



FINANSTILSYNET

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Circular

Requirements for IRB models for banks, mortgage companies and finance companies

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1 Introduction

The internal ratings-based (IRB) approach allows banks to calculate risk weights and capital requirements for credit risk based on their own estimates of risk parameters such as probability of default (PD), loss given default (LGD), the credit conversion factor (CCF), estimated maturity (M) and size (S).

Use of the IRB approach is subject to approval by Finanstilsynet. Permission to use the IRB approach can only be granted on the condition that the IRB system provides for sound risk measurement, that the bank uses the system to approve and monitor individual exposures and as part of its risk management and measurement. The IRB system must also be validated on a regular basis.

This circular sets out Finanstilsynet's expectations regarding banks' use of the IRB approach. Chapter 2 deals with Finanstilsynet's processing of applications and general requirements for the IRB system. Chapters 3 and 4 describe special requirements for the probability of default (PD) and loss given default (LGD) models. Chapter 5 deals with the maturity and size parameters (M and S).

This circular replaces circular 8/2014 on IRB models for residential mortgages, circular 3/2015 on changes to IRB models and circular 9/2016 on the discount rate for calculating realised LGD.

2 Background and general requirements

2.1 Finanstilsynet's processing of applications and assessments

The requirements for an IRB system are specified in part 3, section II, chapter 3 of the Capital Requirements Regulation (CRR). According to CRR Article 144, permission to use the IRB approach shall be granted only if the bank can document to the authorities that the bank's models provide for meaningful classification and quantification of risk, that the bank uses the system to approve and monitor individual exposures and as part of its risk management, and that it has sound risk management systems, including systems and procedures for validating the models.

The regulations require judgment in a number of areas and set strict requirements for the assessments and practices of the banks and the authorities. The European Commission has laid down supplementary rules (technical standards) based on proposals from the European Banking Authority (EBA). Technical standards are implemented in Norwegian law through references in the relevant Act or regulations (incorporation) after being included in the EEA Agreement. In addition, the EBA has prepared comprehensive guidelines for the use and approval of IRB models. Finanstilsynet's understanding and practical application of the

regulations are based on the EBA guidelines. An updated overview of the guidelines underlying Finanstilsynet's practices is available on Finanstilsynet's website.¹

2.1.1 Model changes

Material changes to the models or their scope of application require the prior permission of the supervisory authority, cf. Article 143 of the Capital Requirements Regulation. A separate technical standard² for model changes gives qualitative and quantitative criteria for what should be considered material changes, as well as criteria and notification procedures for other changes. Material changes include changes in risk classification and quantification, changes in the definition of default³, changes in validation procedures and changes in the model's scope of application, i.e. use of the model for new business units or types of products or obligors.

Other changes that entail significant changes in the capital requirement shall also be deemed to be material. In accordance with the technical standards, changes shall be considered material if they are assumed to reduce the capital requirement for credit risk by 1.5 per cent at consolidated level or by 15 per cent for the portfolio for which the model is applied. If the bank makes several parallel or successive changes, the overall effect shall be assessed. Finanstilsynet expects the bank to establish criteria for assessing what can be characterised as an expected variability in the level of the risk parameters compared with the level on which the permission was based. A reduction in the average level in the portfolio beyond the expected variability is regarded as a model change that requires permission.

Model changes deemed necessary to correct underestimation shall be implemented immediately and be notified to Finanstilsynet.

The bank must have systems to identify changes that affect the IRB system and consider whether the changes combined or separately require permission. All changes shall be recorded. Changes that do not require Finanstilsynet's approval shall be notified to Finanstilsynet at least two months before their implementation, cf. Article 5 of the technical standard. If Finanstilsynet is of the opinion that the change requires permission, the bank will be notified of this, normally within one month after the documentation has been submitted.

