# “Basel II implementation - retail credit risk mitigation”


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# Basel II implementation – retail credit risk mitigation

## Abstract

The main objective of this paper is to introduce Credit Risk Mitigation (CRM) as the methodology for the recognition of collateral for retail lending which is Basel II complaint. CRM is the technique that reduces the credit risk associated with an exposure or exposures which the credit institution continues to hold. CRM can be applied in both possible approaches that Basel II offers for the retail segment: the standardized approach and the Internal Ratings-Based (IRB) approach. The standardized approach is relatively easy to apply and it defines standard risk weights, whereas the IRB approach requires internal estimates of risk components in determining the capital requirement for a given exposure. The risk components include measures of the probability of default (PD), loss given default (LGD) and the exposure at default (EAD) and serve as inputs to the risk weight functions that have been developed for separate asset classes.

**Keywords:** Basel II, Credit Risk Mitigation, standardized approach, internal ratings-based approach.
**JEL Classification:** G18, G32.

## Introduction

In June 2004, the Basel Committee on Banking Supervision issued a revised framework on International Convergence of Capital Measurement and Capital Standards (hereafter "Basel II" or the "revised Framework"). When following the "internal ratings-based" (IRB) approach to Basel II, banking institutions will be allowed to use their own internal measures for key drivers of credit risk as primary inputs to their minimum regulatory capital calculation subject to meeting certain conditions and to explicit supervisory approval. In light of the need under Basel II for banks and their supervisors to assess the soundness and appropriateness of internal credit risk measurement and management systems, the development of methodologies for validating external and internal rating systems is clearly an important issue. More specifically, there is a need to develop means for validating the systems used to generate the parameters (such as PD, LGD, EAD and the underlying risk ratings) that serve as inputs to the IRB approach to credit risk. In this context, validation comprises a range of approaches and tools used to assess the soundness of these elements of IRB systems. In anticipation of the need for more knowledge regarding validation methodologies, in 2002, the Research Task Force (RTF) formed a subgroup (the Validation Group) to review and develop research on the validation of rating systems that would be useful to banks and supervisors as they consider options for implementing Basel II. The work of the Validation Group collected in this volume of studies addresses a number of topics on rating system validation, with a particular focus on empirical validation methods. The Validation Group consists of representatives from eleven countries. The main objectives of the project have been:

- to classify rating systems and their dynamic properties, and to develop a common terminology for validation purposes;
- to review validation methodologies that are currently applied in bank practice; and
- to analyze validation methodologies for the three key risk components: probability of default (PD), loss given default (LGD) and exposure at default (EAD) from a theoretical perspective.

Although validation is foremost the responsibility of banks, both bank risk managers and bank supervisors need to develop a thorough understanding of validation methods. Supervisors will need to review banks' validation processes and may also need to employ validation methods in evaluating whether banks' rating systems comply with the operating standards set forth by Basel II. Some validation methods, such as benchmarking risk parameters across banks, may be more practical for supervisors to implement than for banks to implement. The focus of the research in this paper has been on validation methods in general, without regard to whether those methods are implemented by banks or their supervisors.

## 1. Credit Risk Mitigation

Credit Risk Mitigation (CRM) is "a technique used by a credit institution to reduce the credit risk associated with an exposure or exposures which the credit institution continues to hold"[1]. A collateralized transaction is a transaction where the credit exposure or potential credit exposure of the credit institution to a counterparty is hedged – in whole or in part – by collateral posted by the counterparty or by a third party on behalf of the counterparty. Collateralized credit exposures must have a risk-weighted exposure amount lower than the same credit exposure without credit protection[2].

[1] EU Directive 2006/48/EC, Article 4 (30).
[2] EU Directive 2006/48/EC, Article 93 (2).

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It must be differentiated between two types of CRM techniques:

- Under "funded credit protection" (e.g., real estate, financial instruments) is to be understood a CRM technique where the reduction of the credit risk exposure of a credit institution derives from the right of the credit institution in case of default to[1]:

  a) liquidate or retain, at least for a certain period of time, certain assets or amounts;
  b) obtain transfer or appropriation of certain assets or amounts;
  c) retain certain assets or amounts;
  d) reduce the amount of the exposure that has defaulted through the realization of the collateral. The claim of the institution on the whole exposure is then reduced to the difference between the total amount of the exposure and the claim of the institution that was covered by the realization of the collateral;
  e) replace the amount of the exposure that has defaulted through the realization of the collateral. The new exposure of the debtor to the credit institution is the difference between the amount of the former exposure and the amount of the collateral. Due to this replacement of the former exposure of the client by the new one, the credit institution can consider the new account as a re-structured one with losses on irrecoverable debts.

- "Unfunded credit protection" (such as guarantee) is a CRM technique where the reduction of the credit risk exposure of a credit institution derives from the undertaking of a third party to pay an amount in the event of a default of the borrower or on the occurrence of other specified events[2].

According to the EU Directive, credit institutions using the standardized approach or the IRB approach with supervisory loss parameters are allowed to recognize CRM for the calculation of risk-weighted exposures as described under Annex VIII[3]. However, for credit institutions under the IRB approach, this is only valid if they are not using their own estimates of LGD and of CCF to obtain CRM effects[4]. For credit institutions using their own estimates of LGD and of CCF (Advanced IRB for retail exposures), the eligibility criteria and minimum recognition requirements set under the Annex VIII of the European Directive 2006/48/EC are applicable, the calculation of CRM effects on RWA will take place according to Annex VII of the aforesaid Directive.

Table 1. Overview of the main differences between standardized and IRB approaches[5]

| Basel II approach | Standardized approach | | | Anvanced IRB approach | | |
|---|---|---|---|---|---|---|
| | Eligibility | Valuation frequency | Risk-weight of the collateralized part | Eligibility | Valuation frequency | CRM effects on |
| *Category of collaterals* | | | | | | |
| *Physical collaterals:* 1) Residential real estate (private house, flat, residential land, other) | yes | Every three years | 35% | yes | Every three years | LGD |
| 2) Commercial real estate (business property, warehouse, industrial land, other) | yes | Once a year | 50% | yes | Once a year | LGD |
| 3) Other physical collaterals (truck, ship, van, equipment, etc.) | no | | | yes | Once a year | LGD |
| *Life insurance policies* | yes | Every six months | Risk-weight of the insurance company | yes | Every six months | LGD |
| *Cash:* Cash (debtor's exposure and collateral are labeled in the same currency) | yes | Every six months | 0% | yes | Every six months | LGD |
| Cash (debtor's exposure and collateral are labeled in the different currencies) | yes | Every six months | 20% | yes | Every six months | LGD |
| *Gold* | yes | Every six months | 0% | yes | Every six months | LGD |
| *Equities:* 1) Equities traded on a main index (ordinary shares or preference shares) | yes | Every six months | >20% | yes | Every six months | LGD |

[1] EU Directive 2006/48/EC, Article 4 (31). Points d) and e) mean that the credit institution can minder its losses to the difference between the exposure and the value of the collateral when it realizes (e.g., sells) the collateral.
[2] EU Directive 2006/48/EC, Article 4 (32) and EU Directive 2006/48/EC, Article 92 (4).
[3] This concerns only non-retail exposures that are treated under the Foundation IRB Approach. For retail exposures, the Advanced IRB approach must be used and there is no possibility to use supervisory loss parameters under the IRB approach. Credit institutions have to make their own estimates of loss parameters for retail exposures.
[4] EU Directive 2006/48/EC, Article 91.
[5] EU Directive 2006/48/EC, Annex VI, VII, VIII.

