IMPLEMENTATION AND VALIDATION OF BASEL II ADVANCED APPROACHES IN SPAIN

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In Mr. Palomar's life there was a period when his rule was this: first, to construct in his mind a model, the most perfect, logical, geometrical model possible; second, to see if the model is adapted to the practical situations observed in experience; third, to make the corrections necessary for model and reality to coincide.

(ITALO CALVINO, *Mr. Palomar)*

By publishing this paper, the Banco de España seeks to make known the objectives, criteria, calendar and basic documentation necessary for the implementation of the advanced approaches envisaged in the new capital regulations and the content of the processes for validating such approaches, processes that need to be carried out so that these approaches can serve as a basis for calculating the minimum capital requirement of a credit institution or group of credit institutions. The paper also explains the way in which we consider that collaboration between the various supervisory authorities could take place.

The paper is structured into two parts and a number of annexes. The first part refers to the process of implementing and validating the advanced approaches for calculating the minimum capital requirements for credit, market and operational risk and is divided into five sections. Following an introduction, Section 2 refers to the general aspects of implementation and validation. In particular, it sets out the objectives of the new rules and of the Banco de España itself, it refers to the relevant background in Spain and, focusing on credit risk, it explains in depth the evolution of advanced management models, their essential elements and potential users, as well as the main aspects that affect the risk factors of these approaches. Section 3 then specifies how access to the advanced approaches in Spain is envisaged for credit, market and operational risks, indicating the most important milestones. Section 4 explains in detail the implementation schedule and the content of the basic documents designed by the Banco de España to carry out the process of validating and monitoring models. Finally, the last section of the first part of the paper, Section 5, specifies the necessary conditions to carry out the validation processes, with sufficient detail to understand how these processes will be carried out.

The second part addresses collaboration between supervisors in six different sections. These describe the aspects necessary to achieve effective supervision of international banking groups, the requirements for good governance of these groups and the principles for appropriate cross-border application of the new rules. Thereafter, a practical scheme of co-operation among supervisors is proposed for the validation of advanced approaches, considering the Banco de España's dual capacity as consolidated and host supervisor, as the case may be. Finally, the actions undertaken to carry out this co-operation in a reasonable manner are discussed.

This paper marks the opening a new subsection of the Supervision section of the Banco de España website, on the new capital rules and their implementation in Spain. It has been conceived as open-ended by nature, so that it will be updated, completed or developed (in whole or in part) by other subsequent papers through such website, in the light of the experience gained and any additional criteria that may be adopted in future.

ABBREVIATIONS

AIG	Accord Implementation Group
AIRB	Advanced internal ratings-based approach
AMA	Advanced measurement approach
ASA	Alternative standardised approach
ASBA	Asociación de Supervisores Bancarios de las Américas
BIA	Basic indicator approach
CCF	Credit conversion factor
CEBS	Committee of European Banking Supervisors
CRMT	Credit risk mitigation techniques
EAD	Exposure at default
FIRB	Foundation internal ratings-based approach
FSI	Financial Stability Institute
IAA	Internal assessment approach
LGD	Loss given default
M	Maturity
PD	Probability of default
QIS	Quantitative impact study
RBA	Ratings-based approach
RWA	Risk weighted assets
SA	Standardised approach
SABER	*Supervisión de la Actividad Bancaria bajo Enfoque Riesgo* (Supervision of banking activity under the risk approach)
SF	Supervisory formula
VaR	Value at Risk

CONTENTS

PROCESS FOR IMPLEMENTATION AND VALIDATION OF THE ADVANCED APPROACHES IN PILLAR 1

1 Introduction

The new international rules on capital, usually known as "Basel II", took their definitive shape in the paper "International Convergence of Capital Measurement and Capital Standards: A Revised Framework" published in June 2004 by the Basel Committee on Banking Supervision. It took five years to prepare, with a first round of proposals in June 1999, followed by additional proposals in 2000 and 2003, which finally crystallised in the definitive 2004 document. This long process was not solely an initiative of banking regulators and supervisors, but was characterised by the active participation of all the interested parties, especially financial institutions. In addition, it has helped to extend a common language and culture in relation to risk, which has been useful to facilitate the development of advanced measurement and control systems.

In the European Union, the definitive text of the new Framework has been incorporated into Community law by the Directives 2006/48/EC and 2006/49/EC of the European Parliament and of the Council of 14 June 2006, which update, respectively, Directive 2000/12/EC relating to the taking up and pursuit of the business of credit institutions and Directive 93/6/EEC on capital adequacy of investment firms and credit institutions.

The new European rules will, in turn, be transposed into national law for entry into force from December 2006. A high-level working group has been set up for this purpose led by the Ministry of Economy, with the participation of the Banco de España and the National Securities Market Commission. This group is responsible for studying the most suitable way of incorporating directives[1] into Spanish law, analysing which elements should be included in the Law and which in its implementing Royal Decree. The most technical aspects will be included in a Circular to be issued by the Banco de España.

As is well known, the new capital rules are based on the definition of three "pillars". Pillar 1 regulates the minimum capital[2] requirements for an institution's credit, market and operational risks ("Pillar 1 risks"). Pillar 2 takes into account all the risks faced by the institution or group, and establishes the need for a process whereby institutions assess their own capital needs and the internal allocation of such capital, and the review of this process by the supervisor. Pillar 2 also highlights the need for institutions and groups to carry out their activity with a reasonable capital buffer, and the importance of rapid intervention by the supervisor to correct any erosion of capital that may take place. Pillar 3 refers to market discipline and seeks, by means of information transparency, to ensure that unrestricted market forces provide external incentives that complete the measurement carried out in Pillar 1 and the result of the assessment of capital needs under Pillar 2. This can be illustrated graphically by the scheme 1.1.

The new Framework offers a broad range of alternatives for the measurement of the Pillar 1 risks, from which institutions may choose according to their strategies, necessities and risk profiles. Apart from the standardised approaches for calculating the minimum capital requirements for credit, market and operational risks, the possibility has been established of using internal models to measure these same risks in order to determine capital requirements. This is consistent both with modernisation of the risk management performed by institutions and with the evolution of supervisory procedures, which are increasingly based on the institution's risk profile.

For supervisors to accept the regulatory use of internal models, these must not only comply with a number of quantitative requirements, but also with other very demanding qualitative ones. All these requirements can be grouped, as seen in the scheme 1.1, into five

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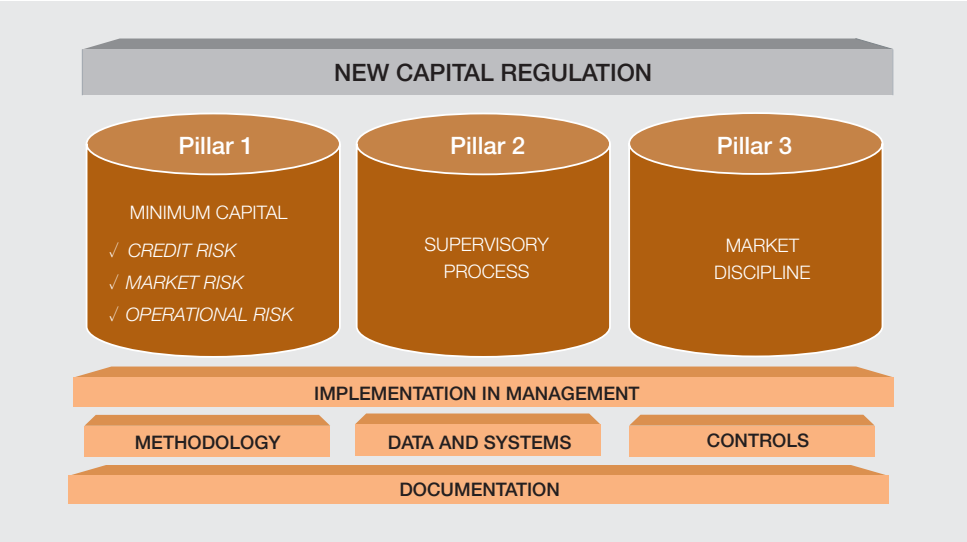
1. The terms "new rules", "Directive", "new Framework" and "Basel II" shall be used interchangeably in this document. **2.** The term "capital" is used in the sense of own funds.

SCHEME 1.1



categories that are the foundations of the new rules and which we shall briefly discuss below.

First, the models must be fully integrated into management, so that they are used as a basis for both strategic and day-to-day decision-making in the organisation. Supervisors cannot be expected to accept the regulatory calculations deriving from a model when the institution does not give sufficient evidence of its use in its regular activity. Commitment in good faith on the part of the governance and management bodies is obviously important in the concept of "integration into management".

The methodology used must be appropriate for both present and planned business, and be adapted to the environment in which the institution operates. It must also be understood by the institution, which must be capable of explaining it to the supervisor in sufficient detail.

The data and the technological systems are critical. If a technically appropriate methodology is applied to poor quality, erroneous or unreliable data, the output obtained from the models and the decisions that may be taken on the basis thereof will probably be wrong. In consequence, this aspect, which is often not addressed in sufficient detail and which consumes a large amount of resources, may become a problem that prevents the model functioning properly and, even more importantly, its improvement or adaptation may require a long period of time.

Taking into account the complexity of these approaches, the amount of information they need and the fact that different areas of the institutions are involved in their functioning, it is vital that there be a strict system of controls to ensure their reliability and proper functioning, so that they can achieve the purposes for which they were implemented. In this respect, the existence and adequate functioning of internal validation units is vital. However, they should not substitute, but rather complement, other necessary mechanisms to control the various components of the models.

Proper documentation of the various elements and processes that make up or are related to the models is very important to enable interested third parties, other than those who build, develop or use them to understand all the relevant aspects that need to be considered. On many occasions, insufficient attention is devoted to this aspect, although without the correct documentation it is not possible to carry out the internal and supervisory validation processes correctly.

The Banco de España considers that these aspects are the critical factors that need to be taken into account to ensure that the implementation of the new regulations at institu-

tions and, specifically, of the regulatory use of advanced risk measurement approaches is of sufficiently high quality. For these reasons, a strict validation process for the models presented by the institutions has been put in place and a set of documents has been designed to ensure that all the information needed for these processes to be executed in a reasonable and realistic manner is available in an orderly fashion.

2 General aspects

2.1 Objectives

One of the main reasons for Basel II, or the New Capital Framework, has been the need for capital requirements to be more sensitive to risk, which means applying different requirements to qualitatively different risks, something that the previous accord known as Basel I was not capable of doing properly. One consequence of this is the complexity of the Framework and, in particular, of the advanced approaches. The use of such approaches to determine minimum regulatory capital requires the prior authorisation of supervisors and their ultimate effect is that regulatory capital under Basel II is similar to, but not the same as, economic capital.

Requiring regulatory capital to be closer to the effective level of risk involves supporting the improvement in risk management by institutions and ensuring that those with lower risk parameters need less capital. Saving on a scarce good such as capital is a good incentive for efficient risk management. Accordingly, incorporation of the most modern techniques to measure and manage capital, using advanced tools that we generally call "models", is promoted.

Having a figure for capital is no substitute for the need for adequate risk management and control. An efficient institution will be one whose systems enable its exposure to the different risks assumed in its activity to be reduced to a reasonable level, which will involve a lower capital requirement, with the consequent improvement in profitability. The objective should not be to obtain more capital to cover a given level of risk, but to control the latter in order to reduce the necessary level of capital, so that the surplus can be used for new business in accordance with established policies. Accordingly, the risk-adjusted return on capital, calculated using the appropriate methodologies, becomes a key aspect that will be, and indeed already is, taken into account, not only by supervisors, but by the market itself, and should also be a basic element in the definition of an institution's strategy and in its internal management.

Responsibility for risk management and for ensuring that the level of capital is appropriate for the risk profile of the institution lies with its governance and management bodies. Indeed, senior management has to know clearly both the current and the target risk profile, according to the business strategy chosen, for which purpose it should accept the need to have adequate measurement and control procedures and systems, ensuring that the institution has the necessary organisation and resources. Likewise, they need to establish the sources and mechanisms to obtain and maintain the appropriate level of capital, ensuring that its composition and distribution within the group is suitable.

Basel II also seeks to increase the security and health of the financial system, maintaining approximately its current level of capitalisation. This means that, although the overall amount of capital is adequate, it needs to be better distributed among the institutions according to their actual risk levels.

Finally, another objective of the agreement is to support a level playing field across institutions and countries and to try to apply uniform criteria to portfolios with similar risk profiles.

However, it should be noted that Basel II has generated a variety of concerns, especially as regards its complexity, its somewhat pro-cyclical impact and the implementation difficulties involved.

With regard to its complexity, understood from the viewpoint of the regulatory use of advanced approaches, the institutions should carry out a prior in-depth process of analysis of the different options offered by Basel II, to try to find a balance between the sophistication of the models to use, the institution's risk profile and the costs of implementing and maintaining the most advanced methodologies. This does not mean that institutions should not be progressing towards the use of techniques that improve their management, but that these tech-

niques do not always need to have an effect in the determination of the capital requirements, given the strict conditions that must be complied with to obtain the supervisor's authorisation. What must be understood is that the regulatory use of complex advanced approaches is not imposed, but rather institutions are offered a range of alternatives so they can choose those they deem most appropriate in accordance with their current situation and strategy.

Procyclical effects are not desirable in a capital measurement system, since the function of such capital is precisely to protect the solvency of the institution and its long-tem stability. Accordingly, institutions need to be especially prudent when calculating risk parameters and assessing their own capital, applying conservative criteria and making appropriate adjustments to the business cycle of the market in which they operate.

Now that the new Framework has been published and its adaptation to the respective national laws is in the final phase, a new challenge arises: its implementation. The incorporation of the new concepts and the creation and assimilation of a new risk culture at institutions is a long and costly process that institutions will have to address. For its part, the supervisor must know and assess whether that implementation is being carried out appropriately at each institution or group.

In addition, the implementation process for international groups involves another important type of challenge, arising from the need for a close relationship between the supervisors of the various countries in which a single banking group operates. These countries may have various practical ways of exercising supervisory functions, different legal frameworks and even different rates of implementing the new regulations, and all this means that a supplementary co-ordination effort is also required.

In the Spanish case, the objectives of the new Framework are consistent with the Banco de España's supervisory approach. The latter is structured according to a risk-based supervisory methodology, which we call SABER (the Spanish acronym for supervision of banking activity under the risk approach). It is based on knowing and keeping updated the risk profile of each supervised institution, with emphasis on analysis of the individual and overall risks assumed by the institution and on the internal controls and risk management systems applied for their mitigation. This supervisory approach also involves assessment of the quality of the assets, analysis of the strength and regularity of the results, and the quality and sufficiency of the capital.

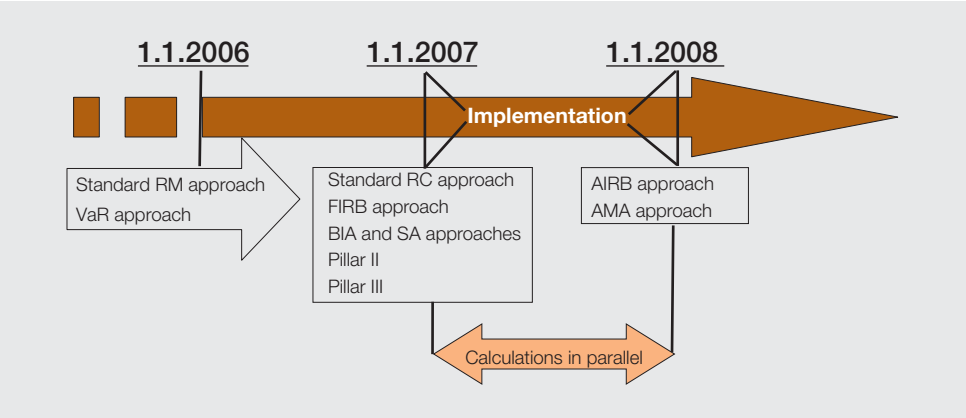
As a result, appropriate implementation of Basel II should involve maintenance of the current level of solvency and profitability of Spanish institutions and promotion of the best risk-management practices. It should be noted that the advanced approaches used to estimate the Pillar 1 risks (credit, market and operational) must be complete, so that, insofar as possible, they enable each of these risks to be captured and valued. It is not good enough for these approaches to omit part of such valuation and to leave it for Pillar 2, on the basis that the risks had been poorly assessed previously or that the model was not capable of measuring them correctly.

In short, advanced approaches are complex and costly, it is essential that the quality of the effective implementation of the new rules be ensured and the Framework must be consistently applied in the international environment. All this can only be achieved by following a highly demanding and rigorous process of validation and approval of advanced models for their regulatory use.

The scheme 2.1 summarises the implementation calendar.

In fact, market risk is already regulated in the Spanish legal system, both as regards the standardised approach and the use of VaR-type models, so that the new Framework will not have a significant impact in this regard. In January 2007, following the incorporation of the new Directive into Spanish law, the standardised approach and the foundation internal ratings-based approach to credit risk, the basic indicator approach and the standardised approach to operational risk, and the obligations arising under Pillars 2 and 3 will come into force. In Janu-

SCHEME 2.1



ary 2008, the more complex approaches will come into force, the advanced internal ratings based approach for credit risk and the advanced measurement approach (AMA) for operational risk. Meanwhile, in 2006 and 2007 parallel exercises will be carried out to assess the magnitude of the change in the requirement for capital as a result of moving from the regulatory calculations of Basel I to the use of advanced approaches in Basel II.

2.2 The background in Spain

Use by institutions of their own internal models to make the calculations that determine regulatory requirements is not a complete novelty for the Banco de España, which has accumulated relevant experience, from the technical and conceptual viewpoint, in reviewing this type of measurement method, especially with regard to market and credit risk.

The VaR-type models applied internally by institutions to assess and control market risk have normally been analysed by the Banco de España as just one more element within the scope of inspections of the treasury operations and capital market areas of the Spanish institutions most active in this field. As a result, the inclusion in regulations, in June 2003, of the conditions that market-risk management models had to fulfil in order for the supervisor to be able to authorise their use to calculate the capital requirements for such risk did not involve a substantial change in the review process, beyond the formal aspects involved in a formal validation and authorisation.

In relation to credit risk, the accounting rule that established the statistical provision (generally known as "FONCEI") in 1999, provided that institutions could estimate the necessary amount of this provision by means of internal calculation methods based on their own experience, provided that they formed part of an appropriate credit risk measurement and management system.

During the period that this legislation was in force, from July 2000 to December 2004, when the new Banco de España Circular 4/2004 of 22 December 2004 abolished the separate identity of this provision, various institutions requested authorisation to calculate the statistical provisions using internal methodologies applied to data reflecting the institution's own experience. The Banco de España carried out the relevant validation processes to determine these applications, which has given it valuable practical experience in this area.

The quantitative and qualitative requirements that internal models to estimate the statistical provision had to fulfil were actually very similar to those established for the IRB approaches under Basel II. The most relevant ones were: that the institutions' calculations had to be based on their own experience of non-payment and on the expected losses on homogeneous categories of credit risk; that the historic database should cover a complete business cycle, or the necessary adjustments should be made to reflect the effect of a complete cycle; and the rating systems had to form part of an integrated credit risk measurement and management model.

After four years carrying out this work with different portfolios and at different institutions, the Banco de España drew a number of conclusions that are very useful in relation to the current challenge of implementing Basel II. The main ones, some relatively obvious now with the experience acquired, are the basis for the initiatives undertaken to carry out the processes of validating IRB approaches in Spain. They are summarised below, without prejudice to their subsequent elaboration later in this paper:

- It is necessary to consider all the factors affecting advanced credit risk management systems, not only the methodological aspects.
- It is vital to ensure the integrity and consistency of the databases, the quality of the processes for their construction and maintenance, and the sufficiency of the information systems and technological environment supporting the model.
- Many resources are needed to review and process the data. Accordingly, the supervisor must be able to use the previous work of third parties, be they internal units of the institutions or external professionals.
- There are no standard procedures to validate risk parameter estimates. Each institution is a distinct reality and, even when uniform general criteria are applied, it is essential to perform a case-by-case analysis.
- It is very difficult to validate models that replicate external ratings. In any case, the institutions must understand such models and use them in their management.
- Approving a model is not enough; it is necessary to ensure that it is monitored from the outset.

Finally, as a result of the experience accumulated in recent years, the Banco de España is actively contributing to international fora, making eminently practical contributions, which we consider very useful for other international supervisory authorities.

2.3 Evolution, essential elements and uses of advanced credit risk management systems

The concept of an advanced credit risk management system is wider than that of a rating system and goes beyond the use of statistical models to estimate the probability of default (PD), loss given default (LGD) and exposure at default (EAD).

To understand the complexity of the credit risk management systems existing at the most advanced institutions, and the various essential elements that make them up, it is useful to know the way in which this complexity has progressively come about. Having described the evolution of advanced management systems it will be easier to identify and understand the role of the various elements of which they are composed.

2.3.1 EVOLUTION OF ADVANCED CREDIT RISK MANAGEMENT SYSTEMS

For credit risk management systems to become sufficiently mature for risk management to be based on the results obtained from them and for third parties to be able to take decisions based on such information with sufficient guarantees[1], a number of steps have to be taken. These, in accordance with the manner in which institutions have actually been evolving, and although they may vary from one to another, are broadly defined below and detailed in Box 2.1:

- Step 1: Credit scoring systems
- Step 2: Introduction of internal rating for corporate segments

1. For example, that the transparency and reproducibility (among other requirements) of the information generated enables supervisors to accept certain results of the models as regulatory inputs.

EVOLUTION OF ADVANCED CREDIT RISK MANAGEMENT SYSTEMS

BOX 2.1

Step 1: Credit scoring systems

Adoption of scoring systems for approving or granting credit, basically in retail segments, with progressive dependence on such systems as the basis for approval. This step was taken by most institutions some time ago.

The fundamental reason for the adoption of these systems of approval was the idea that, in the case of certain very standardised loan transactions in retail segments (acquisition of a vehicle, acquisition of a flat with a mortgage loan, small loans for no defined purpose), human intervention in the assessment, at least in the initial stages, had no advantages over the use of scorings obtained from procedures determined entirely on the basis of objective information on the customer and transaction.

In these systems, each transaction is given a score that serves to assess the quality of the credit granted. Moreover, these scores enable the credit granting policies to be parameterised in accordance with the objectives set. In its simplest variant, such parameterisation is achieved by fixing for each type of transaction an upper threshold above which applications are directly approved, a grey area below this upper threshold in which some other type of analysis or procedure needs to be carried out to take the decision, and a lower threshold below which applications are automatically rejected.

The advantages of these procedures are that:

- They lower the cost of analysis and reduce the time taken for credit to be granted.
- They standardise an institution's credit-quality assessments.
- They facilitate the implementation of different granting strategies.
- They enable changes in the quality of applications to be rapidly detected.

At the same time these systems require:

- Controls over the quality of the information supplied to the scoring system and, in particular, over the way in which offices or branches introduce the initial data.
- Monitoring of transactions, so that the scores assigned by the system are compared with the losses that occur, in order to detect whether the scoring system is not working as expected.
- Frequent changes in the weights of the existing variables or, even, the introduction of new variables, in order to adapt the system to reality in the light of experience.
- Capacity to store and process a large amount of information on transactions and customers.

As institutions have gained confidence in the reliability of these scoring systems, their number, complexity and applications (pre-arranging overdrafts, credit cards, offering personalised consumer loans) have grown.

Step 2: Introduction of internal ratings for large corporate segments

These are procedures that attempt to classify borrowers in a similar way to the methodology applied for some time now by rating agencies to bond issues. However, in this case, far fewer institutions have taken this step rapidly and there are great differences between the systems in existence on account of the greater complexity of these systems, in which expert opinion has a significant weight, and because of the advantage of critical size in enabling the existence of teams of sufficiently qualified analysts to be profitable.

The most active institutions in this business segment traditionally depended on internal assessments of obligors' creditworthiness based on both public information and private information supplied directly by the firms to the credit institution. The larger size of institutions and their movement into new markets, with the consequent increase in the number of obligors, and the increase in the amount and complexity of the information available, have been making it progressively more difficult to maintain this traditional model for rating borrowers.

Accordingly, a trend began towards standardisation of the content of the reports and of the minimum documentation to consider, which culminated in the introduction of systems that, without dispensing with subjective assessments, required the explicit assessment of certain factors considered relevant to be able to pronounce upon an obligor's creditworthiness. In some of these systems the assess-

ment is made using qualitative scales (e.g. very good, good, normal, deficient, very deficient) and in other systems quantitative scales are used that enable the final opinion to be summarised by a number obtained on the basis of the scores for the different factors.

In any case the final product is the classification of obligors into homogeneous risk classes, that is to say internal ratings classes, normally based on the expected probability of default. Frequently these classifications are similar in form to those used by rating agencies.

Initially these internal ratings were calculated for borrowers applying for new credit and for renewals. Later, institutions began to establish further situations in which a new rating had to be calculated for an obligor[1], significantly increasing the burden of work on those responsible for assigning ratings.

The advantages of internal rating procedures for firms are that:

- Standardisation of the information to be used and the assessment criteria is facilitated.
- A better perception is obtained of the overall quality of the credit portfolio given the ability to segment it into rating classes.
- Problem borrowers or those requiring vigilance (now associated with the lowest ratings) are identified in greater detail.
- In the case of banking groups, the rating of each borrower can be made available to all the institutions in the group.

The problems are:

- Difficulties properly defining the different rating grades or classes.
- Ensuring the uniform application of the criteria over time and by different analysts or teams of analysts.
- The need to assess obligors each time relevant new information appears.
- The obligor rating does not contain all the information necessary to decide whether to approve or reject a transaction. This decision needs to take into account other information relating to the particular details of each transaction (terms, security, purpose, etc) and the profitability of the customer and of the proposed transaction.
- The impossibility of checking the accuracy of the classification directly via comparisons with observed defaults, given the absence of a significant number of defaults.

Step 3: The coverage of exposure classes is widened and new types of rating system appear

New scoring or rating systems are introduced to exploit existing internal information on obligors or to cover portfolios of small- and medium-sized entities.

The purpose of these new systems is to ensure that all the exposures and borrowers subject to credit risk in the institution's portfolio have an associated rating or score and that all the relevant internal information is used.

There appear the first systems of behavioural scoring for customers, ratings of small-and medium-sized entities created on the basis of scores, and replica ratings for larger segments of medium-sized entities:

- In the retail segment: the existence of updated internal information, in a format that can be automatically processed, on customers (balances, past dues, direct debits, payslip amounts and other periodic payments, other products purchased from the institution, …) enables behaviour scoring systems to be created which, by incorporating recent information on the customer, improve their predictive capacity and permit updating[2].
- In the small- and medium-sized entity segments, similar scorings are introduced to those for retail customers, which combine financial information with other relevant objective information. These scorings are used to form rating classes that group together borrowers with scores within a particular range.

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1. Frequently, the ratings of all borrowers with significant activity are revised at least once a year. **2.** These scoring systems are normally associated with the obligor and not with a specific transaction since they include all the available information on the obligor concerned.

– For the largest corporates in these segments, higher quality financial information is available and a clearly different past-due behaviour is seen. Accordingly, other models need to be used. In some cases systems are designed which aim to directly replicate agencies' ratings on the basis of financial information, by means of a sample of externally rated firms for which certain financial ratios are unknown. The application of replica algorithms to the portfolio to be rated enables homogenous classes to be obtained, which are formerly similar to those of the original sample, although in practice the differences between the sample of rated borrowers and the borrowers in the portfolio may mean that the nominally similar external and internal classes may in fact be different.

Step 4: Loss distributions are obtained and complexity increases

Theoretical advances in modelling credit risk[3] have led to a radical change in the applications and in the complexity of the models used.

The difficulty of directly modelling the structure of default correlations in a portfolio for some time hampered advances in modelling the credit risk of complete portfolios. The situation changed completely with the development of factor models of credit risk in which the structure of correlations between the components of the portfolio depends on a small set of common factors (economic situation, membership of a sector, geographical location, etc.). In their simplest variants, these factor models are single-factor models of single-period default, i.e. they only consider losses owing to the appearance of defaults during a pre-fixed time period or horizon, which is normally annual.

In practice, institutions have been establishing multí-factor models and models that recognise losses due to changes in the value of assets owing to a decline in credit quality. Basically, the qualitative change is that at this degree of development institutions can estimate loss distributions, at a given horizon, for their portfolios with credit risk. The stages to obtain these loss distributions and their main applications are summarised below:

– Calibration of rating systems: these models require, first, that the portfolio be divided into homogeneous classes (with a similar PD at a given horizon) and a representative PD estimated for each. Also, to obtain a loss distribution for the portfolio considered, an LGD needs to be assigned to each element of the portfolio. The assignment of PDs (normally to each rating class) and of LGDs (normally to each element of the portfolio) is called calibration, although in its broad sense this term also includes, at least, the estimates of probabilities of movement between rating classes and the credit conversion factors (CCFs) necessary to determine the exposure at default (EAD).
– Allocation of economic capital to portfolios and transactions.
– When one has a loss distribution for a portfolio at a given horizon[4], one can determine the level of capital for which the probability of the portfolio becoming insolvent[5] is less than or equal to a certain value (confidence level). This value is fixed to ensure that a pre-set objective rating is achieved. Accordingly, the economic capital allocated to each portfolio is obtained as a percentile of the loss distribution.
– To allocate economic capital to the transactions individually requires the marginal contribution to risk to be calculated too[6]. In the particular case of single-factor models, under the hypothesis of sufficiently large portfolios, this process has no special problems. In other more general models, computational difficulties persist that have not been fully resolved, so that institutions resort to simplifications and approximate calculations.
– Allocation of economic capital to the different units and to the group. In order to allocate capital to a set of different portfolios (for example to a complete unit or to the whole group) some procedure must be explicitly or implicitly used that takes into account the additional diversification that arises from the existence of factors that contribute to the

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3. Factor models and loss distributions by credit risk for different portfolios. **4.** It is possible to distinguish between the expected loss of the portfolio (to be covered by provisions or future margins) and the rest of the loss (unexpected loss, which should be covered with capital), but from a conceptual viewpoint the modelling differences are not great. **5.** That is to say, that the loss actually observed at the end of the period is greater than the capital allocated. **6.** That is to say, it is necessary to calculate the capital for the pre-existing portfolio and the new capital required when the transaction is included, the marginal contribution being the difference between these amounts.

credit risk of the different portfolios differently[7]. At this level of development, procedures based on subjective estimates are frequently used to incorporate these diversification effects.

- Measurement of risk-adjusted profitability. Starting from nominal profitabilities and estimates for the expected loss and capital consumed, different measures of risk-adjusted profitability can be constructed and used to fix minimum profitability thresholds.
- Introduction of internal pricing models. Given that they had the data for the transaction (transaction type, amount, repayment schedule, rating class, information on security, etc.), for the rating system and for the PDs for each transaction in the different periods of its life (for example, obtained from the PDs associated with each rating class and from the estimate of the probabilities of movement between classes), the institutions began to use models to determine minimum internal prices. These prices are used almost exclusively as internal references.
- The exposures of different portfolios are grouped overall by means of the introduction of master scales in terms of PDs[8].

The advantages in this case are:

- Being able to determine, at least for certain portfolios and units, the allocation of economic capital using bottom-up procedures (based on transactions), as against the more extended practice of allocating capital to units on the basis of top-down procedures (normally using managers' subjective perceptions).
- Information that is highly valuable for the institution's senior management is obtained: risk-adjusted profitability of transactions, portfolios and units; classification of exposures into homogeneous risk classes; etc. Thus, the role of the results of internal models in the information supplied to senior management takes a qualitative leap.
- The introduction of much more selective lending policies is facilitated, as it is possible to identify groups of customers that create value and others that destroy it.
- Overall risk management begins to take shape, enabling the attraction of customers and customer relations (managed by a department of the institution) to be separated from management of credit risk (for which a different department is responsible).

The problems are:

- Difficulties in the calibration of low-default portfolios, which account for a very significant proportion of the exposures of universal banks.
- The difficulty of estimating certain model parameters (especially asset correlations and correlations between different portfolios), which shows how difficult it is in practice to justify the quantitative effects of diversifying credit portfolios.
- The need for much greater integration between the different applications that enable these models to function.
- The inexistence of clearly established responsibilities in relation to monitoring model functioning, methodologies and internal validation.
- Clearly insufficient resources dedicated to monitoring, updating and maintaining the methodologies, the data and the actual functioning of the internal models.
- Lack of complete coverage at the major groups and the existence of inconsistencies in the methodologies and problems of integrity and of database consistency.

Step 5: Consolidation

The most advanced institutions are attempting to consolidate their internal models, focusing on solving the problems revealed in the previous section. Accordingly, they are attempting to:

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7. The economic capital of the group or of the unit is not simply the sum of the economic capital required for each of the portfolios that make it up, but is less than that (diversification effect). **8.** Frequently, with similar PD intervals to those used by rating agencies.

EVOLUTION OF ADVANCED CREDIT RISK MANAGEMENT SYSTEMS (Cont.) BOX 2.1

- Implement the models efficiently, consistently and across the board (this is especially critical at large international banks).
- Renew and adapt the technological platform to support the integrated and effective functioning of these models.
- Establish clear responsibilities for the development or acquisition of models and for their use and internal validation.
- Adapt the internal models, so that they can be used for new purposes, both internal and external, particularly for regulatory purposes (IRB approaches, new accounting framework).

- Step 3: The coverage of portfolios is widened and new types of scoring appear
- Step 4: Loss distributions are obtained and complexity increases
- Step 5: Consolidation of rating systems

Institutions currently in this latter phase of the process of developing and improving integrated risk-management systems are natural candidates to opt for an IRB approach to calculate their minimum capital requirements. One should be aware that the magnitude of these changes entails significant consumption of resources and, consequently, a high cost, in addition to a cultural change at the institution or group, making a transition period of several years necessary, especially at the largest institutions.