2.1.2 Portfolio size

Requirements for the use and quality assurance of the IRB system, including the data, level of expertise and resources required for the development and validation of models, indicate that the bank's portfolios should be of a certain size. Finanstilsynet has observed that the IRB system is used to a lesser extent when granting and following up residential mortgages and other retail exposures, and that it is very difficult for the bank to collect data for such exposures from bad years. Finanstilsynet has also noted that it is particularly difficult for banks with small corporate portfolios to meet the requirements for IRB systems. Based on this experience, it is Finanstilsynet's assessment that banks with corporate portfolios of less than NOK 30 billion normally cannot expect to be granted permission to use the IRB approach.

¹ <https://www.finanstilsynet.no/regelverk/eba-retningslinjer/eba-retningslinjer/> (in Norwegian only)

² Commission Delegated Regulation (EU) No 529/2014 of 12 March 2014

³ Cf. Finanstilsynet's circular 4/2020: 'Identification of defaulted exposures' (in Norwegian only)

2.2 Historical data and safety margins

All relevant information shall be taken into account in the estimates. The estimates for PD shall reflect long-term outcomes, and the estimates for LGD shall reflect economic downturns.

The underlying historical observation period used must normally extend beyond the minimum period of five years, cf. Articles 180–182 of the Capital Requirements Regulation. A particular challenge for Norwegian banks is that the data underlying the models consistently reflect good economic times. In Finanstilsynet's assessment, the banking crisis in the early 1990s is thus far the latest serious downturn in the Norwegian economy. The Covid-19 pandemic has led to a serious economic downturn, but the future path of the crisis is highly uncertain, and it will take time before complete historical data from this crisis will be available. Finanstilsynet therefore requires that experience from the banking crisis is reflected in the bank's estimates. This is elaborated on in chapters 3 and 4.

In order to take into account the uncertainty surrounding the estimates, safety margins shall be added, cf. Article 179 of the Capital Requirements Regulation. The safety margins shall reflect statistical uncertainty and uncertainties and deficiencies in the data and the modelling. In its guidelines for PD and LGD estimation⁴, section 4.4, the EBA points to the following aspects that indicate a need for additional safety margins:

- missing, inaccurate or outdated data, e.g. on risk drivers over time
- missing, inaccurate or outdated data from economic downturns and weaknesses in the methods used to make adjustment for this
- changes in the definition of default over time
- changes in the bank's credit approval process, risk tolerance, exposure follow-up and recovery practices
- changes in market conditions or regulatory and legal frameworks that make the data less representative

Furthermore, an additional safety margin shall be added for the general uncertainty surrounding model use.

2.3 Responsibilities of the Board of Directors

The Board of Directors is responsible for ensuring that the bank's IRB system functions in accordance with the requirements and shall approve all significant changes to the IRB system, cf. Article 189 of the Capital Requirements Regulation. In order to fulfil this responsibility, the Board must review validation and internal audit reports at least annually. The Board of Directors shall also ensure that the bank's control functions are sufficiently independent.

⁴ EBA GL 2017/16

2.4 Validation

The bank shall at least annually validate the models by comparing the estimates with observed defaults and losses, cf. Article 185 of the Capital Requirements Regulation. The comparisons shall be based on all available and relevant historical data, and the same assumptions should be applied to observed values and estimates. This means that observed values must be seen in light of the economic conditions, and that the model estimates set on the assumption of an economic downturn should be adjusted to reflect the current economic situation. The model estimates should be validated without safety margins. In addition, the bank must validate the level of its safety margins and review the assumptions made when adjusting the model estimates to take into account downturn conditions.

Furthermore, the bank must assess whether the data are representative of the current portfolio, for example by comparing the impact on the main explanatory variables in the current portfolio with the dataset used to estimate the model. If there are discrepancies, beyond the expected variability, between average risk parameter levels and the levels on which the permission was based, the bank must adjust the model estimates or apply for permission to change the model, cf. point 2.1.1.