Table 2 (cont.). Overview of the main differences between standardized and IRB approaches

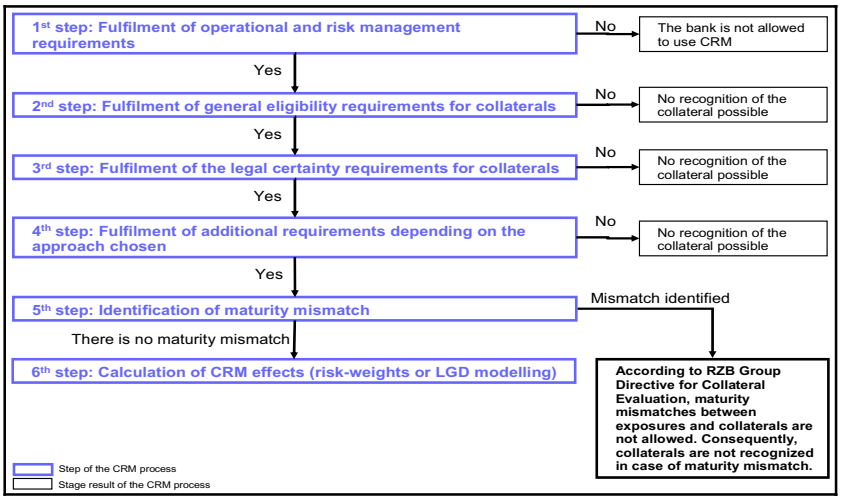
| | | | | | | |
|---|---|---|---|---|---|---|
| 2) Equities not included in a main index but traded on a recognized exchange | no | | | yes | Every six months | LGD |
| *Debt securities* | yes | Every six months | Risk-weight depending on the issuers (>20%) | yes | Every six months | LGD |
| *Leased properties*<br>1) Residential real estate | yes | Every three years | 35% | yes | Every six month | LGD |
| 2) Commercial real estate | yes | Once a year | 50% | yes | Every three years | LGD |
| 3) Other physical collaterals | no | | | yes | Once a year | LGD |
| *Guarantee provided by:*<br>1) central government and central banks | yes | | Risk-weight of the guarantor | yes | Once a year | LGD |
| 2) regional government and local authorities | yes | | Risk-weight of the guarantor | yes | | LGD |
| 3) multilateral development banks | yes | | Risk-weight of the guarantor | yes | | LGD |
| 4) international organizations with a 0% risk-weight under the standardized approach | yes | | Risk-weight of the guarantor | yes | | LGD |
| 5) PSE | yes | | Risk-weight of the guarantor | yes | | LGD |
| 6) institutions | yes | | Risk-weight of the guarantor | yes | | LGD |
| 7) other corporates entities | yes | | Risk-weight of the guarantor | yes | | LGD |
| 8) insurance undertakings | yes | | Risk-weight of the guarantor | yes | | LGD |
| 9) reinsurance undertakings | yes | | Risk-weight of the guarantor | yes | | LGD |
| 10) export credit agencies | yes | | Risk-weight of the guarantor | yes | | LGD |

Source: internal sources.

**1.1. General requirements for Credit Risk Mitigation.** CRM may be recognized by supervisors as long as the techniques or collaterals used are eligible. The eligibility of the collaterals used in the context of CRM techniques depends on the approach used under Basel II to calculate the risk-weighted exposures (standardized approach or IRB approach)[1]. In addition, under the standardized approach, the bank has the possibility to choose between two methods to valuate its financial collaterals. Consequently, it must be further differentiated between the Financial Collateral Simple Method and the Financial Collateral Comprehensive Method regarding financial collaterals.

The following table presents an overview of main differences between the standardized approach and the IRB approach concerning eligibility, valuation frequency and risk-weights used.

In order to determine if the collaterals can be recognized for credit protection in the bank, following steps must be realized:




Source: internal sources.

**Fig. 1. Steps for calculation of the CRM effects**

[1] EU Directive 2006/48/EC, Annex VIII, Part 1, point 6.

*1st step: Fulfilment of operational and risk management requirements*

In order to be allowed to use CRM techniques, each unit bank must be able to prove to competent authorities that it has adequate risk management processes to control the risks it is exposed to in the collateralized transaction[1]. This includes that:

1) each unit of the bank possesses efficient procedures for the eligibility determination and recognition of collaterals under the approach chosen;
2) each unit of the bank must regularly check the effectiveness of the credit protection and assess all risks related to the collateralized transaction. This includes, for example:
   – a regular check (e.g., once a year) that there is a market for the collaterals in order to receive the proper value of the collateral;
   – a regular check of the actual state and conditions of the collateral if it is a real estate property since the value can be influenced by new construction.

Consequently, processes assessing the CRM must be included in the credit risk management processes of the bank, i.e. each unit of the bank must have defined and documented procedures concerning valuation methods and valuation frequency of each type of collateral[2].

*2nd step: Checking the collateral eligibility*

In order to be eligible, collateral must principally fulfil following requirements:

- Sufficient liquidity and stable value over time for funded protection.

Assets recognized for funded credit protection must be sufficiently liquid (i.e., there exists an efficient and legal market for the collateral) and their value over time should be sufficiently stable to provide appropriate certainty as to the achieved credit protection, depending on the approach chosen under Basel II and on the degree of recognition allowed. The value of the collateral must not depend on the creditworthiness of the obligor in a too important way[3,4].

- Sufficient reliability of guarantors and legal effectiveness of unfunded credit protection.

Guarantors recognized for unfunded credit protection must be sufficiently reliable (e.g., the guarantor has a reputation of fulfilling his/her commitments in similar contracts or the guarantor has a sufficient financial standing) and the protection agreement must be legally effective in the relevant jurisdictions. By fulfilling strict requirements concerning the legal effectiveness, the protection agreement provides appropriate certainty and thus can be recognized as credit protection under the approach chosen under Basel II. The certainty of the involvement of the guarantor must also be assessed with regards to the degree of recognition of the collateralization, i.e. the probability with which the guarantor is going to hold his/her engagement regarding the unfunded credit protection[5].

*3rd step: Checking the legal certainty of the collaterals*

When the bank has fulfilled the first two steps, it is allowed to use collaterals, however, only under the condition that the legal certainty of each collateral is generally assured. The legal certainty of the collaterals involved in the transaction covers at least[6] the four criteria listed below:

- Legal effectiveness and enforceability in all relevant jurisdictions, i.e. jurisdictions of all countries involved in the transaction.

In order to fulfil these requirements, the legal certainty of the credit protection must cover the actions (including filing and registration of the collateral contract), the steps taken, the procedures and policies implemented by each unit of the bank[7]. The checking of the legal certainty of the collaterals can be performed either internally or can be outsourced by each unit of the bank (e.g., law firm). If the bank decides to check the legal certainty of the collateral internally, it must define standards and processes in order to ensure the legal enforceability on a regular basis for the length of the contract (e.g., regular involvement of legal advisors). Internal concepts documenting standards and processes chosen by the bank must cover at least the following two topics:

1) internal/outsourced continuous monitoring of legal framework development in countries implied in collateralized transactions;
2) identification of contracts that are concerned by changes of the legal framework.

