

# **MOODY'S KMV INTERNAL RATING PLATFORM AND THE BASEL II IRB APPROACHES**

**ADDRESSING ISSUES RAISED BY THE NEW BASEL CAPITAL  
ACCORD'S INTERNAL RATINGS-BASED APPROACH**

## **ABSTRACT**

In June 2004, the Basel Committee on Banking Supervision issued the long-awaited “International Convergence of Capital Measurement and Capital Standards: a Revised Framework” describing changes to the regulatory capital requirements for banks. A key element of the new Accord is greater reliance on banks’ internal rating systems in the calculation of regulatory capital charges.

The Moody’s KMV internal rating platform can accommodate a wide variety of risk rating models. Specifically, it is used to deploy risk models across a bank’s local and global lending network and to manage the data requirements of the credit rating process. Banks around the world are making the platform a critical component of their credit risk process as they prepare for Basel II IRB compliance.

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# 1 OVERVIEW: THE NEW BASEL CAPITAL ACCORD AND MOODY'S KMV

In June 2004, the Basel Committee on Banking Supervision issued the long-awaited “International Convergence of Capital Measurement and Capital Standards: a Revised Framework” describing changes to the regulatory capital requirements for banks.<sup>1</sup> These changes are known as the New Basel Capital Accord, or more commonly as “Basel II.” The new Accord, under discussion since June 1999, is designed to replace the 1988 Basel Accord with a more risk-sensitive set of regulations. A key element of the new Accord is greater reliance on banks’ internal rating systems in the calculation of regulatory capital charges. Basel II will be adopted by most banking regulators by 2007.

Moody’s KMV believes that all lending institutions, whether or not they are required to comply with the new regulations, should carefully consider the credit policy issues and recommendations raised by the Basel Committee in the context of managing risk and measuring customer profitability. Moody’s KMV offers several products and services that help banks develop solutions that meet regulatory requirements and contribute to improved business performance:

- Moody’s KMV Risk Advisor™ and RiskAnalyst™ allow institutions to create and deploy internal rating models based on both quantitative and qualitative criteria.
- Moody’s KMV BaselCalc™ gives banks an optimized calculation of required regulatory capital across any reporting jurisdiction.
- Moody’s KMV RiskCalc®, Moody’s KMV CreditEdge®, and Moody’s KMV Credit Monitor® produce Expected Default Frequency™ (EDF™) credit measures for individual borrowers.<sup>2</sup>
- Moody’s KMV LossCalc™ produces estimates of loss in the event of default.
- Moody’s KMV Professional Services provides implementation, modeling, portfolio advisory, and benchmarking services for the banking industry.

This paper focuses on Risk Advisor and RiskAnalyst,<sup>3</sup> which comprise the Moody’s KMV internal rating platform. These products provide a framework within which banks and other credit providers can determine default estimates, obligor, facility and obligation ratings, and severity estimates. They allow the capture of financial information, judgments about the obligor, and details of facilities and credit risk mitigants. In addition, EDF credit measures can be brought into the platform for benchmarking and/or inclusion within ratings. The products provide a flexible architecture, supporting changes of various types and complexity, that can be used to incorporate a bank’s own rating methodology.

The design of the products has been heavily influenced by the Moody’s KMV Risk Advisor Advisory Group (MRAAG), an industry steering group established by Moody’s KMV to ensure that its internal rating platform and models meet current standards and requirements. The group is made up of heads of credit from a number of major lending institutions around the world. Input from the group’s regular meetings is used to inform subsequent product releases in order to provide clients with the best possible starting point for their internal rating systems.

The platform differs significantly from many other commercially available products as it incorporates the judgments of credit officers into its ratings. Supporting the inclusion of judgment within the platform allows this be more consistently structured and better controlled. We believe that the inclusion of judgment within ratings is considered important by both the regulators<sup>4</sup> as well as the banks themselves. Treacy and Carey<sup>5</sup> summarize this view very succinctly: “Many

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<sup>1</sup> The document referred to herein is the “International Convergence of Capital Measurement and Capital Standards: a Revised Framework” issued by the Basel Committee on Banking Supervision, dated June 2004. It is available at [www.bis.org/bcbs](http://www.bis.org/bcbs).

<sup>2</sup> Moody’s KMV Expected Default Frequency™ (EDF™) credit measures are powerful, forward-looking default probabilities for public and private companies. They lend themselves to precise decision-making and can be incorporated into valuation and portfolio models. EDF credit measures have been extensively validated on defaults and credit spreads and have become the de facto standard for lenders and investors.

<sup>3</sup> Both Risk Advisor and RiskAnalyst perform similar functions. Risk Advisor is a client server application whereas RiskAnalyst is implemented using a thin-client architecture.

<sup>4</sup> For example see the remarks on paragraph 417 below.

<sup>5</sup> William F. Treacy and Mark S. Carey, “Journal of Banking & Finance,” Volume 24, Issues 1-2, January 2000, Pages 167-201.

banks use statistical models as an element of the rating process, but banks generally believe that the limitations of statistical models are such that properly managed judgmental rating systems deliver more accurate estimates of risk. Especially for large exposures, the benefits of such accuracy may outweigh the higher costs of judgmental systems. In contrast, statistical credit scores are often the primary basis for credit decisions for small lending exposures such as consumer credit.”

