

MODELING METHODOLOGY

IFRS 9 Impairment Regulations: Implementation Challenges and Potential Solutions

Authors

Eric Bao
Maria Buitrago
Jun Chen
Yanping Pan
Yashan Wang
Jing Zhang
Janet Zhao

Acknowledgements

We would like to thank Christopher Crossen, Cayetano Gea-Carrasco, Emil Lopez, and Nihil Patel for their comments and editorial assistance.

Contact Us

Americas
+1.212.553.1653
clientservices@moodys.com

Europe
+44.20.7772.5454
clientservices.emea@moodys.com

Asia-Pacific (Excluding Japan)
+85 2 3551 3077
clientservices.asia@moodys.com

Japan
+81 3 5408 4100
clientservices.japan@moodys.com

Abstract

As part of the response to the last financial crisis, the International Accounting Standards Board (IASB) recently issued IFRS 9. This reformed accounting standard for financial instruments is required in more than 100 countries. Improvements include a logical model for the classification and measurement of financial instruments, a forward-looking "expected loss" impairment model, and a substantially reformed approach to hedge accounting. IFRS 9 aims to streamline and strengthen risk measurement and the reporting of financial instruments in an efficient and forward-looking manner, and it will have far-reaching impacts on global institutions' accounting practices and performance results.

This paper focuses specifically on the IFRS 9 impairment model. We discuss the new requirements for measuring the impairment of financial assets, namely the expected loss model for impairment. We highlight challenges faced by institutions in interpreting the IFRS 9 requirements and meeting requirements in areas such as portfolio segmentation, thresholds for transitions among impairment stages, and calculating expected credit losses. We then lay out various solutions for overcoming these challenges leveraging Moody's Analytics expertise in credit risk modeling.

Table of Contents

1. Overview	3
2. IFRS 9: New Requirements and Challenges	5
2.1 Classification and Measurement of Financial Assets	5
2.2 Impairment Model	6
2.3 Key Challenges to Implementing IFRS 9 Impairment Requirements	7
2.3.1 Portfolio Segmentation	7
2.3.2 Determining Significant Changes in Credit Quality	8
2.3.3 Expected Credit Loss Calculation	9
3. Potential Solutions for IFRS 9 Impairment Model Implementation	10
3.1 Portfolio Segmentation	10
3.2 Determining Significant Changes in Credit Quality	10
3.3 Expected Credit Loss Calculation	12
3.3.1 PD Models	12
3.3.2 LGD Models	14
3.3.3 EAD Models	15
3.3.4 Loss Rate Method	15
4. Summary	17
Appendix: Moody's Products and IFRS 9 Requirements	18
References	21

1. Overview

IAS 39 *Financial Instruments: Recognition and Measurement*, has been the international standard for determining financial assets and financial liabilities accounting in financial statements, since it was set by the International Accounting Standards Board (IASB) in 2001. This standard was widely criticized by preparers, auditors, and other users for its high degree of complexity and internal inconsistencies. The IASB has long-acknowledged the need to improve IAS 39 and to enhance its relevance and understandability.

In October 2008, the IASB and the Financial Accounting Standards Board (FASB) launched a project to address reporting issues arising from the recent global financial crisis. They established the Financial Crisis Advisory Group (FCAG) to advise the two accounting boards regarding standard-setting implications during the crisis and potential changes in the global environment afterward. FCAG considered how improvements in financial reporting could help enhance investor confidence, and it identified weaknesses in the accounting standards for financial instruments, as well as in the application of these standards. To improve the accounting and reporting of financial assets and liabilities, IASB divided this joint project into phases and published IFRS 9, designed to replace IAS 39. The IASB introduced the new classification and measurement requirements in 2009 and 2010, and a new hedge accounting model in 2013. In July 2014, the IASB finalized the impairment methodology for financial assets and commitments and published the final version of IFRS 9, which marked the completion of replacing IAS 39. The new IFRS 9 standard is now available for early adoption, with a mandatory effective date of January 1, 2018.

IFRS 9 introduces a logical approach to classifying financial assets based on cash flow characteristics and the business model in which an asset is held. This single, principle-based approach replaces rule-based requirements that were complex and difficult to apply. The new approach affects both financial and non-financial services firms. Implementing IFRS 9 poses significant challenges for financial firms, especially banks, because the new classification and measurement requirements demand a thorough assessment of financial asset classification, and the business model and contractual cash flow characteristic requirements are substantially different from IAS 39.

FCAG's July 2009 report points out two critical issues that hamper the IAS 39 standard: the delayed recognition of credit losses on loans and other financial instruments and the complexity of multiple impairment approaches for different types of financial instruments. The impairment model in IAS 39, the so-called "incurred loss" model, does not recognize credit losses until there is evidence of an impairment trigger event. According to the IASB, this delay was designed to limit management's ability to create hidden reserves during good times, which could then be used to flatter earnings during difficult times. As the financial crisis unfolded, it became clear that the incurred loss model provided much room for different types of earnings management, namely postponing losses. Even though IAS 39 did not require waiting for actual default before impairment was recognized, in practice, this often happened. The complexity of IAS 39, which used multiple impairment models for different financial instruments, was also identified as a problem by the FCAG.¹

To address the over-complexity and the "too little, too late" loan loss reserve issue arising from the incurred loss model, IFRS 9 adopts a single expected credit loss model for recognizing and measuring impairment loss, which applies to all the financial assets in scope.² The main advantage of this model is its forward-looking nature, which enables early and timely recognition of subsequent losses. The model eliminates the threshold for the recognition of expected credit losses, so that it is no longer necessary for a trigger event to occur before recognizing credit losses. Consequently, more timely information is required regarding expected credit losses. In contrast, when measuring credit losses under IAS 39, a firm only considered those losses arising from past events and current conditions. The effects of possible future credit loss events could not be considered, even when expected. IFRS 9 broadens the information a firm must consider when determining its expected credit losses. Specifically, IFRS 9 requires basing the expected credit loss measurement on the reasonable and supportable information available without undue cost or effort, which includes historical, current, and forecasted information.

IFRS 9 also covers new classification and measurement of financial assets and hedge accounting. While Section 2 of this paper provides a brief review of the new classification and measurement model for financial assets, we focus primarily on the largest changes in the new standard—the IFRS 9 impairment requirements. We discuss the methodological challenges of the IFRS 9 expected credit loss calculation implementation process and potential solutions.

PORTFOLIO SEGMENTATION

For purposes of loan loss forecasting, firms usually segment portfolios along business lines, product types, and risk characteristics. IFRS 9 requires a more granular and dynamic approach for portfolio segmentation. Firms must group financial assets based on shared credit characteristics that typically react in a similar way to the current environment, forward-looking information, and macroeconomic factors. Groupings should be re-evaluated and re-segmented whenever there is new relevant information (e.g., a

¹ The other two critical issues are: 1. the difficulty of applying fair value ("mark-to-market") accounting to financial instruments in illiquid markets, and 2. the broad range of off-balance sheet financing structures, especially in the U.S.

² Section 2 describes the scope.

change in economic conditions) or the firms' risk expectations change. Exposures must not be grouped in such a way that the performance of the segment as a whole masks an increase in a particular exposure's risk.

DETERMINING SIGNIFICANT INCREASES IN CREDIT RISK

Under IFRS 9, a portion of expected credit losses (a 12-month measure) is recognized for all relevant financial instruments³ from first origination or acquisition. In subsequent reporting periods, if a significant credit risk increase occurs, full, lifetime expected credit losses are then recognized. To determine significant credit deterioration, a firm should consider reasonable and supportable information available without undue cost or effort and then compare: 1. the risk of default as assessed at the reporting date, and 2. the risk of default as assessed at the date of initial recognition. Possible quantitative and qualitative measures for identifying significant risk increases since initial recognition include Probabilities of Default (PDs) and behavioral information. If using PD changes, we recommend assessing the logarithmic change in PDs instead of changes in raw PDs. Changes in PD-implied rating, expressed as notch differences, can serve as another option for determining significant increases in credit risk. Behavioral information can serve as the alternative measure for assessing significant increases in credit risk, if a correlation can be established between behavioral indicators and the default risk. Regardless of how increases are determined, there is a rebuttable presumption that risk has increased significantly when payments are more than 30 days-past-due.

EXPECTED CREDIT LOSS CALCULATION

IFRS 9 defines "credit loss" as an estimate of the present value of all cash shortfalls over the expected life of the instrument. A cash shortfall is the difference between the present value of the cash flows due, in accordance with the contract, and the present value of the expected cash flows. IFRS 9 stresses that the expected credit loss estimate must reflect: 1. an unbiased and probability-weighted amount determined by evaluating a range of possible outcomes; 2. the time value of money, where the expected credit losses should be discounted to the reporting date; and 3. reasonable and supportable information available without undue cost or effort at the reporting date regarding past events, current conditions, and forecasts of future economic conditions. Firms can implement different solutions for calculating expected losses, including internal models, vended models, or developing new tools. Basel and Stress Testing Models can be leveraged for IFRS 9 purposes. One challenge is including forward-looking information in estimations, which can be based on signals from macro-economic variables or from the equity or debt markets. Possible approaches for incorporating forward-looking information include transition matrices, scenario-dependent estimations, and simulation approaches.

Other challenges concern extending the one-year PD, loss given default (LGD), and exposure at default (EAD) estimations to the instrument's lifetime, for which different statistical techniques may be used. Possible methods include transition matrices, time-dependent models, separate models for different time horizons, and models that use the most up-to-date information at each point in time. Additional challenges include specific adjustments to models based on Basel requirements, such as elimination of the downturn component in LGD or EAD estimations and the discount rate adjustment.