2.3.2 ESSENTIAL ELEMENTS OF ADVANCED CREDIT RISK MANAGEMENT SYSTEMS

For a given portfolio, an advanced credit risk management system should include at least the following essential elements:

- Methodologies that describe and provide the basis for:
  - A set of basic definitions: default, loss, portfolio segmentation.
  - A rating or scoring system that classifies or orders counterparties and transactions according to their credit quality[2]. These systems should, in principle, enable credit exposures to be classified into sufficiently homogeneous classes in terms of the PD and LGD.
  - Estimation algorithms for different risk parameters: PD, LGD, CCF,…
  - Estimation algorithms for the final results: regulatory and management.
- Databases:
  - A calibration database: historical data on transactions and borrowers used to calibrate (obtain estimates of the PD, LGD, CCF for each homogeneous class of risk or type of transaction). This database is obtained from internal and external sources, and from internal processes.
  - A database that enables the current exposures of the portfolio to be obtained.
  - A historic database that stores different results so that their evolution can be analysed: PDs, LGDs, CCFs, classified exposures, etc.
- Processes that generate:
  - Initial results, rating or scoring, identification of defaults, losses associated with transactions in default,…
  - Intermediate results (PD, LGD, CCF,…)
  - Final results: regulatory (capital, provisions, stress testing) and management (limits, price setting, economic capital, alarms).

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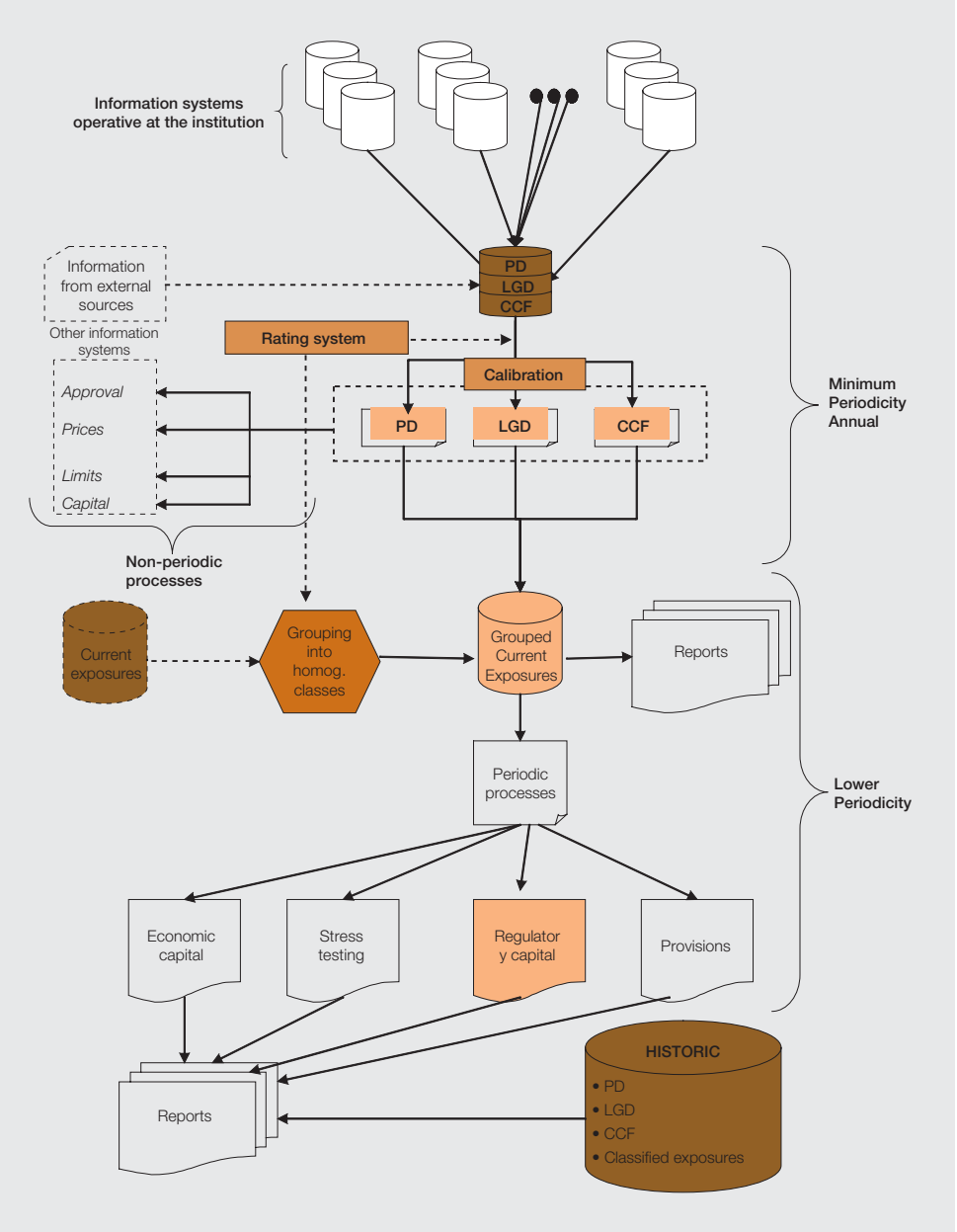
2. Normally, credit quality in terms of probability of default, PD.

ESSENTIAL ELEMENTS OF ADVANCED CREDIT RISK MANAGEMENT SYSTEMS

SCHEME 2.2



– Set of controls that attempt to ensure the smooth functioning of the system.
– Resources (technological and human) structured to facilitate their effective use.

The scheme 2.2 summarises the essential elements, and shows the fundamental role of the rating or scoring system and of risk parameter estimates in internal models. It is important to note that the procedure for classification into rating classes or homogeneous groups and the calibration (assignment of risk parameter estimates to each of those classes) are different things. In fact, there may be different calibrations for a single classification system according to its purpose (price setting, IRB approach, economic capital).

It is particularly difficult to validate the risk parameter estimates (PD, LGD and CCF). Notable among the proposed techniques are: benchmarking, backtesting and sensitivity and stability analyses. However, there is no standard procedure suitable for all the situations that arise in practice. It does seem clear that separate validation of each risk parameter is not sufficient, since both the opinion on the adequacy of the data and the processes for

obtaining them, and the decisions taken to calculate the losses incurred or the defaults, the comparison references and stability analyses, should be performed jointly for the different risk parameters (for example, both the data and the definitions of default used in the PD and LGD estimates should be compatible). In addition, the joint impact of the risk parameters on the final results (expected loss and regulatory capital) is especially important for supervisory validation.

2.3.3 USES AND USERS OF INTERNAL MODELS

As mentioned above, some of the most significant results of internal models that used to be used only internally, now facilitate the work of external users and are distributed beyond the institution. For example, in the most advanced countries, external auditors, rating agencies and supervisors now use certain results of internal models to quantify the risk profile of some portfolios in the case of institutions with developed models. Also, these institutions now supply to the public in their annual reports a significant volume of information, especially on credit risk: internal rating and scoring systems; the credit risk profile of the institution, units or portfolios; economic capital and risk adjusted profitabilities.

Different types of users can be distinguished according to the type of use and the degree of interaction with the model. The main ones are characterised by having a high degree of control over the result specifications and very close interaction with those internally responsible for their implementation, maintenance, supervision and validation; they may be internal or external, and notable among them are supervisors. Other interested users are final investors, analysts and rating agencies, whose importance is growing.

2.3.4 BASEL II AND SUPERVISORS AS USERS OF INSTITUTIONS' INTERNAL MODELS

With the new Capital Framework this trend towards increasing external uses is becoming more pronounced, at least for institutions that are going to adopt IRB approaches. In these cases, the supervisor becomes the main user of internal models, as is made clear in each of the three pillars:

- Pillar 1, minimum capital requirements. The possibility of calculating minimum capital using internal estimates of risk parameters (PD, LGD, CCF) means that the supervisor must become the main user, since:
  - It specifies a very specific set of requirements for the necessary results.
  - It requires very detailed knowledge of uses, validation and internal controls.
  - It explicitly approves this regulatory use following a supervisory validation.
  - It establishes new obligations to report to the supervisor.
- Pillar 2, the capital adequacy assessment process carried out by institutions and review by the supervisor. The need to pronounce on the sufficiency and adequacy of the existing capital translates, in practice, into the supervisor having to understand in detail the functioning and limitations of the procedures for assigning economic capital.
- Pillar 3, market discipline. Irrespective of how the requirements relating to market discipline are finally framed, the quality, degree of detail and comparability of the information that institutions will have to publish on their internal models is going to increase considerably.

2.3.5 THE MODEL UNDERLYING BASEL II AND ITS RELATIONSHIP AND MAIN DIFFERENCES WITH INTERNAL MODELS THAT CALCULATE ECONOMIC CAPITAL

Basel II has opted to introduce a uniform supervisory model to calculate minimum capital requirements for credit risk, instead of permitting each institution to use its own internal capital estimates as a basis for the regulatory requirements. The main reasons for this decision are:

– The need to establish reasonably objective capital requirements verifiable by third parties that do not introduce hard-to-justify competitive differences.
– The difficulty of validating the internal estimates used in institutions' models of economic capital, especially the different default correlations.
– The preference for capital calculation procedures that are not excessively procyclical, so that certain additional requirements concerning the type of estimates of risk factors are introduced.
– The complexity involved in such a large change in the procedures for setting minimum capital requirements, which makes it advisable to introduce additional more sophisticated measures as and when the sector incorporates and assumes these advances sufficiently.

The approach used by the new Framework, in line with the most advanced models used by the sector, is based on the idea of requiring sufficient capital[3] to reduce the probability of crisis, fixing a specific confidence level for this purpose.

Basel II uses certain formulae that, along with risk factors and existing exposures, enable a percentile[4] of the loss distribution[5] to be obtained for each type of portfolio[6] that, after subtracting the expected loss, becomes the minimum capital requirement for credit risk for the portfolio considered. Finally, the total requirements are obtained by summing the figures obtained for each of the portfolios[7].

The new Framework has different formulae depending on the type of portfolio, but they all have the same essential base[8]: the use of a model[9] for the loss distribution of the portfolio based on a single systemic factor (single factor model), under the hypotheses that the portfolio is sufficiently large and each individual exposure sufficiently small (homogeneous asymptotic portfolio). With these hypotheses, the calculation of the capital for the portfolio can be obtained by summing the capital estimates for each of the rating classes considered[10].

The fundamental reason for using different formulae for each of the portfolios considered is to ensure that the model takes into account the different default correlation actually observed for the different types of portfolio, by using the various values of the asset correlation parameter[11]. The latter is a key parameter in this type of model and is responsible, along with the PD for each type of rating, for determining the strength of the default correlation in each portfolio. Its essential effect is that, ceteris paribus, the higher the value of the asset correlation, the greater the capital requirement. This relationship is explained intuitively by the fact that a higher asset correlation translates into a higher default correlation, which means that the really unfavourable years (the tail of the loss distribution) will be worse the higher the default correlation (defaults tend to be grouped in time, increasing the losses in bad years).

Accordingly, the model underlying the Basel II proposal for Pillar 1 in the IRB approaches is, in essence, similar in many aspects to the most advanced ones used by the sector. However, there are some very important conceptual differences[12], among which the following are notable:

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3. In fact, it was finally decided to apply the level of confidence to be achieved to coverage of the so-called unexpected loss, i.e. the total loss less the expected loss. **4.** Specifically, the percentile associated with the 0.001 confidence level, i.e. a sufficiently high loss value so that the probability that the observed loss on the portfolio exceeds such value is equal to 0.001 (one in a thousand). **5.** At the one-year horizon. **6.** Five major types and various sub-types. **7.** The procedure for obtaining total capital by summing the individual capital amounts is justified by the additional hypothesis that the systemic factor is the same for all the portfolios considered. **8.** The formulae proposed also incorporate in some cases, a term for adjustment by maturity that seeks to penalise exposures granted at longer maturities and whose basis is not the model described. **9.** This type of model is known as an "Asymptotic Single Risk Factor" (ASRF). **10.** This property depends critically on the model only considering one systemic factor. **11.** These values have been estimated using real data. The way in which the real estimates have been incorporated into the supervisory model has taken into account other factors with a practical impact. **12.** There are also many more differences in the detail that are not discussed here.

- The internal models for calculating economic capital are more complex, especially in their treatment of diversification.
- Many systemic factors are used that allow the impact of diversification by geographic area, sector, type of industry, etc. to be modelled. The regulatory model does not allow the effects of multi-factor diversification to be incorporated.
- Economic capital is obtained by non-additive procedures and calculating the marginal contributions to risk.
- Internal estimates of asset correlations are used that may differ from those proposed in the regulatory model.
- The risk parameter estimates are of a different type.
  - The regulatory PDs must essentially be long-run average estimates[13], while internal models use non-biased estimates of the PDs for different time horizons.
  - The regulatory LGDs must be for downturn conditions, i.e. sufficiently conservative LGDs that take into account the cyclical variability of recoveries. By contrast, in their internal calculations institutions try to use unbiased estimates based on existing economic conditions.
- The procedures to estimate the risk parameters are much more restrictive in the case of Basel II:
  - For example, purely subjective estimates of the values of the risk factors that institutions use in practice for low-default portfolios are not permitted for regulatory calculations.
  - The minimum requirements relating to the run of data, the origin of the data, etc. are much stricter.
- There are many more restrictions on the recognition of different credit risk mitigation techniques.

For all these reasons, the minimum regulatory capital for credit risk calculated using IRB approaches will continue to differ[14] from the economic capital obtained from the institutions' internal models to cover such risk.

2.4 IRB inputs

The new regulation of credit risk offers two alternatives for calculating the minimum capital requirements for credit risk:

- The standardised approach. This conserves the structure of the 1988 Accord, in which standard weightings are applied to transactions according to the level of their credit risk and capital equal to 8% of the risks so weighted is required. The changes introduced by the new Accord, to achieve greater sensitivity to risk, are: accepting the use of external ratings, increasing the number of weightings and broader recognition of risk mitigation techniques. Also, in the case of mortgages, retail transactions and those with small- and medium-sized entities (SME) the weightings are reduced significantly. The main advantage of this approach lies in its simplicity, so that it can be applied by every type of institution.
- Internal ratings-based (IRB) approaches. A regulatory model has been developed for these approaches and institutions are allowed to estimate certain risk factors or model inputs internally. To use this approach institutions must have internal rating systems that enable them to classify their customers into a sufficient number of categories, fulfil a minimum number of requirements and have the approval of the supervisor.

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13. In the case of retail business the accord is more flexible. **14.** As already mentioned when discussing Pillar 2, the capital estimated by the institution and the underlying model are central to supervisory review.

The risk factors that institutions can calculate internally under the IRB approaches are:

- The probability of default (PD), an estimate of the average percentage of borrowers that will default in each rating category during one year.
- Exposure at default (EAD), an estimate of the borrower's potential debt in the event of its default.
- Loss given default (LGD), an estimate of the loss that will be suffered if the borrower defaults on its obligations, which is expressed as a percentage of EAD.
- The maturity of the transaction (M).

IRB approaches include two alternatives: the foundation and the advanced approaches. Under the foundation IRB, institutions may use the PD associated with each category to calculate the capital requirements by means of a model that will weight the risks in accordance with that variable. Under the advanced IRB approach, institutions will also use their own estimates of the LGD, EAD and M. These variables, under the foundation approach, are set by the supervisor. Other risk factors such as asset correlations are set by the supervisor in all cases.

Having estimated the different risk factors for each exposure the formulae established by the regulator to obtain risk-weighted assets (RWA) are used, the minimum capital required for the exposures being 8% of such RWA. The table below gives an example of the calculation of the capital requirements for a loan to a corporation. The minimum capital requirements for credit risk are calculated as the sum of the individual requirements for each exposure.

2.4.1 CONSIDERATIONS REGARDING ESTIMATION OF THE PD

The estimate of the PD shall consist of a long-run average of the annual default rates of the borrowers included in the category, i.e. a probability of default should be estimated that does not depend on the business cycle position.

The purpose of using a long-run average PD is to capture the behaviour of defaults over a complete business cycle, so that a parameter can be estimated that remains relatively stable in the face of economic fluctuations. Thus, the ideal would be to have, at least, information on defaults in the period spanned by the last cycle. Given that the duration of a business cycle varies from country to country, it would not be practical to fix a specific number of years. Rather, estimation of the PD for regulatory purposes should consider as many years in which the economic situation was favourable as years in which it was unfavourable.

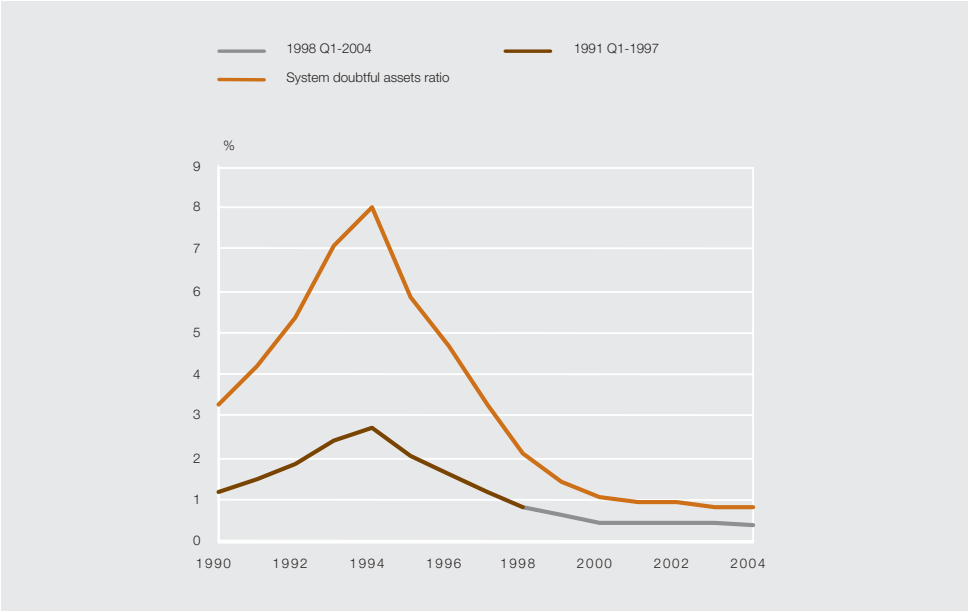
For example, in Spain the current business cycle can be considered to have begun in around 1990, spanning the initial years of recession, the recovery and the subsequent expansion from 1995. Accordingly, if only the last 6 or 7 years of history are considered, the behaviour of the model in the downturn would not be captured.

The idea of fitting the cycle is as follows: suppose that observed default rates are known (i.e. the proportion of transactions on which the borrower defaulted each year) for a specific rating class in a portfolio from 1998 onwards. The path of a cyclical variable whose behaviour is considered to be similar to that of the observed default frequency is then analysed. One possible candidate variable would be the system problem loan ratio. Although this is a stock variable, it seems very reasonable to think that when the problem loan ratio rises, the number of defaults will also increase.

Thus, if a relationship can be found between these two variables, the default rates that would have been observed in the bad years of the cycle can be estimated using the problem loan ratio of the system observed during those years.

The proposed fit can be depicted as follows:

FITTING THE CYCLE CHART 2.1



The pink line depicts the default frequencies observed from 1998 to 2004. The long-run average obtained from these observations is 0.5%. However, if the behaviour of the default frequencies in the downturn (grey line) had been observed, the long-run average would have risen to 1.2%.

Therefore, when the available data are not sufficient to capture the long-term behaviour of defaults, an adjustment needs to be made to the resulting estimates, which will depend on the circumstances of each institution and the information existing.

2.4.2 CONSIDERATIONS REGARDING ESTIMATION OF THE LGD

Various techniques can be used, individually or in combination, to estimate the LGD, although that based entirely on expert opinion is not permitted. Many of these techniques are based implicitly or explicitly on the discounting of flows received after default by a borrower or on an exposure. In these cases, special attention must be paid to the criteria used to determine the discount rate, the reference recovery period, and the estimation of the value of the guarantees and all the relevant direct and indirect costs.

In addition, the estimation of the LGD should have considered an unfavourable economic situation and the value of the estimate may not be less than the long-run default-weighted loss, calculated on the basis of the economic loss in the case of all the defaults observed. Institutions must consider the possibility that the LGD should be above that value, when credit losses are significantly above their average value.

The purpose of requiring institutions that use IRB approaches to estimate a downturn LGD, is to ensure that the volatility of credit losses over time is properly reflected. The formulae for calculating minimum capital under IRB approaches are based on a theoretical model (one-factor model) that takes into account the effect on the PDs of systemic risk, i.e. that which depends on the general economic situation. However, in the case of the LGD, the effects of systemic risk must be directly incorporated into its estimation.

If the recoveries for certain portfolios or exposures are below-average (i.e. the LGD is higher) when default rates are high, failure to take this into account in the estimation of the LGD could mean that capital requirements are underestimated.

The experience obtained from validating internal models in Spain for the purposes of the statistical provision has also served to detect signs of the existence of a positive correlation between default rates and the LGD in certain domestic portfolios,

although this relationship may be affected by the monitoring and recovery procedures and policies.

Given the impact that the existence of adverse dependencies between the default and recovery rates may have on the estimation of the capital requirements, institutions need to have procedures to identify them and to incorporate them into their calculations of the LGD, as indicated in the document published by the Basel Committee in July 2005 on the estimation of the downturn LGD[15]. If no significant adverse dependence is identified, the estimation of the LGD shall be the long-run average loss weighted by the number of defaults.

2.4.3 CONSIDERATIONS REGARDING THE ESTIMATION OF THE EAD

According to the new rules, the EAD is defined as the gross exposure of the transaction if default occurs. The calculation procedure distinguishes between the on-balance sheet positions and the off-balance sheet positions. The aim is to estimate the amount to which the institution will be exposed in each transaction at the time default occurs, while ensuring consistency over time with the PD and LGD estimates.

For on-balance-sheet transactions, the value assigned to the EAD shall be not less than the current amount drawn, and the netting effects may be recognised in its calculation in accordance with the requirements established for the foundation approach. However, for off-balance-sheet items, those institutions opting to use internal models must estimate the value of the EAD for each facility type. It should be noted that although the parameter used in the supervisory formula to calculate the minimum capital requirements is the EAD, it may be necessary to estimate the conversion factor (CCF), deemed to be the percentage of commitments currently undrawn that it is estimated will be drawn at the time of default. This estimation must be the long-run average, i.e. it must reflect a complete business cycle. For example, in the case of a credit line, it is necessary to take into account both the undrawn amount at the present time that may be drawn at the time of default, and the amount that may potentially be drawn beyond the limits granted.

As in the case of the LGD, the EAD must consider the effects of an unfavourable economic situation, so that the considerations made in relation to the LGD apply here too.

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15. The document is a guide to help institutions interpret and calculate the so-called downturn LGD referred to in paragraph 468 of the new Framework.

3 Access to advanced approaches in Spain

Following publication of the new Framework by the Basel Committee on Banking Supervision in June 2004, the Banco de España considered that the time was right to actively initiate in Spain the next phase of the process: implementation.

The decision to launch the process without waiting for the definitive incorporation of the new Framework into Spanish law, is justified by the need to ensure the quality of the implementation of the new capital measurement standards, given their significance for the solvency of the institutions and the stability of the system. An exacting and profound validation of the internal models that the institutions intend to use for regulatory purposes requires having a sufficient period of time available, given the novelty of the approach both for supervisors and for supervised institutions.

3.1 IRB approaches to credit risk

3.1.1 MAIN MILESTONES ON THE ROAD TO ACCESS TO IRB APPROACHES IN SPAIN

In March 2004, when the final draft of the new Framework was still taking shape and the implementation dates were being fixed, the Banco de España considered that it was the appropriate time to carry out a survey to find out institutions' ideas regarding the treatment of credit risk within the scope of what was then known as the New Basel Capital Accord. Accordingly, a questionnaire was sent to the institutions of the system (banks, savings banks, credit co-operatives and specialised financial institutions)[1] with five questions relating to: a) the approach that they then intended to adopt when the Accord came into force; b) in the case of IRB approaches, what percentage of the significant exposures in their portfolio would be affected; c) whether the planned option had been approved by the board and senior management; d) with what external support the projects were being developed; and e) the implementation budget.

The responses received[2] indicated that most Spanish institutions[3] were intending at that time to adopt foundation or advanced IRB approaches upon the entry into force of the Accord, at least for a significant part of their portfolios. However, in fewer than half of the cases[4] had the decision been taken by the board or senior management. Also, around two thirds[5] of the institutions that aspired to use IRB approaches depended on sector projects, which have not subsequently developed as then foreseen.

A process of analysis, reflection, design and preparation for the implementation of Basel II took place in Spain, basically during the second half of 2004, following the definitive publication of the new Framework.

The point of departure was the prior knowledge of the internal credit risk models of various institutions that had applied to use them to calculate the statistical provision, which was then still in force; the information used was that available from the Third Quantitative Impact Study (QIS3) carried out in 2002 in relation to the version of Basel II then existing; additional specific contacts were maintained with a number of institutions to obtain greater knowledge of their situation in this field; experiences and views were exchanged with other supervisors; and, finally, this information was checked against the direct and specific knowledge that the Banco de España inspection groups had of the supervised institutions.

It was concluded, following the evaluation carried out, that many institutions, despite the intentions they had expressed, were not going to be adequately prepared by the date of

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1. 285 institutions. **2.** 266 responses received. Of the remaining 19 institutions, 2 had not formed an opinion and the other 17 were inactive or not carrying out any lending activity. **3.** 171 institutions, 64% of those that responded, representing 92% of average total assets. **4.** Specifically, 41%. **5.** 105 out of 171, or 61%.

entry into force of the Framework to have credit risk models meeting the requirements established in the new rules. One of the main reasons was the insufficient involvement of the institutions' board and senior management; in many cases the development of internal models was an incipient theoretical construct and an objective of risk control departments, not a reality implemented in the management process, and the cultural change necessary for these approaches to be used effectively was not taking place. Another obstacle was the scarcity and low quality of the available data, and the technological inadequacy of information systems to properly support the new developments and the changes necessary in the applications and information circuits. In many cases, the lack of internal methodological specialisation and the strong dependence of the institutions on external projects that were outside their control suggested that the implementation schedules were hardly realistic.

In view of this situation, it was considered that the best way of ensuring high quality implementation of advanced Basel II approaches in Spain was not for a large number of institutions to formally present their models to the supervisor initially. The reason for this was that in many cases they would clearly not meet the requirements for approval, but would require a huge review effort, which would stretch the limited supervisory resources, preventing them from being concentrated to enable rigorous validation of the most highly developed models that are well established in the management process. What is most important is that the models should form part of the institutions' management culture, be methodologically robust, be supported by consistent data, be based on technologically adequate systems and have been sufficiently tested internally. Only when these conditions have been fulfilled is it logical to request the supervisory authority to validate the model concerned.

Accordingly, it was considered that only institutions complying with a number of criteria that enable one to assume that they meet the necessary conditions to successfully complete the validation processes on the dates established, would be in a position to apply to use advanced approaches to credit risk for regulatory purposes upon entry into force of the new rules.

On this premise, the implementation schedule[6] for the new Framework, until its entry into force, was proposed before the end of 2004 and the initial versions of the basic documents[7] to carry out the validation and monitoring of the models by the supervisor were designed. At the same time, the composition of the mixed teams of the Directorate General Banking Supervision of the Banco de España, which would be charged with validating the models, was determined. These consisted of personnel from the inspection groups charged with the direct supervision of institutions and supervisory personnel specialising in risk management models.

3.1.2 ACCESS TO IRB APPROACHES UPON THE ENTRY INTO FORCE OF THE NEW RULES

The Banco de España identified those institutions that could potentially be in a position to use advanced models upon the entry into force of the new regulations on the basis of its knowledge of the situation of institutions and of their aptitude to adjust to Basel II within the demanding period established. This knowledge was obtained from: a) reviewing the institution's internal models for other regulatory uses; b) the results of its participation in the impact studies; c) the on-going monitoring of the institution as part of the supervisory process.

The criteria taken into account to carry out this identification included: the prior experience of the institution in the use of rating systems; the effective possibility of using advanced approaches for a significant part of its portfolio; its international presence; the technical resources available; the degree of development of appropriate information and data processing systems; the existence of independent control units; the existence of an adequate internal validation process; and, finally, as a pre-condition, over a sufficiently long period of time, effec-

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6. Explained in detail in Section 4.1. **7.** Discussed in detail in Section 4.3.

tive implementation in the organisation of internal risk measurement models and their full integration into the day-to-day management process.

When this analysis was performed, in November 2004, not a single Spanish institution and probably no institution in any other country either, fully met all the conditions indicated. However, what was important was to evaluate if they might be able do so upon the entry into force of the new regulations.

As a result, nine Spanish groups were identified that together accounted for around two thirds of the average total assets of the Spanish financial system.

Thereafter, in accordance with the schedule established[8], contacts between the Banco de España and these institutions were intensified, in order to study in depth the viability of regulatory use of the IRB approach. At the end of 2005, one of the banking groups decided to put back its implementation target date. The other eight groups are still participating, with varying degrees of progress, in the validation processes established.

On current forecasts, in January 2008, between 55% and 99% of the credit exposures of these groups will be treated with IRB approaches. These are the exposures of some 50 individual institutions, including foreign subsidiaries, and the number of different models that have to be validated is around 200. These groups, which together represent around 60% of the Spanish banking system (on data for business in Spain), have also established reasonable roll-out plans for the rest of their significant exposures.

With regard to foreign subsidiaries in Spain, it is necessary to distinguish between those belonging to parent entities established in the European Union, to which the provisions of the capital directives shall be applied and, in particular, the regulations for enhanced co-operation between supervisors within the European Framework, and the subsidiaries of non-European groups that operate in Spain. In any event, possible applications for the authorisation of IRB approaches and the performance of the necessary validation processes will depend both on the situation and organisation of the parent entities and of their Spanish subsidiaries, and on the relationship between the supervisors of the home country (the country in which the parent institution is authorised) and the host country (the country in which the subsidiary is authorised). This matter is addressed in detail in section two of this paper. It is currently anticipated that about four subsidiaries in Spain of groups with foreign parent entities will aim to use IRB approaches upon the entry into force of the Framework.

3.1.3 COMMUNICATION PLAN

Besides the individual communications with those institutions that may be authorised to use IRB approaches at the earliest possible date, referred to in the previous section, the Banco de España has made a number of communications in relation to the implementation of Basel II in Spain.

In January 2005, letters were sent to the professional associations of the financial sector, notifying them of the actions that were being taken in relation to the implementation of the new Framework in Spain. These letters explained the criteria mentioned above and stressed the cultural change entailed by the adoption of advanced methodologies and the need for effective implementation of the models in the management process, the development of systems and treatment of information, quality data, the existence of a rigorous internal validation process, effective control units, adequate personnel training and the allocation of sufficient resources.

Communications[9] were also sent to the supervisors of those countries in which international Spanish groups have a relevant presence. These set out the proposal for the co-ordination that the Banco de España considers should take place when the new Framework is implemented by groups with a presence in more than one country, summarised the implemen-

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8. Explained in detail in Section 4.1. **9.** 39 letters in all, of which 19 related to Latin American countries.

tation plans of Spanish institutions, explained the initiatives that the Banco de España was taking in each case, and made a specific proposal for collaboration. In addition, a number of meetings were held with supervisors of different countries to advance this proposal.

3.2 Value at risk (VaR) models of market risk

Access to the use of internal models of market risk that use measurements of the value-at-risk (VaR) type to calculate the minimum capital requirements for institutions' trading activity is already regulated in Spain by Circular 5/1993, which included this possibility, not previously permitted by Spanish law, in June 2003. The new Framework put in place by Basel II does not substantially change the current rules.

Circular 5/1993 stipulates the basic requirements necessary to apply to the supervisor for approval of regulatory use of the internal model. When the application has been received, along with the necessary information, provided using the documents designed by the Banco de España[10], the validation process shall commence.

Along with the conditions of effective use in the management process, having an adequate measurement and control system and the other requirements laid down for an internal model to be authorised for regulatory use, the institution must have a minimum volume of trading activity. This is because if there are few transactions and very few positions in optional instruments then the application of the model may provide the wrong conclusions, insofar as it will have only been possible to test it in favourable conditions and its quality and ability to generate reliable results in the event of more intensive use would not have been sufficiently substantiated. It would not be reasonable to approve a model that may not be valid in the event of a certain operational change at the institution. However, this does not mean that it cannot be used for internal management purposes.

3.3 AMA models of operational risk

The measurement of operational risk and, specifically, the use of advanced models to calculate the minimum capital requirements for this risk is one of the major innovations of the new solvency rules.

Basel II offers institutions three methods to measure operational risk: the basic indicator approach (BIA), the standardised approach (SA) and the advanced measurement approaches (AMA). Each institution will have to analyse the approaches and decide which is most appropriate according to their circumstances, such as size, nature and the complexity of their activities. In addition, the new regulations include the possibility of using another approach known as the alternative standardised approach (ASA). This is a variant of the standardised approach designed for institutions that, because they operate in emerging markets, lend with a high risk premium and are subject to double counting of credit risk and operational risk. Only institutions operating under these conditions (i.e. only when the existence of PDs that are clearly higher than, in our case, those of the Spanish market can be demonstrated) will be permitted to use this approach, and then only with the prior approval of the supervisor.

Access to AMA approaches will follow a procedure[11] similar to that provided for IRB approaches to credit risk. However, taking into account, on one hand, that the models of operational risk are still in the development phase and, on the other, that the flexibility of the AMA is very great, it was decided to set a timetable for analysis that commences after that for credit risk. In any case, those institutions that wish to use AMA models to estimate regulatory capital for operational risk shall demonstrate that the model in question is used to take decisions, is adequate and strictly complies with all the requirements established.