## **2 HELPING BANKS COMPLY WITH THE ACCORD**

The Moody’s KMV internal rating platform can accommodate a wide variety of risk rating models. Specifically, it is used to deploy risk models across a bank’s local and global lending network and to manage the data requirements of the credit rating process. Banks around the world are making the platform a critical component of their credit risk process as they prepare for Basel II compliance.

Basel II is divided into three compliance approaches: a Standardized approach and two variations of the Internal Ratings-Based (IRB) approach, known as Foundation and Advanced. This paper addresses the two IRB approaches together, as they provide similar treatment in the areas addressed by the Moody’s KMV platform.

### **2.1 Probabilities of Default**

The core of the IRB approach is to encourage banks to differentiate borrowers based on risk. Under this approach, banks will categorize their borrowers into corporate, banks, sovereigns, retail, specialized lending, and equity. The method is based on an internal estimation of probabilities of default (PD) for each borrower. For banks pursuing Advanced IRB compliance, it will also include estimation of Loss Given Default (LGD) and Exposure at Default (EAD) for each transaction. In addition, there are standards for treating risk mitigation vehicles such as guarantees and credit derivatives.

The Moody’s KMV internal rating platform creates Borrower Ratings, which are relative measures of a borrower’s creditworthiness that can be mapped by a bank to a risk grade and then to a PD with internal data. A bank is able to use the mapping approach that best meets its needs. The platform also supports the use of EDF credit measures, such as those from RiskCalc, as inputs along with financial and non-financial variables entered by the credit analyst into the bank’s risk rating methodology.

The next section discusses how the platform helps banks meet the proposed rules for corporate exposures. The final section discusses how the platform enables banks to achieve the minimum requirements for Basel II compliance.

### **2.2 Rules for Corporate Exposures**

The rules drawn up by the Committee, presented in Section III C of the framework, are grouped into two sections: risk-weighted assets and risk components. Our focus is risk components, which include: probability of default (PD), loss given default (LGD), exposure at default (EAD), and effective maturity (M).

While this section of BIS II covers rules for corporate exposures, specialized lending, and sovereign and bank exposures, the following discussion focuses on corporate exposures.

Para.	Description of Requirements	Moody's KMV Comments
<b>Probability of Default</b>		
285 <sup>6</sup>	For corporate and bank exposures, the PD is the one-year PD associated with the internal borrower grade to which that exposure is assigned or 0.03%, whichever is greater.	The platform provides a framework from which an internal grade can be derived for each borrower. This grade can be mapped to a PD using a flexible method specified within the platform. Moody's KMV provides a calibration service that helps banks create such a mapping. A floor of 0.03% is applied to all corporate PDs.
<b>LGD - Foundation IRB Approach</b>		
287-290	For unsecured claims and claims with unrecognized collateral, LGDs of 45% and 75% should be used, depending on whether the claim is senior or subordinated. Four types of collateral are recognized: <ul style="list-style-type: none"> <li>• Financial collateral</li> <li>• Receivables</li> <li>• Commercial and residential real estate (CRE/RRE)</li> <li>• Other collateral</li> </ul>	The platform distinguishes between senior and subordinated facilities, allocating the required LGD to any unsecured part of a facility. It also supports the distinction between eligible and ineligible collateral. Ineligible collateral is automatically removed from the calculations. Collateral types, eligibility criteria, and seniority levels for facilities are all configurable. This solution helps banks evaluate all four collateral types.

<sup>6</sup> These numbers refer to paragraphs within the "International Convergence of Capital Measurement and Capital Standards: a Revised Framework" issued by the Basel Committee on Banking Supervision, as referenced on page 1.