The remainder of the paper is organized as follows:

- » Section 2 describes the new IFRS 9 classification requirements and the impairment model and various challenges anticipated during the implementation process.
- » Section 3 lists alternative solutions Moody's Analytics recommends for addressing the challenges of credit risk modeling and the expected credit loss calculation arising during the implementation of the IFRS 9 impairment model.
- » Section 4 concludes.
- » The Appendix provides a brief description of Moody's Analytics products, and how they comply with the IFRS 9 requirements.

³ There is a simplified approach for addressing lease receivables, trade receivables, and contract assets that excludes a significant financing component and uses a special, "credit-adjusted EIR" method for purchased or originated credit-impaired financial instruments.

2. IFRS 9: New Requirements and Challenges

This section describes the new IFRS 9 classification requirements and the impairment model for financial assets and various implementation challenges.

2.1 Classification and Measurement of Financial Assets

The accounting classification rule determines how institutions account for financial assets, and how they measure financial assets on an ongoing basis. Classification and measurement requirements are the foundation of financial accounting, and they provide a basis for impairment and hedge accounting.

Most international firms are required to abide by accounting standards established by the IASB. These accounting standards enable users to better understand and trust financial statements, as well as to obtain better insights into credit risk. These standards evolve over time. The current IFRS 9 standard strives to improve upon its predecessor by addressing many of the application issues related to IAS 39's multiple classification categories and measurement rules for financial assets. In an effort to improve usability, IFRS 9 eliminates the "held-to-maturity," "available-for-sale," and "loans and receivables" categories used under IAS 39. IFRS 9 requires the financial assets in scope⁴ to be classified into only one of the following three categories, based on the results from a business model test and a contractual cash flow characteristics test:

- » Amortized cost
- » Fair value through other comprehensive income (FVOCI)
- » Fair value through profit and loss (FVTPL)

The business model test examines how a firm manages its financial assets in order to generate cash flows — by collecting contractual cash flows, selling financial assets, or both. The contractual cash flow characteristic test assesses whether the contractual cash flows are solely payments of principal and interest (SPPI), where interest can comprise a return not only for the time value of money and credit risk, but also for other components such as a return for liquidity risk, amounts to cover expenses, and a profit margin. Only financial assets with such cash flows are eligible for amortized cost or fair value via other comprehensive income measurement, depending on the business model in which the asset is held. While the business model test is done at the individual instrument level, the business model is determined on a level that reflects how financial assets are managed to achieve a particular business objective. The test does not depend on management's intentions for an individual instrument and should be made at a higher aggregation level.

The implications of the cash flow test follow. If a financial asset is a simple debt instrument, and the objective of the firm within which it is held is to collect its contractual cash flows, the financial asset is measured at amortized cost. In contrast, if that asset is held in a business whose objective is achieved by both collecting contractual cash flows and selling financial assets, then the financial asset is measured at fair value on the balance sheet, and amortized cost information is provided through profit or loss. If the business model is neither of these, then fair value information is increasingly important, so it is provided both in profit or loss and in the balance sheet.

⁴ IFRS 9 covers all financial instruments within the scope of IAS 39. For the recognition and measurement of expected credit losses, IFRS 9 also includes certain loan commitments not measured at FVTPL and contract assets as defined by IFRS 15. The main financial instruments excluded from IFRS 9's scope include:

- » Investments in subsidiaries, associates, and joint ventures (as dealt with by IFRS 10, IAS 27, 28, and 32), although derivatives relating to these investments remain within the scope of IFRS 9.
- » An issuer's own equity instruments, as defined by IAS 32 (including options and warrants). This exclusion adds further importance to the distinction between debt (financial liability) and equity.
- » Leases (accounted for under IAS 17), although IFRS 9 applies to de-recognition, impairment of lease receivables, finance lease payables, and embedded derivatives, e.g., cancellation options within leases.
- » Employee benefit plans (covered by IAS 19).
- » Share-based payments (dealt with under IFRS 2), unless they fall within the criteria noted below for certain contracts to buy or sell non-financial items.
- » Rights and obligations under insurance contracts. Insurance contracts are defined in IFRS 4. IFRS 9 applies to a derivative embedded in an insurance contract, if the derivative is not itself a contract within the scope of IFRS 4
- » Contingent consideration in business acquisitions, respective of the acquirer (dealt with by IFRS 3).
- » Loan commitments, although IFRS 9 includes rules for provisions, respective of commitments to issue loans at less than market value. This exclusion does not apply where:
 - The commitment can be settled net in cash or by delivering or issuing another financial instrument, which are derivative
 - The firm designates commitments at fair value through profit or loss
 - Commitments provide a loan at a below-market interest rate

2.2 Impairment Model

The revised IFRS 9 impairment model applies to financial assets measured at amortized cost or fair value through other comprehensive income — financial assets including loans, debt securities, and trade receivables all belong to this category, loan commitments, and financial guarantee contracts not measured at FVTPL, lease receivables in the scope of IAS 17, and contract assets in the scope of IFRS 15.⁵ The revised impairment model aims to provide users of financial statements with more transparent and useful information regarding expected credit losses on financial instruments.

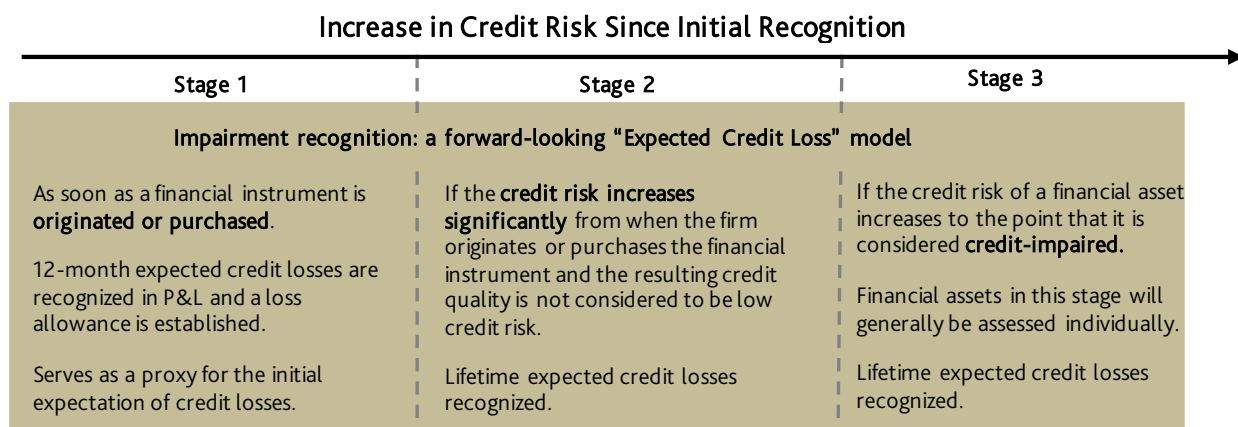
Under the IAS 39 “incurred loss” model, impairment is measured differently, depending on how a financial instrument is classified. This IAS 39 treatment was criticized during the recent financial crisis. For example, the same credit-impaired debt security could have an impairment, calculated based on either market prices or on contractual cash flows, because it was classified as “available-for-sale” or “held-to-maturity,” respectively. Under the new IFRS 9 model, measurement of impairment is the same, regardless of instrument type and classification.

The IFRS 9 requires recognition of loss allowance for expected credit losses at all times and updating its amount, recognized at each reporting date, to reflect changes in the credit risk of financial instruments in scope. IFRS 9 provides three approaches for recognizing the impairment loss of the financial assets:

- » A general “three-bucket” approach for regular financial instruments
- » A simplified approach for lease receivables, trade receivables, and contract assets without a significant financing component
- » A special, “credit-adjusted Effective Interest Rate (EIR)” method for purchased or originated credit-impaired financial instruments

Figure 1 provides a diagram of the general “three-bucket” approach.

Figure 1 IFRS 9 Three-Bucket Impairment Approach



Under the general three-bucket approach, a portion of expected credit losses (a 12-month measure) is recognized for all relevant financial instruments at origination or acquisition. In subsequent reporting periods, if there has been a significant increase in the credit risk of a financial instrument, lifetime expected credit losses are then recognized. The financial instruments transferred to Stage 3, as illustrated in Figure 1, are very similar to those exposures that have suffered individual incurred losses identified under IAS 39. In addition, financial instruments are allowed to transfer back into a better credit stage when credit risk decreases.

The simplified approach does not require firms to track the changes in credit risk, and it recognizes a loss allowance based on the lifetime expected credit losses at each reporting date, beginning from the origination or acquisition date.⁶

The special treatment for purchased or originated impaired financial instruments remains the same as under IAS 39. These financial assets are very likely to be acquired or originated at a deep discount, which already reflects the amount of future losses. In subsequent reporting periods, a firm is required to recognize the cumulative changes in lifetime expected credit loss since recognition as a loss allowance. The amount of any changes in lifetime expected credit loss is recognized as impairment gain/loss.

While IFRS 9 does not prescribe any specific method to calculate the expected credit loss, it defines “credit loss” as an estimate of the present value of all cash shortfalls over the expected life of the financial instrument. The cash shortfall is the difference

⁵ Investments in equity instruments are outside the IFRS 9 impairment model's scope, a very helpful simplification compared to the IAS 39 impairment model.