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10. Detailed in Section 4.4. **11.** Explained in Section 4.5.

The Banco de España, anticipating consolidation of the development of AMA models, and in the interest of achieving a higher degree of quality for such models, does not intend initially to require the access to advanced approaches to operational risk to coincide in time with the use of IRB systems for credit risk or internal models for market risk.

3.4 Access to advanced approaches after the entry into force of the new regulations

One of the main objectives of the new capital Framework is to promote the use by institutions of the best management techniques. The Banco de España therefore hopes that, in the medium term, a significant number of institutions will comply with the strict requirements laid down in Basel II and in the European directives for the use of advanced methodologies.

As explained previously, in the case of credit risk, once the new capital rules are legally applicable in Spain, those institutions that show they comply with all the qualitative and quantitative requirements may apply for authorisation to use IRB approaches to calculate minimum capital for credit risk and to gain access to the validation processes established. All or some of the institutions that have so far been identified as potential candidates to successfully complete the validation processes in progress on the dates of first implementation will foreseeably be the first ones authorised, with other applications that may be made being resolved subsequently.

However, it should also be noted that the use of advanced approaches is a voluntary option for the institutions, so that before taking a decision, they should carry out a process of profound internal reflection to analyse which of the alternatives on the menu offered by Basel II is most suited to their characteristics and to the markets in which they operate, also taking into account the demanding and costly validation process they will have to carry out.

4 Implementation of advanced approaches

In late 2004, the implementation schedule for the new Framework was defined, in particular with regard to the advanced IRB approaches to credit risk, whose regulatory use may be permitted from 1 January 2008. Annex 1 is the Banco de España road map which sums up this schedule for the period from January 2005 to December 2007.

At the same time, in order to make the processes for validating advanced approaches to the measurement of the different risks more efficient, the Banco de España has undertaken the task of making the information required from the institutions to be able to analyse the degree of progress made in implementing these approaches as systematic as possible.

The most relevant documents designed as part of this systematisation work, as shown in the diagram below, are the Implementation Plan, the Validation Files and the Model Dossiers. The object of the Implementation Plan is to collect general information from the consolidable group on the three pillars and the three Pillar 1 risks (credit, operational and market). Each File focuses on a specific risk at the level of the institution, descending to a level of detail at which it is possible to determine the degree of compliance with the minimum requirements established by Basel II for the use of a specific advanced approach for risk measurement. The information contained in the Files will be a basic instrument in the supervisory validation process. Finally, the Model Dossier refer to each specific model and are the basic tool that will be used, once regulatory use of the model is authorised, to subsequently monitor and control it.

4.1 Implementation schedule: road map

Following the close contacts maintained between the Banco de España and the institutions that could potentially be in a position to use advanced models upon the entry into force of the new regulatory Framework, in January 2005 the Banco de España sent a letter to each of them. This letter requested, given the resolute intention expressed by the financial group, the details of the plan to implement Basel II, with respect to the three pillars of the Framework, in the various institutions making up the group. The structure of the minimum information that this Implementation Plan should contain was annexed to the letter[1].

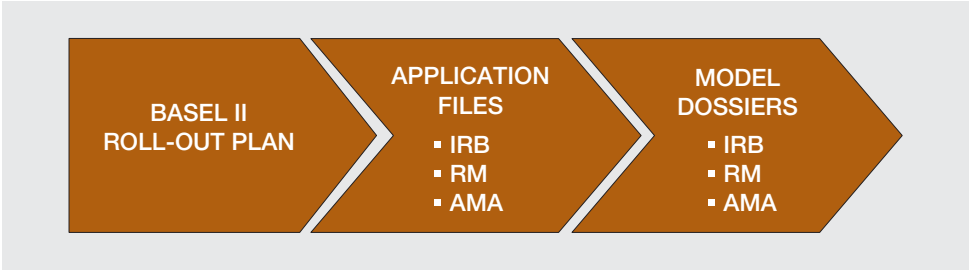
According to this request the group had approximately one month (until 28 February 2005) to send to the Banco de España the information requested, in a letter signed by a sufficiently senior member of the board or senior management, which would explicitly express their commitment to allocate all the human and material resources necessary for effective implementation of the proposed approaches, as well as to improve those areas in which the Banco de España may have detected weaknesses or deficiencies during the validation and approval process.

Having received the Implementation Plans along with the above-mentioned letters, the mixed validation teams analysed their contents to obtain an initial overview of the situation of each group with regard to implementation of the three pillars of the new Framework, both at that time and, according to their plans, on the date of its entry into force. To complete the information they held meetings with the institutions and had frequent contacts with them, until the teams were able to assess the capacity of the group to follow the Road Map in accordance with the time periods established.

In May 2005, as a result of this assessment, the Banco de España again sent a letter to the financial groups. First it notified them of the deficiencies detected in the implementation process and requested the relevant clarifications and proposed solutions. Second, it was explained that implementation of the Basel II advanced approaches is a voluntary option for the

1. Section 4.2 gives more details.

SCHEME 4.1



institutions to be carried out following a very demanding process that entails the allocation of sufficient resources by them, and they were asked to reiterate their commitment in this respect. Third, the letter focused on Pillar 1 credit risk, stating that to be able to gain access to the use of advanced approaches very detailed documentation on the various internal models was required, for which purpose the inspection services had designed the IRB File[2], attached as an annex, whose main objectives were to determine the degree of compliance with the minimum requirements and to obtain the necessary information to carry out the validation process.

Further, it was stated that, taking into account the need for and importance of the involvement of governing and management bodies, both the commitments assumed and the content of any letter that might be submitted to the Banco de España stating the desire of the institution to use advanced approaches to credit risk should be approved by the board of directors and that such letter would have to be signed by the chief executive officer or equivalent, and be sent to the Banco de España before 31 July 2005. Along with this letter, the parent entity of the group had to submit a properly completed IRB File for each consolidable institution that intended to use advanced approaches upon the date of entry into force of the Framework and, in June 2006, files for institutions that, according to the roll-out plan, will use advanced approaches at a later date.

As the quality of the databases used and the existence of an appropriate technological environment are fundamental for the supervisory validation of IRB approaches, it has been considered necessary to ask the institutions to submit specific internal and external auditor's reports on these matters[3]. In addition, the internal audit report must also cover another essential aspect, effective implementation of the models in the institution's management processes. Updated reports must be submitted half yearly until approval by the Banco de España of the approach presented by the institution.

In May, June and July 2005, the validation teams continued to extend their knowledge of the groups' implementation plans, they analysed the solutions to the deficiencies detected and they monitored, as far as possible, the preparation and compilation by the institutions of the Files they were required to submit. This activity involved continuous contact with the departments of the institutions responsible for Basel II, by the means appropriate at each given moment, including specific meetings and on-site inspections.

In accordance with the schedule established, at the end of July the letters were received in which the banking groups notified the Banco de España of their desire to use the internal ratings-based approach to calculate the group's minimum capital requirements for credit risk upon the entry into force of the new Framework, and to participate in the necessary validation processes and in the parallel calculations envisaged. These letters attached the initial information requested in the IRB File, including the internal audit and external auditor's reports for each model. As requested, the groups reiterated their resolute commitment to dedicate all the human and material resources necessary for successful completion of the

2. Discussed in greater detail in Section 4.3.1.1. **3.** Discussed in greater detail in Section 4.3.2.

Implementation Plan, and to resolve the deficiencies and make the improvements that might be indicated by the Banco de España. It was also stated that the board of directors of the group had approved the content of the letter.

Between August and December 2005, the validation teams reviewed the large amount of information received from the institutions in the IRB Files and the audit reports, and continued to maintain fluid relations with the institutions to complete the necessary basic documentation and to clarify the queries that arose during this review. The objective of the work of the teams in this period was to be able to issue an opinion as to whether each group was in a position to be admitted to the validation process to be commenced subsequently. It is important to point out that this did not involve any kind of pre-validation, but only an assessment of whether it was reasonable for the groups to move on to the next phase of the process, according to the quality of the information received and the rest of the data known.

Finally, in December 2005, the teams formulated their conclusions. Overall, the opinions obtained were sufficiently positive, though subject to more or less uncertainty, and always on the assumption that the improvement plans established would be completed by the dates indicated by the groups. However, in general terms, as indicated to the institutions during the preceding months, although they were on the right path, much work remained to be done. The main problems detected related to the lack of effective implementation in the management process, the short period covered by the databases, the deficient quality of the data, the insufficiency of IT systems and processes, the scant development of the internal validation processes, the lack of documentation and the slow progress of the methods for allocating economic capital.

Despite these problems, taking into account that there was a period of two years until definitive authorisation of IRB approaches could take place, and that the institutions had promised to comply with all the requirements established during such period, the Banco de España considered that the groups that had supplied the File and had completed the necessary information could be admitted to the validation process itself. This process begins in 2006, and is expected to continue until the end of 2007, when the supervisor will grant or refuse the groups' applications.

In consequence, in February 2006, the Banco de España sent these groups a letter of admission to the validation processes and parallel calculations that will in due course end with a mandatory pronouncement by the Executive Commission of the Banco de España on the regulatory use of the approaches applied for. The uncertainties, weaknesses and areas for improvement identified at each institution were specified and they were requested to notify the Directorate General Banking Supervision of the Banco de España, as soon as possible, of the progress being made to resolve the aspects indicated and, where applicable, of compliance with the conditions set within the periods established.

The structure of the minimum content of the IRB Model Dossier[4] was attached to this letter, in order to facilitate its preparation, taking into account that when the IRB approaches begin to be used for regulatory purposes it will be necessary for the institutions to keep available at all times for the Banco de España the documentation of the internal model, duly updated, as well as the data incorporated, the calculations made and their evolution.

However, it should be noted that the application referred to cannot be formalised until the Community legislation that provides for authorisation by the supervisor to use advanced approaches is incorporated into Spanish law. As a result, this initial set of groups have only stated their *desire to use the internal ratings-based approach, but have not yet made the formal application for authorisation* itself. Despite this situation, for practical purposes the model validation processes have already been commenced. The main reason for this, learnt from the Banco de España's experience reviewing the internal models for calculating the

4. Discussed in greater detail in Section 4.3.1.2.

former statistical provision, is that the quality of the validation process can only be assured if there is a sufficiently long period available. This is because of the complexity of the advanced approaches and the rigorous requirements they have to comply with, especially at these early stages of the effective implementation of Basel II, when institutions are still in the process of developing and improving many of their models.

Following the letter of February 2006, the validation teams have established work plans tailored to the needs of each group in order to properly plan the tasks and co-ordinate with the institutions the development of the process in 2006 and 2007. Basically, this planning has been carried out on the basis that in the first year the activity should be focused on the most important portfolio or portfolios that would use advanced IRB approaches in January 2008 and on the methodological aspects, use tests, controls, data and systems that are common to all the portfolios of the institution. In the second year, those aspects that have remained outstanding from the previous year shall be completed and the detailed work on the rest of the portfolios shall be commenced. In addition, the envisaged parallel calculation procedures shall be carried out. The field work will be intense, and all the necessary information will be requested, as well as half yearly reports by the internal and external auditors. This work will be carried out very closely with the departments of the institutions concerned with Basel II and shall conclude with a technical validation report that will form the basis of the final decision by the Banco de España to authorise or disallow regulatory use of the IRB approaches applied for.

As regards the applications for authorisation that may be made by other institutions, in accordance with the provisions of the new solvency regulation, when it has been incorporated into Spanish law, the Banco de España is likely to follow a process similar to the one discussed in this section. It would seem reasonable to start with prior contacts in which the institutions can explain their approach to implementation of the new Framework and the regulatory use of advanced models for risk management. Subsequently, the institutions would formalise this implementation with the Banco de España in a specific plan referring to the three pillars. It would then be necessary, for each Pillar 1 risk for which it is intended to use models, to comply with all the requirements indicated in the regulations and to provide the necessary documentation established in the IRB Files, including the audit reports. Having analysed and, where necessary, completed this information, the Banco de España will then be able to initiate the relevant validation processes that enable it to take the final decision to approve or dismiss the application, giving the reasons on which it is based.

4.2 Implementation Plan

Of the three types of document developed by the Banco de España to carry out the processes of validating advanced approaches to the measurement of the various risks, the Implementation Plan is the first that institutions must complete.

The Implementation Plan is the first firm declaration of intent by the institution to use advanced methods to calculate the minimum regulatory capital, since it has to be approved by the most senior governing body and must clearly explain the human and material resources plan for carrying out the project. The structure of the Implementation Plan is attached as Annex 2.

As regards general aspects, besides describing in detail the financial group, the organisational structure should be attached, specifying the responsibilities and functions of the various areas involved in the management and control of the different risks, with particular attention to the units responsible for the development and internal validation of the internal models used.

With respect to Pillar 1 of Basel II, information is requested on credit risk, operational risk and market risk. It is expected that those institutions that are capable of adopting advanced models to measure one of these risks will eventually measure all of them using ad-

vanced approaches, unless they are insignificant for the institution. It is not necessary to be in a position to calculate the minimum capital requirements for all the risks by means of internal estimates at the same time, but progress should be made to reach this situation within a reasonable period.

As regards credit risk, the approach that each institution of the banking group plans to apply on the date of entry into force of the Directive to the different asset classes and subclasses should be clearly indicated. In addition, the roll-out plans for asset classes and subclasses to which an approach other than the advanced IRB approach is initially going to be applied must be specified. The Basel Committee itself recognises that, for various reasons, it will not be feasible for many institutions to apply the IRB method simultaneously to all significant classes of assets and to all significant business units. Accordingly, the progressive adoption of the IRB method by the group may be permitted. However, the whole group will eventually be expected to use the most advanced approach, so that a reasonable timetable for adoption of the IRB approaches in all significant units should be proposed to the Banco de España.

Furthermore, an internal assessment is needed of the degree of compliance, as at the date of presentation of the Implementation Plan, with the minimum requirements to use the IRB approach selected, indicating the aspects that involve most difficulty. The institution itself shall make a self-assessment of its own situation with regard to observance of the requirements established in the new Framework.

Under the credit risk heading, it is also necessary to make a summary description of the models that are going to be applied in the different asset classes and sub-classes, indicating:

- The date of implementation of each rating system.
- The scope of the use made thereof in the institution.
- The historic depth of the databases that will be used to estimate the various risk parameters, describing the use of external data where applicable.

The objective of this information is to obtain an initial view of whether the models comply with the requirements relating to their use and to the number of years of data available to calibrate the PD, LGD and EAD.

Owing to the particular importance of the technological support, special emphasis is placed on an internal assessment being made of the technological environment, of the applications that make effective use of the internal models possible, and of the systems and procedures that ensure the integrity and consistency of the databases used.

The section dedicated to operational risk is less detailed. Information is only required on the approach the institution intends to adopt upon the entry into force of the Directive, and on the roll-out timetable and work plans in the event that it is intended to adopt more advanced approaches in future. As in the case of credit risk, an internal assessment is required of compliance with the minimum requirements.

As for market risk, the situation is different from that of the two previous risks; as rules already exist in Spain to enable capital requirements to be calculated on the basis of internal estimates, it is not necessary to refer to long-term plans. In this case, a description is requested of the potential scope of application of the model and details of the portfolios for which it is planned to apply for authorisation to use internal models.

The section on Pillar 2 should include the plans that have been developed to assess the risks not treated in Pillar 1. Specifically, reference must be made to the measurement of concentration risk, and of the risk of changes in interest rates insofar as they affect activities that do not form part of the trading book.

Taking into account that credit institutions have to demonstrate that they possess internal capital that, given the risks to which they are or may be exposed, is sufficient in quan-

tity, quality and distribution, the Implementation Plan must describe the procedures established to assess the sufficiency of this capital and its internal assignment. Also, the stress tests performed and scenarios considered shall be explained.

Finally, and as an indication of the progress made by institutions in relation to Pillar 3, they are asked to describe the information currently being disclosed and plans for complying with the requirements of this pillar.

4.3 IRB approaches to credit risk

4.3.1 DOCUMENTS DESIGNED BY THE BANCO DE ESPAÑA FOR THE VALIDATION OF IRB APPROACHES

As mentioned above, the Banco de España has designed a number of documents that enable an orderly process of validation and monitoring of the IRB approaches to credit risk to be carried out. These documents have been developed initially for the case of institutions that are going to opt for IRB approaches from the time of implementation of Basel II in Spain, and a long period of time will elapse between their initial contacts with the Banco de España and their use of the results of the models for regulatory purposes if and when authorisation has been obtained.

Depending on the experience obtained in the process in course, it is possible that these documents will have to be updated in order to be appropriate for those institutions that apply in future, when the new solvency rules are in force in Spain, for approval of regulatory use of their IRB models. However, it is very likely that the basic contents of these documents will remain similar and it will only be necessary to make some improvements and specific adaptations.

The following sections provide further details of these documents.

a. IRB File

Having analysed the Basel II Implementation Plan, if the Banco de España considers that there are no serious deficiencies preventing progression to the next phase, the institutions that intend to use advanced approaches to calculate regulatory capital for credit risk shall complete the so-called IRB File.

The IRB File focuses on Pillar 1 credit risk and is the means of making a common request for the information necessary to enable the processes for validating the IRB approach applied for (foundation or advanced) to be carried out. It is a very broad document that will enable an analysis to be made of whether the institution is in a position to participate in the validation process and of the degree of compliance with the minimum requirements established by Basel II.

An IRB File should be completed for each consolidable institution that intends to use advanced approaches upon the entry into force of the Framework, and all the Files relating to a single financial group must be delivered to the Banco de España together with a letter signed by the chief executive officer or equivalent. This letter shall include a description of the scope of application of Basel II within the group and an explicit commitment to dedicate all the human and material resources necessary for the implementation of the approaches selected to be completed successfully.

As a critical aspect of the validation, the Banco de España considers that the integrity and consistency of the databases, as well as the quality of the processes for their construction and maintenance, are one of the fundamental bases for the development and proper operation of the models. For this reason it has also been considered necessary for institutions to send reports by their internal and external auditors basically covering these aspects. These reports are discussed in detail in Section 4.3.2.

The validation processes planned include in-depth reviews of the data used to build the models and estimate the risk parameters, so that the IRB File indicates that the institution

must be in a position to make available to the Banco de España, at any time, the databases that have been used to make the calculations.

The IRB File, which is attached in its entirety as Annex 3, is structured into nine chapters of very detailed requests, the content of which is briefly summarised in Box 4.1

b. IRB Dossier

Having accepted the regulatory use of the models to calculate the minimum capital requirements for credit risk on a consolidated basis in the IRB approach, the institution shall keep the duly updated documentation of the internal model, its internal calculations and past results available to the supervisor. To have this information assembled and organised, the Banco de España has designed the IRB Dossier, whose minimum structure is very similar to that established for the IRB File.

The IRB Dossier is not intended to be a manual, since its purpose is to include, in an ordered fashion, the most important information on the internal credit-risk model so that it can be reviewed and monitored by a third party (the supervisor, internal validation unit, internal audit department, external auditors, etc.). The Dossier need only include a descriptive reference or link to manuals, documents or files of the institution.

The Dossier is needed because, even if a model is approved on a certain date, as being considered suitable for regulatory use, it is a fact that procedures and portfolios change. This means that supervisors and institutions themselves must continue to improve and control the model's evolution.

Among the reasons why models change, in practice, are the modifications made to the scoring or rating systems and the changes that occur in strategies, organisation and internal controls. Also, the stage of the business cycle and the different lending policies adopted by the board and senior management of the institutions have a direct bearing on the composition of the portfolios.

As a result, an in-depth review on a given date is not sufficient and cannot be considered so by the supervisor when validating the models, nor by the credit institutions themselves. The initial validation process should be completed with an on-going analysis, for which the IRB Model Dossier provides a basic tool.

The institution must complete a Dossier for each of its models, which shall serve to facilitate their monitoring and to be able to meet the documentation requirements established both internally and by supervisors. To be able to complete the Dossier institutions need to generate, store and update the most relevant information on the evolution of portfolios and internal models.

The Dossier, which shall be available to the supervisor, establishes minimum standardised information, which includes the main results, changes and problems detected during a specific period.

Institutions shall design their own Dossiers, but they will have to respect the minimum content indicated, including any other information they may consider relevant for assessing the model's behaviour, the control of its functioning and the detection of possible errors. In order for the Dossier to reflect the true situation of the model and to be continuously updated, the institution must make a unit responsible for its content, which shall be reviewed periodically by internal audit.

Notwithstanding, any significant change to the model shall be notified immediately to the Banco de España. The necessary updating of the Dossier shall not be sufficient in such cases.

The completion and maintenance of this Dossier is additional to the reporting obligations that institutions must comply with pursuant to the solvency rules that may exist from time to time.

IRB FILE SUMMARY BOX 4.1

I. Categorisation of exposures

Describes the segmentation used within the framework of the internal management of the institution and the process for assigning these exposures to the asset classes and sub-classes established in Basel II:

- Corporate exposures (distinguishing specialised lending)
- Sovereign exposures
- Bank exposures
- Residential mortgage retail exposures
- Qualifying revolving retail exposures
- Other retail exposures
- Exposures to SMEs treated as corporate
- Exposures to SMEs treated as retail
- Equity exposures
- Eligible purchased receivables

Also the different rating systems that are going to be applied to each segment must be detailed.

The aim is to construct a "map of models", i.e. to define the correspondence between the Basel II asset classes and sub-classes and the segmentation used internally by the institution, by means of a double-entry table in which the total exposure to credit risk is distributed as a function of both criteria.

II. Adoption of the IRB approach in the various asset classes (roll-out)

Application plan specifying to what degree and at what time it is planned to adopt IRB methods for the different relevant asset classes (or sub-classes, in the case of retail exposures) and for the different business units.

III. Estimation of the minimum regulatory capital requirements

Table that contains the average estimated risk parameters, the expected loss, the related accounting provisions and the regulatory capital requirements resulting from these estimates.

IV. Credit risk mitigation techniques (CRMT)

This chapter requests information on financial "collateral", guarantees, credit derivatives, netting agreements, CRM pools and financial leasing transactions.

V. Corporate, sovereign and bank exposures

In general, it is foreseeable that more than one model may have been developed to measure the risk of transactions belonging to these segments. It will be normal to find different rating systems for sovereign exposures and for bank exposures. Also, there may even be more than one type of model within a single type of exposure. For example, different models for large firms and for medium- and small-sized firms.

This section will include the details of all the models developed to quantify the risk of corporate, sovereign and bank exposures.

VI. Retail exposures

As in the previous case, in general there will be different models to treat the different retail exposures (mortgages, credit cards, etc.) and even more than one for each sub-segment, so that the details of all the models developed to quantify the risk of exposures to individuals will be included.

VII. Equity

The portfolios will be identified to which each of the approaches will be applied [market (internal models and simple approach) and PD/LGD approaches], distinguishing equities traded on a recognised exchange from the rest, justifying the reasons for the treatment chosen. Also, the methodologies used in each case must be described.

IRB FILE SUMMARY (Cont.) BOX 4.1

VIII. Treatment of eligible purchased receivables

Those products considered to be receivables shall be described, specifying the minimum regulatory capital requirements for default risk and dilution risk for each of the pools considered and explaining the calculation methodologies used.

IX. Treatment of securitisation exposures

The securitisations made must be defined for each portfolio, indicating the treatment given to both the underlying assets (standardised, FIRB or AIRB approaches) and the securitisation exposures (standardised approach, IAA[1], SF[2], RBA[3], etc.), describing in each case the procedures for calculating the minimum regulatory capital arising from these exposures.

Of the chapters mentioned above, the two that require the largest volume of information are those relating to corporate, sovereign and bank exposures (Chapter V of the File) and to retail exposures (Chapter VI), which are divided into the following sub-sections:

a. Portfolio definition

The portfolio subject to analysis shall be characterised in detail, describing its origin and how it has reached its present composition. Among other aspects, the following shall be detailed:

- original applications,
- migration to new applications (if any),
- channels used to capture transactions,
- the composition (present and historical) of the portfolio by maturity, product, etc.

b. Rating system

A detailed description shall be provided of the design of the rating system, which shall cover at least the following subjects:

- Distribution of the portfolio risk in accordance with the different risk tranches defined by the rating system.
- Model used: type of model, algorithm applied, variables used, etc.
- If there are any unrated exposures, the treatment planned for them shall be detailed.
- Main changes in the rating system.
- Integration of the rating system with warning systems.
- Measurements of discriminatory power.

With respect to the use of the rating system, the scope of its use within the organisation shall be described, stressing its relationship with the process of approving transactions, the periodicity of review of the ratings and the treatment of exceptions. Also, the manual that details the functioning of the model must be attached to the File.

c. Estimation of risk parameters and exposures

For each of the risk parameters, PD, LGD and EAD, at least the following shall be detailed:

- The definition of default used, specifying the situations that the institution considers subjective defaults and describing any adjustment made (where necessary) to align this definition with the regulatory one.
- Definition of what is considered a "material credit obligation to the banking group"[4].
- Calculation method used.
- The latest estimates and their historical values.
- Description of the database used to make the estimates (periods covered, variables, etc.), specifying the external sources used.

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1. Internal assessment approach. **2.** Supervisory formula. **3.** Ratings based approach. **4.** In accordance with the provisions of paragraph 452 of the Framework.

Also, the effect of the application of the risk mitigation techniques shall be explained.

d. Model outputs

A table is incorporated to include the regulatory model outputs: expected loss, related accounting provisions and the minimum regulatory capital resulting from these estimates.

The internal processes for which the model outputs are used (transaction approval, pricing, limits, economic capital etc.) shall be identified and described. Also, in the event that the risk parameters used internally do not correspond with those applied in the calculation of regulatory capital, the reasonableness of the criteria used shall be documented and explained.

e. Internal validation

The institution must explain how it carries out the process of internal validation of the models, and describe the techniques it uses for such purpose: comparisons with other similar (internal or external) portfolios and benchmarking, stress tests, backtesting, analysis of the stability and sensitivity of the outputs, etc.

f. Technological environment, information systems and maintenance

Description of the technological environment, of the information systems and of the applications that enable the model to be used effectively.

For this purpose, the processes used to obtain the information required by the model from the institution's applications and databases shall be explained, attaching existing technical documentation. The processes established to periodically obtain the regulatory capital requirements shall also be defined.

In addition, a description shall be included of the procedures used to store information relating to the rating system, the parameters estimated and any other relevant aspect, indicating the units responsible.

g. Qualitative aspects

Detailed information of the qualitative aspects necessary to understand and frame the use of the models, in particular on:

- Transaction approval and renewal policies
- Pricing policies
- The delegation of powers
- The involvement of the board and senior management
- The organisational structure
- The reports based on data generated by the model and their use

h. Internal controls

Description of the internal controls used to ensure that the whole advanced credit-risk management system functions correctly, according to the uses for which it has been designed and the situation and specific environment in which the institution operates.

i. Independent reviews

Information on the activities carried out by the institution's internal audit department, by external auditors and/or by consultants relating to the measurement and control of the risks arising from each portfolio.

j. Weaknesses and future developments

The weak points of the model and the timetable for addressing them shall be specified. Also, details shall be provided of anticipated changes in or future plans for the models and systems.

The structure of the IRB Model Dossier is the same as that of the IRB File described in the previous section, with the addition of two new points, the first identifying the persons responsible for its content and the second referring to the terminology. The Dossier shall have the following structure, the details of which are included in Annex 4.

1 Institution, author(s) and person(s) responsible for the contents
2 Portfolio definition and description
3 Scoring or rating system
4 Risk parameters and exposures
5 Model outputs
6 Internal validation
7 Technological environment, information systems and maintenance
8 Qualitative aspects
9 Internal controls
10 Independent reviews
11 Weaknesses and future developments
12 Acronyms, terminology and definitions

4.3.2 ROLE OF INTERNAL AND EXTERNAL AUDITORS

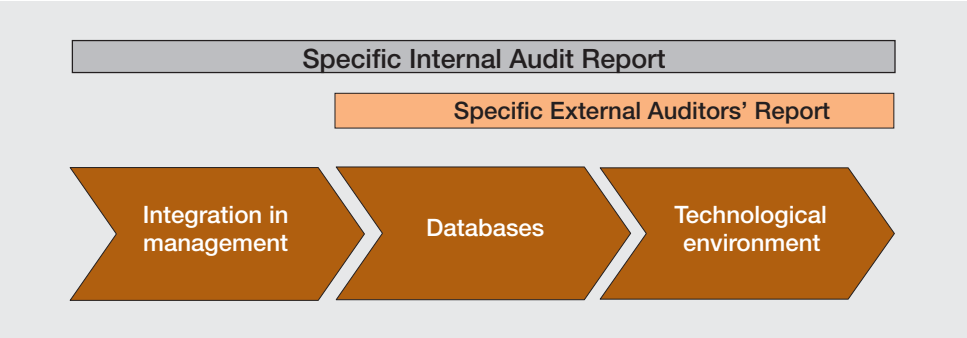
The processes for implementing the advanced approaches to credit risk in institutions are complex. Currently, and in accordance with the experience acquired from the procedures to approve internal models to calculate the former statistical provision, a number of critical aspects have been identified for which the supervisory validation should be supported by a prior analysis carried out by the institutions' internal audit departments and by firms of external auditors. This is because the large quantity of resources consumed by the verification of these aspects and their specific nature make it preferable for the supervisor's study to be based on a preliminary assessment.

First, specific internal audit reports are required. The purpose of the analyses by internal auditors must be to attain a sufficient degree of understanding with regard to the critical aspects referred to above and to issue a well-founded opinion on each of them. Also the deficiencies and weaknesses identified must be detailed, the possibility of resolving them assessed and a feasible timetable for addressing them set. In the event that there are weaknesses or deficiencies that are difficult to overcome, the impact they have on the final model outputs should be analysed, these being understood to include the risk parameter estimates and the minimum capital requirement calculations. In addition, all the results of the tests carried out to reach the opinion issued on each of the critical aspects shall be available to the supervisor. Finally, in line with the provisions of the new rules, the existence and quality of the documentation that serves to substantiate each of the points analysed shall be assessed. This documentation must be sufficient, issued by the competent bodies and updated with the appropriate periodicity, and it must be possible to identify at all times the units responsible for it. The internal auditors shall carry out this activity in relation to three major categories: integration in management, databases and the technological environment.

In addition, external auditors' reports are required, which shall draw conclusions on the aspects relating to two of the categories mentioned above: databases and the technological environment. Like the internal audit report, they shall include all the tests, analyses and results obtained in the study as well as the details of the deficiencies and weaknesses identified, with an assessment of their importance. Also a timetable shall be attached with the periods established in which the observed deficiencies and weaknesses are to be addressed.

Annexes 3 and 4 of the IRB File include the details of the minimum scope of the internal and external auditors' reports. The most important aspects relate to the integration in

SCHEME 4.2



management, the databases and the technological environment. The scheme 4.2 summarises the required scope of each report, which is then briefly discussed.

a. Integration in management

The integration of the rating systems into the institutions' daily management process should be assessed under this category. The aim is to ensure that the rating systems are used in the normal risk analysis and assessment processes, and that they have not been constructed solely in order to comply with the minimum requirements for regulatory purposes.

It is therefore essential to analyse the whole process that ensures that the systems are effectively used, beginning with the verification of the existence of internal rules drawn up by the competent bodies, which involve acceptance by the institution of the fact that these rating systems are a basic tool of daily management. Depending on their degree of integration in the institution, the use made of them shall cover a larger or smaller number of activities, including the approval of transactions, the establishment of limits, the calculation of economic capital, the setting of prices, the calculation of provisions and the remuneration of managers in accordance with measures of risk-adjusted profitability. The auditor must assess whether these rules are sufficient to ensure correct integration of the rating systems into the institution's daily management.

Besides verifying the existence of these rules, their correct application must be assessed, and a well-founded opinion given as to whether they are being used in the manner and within the periods established. Emphasis must be placed on the procedures for assigning ratings to transactions and for reviewing such ratings, checking that all the relevant information is available when they are carried out and that it is duly updated. It is also important to consider the approval processes, analysing whether the assessment of the transaction is taken into account in accordance with the internal rules established.

In addition to the foregoing, the controls established in relation to integration in management shall be reviewed, these being all the processes designed to ensure that the internal rules are being duly complied with. The auditor shall therefore give an opinion on the sufficiency of these controls, reporting any deficiencies and weaknesses identified.

b. Databases

The quantification of credit risk requires having historic databases that enable rating tools to be constructed and calibrated (by estimating the PD, LGD and CCF of the obligors or transactions and guarantees) and current exposures to be known. The experience acquired in Spain from reviewing internal models for supervisory purposes has shown that ensuring the databases are appropriate is one of the most complicated parts of model implementation and review and, without a doubt, that which involves the highest consumption of resources. It is the institution's responsibility to ensure the sufficiency and adequacy of the stored information and to verify the same. Therefore, the internal auditors are asked to issue a well-founded opinion on the quality of the databases and the external auditors shall also give an opinion on such

quality. These databases are those that have been used to calibrate the risk parameters, those that generate the calculations of the minimum capital requirements at any given time and those containing the historical information.

The analyses shall verify the quality of the data. For this purpose, specific studies shall be made of the databases, analysing the consistency of the stored information at any given time and over time, its integrity and accuracy. Also, as different sources of information tend to be used to create each database, it must be ensured that such sources are consistent with one another.

An opinion is also necessary on the sufficiency and functioning of all the controls established over the procedures for treatment and storage of the information relating to the model. Finally, apart from analysing the general characteristics of the supporting documentation, in the case of the databases it is also necessary to verify that the precise definition of each field, as well as the origin and traceability of each item of data, is included.