Para.	Description of Requirements	Moody's KMV Comments
130-135, 145-147, 151-152, 166-169	<p>Banks must calculate adjusted exposure to take the effect of collateral into account.</p> <p>Haircuts should be used to adjust collateral value to account for the volatility of financial collateral and fluctuations in exchange rates.</p> <p>The size of the haircut will depend on the type of collateral, the frequency of marking to market, and revaluation.</p> <p>Either standard regulatory haircuts or own-estimate haircuts may be used.</p> <p>Various eligibility criteria are applied, and the haircuts vary by collateral type.</p>	<p>The platform implicitly adjusts exposure by segmenting it into portions covered by different collateral and guarantee types, with any remaining exposure left as unsecured.</p> <p>It captures detailed information about each item of collateral and automatically applies eligibility criteria to determine the appropriate haircut.</p> <p>The architecture is highly configurable, allowing collateral factors, eligibility criteria, and haircuts, together with adjustments for lending type and revaluation criteria, to be amended as required by each bank.</p>
140-142, 195, 302-305	<p>If guarantees and credit derivatives satisfy certain criteria, the credit protection they provide may be taken into account.</p> <p>A range of guarantors and credit protection providers are recognized.</p> <p>These are sovereigns, public sector entities, banks and securities firms, and other entities with a PD equivalent to a rating of at least A-.</p> <p>A substitution approach will be applied, per the 1988 accord. This means that the risk weight of the guarantor is substituted for the risk weight of the borrower; the PD will be the guarantor's and the LGD will be associated with the guarantee.</p> <p>If the guarantee does not cover the entire facility, only the part of the facility covered by the guarantee receives the lower risk weight. The remainder of the facility is assigned the risk weight of the underlying obligor.</p> <p>Guarantees will only be recognized if they are provided by entities with lower risk weights than the counterparty.</p>	<p>The platform, as delivered, supports the mitigating effects of guarantees but not credit derivatives.</p> <p>It captures information about each guarantee entered and determines eligibility based on type.</p> <p>For corporate guarantees, it ensures that the guarantor PD is at least 9 basis points<sup>7</sup> (0.09%).</p> <p>In addition, this solution compares the guarantor's PD and LGD to those of the counterparty to determine eligibility.</p> <p>It does not calculate risk-weighted assets but supports guarantee substitution by determining the part of the exposure covered by guarantees and the part covered by collateral or left unsecured.</p> <p>The platform determines the part of the exposure covered by each guarantee and stores the guarantee PD and LGD alongside.</p> <p>For the non-guaranteed part of the exposure, it determines a standalone LGD.</p>
150	<p>If the collateral is a basket of assets, the haircut will be a weighted average.</p>	<p>The platform applies the appropriate haircut to each asset to determine the portion of the exposure covered by the asset. Summing these portions determines the value of the basket after applying the weighted average haircut.</p>
154	<p>Supervisors may permit banks to calculate haircuts using their own estimates.</p>	<p>All the parameters are configurable. Therefore, they may be amended to fit the bank's own estimates.</p>

<sup>7</sup> This value is configurable by the institution based on guarantor type.

Para.	Description of Requirements	Moody's KMV Comments
166-169	<p>Depending on the nature and frequency of the revaluation and remarking provisions, different holding periods are appropriate for some transactions. The framework distinguishes between repo-style transactions, other capital market-driven transactions, and secured lending. Formulas are provided to transform haircuts from one basis to another.</p>	<p>The transformation formulas are implemented within the platform with configurable values for the minimum holding period, revaluation period, and holding period used to determine the haircuts. In the platform as initially configured, these are set to 20 days, 1 day, and 10 days, respectively. This coincides with the minimum holding period for secured lending and the holding period associated with the supervisory haircuts.</p>
295-296	<p>The current value of the collateral received as a proportion of the EAD must exceed a minimum collateralization level. This level is dependent on the type of collateral. If the value is not exceeded, the facility will receive an LGD associated with an unsecured facility. If a pool of collateral is used, the facility will be subdivided into portions covered by only one CRM type. When calculating the portion for eligible financial collateral, the associated haircut(s) must be applied first. The value of eligible financial collateral and receivables should be deducted from the exposure to derive a reduced exposure. The sum of the real estate and other collateral should then be compared to the reduced exposure to determine whether the minimum collateralization level has been attained. Senior exposures are divided into fully collateralized and uncollateralized portions. If the required minimum collateralization hurdle is exceeded, the collateral value is reduced by dividing it by a required level of overcollateralization. The RWA for each fully secured portion of the exposure must be calculated separately.</p>	<p>The platform divides the facility into portions, each covered by a guarantee, an item of eligible collateral, or unsecured. A minimum collateralization level is associated with each item of collateral. It uses this to identify collateral items to which the minimum collateralization hurdle applies. In order to determine the minimum collateralization hurdle, the guarantee values and collateral with a zero minimum collateralization level (eligible financial collateral after the appropriate haircut and receivables) are deducted from the EAD to determine the adjusted exposure. The minimum collateralization hurdle is the product of this adjusted exposure and the minimum collateralization level for the other collateral items (e.g., 30%). For the facility, the platform determines the total value of collateral with a non-zero minimum collateralization level (real estate and other collateral). This value is compared to this hurdle value to determine whether the collateral is eligible. It also applies the required level of overcollateralization to each item of collateral. This is configurable by collateral type and is represented as a haircut within the system (overcollateralization level = <math>1/(1 - \text{haircut})</math>). Separate LGDs are calculated for each CRM, allowing the RWA for each portion of the exposure to be calculated separately.</p>