⁶ Moreover, the standard provides a practical expedient for measuring the loss allowance for short-term trade receivables by using a provision matrix.

between the present value of the cash flows due to a firm, in accordance with the contract and the present value of the cash flows that the firm expects to receive. Therefore, the "lifetime expected credit losses" are the expected credit losses that result from all possible default events over the expected life of a financial instrument; the "one-year expected credit loss" is the portion of lifetime expected credit losses that represent the expected credit losses that result from default events within the next year after the reporting date. In addition, IFRS 9 stresses that the estimate of expected credit loss must reflect the following:

- » An unbiased and probability-weighted amount determined by evaluating a range of possible outcomes. The use of an outcome based on a best- or worst-case scenario is not permitted.
- » The time value of money, where the expected credit losses should be discounted to the reporting date
- » Reasonable and supportable information available without undue cost or effort at the reporting date regarding past events, current conditions, and forecasts of future economic conditions

To calculate the expected cash shortfalls, IFRS 9 requires estimating cash flows by considering all contractual terms of the instrument (e.g., prepayment, extension, call and similar options) throughout its expected life, if the expected life can be estimated reliably. For instruments with a loan and an undrawn commitment component, and only for those instruments, the firm estimates the expected portion of the loan commitment to be drawn within the next 12 months from the reporting date, when estimating 12-month expected credit losses, or over the expected life of the loan commitment when estimating the lifetime expected credit losses. The expected credit loss is the present value of cash shortfalls between the contractual cash flows due to the firm, if the holder of the loan commitment draws down that expected amount of the loan, and the cash flows that the firm expects to receive if that expected amount of the loan is drawn.

Estimates of expected cash shortfalls for collateralized financial instruments should include the cash flows from the realization of the collateral and other credit enhancements that are part of the contractual terms and not recognized separately by the firm. For example, these estimates exclude any recoveries from credit insurance or guarantees purchased separately from the original instrument from the expected credit loss calculation.

Finally, when determining the discount rate used to reflect the time value of money for the expected credit losses, the standard requires using the original, effective interest rate to discount expected credit losses. For purchased or originated credit-impaired financial assets, the discount rate is the credit-adjusted effective interest rate. For loan commitments and financial guarantee contracts, an approximation of the effective interest rate may be applied. For lease receivables, the rate that the lessor charges the lessee or the effective interest rate implicit in the lease is applied, depending on which rate is used for measuring the lease receivable.

2.3 Key Challenges to Implementing IFRS 9 Impairment Requirements

The new standard applies to all firms reporting financial statements under IFRS 9. In particular, IFRS 9 impairment requirements affect firms holding financial instruments such as loans, investments in debt⁷ and trade and lease receivables. The revised IFRS 9 model is expected to have the most significant impact on banks and insurance firms, due to their large financial instrument holdings. Non-financial corporates that hold portfolios of trade and lease receivables, debt securities, and intragroup loans must also revise current impairment loss calculations to comply with IFRS 9. Firms are required to capture and collect historical data and other trend information required for building a forward-looking impairment model and for tracking credit risk migration since the origination and recognition of the financial instrument. Data will include the historical probability of defaults, ratings, loss amount, product features, and economic scenario variables. Firms may also need to develop new models and processes or upgrade existing models in order to identify an increase in credit risk and to calculate one-year or lifetime expected losses. Much literature discusses the challenges related to IFRS 9-compliant data management and collection for underlying financial instruments.⁸ In fact, gathering granular data has been ranked the number one challenge by banks responding to a recent Moody's Analytics survey.⁹ In the following discussion, we list the major methodological and analytical challenges for implementing the IFRS 9 impairment model, assuming a large amount of required data are already available.

2.3.1 Portfolio Segmentation

Firms usually segment portfolios along business lines, product types, and risk characteristics for impairment calculation. IFRS 9 requires developing a more granular and dynamic approach for portfolio segmentation. Firms must group financial assets based on shared credit characteristics that typically react in a similar way to the current environment and macroeconomic factors. These

⁷ Investments in equity instruments are outside the scope of the IFRS 9 impairment requirements, because they are accounted for either at FVTPL or at FVOCI, with no reclassification of any fair value gains or losses to profit or loss (i.e. the FVOCI election for equity instruments).

⁸ Ernst & Young, "Facing the Challenges: Business Implications of IFRS 4, 9, and Solvency II for Insurers." 2015; Deloitte, "Fifth Global IFRS Banking Survey, Finding Your Way." 2015.

⁹ Gea-Carrasco, Cayetano, "IFRS 9 Will Significantly Impact Bank's Provision and Financial Statement." Moody's Analytics, 2015.

characteristics include instrument type, credit risk ratings, industry, geographical location, date of initial recognition, remaining term to maturity, and underlying collateral. Groupings are re-evaluated and re-segmented whenever there is new, relevant information (e.g., change in economic conditions) or credit risk expectations change. When exposures have experienced a significant increase in credit risk, that relevant group or subgroup will transfer to Stage 2 as a whole, even though it might not be possible to identify the increase in credit risk on an individual exposure basis. Where changes in credit risk affect only some exposures within a group, those exposures must be segmented out into relevant subgroups to ensure appropriately updated provisioning levels.

2.3.2 Determining Significant Changes in Credit Quality

When credit is first extended, the borrower's initial creditworthiness and the initial expectations of credit losses are taken into account in determining acceptable pricing and other terms and conditions. Accordingly, recognizing lifetime expected credit losses from the initial recognition disregards the link between pricing and the initial expectations of credit losses. A true economic loss arises when expected losses exceed initial expectations — for example, when the lender is not receiving adequate compensation for the risk exposure. Recognizing lifetime expected credit losses after a significant risk increase reflects economic loss more accurately in the financial statements. To determine significant credit deterioration, a firm should consider reasonable and supportable information available without undue cost or effort and then compare the following:

- » The risk of a default at the reporting date
- » The risk of a default at the date of initial recognition

A significant increase in credit risk assessment may be done on a collective basis (for example, on a group or subgroup of financial instruments), if evidence is not yet available at the individual level. While IFRS 9 does not prescribe any specific approach for assessing changes in credit risk, it allows the following operational simplifications for assigning the instrument into different stages:

- » A rebuttable presumption of a significant increase in credit risk when the borrower is 30 days-past-due.¹⁰ This indicator is not absolute, but it is presumed to be the latest point.
- » For instruments with low credit risk, firms can continue to recognize a 12-month allowance.

The low-credit-risk exemption is often viewed as a suitable approach for wholesale/ corporate exposures, because firms can often map internal grades to external rating agencies, and the 30 days-past-due criterion is often applied to retail portfolios, because firms usually cannot map the portfolio to external ratings. However, the Basel committee¹¹ maintains higher expectations for banks implementing IFRS 9. The committee considers both the low-credit-risk exemption and the 30 days-past-due criterion to be a "very low quality implementation" of an expected credit loss model. The committee has strong expectations that a bank will not fall back on the 30 days-past-due assumption, unless all forward-looking information has no substantive relationship with credit risk. The appropriate approach will vary by sophistication level, the financial instrument, and data availability.

Given these requirements, the following challenges will likely arise during the credit risk assessment process:

- » Interpretation and measurement of "significant deterioration in credit quality." Will the deterioration be measured by an absolute or relative percentage change in the one-year or lifetime probability of default since origination, the number of missed payments (if firms plan to rebut the 30 days-past-due criteria), the number of notches down the internal ratings, or other criteria?
- » Transactional level measurement. How to identify a significant increase in credit risk on a transactional level where credit risk assessment is currently done on a counter-party level?
- » Missing/limited credit quality information at origination. How to backfill missing information? In many cases, internal rating systems were implemented after instruments' origination.
- » Forward-looking assessment in determining the threshold. How do firms include the "reasonable and supportable" forward-looking information regarding uncertain future events in the assessment, in addition to the current and historical status of the instruments?
- » Trade-off between Type I and Type II error in establishing the threshold. How to design the threshold and maintain the balance of early and accurate recognition of loss but minimize the "false positive"?

¹⁰ According to IFRS 9 5.11, when information that is more forward-looking than past-due status (either on an individual or a collective basis) is not available without undue cost or effort, a firm may use past due information to determine whether there have been significant increases in credit risk since initial recognition.

¹¹ Basel Consultative Paper, "Guidance on Accounting for Expected Credit Losses." February 2015.

2.3.3 Expected Credit Loss Calculation

The IASB acknowledges firms may measure expected credit losses (ECL) using various techniques. For example, for the 12-month expected credit loss measurement, a firm can use techniques that do not include an explicit 12-month probability of default as an input, such as a loss-rate methodology. Using this approach, the firm develops loss-rate statistics on the basis of the amount written off over the life of the financial assets. Adjusting these historical credit loss trends for current conditions and expectations regarding the future will be another analytical challenge.

While IFRS 9 does not explicitly require it, Moody's recommends that banks and insurers consider a more robust and sophisticated "expected loss approach" for most portfolios. The expected loss approach breaks the total loss amount modeling into four parts: probability of default (PD), loss given default (LGD), exposure at default (EAD), and expected life estimation (for the lifetime expected credit loss calculation). Many banks may rely on their existing internal credit risk management systems and expected loss calculation processes used for Basel regulatory requirements, but they will need to modify them to comply with IFRS 9 impairment requirements. Modifications include adjustments for through-the-cycle vs. point-in-time estimates and extending the Basel one-year PD/LGD/EAD term structure to capture the expected lifetime of financial instruments. Other institutions may use in-house models and processes for stress testing and adjust the forecast for the forward-looking scenario rather than stressed scenarios. Estimating "forward-looking," future economic conditions is only the first step of the adjustment process, for which institutions may need to develop single or multiple economic scenarios to calculate expected credit losses. The most challenging aspect of the change may be incorporating the macroeconomic factors forecast (interest rates, unemployment, GDP growth, etc.) into the PD/LGD/EAD modeling and, thus, into the expected credit loss calculation. Adjusted models must reflect how such changes in factors affected defaults and losses in the past. However, it is possible that the combination of forecasted factors may never have been seen historically.