2.5 Use test

The IRB system shall be used in the credit processes and as part of the risk management process. However, the risk parameters used in the credit processes and risk management may differ from the parameters used in capital requirements calculations if these deviations are justified and documented. In accordance with the guidelines on PD and LGD estimation, the bank may for internal purposes use estimates without downturn adjustment or the special safety margin required to ensure that capital requirements are at a prudent level. Finanstilsynet emphasises that in such cases, the uncertainty of the estimates must be specified, along with the risk estimates provided by the models approved by the competent authorities. Furthermore, internal estimates must be validated and followed up in the same way as the approved model.

3 Requirements for models for probability of default (PD)

According to Article 180 of the Capital Requirements Regulation, institutions shall estimate long run average default rates. In their assessment and follow-up of IRB applications, the authorities must ensure that the historical data cover expected variability, cf. Article 46 of the European Commission's draft technical standard for model assessments⁵. In its guide-lines for PD and LGD estimation, section 5.3.4, the EBA emphasises that the data used must have elements of bad years, and that the bank must adjust the PD estimates if data from bad years are insufficient.

⁵ Cf. the EBA's 'Regulatory Technical Standards on Assessment Methodology for IRB Approach': <https://www.eba.europa.eu/regulation-and-policy/credit-risk/regulatory-technical-standards-on-assessment-%20methodology-for-irb-approach>

Finanstilsynet expects at least 20 per cent of the data used to reflect a downturn corresponding to the banking crisis in the early 1990s. If the bank does not have sufficient data from a severe downturn, it must estimate default frequencies for downturns that are representative of the bank's portfolio, and weight these estimates by minimum 20 per cent in the estimation of long-term default. Safety margins shall be added to the estimates to reflect insufficient data and the uncertainty of the estimation. For cyclical industries, there is considerable uncertainty regarding the weighting of good and bad years and the relevance of historical data. The bank must consider which industries and segments are cyclical and in need of special safety margins.

With respect to residential mortgages, particular uncertainty is attached to the quality of data from the banking crisis. The uncertainty is reinforced by the fact that the bank's other data reflect very good years in the Norwegian economy and brisk house price growth. The bank must assume a default rate of at least 3.5 per cent during a severe downturn. The level is calculated on the basis of observed problem loan ratios during the banking crisis (adjusted, among other things, for the ratio of problem loans to new defaults). In order to take account of insufficient data in segments with low default rates, the bank must add a safety margin to particularly low PDs, thus making sure that all residential mortgages have a PD of at least 0.2 per cent.

When validating PD models, their discriminatory power and calibration should be tested separately. To assess the models' predictive power over time, their discriminatory power must be tested over a period of at least two years. The PD level of each risk grade shall be compared to observed default rates both in the year of validation and over a longer period of time.

4 Requirements for models for loss given default (LGD)

4.1 Economic downturns

The estimates for LGD and CCF shall reflect loss ratios and limit utilisation during downturn conditions if these are assumed to be higher than under normal conditions, cf. Articles 181 and 182 of the Capital Requirements Regulation. According to these Articles, the EBA shall develop a draft regulatory technical standard that sets criteria for identifying economic downturns. According to the EBA, economic downturns shall be identified based on real economic factors such as developments in GDP and unemployment, loan defaults and losses, as well as sector-specific indicators such as property prices, commodity prices, industrial indices, household debt and disposable income.⁶ The bank shall use the most severe downturn period over the last 20 years, but, if necessary, look further back in time.

Finanstilsynet regards the banking crisis in the early 1990s as the most recent economic downturn, associated with a serious, concurrent decline in macroeconomic indicators such as GDP growth, unemployment and property prices, combined with subsequent significant loan

⁶ [Final Draft Regulatory Technical Standards \(EBA/RTS/2018/04\), 16 November 2018](#)

defaults and losses in the banking sector. During more recent downturn periods, slowdowns in GDP growth have been relatively short-lived, and the increase in unemployment, fall in property prices and defaults and losses in the banking sector have all been moderate.

If the bank does not have sufficient data from downturn periods, it must estimate the decline in collateral values and the effect on other model parameters during a downturn or extrapolate historical data backwards, including estimated losses during an economic downturn.