<b>LGD - Advanced IRB Approach</b>		
297	Subject to certain minimum requirements, supervisors may permit banks to use their own internal estimate of LGD. This must be measured as the LGD as a percentage of EAD.	The platform model provides a configurable architecture based around the methodology incorporated into the Foundation approach. LGDs are measured in both cash terms and as a percentage of the EAD. As such, if a bank's Advanced methodology broadly follows that laid out in the Foundation approach, the platform will support the implementation of its model without the need for additional customization. If not, then customization will be required.
306-307	Banks using the Advanced IRB approach may reflect the presence of risk mitigating effects of guarantees and credit derivatives by adjusting either PD (as per the Foundation approach) or LGD estimates to reflect the presence of the guarantee or credit derivative.	As described above, this solution supports PD adjustments to reflect the risk-mitigating effects of guarantees. In addition, a configuration option is available to allow guarantees to be considered after the mitigating effects of collateral are evaluated. This configuration option would allow the guarantee to be used to reduce the LGD, or part or all of the unsecured portion of the facility, depending on the guarantee limit and expected realization.
<b>EAD - Foundation IRB Approach</b>		
311-314, 82, 85, 1988 Accord Annex 3	Off-balance sheet items will be converted to credit exposure equivalents through the use of credit conversion factors (CCFs). Different CCFs are applied, depending on the facility type and original maturity. The amount to which the CCF is applied is the lower of the value of the unused credit commitment line and a value that reflects any possible constraints on the facility. If the facility is unconditionally and immediately cancelable, a zero-percent CCF may be applied. Monitoring requirements apply in order for the bank to recognize reductions in EAD due to constrained and immediately cancelable facilities.	The platform splits the facility into a used and an unused portion. Adjustment factors (CCFs) are specified for both portions, and support the calculation of the EAD. These factors are driven by facility type, original maturity, and whether the facility is immediately cancelable. The platform, as delivered, does not explicitly support constraining of facilities. However, the constrained limit can be specified as the facility limit.
<b>EAD - Advanced IRB Approach</b>		
316	Banks that meet the minimum requirements will be allowed to use their own estimates of CCFs, provided that the exposure is not subject to a CCF of 100% in the Foundation IRB approach.	The EAD calculation architecture is highly configurable. The CCFs or adjustment parameters can be changed, as can the facility types and other drivers that determine which CCF to use.

Effective Maturity		
318-322	Under the Foundation IRB approach, effective maturity will be 2.5 years except for repo-style transactions. Under the Advanced IRB approach, a time weighted cash flow formula is generally used to determine effective maturity, where possible. For many facilities, a floor of one year applies. Under some circumstances, facilities for smaller corporate borrowers may be exempt from this requirement.	The platform, as delivered, does not calculate effective maturity. This can be addressed as part of a customization if required.

## 2.3 Minimum Requirements for Corporate Exposures

The Committee has proposed twelve broad requirements that banks must meet in order to qualify for the IRB approach. Each requirement relates to a different aspect of the rating and risk measurement process. Ten are relevant to the platform: composition of minimum requirements, compliance with minimum requirements, ratings system design, rating system operations, corporate governance and oversight, use of internal ratings, risk quantification, internal validation, supervisory LGD and EAD estimates, and disclosure.

### 2.3.1. Requirement 1: Composition of Minimum Requirements

Para.	Description of Requirements	Moody's KMV Comments
389, 391	Risk estimation and its relation to the bank's risk rating system must provide meaningful, reasonably accurate differentiation of risk. All IRB banks must produce their own estimates of PD.	By incorporating both financial and judgmental data into each rating decision, the platform gives banks the power to differentiate borrower risk across a number of important dimensions, including financial metrics (e.g., liquidity, capital structure, and operations) and judgmental factors (e.g., competitive position, management quality, and customer mix).
	IRB banks have the option of generating their own PDs for specialized lending (SL), <sup>8</sup> primarily project finance, asset-based lending, and commercial real estate loans or they can rely on the supervisory slotting methodology that is provided to measure SL loan risk.	Its flexibility allows banks to incorporate many types of risk rating models in the software, including those used to measure the risk of SL assets and other types of loans where determining loss characteristics requires a different framework from traditional corporate lending.

<sup>8</sup> See paragraphs 187-196, 218-220, and 244-253 for further details.

## 2.3.2. Requirement 2: Compliance with Minimum Requirements

Para.	Description of Requirements	Moody's KMV Comments
392	Banks' credit risk management practices must be accepted by the Committee and national supervisors.	The platform has been used by institutions around the world to rate millions of credits. Many utilizing it have received approval from regulatory supervisors on their credit risk management practices. The Moody's KMV Risk Advisor Advisory Group (MRAAG) helps ensure that this solution utilizes industry best practices to produce risk assessments for single obligors.