Even if all the IFRS 9-compliant models for loss rate and the different components in the expected loss approach are readily available, additional issues will arise when determining the ECL. Rules require discounting the expected cash shortfalls in order to obtain the current value at the reporting date. Current regulatory calculations do not discount at all or discount only to the date of the expected default point. Firms will need to modify existing systems to better capture the expected timing of credit losses and to discount future amounts to the reporting date. IFRS 9 requires the use of the effective interest rate at initial recognition when discounting the cash flows. Firms must also complete the effective interest rate for financial instruments if this information is missing in the current accounting system. In addition, firms may need to enhance or replace a current loan loss calculation engine to accommodate the demanding computational loads of exposure level, cash flow-based, life-time expected credit loss calculations.

3. Potential Solutions for IFRS 9 Impairment Model Implementation

We next describe solutions to the challenges listed in Section 2. We first discuss portfolio segmentation methods and the different thresholds for transition among stages. We then list current measurement methods commonly used for loss allowance modeling and how these methods may be enhanced to meet the IFRS 9 requirement.

3.1 Portfolio Segmentation

Calculating expected credit losses usually begins by finding the appropriate segmentation scheme that groups exposures into different portfolios. Institutions often segment exposures into pools with similar characteristics. Segmentation analysis is often done based on portfolio materiality and firm sophistication. Segmentation analysis usually begins at the highest level where each exposure can be grouped into broad categories such as Retail, Wholesale, Sovereign, Bank, etc. Within each of the above categories, segmentation can be further grouped by lines of business. For example, the Wholesale category may include portfolios from C&I, SME, CRE, Special Lending, and other corresponding business lines. Within each business line, its portfolio will be grouped into smaller subgroups based on the exposure's borrower or collateral characteristics. The commonly used segmentation criteria for "Wholesale" exposures include product purpose (construction, real estate, farm, income producing, etc.), product type (loan or revolver, fixed or floating), collateral type, risk ratings, geography, etc. For "Retail" exposures, the criteria may include product purpose (mortgage loan, credit card, auto loan, student loan, etc.), product type (fixed rate mortgage loan, adjustable rate mortgage loan, etc.), credit risk (FICO score, prime vs. subprime, delinquency status, etc.), balance (jumbo vs. conforming), vintage, geography, etc.

Generally speaking, implementing the IFRS 9 impairment model results in a granular and dynamic portfolio segmentation scheme. As noted in Section 2, financial instruments should be segmented based on shared credit risk characteristics. Instruments grouped together should respond to historical and current environments as well as to forward-looking information and macroeconomic factors in a similar way, with respect to changes in credit risk level. As the Basel consultative paper points out, the grouping method should be granular enough to assess changes in credit quality leading to migration to a different credit risk rating, thus impacting the estimation of expected credit losses. The segmentation scheme implemented upon initial recognition may not necessarily be appropriate subsequently, since the responsiveness to those credit risk characteristics may change over time. Segmentation should be re-evaluated and exposures re-segmented whenever there is relevant new information or when a bank's credit risk expectations change. Most importantly, exposures should not be grouped in such a way that the performance of the segment as a whole masks an increase in a particular exposure's credit risk. When credit risk changes after initial recognition affect only some exposures within a group, those exposures should be segmented out into appropriate subgroups. For example, when some exposures in the Stage 1 group experience a significant increase in credit risk, they should be transferred to a sub-portfolio in Stage 2.

3.2 Determining Significant Changes in Credit Quality

As stated in Section 2.3.2, IFRS 9 requires assessing financial instruments for significant credit risk increases since initial recognition. To perform this assessment, firms must use change in lifetime default risk (considering qualitative and/or quantitative information), a low-credit-risk exemption, and a rebuttable presumption of 30 days-past-due. For instruments whose default occurrences are not concentrated at a specific point in time during the expected life, firms can use the one-year changes in default risk to approximate the changes in lifetime default risk.

Possible approaches for identifying significant credit risk increases since initial recognition include PDs and behavioral information. Either approach should consider the following:

- » The change in the default risk since initial recognition
- » The expected life of the instrument
- » Historical, current, and forward-looking information available without undue cost or effort

If using a loss rate approach to measure credit risk increases, firms should use changes in credit risk isolated from other expected loss drivers, such as collateral. Also, the loss rates should be applied to groups defined in a similar way to the groups for which the historical credit loss rates are calculated. Since loss rates should incorporate information regarding current and forward-looking economic conditions, firms should apply historical loss rates consistent with the current and expected economic conditions. If the historic economic conditions differ, an adjustment is needed. A possible approach for calculating loss rates dependent upon economic conditions is to develop a model linking loss rates with economic variables.

PDs can also be used to identify significant increases in credit risk. If using changes in PDs, Moody's recommends assessing the logarithmic change instead of raw changes,¹² as the significance of a specific change in PD depends on the starting point. For example, if the starting PD is 0.01%, and there is a 5 bp increase, the change would be considerable, but if the starting PD point is 10%, and the change is also 5 bp, the change might not be significant.

Additionally, IFRS 9 states firms cannot simply compare the change in absolute risk over time, but rather they should incorporate the relationship between expected life and default risk. The reasoning behind this point is that when credit quality remains unchanged, the default risk usually decreases as the financial instrument moves closer to maturity. Therefore, for example, there may be a significant increase in credit risk of an instrument that has the same cumulative PD at initial recognition as five years later, when fewer years to maturity remain. One possible approach to incorporating the relationship between expected life and default risk is to use annualized PD values instead of cumulative PD values.

For instruments whose default patterns are not concentrated at a specific point in time, one can use 12-month PD changes as an approximation of the lifetime default risk change. This approach may not be suitable for instruments with only significant payment obligations after the next 12 months, or for which changes in macro-economic or other credit-related factors are not adequately reflected in the default risk during the next 12 months.

In addition to using PD changes, changes in the PD-implied rating, expressed as notch differences, can also determine significant increases in credit risk. Ratings are sometimes preferred over PD measures, as many users are more familiar with agency ratings. However, implied ratings have the disadvantage of being non-continuous (like PD measures). Additionally, if using an internal rating system, it must be well-designed, incorporating a reasonable number of rating categories and avoiding too many credits classified into specific categories. For IFRS 9 purposes, an internal rating system should also incorporate the relationship between expected life and default risk. The internal rating mappings therefore should depend on the instrument's maturity.

One challenge regarding relative thresholds is determining the interpretation of "significant" for a particular portfolio. In terms of agency rating differences, a change of two or three notches is usually considered substantial. Regardless of the method used to determine the changes, it is important to determine a threshold that balances early and accurate loss recognition and one that minimizes "false positives." Firms should minimize the percentage of reversals between recognizing lifetime expected credit losses (Stage 2) and recognizing 12-month expected credit losses (Stage 1). The threshold may differ by the original risk level. For example, a two-notch downgrade may be more significant for a Baa3 credit than for an Aaa credit.

Behavioral indicators can also be used to identify significant increases in credit risk, if a correlation can be established between the behavioral indicators and the risk of a default occurring. Examples of behavioral indicators include changes in expected payment patterns (e.g., moving from full payment to something less than full payment), higher-than-expected facility utilization, and/or failure to make a loan payment with a different lender. Behavioral information should not rely solely on a firm's own experience, but should make use of other, readily available credit information, such as credit bureau data. Additional approaches for recognizing significant increases in credit risk are to identify major events during the lifetime of the financial instrument, such as modifications, forbearances, or entries to a watch list. If using any of these methods, they should incorporate forward-looking information, if available without undue cost or effort.

The IASB considered alternative methods for defining transitioning between stages. One alternative was to use absolute thresholds. Using this approach, firms would identify transitioning between stages based on a pre-defined level of risk. For example, they would distinguish between investment- and speculative-grade instruments, or between instruments that are 30 or more days past due and instruments that are less than 30 days-past-due. However, IASB determined that the absolute level of credit risk approach is not appropriate,¹³ as it does not take into account the initial credit loss expectation and subsequent changes. If the threshold is too high, expected losses would be understated, and if too low, expected losses would be overstated. Also, this approach might be similar to the incurred loss model in IAS 39, if the selected threshold corresponds to a trigger event.¹⁴

Regarding the use of past due information as a threshold, the IASB states that, if forward-looking information is available without undue cost or effort, a firm cannot rely solely on past-due information to determine significant increases in credit risk. However, there is a 30 days-past-due threshold as a last line of defense — regardless of how a firm determines credit risk increases, there is a rebuttable presumption that credit risk has increased significantly when payments are more than 30 days-past-due. If a firm

¹² Logarithmic changes are similar to percentage changes for small fluctuations. However, logarithmic changes have more desirable properties, as they are symmetric and additive.