Annex 2 of the IRB File sets out the minimum requirements currently considered necessary for the calibration and current exposures databases, to assist the institutions in designing the necessary databases.

c. Technological environment

This last category refers to all the applications and processes that make effective use of the models possible, both in the institution's daily management and in the calculations of the minimum capital requirements. The aim is to know whether they are adequate to make the necessary calculations and to maintain the information with sufficient quality, as well as their degree of integration in the institution's ordinary systems. Also, as for the rest of the critical aspects, it will be necessary to assess the sufficiency of all the related supporting documentation.

d. Periodicity

It is intended that the first reports of the internal and external auditors be sent to the Banco de España at the same time as the IRB Files, and that they be periodically updated until the models are approved. Thereafter, the updating shall take place at least annually.

4.4 VaR models of market risk

Coinciding with the development in Spain of the financial and capital markets, and with the commencement of trading in advanced financial derivatives, the Banco de España gave greater attention to operations and specialised treasury activities.

Given the accumulated experience of the supervision of the treasury activities of credit institutions, and in the measurement of market risks using VaR approaches, the review of advanced market risk models for their regulatory consideration is merely a natural development of the supervisory activity that has been performed in the past.

The processes of validating internal market risk models were incorporated into the rules issued by the Banco de España in 2003 with the publication of Circular 3/2003, which amended Circular 5/1993 on capital. This provided, for the first time, for the possibility of using internal models, as an alternative to the standardised approach, to calculate the minimum capital for market risk.

4.4.1 DOCUMENTS DESIGNED BY THE BANCO DE ESPAÑA FOR VALIDATING MODELS OF MARKET RISK

To validate internal market risk models, the Banco de España has designed the following basic documents:

a. MR File

The internal models for which authorisation is requested for the purposes of calculating the minimum capital requirements for market risk shall meet the qualitative and quantitative requirements contained in the rules in force.

Along with the authorisation application, accompanied by the required internal audit report on the model, the applicant institutions will have to provide a report whose content is detailed in the application file for internal market risk models, known as the MR File. This describes the internal model implemented and the risk-management control system established, and shall also substantiate compliance with the quantitative and qualitative requirements of the current rules.

The analysis of the documentation provided in the MR File, the full contents of which are included in Annex 5, will permit an initial assessment of whether the model proposed forms part of an integrated system for the measurement, management and control of market risk, and whether it is applied effectively and consistently in the daily management of this risk.

In short, the information required in the MR File is structured in the following sections:

a.1. Scope of application

The scope of application of the model for which approval is requested shall be precisely determined, in terms of the risks assumed and the institutions of the consolidable group covered. The scope of the internal model shall coincide with the trading activity and operations performed by the institution in relation to the products subject to market risks.

If the potential activity involving market risk does not coincide with the scope of the application, an explanation shall be given as to why part is excluded from the model. The transactions not included shall, in any event, be exceptional and of marginal importance in relation to the institution's total trading activity.

a.2. Description of the exposures

Details of the current exposures by product and risk factor (valuation of positions and estimated value at risk) and the distribution of risk by business unit with the most detailed breakdown possible.

a.3. Estimation of regulatory capital

Information on the estimated regulatory capital for market risk, calculated both by applying the internal model and by the standardised method.

a.4. Policies and organisation

Details shall be given, including a definition of their responsibilities and functions, of the position in the institution's organisational structure of the committees and units involved in the market risk management function. The information given shall enable an assessment to be made as to whether there is an efficient separation of responsibilities and sufficient functional independence of the market-risk control and measurement units.

With respect to these units, it will be necessary to describe their functions, the numbers and qualifications of the staff, the details of their reporting lines and their relations with other areas of control and with business units.

A list shall be included of the internal manuals of policies, procedures, methodologies, supplementary analyses (backtesting and stress testing) and information systems that shape market-risk management, measurement, control and information.

This section of the File shall also include a list of authorised products and any restrictions on their related transactions (terms, volumes, trading and hedging strategies, etc.), as well as the procedures established for the approval of new products.

a.5. Measurement systems

A detailed description of the methodology used for VaR estimates shall be given including the following aspects:

– *Model input values,* with details of the historical period of observation of the risk factors used and of the time horizon for the maintenance of positions, indicating the methodological treatment employed if such time horizon differs from the regulatory one.
– *Market variables captured,* with details of the sources and methodology of the secondary calculations derived from such market input values: estimation of zero coupon curves, calculation of market factor volatilities and description of any smoothing criteria, estimation of risk-factor correlations, etc.
– *Input values and integrity of positions* subject to market risk, with a description of the methodology employed in the introduction of input values for positions in the model (in particular, any cash flow association techniques and estimation of sensitivity to the different risk factors in financial options).
– *Methodology for product valuation and VaR estimation,* with a description of the valuation models used, of the specific methodology applied in the estimates of value at risk and in the aggregation of risk across different business units, of the criteria for simulating risk factors, and of the coverage by model of the specific risk of private fixed-income and equities. The different methodologies applied must be appropriate for the level and complexity of the operations, with any known limitations specifically identified.

a.6. Stress analysis programme

The description of the structure of stress analysis programmes shall include the definition and selection methodology for scenarios, the periodicity and criteria for their review, as well as the policies for limits on risk assumption in stress situations and the information periodically supplied to the directors and senior management. The stress scenarios considered (whether historic, anticipatory, or worst-case) shall be those that are most appropriate given the risk positions and structures maintained by the institution.

a.7. Backtesting programme

Together with the results of the previous year's backtesting, the model contrast tests shall be explained [especially the definition of daily profits and losses (hypothetical or actual) and any adjustment criteria].

Irrespective of other considerations regarding the tests carried out on actual profits or losses, which incorporate intraday operations and other commissions charged or paid, how good the model is shall be assessed on the basis of hypothetical or "clean" backtesting, carried out daily by comparing the estimated value at risk on end-of-day positions with the hypothetical change in the value of the same portfolio at the end of the following day.

For the purposes of determining regulatory capital the backtests, and any increase in the scaling factor arising from the number of exceptions observed over the last 250 days, shall be carried out overall on the whole portfolio. However, additional contrast tests shall be performed at disaggregated levels, broken down by portfolio, dealing unit and type of risk in order to test the model's predictive power more efficiently.

a.8. Technological environment and information integrity controls

The description of the technological environment shall include a diagram explaining the systems involved in the process of measurement and control of market risk (basically, systems to capture market variables, systems to capture positions, valuation systems and VaR calculation systems) and information flows between systems.

Of the controls established to ensure the integrity of the information, at least the following procedures shall be detailed:

– Processes to reconcile positions between the trading-room, accounting and risk systems.
– Procedures to identify the boundaries of the portfolios included in the model.
– Procedures for the daily analysis of risk exposures.
– Procedures for validating the sources of market prices, their volatilities and correlations.

a.9. Structure of limits

The information supplied on limits put on market risk shall cover their definition, the hierarchical structure and the procedures established for their approval, modification, control and monitoring, and notification of excesses over such limits.

The use tests available to ensure the efficacy of the approved limits, both in terms of their actual utilization and in relation to the business budget of the units involved, shall be attached.

a.10. Information systems

The description of the information systems established shall include the details of the different regular or ad hoc reports, to notify the risks assumed, the management results and any excesses or deviations, as well as their recipients.

Institutions shall attach all relevant information that ensures the effectiveness of the communication systems established for taking decisions (the minutes of business and risk committees, the management of possible excesses over risk limits, loss limits, decisions to close or hedge positions assumed, etc.).

a.11. Databases of the relevant information for market risk management:

– Daily VaR series, correlated at the overall and disaggregated levels, with the highest degree of detail available.
– Series of profits and losses used in backtests, with the highest level of disaggregation available.
– Daily series of the various risk factors (interest rates, exchange rates, equity prices, implied volatilities in options, etc.) used in VaR estimates.

a.12. Details of tables of applications to calculate market risk

Institutions shall include the functional application manuals of the VaR calculation and the tables of model input values (positions and market factors), with details of the fields and their description, and the details of the tables of the partial calculations necessary to estimate the overall market risk of the scope of the model.

The ability to make available to the Directorate General Banking Supervision of the Banco de España the data necessary to verify the integrity of the information and to permit VaR estimates at a particular date to be replicated shall be substantiated.

a.13. Future developments and implementation schedule

In particular, the incorporation of any units or portfolios subject to market risk, that were initially excluded from the scope of the model, and any planned changes or future plans that have a bearing on the systems used to measure and control the risks to which the authorisation application refers shall be explained.

a.14. Other independent assessments

Reference to internal audit reports, with the scope indicated in the rules in force, and any external audits that may have been carried out, along with the tests performed to review the risk

control systems and, in particular, the procedures implemented to measure and verify precisely and rigorously the position input values.

b. MR Model Dossier

Institutions that have an internal model approved to calculate their minimum capital requirements for market risk shall keep updated a dossier to monitor the internal model, known as an MR Model Dossier, notwithstanding the periodic and regular information that they must submit to the Banco de España on the market risks assumed.

With a similar content to that already set out in the MR File, the MR Model Dossier is the basic tool for gaining adequate knowledge of changes in the approved model, as it includes the relevant information on the model, on its evolution and on any changes that may be recorded. It shall be kept continuously updated with the incorporation of the revisions or modifications made to the approved model (new products, modifications to the scope of the model, revision of sources of external data, modifications in the applications, organisational changes, etc.).

However, any relevant change in the model (strategies, new business, modifications to its scope, significant change in the systems or in the quantitative or qualitative requirements, etc.) must be immediately notified to the Banco de España. It will not be enough in such cases to carry out the necessary updating of the Model Dossier.

Keeping the MR Model Dossier for the approved model, the full contents of which are included in Annex 6, updated will enable interested third parties (supervisors, auditors, control units, etc.) to gain a reasonable knowledge of the general characteristics and current situation and evolution of the model.

By its nature, the Model Dossier is not a risk manual and, to avoid duplication in its completion, it is not necessary to incorporate the full contents of the various management and operating manuals that establish and develop the risk management and control function. A descriptive reference or link to such manuals, documents or files is sufficient for these purposes.

The information included in the MR Model Dossier is basically structured into the following sections:

1 Authors responsible for the contents, date updated
2 Description of the scope of application of the model
3 Risk exposures and levels
4 Policies and organisation
5 Measurement system
6 Stress analysis programme
7 Backtesting programme
8 Uses of VaR within the institution
9 Technological environment and information integrity controls
10 Independent assessments
11 Weaknesses and future developments

4.5 Implementation of AMA models for operational risk

Unlike credit risk, whose regulatory treatment has traditionally involved the imposition of minimum capital requirements, operational risk has, until now, been supervised solely from a qualitative standpoint. In fact, one of the most important changes in Basel II has been the introduction of an explicit capital charge for this risk.

The regulatory use of advanced AMA models by institutions means that they can comply with capital requirements using the results of their internal models directly. This involves an extra step compared to the advanced approach in credit risk, in which it is envisaged

that institutions should use their internal models, not to obtain the final amount of the capital requirements, but to calculate certain parameters that are subsequently introduced into a regulatory formula that gives the amount of capital required. In this respect, in relation to operational risk there is a greater similarity with the current regulation of market risk, since the amount of capital is given directly by the model that has been created in accordance with management needs, although the flexibility granted in relation to this risk is even greater, since the measurement method to be followed is not specified.

Currently, operational risk measurement models are not fully developed by the institutions. Firstly, as this is the risk with least tradition and experience of measurement, since resources have traditionally been dedicated to the management of credit risk, which is the main risk facing financial institutions, and to a lesser extent to other ones such as market risk. Second, because this risk, unlike credit and market risk, is not limited to particular units of the institution or group, which means that the scope of these models is very broad. Every unit of a credit institution is exposed to operational risk. Therefore, all the institution's units (both in lines of business and lines of support) are involved in managing this risk, and the identification, monitoring and mitigation of operational risk is the responsibility of each unit manager.

The possibility of using more advanced approaches is a voluntary option for the institutions and not an imposition by the supervisor. In any case, institutions that decide to adopt AMA models shall fully comply with the qualitative and quantitative criteria established by the new rules, and pass through the process of supervisory validation, so that the figure obtained from the model has regulatory effects.

Access to advanced approaches will follow a similar process to that described in relation to credit risk. Currently, an application file is being developed for advanced operational risk models, known as the AMA File. This is being designed in the light of the experience of the Banco de España, gained from specific visits to the most advanced institutions in this field, and of other supervisors and shall include sufficient and appropriate information to enable the validation processes to be commenced. The documentation requested in this File shall be sent to the Banco de España, to assess the advisability of accepting the institution for the supervisory validation process to be commenced in 2007.

Also, it has been considered necessary that the institutions wishing to apply an advanced approach should be required to develop an internal audit plan for ongoing review of the operational risk management framework and of the unit specialised in operational risk management and measurement. This plan should cover all significant activities that expose groups to substantial operational risk.

At a minimum, this review should verify the following:

- Integration of the measurement system in the institution's day-to-day management process.
- Management procedures and tools.
- Constituent elements of the measurement systems:
  - internal databases
  - external databases
  - scenarios
  - business environment and internal control factors I.
- Technological environment and applications.

The specific internal audit reports issued under this plan will be sent to the Banco de España half-yearly from June 2006 by the institutions that wish to use the AMA approach from the earliest implementation date of the new Framework. Annex 7 sets out the minimum content of this internal audit report. Once the use of AMA approaches has been authorised for regulatory purposes, this report will probably be annual.

As with credit and market risk, although a model may be accepted for regulatory use on a given date, both models and reality change over time, so supervisors and institutions will have to continue monitoring their status. Consequently, the initial validation process should be completed by the monitoring of the model. To facilitate this task, the Banco de España is developing an operational risk model monitoring dossier, to be called the AMA Model Dossier. This Dossier, whose minimum information structure will be similar to that established in the AMA File, should be kept permanently up-to-date by institutions and at the disposal of the Banco de España.

Notwithstanding, any significant change that has a bearing on the model shall be notified immediately to the Banco de España. The completion and maintenance of this Dossier is additional to the reporting obligations derived directly from the solvency rules that may exist from time to time.

Finally, it should be kept in mind that, in the area of operational risk, the supervisor will continue to verify, in addition to capital adequacy, whether an institution's qualitative management criteria are suitable for its risk profile[5]; or, put another way, whether the risk management systems are effective and truly assist in analysis and in mitigating the operational risk incurred by institutions.

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5. In February 2003 the Basel Committee published a compendium of best practices for operational risk management, "Sound practices for the management and supervision of operational risk", which contains ten basic principles for the management and supervision of this risk and which is applicable to all kinds of institutions regardless of the measurement approach they intend to use.

5 Supervisory validation of advanced approaches

5.1 Preconditions

The new capital rules set very strict minimum requirements for institutions wishing to use the advanced approaches to credit, market and operational risk. It is important to note that compliance with these requirements is a step that must precede supervisory validation. Accordingly, the institutions that wish to request authorisation to use these approaches have to first analyse in detail their degree of compliance with the minimum requirements.

However, based on past experience in Spain of supervisory review of internal models, the following may be highlighted as critical matters prior to supervisory validation:

5.1.1 IMPLEMENTATION AND EFFECTIVE USE OF ADVANCED MANAGEMENT SYSTEMS: USE TEST

The main aim of developing internal models should be to improve risk management. Although regulatory changes have unquestionably spurred certain institutions to set in train or speed up a process of change in their risk measurement systems, from a supervisory standpoint it is not admissible for an institution to develop models solely for the purpose of calculating regulatory capital, seeking thereby to reduce its capital requirements and enhance its image in some way.

For this reason, as mentioned above, a basic requirement for regulatory use of the models is that they must be integrated in day-to-day risk management and form part of the institution's culture and customary procedures. The use of the models, for, among other purposes, assuming and monitoring risks, pricing, setting limits, allocating capital, assessing results and drafting reports for management, will help to ensure that the model is fully implemented and facilitate the detection of possible errors by the various areas involved.

The fact that the model approved for regulatory purposes is integrated in the management process does not mean that the outputs generated by it need to be the same for management and for regulatory purposes. Thus, for example, the time horizon and the confidence level set by Basel II for estimating value at risk, in the case of market risk, or the credit risk factors used in capital calculations, so as to standardise these calculations across institutions, need not be the same as those used internally by the institution for pricing, calculating economic capital or any other purpose. In other words, it is reasonable and can be expected that a single model will generate different results depending on the purpose for which it is to be used (regulatory or management), but it is not acceptable to develop two different models.

Checking a model's effective implementation in day-to-day risk management and its internal uses of is a key factor both in internal validation and in the supervisory review associated with the process of authorising that model. This is what is known as the use test. Supervisory validation is not possible unless the systems have been fully operational for a sufficiently long period. For example, in the case of credit risk, before IRB approaches can be used the new Framework requires the rating systems to have been used internally for a minimum period of three years after the transition period has ended.

Specifically, in the case of credit risk, the conditions to be met before authorisation to use the IRB approaches can be requested are as follows:

- The exposures falling outside the IRB treatment must not be significant in risk terms. For this purpose, the minimum initial required coverage under the IRB approaches must exceed 50% of the total exposures in terms of EAD.
- For an institution to be authorised to use IRB approaches in a part of its exposures, it must develop systems that enable it to apply those approaches to all its signifi-

cant exposures in a period that is reasonable and adequate for the institution's risk profile and characteristics.

- Consequently, by the end of the progressive implementation period, the institution would have to be treating around 90% of exposures under IRB approaches. To make this calculation, the segments for which permanent partial use is acceptable will be excluded and the exposures will be calculated in terms of EAD.
- The foundation IRB approaches are expected to be of a transitional nature, so the institutions that choose to apply them to any of their segments should be capable of developing systems for the use of advanced IRB approaches within a reasonable period from when they are authorised to use foundation approaches; this entails calculation of all the risk parameters included in the advanced approaches (LGD, EAD and M).

5.1.2 DOCUMENTATION

Another essential step prior to supervisory validation, which sometimes does not receive sufficient attention, is the documentation of all the policies and procedures that shape an institution's activity in the risk management area, including measurement systems and internal validation procedures.

Documentation cannot be regarded as a mere regulatory requirement. Rather, it must be useful for the areas involved in risk management, whose participation in preparing it is essential. Accordingly, a balance must be sought between a sufficient level of detail and practical usefulness. Also, maintenance mechanisms must be devised to ensure that documentation is kept up to date and reflects reality.

The new rules establish very strict requirements for written documentation of the design and operational details of internal risk management and control systems, including, inter alia, compliance with minimum requirements, the organisation and responsibilities of all departments involved in risk management and the methodology of the statistical models used to measure risk, with an indication of their limitations, as well as the procedures for validating them.

The use of models acquired from third parties does not carry exemption from documentation requirements. The institution should have sufficient knowledge of how these models work and make up for the possible lack of confidential information on the development of any of their parts through the use of other validation techniques. In short, it should be able to demonstrate to the supervisor that the acquired models meet the minimum requirements set by the regulator.

5.1.3 DATABASES

Providing for the appropriate databases used in implementing and reviewing risk measurement systems is a complicated matter, although the difficulty varies depending on the risk in question. It is much more complex to model the behaviour of risk factors in the case of credit and operational risk than in the case of market risk.

Two frequent problems encountered in the information available in databases are its lack of quality, mainly because it is incomplete or inconsistent, and its traceability, defined as how easy it is to identify the sources from which the information came. To ensure quality, procedures have to be put into place to reconcile the information used in credit risk management with the accounting and other management information. Traceability is a basic requirement in order for the information used to be auditable.

The new rules establish, in general, very strict requirements for the collection, storage and organisation of information and for the necessary observation period. Furthermore, when the available information is limited — obviously not to the point of making it insufficient for estimating the risks assumed — a greater prudential margin must be added to the estimates made.

5.1.4 INTERNAL VALIDATION AND MONITORING

Internal validation is a compulsory prerequisite for supervisory validation. In internal validation, a specialised, sufficiently independent unit of the institution in question issues a technical opinion on whether the internal model is adequate to be used for the specified management purposes. All significant uses, both internal and regulatory, must be identified and a conclusion reached on its usefulness and effectiveness.

This validation must not limit itself to the methodological and quantitative aspects of the models, but rather must extend to the verification of compliance with all the minimum requirements established by the regulator for using the advanced approaches.

The function of internal validation must be clearly defined. At a minimum, this internal validation must:

- Have adequately identified objectives and procedures.
- Be sufficiently centralised and co-ordinated with internal audit and with the users of internal models.
- Be independent of whoever uses the models and develops or acquires them.
- Identify all significant uses and arrive at an opinion on the usefulness of each model for each of these uses.
- Continuously monitor the models, given that they will be changing over time.

It should be noted that whereas the function of internal audit is to verify the proper functioning of the procedures in place for risk management and control, including those of internal validation itself, the function of internal validation includes the assessment of whether those procedures, including risk calculation methodologies, are suitable for the institution's strategy and risk profile.

5.1.5 ASSESSMENT OF CAPITAL ADEQUACY

Although the new rules do not distinguish in Pillar 2 between institutions applying the standardised or advanced approaches, it should be repeated that measurement systems or estimates are not acceptable if they are designed and applied for the sole purpose of using those approaches and are used only to calculate regulatory capital requirements.

Consequently, the more advanced institutions should not allocate capital solely on the basis of minimum regulatory requirements, since these do not cover all risks and the regulatory model does not take into account certain factors that institutions must consider, such as the degree of diversification or concentration in the case of credit risk. The process of assessing capital adequacy should have as its starting point a calculation of economic capital, not a mere extension of regulatory capital, and it should, in addition, be used in the management process.

Therefore, before any process of supervisory validation is commenced, the institution has to demonstrate that it is able to equip itself with an economic capital model allowing it to assess the adequacy of its capital.

5.2 Validation of IRB approaches to credit risk

The use of the foundation and advanced IRB approaches must be specifically approved by the supervisor. Therefore, for each significant portfolio, the supervisor must form an opinion of the adequacy of the internal estimates of risk factors for use in Pillar 1.

The supervisory validation of these estimates aims to obtain a reasoned opinion on the validity of the use of IRB procedures for Pillar 1 in each portfolio. These opinions, together with other information available on the credit institution, form the basis on which the supervisor finally approves or not the use of an IRB approach.

The existing practical experience of this type of estimates suggests that it is not possible to validate based only on pure backtesting. Consequently, indirect methods, human

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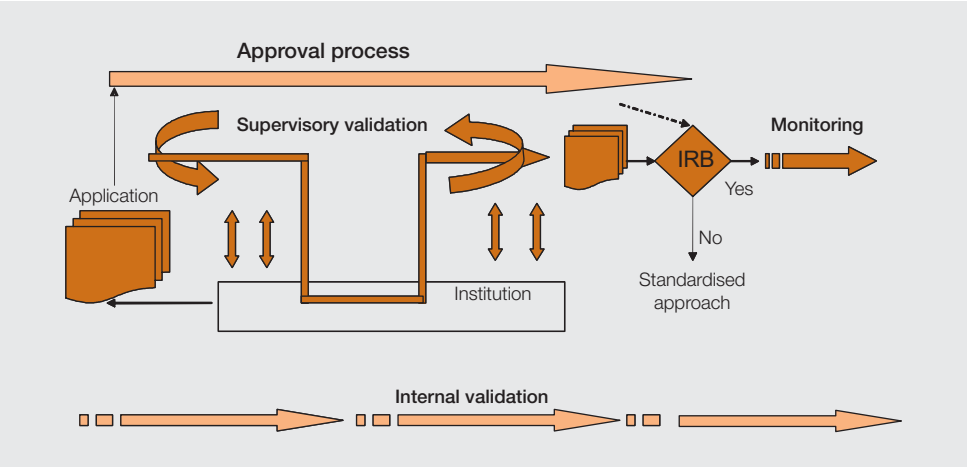

judgement, comparison with other estimates, stability analyses and qualitative elements play a fundamental role in deciding whether or not it is reasonable to use these estimates for calculating minimum regulatory capital.

The scheme 5.1 summarises the relationship between the approval process, supervisory validation, monitoring of the IRB approach and internal validation of models.

The purpose of supervisory validation of an internal credit risk model is to obtain a technical opinion on whether it is suitable to be used for regulatory purposes.

The process of supervisory validation consists of examining and assessing, for each significant portfolio, all the essential elements of the credit risk management system to check that it:

- Is in place in the organisation and is being used.
- Produces reasonable results in its regulatory application.
- Has appropriate technological and control environments for the specific conditions in which it is applied.
- Is subject to appropriate internal validation and monitoring procedures.
- Complies with the other minimum requirements specified in the rules.

5.2.1 PROCESS OF SUPERVISORY VALIDATION

From a practical standpoint, it is efficient to divide the validation process into stages consisting of groups of tasks. These tasks analyse or examine the matters that affect, individually or as a whole, the different risk parameters. To conduct the system review, five stages have been identified, each corresponding to an area of attention:

- Methodology and documentation.
- Data.
- Quantitative procedures.
- Qualitative procedures and control environment.
- Technological environment.

First, the methodologies used have to be understood by examining the existing documentation. Hence it is advisable to group these two items together.

The next step is to obtain reliable databases so that the methodologies can be used to conduct quantitative tests. Interpreting these tests requires a consideration of qualitative aspects.

In addition, the control environment must be understood, its adequacy verified and a check made that its organisation and internal use are conducive to the usefulness and proper

functioning of the system. Lastly, it seems necessary to analyse whether the technological environment enables it to be used effectively.

If the IRB approach is approved for regulatory purposes, the supervisory validation is not limited to the foregoing, since the model has to be monitored.

To make the validation process more efficient, the supervisor can use either the institution's own resources or external resources, provided their independence and capabilities are sufficiently assured, to carry out some tasks and even entire stages if these require considerable time or resources. The use of external resources must be compatible with a reasonable level of supervisory risk.

The assessment of methodology and documentation, and the quantitative and qualitative reviews[1] basically have to be carried out by the supervisor. As far as the reviews of the databases and of the technological environment are concerned, the most effective way, especially in large, complex institutions, is to call on the institution to provide a sufficiently detailed preliminary review which will generally be completed with specific tests in each case.

Although in the future it will be advisable for internal audit to be involved in all phases of model validation, the foreseeable limitations of resources and the absence of qualified personnel for certain tasks make it recommendable for the internal audit to initially focus at least on the data review phases, on the control and technological environment and on certain qualitative aspects, such as effective implementation of the model in management. For this purpose the Banco de España will, as indicated above, require a specific internal audit report.

Additionally, to reduce supervisory risk as much as possible, it is useful to have also a specific report from an external auditor addressing at least the data and technological environment review phases.

In the case of subsidiaries in other countries, these internal and external audit reports should be used by both the local supervisor and by the parent supervisor, so that both can base themselves on the same data with relative confidence.

It should be pointed out that not only the methods of rating exposures or borrowers and of calibration (obtaining risk parameter estimates for each homogeneous risk category), but also the available information and the way of managing credit, differ greatly depending on the characteristics of the portfolio.

Below, objectives are specified and procedures are indicated for each of the aforementioned stages, without discussing in detail the particulars of each type of portfolio.

a. Review and assessment of methodology and documentation

The information provided by the institutions is to be used to:

– *Understand and analyse the rating or scoring system:* the type of classification or rank-ordering model and the logic behind it, the explanatory variables and the tests used to develop and validate it. It is particularly important to look at who developed the model, what data were used, for what purpose and which tests were conducted internally or externally to validate its initial operation.

  The type of procedure used to assign ratings depends on the particulars of each portfolio type. Normally systems of this type focus on grouping borrowers or transactions of similar credit quality in terms of probability of default, with the dimension considering the LGD of each exposure being incorporated at a later stage.

  Following is a list, which is not intended to be exhaustive, of the most frequent combinations in Spanish institutions:

  • Corporates. The systems focus on the borrower and incorporate the LGD associated with each individual exposure at a later stage:

1. Many of the tasks have both qualitative and quantitative components.

  - Rating systems based on direct assignment to rating grades defined through description of the categories.
  - Rating systems based on an underlying score with rating grades defined in terms of score intervals. Normally some of the input values of the score include assessments made by analysts.
- Retail. Transaction-focused systems that normally do not include the LGD directly in the assignment of the score, although there are exceptions:
  - Credit scoring systems (sociodemographic): these are used for approving transactions and for reassessing transactions recently granted (typically during the first year of life of the operation).
  - Behavioural scoring systems: focused on the approval of customer transactions and on reassessing portfolios as at a given date.

In portfolios with few defaults, which are particularly common with large corporates, banks and sovereigns, a proper understanding of the rating or scoring methodology and of its limitations is particularly important due to the absence of direct backtesting procedures (unavailability of a sufficient number of defaults). By contrast, in the validation of many scoring systems applied in retail segments, a more important role is played by analysis of the model's behaviour in terms of internal experience and quantitative backtesting procedures.

In practice, an exhaustive knowledge of the methodology used may not be easy or possible. For example, if an institution uses models acquired from third parties (vendor models) and the third party supplies the rating or scoring procedure or significant parts thereof, frequently some of the classification algorithms and basic steps in obtaining the variables and parameters used will not be known by the user institution. From the standpoint of validation, this lack of ultimate knowledge of some details of the methodology used has very different implications depending on the characteristics of the portfolio analysed, as mentioned above.

– *Analyse the basic definitions.* It is fundamental to analyse the definitions of default and of loss, the criteria for obtaining homogeneous risk categories (both those used internally and those finally used for regulatory calculations) and the basic principles of the algorithms for estimating the risk parameters (calibration). Regarding the definition of default, as a minimum an assessment should be made of both the objective and the subjective parts, the criteria for determining technical default and the treatment of refinancing. As far as the definition of loss is concerned, an understanding must be had of the decisions adopted for adequately calculating economic losses (discount rate, the point in time when the recovery process ends, and allocation of costs).

  The basic principles of the calibration algorithms are increasingly complex and properly understanding them requires, on the part of both institutions and supervisors, the participation of personnel highly trained in statistics and probability models.

  - Regarding the assignment of PD:

    In retail portfolios the most commonly used techniques are simple logistic regression models with simple cyclical adjustments based on scaling of the theoretical default frequencies obtained from the regression as a simple average of the long-term problem loan ratio, as appropriate for the portfolio and institution under consideration. In some cases more complex cyclical adjustments are proposed which use macroeconomic variables allowing consideration of estimates linked to a particular time in the cycle. Finally, these cyclical estimates are averaged to obtain an estimate suitable for calculating regulatory capital.

In corporate portfolios, particularly for segments affected by problems of scarce information on defaults, two types of methods are basically applied:

– Techniques of association with an external scale (mapping): in these the problem of assigning estimates is resolved by using a procedure that identifies the internal categories with external categories for which PD estimates are already known. The most typical case is that in which each internal category is associated with a certain rating grade within the scales of rating agencies and then the PD estimates available for these external scales are used.
– Methods based on making strong assumptions about the stochastic behaviour of the rating model and using properties of these theoretical models to determine implied PD estimates from observable information other than that on defaults.

  Depending on the information used, they can be classified as:

  • Methods based on market information: credit spreads, macroeconomic variables, share prices, etc. An example is the Merton-type models.
  • Methods not based on market information: internal or external transition matrices. For example, it is assumed that internal ratings transitions follow a stationary Markov process in a given time horizon and use is made of a matrix of observed transitions with a sufficiently long time horizon (typically 3 years) to obtain implied PDs for each rating grade over a 1-year time horizon.

• Regarding LGD and CCF, the current situation is radically different. Generally, institutions use very simple aggregate procedures based on historical averages. Foreseeably the situation will change as more data become available to enable risks to be adequately distinguished in terms of risk components for these parameters.

– *Identify changes over time* in different elements of the rating system: changes over time have to be identified in the rating or scoring systems, in the definition of default or loss and in portfolio segmentation that may affect the homogeneity of data or the predictive power of the model. In particular, the criteria and procedures used to reassess transactions or borrowers (obtainment of the current score or rating) initially assessed by other systems.
– *Detect deficiencies in documentation:* these will have to be remedied by the institution. In particular, rating manuals and other documentation of compliance with minimum requirements are reviewed.

  To facilitate this stage, it is useful to standardise the information by designing and using certain minimum contents.

b. Review of data

The opinion formed on the databases used to estimate risk parameters and on others needed to calculate regulatory capital is fundamental in supervisory validation. Also, it is important to be sure that their quality will be maintained over time and, accordingly, the construction and maintenance procedures must be analysed. The basic objective of this stage is to obtain calibration databases[2] and reliable current rated exposures that enable a quantitative review to be conducted.

The main tasks in this stage are as follows:

– Regarding the models' *calibration databases*[3], form an opinion on:

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2. Those serving to obtain estimates of PD, LGD and, where applicable, EAD (through CCF). **3.** In the future they may conceivably be standardised for sufficiently significant portfolios.

- The suitability of their structure and the adequacy of the information they contain, distinguishing between original fields and calculated fields, and identifying the fields needed for the IRB approach.
- Their integrity and consistency:
  - Inclusion of all transactions meeting the specifications of the model's scope of application.
  - Internal consistency of the information comprising the working database.
  - External consistency, anchoring of data with other significant elements in the institution's IT systems: accounting statements, regulatory returns, management statements, etc.

– Assess the *adequacy of the databases used*[4] to build the model's calibration databases, identifying all significant fields, and analyse, among other things:
  - The procedures for building the calibration database: loading of data from the various source applications or databases, criteria for selecting data (particularly those of customers and transactions), reasonableness of the assumptions used in the event of lack of information or of the algorithms used to obtain certain critical fields (transaction origination date, default date, settlement date and reassessed ratings), etc.
  - The different *definitions of default* that may have been used[5] in the calibration database, their consistency over time and their homogeneity for regulatory purposes.
  - The *possibility of reassessment* of old transactions[6] in accordance with the rating systems in use at the review date and, if applicable, the latest reassessment carried out for calibration of the model.
– For the purposes of regulatory calculations, analyse the processes for obtaining the database of current exposures, and those followed for correctly assigning the relevant risk parameters to each transaction.