The requirements regarding legal enforceability concern standard contracts as well as individual ones. For individual contracts, each one must be checked regarding its legal enforceability in the

[1] EU Directive 2006/48/EC, Annex VIII, Part 2, point 1.
[2] EU Directive 2006/48/EC, Article 92 (2).
[3] EU Directive 2006/48/EC, Article 92 (3) and 92 (4).
[4] This means, for example, that equities issued by the debtor are not eligible collaterals. However, further concretization of this phrase still has to be done by FMA.
[5] EU Directive 2006/48/EC, Article 92 (5).
[6] For all collateral types, the EU Directive defines stronger requirements to check their legal certainty. The concerned requirements will be defined in corresponding sections of this document.
[7] EU Directive 2006/48/EC, Article 92 (1).

concerned jurisdictions. For standard contracts, the checking has to take place only once, before the contract is in use. The legal enforceability of each contract must be checked if laws concerning this type of contracts are changed.

- Sufficient level of risk reduction.

Eligible credit protection is to be recognized by supervisors when reduction in the level of credit risk on the exposure as a result of the CRM is sufficiently certain, e.g., the contract setting the collateral to the transaction cannot be changed unilaterally or the realization of the collateral can be led in a defined timeframe. Therefore, each bank must possess efficient processes for the realization of its collaterals.

In addition, each bank requires that the collateral is realizable in cash within a reasonable time, proven by a favorable track record of the jurisdiction in the concerned country. Each unit of the bank must especially pay attention not to take collateral items which could lead to reputation damage in case of its effective realization. E.g., the bank takes a mortgage on a hospital building and if the debtor defaults, it is not realistic that the credit institution will use this collateral since it could damage its reputation. This is also valid for buildings having a strategic importance, the realization of which could lead to political or reputation problems for the bank.

Regarding funded protection, the legal rights of the bank must be enforceable in case of the default, insolvency or bankruptcy of the counterparty or of the custodian of the collateral. If the transaction documentation mentions additional specified credit events relating to the counterparty or of the custodian, this right may be used as well[1].

For all collaterals, the contestation risk needs to be assessed and taken into account while estimating the legal certainty and effectiveness of the collateral.

*4th step: Additional requirements depending on the approach chosen*

Once the legal certainty of collaterals has been checked, further requirements set by the EU Directive must be fulfilled. These requirements concern operational systems of the bank and characteristics of collaterals (stronger requirements for legal certainty, eligibility and recognition).

*5th step: Identification of "maturity mismatch"*

"Maturity mismatch" means that the residual maturity of the protected exposure concerned is longer than the residual maturity of the credit protection involved.

If there is a maturity mismatch, the credit protection cannot be recognised according to the EU Directive in the following cases[2]:

a) the residual maturity of the credit protection is less than three months[3];
b) the original maturity is less than one year[4].

*Currency mismatch*

"Currency mismatch" means that the credit protection is labelled in a currency different from the currency of the exposure[5]. Currency mismatches are allowed according to the EU Directive 2006/48/EC under the standardized and IRB approaches[6].

*6th step: Determination of the CRM effects*

After determining which collaterals can be used by the bank as such, the risk mitigation on the exposure must be calculated according to the approach chosen under Basel II.

The CRM has an effect only on the part of the exposure that is covered by the credit protection, as valuated according to the regulatory requirements. If the amount collateralized or guaranteed is lower than the amount of the exposure and the secured and unsecured portions are of equal seniority (i.e., the bank and the guarantor share losses on a pro-rata basis), capital relief will be performed on a proportional basis. This means that the protected part of the exposure will receive the treatment applicable to the collateral or counterparty, while the remaining part of the exposure (not collateralized) will be treated as unsecured.

**1.2. Credit Risk Mitigation for retail exposures under the standardized approach.** Banks use a number of techniques to mitigate the credit risks to which they are exposed. Exposure may be collateralized in whole or in part with cash or securities, or a loan exposure may be guaranteed by a third party. No transaction in which CRM techniques are used should receive a higher capital requirement than an otherwise identical transaction where such techniques are not used.

The effects of CRM will not be double counted. Therefore, no additional supervisory recognition of

[1] EU Directive 2006/48/EC, Article 4 (31).

[2] Maturity mismatch is not allowed for financial collaterals under the Financial Collaterals Simplified Approach. The definition and restrictions given here concerned other collaterals under the standardized approach and financial collaterals under the Financial Collateral Comprehensive Method and the IRB approach.

[3] EU Directive 2006/48/EC, Annex VIII, Part 4, point 1.

[4] EU Directive 2006/48/EC, Annex VIII, Part 4, point 2.

[5] EU Directive 2006/48/EC, Annex VIII, Part 3, point 84.

[6] Currency mismatches for collaterals are allowed under the standardized approach under certain restrictions.

CRM for regulatory capital purposes will be granted on claims for which an issue-specific rating is used that already reflects that CRM. Principal-only ratings will also not be allowed within the framework of CRM. Although banks use CRM techniques to reduce their credit risk, these techniques give rise to risks (residual risks) which may render the overall risk reduction less effective. Where these risks are not adequately controlled, supervisors may impose additional capital charges or take other supervisory actions as detailed in Pillar 2.

While the use of CRM techniques reduces or transfers credit risk, it simultaneously may increase other risks to the bank, such as legal, operational, liquidity and market risks. Therefore, it is imperative that banks employ robust procedures and processes to control these risks, including strategy; consideration of the underlying credit; valuation; policies and procedures; systems; control of roll-off risks; and management of concentration risk arising from the bank's use of CRM techniques and its interaction with the bank's overall credit risk profile.

The Pillar 3 requirements must also be observed for banks to obtain capital relief in respect of any CRM techniques.

*1.2.1. Qualitative requirements for the standardized approach.* The rules set out in this section are applicable to the banking book retail exposures under the standardized approach.

Specific operational requirements must be fulfilled by each unit of the bank under the standardized approach in order to fulfil the minimum requirements for recognition of their collaterals[1]:

- *A proper documentation of the collateralized transactions.*

This includes a clear identification of the credit institution, the debtor (name, address, etc.) and of the collateral(s) involved in the transaction (location in case of physical collateral, owner, value, etc.). Moreover, each unit of the bank must check whether the relevant jurisdictions are already mentioned in the documentation of a transaction. The documentation must also be stored during at least the whole duration of the collateralized transaction.

- *Clear and robust procedures for the timely liquidation of the collateral.*

This means that each unit of the bank must possess a handbook for the liquidation for each type of collateral, determining the different steps of the liquidation (contact with lawyers if necessary, experts for the valuation, etc.) as well as trained persons responsible for the liquidation.

- *Strong procedures and processes for the risk management.*

The risk management must especially cover the control of risks arising out of collateralization (failure or reduction of the credit protection), the valuation of the continuous risks and of the risks associated with the termination of the credit protection. This means that, for each type of collaterals, the bank must possess a handbook defining procedures for risk assessment, risk monitoring and "limits" from which the reduction of the credit protection must have to be tracked by a regular monitoring (early-warning system).

The risk management process also covers the determination of concentration risks and their effects on the risk profile of the bank. Thus for each type of product, the bank must check that diversified collaterals are used to collateralize exposures (e.g., real estate must at least have a different geographical location).

- *Documented policies and practices concerning the types and amounts of collaterals accepted.*
- *A regular valuation system of the financial collateral at market value (at least every six months or when a significant decrease of its market value might have occurred).*

Real estates are submitted to different treatments: Residential Real Estates (RRE) must be valuated at least every three years, whereas Commercial Real Estates (CRE) must be valuated at least once a year.

In case of important changes in the valuation conditions of a real estate, the valuation must be more frequent.