¹³ IASB, BC5.160

¹⁴ IAS 39 requires firms to determine if there is objective evidence of impairment as a result of one or more events that occurred after the initial recognition of the asset: (a) significant financial difficulty of the issuer or obligor; (b) a breach of contract, such as a default or delinquency in interest or principal payments; (c) granting a concession to the borrower due to the borrower's financial difficulty; (d) high probability of bankruptcy or other financial reorganization; (e) disappearance of an active market for that financial asset because of financial difficulties; or (f) data indicating that there is a measurable decrease in the estimated cash flows from a group of financial assets, although the decrease cannot yet be identified with the individual assets in the group.

determines that the credit risk increased significantly before payments are more than 30 days-past-due, the rebuttable presumption does not apply.

One of the challenges in calculating credit risk changes is the back-filling of credit risk assessment at origination. For this purpose, it is necessary to consider the credit risk characteristics at initial recognition, for which historical information is needed, such as internal ratings, external ratings, financial statements, and/or economic conditions statistics.

Another challenge concerns identifying credit risk at a transactional level, while credit risk assessment is currently done at a counterparty level. This challenge is particularly relevant to real estate instruments, where the default risk depends on the value of the collateral supporting the obligation. For example, if the value of the collateral declines, some borrowers may have a greater incentive to default. Therefore, firms should incorporate the particular characteristics of a transaction when they affect the default risk. In other segments, such as Commercial & Industrial loans, changes in credit risk assessment can be assessed at counterparty level, as the default risk does not necessarily depend on particular transaction characteristics. However, in order to measure expected losses, the particular transaction characteristics should be taken into account using LGD and EAD measures.

The next section discusses incorporating forward-looking information into credit risk measures, as well as other challenges in calculating expected credit losses.

3.3 Expected Credit Loss Calculation

To overcome the expected loss calculation challenges, firms can implement different solutions to comply with the IFRS 9 standard, including the use of existing internal models or development of new tools. However, the targeted IFRS 9 solution should possess the following characteristics:

- » Applies a default definition consistent with internal credit risk practices
- » Reflects an unbiased and probability-weighted amount of expected credit losses
- » Calculates expected losses for both one year and the expected life of the financial instruments
- » Incorporates information regarding past events, current conditions, and forecasts of future economic conditions
- » Discounts expected credit losses to the reporting date, using the effective interest rate as the discounting rate
- » Reflects cash flows expected from collateral and other credit enhancements that are part of the contractual terms
- » Considers all contractual terms of the financial instrument (e.g., prepayment, extension, call and similar options)
- » Estimates the portion of the commitment to be drawn down for financial instruments that include both a loan and an undrawn commitment component

Basel and stress testing models may be leveraged for IFRS 9 purposes. Another option leverages vendor models that comply with IFRS 9 requirements. In particular, Moody's Analytics offers off-the-shelf products that comply. These products are currently used by a wide range of banks and other financial institutions to generate internal rating and regulatory model inputs, as well as for other purposes. The Appendix provides product details and how they comply with the IFRS 9 requirements.

3.3.1 PD Models

Most banks are subject to the Basel Capital Standards, which state three possible approaches for calculating capital requirements for credit risk: the Standardized Approach, the Foundation Internal Ratings-Based (FIRB) Approach, and the Advanced Internal Ratings-based (AIRB) Approach. The Standardized Approach uses pre-defined risk weight values set by the regulator, and these values are not suitable for the IFRS 9 requirements. However, banks estimate PDs under both FIRB and AIRB, which can be used as a starting point for calculating IFRS 9-compliant PDs.

Under the FIRB and AIRB approaches, banks calculate one-year PDs, long-run averages of one-year default rates for borrowers within a rating grade.¹⁵ Banks may incorporate the risk-mitigating effect of guarantees and credit derivatives by adjusting PDs or LGDs, and must add a margin of conservatism to estimates.

¹⁵ For retail exposures, Basel states that "The definition of default can be applied at the level of a particular facility, rather than at the level of the obligor."

In order to use the Basel framework to obtain PDs for the IFRS 9 calculation, firms should consider the following adjustments:

I. Align the Basel definition of default and the institution's risk management practice

IFRS 9 states that firms shall apply a definition of default consistent with the definition used for internal credit risk management purposes. However, there is a rebuttable presumption that a default does not occur later than when the instrument is 90-days-past-due. The firm may rebut the presumption if it has reasonable and supportable information to determine that a more lagging criterion is more appropriate.

Basel defines default as 90-days-past-due on any material credit obligation or when the bank considers the borrower is unlikely to pay. Therefore, to leverage the Basel models, firms should align the Basel definition of default and their risk management practice.

II. Apply adjustment for economic cycle and incorporate forward-looking information

The desire for stable capital requirement estimates leads many banks to adopt through-the-cycle¹⁶ (TTC) PDs. Since IFRS 9 requires firms to incorporate information regarding current conditions and forecasts of future conditions, TTC PDs require a cycle adjustment incorporating forward-looking information.

In particular, firms can leverage TTC PDs and apply a cyclical adjustment. The adjustment can be based on credit cycle signals from macro-economic variables or information from the equity or debt markets, which incorporate market participant's expectations and, therefore, reflect forward-looking information.

Since the credit cycle affects industries in different ways, adjustments should be industry-specific. If the credit signals show an increase in risk level, PD levels should be adjusted upward. If the risk level falls, PD levels should be adjusted downward.

One possible implementation adjustment is via a Z factor, as illustrated in Aguais, *et al.*,¹⁷ a single parameter that represents the credit cycle. The Z factor may be based on default or loss rates, and it is standardized to have a zero mean and unit variance. When the Z factor is positive, credit conditions are better than the historical average, implying a lower than average default rate for each initial credit rating and a higher average ratio of upgrades to downgrades. When the Z factor is negative, the opposite applies. Z factors can be used to calculate transition matrices conditional on an assumed value for Z. For IFRS 9 purposes, forward-looking information must be embedded into Z factors.

Another option for incorporating forward-looking information into an existing PD is to use a stress testing approach, where the projected PD depends upon particular economic scenarios. For example, loan-level risk drivers, such as collateral performance and contractual cash flow, are projected based on economic growth forecasts, interest rates, and other macroeconomic factors. The resulting risk factor projection is then fed into the stressed PD model to produce a forward-looking PD measure. Various groups, including the Federal Reserve and Moody's Economy.com publish economic scenarios on a regular basis. These scenarios reflect different possibilities of future economic trends. The wide variety of scenarios leads to two ways of implementing the stress testing approach: considering multiple scenarios or considering the best scenario estimation. If using multiple scenarios, it is necessary to estimate the associated probability for each. On the other hand, the probability of default can be calculated using the best reasonable estimate for a scenario. For this option, the most likely economic outcome can be used.¹⁸

A third option is to develop a PD model that incorporates the current explanatory variables as well as forward-looking variables, such as forecasts of macroeconomic variables and/or signals from the equity market. This approach is related to the stress testing approach, as the corresponding PD is also scenario-dependent. Therefore, it is possible to combine the two by including both economic forecasts and forward-looking loan-level risk factors in the PD model.

In addition to the aforementioned three approaches for developing the PD model, firms can also consider simulating individual loan and collateral performance, as well as corresponding market conditions, based on historical probability distributions. With a sufficiently large number of simulation paths, the final PD becomes an unconditional risk measure, which reflects a probability-weighted outcome, as required by IFRS 9.

¹⁶ While there is no universally agreed upon definition, the conventional view is that a rating system or a PD model with outputs that remain relatively stable across different macroeconomic conditions is a TTC system.

¹⁷ See Belkin, Suchower, and Forest 1998a, 1998b; Aguais, *et al.*, 2004; Aguais, *et al.*, 2006.

¹⁸ In particular, Moody's Economy.com produces a baseline scenario, which represents the most likely economic outcome, with a 50% chance that the economy will do better than the baseline, and a 50% chance that it will do worse.

III. Calculate lifetime PDs

To calculate lifetime expected loss, it is necessary to construct a term structure of PDs beyond one year. Different modeling techniques can be used to construct the term structure:

- » Develop separate models for different time horizons and interpolate probabilities of default for intermediate maturities; developers must ensure that PDs of long horizons are higher than PDs of short horizons.
- » Develop a model that uses the most up-to-date information at each point in time. The resulting PD is not time-dependent, but requires forecasting the risk factors for each loan's lifetime.
- » Use transition matrices, which measure the probability of moving between credit categories. One of the categories is default, and, therefore, probabilities of default can be calculated. The hazard model is one type of transitioning model that can be used for different maturities.
- » Develop a model in which the PD is time-dependent.

3.3.2 LGD Models

Some firms also develop internal LGD models for Basel and risk management purposes, which they can leverage for IFRS 9 purposes. Specifically, under the Basel AIRB approach,¹⁹ firms compute LGDs, which should reflect economic downturn conditions and cannot be less than the long-run default-weighted average loss rate given default. The definition of loss in estimating LGD is economic loss, which must include material discount effects and material costs associated with collecting on the exposure. Banks may reflect the risk-mitigating effect of guarantees and credit derivatives via adjusting PDs or LGDs, and they must add a margin of conservatism to estimated values. For some exposures, it is important to incorporate the cyclical variability.

To use the Basel framework to obtain IFRS 9-compatible LGDs, firms must make the following adjustments:

I. Remove the downturn component

While IFRS 9 states that expected loss estimations should reflect current and forward-looking expected losses, not downturn economic conditions. This method disregards the conservative approach suggested by the Banking Supervision Committee. Therefore, for IFRS 9 purposes, the downturn component should be removed.

II. Adjust the discount rate

Basel does not specify which discount rate to use for estimating the LGD. IFRS 9 requires using the effective interest rate or an approximation thereof. Therefore, in order to use Basel models, firms should align the interest rate used or apply an adjustment. Also, under IFRS 9, firms must discount expected losses to the reporting date, while Basel states discounting to the default date.