For this stage, as mentioned above, it is most efficient to work on the basis of the specific reports issued by the internal or external auditors. However, these reports generally have to be completed with specific tests for each case. At a minimum, the supervisor should directly review the distributions associated with the critical fields: default, realised losses, exposures, etc., in order to detect unusual values (outliers), suspicious correlations, abnormal concentrations, etc.[7]

c. Quantitative review

Once the methodologies are understood and calibration databases and reliable rated exposures are available, different quantitative tests can be conducted. These can basically be divided into four groups: replication procedures, numerical comparisons (or indicators), stability analyses and sensitivity analyses.

– *Replication procedures*

  These are intended to obtain results already calculated by the institution using the databases and algorithms analysed in the methodology review stage. This type of test is particularly useful for confirming that the definitions being used, the algorithms for estimating risk parameters, etc. have been properly understood and that

4. Source databases used to feed the calibration databases. **5.** In the event that the definitions implicit in various tables in the databases differ because of changes over time, differences across risk factors or even in a single risk factor if there are homogeneity problems. **6.** All transactions approved under a rating system that is no longer in use. **7.** Simple tools for descriptive analysis of distributions are very useful for this purpose.

the databases analysed are actually those used by the institution to calculate the internal estimates and the outputs of the IBR approach. In particular, the following are replicated:

- Defaults[8].
- The losses associated with the transactions marked as defaulted[9].
- Segmentation of the portfolio into homogeneous categories.
- Scores or ratings of transactions or borrowers[10].
- Calibration, i.e. estimates of risk parameters (particularly PD and LGD).
- The model outputs.

– *Numerical comparisons (indicators)*

These are statistical indicators obtained from observed data, which are used to quantify, inter alia, the discriminatory power of the rating or scoring system, the accuracy of risk parameter estimates (backtesting), the homogeneity of ratings (over time or across units) and the compatibility of two rating systems. More specifically, with respect to:

- PD backtesting: Unfortunately, even in portfolios with a large number of borrowers, owing to correlation between defaults it is difficult to find an appropriate statistical comparison to determine whether the observations support the PDs estimated by the model. Hence these exercises are generally inconclusive, although they provide additional information that may help to understand the PD estimate made.

In certain systems (generally corporates), the model explicitly provides estimates of the frequencies of default to be observed in the coming year for each rating grade or homogeneous segment. These estimates are used as input values to produce a long-term average estimate meeting the specifications set in capital adequacy rules. In these cases direct comparison between default frequencies estimated ex ante and those observed ex post is meaningful.

By contrast, in many scoring systems there is no explicit estimate of the default frequencies to be observed in the coming year, since the estimation methods directly use averages and data that cover a certain number of years observed under different macroeconomic conditions, without explicitly incorporating those variables into the model. In these conditions, direct comparison of frequencies observed in a given year with the model's estimates is not homogeneous and, in general, the estimates and the observed averages cannot be compared over a sufficiently long period due to lack of data (or lack of comparable data).

- Quality of the rank ordering induced by the rating system. In general, it is possible to decide on the discriminatory power of the rating or scoring system by using diverse indices[11]. The aforementioned measures are normally used to quantify

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8. Using the calibration databases and the parameterisable (objective) part of the default definition, one should be able to replicate the defaults present in the database for objective reasons. Should this not be so, the reason would have have to be ascertained in order to eliminate the discrepancies. **9.** It is important to note that, in general, the losses on defaulted transactions in which the recovery process has ended are not totally defined, since it may be necessary to discount flows, choose discount rates, allocate direct and indirect costs, etc. **10.** In practice, there are basically two kinds of problems: a) Replicas of ratings based on subjective assessments (which incorporate internal or external judgements of analysts): replication is questionable when the assignment of the score or of the rating grade depends on subjective interpretations of imprecise definitions or when it is wished to replicate the analyst's assessment using as input values the information on which the analyst based his assessment. Normally, the reasonable minimum requirement in this situation is that the existing documentation and the interaction with the analysts should enable the assessments to be understood. Experience shows that, in general, it is difficult to go much further (replicate the assessment using the information originally used by the analyst). b) Replicas of scores originally assessed via systems no longer in service at the institution that used variables different from those used by the new tools. This is frequent in minority shareholdings. **11.** Accuracy ratio, area under the ROC curve, Kolmogorov-Smirnov statistic, etc.

overall discriminatory power[12] (total portfolio). However, under IRB approaches we are interested both in testing that the theoretical rank ordering of the rating or score is supported by the observed data and in looking at the quality of the local rank ordering (which affects a segment of the portfolio with ratings in a given range)[13]. Measures similar to those mentioned above can be used to obtain indicators of the quality of the local rank ordering.

- Homogeneity in assignment of rating. There are also statistical procedures, such as multivariate analysis techniques, that can help to detect possible rating homogeneity problems[14], whether they be over time or among different units within the institution. Generally these early-warning procedures have to be completed with a detailed analysis of each case in order to effectively conclude that the ratings are not homogeneous.
- Compatibility between different rating systems. It is important to find procedures for deciding whether two rating or scoring systems are compatible or not in the sense that they tend to maintain the existing relative order of obligors or transactions. If there is a sufficiently large sample of transactions assessed by both systems, use can be made of indices that quantify the degree of concordance between the two rating systems. This type of analysis is important in providing support for certain techniques of association used in institutions' practices for certain portfolios.

– *Analyses of the stability of discriminatory power and of risk parameter estimates.* These analyses aim to ensure that the ordering induced by the rating system and the risk parameter estimates are sufficiently robust (stable in the face of changes in data). Most notable among the different types of stability analysis are the following:

- *Out-of-sample test.* A subset of the available data is used to adjust the model and observe what happens to the various risk parameter estimates (stability) and to the predictive power (Does discriminatory power change much when the sample alters?).

This type of analysis is particularly important in the development and initial acceptance phase of the model. Also important is the ex post validation of certain sophisticated rating models that exploit certain theoretical properties dependent on assumptions very difficult to prove (or outrightly false although they allow useful simplifications for certain purposes) and that provide numerical results enabling the different credit quality of very similar categories to be quantified. For example, they allow PDs differing by only a few basis points to be assigned to high-credit-quality rating grades for which there are problems with other more direct methods due to the lack of defaults. A case that is important because of its usefulness is that where models are used to obtain PDs for categories of very high credit quality with few defaults based on the theory of stochastic processes, assuming stationary Markov-type behaviour and exploiting the information on transitions).

- *Out-of-time test.* These are similar to those described above, except that the elements excluded from the development sample are associated with a time interval. The objective is to verify that the model continues to have predictive power in the time interval analysed (that excluded from the sample) and to analyse the stability of the estimates over time.

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12. Measures of overall discriminatory power estimate the degree of ex ante separability using the rating or score between the distributions of good transactions (transactions that have not ended in default in the 1-year time horizon) and bad transactions. **13.** This is crucial for internal objectives if the model is used in pricing or in allocating economic capital. **14.** The problem of homogeneity is particularly important in rating systems that use essentially the (internal or external) subjective assessments of analysts. Systems of this type are very common in corporate portfolios.

This type of analysis is frequent in retail portfolios and in those SME segments for which there is a sufficient number of defaults. Basically, institutions calculate an index of predictive power and examine its course over time. If a significant decline in predictive power is observed, a review is conducted of the weights assigned to the model variables or of the entire score assignment model. In practice, the main problems are to determine when the differences in predictive power are significant, to analyse why and to determine (if the institution opts for decision-making rules of this type) what critical level triggers review or substitution of the model. The primary consideration is that the indices calculated are estimates of predictive power and are therefore subject to sample variability. The immediate implication is that this variability has to be taken into account (for example, in calculating confidence intervals for the index value) in order to conclude that the decline in predictive power is significant.

- Sensitivity analyses of final outputs (regulatory capital, expected loss, etc.)

These seek to quantify how changes in certain model parameters or assumptions affect minimum capital. A special type is stress test analysis, in which unfavourable conditions are simulated to ascertain their possible effects on regulatory requirements.

d. Qualitative review

This focuses on overall assessment of the quality of the internal model and on gauging compliance with minimum regulatory requirements, and it complements the results of the aforementioned stages. Most of this review requires very close co-operation and interaction with the persons responsible for the various areas of the institution and, accordingly, it would seem advisable for a good part of this stage to be carried out on site.

– *Use test and internal information*

Once the intermediate and final outputs have been identified, the next step is to check that the institution is effectively using the rating system and the different outputs in its credit risk management processes. In particular, it is necessary to:

- Identify and understand the differences between the procedures and estimates used for the IRB approach and those used for other internal purposes.
- Especially in the case of rating systems based on subjective assessments, it is advisable to review the actual procedures for assignment of ratings, check that they coincide with the theoretical procedures described in the rating manuals and evaluate the capacity of analysts. Also, it is necessary to understand the subjective ratings, the actual functioning of committees that approve ratings and the exceptional procedures.
- Finally, the quality, purpose, adequacy and recipients of the internal information must be analysed. This is particularly important for assessing the degree to which the institution places value on, uses and has confidence in the information generated by its internal models.

– *Benchmarks used in the model*

The purpose of these exercises is to identify unusual values that will have to be explained, essentially using specific, normally external (public or private) information for each case. Basically, this technique seeks to compare the outputs of the IRB approach in the analysed portfolio with the following:

- Outputs obtained in similar, previously analysed portfolios. Once comparable portfolios and outputs have been identified, the next step is to explain the differences in the intermediate and final outputs of the portfolio being analysed and

the benchmark portfolios. This type of benchmark is particularly practicable and useful for supervisors given their access to portfolios of other institutions.

- External benchmarks (public LGDs, agency ratings, etc.). These comparisons present problems of interpretation because of the lack of information on how the benchmarks were obtained and on the source and bias of the data.
- The outputs obtained for the portfolio by applying a possible supervisory model that, in theory, would allow more homogeneous comparison between institutions. These supervisory models are starting to be developed in certain countries, although they present problems relating to the definitions of default, the estimation of LGD and the availability of information and, as a result, are not operational.

In the case of comparisons between portfolios, explaining the differences calls for a deep knowledge of their specific features and of institutions' approval, monitoring and recovery policies. In the other cases, a similar analysis is required of the specificities of each model or of the procedure for obtaining the external benchmark.

– *Role of senior management and organisational matters*

An assessment has to be made of the level of knowledge that senior management — in the broad sense of the term — has of the rating system and of the internal uses of the various outputs. It is important to determine the level of support and confidence in the institution regarding the use of these internal models. In particular, the following has to be done:

- Analyse the organisational structure and the resources assigned, and assess how well they meet the requirement of independence imposed on the unit entrusted with validating the internal model.
- Identify the bodies that approved the rating systems, the calibration procedures and the various internal uses of the model.
- Analyse in detail the frequency, content and use of the senior management information of an internal nature that employs the outputs of the model.

– *Analysis of the internal control environment, of internal validation procedures and of internal model monitoring*

- *Internal control environment:* understand the roles of the departments specialised in risk control, of the internal audit department, of the external auditors and of other external experts in the control and validation of the model. In particular, know who is responsible for internal validation and conclude on the adequacy of the controls established to detect problems in the model.
- *Internal validation and monitoring of the model:* understand the internal validation procedures and identify the type of tests conducted and how useful they are for supervisory validation. In particular, assess the adequacy of the frequency with which different outputs of the rating system are controlled and compared: ratings, risk parameters (PD, LGD, CCF, transition matrices,...), final outputs (economic capital, expected loss, regulatory capital,...), etc.

To carry out certain tasks in the qualitative review stage, the starting point that should be used is the aforementioned specific internal audit report, i.e. the one relating to integration of rating systems in the management process[15].

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15. Particularly in regard to: a) Compliance with internal rules and procedures for assigning and reviewing ratings, b) The information generated by the model and its use in the institution's essential management processes (allocation of economic capital, pricing, approval policies, etc.), c) The adequacy of the established controls on the model and the identification of weaknesses and d) The documentation containing rating procedures, credit policies and delegation of responsibilties.

e. Review of technological environment

Effective use of the model calls for an appropriate technological environment (systems and applications). Assessing it requires reaching a conclusion on:

- The degree of *internal integration* (between model components) and external integration (with other IT systems in the institution), identifying manual procedures and technological weaknesses.
- Regarding *applications:*
  - The *availability* of data and the *replicability* of the calibration database over time.
  - The degree of *automation* of periodic processes for the proposed regulatory use.
  - Appropriate programming of the calculation *methodologies* used in the model.
  - The *replicability* of model outputs.
- The model as an IT system:
  - *Maintenance processes.*
  - Management of *historical* tables (PD, LGD, CCF, rated exposures, etc.).
  - *Contingency* plans.
  - Adequacy of *resources.*

Particularly necessary in this stage is the collaboration of internal and external auditors through the aforementioned specific reports, which can be supplemented by certain checks as befitting each particular case.

5.2.2 MODEL MONITORING

The credit risk models and portfolios of institutions are dynamic:

- The models change over time due to modifications in scoring or rating systems and in controls. Also, the estimates used in IRB approaches change due to variations in the data used and to advances in estimation methods.
- The portfolios are affected by institutions' credit policies (which also change over time) and by the impact of the business cycle.
- Therefore, it is evident that a detailed review as at a given date is not sufficient for the supervisor (supervisory validation), and neither can it suffice for the institution (internal validation). For this reason, the process of internal validation is continuous and the initial supervisory validation must be completed with the monitoring of the model. To enable this, supervisors need the institutions to generate, store and update relevant and consistent information on changes in portfolios and in internal models.
- As mentioned above, for ease of model monitoring and documentation by all those interested in changes in and control of the model, it is considered useful to use the IRB Dossier.

5.3 Validation of VaR market risk models

The regulatory use of VaR-type internal measurement models by institutions requires the express prior approval of the Banco de España, as stipulated in current regulations. To obtain this authorisation, institutions have to successfully undergo a thorough and demanding process of supervisory validation which follows the procedures established by the Banco de España and is built around the basic documents designed for this purpose and a knowledge of institutions' trading activities and risk profiles.

5.3.1 PROCESS OF SUPERVISORY VALIDATION

For illustrative purposes, we analyse below the following phases of the processes used to validate market risk models:

– Analysis of documentation
– Assessment of scope of the model
– Qualitative review
– Assessment of technological environment and of information integrity
– Quantitative review

a. Analysis of documentation

Documentation contained basically in the MR File mentioned above. The aim is to gather all the information needed to decide whether it is reasonable to start the validation process and identify the critical aspects of the model proposed by the institution for approval.

b. Assessment of the model's scope

Once the proposed scope of the model is known, the next steps are to assess the reasonableness of possible exclusions of some products, activities or companies of the consolidable group which, in principle, should form part of the model's potential scope and to analyse whether the model caters for effective management of actual operations subject to market risk.

Once the model's scope has been determined, its suitability will be determined in terms of:

– Whether the instruments included in the model meet the requirements of the regulatory trading book for solvency purposes, verifying that no positions or portfolios representing trading activity have been excluded from the model.
– Whether the market risk measurement methodology used is appropriate in view of the type of operations conducted.

c. Qualitative review

– *Assessment of policies on risk management, organisation and procedures*
  The *management policies* in place will depend on the type and level of activity, the environment, the culture and the degree of risk aversion of each institution.
  At a minimum, the policies on the operational framework of treasury operations and of the market risk management and control function should be approved and adequately documented, including most notably the following:
  • Organisation of the treasury operations business and definition of the authorised strategies.
  • Objectives of market risk management (to limit losses, optimise risk—adjusted returns, efficiently allocate economic capital, etc.).
  • New product approval processes.
  • Position reassessment policies.
  • Organisational structures, delimitation of responsibilities and segregation of functions among the various units involved.
  • Delimitation of assumable risk levels, risk control procedures and treatment of possible amounts drawn in excess of overdraft limits.
  • Risk measurement systems and methodology, and stress analysis and model accuracy verification programmes.
  • Risk level communication and information system.
  • Details of price and information integrity control procedures.
  • Internal control and validation functions.
  • Internal audit action plans.

The *organisational* structure will be assessed both functionally and hierarchically and in regard to its suitability for the operations carried out, looking at whether functions are ap-

propriately segregated with precisely delimited duties and responsibilities, and at the degree of board and senior management involvement.

The assessment of control procedures focuses, in general, on ensuring the quality and integrity of product and portfolio assessments and of market risk measurements.

– *Assessment of uses of the model and of its integration in management*

  The internal risk management model and the VaR estimates should be integrated in day-to-day risk management, i.e. they should pass the so-called use test. Their uses will thus be reviewed, particularly in the following respects:

  - Information of both a management and a public nature on VaR estimates.
  - Setting of limits, in terms of VaR, on market operations.
  - Allocation of capital.
  - Assessment of earnings in terms of risk assumed.
  - Pricing, incorporating the level of risk assumed.
  - Contingency plans, additional to those of crisis situations, vis-à-vis the respective triggering events (drawdowns in excess of overdraft limits, predefined market volatility limits, etc.) and envisaged actions (close-out of positions, specific hedges, etc.).

– *Analysis of internal audit reports*

  The internal audit reports analysing the basic aspects of the internal risk measurement and management model will be reviewed.

  The minimum content of the internal audit report is set out in current capital adequacy regulations: compliance of policies, effective segregation of duties and independence of market risk units, new product authorisation procedures, risk assessment and measurement models, integrity of position data, analysis of independence and market data reliability, accuracy of valuations and of product sensitivity measurements, scope of considered risks, backtesting procedures, stress-testing programmes, analysis of model integration in day-to-day risk management (limits, reports,...), etc.

d. Assessment of technological environment and of information integrity

Once the computer applications involved in the risk management process (trading room systems, market input value application, product and portfolio valuation applications, risk measurement applications, etc.) have been identified, a review will be made of the information flows between applications, their periodicity and the transmission method (automatic or manual).

Once the technological environment is known, the periodic tests conducted regularly to assure integrity of the information on positions included in the model (reconciliations, formal procedures for periodic identification of portfolios within the model's scope and of those excluded from it, procedures for inclusion of new portfolios or new products, daily analyses of changes in estimated risk levels and in position sensitivities, etc.) will be reviewed.

e. Quantitative review

– *Assessment of measurement system*

  Effective assessment of the system used to measure market risk will basically include the following broad elements:

  - Model input values:
    – Quantitative requirements for parameters: review of the historical observation period for risk factors, of the time horizon for holding portfolios and of the confidence levels used.

  - Market risk factors: review of the reliability and independence of data sources (interest rates, exchange rates, equity prices, etc.) used to supply information on risk factor levels and changes therein. Review of the secondary calculations made using direct market information (estimation of zero-coupon curves, estimation of illiquid asset prices, rates and volatilities[16]).
  - Position input values: review of the criteria for measuring risk positions held and for including them in the risk measurement system.

- Review of the essential features of the model methodology and of the technical details of its implementation:
  - Risk factors considered by the model, with special reference to the treatment of products with non-linear risks.
  - Technical aspects of the methodology used (parametric approximation, simulation, etc.).
  - Criteria for aggregating the risks of the various units or portfolios (aggregation of position input values or aggregation of risk estimates, verifying, in this case, the criteria and assumptions applied).
  - Measurement of the specific risk associated with private debt securities and with equity securities.

- *Analysis of model accuracy (backtesting)*

  The accuracy of the internal risk model will be checked through backtests in which the actual earnings recorded are compared with the risk predictions estimated using VaR methodology.

  The accounting profit and losses include, in addition to the daily impacts of market variations on the positions held, the result of intraday deals (not included in VaR estimates on the portfolios at the close of each session) and other regular income (or expenses) from operations (fees and commissions, sales margin, etc.). To enable comparison on an equal footing, the "clean" backtests will be reviewed to obtain the hypothetical earnings arising from remeasurement of the positions that generated the VaR estimate (at time t0) at market prices at the end of the time horizon of the risk estimates (generally at time t1). Thus, the hypothetical net profits or losses obtained are expressed on a comparable basis with the VaR estimates.

  Backtesting will yield the number of exceptions (number of times that the hypothetical losses exceed the VaR estimates), which, at the confidence level adopted, will be indicative of the quality of the model.

  Briefly, the review of the backtesting programmes will cover the following:
  - Types of backtests conducted and criteria for constructing the earnings used in these tests. The backtests must be "clean" and the results used will be obtained by full revaluation.
  - Level of disaggregation of the backtests.
  - Internal procedures in place: periodicity of the tests conducted, analysis of exceptions (reasons for them and products or units that generated them), observation period, etc.
  - Additional analyses to the calculations of exceptions established in the backtesting programmes (checks of the probability covered by the model, check of the symmetry of exceptions, check of the normality of results, size of exceptions, time distribution of exceptions, etc.)

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16. Fixed- term, the so-called volatility smiles and surfaces, etc.

- Internal procedures for model corrective measures suggested by the backtesting programmes conducted.

As a supplement to the backtesting programmes, a review will be conducted of the internal validation procedures established to check known limitations of the model or of the assumptions made in implementation (valuation models used, normality of yields, suitability of possible use of the statistical technique based on the square root of time to extrapolate the overnight VaR to the regulatory time horizon, suitability of the extrapolation techniques or association techniques, etc.).

– *Assessment of stress-testing programme*

The VaR estimates, which reflect possible losses under normal market conditions, should be supplemented by estimates of profit or loss in crisis scenarios that represent extreme or unlikely situations.

Basically, the following aspects of the stress-testing programmes in place will be reviewed:

- Scenarios considered. Irrespective of how they are formulated (through hypothetical scenarios or by replicating market movements recorded in historical crises), the selection of scenarios should be suitable for the operations in question and address events that could cause significant losses.
- Analysis and impact of worst—case scenarios and of extreme market movements.
- Inclusion of aspects of the risk that have not been efficiently captured in VaR measurements (possible liquidity difficulties of certain positions, concentration effects, volatility smiles, event and default risk, etc.).
- Frequency of calculation, and use and distribution of stress analyses, verifying that those analyses are a customary measurement forming part of day-to-day risk management.
- Contingency plans established for management of crisis situations.

– *Review of the calculation of regulatory capital*

The capital required due to market risk (RPt), determined on a daily basis, will be the greater of the previous day's VaR (VaRt-1) and the average VaR for the last 60 days multiplied by a factor whose minimum value will be 3 and which will be augmented by an amount depending on the ex post behaviour of the measurement model. This additional amount is based on the backtesting results and varies from 0 to 1.

The calculation of required capital and the criteria for including daily VaR estimates in certain situations (possible duality of long and short observation periods in risk factors, possible duality in risk factor estimates with and without exponential smoothing, backtesting estimates disaggregated by portfolio or type of risk, capture of specific risk, etc.).

5.3.2 MODEL MONITORING

Any modifications to essential parameters of the model or of the risk management system (methodology changes, scope modifications due to inclusion or exclusion of certain activities, business units, etc.) should be communicated previously to the supervision services of the Banco de España.

Aside from possible substantial modifications, which would require a fresh validation process to be started, a record will be kept of changes in the models owing to the dynamic nature of operations and of portfolios, with a resulting need for adaptations that measure previously inexistent risks, or to improvements that may be included as a result of internal validation.

The updated MR Model Dossier will contain the significant information on the internal model and changes thereto, as well as on the net asset value and risk level of the portfolios falling within its scope. It will be the basic tool used by the Banco de España for the control and monitoring of the internal models authorised for estimating minimum capital requirements for market risk.

5.4 Validation of AMA operational risk models

In order for the output of internal operational risk models to be accepted as the figure for minimum regulatory capital requirements, the supervisor's approval will have to be obtained. Hence a process of supervisory validation will be required. The process will check compliance with the qualitative and quantitative criteria set in solvency regulations. This review should verify that the model has been implemented and is being used in the management process, and that its output is a reasonable measure of the minimum regulatory capital to be held by the institution.

One of the difficulties encountered by supervisors in establishing a predefined supervisory validation system for internal operational risk models is the great flexibility of the AMA. In fact, the development of internal operational risk models is one of the newest fields in risk measurement and the institutions' models are still in the design and implementation phase. In general, the types of internal models that have been emerging are widely varied and market practice is not uniform, which will greatly complicate their validation.

5.4.1 SUPERVISORY VALIDATION

The first step in the validation process is to determine the model's scope of application. The internal operational risk model should cover the whole financial group, so that the model's output includes all material exposures to this risk. Should certain exclusions have been established, the institution will have to provide a detailed progressive implementation plan to the supervisor, indicating the time horizon and schedule for including them in the model.

In general, the following areas for review can be listed:

- Qualitative requirements.
- Elements of the AMA.
- Quantification methodology.
- Technological environment.

The main aspects of validation of each of these areas are discussed below.

a. Qualitative requirements

These are concerned with assessing model quality and verifying compliance with the management criteria specified in the regulations. As a general rule, the matters to be checked are: the active involvement of senior management and of the board of directors in operational risk management; that the internal model is sound and fully integrated in the institution's risk measurement and management systems (use test); and that the institution has sufficient resources both in its lines of business and in its control and audit areas.

Also, the following will be verified: the existence of an independent operational risk management unit responsible for developing and implementing the calculation methodology; the existence of a system of regular reporting to senior management, to the board of directors and to management of the business and support lines; and the adequacy of the documentation supporting the whole operational risk management and measurement system. Other essential requirements are prior internal validation and the review and control of the model by internal audit.

These qualitative requirements are common to both credit and market risk models. In this respect, the validation process will follow a similar process to that mentioned above for

these risks. However, certain matters in the area of operational risk should be looked at more closely because of their importance or specificity.

– *Use test*

A point reiterated by supervisors is that the so-called use test is a primary requirement in the validation of internal models, since a model whose sole purpose were to calculate regulatory capital requirements would not be acceptable. The use test consists in checking that the measurement model is suitable for active risk management and is used daily by the organisation, which is a matter of particular importance in the case of operational risk. Following is a list of necessary conditions for meeting the use test, which is not intended to be exhaustive:

- The institution has to demonstrate to the supervisor that the model inputs and outputs are both used in day-to-day decision-making in the institution.
- The model must support and improve operational risk management in the institution.
- The model must be dynamic and enable exposure to operational risk to be assessed at all times.

All the foregoing are necessary conditions for the model to meet the use test. A more exhaustive treatment of this topic would have to be on a case-by-case basis, since it depends on the intrinsic circumstances of each institution and of each operational risk model in particular.

In any event, the involvement of the lines of business will be one of the crucial factors in how supervisors evaluate the use test. Unlike market and credit risk, operational risk is present in all areas of the institution. Moreover, this risk is managed precisely in the business and support areas of credit institutions and, therefore, is not confined to the operational risk department. Accordingly, it is of primary importance that these units understand, use and give daily support to the model.

However, unquestionably the greatest difficulty is to establish a true operational risk culture that motivates the units to communicate their own errors and fosters transparency in institutions.

– *Internal validation*

As defined above, internal validation is that performed by an institution itself to check that the model is useful and effective in its management process. The recentness of the obligation to measure operational risk makes it particularly important to have an efficient process of internal validation, because the operational risk model should provide an institution's managers with sufficient qualitative and quantitative information to give them a better understanding of the exposure to that risk and enable them to manage it more effectively. For this reason, it is in the institution's own interest to establish an internal validation system to ensure that the model is used and works properly for its intended purpose.

This validation encompasses the whole of the model and should be carried out by a third unit not involved in its use, development or monitoring. The problem encountered by institutions is that, at present, it is difficult to find personnel sufficiently qualified to carry out a full review of the model, especially the quantitative part. In any event, it is not essential for this review to be done by a single department of the institution, and it can be entrusted to different areas, provided they meet independence standards.

– *Internal audit*

It is necessary for the internal audit department to establish a plan to regularly review the operational risk management and measurement model. As noted in Section 4.4, the institutions that intend to use internal models for regulatory purposes must send these reports regularly to the Banco de España.

b. AMA elements

It is essential to review the integrity and quality of the components of the internal model's measurement system and their consistency with a view to obtaining the capital figure and to checking daily use in the management process. The new Framework establishes four elements that must form part of advanced models, namely:

- Internal databases
- External databases
- Scenarios
- Business environment and internal control factors

Internal data are most representative of an institution's operational risk profile, since they best reflect the structure of the business, of the control systems and of the culture of each organisation. Information on the operational risk losses incurred by each institution is basic for linking a credit institution's risk estimates to its effective loss record.

These data provide information on an institution's profile of past losses, but are not generally sufficient for assessing the risk to which it is exposed. Hence this information must be completed with the other AMA elements. The external data provide information on possible losses that the institution may incur, based on the experience of other institutions. The basic factors of its business environment and its internal control reflect the extent to which the risk can be heightened or mitigated by internal and external circumstances, and the scenarios provide information on external events, based on the opinions of the institution's managers and risk management experts.

Regarding internal databases, the supervisor should check that they are adequate both in quantitative terms and insofar as quality is concerned. A check will be made that, inter alia, the loss data are complete and reflect all the institution's activities and its significant exposures in all geographical locations. The institution should gather sufficient information on the event. As well as the loss, this will consist of minimum information for the management process, including the date of the event, its causes and any recoveries. In addition, the losses considered most significant must be supported by documentary evidence.

Although, from a conceptual standpoint, the compilation of internal data on operational losses may seem a simple task, in practice it is not exempt from difficulties. These include, among others, the delimitation of operational risk so as to distinguish it from other risks, the treatment of multiple or of prolonged events, the setting of an appropriate event compilation threshold, the proper assignment of events to supervisory categories, the absence of sufficiently detailed accounting information[17] and the absence of automated data collection for certain events.

In view of all these difficulties, data are clearly one of the major challenges when it comes to implementing and validating an operational risk measurement and management model. Institutions should have sufficient resources to ensure that their databases are complete and contain all material activities and exposures over a sufficiently long time period and

17. Despite the difficulties in reconciling the database with the accounting records, institutions should attempt to verify at least that accounting information of the kind relevant to measurement of operational risk is effectively included in the database.

to provide assurance as to their quality. Only in this way can an adequate analysis be made of the risk to which each institution is exposed.

To ensure that the database is of sufficient quality, the institutions themselves should monitor and control their losses continuously and rigorously. To do this, they have to maintain a complete and accurate database. Also, they should define their own internal rules designed to ensure data quality.

Regarding the inclusion of external data, the information must be homogeneous and comparable with that of the institution. A review will be carried out especially to check this. It will be necessary to implement a systematic process to determine the situations in which external data are used and the methodologies for employing those data (e.g. inclusion of proportionality adjustments and of qualitative adjustments, or introduction of improvements in scenario analyses). The conditions and practices for the use of external data should be reviewed regularly, documented and subjected to regular independent examinations.

As regards scenarios and business environment and internal control factors, the information is largely qualitative. Therefore, over time, it will have to be validated and re-assessed through comparison with actual loss experience to ensure its reasonableness.

Finally, for the treatment of the four elements discussed in this section, the institutions need to have a technological infrastructure enabling them to store all the required information and providing adequate control of the data capture process and sufficient flexibility to use that data in modelling and in supplying information to the lines of business. The institutions' business continuity plans assure the retrieval of this information.

c. Quantification methodologies

These seek to verify reasonableness and consistency in the calculation of the capital figure resulting from the model. This constitutes the central validation task because it entails reviewing the combination of the essential AMA elements and, in short, the resulting capital figure.

Quantification methodology is currently the least developed area, since institutions are in the process of designing, implementing and refining their models. Also, market practices, given the inherent flexibility of the AMA, are very heterogeneous.

The rules in this respect are very flexible and inevitably leave certain matters open which will have to be gradually clarified as the institutions and supervisors gain further experience.

Although there are a variety of approaches, a preference can be seen for the so-called loss distribution approaches. These consist basically of using internal (and, where appropriate, external) data to estimate an operational risk loss curve, while modelling separately the frequency and severity of the losses.

In any event, regardless of the approach used, the institution should demonstrate that the method identifies tail events in the probability distribution and meets soundness criteria comparable[18] to those for credit risk.

The quantitative review poses a challenge from the statistical standpoint. Precisely one of the main difficulties in the field of internal operational risk models is to obtain an accurate estimate of capital that is, on the one hand, risk sensitive and, on the other, relatively stable over time, since it will constitute the regulatory capital requirement.

Finally, it should be kept in mind that the field of internal risk measurement models is not an exact science and that measurement methodology is not an end in itself, but rather one more tool at the service of an institution's risk management system and, in this respect, should contribute to the control and mitigation of that risk.

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18. That is to say, a time horizon of one year and a confidence level of 99.9%.

d. Technological environment

The adequacy of technological infrastructure and data capture and maintenance should be reviewed to verify their effective use in the model. The review should cover both the degree of internal integration between model components and the degree of external integration with the other systems and applications used in the institution's day-to-day operations.

In this field, it is particularly complicated to provide appropriate technological support for building databases that are fed periodically from a wide variety of internal and external sources and that have to be highly versatile to make efficient use of the operational risk model.

5.4.2 MODEL MONITORING

Finally, it should again be stressed that the models are dynamic and changing. The models evolve over time due to many circumstances. They may undergo internal changes in the very structure of the model, given the ongoing improvements being made, changes caused by the data fed into the model, changes induced by alterations in the business structure and even changes arising from external circumstances that alter the operational risk profile of a business line or of the institution itself.

All this means that a mere occasional review of the model is insufficient. In the case of internal validation, it seems obvious that its purpose would not be achieved through a review of this type. What is needed is an ongoing review that follows the pace at which the model evolves. In the case of supervisory validation, the initial review of the model, albeit necessarily rigorous and detailed, should be completed with subsequent monitoring.

To facilitate this monitoring, and regularly assess the changes in models, the Banco de España is developing the so-called OR Model Dossier, mentioned in Section 4.5. In no case, however, does this obviate the need for institutions to immediately inform the supervisor of any substantial change in their operational risk model.

6 Co-operation between supervisors for the effective supervision of international banking groups

For the supervision of international groups, the basic aim of co-operation between supervisors is, in addition to strengthening international financial stability, to facilitate compliance with the responsibilities of each authority.