## 2.3.3. Requirement 3: Rating System Design

Para.	Description of Requirements	Moody's KMV Comments
395	A bank may utilize multiple rating methodologies/systems within each asset class. Banks must not allocate borrowers across rating systems inappropriately to minimize regulatory capital requirements (i.e., cherry picking by choice of rating system).	The platform allows banks to use multiple risk rating models in the same installation. Configurable installation and account management utilities can be set to present the models that are appropriate to the type of borrower being rated.
<b>Rating Dimensions</b>		
396	The rating system must have two dimensions. The first is an estimate of the risk of borrower default. The second is an estimate of transaction- or facility-specific risk.	It produces a two-dimensional rating that consists of borrower and LGD ratings. The borrower rating provides an assessment of the quality of the firm under analysis and is independent of transaction details. The LGD rating considers facility features and any associated credit risk mitigants.
397	Banks must document the relationship between a borrower grade and its level of risk, particularly the grade's PD and the criteria used to assign that PD.	Moreover, the platform enables each bank to develop and enforce a borrower grade scale with specific definitions or categories of risk. As part of the installation process, Moody's KMV can assist in determining the levels of PD associated with each risk grade.
399	For banks adopting the Advanced IRB approach, facility ratings must exclusively reflect LGD. This assessment can include any and all aspects that impact the value of a facility.	The platform's LGD ratings assess the relative riskiness of a loan's facility. They encompass financial and non-financial aspects of the facility and associated collateral and guarantees, and provide for a comprehensive view of recovery risk.
<b>Rating Structure</b>		
403-404	For borrower and facility ratings, there must be no excessive concentrations of borrowers in any risk grade. Ratings systems must have a minimum of seven passing grades and one for loans in default.	This solution presents assessments from rating models on a continuous, relative scale that can be adjusted by the bank. The bank can map rating model scores to its own grading system, which allows as many individual grades as it requires. Moody's KMV can help fine-tune this mapping during installation.

<b>Rating Criteria</b>		
410	Banks must have specific ratings definitions that are used to assign grades to borrowers and exposures. The definitions must be intuitive and result in a meaningful differentiation of risk.	The system provides a highly structured and secure approach, ensuring that the analyst can consider and document key criteria. It uses a consistent process to analyze these criteria, leading to an intuitive assessment of the borrower's risk profile.
	Each grade must be clearly described to permit consistent, reliable application throughout the bank and across lines of business.	The platform allows articulation of credit policy in terms that are consistent with those used by the bank and supported by the credit culture.
411	Banks must take all relevant, available information into account when assigning ratings to borrowers and facilities. Information must be current.	The platform can combine financial statement data and associated performance ratios with judgmental factors not found in financial reports. Banks can re-rate borrowers or transactions as often as deemed necessary to ensure that current information informs the risk rating.
	An external rating can be the primary factor determining an internal rating, but the bank must consider other relevant information.	Banks can deploy risk rating models that use external ratings and other risk metrics in combination with additional information on the borrower to generate a composite risk rating.
<b>Assessment Horizon</b>		
414-415	Although banks must generate one-year PD estimates for each risk rating, they must use a longer time horizon to assign the rating. In particular, they must evaluate each borrower's ability to meet obligations under unforeseen events. This requirement can be met by incorporating stress scenarios in ratings assignments or taking into account characteristics that reflect the borrower's vulnerability to unexpected events.	The platform can incorporate judgmental factors such as management quality, quality of earnings, relationships with suppliers, and market position to form a forward-looking risk assessment. These factors can address a borrower's ability to meet obligations in times of financial duress. Importantly, banks can easily customize this solution to include the judgmental factors they feel best represent a borrower's ability to repay.

Use of Models		
417	While credit scoring models and other mechanical procedures are permissible as primary drivers of risk assessments, sufficient human judgment is necessary to ensure that all relevant information is considered. When combining models with human judgment, the judgment must take into account all information not addressed by the model.	The platform supports the use of credit scoring models and other external assessments of risk as inputs for a risk rating model. It can incorporate these measures with judgmental and other data elements in a rating model.
	The bank must have a process for validating data inputs for a statistical default model and an assessment of the accuracy, completeness, and appropriateness of the resulting risk ratings. The bank must also have procedures for human review of the model and a regular cycle for model validation.	Moody's KMV Modeling Services can help banks verify the predictive power of their risk rating systems. Additionally, pre-packaged models are updated frequently based on feedback from the Moody's KMV Risk Advisor Advisory Group (MRAAG).

2.3.4. Requirement 4: Risk Rating System Operations

Para.	Description of Requirements	Moody's KMV Comments
422	Each corporate, sovereign, and bank borrower and facility must be assigned a rating as part of the loan approval process.	The platform supports interaction between individuals involved in the rating process and facilitates their understanding of assessments through electronic case files and summary reports.
424	Rating assignments and periodic rating reviews must be completed by a function that does not stand to benefit from the extension of credit. The process must be documented.	Explanation reports combined with an intuitive analysis structure facilitate an understanding of the derivation of platform assessments.
425	At a minimum, borrowers and facilities must have their ratings refreshed annually. A rating review must be initiated if material information on the borrower or the facility comes to light.	Use of electronic case files facilitates manual or automatic re-rating as required. Updated financial statements can be put through the system automatically in batch mode to allow frequent re-evaluation of the portfolio. New judgmental information available on a borrower can be added to a case to determine a revised rating quickly.