III. Incorporate forward-looking information

Since IFRS 9 requires expected loss to be forward-looking, firms should consider building a cyclical adjustment into the LGD model. Similar to PD, the stress testing approach can also be used to produce a forward-looking LGD. In this approach, all cash flows in the liquidation process are projected based on macroeconomic variable forecasts. Proceeds from collateral sales depend on future market conditions, which dictate sales price fluctuations. Meanwhile, some expenses incurred during loan resolution are affected by projected interest rates at each point in time.

To implement the stress testing approach, firms may choose to calculate a probability-weighted average LGD across multiple scenarios or simply use one scenario that represents the best future estimate to produce a single LGD. The implementation method should be consistent between PD and LGD.

III. Term structure

As Basel models typically have a one-year horizon, they should be extended to provide a term structure for LGDs. Modelers may use recovery rate as the dependent variable, which may show a monotonic behavior over time.

Alternatively, firms can develop an LGD model that uses the most up-to-date information at each point in time. The resulting LGD requires that each explanatory variable be forecast for the entire lifetime of each loan, but it does not require an assumption on the LGD term structure.

¹⁹ Under the Standardized and the Foundation Internal Ratings-based Approaches, firms use the supervisory estimate for LGDs.

IV. Other adjustments

Basel LGD estimations may include indirect costs related to collecting on the exposure and credit derivatives used as risk mitigating instruments. Since IFRS 9 requirements do not include these components, they must be removed.

3.3.3 EAD Models

For financial instruments with pre-determined draw and amortization terms (e.g., term loans and bonds), EAD in future periods can be calculated from known contractual terms during the cash flow generation process, taking into account probability of prepayment for pre-payable loans and the probability of the call (or similar) options being exercised for bonds with contingencies.

For irrevocable loan commitment and line of credit with a loan and an undrawn commitment component, firms may need an EAD model to estimate the instrument's exposures to credit losses. One option is to leverage the Basel EAD model, used under the AIRB approach.²⁰ Basel defines EAD as "... the expected gross exposure of the facility upon default of the obligor..."²¹ Estimates should include the possibility of additional drawings before and after the default event. EAD estimates are computed at the facility level, reflecting the long-run, default-weighted, average EAD for similar facilities and borrowers, and estimates must incorporate a margin of conservatism for risk management purposes. Banks should use EAD estimates applicable for an economic downturn for Basel requirements, which is more conservative than the long-run average.

In order to adjust the Basel EAD modeling for IFRS 9 purposes, the following modifications are needed:

I. Remove the downturn component

If the EAD Basel estimation includes an economic downturn component, it should be removed.

II. Term structure

For IFRS 9 purposes, the Basel EAD models should be extended beyond a one-year horizon in order to cover the expected life of the financial instrument. Wholesale exposures typically have a contractual term; IFRS 9 decides that the maximum period over which the expected credit losses are estimated is the contractual period over which the firms are committed to provide credit. IFRS 9 would limit to the existing contractual term with extension options, even if business practice is to extend for longer periods. Retail revolving credit exposures such as credit cards and overdraft facilities do not have a contractual term and a fixed-term of repayment structure, and firms must determine the expected life of these exposures.

3.3.4 Loss Rate Method

Unlike the PD/LGD/EAD modeling approach introduced above, loss rate models estimate credit losses by aggregating PD, LGD, and EAD. These models are often used for short-term portfolios such as credit cards, trade and lease receivables, and some non-material exposures. In addition, medium- or small-size firms often rely on these simple modeling approaches for loss allowance calculation.

Commonly used loss rate models include the following:

- » **Net charge-off rate model.** The net charge-off rate is calculated as the total net charge-off amount divided by the starting exposure over a given time window. Generally speaking, an institution begins by dividing the target exposure into smaller segments, then chooses a look-back period (the time window) to calculate the charge-off rate, and applies the rate forward. Therefore, forecasts for a longer period require a longer look-back period. The charge-off model can produce unreliable results, primarily because it is often delayed and very sensitive to the look-back period. But this model is commonly used with small/nonmaterial portfolios due to its simplicity.
- » **Roll-rate model.** Also referred to as "migration" or "net flow rate" models, roll-rate models are widely used in retail portfolios for loss forecasting. The roll-rate model divides a portfolio into different buckets, e.g. by risk rating or delinquency status, and measures the percentage of exposures that will "roll" or "migrate" to a more severe risk rating, defined as the "roll rate" between these two buckets. Charge-off is assumed to occur when the asset reaches a certain bucket (e.g., 90 days-past-due). After the roll rates are determined for each bucket, the flows from different buckets to the charge-off bucket are aggregated together to determine the expected loss amount. The roll-rate model is considered accurate for forecasting losses during the next few months.
- » **Vintage loss curve model.** This model tracks loss by month during the life of the exposures. Firms that use vintage loss models segment their portfolios by vintage and additional criteria and then create vintage loss curves by plotting the percent of lifetime loss by origination balance against the number of months after the origination. When older vintages

²⁰ Under the Standardized and the Foundation Internal Ratings-based Approaches, firms have less flexibility with EAD calculation.

²¹ Basel Committee on Banking Supervision, "Guidance on Accounting for Expected Credit Losses." p.204, February 2015.

have run their course, the loss curves can be developed to show the loss rate for each month. The loss rate for recent vintages is then forecast by applying the average loss rate observed in the old vintages. Vintage loss rate models provide a simple, reasonable model for both one-year and lifetime expected credit loss forecasts.

All of the above loss rate models are estimated based on the historical performance of an institution's portfolio segments. Past loss rate trends may indicate the loss rate level, variance, and correlation with different economic conditions. However, historical loss experiences do not predict future performance. To improve the accuracy of loss forecasting and to be compliant with IFRS 9 requirements, financial institutions should adjust historical losses with reasonable expectations for future scenarios. In addition, to assess whether the credit risk of an instrument has increased significantly since initial recognition, firms should be able to separate the changes in the risk of a default occurring from changes in other drivers of expected credit losses, such as collateral. One approach is to estimate the PD component of the loss rate model separately. A less complicated approach bases the assessment on the behavioral indicators, if a correlation can be established between the behavioral indicators and the risk of a default occurring. Typical behavioral indicators could include changes in expected payment patterns (e.g., moving from full payment to something less than full payment), higher-than-expected facility utilization, or failure to make a loan payment with a different lender. Behavioral information should not rely solely on a firm's own experience, but should make use of other readily available credit information, such as credit bureau data.

4. Summary

This paper provides market practitioners with an overview of IFRS 9 requirements, focusing on the new impairment model and related details they should understand in order to successfully implement IFRS 9-compliant impairment loss processes.

IFRS 9's new impairment model proposes a single, forward-looking expected credit loss model that applies to all types of financial instruments found in the scope of impairment accounting, and the new model requires recognizing expected losses since origination or acquisition date. More specifically, firms initially recognize 12-month expected credit losses on financial instruments at the point of origination or purchase, and then, when credit quality significantly deteriorates (which may happen before a credit event occurs), recognize lifetime expected losses. The major advantage of the new approach is increasing the timeliness of loss recognition and addressing the over-complexity of the multiple impairment approaches required under the old IAS 39 "incurred loss" model. However, implementation of the new impairment model imposes significant challenges for both financial and non-financial firms.

The key methodological and analytical challenges firms may encounter during the IFRS 9 impairment model implementation process will arise in the following areas: 1. portfolio segmentation techniques for credit risk modelling and expected credit losses calculations; 2. the application of different thresholds for assessing the significant increases in credit risk of financial instruments; and 3. enhancements required for the alternative PD/LGD/EAD and loss rate models for loss allowance calculations, in order to achieve the IFRS 9-compliant expected credit losses calculation.

Finally, we provide recommendations and potential solutions for addressing the significant challenges of implementing IFRS 9. We recommend firms use a more granular and dynamic approach for portfolio segmentation by grouping financial assets based on shared credit characteristics that typically react in a similar way to the current environment and forward-looking information. Most importantly, exposures must not be grouped in such a way that the performance of the segment as a whole masks an increase in a particular exposure's risk. We list the possible quantitative and qualitative measures for identifying significant risk increases, which include estimating the financial instrument's Probabilities of Default (PDs) and its behavioral information or status changes, such as modifications, forbearances, or entries to a watch list. Regardless of how increases are determined, there is a rebuttable presumption risk has increased significantly when payments are more than 30 days-past-due. Firms can implement different credit risk models for calculating the 12-month or lifetime expected losses, including the expected loss approach based on PD/LGD/EAD modelling or loss rate approach. These models can be internally developed or vended models. Credit risk models developed for Basel capital requirement calculation or Stress Testing purposes can be leveraged for IFRS 9 expected credit loss calculation. The forward-looking information required by IFRS 9 can be incorporated in the credit risk models based on signals from macro-economic variables or from the equity or debt markets. Possible approaches for incorporating forward-looking information include transition matrices, scenario-dependent estimations, and simulation approaches. Firms must extend the one-year PD, loss given default (LGD), and exposure at default (EAD) estimations to the instrument's lifetime, for which different statistical techniques may be used. Possible techniques include transition matrices, time-dependent models, separate models for different time horizons, and models that use the most up-to-date information at each point in time. Specific adjustments to models based on Basel requirements will be needed, such as elimination of the downturn component in LGD or EAD estimations and adjust the discount rate to the IFRS 9 required effective interest rate for expected credit loss calculation.