Dialogue and co-operation between authorities are essential for the effective supervision of these internationally active groups and for convergence towards the best supervisory practices. The Banco de España considers that, in view of the multi-branch banking structure of the Spanish banking groups with a significant international presence, the most effective form this co-operation can take is that of bilateral relations between the supervisor of the home country (the country where the group's parent is authorised) and the various supervisors in the host countries (the countries where the subsidiaries are authorised), in a framework of transparency and mutual respect. All this does not rule out multilateral relations, which hasten convergence towards best supervisory practices.

Co-operation between supervisors extends to the communication of any significant information that may realistically help them to better carry out their respective functions, bearing in mind the diverse nature of these functions and, in particular, the fact that the consolidated supervisor needs unrestricted information on the subsidiaries, and the host-country supervisor, insofar as the subsidiary is adequately capitalised and managed, needs the information on the group in general if it is significant for the subsidiary.

Information exchange between supervisors must be understood as being in addition to the dialogue supervisors should have with group management. It should be kept in mind that the main natural source of information for supervisors is the institutions under their jurisdiction. In order for supervisors to receive all the information they need to carry out their functions, this information must flow to the required extent within international banking groups. Specifically, to carry out its functions on a consolidated basis, the home-country supervisor has to obtain from the parent all the group information he needs. This is the natural route for transmitting information between the home-country supervisor and the subsidiaries abroad of international banking groups. To enable this, the managers of these groups must not have restrictions or legal or practical obstacles to ascertaining and assessing the risks located in the subsidiaries of their group. For this purpose, these subsidiaries should provide the parent with whatever information is needed.

Co-operation agreements (MoUs) are an appropriate way of determining the principles and objectives of supervisory co-operation, although there are also other less formal ways, depending on the significance of the subsidiaries and the practical development of the relationship between the two supervisory authorities in question. Apart from information exchange, the agreements can provide for other forms of co-operation, such as the possibility of the home-country supervisor conducting, in exceptional cases and in agreement with the host-country supervisor, inspections in the subsidiary, or vice versa.

Supervisors should focus their co-operation efforts on the institutions that are significant to them. The concept of significance is relative, since it has to be considered from the viewpoint of each of the supervisors responsible. For the home-country supervisor, a subsidiary of a group will be significant if it is significant for the group, whereas for the host-country supervisor that institution will be significant if it is significant in its jurisdiction.

The general framework of co-operation between international supervisors was set in place by the so-called 1983 Basel Concordat. The Concordat establishes that the parent supervisor is also responsible for supervision of the group on a consolidated basis, while the host-country supervisors are responsible for supervision, on an individual and sub-consolidated basis, of the institutions operating in their respective countries. This means that:

– The home-country supervisor exercises individual prudential supervision of the parent and of the group subsidiaries authorised in its country; it also exercises consolidated supervision of the group as a whole. In its capacity as consolidated supervisor, the authority of the home country is responsible for: verification of the consolidated financial statements, which must be prepared under valuation methods consistent with those applied by the parent; control of the aggregate solvency of the group; and surveillance of the internal controls and management systems in place throughout the group.
– The host-country supervisor exercises prudential individual supervision of all subsidiaries authorised in its country. It is responsible for supervision of the sub-consolidated group in its country, made up of the subsidiaries formed in its jurisdiction and of the subsidiaries of these. And it has to verify the individual or sub-consolidated financial statements prepared under the valuation methods of its jurisdiction.

In view of this arrangement, which has been functioning satisfactorily and whose continuity is firmly supported by the Banco de España, the action of the home-country supervisor as consolidated supervisor cannot in any case supplant the important function of the host-country supervisor or its responsibility for the group subsidiaries, since:

– The host-country supervisor has a better knowledge of its local market and its proximity makes it more able to assess the risks of the group's activity in the country. It also has a more precise knowledge of the regulations applicable in the local jurisdiction and can thus exercise closer ongoing supervision of the subsidiary, not only with a greater capacity for control but also more effectively.
– The host-country authority is the one with the necessary legal prerogatives and powers to adopt supervisory and precautionary measures regarding subsidiaries in cases of contingency or crisis. Therefore the correspondence between the authority that grants the licence and the authority that exercises individual supervision must be retained to avoid any confusion or inconsistency between the responsibilities assigned.
– The arrangement is fully consistent with the legal personality of subsidiaries and their liability to third parties.

The role played by the host-country supervisor within this supervisory structure is vital. It represents the most significant contribution to financial stability, since the effectiveness of consolidated supervision depends on the existence of effective supervision by the host country that provides certainty about the subsidiary's financial situation, risks and solvency, and the management and control mechanisms applied.

In the European Union, the single market with its common regulations has led to stronger co-operation mechanisms that are fully consistent with the responsibilities established in the Concordat. Specifically, intra-Community branches are subject to the principle of prudential supervision by the home-country authority when this is also located within the Community, while the host-country supervisory authority is only responsible for certain highly specific matters related to liquidity.

7 Corporate governance requirements for banking groups with an international presence. Principles of capital adequacy, risk management, financial transparency and internal control

Basel II will contribute significantly to better corporate governance of credit institutions. This is a particularly important aspect of the new solvency Framework, as many sections of it expressly refer to matters relating to corporate governance of credit institutions.

Moreover, the use of advanced approaches in Basel II will lead to an improved risk culture in institutions and to more effective internal controls, which are necessary for these approaches to be fully and satisfactorily implemented.

This strategic change should begin at the top of the institution or group, and from there be duly transmitted to all levels, impregnating the whole group with a common culture of effective risk management and internal control.

Accordingly, the following corporate governance requirements for international banking groups are essential for the effective implementation of Basel II:

1 Adequate capitalisation

International banking groups should have an adequate overall level of capitalisation. Moreover, capital should be appropriately distributed within the group, i.e. reflecting the location of risks, so that each bank, including the parent, will have the amount of capital that is appropriate for its risks. And there should be a sufficient capital buffer to cater for organic growth and take advantage of business opportunities. This is precisely the main objective of Basel II: to adjust capital to the risks assumed and locate it where those risks lie.

2 Proper risk management

The board and senior management of subsidiaries must have appropriate responsibility. For this purpose, they will be actively involved in risk control and management, and in disseminating corporate risk culture throughout the organisation, which will help to strengthen the confidence of investors and depositors.

Planning, designing and implementing the required reforms to risk management systems is a priority. Senior management of institutions has to understand that risk management systems are increasingly becoming the distinguishing features of a credit institution, and that management systems must be improved to compete under better conditions in an increasingly complex and demanding environment.

But Basel II is not just a matter for senior executives, and even less an exclusive matter for statistics specialists. All the staff of a credit institution need to participate in the process and understand its implications, since risk management systems are part of the corporate culture, and have to be used by everyone on a day-to-day basis.

In this framework, each subsidiary has to be able to identify, manage and assess its own business risks individually using the techniques, systems and culture common to the group.

3 Financial transparency

Basel II will also help to improve the corporate governance of credit institutions through increased transparency. The third Pillar, i.e. market discipline, strengthened by stricter disclosure obligations for investor information, will provide more incentives for prudent risk management. The increased transparency requirements focus precisely on information about risks and risk management, so that investors can appropriately penalise the higher-risk institutions and reward, through a lower cost of capital, those with more prudent risk management. Naturally, if an institution knows that it is being more closely monitored by the market, because better information is being provided, it will pay more attention to proper risk management and controls.

A particularly significant aspect of the transparency of credit institutions is that of intra-group relations in the case of international banking groups. Regardless of the degree of affiliation among the credit institutions of an international group, each subsidiary should have its own capacity to resort to the markets to finance its activity and to independently allocate adequate capital for its risks. Intra-group transactions should always be conducted at market prices and not be subsidised in any direction. The best way to effectively apply this principle is for the various entities in a banking group to operate directly with the market and thereby improve financial transparency. This will enable an effective knowledge and rating of the group and of each of its components.

4 Adequate internal control

In an international banking group, both the group as a whole and each individual institution should have an effective internal control system in place. In this framework, the managers of each subsidiary are responsible and accountable for its situation and actions, both to the parent and to the host-country supervisor, without prejudice to the application by the subsidiary of the relevant common control mechanisms shared by the group.

Therefore, the group has to have a strong and effective internal audit service, as also should each of the subsidiaries abroad. A reasonable practice would be for the board of directors of the group's parent to ensure that the group, at its various levels, has a sufficiently rigorous internal control system; and for the board and senior management of each of the group's subsidiaries to assume their share of responsibility in the effective implementation of the group's control systems.

Basel II notably addresses this matter and assigns clear responsibility to the institutions for arranging independent internal reviews of the advanced models and, therefore, of the minimum level of capital needed to cater for the various Pillar 1 risks.

8 Co-operation between supervisors for implementation of Basel II

Ensuring the quality of the Basel II implementation process is an objective shared internationally by both institutions and supervisors. And it will require extensive co-operation and co-ordination between the supervisors of international banking groups. The new rules will be applied at each level in these groups, so both home- and host-country supervisors will have to assess the implementation of the new Framework in its various aspects.

When a banking group has operations in various countries, the different host-country supervisors should approve the use of the relevant methods on an individual or sub-consolidated basis, and the home-country supervisor should do this on a consolidated basis. For the implementation of Basel II to be effective and not to alter the current sharing of supervisory responsibilities between home- and host-country authorities, it will, from the home-country supervisor's viewpoint, be important to have the opinion and other inputs from the host-country supervisor regarding calculation of the capital requirements of the subsidiaries abroad, particularly if they are significant subsidiaries for the group.

Co-operation between supervisors for implementation of Basel II is important for diverse reasons:

Basel II is a complex regulatory framework which has several options for the treatment of risks and, furthermore, each of them permits different alternatives or areas of national discretion. Any lack of co-operation and mutual recognition among supervisors might oblige international banks to apply different methods in their calculations at the individual and consolidated levels.

To achieve closer co-operation between supervisors, there are certain conditions for an effective information exchange and mutual recognition that have to be met initially. These conditions will enable a higher level of convergence between supervision and regulation frameworks in the various countries, and also acceptable methods of information exchange and confidentiality between supervisors.

The implementation of Basel II advanced systems will call for a special effort of co-operation between supervisors for their approval. The process of validating and approving Basel II advanced approaches has to be shared among the various supervisors affected so that institutions do not have to establish different calculations at the individual and consolidated levels. From the viewpoint of the home-country supervisor, these agreements are essential because if the host-country supervisor does not have confidence in the effectiveness of the model approved by the home-country supervisor, this may prejudice the effective implementation of the model in the subsidiaries in its jurisdiction.

8.1 High-level principles for the cross-border implementation of Basel II

Considering all the foregoing, in order to implement Basel II it was necessary to push ahead in the practical implications of the Basel Concordat. In August 2003 the Basel Committee published six High-Level Principles for the cross-border implementation of the new Framework, as follows:

- Principle 1. The New Accord will not change the legal responsibilities of national supervisors for the regulation of their domestic institutions or the arrangements for consolidated supervision already put in place by the Basel Committee on Banking Supervision.
- Principle 2. The home-country supervisor is responsible for the oversight of the implementation of the New Accord for a banking group on a consolidated basis.

– Principle 3. Host country supervisors, particularly where banks operate in subsidiary form, have requirements that need to be understood and recognised.
– Principle 4. There will need to be enhanced and pragmatic co-operation among supervisors with legitimate interests. The home-country supervisor should lead this co-ordination effort.
– Principle 5. Wherever possible, supervisors should avoid performing redundant and unco-ordinated approval and validation work in order to reduce the implementation burden on the banks, and conserve supervisory resources.
– Principle 6. In implementing the New Accord, supervisors should communicate the respective roles of home-country and host-country supervisors as clearly as possible to banking groups with significant cross-border operations in multiple jurisdictions. The home-country supervisor would lead this co-ordination effort in co-operation with the host country supervisors.

The way banks manage their risks will condition this process of co-operation. The complex structures of banking groups increase the likelihood that different techniques will be used in different cases. Supervisors therefore need to co-ordinate their activities as far as possible in order to reflect the organisation and structure of each banking group, and thus improve the efficiency and effectiveness of supervision. The degree of integration in a banking group's risk management, the extent to which a banking group uses a common approach, the availability of data and other factors, such as legal responsibilities, should be taken into account in this process of co-operation.

In the implementation of Basel II, the home-country supervisor is better placed to establish criteria and take the lead, because risk management systems are part of the group's common culture. This should be done, however, considering whatever local specificities may be needed, so the host-country supervisor should be involved from the outset. The extent of this participation will basically depend on the type of model developed for each portfolio and on the data that need to be used.

In the phase following the authorisation of models for regulatory use and in the periodic calculations of capital, the host-country supervisors should take the lead in the relationship with their subsidiaries, since their proximity gives them a more detailed knowledge of local banks and of the realities of their market and enables them to make local comparisons with portfolios of other institutions. However, the home-country supervisor will need to have sufficient information about the group's operations in the host country in order to comply with its own responsibilities.

It should be kept in mind that in this co-operation process, credit institutions play an important role in helping supervisors to implement the Accord effectively and efficiently on an international scale. International banking groups should have sound, realistic plans for implementing Basel II and in their absence supervisors cannot replace them. Groups must therefore establish, and communicate to the supervisory authorities, their plans for implementing the advanced models, as a prior step before co-operation can be organised between the supervisory authority of the home country and those of the host countries, for the purposes of approving and validating models. Also, the groups have to communicate their plans internally so that each component knows them and can communicate them to its supervisor.

The co-operation arrangements between supervisors should be practical, so that the implementation of Basel II enhances the quality of banking supervision in all countries, particularly those with emerging market economies, and contributes to an effective banking supervision of foreign institutions operating in every jurisdiction. Also important is the capacity to evolve with Basel II, to take account of the differing national realities. Another consideration is that there are certain preconditions to be met before Basel II can be effectively implemented in every jurisdiction.

In each country, the credit institutions that operate through subsidiaries will have to comply with the supervisory and legal requirements of the host jurisdiction. In certain countries, requirements may also be imposed on the branches of foreign banks. However, the host-country supervisors should take an interest in familiarising themselves with and being able to accept the methods and approval processes used by the credit institution at consolidated level. This would reduce possible regulatory arbitrage.

In situations in which the home- and host-country supervisors adopt different approaches, the home-country supervisor will have the last word in relation to the group, because it is responsible for supervision on a consolidated basis. However, this does not mean that the home-country supervisor will necessarily conduct all the required analyses and assessments, since in the exercise of its duties it can request the opinion of the host-country supervisors, especially when a banking subsidiary in the host country is significant for the group, or when the subsidiary's businesses differ considerably from those of the parent.

It is desirable that the home-country supervisors, in co-operation with the host-country supervisors, explain to the institutions the practical co-operation agreements reached for implementation of the new Framework. The home-country supervisor will lead the development and communication of the co-operation agreement, doing so flexibly and in line with the specific circumstances of each banking group. In any case host-country supervisors should be involved from the outset in implementing the new Framework in international groups even though Basel II is not initially implemented in their jurisdictions, since its application should be a future objective for them.

In line with the above, the European Union's new solvency directive (known as the "Capital Requirements Directive") strengthens these co-operation arrangements, assigning a major leadership role in this process to the consolidated supervisor, and anticipating the need to reach agreements between supervisors for the approval of Basel II advanced approaches:

- In the case of applications for permission to implement advanced approaches submitted by an EU parent credit institution and its subsidiaries, the competent authorities will work together closely to decide whether or not to grant the permission sought and will determine the conditions, if any, to which it is subject.
- The competent authorities will do everything within their power to reach a joint decision on the application within six months.
- In the absence of a joint decision by the competent authorities, the consolidated supervisor will make a decision which will be determinative and will be applied by the competent authorities in the Member States.
- And it should be noted that the new Capital Requirements Directive not only regulates the European supervisors' co-operation framework for implementation of Basel II, but extends the scope of co-operation further, making provision for supervisors to communicate to one other any information essential or significant for the exercise of the other authorities' supervisory tasks.

Given the importance of these articles of the new Directive for the supervision of European banking groups, the Committee of European Banking Supervisors (CEBS) has prepared implementation guides on this subject so as to foster convergent implementation in the EU Member States.

8.2 Banco de España criteria on co-operation between supervisors for effective application of Basel II advanced approaches

In this regulatory framework the Banco de España has established the following criteria on co-operation with other supervisors for the approval of Basel II advanced approaches:

1 *Co-operation between supervisors* must be compatible with the high-level principles developed by the Basel Committee, as follows:
   a) No change to the current responsibilities of supervisors established by the Concordat. The co-operation arrangements must enable each supervisor to carry out its functions and responsibilities effectively.
   b) Within the co-operation framework each supervisor should carry out the tasks that it is in the best position to perform. It is necessary to economise on resources while ensuring the quality of the process.
   c) The consolidated supervisor should lead the process because of its better knowledge of the parent, of the group as a whole and of the global activities and overall controls.
   d) The host-country supervisor should participate actively in the initial validation, due to its better knowledge of the subsidiary, its markets, its risks and its data, and in the subsequent monitoring of the models, as well as being able to establish local benchmarks.
2 In the case of *European subsidiaries,* it must be compatible with the enhanced co-operation framework established by the new European Directive (particularly Article 129.2)[1] and with the documents prepared by the Committee of European Banking Supervisors (CEBS).
3 It is necessary for each supervisor to have confidence in the technical quality and appropriate form of the review conducted by other supervisors. Insufficient confidence in the work of other supervisors may lead a supervisor to consider repeating tasks that in principle should be performed by others. Co-operation should be based on transparent communication of information between supervisors and on the mutual recognition of their validation processes.
4 The *co-operation arrangements* should consider that the main information source for supervisors is the institutions themselves. The home-country supervisor should be able to receive all the group information it needs through the parent, and the host-country supervisors have sufficient prerogatives to require all information on the subsidiaries in their country. Therefore, information exchange between supervisors should focus on information obtained in the respective supervisory review.
5 *Co-operation should be consistent:* each supervisor will be consistent in the actions taken by it as home-country supervisor and as host-country supervisor, as it usually acts in both capacities.
6 *A level playing field must be assured in any local market.* Co-operation should ensure that the subsidiaries of foreign banks have, for the same risk profile, similar capital requirements to those that will apply to domestic banks.
7 *The significance and materiality of institutions at the local and consolidated levels* will shape the degree of co-operation. Supervisors should involve themselves and develop more extensive and detailed co-operation arrangements to the extent that the individual institutions are significant. The size and materiality of portfolios should be considered as the main factors determining this significance.
8 *Co-operation cannot signify the provision of implicit guarantees* by one supervisor to another, or by certain institutions in the group to others, despite their responsibilities under each legal framework.

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1. a) The supervisors have to reach a joint decision within 6 months; b) In the absence of a joint decision, the consolidated supervisor will make its own decision. c) The decision adopted by the parent supervisor applies to the whole group, including the European subsidiaries.

9 The *Basel II advanced models should be used for risk management purposes,* and should therefore use local data whenever possible. It is necessary to have confidence in the data and in the IT systems supporting them. It is very useful if the internal and external auditors are involved in the review of these matters.

10 *Co-operation arrangements should be established for each portfolio,* since the validation of models will depend on how the portfolios have been constructed and implemented, on how they are managed and on how they are controlled. The organisation of the institution and its internal validation procedure should be considered as the main indicators for defining the co-operation arrangements. Accordingly, before these arrangements are established, detailed information is needed about every institution within the group, and this implies a case-by-case analysis.

9 The Banco de España as consolidated supervisor

9.1 Practical co-operation for validation of Basel II advanced approaches in international Spanish banking groups

The process of validation and acceptance of Basel II advanced approaches has to be efficient. It is very positive if the consolidated group calculates its capital requirements with a single model (adapted to the different data and local realities), but what is truly important is whether the common model is also used to calculate the capital requirements of the local subsidiaries, since this will strengthen confidence in its implementation.

That is to say, although Basel II establishes a number of alternatives, the option chosen must be applied to the whole group, although, for practical purposes, some subsidiaries may initially remain outside the implementation process. This principle is rational and builds confidence: the same management techniques and capital requirements calculation methodologies have to serve both for the consolidated group and for each of the individual institutions. This strengthens both processes (risk management and calculation of capital requirements), generating quality and consistency, and lends certainty to the analysis by supervisors under Pillar 2.

Co-operation between supervisors for implementation of Basel II should be organised portfolio by portfolio. For each portfolio, co-operation arrangements must be sought which should identify the main tasks or significant review processes, distinguishing between centralised and local processes. A process is said to be centralised or local according to who maintains the model, i.e. how internal validation is conducted (by the subsidiary or by the group).

The following aspects of validation should be considered:

1 Rating systems

It is likely that an international group will build rating systems with a single, centralised methodology for a good part of the group's portfolios, and for certain portfolios this is practically essential: sovereigns, banks, large corporates, shares, etc.

However, wherever possible, rating systems should be constructed taking into account the characteristics of local markets. And in the case of retail credit portfolios this is indispensable, i.e. significant local market variables must be used and their weights adjusted to reflect the local reality.

In the case of centrally constructed and maintained rating systems, common, group-wide methods will be used to determine the significant variables, to determine their weight and to incorporate, where applicable, the subjective judgement. In this case the Banco de España, as consolidated supervisor, is the authority best placed for review and approval, since it is the one that has the best knowledge (due to its proximity) and can deploy most resources.

The supervisors of subsidiaries abroad would not need to duplicate the work if they had confidence in the internal review conducted by the parent and in the subsequent review by the Banco de España. For this, they would need to receive information on the methodology, on the system's discriminatory power and on how the review has been done.

In the case of locally constructed and maintained rating systems, the methodology in the subsidiary is local and differs from that of the parent, that is to say, the way of determining the significant variables, of determining their weight and of incorporating, where applicable, subjective judgement is specific to the subsidiary and distinctive. This implies a special adaptation to local reality, so the subsidiary's supervisor is the one best placed for review and approval, because it is the one that, due to its proximity, has the most complete knowledge. The Banco de España will not need to duplicate the review if it has confidence in the review by the subsidiary's supervisor. For this to be so, it would need to receive infor-

mation on the methodology, on the system's discriminatory power and on how the review has been done.

2 Calibration of risk factors

Risk factors should be calibrated taking into account the characteristics of local markets, although for certain portfolios (sovereigns, banks, large corporates) this may not be possible due to a lack of local data. In portfolios in which the subsidiary does not have sufficient local data, local benchmarks will have to be used. In the case of retail portfolios, the existence of sufficient local data is essential for calibration.

The definition of default and the calibration of risk factors can also be done on a centralised or local basis. In the case of centralised management of calibration, the definitions, methodology and calibration algorithms are the same in the subsidiary and in the parent. In this case the Banco de España (home-country supervisor) is the authority best placed for review and approval, since it is the one that can most readily gain the relevant knowledge and that can deploy most resources. The subsidiary's supervisor will not need to duplicate the review if it has confidence in the review by the Banco de España. For this to be so, it would need to receive information on and agree with the Banco de España's supervisory calibration criteria regarding the definitions used, the institution's calculation methodology, the algorithms used and how the calibration has been done.

In the case of local management of calibration (total or partial), the methodology and calculation algorithms in the subsidiary differ from those of the parent. This implies a special adaptation to local reality, so the subsidiary's supervisor is the one who, in principle, is best placed for review and approval. It is the authority that, due to its proximity, has the best knowledge of the subsidiary. The Banco de España will not need to duplicate the review totally or partially if it has confidence in the review by the subsidiary's supervisor. For this to be so, it would need to receive information on and agree with the supervisory calibration criteria established by the subsidiary's supervisor in regard to the institution's calculation methodology and to how the review has been done.

In any event, whatever the form of calibration management, it is highly advisable for the risk parameters to be stable throughout the business cycle and for the criteria used in estimating risk parameters to be sufficiently conservative.

3 Data review: Quality and integrity of calibration and rated-exposures databases

Data review is essential and, moreover, a priority in the short term, since Basel II advanced approaches cannot be implemented without robust, reliable data sources.

Hence, to ensure the integrity of input data, the Banco de España requires internal and external audits that have to be performed in the local environment for each model of each institution considered significant, whether it be a Spanish parent, a Spanish subsidiary or a subsidiary abroad of a Spanish banking group.

If the data are local, as they should generally be, the subsidiary's supervisor is the one best placed to review and approve their quality and integrity, since it can make practical checks that call for proximity. The Banco de España will not need to duplicate the review if it has confidence in that conducted by the local supervisor. For this purpose it needs to receive information on the procedure established to ensure reliable information storage and on how database integrity and quality are periodically reviewed.

If overall data are used, as may occur in certain portfolios such as sovereigns, banks and large corporates, the Banco de España is the one best placed to review and approve their quality and integrity, since it can make practical checks. However, the Banco de España may need the co-operation of certain significant local supervisors to carry out this task in their jurisdiction. The local supervisor does not need to duplicate the review if it has confidence in that conducted by the Banco de España. For this purpose it needs to receive information on the

procedure established to ensure reliable information storage and on how database integrity, quality and reasonableness are periodically reviewed.

4 Review of adaptation of technological environment and IT systems to Basel II so that models can be used effectively

This review is essential and a priority in the short term. The implementation of the Basel II advanced approaches will depend on a robust technological environment.

Therefore, to review the adequacy of the technological environment, the Banco de España requires internal and external audits that have to be performed in the local environment of each institution considered significant, whether it be a Spanish parent, a Spanish subsidiary, a subsidiary abroad of a Spanish institution or a subsidiary in Spain of a foreign institution.

This review should be led by the Banco de España (consolidated supervisor), but requires co-operation with the subsidiaries' supervisors, since the capacity of the technological environment has both central and local aspects. Therefore, although the Banco de España is the one best placed to assess the adaptation of the group's overall technological environment and IT systems, the local supervisor should participate in the review in the local environment, since it can make practical checks that call for proximity.

5 Qualitative and control procedures review. Internal use of advanced procedures (use test)

The use of Basel II advanced approaches in the management process is essential and necessary from the outset, in addition to being a basic requirement for the implementation of Basel II. For this reason, the Banco de España will require internal audits that should be performed in the local environment for all models of each institution considered significant, whether it be a Spanish parent, a Spanish subsidiary or a subsidiary abroad of a Spanish credit institution.

The internal use of IRB systems, i.e. their use for day-to-day credit risk management, is, by nature, essentially local (approval and monitoring of facilities, risk profile of the local portfolio, etc.), notwithstanding certain highly specific corporate aspects (analysis and management of the group's overall risk profile).

For this purpose the local supervisor is the one that is best placed for supervisory review, since it is the one that can carry out a practical check because of its proximity. The Banco de España will not need to duplicate the review if it has confidence in that conducted by the local supervisor. For this purpose it needs to receive information on the method of verifying their use and on how that use was reviewed. The Banco de España may need to analyse the internal use of the related group-level advanced approach (analysis and management of the group's overall risk profile).

9.2 Action taken for effective implementation of Basel II

As pointed out above, dialogue and co-operation with other supervisors are essential for effective supervision of Spanish international groups. In view of the structure of Spanish groups, which have expanded internationally in the form of subsidiaries abroad, the most effective way of building this co-operation is through bilateral relations with the host-country supervisors of those subsidiaries in a framework of transparency and mutual respect. Co-operation should always be based on the premise that the function of host-country supervisors is vital for the quality of supervision of Spanish international groups.

In regard to the implementation of Basel II, and as consolidated supervisor of international Spanish groups, the Banco de España has taken the following initiatives:

– *Letters to all host-country supervisors* of the subsidiaries abroad of Spanish international banks, in March 2005: the aim was to keep local supervisors informed of

the activities being undertaken by the Banco de España in relation to the implementation of Basel II in Spanish banking groups, viz:

- Inform of the efforts being made by Spanish credit institutions for effective implementation of Basel II, and of the methods that, as communicated to the Banco de España, would be used for treatment of the various risks.
- Describe the initiatives taken by the Banco de España in monitoring the implementation of Basel II in Spanish international groups.
- Propose the required co-ordination in the Basel II implementation process in those groups.

These letters were intended to establish regular, fluid communication with local supervisors with a view to addressing, inter alia, the following matters:

- General process of supervision of international groups by the Banco de España.
- Monitoring of the Basel II Implementation Plan in Spanish international groups.
- The Banco de España's Road Map for validation and approval of Basel II advanced approaches.
- Status of implementation of Basel II in the subsidiaries of Spanish banks in their country.
- Local supervisors' plans for implementing Basel II in their country.

This was another step forward in continuous, close communication with host-country supervisors to keep them informed about the process of implementation and validation of Basel II advanced approaches in Spain and, at the same time, ask them for up-to-date information on their plans for the subsidiaries of Spanish banks abroad, on implementation schedules, on decisions and concerns regarding areas of national discretion and on any other matter of significance. From an operational standpoint, it was considered appropriate to centralise this co-operation and define the technical details of it. Contact persons have been designated both by the Banco de España and by the various host-country supervisors.

– *Bilateral meetings with other supervisors*

Also, to expedite implementation of Basel II in international Spanish banking groups, meetings were organised with the supervisors of the main Spanish subsidiaries abroad.

The aim was to gain a more detailed, first-hand knowledge of Basel II implementation plans in the respective countries and of the expectations of local supervisors for the subsidiaries of Spanish banking groups in these countries. Concurrently, in all these meetings the Banco de España made a presentation of the process of Basel II implementation in Spain, and stated its ideas on organising co-operation between supervisors, particularly in regard to approval of advanced approaches.

These meetings enhanced the atmosphere of mutual confidence between the operational teams that supervise Spanish parents and their local subsidiaries, and were conducive to fluid contacts aimed at exchanging viewpoints on specific matters relating to Basel II.

In general, these meetings included additionally a presentation to both supervisors by representatives of Spanish parents and their subsidiaries abroad. The purpose of these presentations was for the risk managers of the group and of the subsidiary to transmit to both supervisors together their implementation plans and the progress made at corporate level and in the subsidiary, as well as the practical implementation problems detected.

The co-operation arrangements proposed by the Banco de España for implementation of Basel II advanced systems in the Latin American subsidiaries of Spanish credit institu-

tions will, where possible, be adapted to the local Basel II implementation schedule provided that it sets a reasonable time horizon for the advanced approaches.

The co-operation proposed by the Banco de España for implementation of Basel II advanced systems in the European subsidiaries of Spanish groups falls fully within the scope of application of the co-operation principles established in the Capital Requirements Directive (Art 129.2).

In any event, as consolidated supervisor, it falls to the Banco de España to lead the Basel II implementation process, since it has global knowledge of the banking group. However, the host-country supervisor is always asked to participate actively in regard to local data quality, possible comparisons with other institutions in the country and subsequent monitoring of the model. It is proposed that the methodology be shared and that the validation procedure be co-ordinated between supervisors.

Final responsibility for consistency of the capital requirements of Spanish banking groups lies with the Banco de España. For this purpose, it should have a minimum amount of information that has to be supplied by local supervisors: scheduled visits and letters sent to subsidiaries setting out the recommendations resulting from those visits. For its part, the Banco de España will inform the local supervisors of any significant matter noted in its review, conducted at head office services, of the various aspects of implementation of Basel II in the subsidiaries. All this should be accompanied by fluid, ongoing contact.

In short, the interaction of both supervisors is essential: the host-country supervisors review local methodology, the use test, databases and the local technological environment; and the Banco de España reviews aspects of corporate governance and internal control in the consolidated group, controls performed by specialised departments of the parent, local differences from corporate practices and the consistency of the calibration with respect to the other units in the consolidated group.

The Banco de España has already informed Spanish international groups of the need for internal and external audits of certain Basel II-related matters (databases, technological environment and use test) to also be performed in their significant subsidiaries abroad. Certain host-country supervisors are already sharing with the Banco de España the documentation sent by the Spanish groups regarding the related subsidiary (IRB File).

10 The Banco de España as host-country supervisor

10.1 Practical co-operation arrangements for validation of Basel II advanced approaches in Spanish subsidiaries of foreign groups

The Banco de España's position as host-country supervisor of the subsidiaries of foreign banks in Spain is to co-operate as and when requested with the parent supervisor, for the sake of effective and efficient implementation of the Basel II advanced approaches.

For this purpose, co-operation arrangements should be established in each portfolio to identify the main review tasks or processes, basically distinguishing between centralised and local processes. A process is said to be centralised or local according to who maintains the model, i.e. how the internal validation process is carried out.

The Banco de España considers that the foreign banks' subsidiaries that adopt advanced approaches should follow the same approval process that applies to Spanish banks, i.e. drawing up an Implementation Plan and, in the case of IRB models, submitting the related IRB File and keeping the related IRB Model Dossier. However, if on certain matters the home-country supervisor has asked for equivalent information, the Banco de España may use that information, duly supplemented wherever not covered by the parent supervisor. The information required from institutions should be delivered to the Banco de España in Spanish.

1 Rating assignment systems

In the case of locally constructed and maintained rating systems, the methodological treatment in the subsidiary differs from that in the parent, i.e. the way of determining significant variables and their weights and of incorporating, where applicable, a subjective judgement is specific to the subsidiary. This implies a special adaptation to local reality and, therefore, the subsidiary's supervisor, i.e. the Banco de España, is the one best placed for review and approval, since its proximity gives it the most complete knowledge.

2 Calibration of risk factors

To calibrate risk factors, account should be taken of the characteristics of local markets, although for certain portfolios (sovereigns, banks, large corporates) this may not be possible due to lack of data. If the subsidiary does not have sufficient local data, benchmarks from the Spanish market will have to be used. In the case of retail portfolios, the existence of sufficient local data from the Spanish market is essential for calibration.

The Banco de España considers it highly desirable for the risk parameters to be stable throughout the business cycle and for the criteria used in estimating risk parameters to be sufficiently conservative.

3 Data review: quality and integrity of calibration and rated-exposures databases

When the Banco de España has to conduct this review, it will ask for internal and external audit reports. These audits should be performed in the local environment for the models of each foreign subsidiary considered significant by the Banco de España, among subsidiaries in Spain of foreign banks.