- *Processes to check that custodians strictly separate the collaterals from their own assets.*

**1.3. Credit Risk Mitigation for retail exposures under the IRB approach.** In this section differences between the standardized and the IRB approaches for the treatment and utilization of CRM techniques will be analyzed. Compared to the standardized approach, CRM techniques under the IRB approach introduce new types of collaterals to be recognized as eligible and new requirements for the collateral types already recognized under the standardized approach. However, the main difference between CRM under those two approaches is in the way capital requirements are calculated. Namely CRM under the IRB approach operates through modelling of the LGD parameter whereas the CRM under the standardized approach is based on a substitution of the risk-weight of the debtor by the risk-weight of the protection provider. Credit institutions are authorized to derive their LGD

[1] EU Directive 2006/48/EC, Annex VI, Part 1, points 44 to 60 and Annex VIII, Part 2, point 6.

own estimates from realized losses and appropriate estimates of PDs[1].

Rating systems are a cornerstone for the calculation of banks' regulatory capital charge in the internal ratings-based (IRB) approach of the revised Framework (Basel II) because they are the basis for the determination of a borrower's probability of default (PD). The PD and the other two risk components, loss given default (LGD) and exposure at default (EAD), are key input parameters to the regulatory capital calculation. As a consequence, validation of these three parameters and the underlying rating system is a key component of the supervisory review process.

Explicit requirements in the revised Framework underline the need to validate internal rating systems. Banks must demonstrate to their supervisors that they can assess the performance of their internal ratings and their risk estimation systems consistently and meaningfully. More detailed requirements demand, for example, that realised default rates have to be within an expected range, that banks must use different quantitative validation tools and that well articulated internal standards must exist for situations where significant deviations occur between observed values of the three risk components and their estimates.

The design of a validation methodology depends on the type of rating system. Rating systems can differ in various ways, depending on the borrower type, the materiality of the exposure, the dynamic properties of the rating methodology (e.g., point-in-time vs. through-the-cycle), and the availability of default data and external credit-quality assessments (external ratings, vendor models). As a consequence, validation is a relatively complex issue and requires a good understanding of the rating system and its properties.

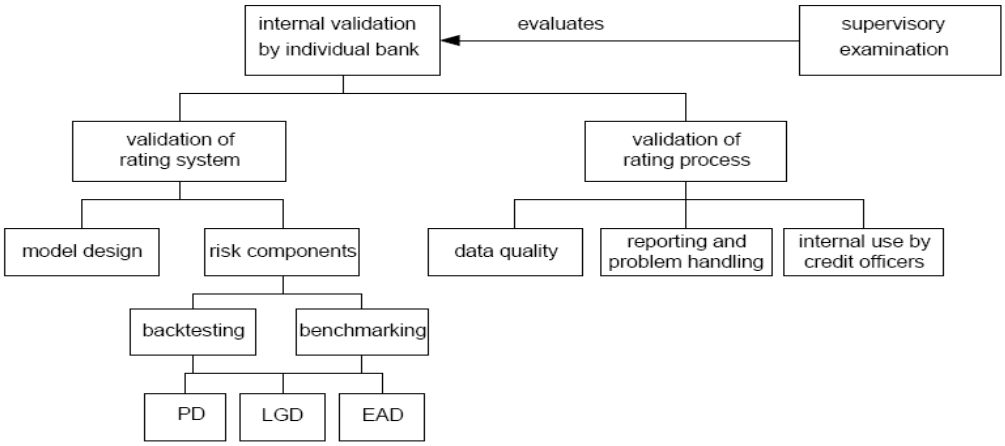
The following part summarizes the work of the Validation Group. This group was formed by the Research Task Force to explore validation methodologies for rating systems from a theoretical perspective and to assess current validation practices in the banking industry.

The Validation Group has explored a broad range of qualitative and quantitative validation techniques. It has considered contributions from the literature and the results from a bank survey in order to understand how validation is treated in academia as well as in the banking industry.

The validation project has progressed in three stages. The first stage began with a literature survey on validation methods and their performance in banking practice. This was important for developing a common terminology and for a classification of rating systems.

A key result of the first stage was that statistical tests are less meaningful to validate PD estimation than they are in the case of internal market risk models. Therefore, backtesting based on statistical tests is generally not powerful enough to determine if an internal rating system is acceptable. Consequently, the focus of the project was extended to benchmarking.

*1.3.1. Key components of validation.* An important issue at the outset of the project was to describe the key components of validation as a concept. The validation process involves the examination of the rating system and the estimation process and methods for the risk components PD, LGD and EAD. It also requires verification of the minimum requirements for the IRB approach. The application of validation methods is closely linked to the type of rating system and its underlying data basis. E.g., ratings for small business lending will typically be of a more quantitative nature, based on a rather large quantity of data. Sovereign ratings instead will typically lay more emphasis on qualitative aspects because these borrowers are more opaque and default data are scarce. Figure 2 shows key components of a validation methodology.




Source: internal sources.

**Fig. 2. Validation components**

[1] EU Directive 2006/48/EC, Annex VII, Part 4, point 83.

Individual banks undertake validation as a means of ensuring that the output produced by internal rating systems is suitable for internal uses and to verify compliance with the use test as defined in the revised Framework. In an examination, supervisors evaluate the validation conducted by the individual bank. As a result, supervisors may use some of the same validation techniques as the banks.

Validation by a banking institution consists of two main components: validation of the rating system and the estimates of the risk components (PD, LGD, and EAD), and validation of the rating process, focusing on how the rating system is implemented.

The validation of the rating system can be further broken down into two components; the evaluation of the rating system design or model design and an assessment of the estimates of the risk components. In both cases, qualitative and quantitative methods can be applied.

In case of a model-based rating system, the validation of the model design should include, for example, a qualitative review of the statistical model building technique, the relevance of the data used to build the model for the bank's specific business segment, the way the risk factors that are the key inputs to the models were selected, and whether they are economically meaningful.

In the analysis of the estimates of the model parameters PD, LGD and EAD we differentiate between backtesting and benchmarking:

- Backtesting means the use of statistical methods to compare estimates of the three risk components to realized outcomes. This differs from the traditional backtesting of market risk models in an important way. Whereas for market risk models backtesting involves the whole model, for internal rating systems only the risk components (model inputs) are tested and the "model" is provided by the supervisor in the shape of the risk-weight functions;
- Benchmarking refers to a comparison of internal estimates across banks and/or with external benchmarks (e.g., external ratings, vendor models, or models developed by supervisory authorities).

In addition to an evaluation of the rating system, validation comprises an evaluation of the rating process. This involves important issues like data quality, the internal reporting, how problems are handled and how the rating system is used by the credit officers. It also entails the training of credit officers and a uniform application of the rating system across different branches. Although quantitative techniques are useful, especially for the assessment of data quality, the validation of the rating process is mainly qualitative in nature and should rely on the skills and experience of typical banking supervisors.

*1.3.2. Validation of PD, LGD and EAD.* Estimation and validation methodologies for PD are significantly more advanced than those for LGD and EAD. For all three risk components, the use of statistical tests for backtesting is severely limited by data constraints. Therefore, a key issue for the near future is the building of *consistent data sets* in banks. Initiatives to pool data that have been started by private banking associations may be an important step forward in this direction, especially for smaller banks.

For the validation of PDs, we differentiate between two stages: validation of the discriminatory power of a rating system and validation of the accuracy of the PD quantification (calibration). Numerous methods exist for the assessment of the discriminatory power. The most common techniques are the cumulative accuracy profile (CAP) and the accuracy ratio, which condenses the information of the CAP into a single number. Portfolio dependent confidence intervals that allow statistical inference from the accuracy ratio are given in the report.