Appendix: Moody's Products and IFRS 9 Requirements

Moody's Analytics offers various products and solutions that help firms perform IFRS 9 impairment calculations for different portfolios.

The following products focus on estimating PD and LGD inputs for expected losses calculation:

- » CreditEdge™ estimates PDs of public companies.
- » RiskCalc™ estimates PDs of private companies.
- » LossCalc™ estimates LGDs of both private and public companies. LossCalc can be used in combination with CreditEdge or RiskCalc to calculate Expected Losses of C&I instruments.
- » CMM™ estimates PDs and LGDs and also calculates Expected Losses of commercial real estate mortgage loans.

Table 1 provides a brief description of the Moody's Analytics products listed above and how each complies with the IFRS 9 requirements.

The main components of the targeted IFRS 9 solution are to meet the following requirements (addressed in Section 3.3):

- » Applies a definition of default consistent with internal credit practices
- » Reflects a probability-weighted amount of expected credit losses
- » Calculates both one-year and lifetime PD and/or expected credit losses
- » Incorporates information regarding past events, current conditions, and forecasts of future economic conditions
- » Incorporates specific requirements regarding the calculation of expected credit losses, such as the use of the effective interest rate and consideration of collateral and other credit enhancements.

Table 1 IFRS 9 COMPLIANCE ANALYSIS OF MOODY'S ANALYTICS PRODUCTS

	CreditEdge	RiskCalc	LossCalc	CMM
Description	Moody's Analytics Public Firm EDF™ (Expected Default Frequency) model estimates forward-looking probabilities of default, known as EDF credit measures.	Moody's Analytics Private Firm model generates EDF measures for private firms. RiskCalc models are built from the world's largest private firm database.	LossCalc, the LGD Module of RiskCalc, provides users with a systematic approach to estimating recovery on a given issue.	Moody's Analytics CMM (Commercial Mortgage Metrics) solution is the leading analytical model for commercial real estate (CRE) mortgage loans.
Definition of Default	Consistent with the Basel definition of default. CreditEdge considers the following credit events: (i) a missed or delayed disbursement of interest and/or principal; (ii) bankruptcy or other legal blocks to the timely payment of interest and/or principal; (iii) a distressed exchange; and (iv) a subsidiary default	Consistent with the Basel definition of default. Exact definition varies by model.	Consistent with the Basel definition of default. Incorporates three types of credit events: (i) a missed or delayed disbursement of interest and/or principal; (ii) bankruptcy, administration, legal receivership, or other legal blocks to the timely payment of interest and/or principal; and (iii) a distressed exchange.	The standard default definition is 90 days or more past due. CMM also allows users to apply PD additive and/or multiplicative factors to align PD with an internal default definition that may be broader than the 90 days-past-due definition.
Probability-Weighted Outcome	CreditEdge outputs an empirical probability of default, which can be used to estimate expected credit losses. EDF measures are calibrated using a large dataset that covers a large number of firms over multiple economic cycles, reflecting a probability-weighted outcome.	RiskCalc outputs an empirical probability of default, which can be used to estimate expected credit losses. EDF measures are calibrated using a large dataset that covers a large number of firms over multiple economic cycles, reflecting a probability-weighted outcome.	Not Applicable	CMM simulates 3,000 NOI and property value growth paths, which represents a wide range of possible outcomes and produces conditional PD and LGD on each path. The final PD and EL are the probability-weighted average across all simulation paths.

12-Month and Lifetime PD and/or Expected Credit Losses	CreditEdge outputs EDF measures between one and 10 years. The current term structure is designed to capture the difference in long-horizon and short-horizon credit risk that a typical firm is exposed to. The EDF9 term structure incorporates three components into the calculation of EDF measures: a long-run, central default tendency, an aggregate factor, and a firm-specific factor. The results are long-term EDF measures that are less sensitive to the credit cycle than one-year EDF metrics and that are, therefore, more stable, both at the portfolio level and the firm level. Outcomes for maturities larger than 10 years can be extrapolated.	RiskCalc models generate one-year and five-year EDF values and use these two-point estimates to fit a Weibull function and, thus, achieve a continuous term structure of EDF values between 0.75 and five years. The Weibull distribution allows us to capture the mean-reverting behavior of the credit quality of the firms — firms that are good credits today tend to become worse credits over time, and firms that are bad credits today tend to become better credits over time. Outcomes beyond five years can be extrapolated.	LossCalc models generate instantaneous (one-month), one-year, and long-run forecasted LGD. Defining excess recovery as the difference between the forecasted recovery on an issue under the one-year model and under the long-run model, we observe that a very good (or very bad) excess recovery today can be expected to gradually revert toward the mean if default occurs at a longer horizon (e.g., two-years, three-years, four-years, five-years) from now. By the law of iterated expectations and using the excess recovery definition, we conduct simultaneous regressions to estimate the term structure of recovery up to five years. Term structure beyond five years can be extrapolated.	CMM outputs quarterly PD/EL for up to 10 years. In addition to term PD/EL, which captures the risk of payment default during the loan term, CMM also produces maturity PD/EL, which captures the refinancing risk associated with a typically large balloon payment at loan maturity. For the few loans that mature beyond 10 years, the lifetime PD can be extrapolated from the CMM output.
Past Events Information	The model is developed using historical default data and three drivers: asset value, asset volatility, and default point.	The model is developed using historical default data, financial statements, and industry classifications.	The model is developed using historical default and recovery data.	CMM is developed using historical CRE loan and market data.
Current Conditions Information	Incorporates current market prices, returns, and interest rates.	RiskCalc Credit Cycle Adjusted (CCA) EDF measures incorporate credit cycle information from the industry and geographic region.	Incorporates industry median distance-to-default, issuer-own EDF, and the aggregate default rate for corporate firms.	CMM updates a collateral's stale NOI/property value using current CRE market conditions, and it uses the most recent loan attributes to estimate PD.
Future Forecasts Information	EDF measures are forward-looking. They reflect the equity market's assessment of credit risk.	RiskCalc CCA EDF measures are forward-looking. They reflect the equity market's assessment of credit risk.	Incorporates information regarding future forecasts from forward-looking variables such as industry median distance-to-default, issuer-own EDF, bankruptcy, and bailout probabilities.	CMM's risk measures are all forward-looking. They incorporate future forecasts of CRE market conditions. In addition, the loan-level risk drivers such as DSCR and LTV also depend on CRE market forecasts as well as future forecasts of interest rates.
Expected Credit Losses	Provides the PD part of the Expected loss calculation.	Provides the PD part of the Expected loss calculation.	LossCalc is based on post-default prices that represent investors' discounted expected recoveries. The model is validated against ultimate recovery discounted at the effective interest rate. Information about collateral can be incorporated using a Qualitative Overlay.	CMM LGD incorporates cash flows both from the sale of collateral and from expenses incurred during the liquidation process. Users are recommended to customize liquidation expense based on historical experience and internal policy (including discount rate).

In addition, Moody's Analytics offers the following tools for calculating IFRS 9 expected losses and other analytics for P&L forecasting:

- » **IFRS 9 EL Benchmarking Tool for wholesale portfolios.** This product will be offered via the RiskBench platform, leveraging Moody's PD models and data for clients without robust risk assessment tools. We calculate IFRS 9-compliant PD, LGD, and EAD on our entire data set of millions of active credit names. We collect these names via Moody's Analytics Credit Research Database (CRD™)²² and prepopulate a platform with underlying loan characteristics and forward-looking expected losses. Users can create cohorts based on region, industry, and size. Based on the query, the output provided cohort level results, and they can be used to assign EL estimates for each counterparty.
- » **IFRS 9 EL Calculator for wholesale impairment calculation.** This tool provides reporting date and forecasting capabilities for IFRS 9 analytics based on user inputs for PD, LGD, and EAD term structures and stages allocation methodology. The EL Calculator can convert an internal rating or a through-the-cycle PD to an IFRS 9-compliant, point-in-time PD term structure. Based on the IFRS 9 classification of the assets, the solution calculates IFRS 9 loss allowance (expected credit loss), fair value, and amortized cost. The solution also offers scenario-based, period-by-period forecasting for IFRS 9 loss allowance, fair value, gross carrying value, amortized cost, interest income, OCI, and P/L. The calculation engine can run in stand-alone mode using an MS Excel front, or it can be integrated into Moody's Analytics Scenario Analyzer for professional management.
- » **Scenario Analyzer.** The IFRS 9 functionality in Scenario Analyzer enables the orchestration and automation of IFRS 9 calculations for on- and off-balance sheet items. Scenario Analyzer integrates with RiskFoundation™, Moody's Analytics risk and finance datamart and centralizes the management of quantitative models and modeling assumptions across different asset classes. Scenario Analyzer includes the ability to centralize data from a variety of source systems and to coordinate and manage a wide variety of models. Scenario Analyzer evaluates IFRS 9 stages and calculates reporting date expected losses and provisions accordingly, it also prepares and exports data required by external accounting systems.

²² Moody's Analytics Credit Research Database is one of the world's largest and most comprehensive financial statement and default databases. It provides unique insight into private firm credit risk through its robust, proprietary, and global data set, covering commercial and industrial (C&I) middle market firms, commercial real estate (CRE), and project finance loans.