Para.	Description of Requirements	Moody's KMV Comments
426	The bank must have an effective process to obtain and update relevant and material information on the borrower's financial condition, and on facility characteristics that affect LGDs and EADs such as the condition of collateral. Once a rating is determined, the bank needs a procedure to update it in a timely fashion.	Financial Analyst can store unlimited financial statement information on borrowers for any length of time. This information is transferred automatically to the platform for use in risk rating models. The platform provides a tool for the capture and maintenance of data about facilities, credit risk mitigants, and the relationships between them. Moody's KMV Professional Services Division, which provides customized services, can create links between the platform and other systems in the institution.
428	Banks must have clear guidelines and procedures on ratings overrides. They must clearly document any overrides and separately track repayment performance.	Any overrides to a risk assessment are clearly identified and notes can be added to the system to explain the justification. It stores both the revised rating and the overridden (i.e., original) rating in the case history.
429	Banks must collect and store data on key borrower and facility characteristics that influence the risk rating assigned, as well as the revised rating and any rating migration. This data will serve as the basis for supervisory reporting.	Data is stored on two levels: borrower and portfolio. At the borrower level, it stores all account information supplied to Financial Analyst, and judgmental evaluations entered by the credit analyst.
430	Banks must retain ratings histories on borrowers and guarantors from the time ratings are assigned. Key data required includes dates and resulting ratings of risk assessments, the methodology and key decision inputs used in deriving the ratings, and the person or model responsible. The identity of borrowers that default, a description of the associated facilities, and the timing and circumstances leading to defaults must be retained. Banks must also retain the PDs and realized default rates associated with ratings grades and ratings migrations in order to track the predictive power of the rating system.	Users can also store and track facility data and link facility information back to the borrower. Overrides and notes are also stored at this level. All information contributing to a risk rating for a borrower or a facility is captured and stored by the archive functionality. At the portfolio level, the platform gives a bank comprehensive reporting functionality that can be used for many purposes, from understanding exposures across the risk-rating curve, to deriving portfolio quality, to assessing historical trends.
431	Banks using the Advanced IRB approach must also collect and store similar data on the LGD and EAD estimates associated with each facility.	The system can also store information relating to statistical PD assessments, facility information, and transaction ratings. The database architecture is very flexible and can be amended by the bank as required.

Para.	Description of Requirements	Moody's KMV Comments
434-436	An IRB bank must have sound stress testing processes in place for use in assessing capital adequacy. This testing should include potential ratings migration and the effect of deterioration of the credit environment on the bank's risk ratings. Additionally, banks should track any potential external ratings migrations on held credits.	Moody's KMV can help banks set up and run stress tests on a lending portfolio by utilizing data captured by, and rating models deployed in, the platform. In addition, the solution allows users to project financial statement information forward under different scenarios. This can facilitate the analysis of each borrower under stressed conditions

### 2.3.5. Requirement 5: Corporate Governance and Oversight

Para.	Description of Requirements	Moody's KMV Comments
438-440	All material aspects of the rating and PD estimation process must be understood and approved by the Board of Directors, management committee, and senior management. Management must continuously ensure that the rating system is operating properly. Internal ratings must be a significant part of this reporting. Reports must include risk profile by grade, ratings migration, estimation of relevant parameters per grade, and comparison of realized default rates against expectations.	The platform does not currently store loss or default information. In order to produce these reports, the bank would need to combine data from the platform portfolio with data from other sources.
441	The bank must have an independent credit review function that is responsible for the design, implementation, and performance of the internal rating system. This function must: <ul style="list-style-type: none"> <li>• Test and monitor internal grades;</li> <li>• Produce and analyze: reports on the outputs of the bank's internal rating system, historical data on credit performance by internal grade, migration analyses, comparison of assigned grades to external ratings or default prediction models, and aggregate monitoring of credits in each grade by key rating criteria;</li> <li>• Verify that rating definitions are applied consistently across departments and geographical areas;</li> <li>• Review and document any changes to the rating process and the reasons for the changes; and</li> <li>• Review the rating criteria to determine if they remain predictive of default.</li> </ul>	The system stores all data relating to rating model inputs and outputs each time a borrower is rated. This information, used in conjunction with other data at the bank, provides the foundation for reviewing the effectiveness of the rating model and its calibration to level of risk per rating grade.

Para.	Description of Requirements	Moody's KMV Comments
442	The credit risk unit must assume responsibility for, and control of, any model used in the rating process.	The platform also permits updating and customization of the assessment methodology as necessary.
443	The bank must internally audit and document its rating system, including quantification of internal ratings, at least annually. In some cases, an external audit may also be required.	Portfolio level reports can be run in the platform to monitor patterns and trends in rating inputs. This capability would support, for example, identification of any bias in the creation of ratings. Alerts and advisories produced by the system may also be used to identify possible inconsistencies.

### 2.3.6. Requirement 6: Use of Internal Ratings

Para.	Description of Requirements	Moody's KMV Comments
444	Internal ratings and their corresponding default and loss estimates must play an essential role in credit approvals, risk management, internal capital allocations, and corporate governance processes at banks using the IRB approach.	The platform is configured and calibrated to the bank's internal credit culture, policies, and experience. It is typically part of a bank's loan approval process and made available to each loan officer in the bank. This approach assures management that consistent and reasonable methods are being used to rate borrower and facility risk.