4 Review of adaptation of technological environment and IT systems to Basel II so that the models can be used effectively

As in the previous case, when appropriate the Banco de España will ask for internal and external audit reports. The audits should be performed in the local environment of each institution considered significant.

5 Qualitative and control procedures review. Internal use of advanced procedures (use test)
The internal use of advanced approaches, i.e. their use for day-to-day credit risk management, is, by nature, essentially local (approval and monitoring of facilities, risk profile of the local portfolio, etc.), notwithstanding certain highly specific corporate aspects (analysis and management of the group's overall risk profile). Therefore the Banco de España is the one best placed for reviewing them.

10.2 Action taken for effective implementation of Basel II

As pointed out above, dialogue and co-operation with other supervisors are essential for effective supervision of international groups. The function performed by the Banco de España is essential for the supervision of foreign groups with subsidiaries in Spain, since the effectiveness of consolidated supervision depends on a robust supervision by the host country providing certainty as to the subsidiary's financial situation and risks, its solvency and the management and control mechanisms applied.

In regard to the implementation of Basel II, the Banco de España, as the host-country supervisor of the subsidiaries of foreign banks, has taken the following initiatives:

– *Participation in multilateral meetings of supervisors*
  The Banco de España has participated in various multilateral meetings of supervisors organised in different countries by the consolidated supervisors of international banks with subsidiaries in Spain.
  These meetings have generally had the following format:
  - Presentation by the parent supervisors of their implementation plans and work regarding the group as a whole.
  - Presentation by the group of its Implementation Plan.
  - Presentations by the different countries on subsidiaries' plans and specific implementation problems.

– *Organisation of bilateral meetings with significant home-country supervisors*
  The Banco de España has held bilateral meetings with various supervisors regarding the implementation of Basel II in the subsidiaries in Spain of international banks.

11 Other action taken by the Banco de España for implementing Basel II

– *Multilateral relations. Participation in international groups*

The Banco de España considers that, when accompanied by specific bilateral co-operation with other supervisors, multilateral relations are very effective for the discussion of conceptual matters and general supervisory practices and are absolutely necessary for the convergent implementation of Basel II.

The Banco de España has been very active in the Basel Committee's Basel II implementation group (AIG, Accord Implementation Group), and in its sub-working groups, since it considers that the AIG is resolutely fostering dialogue and co-operation between supervisors and hence the convergent implementation of Basel II.

At the same time, the Banco de España is participating actively in the work of the Committee of European Banking Supervisors (CEBS) and its working groups to foster convergence in the implementation of the Capital Requirements Directive in the European Union.

– *Organisation of a specific seminar on implementation of Basel II for Latin-American countries, April 2005*

In April 2005 the Banco de España organised a 2-day seminar in Madrid on Basel II implementation and on validation of internal credit risk models, aimed at Latin-American supervisors. The seminar was arranged in response to diverse requests for co-operation received from Latin-American supervisors and associations and its purpose was to share experience of the validation of internal credit risk models and of Basel II implementation by international groups.

The seminar was in the form of presentations made by specialised Banco de España staff on the processes of authorisation and of validation of internal credit risk models, on the experience obtained from the review of internal credit risk models and on topics relating to Basel II implementation by international groups.

The seminar, which was aimed at the top officials responsible for supervision and for Basel II implementation in Latin America, was attended by representatives from 15 countries and by members of the *Asociación de Supervisores Bancarios para las Américas* (ASBA) and of the Financial Stability Institute (FSI), auspiced by the Basel Committee.

– *Addresses delivered in international courses, seminars and technical meetings relating to Basel II*

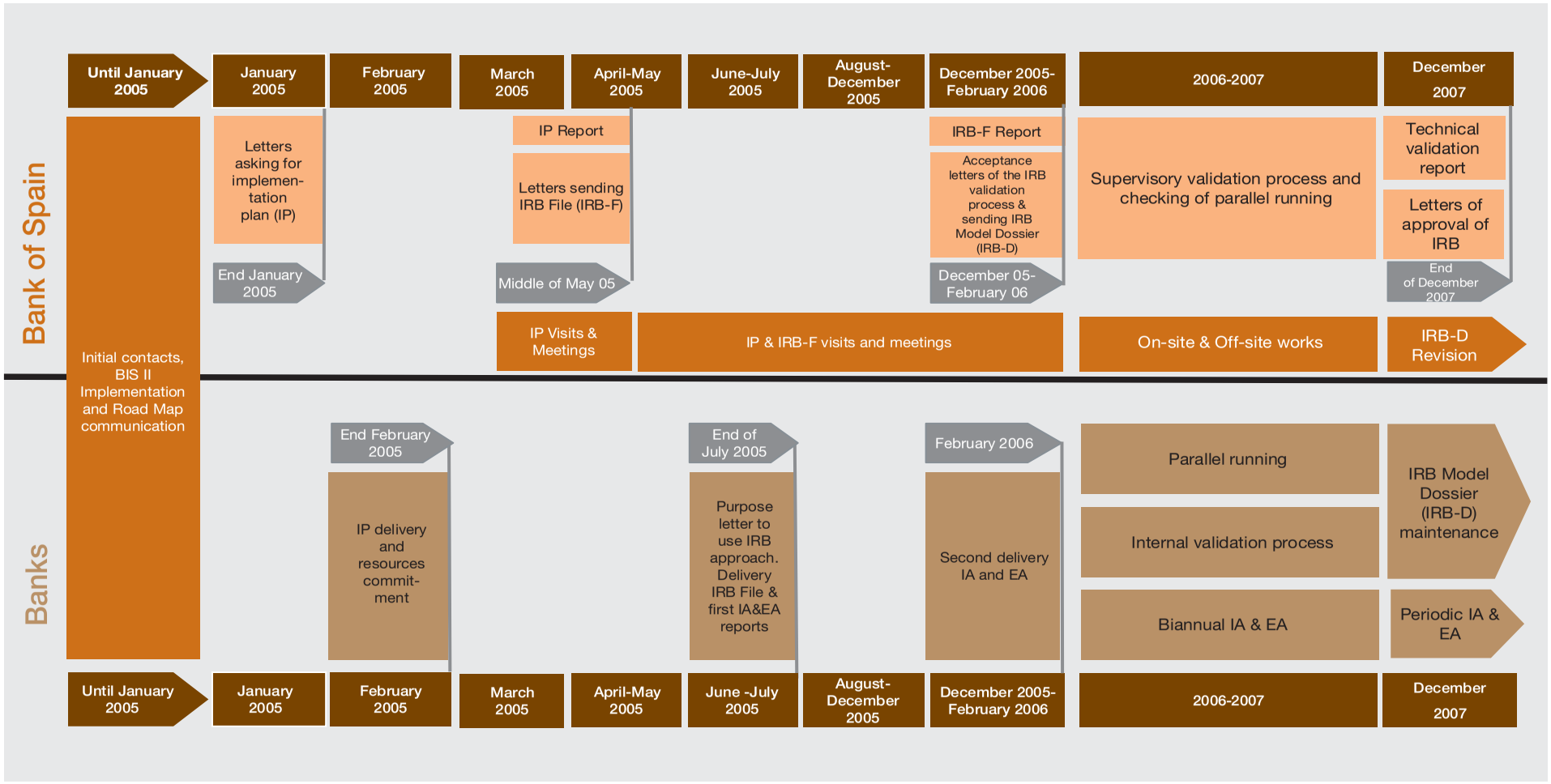
For some time, Banco de España technical staff have been giving talks on Basel II- related matters in international fora.

Also, at the request of other international supervisors, the Banco de España has organised various technical co-operation meetings relating to different practical aspects of the implementation of Basel II.

ANNEX 1 ROAD MAP

IMPLEMENTATION OF BASEL II

ROAD MAP: IMPLEMENTATION SCHEDULE



ANNEX 2 IMPLEMENTATION PLAN

BASEL II IMPLEMENTATION PLAN FOR ADVANCED APPROACH BANKING GROUPS[1]

The information required by the Supervisor is the plan for implementing the new Capital Framework in the banking group. This information must be brief and must give a general view of 1) the group's current situation in regard to implementation of the three pillars of the new Capital Framework, and 2) the work envisaged to meet the minimum requirements for being eligible to use the approaches chosen for the treatment of the different risks.

The information that must be included in the Implementation Plan is detailed below. However, any additional information that the institution considers relevant for evaluating the group's state of readiness for the Basel II implementation process, may also be added.

General matters

1 A detailed description of the banking group, specifying the activity of each individual institution and including a summary table with the relative weight (in terms of current exposure) of each financial institution in the banking group.

2 Approval of the Implementation Plan by the most senior governing body, specifying the date.

3 Organisational structure, describing the responsibilities and functions of the different areas involved in management and control of risks, as well as the committees established.

4 Units responsible for the development and internal validation of the internal models.

5 Human and material resources plan for carrying out the project, with special attention to the IT and internal audit resources.

Pillar I

A. Credit Risk

1 Approach that each institution in the banking group initially intends to use for the treatment of credit risk in each asset class and sub-class (segment).

2 For those segments to which the approach applied in the future will differ from that initially envisaged, specify the estimated roll-out timetable and the work plans.

3 Percentage of all the group's assets included in the selected IRB approach.

4 Internal assessment of the degree of compliance, as at the date of submission of the Implementation Plan, with the minimum requirements for being eligible to use the selected IRB approach. A list of the most difficult aspects of achieving compliance.

[1] For the subsidiaries in Spain of foreign groups, the information required is limited to activities in Spain.

5 List of the models to be used in each segment, indicating: the percentage of the total segment exposures rated by each system, and, if applicable, the date on which all exposures in the segment will be rated by those systems.

The following information must also be reported for each model:

5.1 The implementation date of the rating system.

5.2 The use of the rating system in the institution (approval, setting limits, etc.).

5.3 The following aspects of databases must be reported for each estimated parameter (PD, LGD and EAD):

- Historical length of internal data.

- The use of external data.

6 Internal assessment of the technological environment and the applications that enable effective use of internal models. An internal evaluation of the IT systems and procedures used to ensure the integrity and consistency of databases.

7 Definition of the approach used for assessing the effect of credit risk mitigation techniques.

8 Approaches used for treatment of securitisation positions.

B. Operational Risk

1 Definition of the approach to be used to calculate capital requirements for operational risk.

2 If the approach that will be used in the future will foreseeably differ from that initially adopted, specify the envisaged roll-out timetable and the work plans.

3 Internal assessment of the degree of compliance with the minimum quantitative and qualitative requirements for being eligible to use the selected approach. List of the most difficult aspects of achieving compliance.

C. Market Risk

1 Description of the group's trading activities and of the instruments included in the trading book.

2 List of the group financial institutions, units or centres which are able to assume price risk on the trading book, commodities, exchange rate and gold positions, specifying the systems used to measure the risk in each of them.

3 A list of portfolios for which the institution plans to request authorisation to use internal models, and the estimated application dates.

Pillar II

1 Plans developed to assess the risks not included in Pillar I.

2 Procedures established to assess total capital adequacy based on risk profile.

3 Description of the process of internal capital allocation.

4 List of large positions and risk concentrations.

5 Description of the stress tests used.

Pillar III

1 List of the information currently being disclosed and plans for complying with Pillar III requirements.

ANNEX 3 IRB FILE AND ANNEXES

IRB[1] FILE FOR CALCULATING THE MINIMUM CAPITAL REQUIREMENTS FOR CREDIT RISK

Banking groups that wish to use IRB approaches in their calculation of the minimum capital requirements for credit risk under the new Capital Framework (Basel II), must participate in the validation processes established by the Banco de España. To participate in the said processes, the group's parent entity will have to forward the information[2] included in this file to the Directorate General Banking Supervision together with a letter stating their intention to use the advanced approaches for regulatory purposes (Annex 1)[3].

The information contained herein aims to make known the level of compliance with the minimum requirements established by Basel II for the use of IRB approaches and to determine if institutions will be able to meet these requirements.

Institutions must prepare their systems to use the standardised approach, in case the Banco de España does not accept the submitted IRB approach proposal.

Furthermore, institutions will also have to be prepared to make the capital requirement calculations in accordance with the new standardised approach for those exposures not initially included in the IRB approach (either because the roll-out plan provides for their inclusion at a later stage or for reasons of immateriality[4]).

The following considerations should be taken into account when filling in the information detailed below with respect to the IRB approach:

1. One IRB File should be completed for each institution subject to consolidation that intends to use advanced approaches[5]. However, in the event that the rating systems are the same for various institutions and are used without distinction in each of them, then the completion of only one IRB File for those institutions would be acceptable, although this circumstance should be clearly indicated.

   If more than one internal credit risk model[6] has been developed for a specific institution and segment (asset class and sub-class according to the Basel II definition)[7], the corresponding section should be duplicated for the purpose of filling in the required information for each of the models.

2. Furthermore, for each of the models that institutions intend to use for regulatory purposes, a specific internal audit report and an additional report from an external auditor (the scope of which are detailed in Annex 3 and 4 respectively) should also be included. When necessary, these reports should be updated biannually and forwarded to the Banco de España until the approval of the proposed approach.

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[1] *The Internal Ratings-Based Approach*. Discussed in Section III of Part 2 of the June 2004 document "International Convergence of Capital Measurement and Capital Standards: A Revised Framework" (paragraphs 211 to 537) and in Section IV on the Securitisation Framework (paragraphs 538 to 643).

[2] If necessary, the information forwarded by the institutions will comply with whatever is established by future European and Spanish regulations.

[3] For institutions which are subsidiaries of foreign banking groups, the subsidiaries themselves or, if applicable, the Spanish institution responsible for the consolidation in Spain will forward this information to the Banco de España.

[4] These will have to be substantiated before the Banco de España.

[5] In the case of institutions which are subsidiaries of foreign banking groups, one IRB File should be completed for each Spanish institution that wishes to use the IRB approach when the new Capital Framework comes into force.

[6] In this case, this decision must be justified to the Banco de España.

[7] Paragraph 215.

3. For those exposures initially treated using the standardised approach, and which in the future will be treated using advanced approaches in accordance with the roll-out plan, a first version of the IRB File and the first internal and external auditors´ reports will be sent to the Banco de España together with the letter stating the intention to use IRB approaches. One year before the planned date of implementation of the advanced approaches, an updated version of the IRB File will be delivered to the Banco de España and the frequency of the auditors´ reports will become biannual, until the proposed approach has been approved by the Banco de España.

4. The purpose of this file is not to replicate the minimum requirements pursuant to the new Framework, rather it is understood that all submitted documentation must comply with these requirements.

5. Any additional information to that mentioned in this document which the institution considers relevant for assessing compliance with the minimum requirements for the application of the IRB approach should also be provided.

6. Institutions that intend to use the FIRB approach should disregard Sections IV.B.8.5, IV.C.13, V.C.8, V.C.9 and V.C.10, which clearly state that they refer solely to the AIRB approach.

7. Institutions should be prepared to provide the Banco de España at any time with the calibration [8] and current exposures databases [9] used as the basis for the calculations referred to in this file.

[8] The calibration databases are those that serve to calibrate the model, i.e. to obtain estimates of PDs, LGDs and, if applicable, EADs (CCFs).

[9] Minimum requirements that these databases must comply with are detailed in Annex 2.

CONTENTS:

I. Classification of exposures

1 Describe the segmentation used in the framework of the internal management of the institution and the mapping process for assigning exposures to the regulatory segments (asset classes and sub-classes) established in Basel II.

The asset classes are:

- Corporate exposures
- Sovereign exposures
- Bank exposures
- Retail exposures
- Equity exposures

Within corporates, there are five sub-classes for specialised lending:

- project finance
- object finance
- commodities finance
- income-producing real estate
- high-volatility commercial real estate

and three for retail:

- residential mortgage exposures
- qualifying revolving retail exposures.
- other retail exposures.

It is also necessary to identify which exposures to SMEs are treated as corporate and which as retail.

Exposures corresponding to securitisation positions and exposures treated as eligible purchased receivables should also be identified.

In Annex 5, there is a table that must be completed in order to comply with the information requirements of this section.

2 With regard to securitisation exposures, it is necessary to define the portfolios to which the underlying assets belong and, where the institution acts as an originator bank, the exposure that corresponds to the securitised assets should be indicated, distinguishing between traditional and synthetic securitisations.

Describe the institution's securitisation policy and future plans.

3 Furthermore, the different rating systems that will be applicable to each segment must be detailed.

II. Implementation of the IRB approach for different types of assets (roll-out)

1 Specify the approach adopted for the different classes and sub-classes of assets established by Basel II, according to the table in Annex 6.

2 For material exposures to which the IRB approach will not initially be applied, an implementation plan, clearly specifying the anticipated timetable, should be provided, using the table in Annex 7.

III. Estimation of the minimum regulatory capital requirements

1 For each of the segments, provide a table with all the average risk parameter estimates, expected losses, related accounting provisions, and the regulatory capital requirements resulting from these estimates.

IV. Credit risk mitigation techniques (CRMTs)

A. General information

1 Describe the procedures used to assign credit risk mitigation techniques (CRMTs) to the exposures.

2 It is essential for the institution to have and provide:

2.1 The pertinent tests to ensure that it is possible to legally enforce guarantees at any time.

2.2 The documentation used in collateralised transactions.

2.3 The risk manual describing the calculation methodologies developed and the guarantee monitoring and control system.

2.4 Information on where the financial collateral may be found, ensuring that the institution where these assets are deposited is cognizant of them and considers them to be effective CRM for the loans granted.

3 If shares in UCITs are provided as CRMT, it is necessary to demonstrate that the underlying securities are liquid and listed.

4 The analyses performed on the correlation existing between the risk mitigation technique and the quality of the counterparty.

5 Definition of maturity. Description of the methods used to calculate the maturity of the underlying and the risk mitigation technique as well as its application in capital calculations.

6 Description of the procedures and processes established to control residual risks that may increase with the application of risk mitigation techniques.

B. Collateral

7 Collateral in the comprehensive approach.

7.1 General considerations.

7.1.1 Specify the procedures established to apply haircuts (H)[10].

[10] If own models are used, it is necessary to apply them to all exposures, unless the excluded amount is immaterial.

7.1.2 Description of the procedure established to identify collateral with haircuts equal to zero (H equals 0).

7.2 Supervisory haircuts. Description of the procedure established to:

7.2.1 Identify the haircut corresponding to each collateral and its exposures.

7.2.2 Apply adjustments for different maintenance periods and the revaluation or readjustment of margins.

7.2.3 Adjust the exposures for maturity mismatches.

7.3 Own estimates of haircuts.

7.3.1 Details of the haircuts applied by the institution, which should take into account, at least, the type of instrument, the type of transaction, the frequency of revaluation, and the frequency of remargining.

7.3.2 Description of all processes used for the haircut calculations. It is necessary to describe the controls and procedures used in the risk measurement system.

7.3.3 Description of the procedures established to:

a. Identify the haircut corresponding to each collateral and its exposures.

b. Apply the adjustments for different maintenance periods and the revaluation or readjustment of margins.

c. Adjust the exposures for maturity mismatches.

7.3.4 A report prepared by internal audit[11] on the review of the risk measurement system covering at least the following:

- its integration in daily risk management;

- the validation of any significant change in the risk measurement process;

- the accuracy and completeness of data;

- verification of the consistency, punctuality, and reliability of the sources of data used in the functioning of internal models, as well as their independence;

- the accuracy and adequacy of volatility assumptions.

7.3.5 Description of the procedure used to apply netting agreements in repo style transactions. In this section, it is necessary to include those that have been executed, detailing all related documentation and substantiating its fulfilment of the necessary conditions.

7.3.6 The institution's policies with respect to collateralised OTC derivative transactions.

7.4 VaR methodology (for repos only):

7.4.1 Indicate if the institution has an approved internal model for calculating the minimum regulatory capital for market risk or if it has submitted an application for its approval to the Banco de España.

7.4.2 Indicate if the institution wants to apply an internal model for repo-style transactions, even though it has not been approved. In this case, it is necessary to make a separate approval request according to the procedures established by the Banco de España in this respect.

[11] This is not the specific internal audit report whose minimum scope is detailed in Annex 3.

7.5 Where collateral pools are used, a description of the procedures established for their application is required.

8 Eligible IRB collateral.

8.1 Details of the CRE/REE collateral used by the institution. It is also necessary to include the documentation justifying their application as a risk mitigation technique, particularly with respect to market price valuations and revaluations.

8.2 Description of the procedures set up for the management of eligible financial collateral pursuant to the IRB methodology.

8.3 If other eligible IRB collateral is used, the institution must substantiate that these comply with requirements.

8.4 Treatment of the risk mitigation techniques in purchased receivables, detailing the methodology used to make a distinction between the default risk /dilution risk secured.

8.5 (For the AIRB approach only)

8.5.1 Description of the methodology used for the recognition of collateral in loss estimates.

8.5.2 Segmentation by type of collateral of internal LGD estimates.

8.5.3 Detail of the treatment of netting agreements for repo transactions.

C. Guarantees

9 Procedures established to ensure the general and specific [12] requirements for the recognition of this type of risk mitigation technique (direct, explicit, irrevocable, and unconditional) are complied with.

10 Analyses developed to ensure there is no correlation between the guarantors and the counterparties for whom the guarantees are given.

11 Description of the treatment for partial coverage.

12 Describe the methodology used to ensure that the internal rating assigned to a counterparty is equal to or higher than A-.

13 *(For the AIRB approach only)* If the advanced models (AIRB) are applied, it is necessary to include a description of the methodology used to take into account these guarantees in the risk parameter calculation (PD or LGD).

D. Credit derivatives

14 Description of the credit derivatives contracted, describing their type (CDS, TRS, etc).

15 Controls established to ensure that the definition of credit events reflected in the derivative complies with the requirements established in the new Framework.

16 Detail of the treatment used for residual risk calculations as well as their management.

[12] These requirements depend on the methodology applied, FIRB or AIRB.

E. Netting agreements

17 Procedures ensuring compliance with the necessary requirements for netting transactions.

18 It is necessary to substantiate the ability to identify all on-balance and off-balance sheet positions of the institution with any counterparty. Consequently, the processes used must be described.

19 Details of the procedures established for the joint management of all positions with any given counterparty.

F. CRM pools

20 Description of the processes established for CRM technique pools.

G. Leasing

21 Details of all leasing transactions treated as collateralised exposures and those in which the institution is exposed to residual value risks.

V. Corporate, sovereign, and bank exposures

The following information must be provided for each of these segments:

A. Portfolio definition

1 A definition of the portfolio distinguishing in the case of corporates, the five types of specialised lending (SL) and exposures to SMEs.

It is necessary to classify in detail the portfolio subject to analysis, describing (by including the number of transactions and the risk volume) its origin and how it has reached its current composition. Among other aspects, it is necessary to detail:

- original applications,
- migration to new applications (if any),
- channels used to capture transactions,
- the breakdown (current and historical) of the portfolio by maturity, product, etc.

2 With respect to specialised lending, the institution must specify the approach applied to each asset sub-class.

If it has been decided to apply supervisory slotting criteria to any of the SL sub-classes, the following sections B, C, and D should be disregarded for these exposures. In this case, the institution will provide:

- A description of the transaction granting process (specifying the functions of analysts and risk managers) and the implications of the internal risk ratings with respect to said granting process.

- The internal rating system manuals as well as the people responsible for their maintenance and approval.

- A detailed description of the mapping of exposures to the supervisory categories established by the supervisory slotting criteria method.

B. Rating system

3 Design of the rating system:

3.1 Structure of the rating system: breakdown of current obligors according to two dimensions (the borrower's default risk and specific transaction related factors) showing the distribution (current and historical) of risks among the different classes.

3.2 Model description:

- type of model (expert-based rating, replicas of external ratings, etc.).
- variables used (specifying the frequency with which they are obtained).
- methodology used in its construction (multi-variate analysis, LOGIT/PROBIT, neural networks, expert opinions…) indicating the time horizon considered.
- Indicate the role of the analyst's judgement in determining the rating.

3.3 If there are any unrated exposures[13], quantify them and describe in detail the reasons for this circumstance, as well as the treatment planned for them.

3.4 Modifications in the method used to classify transactions, for example, changes in weighting of ratings, indicating the dates of relevant events. If there have been any modifications, describe the procedures established to reassess old obligors.

3.5 Document the warning systems in place and their integration with the rating system.

3.6 Measurements of the discriminatory power of the rating system and their historical evolution. In general, it is possible to make a judgement with respect to the discriminatory power of the rating/scoring system using various indices (accuracy ratio/area under the ROC curve, the Kolmogorov-Smirnov statistic, chi-square tests, etc.).

4 Use of the rating system:

4.1 Description of the transaction approval process (differentiating the analysts' and risk managers' functions), including the use of the rating in such approval process.

4.2 Period of application and functioning of the model, attaching a table summarising the rating system's historical activity, indicating the customers rated each year.

4.3 Frequency of assignment and rating reviews.

4.4 Treatment of exceptions, and a summary, by type of transaction, of transactions approved without following regular procedures.

5 Rating system documentation. A manual detailing the functioning of the rating system should be attached as an annex.

C. IRB inputs

6 A summary table with the average risk parameters (PD, LGD, EAD and M) by rating grade, as well as the on-balance sheet exposure and the number of transactions corresponding to each grade.

7 Estimation of the probability of default (PD).

[13] This situation should be temporary and exceptional.

7.1 The definition of default used to estimate the PDs, specifying those situations that the institution considers subjective defaults[14], describing the adjustment (if necessary) made to align this definition with the regulatory one.

Identify any modifications to the time frame considered in the default definition used.

7.2 Technical defaults: The definition of what is considered a "material credit obligation to the banking group" in the definition set forth in paragraph 452 should be properly documented.

7.3 Calculation method used to estimate the parameter.

7.4 The latest PD estimates and their historical values.

7.5 Detailed description of the database used to calculate PD estimates (periods covered, variables...)[15], specifying the external sources used.

8 (*For the AIRB approach only*) Estimation of the loss given default (LGD).

8.1 The definition of default used to estimate the LGDs and the adjustments made (if necessary) to align this definition with the regulatory one.

8.2 Detailed description of the concept of loss used, identifying any changes in the definition over time that could have an impact on data comparability and/or the model's predictive power.

8.3 Calculation method used to estimate the parameter.

8.4 The latest LGD estimates and their historical values.

8.5 Detailed description of the database[16] used to estimate the parameter (periods covered, variables, etc.), specifying the external sources used.

9 (F*or the AIRB approach only*) Credit Conversion Factor (CCFs).

9.1 The definition of default used to estimate CCFs and the adjustments made (if necessary) to align this definition with the regulatory one.

9.2 Calculation method used to estimate the parameter.

9.3 The latest CCF estimates and their historical values.

9.4 Detailed description of the database[17] used to estimate the CCFs (periods covered, variables, etc.) specifying the external sources used.

10 (*For the AIRB approach only*) Details of the procedures established to calculate the effective maturity (M).

11 Risk mitigation techniques. In addition to what is set forth in Section IV:

[14] Paragraph 452: "The bank considers that the obligor is unlikely to pay its credit obligations to the banking group in full, without recourse by the bank to actions such as realising security (if held)".

[15] Minimum database requirements are detailed in Annex 2.

[16] Minimum database requirements are detailed in Annex 2.

[17] Minimum database requirements are detailed in Annex 2.

11.1 Define and explain the methodologies used, quantifying the volume of exposures affected.

11.2 Guarantees and credit derivatives: describe the guarantees and the adjustments made, indicating if these were to the PD or the LGD, quantifying the exposures affected and evidencing compliance with the requirements established in the new Framework[18].

11.3 The institution must quantify, in terms of the number and amount of exposures, the transactions subject to netting and justify this treatment.

12 Exposures.

12.1 Detailed description of the rating process used to classify current exposures[19] into homogeneous grades, for applying the CCFs and obtaining the EADs.

12.2 Analysis of the current breakdown of the portfolio by internal risk classes and types of instrument, before and after applying the CCFs and, where applicable, the CRMTs[20].

D. Model outputs

13 A table including, for each rating grade:

- the expected loss,
- related accounting provisions, and
- the regulatory capital requirements resulting from these estimates.

14 Identification and description of the processes that use the model outputs; including at least:

- transaction approval,
- pricing,
- limits, and
- economic capital

15 In those situations in which the risk parameters used internally are not the same as those applied in the regulatory capital calculations[21], it will be necessary to document and explain the rationale behind the criteria used.

E. Internal validation

16 List the studies carried out and the units responsible for them.

16.1 Comparisons with other similar portfolios (internal and external) and benchmarking.

16.2 Stress-tests performed (type, description of data and results).

16.3 Backtesting.

[18] Paragraphs 109 et seq. for the standard approach and 289, 293, 294, 298, 302, 307, 316 and 480 to 490 for the IRB approach.

[19] These exposures should be reconciled with the accounts.

[20] In those cases in which the CRMTs are applied to the value of the exposure.

[21] For example, for pricing, establishing limits and other internal uses of the model, it is possible to use an estimation time horizon that differs from the regulatory one.

16.4 Analysis of the stability of the outputs (confidence intervals, bootstrapping, etc.). It is necessary to include *out-of-sample*[22] and *out-of-time*[23] tests for the statistical validation of the model.

16.5 Sensitivity analysis of final outputs (regulatory capital, expected loss, etc.) carried out to quantify the impact on the minimum capital requirements of changes in the parameters or in the model hypotheses.

16.6 Analysis of the transition matrix by type of rating and its values in recent years.

F. Technological environment, information systems and maintenance

17 Description of the technological environment, information systems, and applications that enable the model to be used effectively.

18 Explain the processes used to obtain the information required by the model from the institution's applications and databases, attaching existing technical documentation.

19 Identification and description of the external sources used by the model.

20 Define the processes established to periodically obtain the regulatory capital requirements.

21 Description of the applications used to store information relating to the rating system, the estimated parameters and any other relevant aspect, indicating the units responsible.

G. Qualitative aspects

22 Summary of the bank's credit policies (for approving and renewing transactions and for pricing) and the delegation of responsibilities.

Describe those situations in which the bank is trying to enter new market segments.

23 The involvement of the board and senior management, providing documents that reflect the approval of the model at the appropriate hierarchical level.

24 Organisational structure describing the responsibilities and functions of the various areas involved in the management and control of this risk, as well as the committees that have been established.

25 Details and qualifications of human resources in all the areas involved in risk control and measurement.

26 A list and brief description of the reports based on data generated by the model, in particular the reports submitted to the board and senior management and management reports.

27 A list of existing manuals on methodological aspects, information systems, policies, and procedures.

[22] *Out-of–sample tests*: these involve the use of a sub-group of available data to adjust the model and observe what happens to the different risk parameter (stability) estimates and the predictive power.

[23] *Out-of-time tests*: these aim to verify that the model continues to have predictive power in the analysed time interval (the one excluded from the sample) and analyse the stability of the estimates over time.

H. Internal controls

28 Description of the internal controls applied to ensure consistency in the approval of transactions, the reliability of the data used in the analysis of transactions, etc. It is necessary to indicate the responsible units and their functions.

I. Independent reviews

29 In addition to attaching the specific reports mentioned in Annex 3 and 4, it is also necessary to detail any other action performed by the bank's internal audit department or by external auditors.

30 Other independent reviews (external auditors, consultants), including studies carried out.

J. Weaknesses and future developments

31 Description of the known weak points of the model and the timetable for addressing them.

32 Details of anticipated changes in or future plans for the models and systems used to measure and control the risks arising from this portfolio.

VI. Retail exposures

A. Portfolio definition

1 Portfolio definition, distinguishing the three segments established in Basel II:

- residential mortgage exposures
- qualifying revolving retail exposures, and
- other retail exposures.

The institution should make a detailed description of the portfolio analysed, specifying (with data on the number of transactions and volume of risk) its origin and how it has reached its current composition. Among other aspects, the following should be detailed:

- original applications
- migration to new applications (where applicable)
- channels to capture transactions
- breakdown of exposures (current and historical) by LTV[24], maturity, product, etc.

B. Rating system

2 Design of the rating system:

2.1 Structure of the rating system: definition of the different exposure pools, indicating the distribution (current and historical) of risks among the different pools, both in terms of the number of customers and amount of exposures.

2.2 Model description:

- type of model (socio-demographic scoring, behaviour scoring, etc.),
- variables used (specifying the frequency with which they are obtained).

[24] Loan to value ratio: ratio of the amount lent to the initial valuation of the property.

- methodology used in its construction (multivariate analysis, LOGIT/PROBIT, neural networks, expert opinion, etc.) indicating the time horizon considered.

2.3 Describe how changes in the risk are taken into account when the rating system considered is a credit scoring system.

2.4 If there are any unrated exposures[25], quantify them and describe in detail the reasons for this circumstance, as well as the treatment planned for them.

2.5 Modifications in the method used to classify transactions, for example, changes in weighting of variables, indicating the dates of relevant events. If there have been any modifications, describe the procedures established to reassess old obligors/transactions.

2.6 Document the warning systems in place.

If the rating system is a behaviour scoring system, describe how the two systems are integrated.

2.7 Measurements of the discriminatory power of the rating system and their historical evolution. In general, it is possible to make a judgement with respect to the discriminatory power of the rating/scoring system using various indices (accuracy ratio/area under the ROC curve, the Kolmogorov-Smirnov statistic, chi-square tests, etc.).

3 Use of the rating system:

3.1 Description of the transaction approval process (differentiating the analysts' and risk managers' functions), including the use of the rating in such approval process.

If the rating system is a behaviour scoring system, describe the process for monitoring the transactions.

3.2 Period of application and functioning of the model, attaching a table summarising the historical activity of the rating system, indicating the transactions requested and approved each year.

3.3 Treatment of exceptions, and a summary, by type of transaction, of transactions approved without following regular procedures.

4 Documentation of rating system. A manual detailing the functioning of the rating system should be attached as an annex.