4.2 Collateral requirements

To the extent that LGD estimates take into account the existence of collateral, the bank shall ensure that internal requirements for the treatment of collateral meet the requirements of Articles 205 to 217 of the Capital Requirements Regulation, cf. Article 181. These estimates shall not solely be based on the collateral's estimated market value, but also take into account the bank's ability to gain control of the collateral and liquidate it. In the event of inadequate information about the collateral, insufficient data for the realisation of comparable objects or a less liquid market for the relevant type of object, a prudent valuation must be made of the collateral, cf. the EBA guidelines for PD and LGD estimation (point 6.1.3). Finanstilsynet would like to point out that for buildings under construction and other collateral assets pending completion, there may be considerable uncertainty associated with a possible realisation, especially during an economic downturn, cf. the EBA guidelines for PD and LGD estimation (item 6.2.3). Finanstilsynet believes that the value of such collateral normally cannot be included in the LGD estimates.

4.3 Calculation of observed loss rates

In order to reflect economic loss, the amount recovered after default must be discounted to the moment of default, cf. section 6.3.1.1 of the EBA guidelines for PD and LGD estimation. If the bank is able to determine the dates of payments linked to individual exposures, it can use the interbank rate plus 5 percentage points as the discount rate. If there is uncertainty regarding the data underlying the payments, so that the bank uses accounting losses or other approaches to estimate payments, the discount rate must be at least 9 per cent.

Collateral payments not taken into account in the LGD estimate shall be regarded as amounts recovered from the unsecured part of the exposure. Such payments shall be documented and monitored separately.

Incomplete recovery processes shall be included in the data for estimation and validation of the LGD models. As stated in the guidelines for PD and LGD estimation (section 6.3.2.3) relevant information from incomplete recovery processes shall be taken into account in a conservative manner. In Finanstilsynet's opinion, this entails that the bank cannot assume reclassification to a non-defaulted status, apart from for exposures awaiting reclassification in accordance with the quarantine provision in point 2.3 in Finanstilsynet's circular 4/2020 on the definition of default. Further recovery must be limited to the realisable value of approved collateral, which must be estimated conservatively.

4.4 Validation of estimates of performing exposures

In many cases, there will be systematic differences between the LGD estimates for performing and non-performing exposures. In such cases, a comparison of the predicted and observed LGD for non-performing exposures will not provide a sufficient basis for assessing the LGD estimates for the performing portfolio. The bank must therefore compare average LGD values in the portfolio with average observed LGD. If possible based on the available data, such comparisons can be made per industry, type of collateral or sub-portfolio.

A comparison between predicted and observed LGD for non-performing exposures is relevant at exposure and LGD grade level. In its assessments, the bank must place special emphasis on the grades that the majority of performing exposures have been assigned to.

4.5 Reference model for residential mortgages

The data used to estimate losses on residential mortgages during a downturn are highly deficient. In order to ensure prudent LGD estimates at portfolio level, Finanstilsynet has developed a reference model for LGD for residential mortgages based on their loan-to-value (LTV) ratio and assumptions about price reductions, recovery values, cure rates and costs during an economic downturn. The average LGD for the bank's portfolio shall not fall below the level indicated in the reference model for a portfolio with a corresponding LTV ratio distribution.

The reference model is based on the following equation:

$$LGD = (1 - cr)(u \cdot (1 - rec) + (1 - u) \cdot l)$$

In the equation, cr is the cure rate, u is the unsecured part of the exposure

($u = \max [0.1 - \frac{1 - haircut}{loan-to-value\ ratio}]$), rec is the part of the unsecured exposure that is recovered, and l is the loss rate for the secured exposure. The technical assumptions used in the reference model are a 10 per cent recovery value, a 10 per cent cure rate, a 5 per cent loss rate on the secured part of the exposure and a 55 per cent haircut to the realisable value relative to market value.

The reference model is applied to the individual bank's portfolio, including residential mortgages transferred to residential mortgage companies. The bank is expected to assess the calibration against the reference model in connection with the annual validation and implement measures if its internal model results in a lower LGD than the reference model. The assessment must be included in the validation report.