### 2.3.7. Requirement 7: Risk Quantification

Para.	Description of Requirements	Moody's KMV Comments
	All banks using the IRB approach must estimate a PD for each internal borrower grade. These estimates must incorporate all relevant and available data and methods.	
<b>Requirements for PD Estimates</b>		
446-447, 452-453	<p>PD estimates must be a long-run average of one-year realized default rates for borrowers in the grade. Estimates must be grounded in historical experience and empirical evidence. Banks must review their estimates at least annually.</p> <p>All banks using the IRB approach must estimate a PD for each internal borrower grade. These internal estimates must incorporate all relevant and available data and methods.</p> <p>To ensure consistent estimation of risk across banks and data sources, a default is always defined as involving one or more of the following:</p> <ul style="list-style-type: none"> <li>• It is determined that the borrower is unlikely to pay its debt obligations (principal, interest, or fees) in full;</li> <li>• The borrower is past due more than 90 days on any credit obligation;</li> <li>• The bank puts the credit obligation on non-accrued status;</li> </ul>	The platform can be configured to allow the calibration of risk rating models to any definition of default used by the bank.

Para.	Description of Requirements	Moody's KMV Comments
	<ul style="list-style-type: none"> <li>• There is a charge-off, specific provision, or distressed restructuring involving the forgiveness or postponement of principal, interest, or fees;</li> <li>• The bank sells the credit obligation at a material credit-related adverse loss;</li> <li>• The bank consents to a distressed restructuring of the credit obligation; or</li> <li>• The borrower has filed for bankruptcy or similar protection from creditors.</li> </ul>	
461-462	<p>To estimate PDs, banks may use one or more of the methods described below. They must recognize the importance of judgmental considerations when combining results of different techniques, and adjust for limitations of techniques and information.</p> <ul style="list-style-type: none"> <li>• Internal default experience: The bank must demonstrate that estimates are reflective of underwriting standards. When using pooled data, the bank must demonstrate that the data is comparable with its own.</li> <li>• Mapping to external ratings: For rated credits, banks may map their internal grades to the scale used by an External Credit Assessment Institution (ECAI). The bank can then attribute the default rate observed from the ECAI to its grades. The basis for the mapping must be documented.</li> <li>• Using a statistical default prediction model: A bank can use a statistical default prediction model but should prove that the population of borrowers closely matches the population of the model's sample.</li> </ul>	<p>Viewed from a portfolio perspective, the platform's borrower ratings represent a rank ordering of cases on a continuous scale. For IRB compliance, this scale must be divided into several distinct grades, with an average PD for each grade. Borrower ratings must be mapped to the appropriate internal grade. This mapping will likely be non-linear to ensure the required spread of risk across the grades. Although the Committee allows banks to use a single method to calibrate its loans to PDs, the experience of Moody's KMV in calibration and validation shows that it is important to use all available information in making these estimates.</p>
463	<p>Irrespective of how a bank derives its PDs, the underlying historical observation period must be at least five years for at least one data source.</p>	<p>It may take many years for some institutions to accumulate a sufficient number of defaults for calibration purposes, in which case limited pooling of data may be a viable alternative, provided that all the banks in the pool have similar borrower rating portfolio profiles. The platform provides a framework to ensure that rating underwriting standards remain consistent over time.</p>

<b>Requirements for LGD and EAD Estimates</b>		
468-470	<p>A bank must estimate an LGD for each facility that reflects economic downturn conditions, where necessary, to capture relevant risks. The bank must consider any interdependence between the risk of the borrower and the risk of the collateral or collateral provider. Any interdependence must be addressed in a conservative manner.</p> <p>Any currency mismatch must also be treated conservatively. LGD estimates must be based on historical recovery rates and not just on the collateral's estimated market value.</p>	<p>This solution provides a configurable architecture that allows a bank to calculate LGD at the facility level and determine key factors specific to the type(s) of collateral. This allows it to determine eligibility criteria, haircuts, and LGD values specific to the collateral. The platform, as delivered, does not explicitly support currency mismatches. It can be used to capture data pertinent to aspects of collateral and guarantees that could be used to estimate future LGD values. The platform presents the user with relevant questions about each CRM that may be correlated with recovery values. These questions can be amended by the bank to suit its view of which data is relevant to this task.</p>
474, 476	<p>For balance sheet items, banks must estimate EAD at no less than the current drawn amount. The additional minimum requirements for the Advanced approach revolve around off-balance sheet items, excluding derivatives. Estimates of EAD must be provided for each facility type. Where estimates differ by facility type, the delineation of the facilities must be clear and unambiguous.</p> <p>The criteria by which estimates are derived must be plausible and intuitive, and represent what the bank believes to be the material drivers of EAD.</p>	<p>The platform provides a configurable interface to capture information on each facility. This interface should support differentiation between facility types and allow the bank to collect data to support future models.</p> <p>Based on the information captured by the platform, different parameters or CCFs can be used to adjust the facility values to determine the EAD.</p>