Compared with the evaluation of the discriminatory power, methods for validating calibration are at a much earlier stage. However, stimulated by the progress of Basel II, such methods have attracted considerable interest in academic research. A major obstacle to backtesting of PDs is the scarcity of data, caused by the infrequency of default events and the impact of default correlation. Even if the final minimum requirements of the revised Framework for the length of time series for PDs (five years) are met, the explanatory power of statistical tests will still be limited. Due to correlation between defaults in a portfolio, observed default rates can systematically exceed the critical PD values if these are determined under the assumption of independence of the default events. This can happen easily for otherwise well-calibrated rating systems. As a consequence, on the one hand, all tests based on the independence assumption are rather conservative, with even well-behaved rating systems performing poorly in these tests. On the other hand, tests that take into account correlation between defaults will only allow the detection of relatively obvious cases of rating system miscalibration. Therefore, statistical tests alone will be insufficient to adequately validate an internal rating system. Nevertheless, banks should be expected to use various quantitative validation techniques, as they are still valuable tools for detecting weaknesses in rating systems.

Due to the limitations of using statistical tests to verify the accuracy of the calibration, benchmarking

can be a valuable complementary tool for the validation of estimates for the risk components PD, LGD and EAD. Benchmarking involves the comparison of a bank's ratings or estimates to results from alternative sources. It is quite flexible in the sense that it gives banks and supervisors latitude to select appropriate benchmarks. An important technical issue is the design of the mapping from an individual bank's estimates to the benchmark. If benchmarking is carried out by the bank, its supervisory authority may choose to focus primarily on assessing the quality of the benchmark and the quality of the mapping. A dynamic approach to benchmarking seems to be promising, and would allow supervisors to make inferences about the characteristics of the internal rating system. Despite the usefulness of benchmarking, it should be used as a complement to, not a substitute for, statistical validation methods.

Compared to PD, much less is known about what drives LGD. Therefore, the studies concentrate more on issues that affect the estimation of LGD than on validation methods.

In general, four methods are available for the estimation of LGDs: a workout LGD based on the discounted cash flows after default; a market LGD based on prices of traded defaulted loans; an implied market LGD that is derived from non-defaulted bond prices by means of an asset pricing model; and (in the special case of a retail portfolio) an implied historical LGD based on the experience of total losses and PD estimates. The studies in this volume focus on workout LGDs because they appear likely to be a common methodological choice of banks attempting to meet the IRB minimum requirements. Several critical issues for the estimation of workout LGDs are highlighted in the studies, including how to measure recoveries, how to allocate workout costs, and how to select an appropriate discount factor. Other important issues for estimation include consistency between the definitions of default used for PD and LGD, and the precise definition of losses (for instance whether the observed losses are censored by forcing them to be non-negative).

The obstacles that impede the validation of LGD are also present when EAD is estimated and validated. The key problem here is to determine the potential future draw-down of unused commitments. Literature on the estimation and validation of EADs is virtually non-existent and data constraints are even more severe than for LGDs, where at least one can draw some inferences from publicly available bond data.

*1.3.3. Dynamics of rating system.* Under Basel II, an IRB bank will be required to report a quantitative assessment of the probability of default for each obligor represented in its loan portfolio. The process by which PDs are assigned to obligors is clearly articulated in the revised Framework[1]. An IRB bank must first assign obligors to "risk buckets". All obligors assigned to a bucket should share the same credit quality as assessed by the bank's internal credit rating system. Once obligors have been grouped into risk buckets, the bank must calculate a "pooled PD" for each bucket. The credit-risk capital charges associated with exposures to each obligor will reflect the pooled PD for the risk bucket to which the obligor is assigned.

The revised Framework establishes minimum standards for IRB banks' internal rating processes and outlines permissible approaches to estimating pooled PDs, but it permits banks a great deal of latitude in determining how obligors are assigned to buckets and how pooled PDs for those buckets are calculated[2]. Although this flexibility allows banks to make maximum use of their own internal rating and credit data systems in quantifying PDs, it also raises important challenges for PD validation. Supervisors and bank risk managers will not be able to apply a single formulaic approach to PD validation because dynamic properties of pooled PDs depend on each bank's particular approach to rating obligors. Supervisors and risk managers will have to exercise considerable skill to verify that a bank's approach to PD quantification is consistent with its rating philosophy.

*1.3.3.1. Characteristic of obligor-specific default probabilities.* In its purest form, a probability of default is a forward-looking forecast of the likelihood that a particular obligor will default over a fixed assessment horizon (usually one year). Not all banks have systems in place for explicitly estimating default probabilities at the obligor level, and the revised Framework does not require that IRB banks develop such systems. Rather, the revised Framework requires that IRB banks be capable of assigning aggregate pooled PDs to risk buckets composed of many obligors. Nonetheless, since a bucket's pooled PD is intended to measure the average PD for obligors assigned to that bucket, our analysis of the dynamic characteristics of pooled PDs begins by focusing on the characteristics of default probabilities associated with individual obligors.

An obligor-specific PD may incorporate information relevant to assessing the obligor's ability and willingness to repay its debts, as well as information about the economic environment in which the obligor

[1] BCBS (2004) paragraph 285 stipulates that pooled PDs should be linked to risk buckets rather than directly to obligors. Paragraphs 452-457 define the default event that PDs are intended to forecast.

[2] BCBS (2004) paragraphs 446-451 set out broad standards for the quantification of IRB risk components including PDs. Paragraphs 461-463 discuss specific requirements for assigning pooled PDs to risk buckets.

operates. It is convenient to divide the information available for forecasting defaults into two categories:

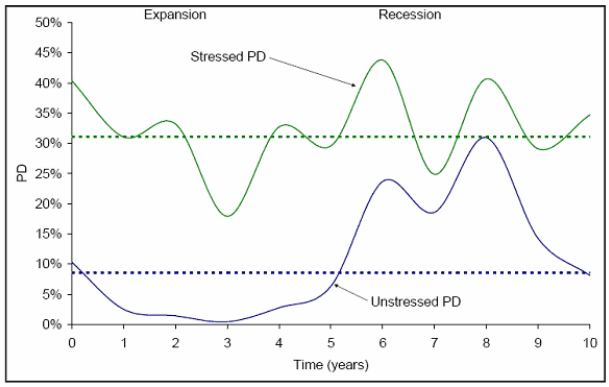
- Aggregate information is the information observable at the time a PD is estimated that is shared in common by many obligors. This category typically includes macroeconomic variables such as exchange rates, GDP growth rates, etc.
- Obligor-specific information is the information that is unique to a particular obligor. Such information may be relatively static, such as an obligor's line of business, or it may be more dynamic in character, such as an obligor's leverage ratio or current revenue.

Like all economic forecasts, obligor-specific default probabilities must either implicitly or explicitly embed assumptions about future economic conditions. These assumptions may be extrapolated from current conditions, or they may reflect conservative stress scenarios. A stress scenario is a collection of assumptions about future economic conditions that are unlikely to occur over an assessment horizon but would tend to induce very high credit losses if they did occur.

Obligor-specific default probabilities are sensitive to the way that they use available information and the assumptions under which they are derived. In the analysis that follows we will consider two idealized representations of obligor-specific PDs.

