for the coupon and redemption payments to the bond holders. The over-collateralization in the amount of 2% prescribed by law does not exist if

$$\sum_{i=1}^{N_D} \sum_{t=t_0}^{T} \frac{A_t^{(i)}}{(1+q_t)^{t-t_0}} < 1{,}02 \cdot \sum_{j=1}^{N_P} \sum_{t=t_0}^{T} \frac{B_t^{(j)}}{(1+q_t)^{t-t_0}},$$

so that in this case as well, the cover pool is deemed to have defaulted. From an overall perspective, therefore, the default event A can be expressed as

$$\bigcup_{t=t_0}^{T} \left\{ \sum_{i=1}^{N_D} \sum_{s=t_0}^{t} A_s^{(i)} < \sum_{j=1}^{N_P} \sum_{s=t_0}^{t} B_s^{(j)} \right\} \cup \left\{ \sum_{i=1}^{N_D} \sum_{t=t_0}^{T} \frac{A_t^{(i)}}{(1+q_t)^{t-t_0}} < 1{,}02 \cdot \sum_{j=1}^{N_P} \sum_{t=t_0}^{T} \frac{B_t^{(j)}}{(1+q_t)^{t-t_0}} \right\}.$$

In the analyses that follow, it is examined separately in each case whether the nominal value or NPV element of the default definition applies.

4.4.5 Stress test modeling

In order to estimate the expected over- or under-collateralization and the risk of incomplete commitment servicing, diverse bank- and Pfandbrief-specific stress test scenarios are examined in the cash flow model. In general, the cover pool of a mortgage Pfandbrief is effected by credit risks, market price risks and operational risks, which may result in liquidity and refinancing mismatches. For example, we define credit risks as the default or non-payment of a percentage of borrowers. Market price risks mainly arise from the scenario of a change in the yield curve or from exchange rate risks. For example, we define operational risks as the risk of delays in the liquidation of loan agreements.

For each scenario, various degrees of severity are defined and examined. In addition to the undisturbed situation (base scenario S0), nine further scenarios are determined in ascending order of severity up to a worst-case scenario (S9). For this purpose, the worst-case scenario

(S9) is first determined on the basis of technical considerations. The remaining severity levels S1 to S8 are determined by downgrading the maximum disturbance.

Once the stress scenarios to be investigated and the severities S0 through S9 have been defined, these are examined in the light of the default definition described in section 4.

4.4.6   Quantitative estimation

On the basis of the results it is possible to state, for each scenario, the greatest severity at which the scenario is still deemed to have been passed. If, for one scenario for example, severities S0 through S5 are deemed to have been satisfied and severities S6 through S9 are deemed to have been not satisfied, severity S5 would be identified as the applicable score. In order to facilitate an aggregation of the individual results, the highest severities satisfied are translated into numerical values, such as 0 through 9. An estimation is finally made by choosing the minimum of the achieved numerical values.

Furthermore, the results of the NPV stress test, giving consideration to the original anchor rating, allow conclusions to be drawn about the amount of over-collateralization required in order to achieve the desired uplift or desired target rating. For this purpose, a factor is determined for each stress scenario and for each severity level by which the cover pool must be modified to ensure that the corresponding severity levels are deemed to have been satisfied. This factor is then used to calculate the required over-collateralization.

Each stress scenario can be assigned to either credit risk, market price risk or operational risk. Taking into account a minimum of 2%, the highest coverage requirement per stress scenario and severity level determines the required coverage for the respective superordinate risk type. The addition of the three individual overcollateralization requirements results in the overcollateralization required to achieve the desired uplift or target rating.

All the results of the quantitative analyses are presented to the analyst for further evaluation.

In consequence, within the framework of assessing the criterion "cover pool analysis", the original issuer rating can be uplifted by a maximum of nine notches.

4.5 Additional rating factors

The rating of a Mortgage Pfandbrief can be affected by further factors, circumstances or events. Requirements and measures imposed by competent supervisory authorities, government agencies, or multinational or supranational authorities and organizations, for example, can make an adjustment of the rating necessary.

The existence of such factors, circumstances or events could have the effect of increasing or decreasing the risk associated with the Pfandbrief. If the incorporation of such factors in an individual rating gives rise to an imprecise representation of detail, a deviation from the original rationale governing uplifts and notch-downs can be contemplated.

In addition, appropriately high over-collateralization can, if necessary, stabilize the Mortgage Pfandbrief to the extent that the maximum rating of AAA is achievable in principle even if the issuer rating is below investment grade.

If the analyst, giving consideration to the outcomes arising from the qualitative and quantitative assessment criteria, ultimately concludes that creditor protection can be ranked so highly, even in a stress scenario, in view of the statutory provisions and stipulations, the quality and amount of the cover pool, and/or the available liquidity buffer in the case of the issuer's insolvency, that the probability of default of the issue does not depend on the credit quality of the issuer, then an uplift can be contemplated that exceeds the defined maximum uplift of nine notches.

5   Presentation of rating result

The rating result consists of the rating, expressed as a combination of letters, a descriptive definition, and a rating outlook.

5.1   Rating scale and rating

The analysts consolidate the findings from the analysis of the qualitative and quantitative assessment criteria in a rating proposal complying with the internationally recognized notation (22 ratings from AAA through D). The rating scale of GBB-Rating is illustrated below:

Rating	Rating Category
AAA	Highest credit quality of financial instruments, strongest capacity for coupon and redemption payments/exceptional ability to pay liabilities
AA+ AA AA–	Very high credit quality, very strong to strong capacity for coupon and redemption payments
A+ A A–	High credit quality, strong capacity for coupon and redemption payments, possible vulnerability to adverse business or economic conditions/developments
BBB+ BBB BBB–	Good credit quality, vulnerability to adverse business or economic conditions/developments
BB+ BB BB–	Speculative credit quality, very moderate coverage of coupon and redemption commitments
B+ B B–	Highly speculative credit quality, coupon and redemption commitments lack long-term security
CCC+ CCC CCC–	Poor protection for investors, indications of default
CC C	Acute danger of default, lack of investor protection, highly speculative
D	Insolvency/default

5.2 Rating outlook

The rating outlook – positive, stable, negative, indeterminate – serves as an early indicator of the direction in which a rating is likely to change within the next 12 to 24 months. Insofar as it projects the anticipated development over the forthcoming 24-month period on the basis of the available information, the rating outlook goes beyond the 12-month assessment furnished by the rating itself.

Forecast expressed by the rating outlook:

- Stable   No indications of a possible change in the rating – only a low probability that the rating will change.
- Positive   Indications exist that the rating may improve – the probability of the rating improving is higher than the probability of it remaining unchanged or deteriorating. The rating is placed on watch.
- Negative   Indications exist that the rating may deteriorate – the probability of the rating deteriorating is higher than the probability of it remaining unchanged or improving. The rating is placed on watch.
- Indeterminate   Indications exist that the rating may change, but the effect/magnitude and direction of such a change cannot be reliably estimated at present. The rating is placed on elevated watch.

5.3 Rating-sensitive factors

Among other things, the descriptive definition of the rating outlines key rating-sensitive factors and drivers that could positively or negatively influence the rating result in the medium term. For this purpose, the material issues and criteria governing the rating result, and therefore the result's sensitivity to same, are examined by analyzing and describing the drivers.