### 2.3.8. Requirement 8: Validation of Internal Estimates

<b>Para.</b>	<b>Description of Requirements</b>	<b>Moody's KMV Comments</b>
500-503	<p>Banks must have a robust system in place to validate the accuracy and consistency of rating systems, processes, and all relevant risk components.</p> <p>Banks must regularly compare realized default rates with estimated PDs for each grade and be able to demonstrate that the realized default rates are within the expected range for their grade. This analysis must be done at least annually.</p> <p>Banks should quantitatively validate their rating systems based on long data histories, and covering a range of economic environments and, ideally, a complete business cycle.</p> <p>Banks must ensure that validation methods do not vary systematically with the economic cycle. Changes in method and data used must be thoroughly documented.</p>	<p>Borrower ratings in the platform are well documented and available for back-testing and internal validation on an ongoing basis. The financial index portion of the standard analysis has been subjected to external validation tests, but judgmental inputs can only be validated internally.</p> <p>The modularity of the model allows changes to be controlled and their impact understood. Moody's KMV Modeling Services is used by banks around the world to measure the accuracy of their rating models and link model outputs to real measures of risk, such as PDs.</p>

### 2.3.9. Requirement 9: Supervisory LGD and EAD Estimates

Para.	Description of Requirements	Moody's KMV Comments
506	Banks using the Foundation IRB approach that do not meet the requirements for own-estimates of LGD and EAD must meet the minimum requirements described in the standardized approach to be recognized for eligible financial collateral (as set out in Section II.D: The standardized approach - credit risk mitigation).	These requirements are discussed in detail above.
507, 509	Eligible CRE or RRE for corporate exposures is defined as collateral where the risk of the borrower is not materially dependent upon the performance of the underlying property or project, and the value of the collateral pledged is not materially dependent on the performance of the borrower. The valuation must be at or less than current market value, the bank is expected to monitor the value of the property frequently, and a professional valuer must evaluate the property when information indicates that the property value may have declined materially relative to current market prices. In some countries, eligible collateral will be restricted to properties where the bank has a first charge.	The platform uses specific questions to verify the independence of collateral and borrower. If these questions reveal a dependence, the collateral is considered ineligible. It also captures information on the valuer, valuation date, and the rank of the charge. However, the platform as delivered does not use this information when calculating the eligibility criteria.
511	Eligible financial receivables are those with claims with an original maturity less than or equal to 1 year.	The platform ensures that all IRB eligibility criteria are properly enforced.
518-519	The bank must maintain a continuous monitoring process that is appropriate for the specific exposures. It should include financial analysis of both the borrower and the issuer of the receivables. The receivables pledged should be diversified and not unduly correlated with the borrower. Where the correlation is high, attendant risks should be taken into account when setting margins. Receivables from affiliates will not be recognized as risk mitigants.	The platform specifies the collateral type as debtors or receivables of less than one year. It captures information on debtor company type including heavily dependent, same industry, and affiliate debtors. In the platform as initially configured, receivables from affiliates are ineligible. The platform performs a financial assessment of the borrower as part of its borrower analysis.

Para.	Description of Requirements	Moody's KMV Comments
521-522	<p>Supervisors may allow for recognition of the credit risk mitigating effect of certain other physical collateral. Each supervisor will determine which, if any, collateral types meet the following standards:</p> <ul style="list-style-type: none"> <li>• Existence of liquid markets for disposal in an expeditious and efficient manner.</li> <li>• Existence of publicly available market prices for the collateral.</li> </ul> <p>The valuation must be at or less than current market value, the bank is expected to monitor the value of the property frequently, and a professional valuer must evaluate the property when information indicates that the property value may have declined materially relative to current market prices. Generally, the bank must have a first claim on the collateral with the exception of certain preferential creditors such as tax authorities and employees. In addition, in the case of inventories and equipment, the periodic evaluation must include physical inspection.</p>	<p>The platform provides a number of other collateral types, which need to be reviewed by each bank to determine local eligibility. The platform ensures that other collateral with prior liens are ineligible, as is inventory where no physical inspection has been performed. It also captures information on the valuer and valuation date, but these do not feed the eligibility criteria.</p>

### 2.3.10. Requirement 10: Disclosure

Para.	Description of Requirements	Moody's KMV Comments
537	<p>Banks must meet the disclosure requirements of Pillar III to qualify for IRB treatment. These include:<sup>9</sup></p> <p>Supervisor's acceptance of the approach to risk rating;</p> <p>Explanation and review of the risk rating system, its linkages to PDs by risk grade, and process for managing credit migration;</p> <p>Description of the internal rating processes for each portfolio;</p> <p>Actual losses for the preceding period and how this compared with expectations; and</p> <p>Performance assessment of the internal rating process for each portfolio.</p>	<p>Extensive online and written documentation, explanation facilities, and portfolio reporting capabilities support the bank's internal disclosure effort.</p>

<sup>9</sup> See paragraph 825-826 for further details.

### 3 CONCLUSION

The IRB regulations of Basel II present significant challenges; banks that are committed to achieving compliance will have to invest considerable time and financial resources in this process. At the same time, these organizations have a critical opportunity to go beyond the basic requirements and make fundamental improvements to their credit risk rating systems.

The Moody's KMV platform can enhance this effort through:

- Ready-to-use infrastructure for compliance with the Basel II IRB approach.
- Flexible framework for the implementation of borrower rating models across different industries.
- Framework for Basel II facility ratings.
- Robust, centralized data storage capability.