- Unstressed PD is an unbiased estimate of the likelihood that an obligor will default over the next year given all currently-available information, including static and dynamic obligor characteristics and aggregate data. Because this PD makes use of observable macroeconomic data, it is likely to fall as macroeconomic conditions improve and rise as they deteriorate.
- Stressed PD measures the likelihood that an obligor will default over the next year using all available obligor information, but assuming adverse stress-scenario economic conditions. Because this PD makes use of dynamic obligor characteristics it will change as an obligor's individual characteristics change, but it will tend not to be highly correlated with the business cycle.

Figure 3 illustrates how these two different types of PDs might evolve over time for a single obligor. In this example, a business cycle peak occurs in years 2 and 3 and a trough occurs in years 7 and 8. Notice that the unstressed PD declines during expansion years and rises during recession years. At any particular date, most of the deviation of the unstressed PD from its long-run average is related to the business cycle. The stressed PD is "cyclically neutral" in the sense that while it moves as the obligor's particular circumstances change, it does not respond to changes in overall business conditions.




Note: dashed lines show long-run average obligor PDs.
Source: studies on the validation of internal rating system.

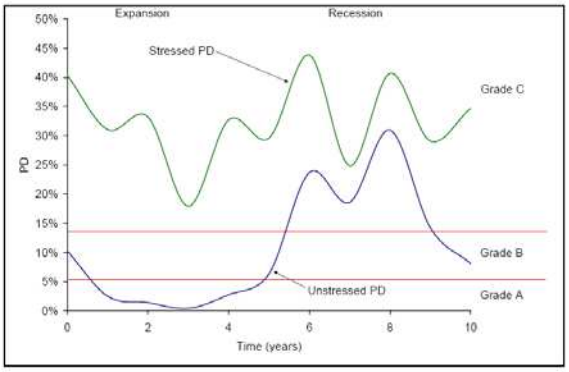
**Fig. 3. Hypothetical stressed and unstressed default probabilities for a single obligor over a business cycle**

*1.3.3.2. Classification of rating system.* All credit rating systems assign obligors to risk buckets that are intended to distinguish among obligors of differing credit quality. However, different rating systems accomplish this task in different ways. Some banks rely almost entirely on empirical credit scoring models. Statistical models map obligor characteristics to credit scores and obligors with similar scores are then grouped into common risk buckets. Other systems rely more heavily on expert judgment. Practitioners use the terms "point-in-time" or "through-the-cycle" to describe the dynamic characteristics of rating systems, but these terms often mean different things to different people. Broadly, point-in-time systems attempt to produce ratings that are responsive to changes in current business conditions while through-the-cycle systems attempt to produce ordinal rankings of obligors that tend not to change over the business cycle. Point-in-time systems tend to focus on the current conditions of an obligor, while through-the-cycle systems tend to focus on an obligor's likely performance at the trough of a business cycle or during adverse business conditions.

- Point-in-time (PIT) rating system uses all currently available obligor-specific and aggregate information to assign obligors to risk buckets. Obligors with the same PIT grade are likely to share similar unstressed PDs. An obligor's rating can be expected to change rapidly as its economic prospects change. Overall, PIT ratings will tend to fall during economic downturns and rise during economic expansions.
- Through-the-cycle (TTC) rating system uses static and dynamic obligor characteristics but tends not to adjust ratings in response to changes in macroeconomic conditions. Obligors with the same TTC grade are likely to share similar stressed PDs. An individual obligor's rating may change as its own dynamic characteristics change, but the distribution of ratings across obligors will not change significantly over the business cycle.

Figure 4 and Figure 5 illustrate simple examples of point-in-time and through-the-cycle rating assignments based on the same obligor-specific PDs plotted in Figure 3. Notice that as the obligor's unstressed PD changes, its PIT rating changes as well. Near the peak of the business cycle the obligor receives a higher PIT rating and near the trough of the cycle it receives a lower rating. In contrast, the TTC rating is tied to the obligor's unstressed PD. This PD fluctuates over time, but is not correlated with the business cycle. As a result, the obligor's TTC rating does not reflect changes in overall business conditions[1].

During the economic expansion the unstressed PD declines and the obligor receives a higher
During the economic recession the unstressed PD increases and the obligor receives a lower

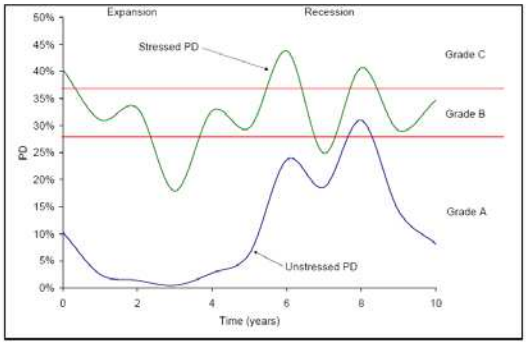



| Year | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Grade | B | A | A | A | A | B | C | C | C | B | B |

Source: studies on the validation of internal rating system.

**Fig. 4. Example of a three-grade point-in-time rating system tied to an obligors unstressed PD**

While the obligor's rating changes as its stressed PD changes over time, its rating is unrelated to the business cycle.




| Year | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Grade | C | B | B | A | B | B | C | A | C | B | B |

Source: studies on the validation of internal rating system.

**Fig. 5. Example of a three-grade through-the-cycle rating system tied to an obligors stressed PD**

*1.3.4. Loss Given Default Validation.* LGD is an important element of the IRB approach to capital measurement. LGD is particularly important because the minimum regulatory capital charge is highly sensitive to the LGD that is reported by a financial institution. Under the advanced approach, financial institutions are allowed to use internally derived measures of LGD rather than a standard LGD given by the revised Framework. Thus, the validation of internal measures of LGD is crucial to the validation of the appropriateness of the capital measures.

*1.3.4.1. Definition of LGD.* In general, LGD is the loss, expressed as a percentage of the EAD, on a credit facility if the credit defaults[2]. We can further refine this definition to distinguish between the ex-post measures of LGD on defaulted facilities and ex-ante measure on non-defaulted facilities.

LGD for a non-defaulted facility can be defined as the ex-ante estimate of loss conditional on the default, expressed as a percentage of the EAD. The LGD associated with a non-defaulted facility can be viewed as a random variable. Frequently, we are interested in having one figure for the value of the LGD which is typically based on an estimate for the expectation of this random variable, i.e. expected LGD.

LGD for a defaulted facility is the ex-post loss expressed as a percentage of the exposure at the time of default. If there is complete information on all of the losses related to a facility, and a method to calculate losses has been chosen, we can directly calculate realized LGD. If there is not complete information on the losses related to a defaulted facility, for example, if the facility is in the process of workout, LGD is a random variable. We can calculate an estimate of LGD for these defaulted facilities by using complete information from a sample of similar facilities.

A reference data set (RDS), which includes realized LGDs on defaulted facilities, can be used to estimate LGD on non-defaulted facilities. There are different methods that can be used to assign an LGD to non-defaulted facilities. These can be classified as subjective and objective methods according to the type of input used.

- Subjective methods are based on expert judgment. Banks use these methods in portfolios for which there are no defaults or at the early stages of use of their internal models.
- Objective methods use numerical data containing information on LGD as the main input. Additionally, it is possible to subdivide objective methods into explicit and implicit methods.

  *In explicit methods*, the LGD is estimated for each facility using a reference data set (RDS) of defaulted facilities. The first step is to determine the realized LGD of each facility included in the

[1] Studies on the Validation of Internal Rating Systems (May 2005). Working Paper No. 14.