Haircuts may be adjusted upward if, over time, house prices grow faster than household income. A drop in house prices may reduce the haircut. In forecasts and stress tests used for the Internal Capital Adequacy Assessment Process (ICAAP), the bank can assume that changes in LTV ratios as a result of a drop in house prices will be offset by a reduced haircut in the reference model, so that the LGD levels will not be affected.

5 Other parameters included in the risk weight calculation

For exposures other than retail exposures, the maturity and the size of the counterparty are also included in the risk weight calculation. These parameters are not included in the banks' modelling, but are determined in accordance with regulatory provisions.

5.1 Maturity parameter (M)

The maturity parameter, M, shall capture the fact that short-term lending may be less risky than long-term lending. Banks that are permitted to use their own estimates for LGD shall, in accordance with Article 162, paragraph 2 of the Capital Requirements Regulation, calculate M based on the contractual repayment profile (letter a) or the maximum remaining time that the customer is permitted to take to fully discharge its contractual obligations (letter f), where M shall be minimum one and maximum five years. For banks that have not received permission to use their own LGD estimates, M shall be 2.5 years, cf. Article 162 no.1 of the Capital Requirements Regulation.⁷

When asked whether the institution's opportunity to prolong contracts should be taken into account in the maturity calculation, the EBA has replied that the contractual maturity can be applied where the customer is not in the position to prolong the contract or to otherwise change the schedule in a way resulting in longer maturities, and that the regulations do not require that the banks take their opportunity to prolong contracts into account when determining the maturity.⁸ Finanstilsynet would like to point out that although the customer cannot demand a longer maturity, the bank may have to prolong the maturity due to the customer's situation. This applies, for example, to loans with a sizeable repayment towards the end of the contract period, where it is assumed that the loan will be renewed or that the borrower will obtain new financing. Obtaining new financing may be demanding, especially if the risk is high or has increased since the existing loan was granted. There is thus a risk that the customer will not be able to refinance on the contractual date, whereby the loan will have to be extended. The same applies to lines of credit that are regularly renewed, since such financing is assumed to be essential to the borrower's continued operations and debt servicing capacity.

In cases where it is challenging to terminate the loan relationship at the end of the contract period, the bank's real risk exposure will surpass the term of the contract. This may typically apply to financing of real estate and other long-term investments. Against this background, the bank should consider setting M at the maximum value of five years for the financing of commercial real estate and other long-term investments. For current working capital facilities subject to annual or more frequent renewal, the bank should consider whether M should be set longer than one year to reflect the actual period during which the customer is permitted to discharge its obligations if the contract is not extended. Furthermore, for loans where the

⁷ Separate provisions apply to derivatives, repurchase agreements, etc.

⁸ Cf. question 687 (2013) in the EBA's Q&A service:

https://www.eba.europa.eu/single-rule-book-qa/-/qna/view/publicId/2013_687

credit risk has increased considerably since they were granted, the refinancing risk may have increased significantly. Thus, the bank should consider setting a higher M for such loans. According to Article 162 no. 4 of the Capital Requirements Regulation, banks using their own LGD estimates may choose to consistently set M at 2.5 years for all exposures to corporates within certain size limits. Finanstilsynet assumes that the banks, for risk management purposes, will estimate the maturity of all exposures and therefore will not need to use this provision.

If the maturity parameter used in the risk weight calculations does not reflect the actual risk, this risk shall be assessed when calculating Pillar 2 capital requirements, cf. Article 104 of the Capital Requirements Directive.⁹

5.2 Size parameter (S)

The banks may take the size of the counterparty into account when calculating the correlation parameter included in the risk weight formula, cf. Article 153 no. 4 of the Capital Requirements Regulation. The calculation of the size parameter, S, is normally based on the firm's total annual sales in EUR. However, the banks shall base their calculation on total assets if this is a more relevant indicator of firm size. In both cases, consolidated figures for the group of which the firm is a part are to be used as a basis.