References

- Basel Committee on Banking Supervision, "Guidance on Accounting for Expected Credit Losses." February 2015.
- Aguais, Scott, *et al.*, M. Ong (ed.), "Point-in-Time versus Through-the-Cycle Ratings." Risk Books: *The Basel Handbook: A Guide for Financial Practitioners*, 2006.
- Aguais, Scott, *et al.*, M. Ong (ed.), "Designing and Implementing a Basel II Compliant PIT-TTC Ratings Framework." Risk Books: *The Basel Handbook: A Guide for Financial Practitioners*, 2006.
- Belkin, Barry, Stephan Suchower, and Lawrence Forest, "The Effect of Systematic Credit Risk on Loan Portfolios and Loan Pricing." *Credit-Metrics Monitor*, pp 17–28, 1998a.
- Belkin, Barry, Stephan Suchower, and Lawrence Forest, "A One Parameter Representation of Credit Risk and Transition Matrices." *Credit-Metrics Monitor*, pp 17–28, 1998b.
- Deloitte, "Fifth Global IFRS Banking Survey, Finding Your Way." 2015.
- Ernst and Young, "Facing the Challenges: Business Implications of IFRS 4, 9 and Solvency II for Insurers." 2015.
- Gea-Carrasco, Cayetano, "IFRS 9 Will Significantly Impact Bank's Provision and Financial Statement." Moody's Analytics White Paper, 2015.
- International Accounting Standards Board, "International Financial Reporting Standard: IFRS 9 Financial Instruments." July 2014.
- International Accounting Standards Board, "Implementation Guidance: IFRS 9 Financial Instruments." July 2014.
- International Accounting Standards Board, "Basis for Conclusions: IFRS 9 Financial Instruments." July 2014.
- International Accounting Standards Board, "IFRS 9 Project Summary." July 2014.
- McPhail, Joseph and Lihong McPhail, "Forecasting Lifetime Credit Losses: Modeling Considerations for Complying with the New FASB and IASB Current Expected Credit Loss Models." Working paper, 2014.

© Copyright 2015 Moody's Corporation, Moody's Investors Service, Inc., Moody's Analytics, Inc. and/or their licensors and affiliates (collectively, "MOODY'S"). All rights reserved.

CREDIT RATINGS ISSUED BY MOODY'S INVESTORS SERVICE, INC. ("MIS") AND ITS AFFILIATES ARE MOODY'S CURRENT OPINIONS OF THE RELATIVE FUTURE CREDIT RISK OF ENTITIES, CREDIT COMMITMENTS, OR DEBT OR DEBT-LIKE SECURITIES, AND CREDIT RATINGS AND RESEARCH PUBLICATIONS PUBLISHED BY MOODY'S ("MOODY'S PUBLICATIONS") MAY INCLUDE MOODY'S CURRENT OPINIONS OF THE RELATIVE FUTURE CREDIT RISK OF ENTITIES, CREDIT COMMITMENTS, OR DEBT OR DEBT-LIKE SECURITIES. MOODY'S DEFINES CREDIT RISK AS THE RISK THAT AN ENTITY MAY NOT MEET ITS CONTRACTUAL, FINANCIAL OBLIGATIONS AS THEY COME DUE AND ANY ESTIMATED FINANCIAL LOSS IN THE EVENT OF DEFAULT. CREDIT RATINGS DO NOT ADDRESS ANY OTHER RISK, INCLUDING BUT NOT LIMITED TO: LIQUIDITY RISK, MARKET VALUE RISK, OR PRICE VOLATILITY. CREDIT RATINGS AND MOODY'S OPINIONS INCLUDED IN MOODY'S PUBLICATIONS ARE NOT STATEMENTS OF CURRENT OR HISTORICAL FACT. MOODY'S PUBLICATIONS MAY ALSO INCLUDE QUANTITATIVE MODEL-BASED ESTIMATES OF CREDIT RISK AND RELATED OPINIONS OR COMMENTARY PUBLISHED BY MOODY'S ANALYTICS, INC. CREDIT RATINGS AND MOODY'S PUBLICATIONS DO NOT CONSTITUTE OR PROVIDE INVESTMENT OR FINANCIAL ADVICE, AND CREDIT RATINGS AND MOODY'S PUBLICATIONS ARE NOT AND DO NOT PROVIDE RECOMMENDATIONS TO PURCHASE, SELL, OR HOLD PARTICULAR SECURITIES. NEITHER CREDIT RATINGS NOR MOODY'S PUBLICATIONS COMMENT ON THE SUITABILITY OF AN INVESTMENT FOR ANY PARTICULAR INVESTOR. MOODY'S ISSUES ITS CREDIT RATINGS AND PUBLISHES MOODY'S PUBLICATIONS WITH THE EXPECTATION AND UNDERSTANDING THAT EACH INVESTOR WILL, WITH DUE CARE, MAKE ITS OWN STUDY AND EVALUATION OF EACH SECURITY THAT IS UNDER CONSIDERATION FOR PURCHASE, HOLDING, OR SALE.

MOODY'S CREDIT RATINGS AND MOODY'S PUBLICATIONS ARE NOT INTENDED FOR USE BY RETAIL INVESTORS AND IT WOULD BE RECKLESS FOR RETAIL INVESTORS TO CONSIDER MOODY'S CREDIT RATINGS OR MOODY'S PUBLICATIONS IN MAKING ANY INVESTMENT DECISION. IF IN DOUBT YOU SHOULD CONTACT YOUR FINANCIAL OR OTHER PROFESSIONAL ADVISER.

ALL INFORMATION CONTAINED HEREIN IS PROTECTED BY LAW, INCLUDING BUT NOT LIMITED TO, COPYRIGHT LAW, AND NONE OF SUCH INFORMATION MAY BE COPIED OR OTHERWISE REPRODUCED, REPACKAGED, FURTHER TRANSMITTED, TRANSFERRED, DISSEMINATED, REDISTRIBUTED OR RESOLD, OR STORED FOR SUBSEQUENT USE FOR ANY SUCH PURPOSE, IN WHOLE OR IN PART, IN ANY FORM OR MANNER OR BY ANY MEANS WHATSOEVER, BY ANY PERSON WITHOUT MOODY'S PRIOR WRITTEN CONSENT.

All information contained herein is obtained by MOODY'S from sources believed by it to be accurate and reliable. Because of the possibility of human or mechanical error as well as other factors, however, all information contained herein is provided "AS IS" without warranty of any kind. MOODY'S adopts all necessary measures so that the information it uses in assigning a credit rating is of sufficient quality and from sources MOODY'S considers to be reliable including, when appropriate, independent third-party sources. However, MOODY'S is not an auditor and cannot in every instance independently verify or validate information received in the rating process or in preparing the Moody's Publications.

To the extent permitted by law, MOODY'S and its directors, officers, employees, agents, representatives, licensors and suppliers disclaim liability to any person or entity for any indirect, special, consequential, or incidental losses or damages whatsoever arising from or in connection with the information contained herein or the use of or inability to use any such information, even if MOODY'S or any of its directors, officers, employees, agents, representatives, licensors or suppliers is advised in advance of the possibility of such losses or damages, including but not limited to: (a) any loss of present or prospective profits or (b) any loss or damage arising where the relevant financial instrument is not the subject of a particular credit rating assigned by MOODY'S.

To the extent permitted by law, MOODY'S and its directors, officers, employees, agents, representatives, licensors and suppliers disclaim liability for any direct or compensatory losses or damages caused to any person or entity, including but not limited to by any negligence (but excluding fraud, willful misconduct or any other type of liability that, for the avoidance of doubt, by law cannot be excluded) on the part of, or any contingency within or beyond the control of, MOODY'S or any of its directors, officers, employees, agents, representatives, licensors or suppliers, arising from or in connection with the information contained herein or the use of or inability to use any such information.

NO WARRANTY, EXPRESS OR IMPLIED, AS TO THE ACCURACY, TIMELINESS, COMPLETENESS, MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE OF ANY SUCH RATING OR OTHER OPINION OR INFORMATION IS GIVEN OR MADE BY MOODY'S IN ANY FORM OR MANNER WHATSOEVER.

MIS, a wholly-owned credit rating agency subsidiary of Moody's Corporation ("MCO"), hereby discloses that most issuers of debt securities (including corporate and municipal bonds, debentures, notes and commercial paper) and preferred stock rated by MIS have, prior to assignment of any rating, agreed to pay to MIS for appraisal and rating services rendered by it fees ranging from \$1,500 to approximately \$2,500,000. MCO and MIS also maintain policies and procedures to address the independence of MIS's ratings and rating processes. Information regarding certain affiliations that may exist between directors of MCO and rated entities, and between entities who hold ratings from MIS and have also publicly reported to the SEC an ownership interest in MCO of more than 5%, is posted annually at www.moody.com under the heading "Shareholder Relations — Corporate Governance — Director and Shareholder Affiliation Policy."

For Australia only: Any publication into Australia of this document is pursuant to the Australian Financial Services License of MOODY'S affiliate, Moody's Investors Service Pty Limited ABN 61 003 399 657AFSL 336969 and/or Moody's Analytics Australia Pty Ltd ABN 94 105 136 972 AFSL 383569 (as applicable). This document is intended to be provided only to "wholesale clients" within the meaning of section 761G of the Corporations Act 2001. By continuing to access this document from within Australia, you represent to MOODY'S that you are, or are accessing the document as a representative of, a "wholesale client" and that neither you nor the entity you represent will directly or indirectly disseminate this document or its contents to "retail clients" within the meaning of section 761G of the Corporations Act 2001. MOODY'S credit rating is an opinion as to the creditworthiness of a debt obligation of the issuer, not on the equity securities of the issuer or any form of security that is available to retail clients. It would be dangerous for "retail clients" to make any investment decision based on MOODY'S credit rating. If in doubt you should contact your financial or other professional adviser.