[2] Under the advanced approach, "LGD must be measured as the loss given default as a percentage of the EAD". BCBS (2004), paragraph 297.

RDS. The second step consists of assigning an LGD to each non-defaulted facility (using a model)[1]. As we will show in following sections, the loss can be computed using either market values (explicit market LGD) or discounted cash-flows derived from the recovery process (workout LGD).

*Implicit methods* are not based on the realized LGD on defaulted facilities contained in RDS. Instead, LGD is derived using a measure of total losses and PD estimates.

Table 2. Classification of the objective methods to obtain LGDs

| Source | Measure | Type of facilities in the RDS | | Most applicable to |
|---|---|---|---|---|
| | | Defaulted facilities | Non-defaulted facilities | |
| Market values | Price differences | Market LGD | | Large corporate, sovereigns, banks |
| | Credit spreads | | Implied market LGD | Large corporate, sovereigns, banks |
| Recovery and cost experience | Discounted cash flows | Workout LGD | | Retail, SMEs, large corporate |
| | Historical total losses and estimated PD | Implied historical LGD | | Retail |

Source: studies on the validation of internal rating system.

*1.3.4.2. Workout LGD.* This section looks at the process of computing the workout loss of a defaulted facility, and discusses issues related to the measurement of the various components of the workout LGD including recoveries, costs and the discount rate.

There are three main components for computing a workout loss: the recoveries (cash or noncash), the costs (direct and indirect) and the discount factor that will be fundamental to express all cash flows in terms of monetary units at the date of default. If all the cash flows associated with a defaulted facility from the date of default to the end of the recovery process are known (i.e. we have complete information) then the realized LGD, measured as percentage of the EAD at the time of default, is given by:

$$Realized\ LGD = \left[1 - \frac{\sum_i R_i(r) - \sum_j P_j(r)}{EAD}\right], \quad (1)$$

where $R_i$ is each of the $i$ discounted recoveries of the defaulted facility, $P_j$ is each of the $j$ discounted payments or costs during the recovery period, and $r$ represents a discount rate.

When loss is calculated by setting all negative observations of loss to zero, as shown in equation (2), it is referred to as censoring the data.

$$Realized\ LGD = Max\left[1 - \frac{\sum_i R_i(r) - \sum_j P_j(r)}{EAD}, 0\right]. \quad (2)$$

Censoring the data does not change the definition of default. In contrast, when defaults with zero or negative LGD are removed from the dataset, referred to as truncating the data, the definition of default has changed.

If the data have not been censored or truncated, then the realizations of LGD could be negative (representing an economic gain on the asset)[2]. This would be more likely if the definition of default was broader, such as 30-days past due. In principle, the constraint of realized LGD being greater or equal to zero, for regulatory purposes, can be imposed for prudential reasons. However, banks do not necessarily impose this condition in their estimates for non-regulatory use (for instance, pricing).

*1.3.4.3. Validation of LGD.* The LGD validation process involves the examination of all the elements that are needed to produce LGD estimates. This includes all of the assumptions made to construct a reference data set, calculate realized LGD, and generate LGD estimates from the reference data set. Validation also requires verification that the minimum regulatory requirements are met. Figure 6 below presents an example of the validation process. The same type of process can be used to verify that LGD estimates used for internal capital purposes are appropriate as well. At each step in the figure, both the assumptions made and the calculation must be validated.

Consider a grade that contains facilities with the same or similar type of collateral, product, industry, purpose, etc[3]. Given a facility of this grade, for which an LGD has to be estimated, the first step is to obtain a reference data set (RDS) of defaulted facilities[4]. This RDS must include seven years of data for corporate but for retail five years are enough (ideally a complete economic cycle)[5], use a definition of default consistent with the one used to

[1] The easiest procedure is to use the sample mean of the realized LGDs in the reference data set, though there are more sophisticated rocedures.

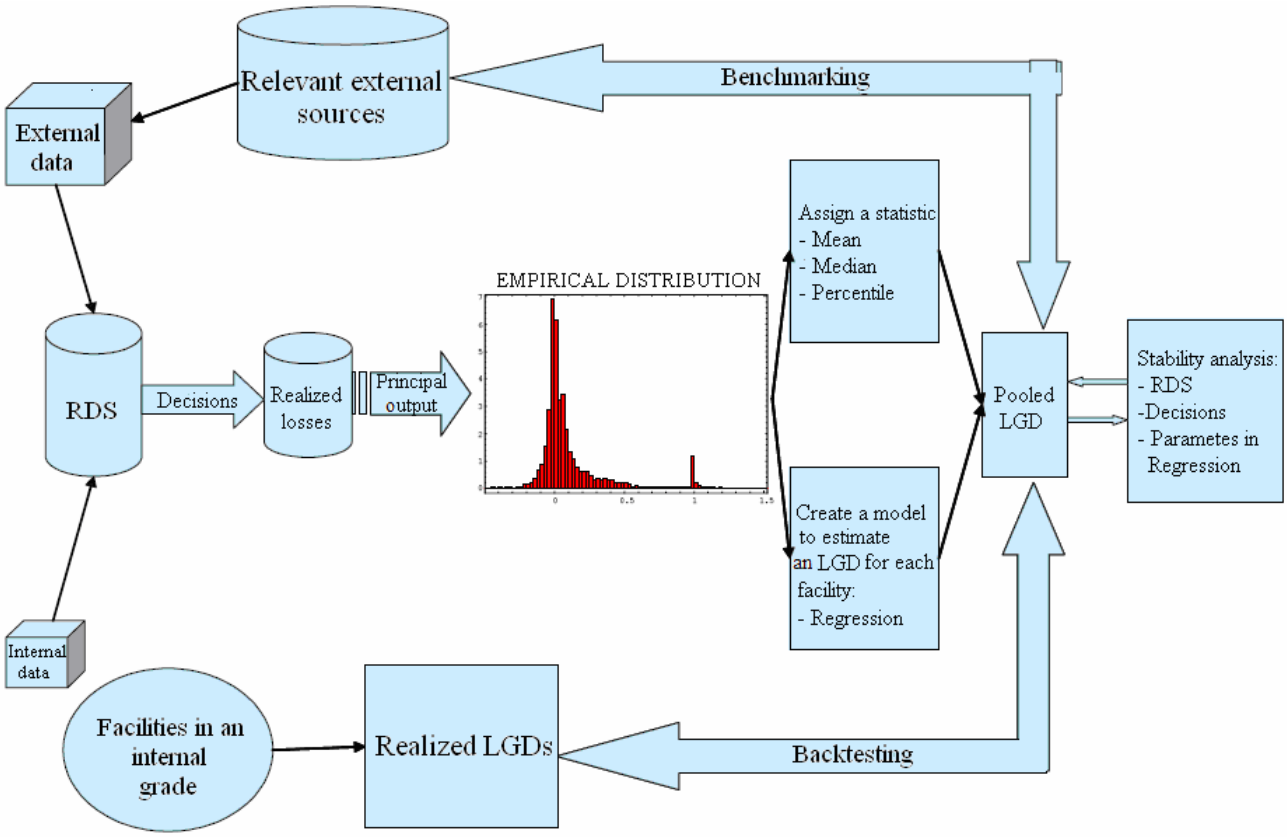
[2] Typically, this occurs when the opportunity cost implicit in the discount rate is lower than the income from interest and fees on the defaulted loan. Censoring the data is consistent with not recognizing future margin income.

[3] BCBS (2004), paragraph 399.

[4] It is assumed that there are enough data in the RDS.

[5] BCBS (2004), paragraphs 472 and 473.

estimate PDs (ideally the same definition)[1], and include internal and/or external facilities similar to the given facility[2]. The reference data set should also include data on the relevant drivers for the loss estimates[3].




Source: studies of the validation of internal rating systems.

**Fig. 6. Example of the validation process**

*1.3.4.4. Modelling LGD.* LGD = 100% - Recovery Rate % + Economic Cost Rate%

In detail:

$A_{qi}$ = Sum of all recoveries within the recovery period (see later) referring to defaults occurred in a pool in a defined measurement period (e.g., one quarter – $q_i$); $B_{qi}$ = Sum of all costs related to collections within the recovery period referring to the recoveries included in $A_{qi}$ ; $C_{qi}$ = Sum of all amounts defaulted in the given measurement period (sum of EADs of defaulted exposures).

I suggest a measurement period of one quarter $q_i$. Then the LGD per quarter and pool is defined as follows:

$$LGD_{qi} = 100\% - ( A_{qi} - B_{qi} ) / C_{qi} . \quad (1)$$

Recoveries must belong to the respective default accounts in the given 5 year period.

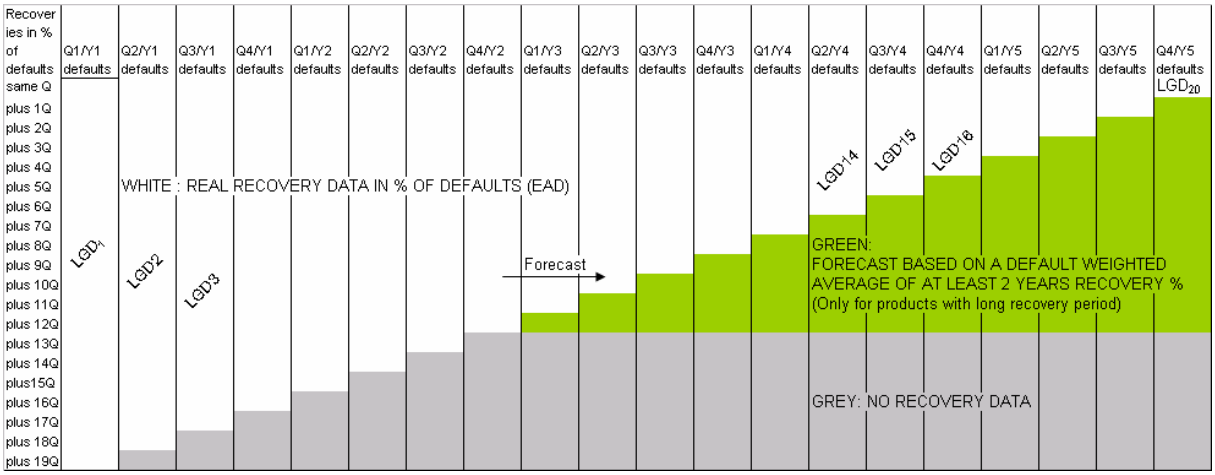
Recoveries from realizing collateral (e.g., mortgage) might begin to show only after 2-3 years, depending on the legal situation. This implies an understated recovery rate. For that reason it is suggested to apply a default weighted average of at least two real annual recovery ratios in estimation of recoveries of products with a long recovery period (one year and more)

Note:

1) The number of years necessary to know what the recovery rate of a defaulted account will be is product and country dependent.
2) LGD should include cost of funding.
3) Future cost (e.g., collection costs) and incomes (e.g., recoveries) should be calculated as Net Present Values.

$A_{qi}$ would cover the amount recoveries in white and green areas corresponding to recovery % data (see Fig. 7).

[1] BCBS (2004), paragraph 456.
[2] BCBS (2004), paragraphs 448 and 450.
[3] Studies on the validation of internal rating systems (May 2005). Working Paper No. 14.




Source: internal sources.

**Fig. 7. Recovery – Vintage – Analysis**

LGD per pool:

$$LGD_{pool} = (1/\sum_{(i=1 \text{ to } 20)} d_{qi}) * \sum_{(i=1 \text{ to } 20)} (LGD_{qi} * d_{qi} * w_{qi}), \quad (1)$$

$$\sum_{(q=1 \text{ to } 20)} w_q = 1, \quad (2)$$

where: $d_{qi}$ is number of defaults in quarter $q_i$; $w_{qi}$ defines the weight a bank assigns to a quarter $q_i$ ; $LGD_{qi}$ – Loss given default in quarter $q_i$.

Note:

1) Provided that sufficient data are available, for best risk management practices, banks should compute LGD at individual exposure level (rather than pool level) using scoring models. As a result, better credit decisions can be made using Expected Loss Rate (ELR = PD * LGD) rather than expected bad rate alone (i.e., PD). This will fulfil the Basel II "use test" requirement in helping banks to better:

- accept applicants;
- set credit limit;
- prioritize collections;
- define pricing;
- set provisions.

2) Recoveries since default; this will mostly be recoveries after 90 days past due. Collected fees from defaulted borrowers, including fees for late payment, may be treated as recoveries for the purpose of the bank's LGD estimation. Unpaid late fees, to the extent that they have been capitalized in the bank's income statement, must be added to the bank's measure of exposure or loss.
3) Economic cost since default; e.g., legal costs, total operational costs of the function related to collections of defaulted accounts. If a country outsources 90+ collections to an agency and this agency would gain a percentage of x% of the recovered amount, this percentage would also be found in the 'Economic Cost Rate'.
4) It will be up to the countries to develop an LGD scorecard based on defaulted accounts covering demographic, collateral, behavioral data and measured 'real' LGD on account level.

## Conclusion

Analysis of a stylized model of rating systems indicates that the default probability assigned to each obligor rating grade and its dynamics strongly depend on the type of rating methodology and quantification techniques employed. Therefore, banks and supervisors should take into account differences in rating assignment methods and quantification approaches when applying a validation methodology.

The dynamics of default probabilities assigned to rating grades are explored by analyzing the properties of stylized rating systems of the types often described as point-in-time and through-the-cycle. The impact of using idealized stressed rather than unstressed obligor specific PDs to determine the pooled PD for a risk "bucket" (such as an internal obligor grade) is also considered. The analysis of these stylized rating systems provides some interesting insights into the impact of using the approaches outlined in the revised Framework (i.e., the historical default experience approach, the statistical model approach or the external mapping approach) for PD estimation in different rating systems.

The results of this analysis suggest that the pooled default probability assigned to each rating grade and its dynamics strongly depend on the type of rating system and the PD estimation method. The estimation from historical default rates is most meaningful when the pooled PDs are unstressed, which means that they are unbiased estimates of the likelihood of default in the following year. Furthermore, the

analysis suggests that the long-run average default frequency for a through-the-cycle bucket will not provide a good approximation of that bucket's unstressed pooled PD. The reason is that the unstressed pooled PD will tend to be lower than the long-run average default frequency during cyclical peaks and higher than the long-run average default frequency during cyclical troughs.

The statistical models approach is potentially more flexible, but is only as accurate as the underlying statistical models used to estimate obligor-specific PDs.

In the case of external mapping, the analysis suggests that if there are differences in the dynamics of a bank's internal rating system and the external rating system used to quantify pooled PDs, then one might expect the mapping between internal and external grades to change from year to year. Only if a bank's approach to setting internal ratings is the same as that used in setting the external ratings one can expect the mapping between the two systems to remain stable over time.

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