C. IRB inputs

5 A summary table with the average risk parameters (PD, LGD, EAD) by pool of transactions, as well as the on-balance-sheet exposure and the number of transactions corresponding to each pool.

6 Probability of default (PD).

6.1 The definition of default used to estimate the PDs, specifying those situations that the institution considers subjective defaults[26] and describing the adjustment (if necessary) made to align this definition with the regulatory one.

[25] This situation should be temporary and exceptional.

[26] Paragraph 452: "The bank considers that the obligor is unlikely to pay its credit obligations to the banking group in full, without recourse by the bank to actions such as realising security (if held)"

Identify any modifications to the time frame considered in the default definition used.

6.2 Technical defaults: the definition of what is considered a "material credit obligation to the banking group" in the definition set forth in paragraph 452, should be properly documented.

6.3 Calculation method used to estimate the parameter.

6.4 The latest PD estimates made and their historical values.

6.5 Detailed description of the database used to estimate the PDs (periods covered, variables, etc.)[27], specifying the external sources used.

7 Estimation of loss given default (LGD).

7.1 The definition of default used to estimate LGDs and the adjustments made (if necessary) to align this definition with the regulatory one.

7.2 Detailed description of the concept of loss used, identifying any changes in its definition over time that could have an impact on data comparability and/or the model's predictive power.

7.3 Calculation method used to estimate this parameter.

7.4 The latest LGD estimates and their historical values.

7.5 Detailed description of the database[22] used to estimate LGDs (periods covered, variables, etc.), specifying the external sources used.

8 Estimation of credit conversion factors (CCFs).

8.1 The definition of default used to estimate CCFs, and the adjustments made (if necessary) to align this definition with the regulatory one.

8.2 Calculation method used to estimate this parameter.

8.3 The latest CCF estimates and their historical values.

8.4 Detailed description of the database[22] used to estimate CCFs (periods covered, variables, etc.), specifying the external sources that were used.

9 Risk mitigation techniques. In addition to what is set forth in Section IV:

9.1 Define and explain the methodologies used, quantifying the volume of exposures affected.

9.2 Guarantees and credit derivatives: describe the guarantees and adjustments made, indicating if these were to the PD or the LGD, quantifying the exposures affected and evidencing compliance with the requirements established in the new Framework [28].

9.3 The institution must quantify, in terms of the number and amount of exposures, the transactions subject to netting and justify this treatment.

10 Exposures.

[27] Minimum database requirements are detailed in Annex 2.

[28] Section III.H of Part 2 and paragraphs 188, 474 to 477 and 479.

10.1 Detailed description of the rating process used to classify current exposures into homogeneous grades, for applying the CCFs and obtaining the EADs.

10.2 Analysis of the current breakdown of the portfolio by internal risk classes[29] and type of instruments, before[30] and after applying the CCFs and, if applicable, CRMTs [31].

D. Model outputs

11 A table including, for each pool of transactions:

- the expected loss
- related accounting provisions, and
- the regulatory capital requirements resulting from these estimates.

12 Identification and description of the processes that use the model outputs; at least:

- transaction approval,
- pricing,
- limits, and
- economic capital

13 In those situations in which the risk parameters used internally are not the same as those applied in the regulatory capital calculation [32], it will be necessary to document and explain the rationale behind the criteria used.

E. Internal validation

14 List the studies carried out and the units responsible for them.

14.1 Comparisons with other similar portfolios (internal and external) and benchmarking.

14.2 Stress-tests performed (type, description of data and results).

14.3 Backtesting.

14.4 Analysis of the stability of outputs (confidence intervals, bootstrapping, etc.). It is necessary to include *out-of-sample* [33] and out-of-time[34] tests for the statistical validation of the model.

14.5 Sensitivity analysis of final outputs (regulatory capital, expected loss, etc.) to quantify the impact on the minimum capital requirements of changes in the parameters or in the model hypotheses.

F. Technological environment, information systems and maintenance

15 Description of the technological environment, information systems, and applications that enable the model to be used effectively.

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[29] A risk class is understood to be a pool of transactions to which a single PD is assigned.

[30] These exposures should be reconciled with the accounts.

[31] In cases in which CRMTs are applied to the value of the exposure.

[32] For example, for pricing, establishing limits, and other internal uses of the model, it is possible to use a time horizon for the estimate different from the regulatory one.

[33] See note 21.

[34] See note 22.

16 Explain the processes used to obtain the information required by the model from the institution's applications and databases, attaching existing technical documentation.

17 Identification and description of the external sources used by the model.

18 Define the processes established to obtain periodically the regulatory capital requirements.

19 Description of the applications used to store information relating to the rating system, the estimated parameters and any other relevant aspect, indicating the units responsible.

G. Qualitative aspects

20 Summary of the bank's credit policies (for approving and renewing transactions and for pricing) and the delegation of responsibilities.

Describe those situations in which the bank is trying to enter new market segments.

21 The involvement of the board and senior management, providing documents that reflect the approval of the model at the appropriate hierarchical level.

22 Organisational structure describing the responsibilities and functions of the various areas involved in the management and control of this risk, as well as the committees that have been established.

23 Details and qualifications of human resources in all the areas involved in risk control and measurement.

24 A list and brief description of the reports based on data generated by the model, in particular the reports submitted to the board and senior management and management reports.

25 A list of existing manuals on methodological aspects, information systems, policies, and procedures.

H. Internal controls

26 Description of the internal controls applied to ensure consistency in the approval of transactions, the reliability of the data used in the analysis of transactions, etc. It is necessary to indicate the responsible units and their functions.

I. Independent reviews

27 In addition to attaching the specific reports mentioned in Annex 3 and 4, it is also necessary to detail any other action performed by the bank's internal audit department or by external auditors.

28 Other independent reviews (external auditors, consultants), including the studiescarried out.

J. Weaknesses and future developments

29 Description of the known weak points of the model and the timetable for addressing them.

30 Details of anticipated changes in or future plans for the models and systems used to measure and control the risks arising from this portfolio.

VII. Equity exposures

A. Portfolio definition

1 Identity which equity exposures are included and which are not included in the trading book.

2 For the equity not included in the trading book, the institution must identify the portfolios to which each of the approaches is to be applied (market based approaches —internal models and the simple risk weight method— and the PD/LGD approach), distinguishing that part corresponding to equity traded on a recognised stock exchange. Explain the reasons for the choice of treatment, taking into account the limits established by the supervisor.

Detail the instruments which make up the equity portfolio to which each of the approaches is to be applied. In particular, investments in funds are to be identified and their treatment specified.

B. Information on PD/LGD approaches

3 The institution must provide similar Information to that referred to in the FIRB approach of the corporate portfolio[35], Section V.

4 Details shall be provided of those cases in which the institution does not have enough information to calculate the PD and it is necessary to apply the 1.5 scaling factor.

5 Detailed information shall be provided on the portfolio with a 100% risk weight.

C. Information on internal models

6 Methodology of calculation:

6.1 Describe in the greatest possible detail the methodology or methodologies used, including the price series used, an explanation for the observation period and any adjustments made.

6.2 Indicate expressly how the model reflects the overall and specific risk, detailing its measurement methodology.

6.3 Justify the suitability of the internal models for the institution's activity and identify the assumptions and limitations of the measurement systems.

6.4 If proxies are used, the institution should provide detailed information about them as well as the mapping procedures established, documenting the analyses that demonstrate that the risks of the corresponding positions are adequately taken into account.

7 Model outputs:

7.1 Estimation of the minimum regulatory capital requirements.

7.2 Identification and description of the processes that use the model outputs, including their use in:

- The establishment of the critical rate of return on the investment and the consideration of alternative investments.

[35] Equity of companies that are included in the retail asset class is also subject to the minimum requirements of the FIRB approach for corporate exposures, assuming an LGD of 90%.

- The calculation and evaluation of the equity portfolio yield (including the risk-adjusted yield).
- The assignment of economic capital to equity positions.
- The limit structure.

7.3 In those situations in which the risk parameters used internally are different from those applied in the calculation of regulatory capital, the institution should explain and document the reasonableness of the criteria used.

8 Internal validation:

8.1 Studies performed and the departments responsible for said studies.

8.2 Stress-tests performed (type, description of data and results).

8.3 Backtesting.

8.4 Historical results of backtesting and stress-testing.

9 Technological environment, information systems and maintenance:

9.1 Description of the technological environment, information systems, and applications that enable the model to be used effectively.

9.2 Explain the processes used to obtain the information required by the model from the institution's applications and databases, attaching existing technical documentation.

9.3 Identification and description of the external sources used.

9.4 Define the processes established to obtain periodically the regulatory capital requirements.

9.5 Description of the applications used to store information.

10 Qualitative aspects.

10.1 The involvement of the board and senior management, providing documents that reflect the approval of the model at the appropriate hierarchical level.

10.2 Risk management policies for non-traded equity and the organisational structure, describing the responsibilities and tasks of the different departments involved in the management and control of this risk, as well as the committees established.

10.3 Details and qualifications of human resources in the departments concerned with this portfolio.

10.4 A list of authorised products and procedures in place for the use of new products.

10.5 A list and brief description of reports based on the data generated by the model, in particular the reports submitted to the board and senior management and management reports.

11 Internal controls:

11.1 Description of the internal controls that guarantee the portfolio mix, the reliability of data used to analyse transactions, etc. The institution must also identify the responsible departments and their duties.

11.2 Total risk assumed according to internal calculations performed.

12 Independent reviews:

12.1 Descriptive report and tests carried out by internal audit to review the risk control systems and, in particular, the measurement systems. Also a detailed description should be provided of the tests performed on the accuracy and rigour of the exposure data.

12.2 Other independent reviews (external auditors, consultants), including the studies carried out.

13 Weaknesses and future developments:

13.1 Description of the known weak points of the model and the timetable to address them.

13.2 Detail of anticipated changes in or future plans for the models and systems used to measure and control the risks arising from this portfolio.

VIII. Treatment of purchased receivables

A. Overview

1 Describe the products considered to be eligible purchased receivables. Determine the exposure corresponding to each of the categories of risk (retail, large corporations, etc.)

2 List the risk weight functions applied in each case. If hybrid purchased receivables (affected by different functions of risk) exist, it is necessary to specify which risk weight function is being applied.

3 Provide the minimum regulatory capital requirements for default risk and dilution risk for each of the pools considered.

4 If any credit risk mitigation techniques are used, describe the methodology used to determine the coverage of the default risk, the dilution risk or both. If guarantees are used, describe the procedures established to assign to each guarantor the corresponding risk function.

5 In order to use PD and LGD (or EL) estimates for eligible purchased receivables, compliance with the requirements imposed must be demonstrated[36].

B. Default and dilution risk

6 Retail:

6.1 For each homogeneous group, the estimates of the risk parameters must be included. In each case it should be specified whether internal data, external data or both are being used.

[36] Paragraphs 491 to 499.

6.2 Description of the methodology used to estimate expected loss due to dilution risk.

6.3 Quantify the minimum regulatory capital required for each homogeneous group for dilution risk.

7 Corporates:

7.1 Define the pools to which top-down methodology is applied.

7.2 Details must be given of the EL values estimated for each pool. If a size adjustment is being carried out, the details of this calculation must be included.

7.3 Description of the methodology used to estimate the expected loss due to dilution risk.

7.4 If the foundation approach is used, the institution must include details of the estimates of expected loss, PDs and the capital required for dilution risk that have been used, as well as the estimates of EAD and LGD.

7.5 When using the advanced approach, it is necessary to attach the calculation procedure used to estimate the risk parameters (PD, LGD and M), with details of the results obtained in each case, as well as the EAD calculations, with details of the amount of capital required for dilution risk..

IX. Treatment of securitisation exposures

A. Scope of application

1 Define, for each portfolio, the securitisations that affect it, indicating the date of each securitisation, the securitised volume and the outstanding risk corresponding to such securitisations as at the current date, as well as the percentage they represent of the total of each portfolio.

Also, the institution should indicate how the underlying assets (standardised approach, FIRB or AIRB) and securitisation exposures (standardised approach, IAA, SF, RBA, etc.) are treated.

2 The exposure amount and a description of all the "securitisation exposures" of the bank in each portfolio, both on the date of the securitisations and on the current date, indicating the type referred to (asset-backed securities, credit enhancements, liquidity facilities, etc.)

3 Procedures established to guarantee the correct classification of a structure as securitisation, in accordance with the requirements of the new Framework[37].

B. Recognition of risk transference. For each portfolio and securitisation:

4 Traditional securitisations.

4.1 Detail all relevant information about the securitisation that guarantees effective transference of the risk.

4.2 Attach the pertinent legal reports affirming that the assets have been isolated from the transferor, in such a way that the latter does not maintain effective or indirect control over the transferred positions.

[37] Paragraphs 553 to 559.

5 Synthetic securitisations.

5.1 Detail the structure used (collateral, guarantees, credit derivatives, etc.) that enables it to be recognised as a synthetic securitisation.

5.2 Legal opinions confirming the enforceability of the contracts in all pertinent jurisdictions.

6 Clean-up calls:

Procedures established to catalogue relevant clean-up calls in the group that do not require regulatory capital.

C. Deductions and implicit support

7 Description of all the deductions from capital due to securitisation transactions, detailing which ones they relate to and the amount deducted.

8 In the case of securitisation in which the institution provides implicit support, as defined in the Accord, it is necessary to describe the procedure to calculate the minimum regulatory capital.

D. Ratings-based approach (RBA)

9 If external credit assessments are used:

9.1 Attach a classification of exposures according to the different external assessments.

9.2 Specify the ECAI being applied.

9.3 If the securitisation contains any of the accepted CRMTs, the institution must indicate whether or not the rating of the ECAI already takes into account the CRMT.

10 If inferred ratings are used in the RBA method, the institution should detail the procedure used.

E. Internal assessment approach (IAA)

11 Detail the methodology used to assign the internal rating and justify compliance with the requirements of the new Framework.

ANNEX 1

Letter stating the intention to use IRB approaches

PLACE, _____, *200_*

Banco de España
Dirección General de Supervisión
Alcalá, 48
28014 Madrid

[*Name of the institution/banking group*], hereby states its intention to use the IRB approach to calculate the minimum capital requirements for credit risk on a consolidated basis, as well as to participate in such validation processes as may be established.

For each group institution [38] that plans to use advanced approaches,, we attach the initial information required in the IRB File, including the reports of internal audit and of the external auditor for every model, which, when necessary, will be updated biannually until the approach selected has been approved for regulatory use[39]. We attach as an annex hereto a description of the scope of application of the new Framework in the group.

For those group institutions that will initially use the standardised approach[40] for any segment that will in future be treated with advanced approaches according to the roll-out plan submitted, a first version of the part of the IRB File referring to such segments and the first internal and external auditors´ reports relating to them are also attached hereto. One year before the date of implementation of the advanced approaches according to the roll-out plan, an updated version of the IRB File will be delivered to the Banco de España and the frequency of the auditors´ reports will be biannual until the approach presented for regulatory use has been approved.

As requested by you, we reiterate the firm commitment of [*Name of the institution/banking group*] to dedicate all the human and material resources necessary for successful completion of the implementation plan presented, as well as to correct any deficiency detected and carry out such improvements as may be indicated by the Banco de España with respect to the implementation of Basel II in [*Name of the institution/banking group*].

We also inform you that the board of directors of [*Name of the institution/banking group*] approved the content of this letter on _____ 200-.

We are at your disposal to complete any aspect you consider necessary, and to provide any appropriate verification.

[*SIGNATURE OF CEO OR SIMILAR*]

ANNEX ON THE APPLICATION OF THE NEW FRAMEWORK IN [*Name of the institution/banking group*]

[38] For institutions which are subsidiaries of foreign banking groups, the reference to group shall be understood to refer to the group in Spain and the letter shall be sent by the institution responsible for the consolidation in Spain.

[39] In the case of institutions which are subsidiaries of foreign banking groups, this information should be completed for each Spanish institution that wishes to use the IRB approach.

[40] This paragraph shall only be included when the group has institutions in the situation to which it refers.

Further to our letter of _____ *200_*, we attach the following information[41]:

1 Identification of the significant minority investments in banking, securities and other financial entities over which control is not exercised, defining and justifying the treatment to be applied.

2 Identification of investments in insurance entities.

3 Identification of significant investments in commercial entities.

4 For each institution of the banking group:

1. Approaches the institution initially intends to use for the different asset classes and subclasses.

2. The roll-out plan is specified for those portfolios that will be treated in the future with a different approach from the initial one.

3. For every asset class and subclass, the percentage of the total assets of the group to which IRB approaches will be applied.

[41] For institutions which are subsidiaries of foreign banking groups, this information will refer to the banking group in Spain.

ANNEX 2

Minimum requirements for calibration and current exposures databases

- A detailed description of the fields and formats that appear in the databases must be attached. The definition, the range of possible values and the source of the data must be provided for each field.

- Apart from the tests performed by internal audit to assess the integrity and consistency of the model data, the department responsible for the definition and content of the databases supplied must carry out various specific checks before sending them[42]:

  - Variables should not have values outside a reasonable range
  - Special attention should be given to dates to ensure that there are no inconsistencies (i.e. default dates prior to origination dates or after maturity dates).
  - It must be ensured that there are no duplicated records.
  - The formats of each record should comply with the formats defined for each variable (for example, a date variable should have the same format in all records).
  - There should be no blank records for a variable, in those records that should contain information.

- If the original data have been filtered in order to achieve the required data consistency, the institution should describe the procedure used. Additionally, the deleted records should be detailed, including the reasons for their deletion.

The calibration databases of the model must contain at least the following data[43]:

- An identifier for each record, containing at least:
  - a mandatory field that identifies the transaction (contract number, file number or similar),
  - a mandatory field with the obligor's NIF/CIF (Spanish tax ID number) , and
  - a field with the internal obligor identification used by the institution, in the event that this is different to the NIF/CIF.
- Banco de España code of the institution which records the transaction in its accounts.
- Scoring and rating grade and the rating date..
- Product type (loan, credit line, technical guarantee, financial guarantee, etc.).
- Origination date.
- Original maturity.
- Maturity date.
- Total amount approved.
- Settlement date.
- Date of default (in the event of having defaulted on various occasions, the date of each default and the date on which the loan returned to “normal” status).
- Where the institution uses internally a definition of default that differs from the supervisory one, the dates when defaults occurred according to this internal definition.

[42] This is not an exhaustive list of all the checks that could be made, but a guide to the analyses that must be performed on the databases.

[43] The calibration databases are those that contain all the information required to estimate the risk parameters (PD, LGD and CCF).

- Restructuring date.
- Novation date.
- Adjustment date due to cash payment.
- Securitisation date.
- Securitisation identifier code.
- Guarantee type.

- In order to analyse the severity of defaulted transactions, the following fields are also necessary:
  - Outstanding capital at the date of default.
  - Outstanding interest at the date of default: unpaid accrued interest on the default date.
  - Exposure at the date of default: this will be equal to the capital plus outstanding interest in the case of loans, although not for guarantees or credit lines.
  - Exposure at the date of default according to the institution's internal definition (if there is one).
  - Dates and (undiscounted) amount of every revenue or expense flow derived from the recovery process, as well as a code indicating the type of flow (interest charge, payment to lawyers, etc.). Estimated flows should be marked as such.
  - Discount rate used to discount each flow.
  - Date of completion of recovery process (in economic, not accounting terms).
  - In the case of mortgage loans:
    - Initial appraised value of the collateral.
    - LTV (ratio of the amount lent to initial appraised value).
    - Value and date of subsequent appraisals, if any.
    - If the institution forecloses on a mortgage:
      - the agreement date, when the property is sold to a third party at an auction.
      - In the case of repossession by the institution:
        - Date of repossession.
        - Date property sold and sale proceeds.
        - Expense flows arising between foreclosure and sale of the property.
  - For personal loans associated with a mortgage, the same information is required.

- CCFs should be calculated for guarantees and credit lines in order to estimate the exposure at the time of default. The fields used in this estimation should be included for these product types.

In addition, the data on the current portfolio that produce the expected loss and regulatory capital values should be incorporated. The following data should be provided for this purpose:

- An identifier for each record, containing at least:
  - a mandatory field that identifies the transaction (contract number, file number or similar),
  - a mandatory field with the obligor's NIF/CIF (Spanish tax ID number) and
  - a field with the internal obligor identification used by the institution, in the event that it is different to the NIF.

- Banco de España code of the institution which records the transaction in its accounts.
- Asset class to which the transaction belongs according to the New Capital Accord (BIS II).
- Rating used to classify the transaction or obligor by credit quality and that, in general, is used to assign a probability of default to the transaction.
- Probability of default (PD) assigned to the transaction/obligor.
- Guarantees, collateral or any credit risk mitigation technique (CRMT) assigned to the transaction and their amount. This variable should contain the code used to identify what type of CRMT is applied to the transaction.
- Severity (LGD) that the institution assigns to the transaction concerned.
- Any other variable that the institution uses to assign values to risk parameters: for example, if the PD varies according to the age of the loan, this variable should be provided. If the LGD is calculated as a function of the LTV, the LTV should appear in the database of the transactions currently belonging to the portfolio.
- On-balance-sheet exposure[44].
- Off-balance-sheet exposure.
- Credit conversion factor (CCF) applied to the transaction.
- Exposure at the time of default (EAD), which reflects the effective exposure of the institution in this transaction.
- Estimated maturity (M).
- Expected loss.
- Minimum regulatory capital requirements for the transaction.

Dates should indicate at least the quarter and the year, although it is preferable to indicate the month and the year or the specific day.

It is not necessary to present all the information in a single file, but the integrity of the data should be checked if they are treated separately.

As the information the institution needs to estimate the severity only appears in the event of a default, then the separation of data in relation to PD and LGD could facilitate its treatment. When calculating the LGD, other data may also be taken into account in addition to those used as the basis of the PD calculation[45]. In this case the consistency of the common data that appear in both databases should be checked and any differences explained.

In any event, when multiple databases are used, they should include a reference field that is identical in all of them in order to identify the transactions.

[44] These exposures should be reconciled with the accounting statements.

[45] There may be transactions with information regarding recoveries that cannot be used to estimate default probabilities (for example, unrated transactions due to a technical problem, but that are considered in other respects the same as the rest of the portfolio).

ANNEX 3

Specific internal audit report on internal ratings based approaches (IRB) for calculating the minimum capital requirements for credit risk

Internal audit should, independently of other requirements under prevailing regulations, issue a specific report for each internal credit risk model, detailing explicitly at least the following aspects and documenting its conclusions:

A. ***Integration*** *of the rating/scoring systems into the* ***management*** *process, and in particular:*
   1. *Compliance with internal rules* and the procedures for assigning and reviewing ratings.
   2. The information generated by the model and its use in the institution's essential management processes (allocation of economic capital, pricing, approval policies, etc.).
   3. The adequacy of the established *controls* relating to the internal credit risk model and the identification of weaknesses that require new controls, if appropriate.
   4. The *documentation* that contains the rating procedures[46], the institution's credit policies and the delegated responsibilities.

B. *The* ***databases used*** *and the procedures to construct the calibration[47] and current exposures databases*, especially with reference to:
   1. The *integrity and consistency* of the calibration databases, and in particular:
      a. Inclusion of all transactions that meet the specifications of the scope of application of the model.
      b. Internal coherence of the data that constitutes the calibration database.
      c. External coherence: linking of the data with other relevant elements of the institution's IT systems (accounting, regulatory and management statements, etc.).
   2. The suitability of the source databases used[48] to construct the calibration databases, identifying all the relevant fields, including among other aspects:
      a. The *construction procedures* of the calibration databases: uploading of data from the various source applications or databases, data selection criteria (especially for obligors and transactions), …
      b. The different *definitions of default* that have been used in the calibration databases, their consistency over time and their homogeneity for regulatory purposes[49].
      c. The possibility of replicating the ratings calculated by the rating system, as well as the quality of the information used as input for this system.
      d. The *possibility of reassessing old transactions[50] using the rating systems in use on the date of revision, and if applicable, the quality of the latest reassessment made*.

[46] These manuals must be sufficiently clear and detailed to allow a third party to understand and replicate the ratings.

[47] The calibration databases are those used to obtain estimates of PDs, LGDs and, if applicable, EADs.

[48] Source databases that feed the calibration databases.

[49] In the event that the definitions implicit in the various database tables are different: having changed over time, differences between risk parameters or uniformity problems for a single risk parameter.

3. The current exposures database, for regulatory calculation purposes:
    a. procedures established to obtain the current exposures
    b. reconciliation of these exposures with the accounts
    c. processes followed to assign the correct risk parameters to each transaction.
4. *Details of the weaknesses detected*, distinguishing between those attributable to past circumstances and those arising from current causes, together with the measures and timetables to resolve them.
5. *Details of the audit tests carried out* to support each of the opinions issued, as well as their results. These include:
    a. *Checking,* for a significant sample of transactions, all the relevant fields of the model, and the supporting documentation. In particular, specific tests should be used to assess the reasonability of the assumptions made in the absence of information, and the algorithms used to obtain certain essential fields (transaction origination date, default date, date of settlement and reassessed ratings).
    b. *Verification of the definitions of default* used, their consistency over time and their homogeneity.
    c. *Consistency among the databases* used to estimate PDs, LGDs and EADs, explaining the discrepancies.
6. *Documentation*, essentially for the fields and structure of the calibration databases, the procedures used to construct them and the definitions of default and loss.

C. The ***technological environment and the applications*** that allow the model to be used effectively, in particular:
1. The degree of *internal integration* (between the model's components) and *external integration* (with other IT systems of the institution), identifying manual procedures and technological weaknesses.
2. In relation to the *applications*:
    a. The *availability* of data and the *possibility of replicating* the calibration databases over time.
    b. The degree of *automation* of the periodic processes for the proposed regulatory use.
    c. The appropriate programming of the calculation *methodologies* used in the model.
    d. The ability to *replicate* the model outputs.
3. *Regarding the model as an information system*:
    a. *Maintenance* processes.
    b. Management of historical database files (PDs, LGDs, CCFs, classified exposures)
    c. *Contingency* plans.
    d. Adequacy of resources.
4. The *technical documentation* existing.

[50] Any transaction approved in accordance with a rating system that is no longer used.

ANNEX 4

Specific report of an external auditor on internal ratings based approaches (IRB) for calculating the minimum capital requirements for credit risk

An external auditor should, independently of other requirements under prevailing regulations, issue a specific report for each internal credit risk model, detailing explicitly at least the following aspects and documenting all the conclusions:

A. *The **databases used** and the procedures to construct the model calibration[51] and current exposures databases*, especially with reference to:

   1. The *integrity and consistency* of the calibration databases, and in particular:

      a. Inclusion of all transactions that meet the specifications of the scope of application of the model.

      b. Internal coherence of the data that constitutes the calibration database.

      c. External coherence: linking of the data with other relevant elements of the institution's IT systems (accounting, regulatory and management statements, etc.).

   2. The suitability of the databases used[52] to construct the model calibration databases, identifying all the relevant fields, including among other aspects:

      a. The *construction procedures* of the calibration databases: uploading of data from the various source applications or databases, data selection criteria (especially for customers and transactions), …

      b. The different *definitions of default* that have been used in the calibration databases, their consistency over time and their homogeneity for regulatory purposes[53].

      c. The possibility of replicating the ratings allocated by the rating system, as well as the quality of the information used as input for this system.

      d. The *possibility of reassessing old transactions[54] using the rating systems in use on the date of revision, and if applicable, the latest reassessment mde to calibrate the model*.

   3. The current exposures database, for regulatory calculation purposes:

      a. procedures established to obtain the current exposures

      b. reconciliation of these exposures with the accounts

      c. processes followed to assign the correct risk parameters to each transaction.

   4. *Details of the weaknesses detected*, distinguishing between those attributable to past circumstances and those arising from current causes, together with the measures and timetables to resolve them.

   5. *Details of the audit tests carried out* to support each of the opinions issued, as well as their results. These include:

      a. *Checking,* for a significant sample of transactions, all the relevant fields of the model, and the supporting documentation. In particular, specific tests should be used to assess the reasonability of the assumptions made in the absence

[51] The calibration databases are those used to obtain estimates of PDs, LGDs and, if applicable, EADs.

[52] Source databases that feed the calibration databases.

[53] In the event that the definitions implicit in the various database tables are different: having changed over time, differences between risk parameters or uniformity problems for a single risk parameter.

[54] Any transaction approved in accordance with a rating system that is no longer used.

of information, and the algorithms used to obtain certain essential fields (transaction origination date, default date, date of settlement and reassessed ratings).

b. *Verification of the definitions of default* used, their consistency over time and their homogeneity.

c. *Consistency among the databases* used to estimate PDs, LGDs and EADs, explaining the discrepancies.

6. *Documentation*, essentially for the fields and structure of the calibration databases, the procedures used to construct them and the definitions of default and loss.

B. The ***technological environment and the applications*** that allow the model to be used effectively, in particular:

1. The degree of *internal integration* (between the model's components) and *external integration* (with other IT systems of the institution), identifying manual procedures and technological weaknesses.

2. In relation to the *applications*:

a. The *availability* of data and the *possibility of replicating* the calibration databases over time.

b. The degree of *automation* of the periodic processes for the proposed regulatory use.

c. The appropriate programming of the calculation *methodologies* used in the model.

d. The ability to *replicate* the model outputs.

3. *Regarding the model as an information system*:

a. *Maintenance* processes.

b. Management of historical database files (PDs, LGDs, CCFs, classified exposures)

c. *Contingency* plans.

d. Adequacy of resources.

4. The *technical documentation* existing.

ANNEX 5

Classification of exposures

Asset classes according to Basel II and internal models treating them

Credit risk current exposures: figures in millions of euro

Date: / /20

Asset classes and sub-classes	Internal segment 1	Internal segment 2	Internal segment 3	[...]	Pending assignment to an internal segment
1a) Drawn exposures					
Total corporate; of which:					
Corporate (not including SMEs, specialised lending and eligible receivables)					
HVCRE specialised lending					
Specialised lending not including HVCRE					
Sovereign					
Bank					
Retail (not including SMEs); of which:					
Residential mortgages					
Other retail					
Qualifying revolving retail exposures					
SMEs; of which:					
Treated as corporate					
Treated as retail					
Equity; of which:					
Non material					
Excluded (grandfathered, legislative programmes (0% RW in Standardised))					
Market based approach					
PD/LGD approach					
Eligible purchased receivables					
Securitised assets (including liquidity facilities and early amortisation provisions)					
Pending assignment to a Basel II asset class or subclass					
1b) Undrawn lines – committed and uncommitted *[Disponibles...]*					
Total corporate; of which:					
Corporate (not including SMEs, specialised lending and eligible receivables)					
HVCRE specialised lending					
Specialised lending not including HVCRE					
Sovereign					
Bank					
Retail (not including SMEs); of which:					
Residential mortgages					
Other retail					
Qualifying revolving retail exposures					
SMEs; of which:					
Treated as corporate					
Treated as retail					
Pending assignment to a Basel II asset class or subclass					

1c) Repo-style transactions (counterparty exposures)

Corporate (not including SMEs, specialised lending and eligible receivables)					
Sovereign					
Bank					
Other retail (not including SME)					
SMEs; of which:					
Treated as corporate					
Treated as retail					
Pending assignment to a Basel II asset class or subclass					

1d) OTC derivative exposures (counterparty exposures)

Total corporate; of which:					
Corporate (not including SMEs, specialised lending and eligible receivables)					
HVCRE specialised lending					
Specialised lending not including HVCRE					
Sovereign					
Bank					
Other retail (not including SME)					
SMEs; of which:					
Treated as corporate					
Treated as retail					
Pending assignment to a Basel II asset class or subclass					

1e) Other off-balance sheet exposures *[Avales...]*

Total corporate; of which:					
Corporate (not including SMEs, specialised lending and eligible receivables)					
HVCRE specialised lending					
Specialised lending not including HVCRE					
Sovereign					
Bank					
Retail (not including SMEs); of which:					
Residential mortgages					
Other retail					
Qualifying revolving retail exposures					
SMEs; of which:					
Treated as corporate					
Treated as retail					
Pending assignment to a Basel II asset class or subclass					

ANNEX 6

Approaches intended to be used

Asset classes according to Basel II and internal models treating them

Asset classes and sub-classes	Internal segment 1	Internal segment 2	Internal segment 3	[...]	Pending assignment to an internal segment
Total corporate; of which:					
Corporate (not including SMEs, specialised lending and eligible receivables)					
HVCRE specialised lending					
Specialised lending not including HVCRE					
Sovereign					
Bank					
Retail (not including SMEs); of which:					
Residential mortgages					
Other retail					
Qualifying revolving retail exposures					
SMEs; of which:					
Treated as corporate					
Treated as retail					
Equity; of which:					
Non material					
Excluded (grandfathered, legislative programmes (0% RW in Standardised))					
Market based approach					
PD/LGD approach					
Eligible purchased receivables					
Securitised assets (including liquidity facilities and early amortisation provisions)					
Pending assignment to a Basel II asset class or subclass					

ANNEX 7

Roll-out plan

Asset classes according to Basel II and internal models treating them

ROLL-OUT: Approaches that will be adopted in the future and date of adoption

Asset classes and sub-classes	Internal segment 1		Internal segment 2		Internal segment 3		[...]	Pending assignment to an internal segment	
	FIRB adoption date	AIRB adoption date	FIRB adoption date	AIRB adoption date	FIRB adoption date	AIRB adoption date		FIRB adoption date	AIRB adoption date
Total corporate; of which:									
Corporate (not including SMEs, specialised lending and eligible receivables)									
HVCRE specialised lending									
Specialised lending not including HVCRE									
Sovereign									
Bank									
Retail (not including SMEs); of which:									
Residential mortgages									
Other retail									
Qualifying revolving retail exposures									
SMEs; of which:									
Treated as corporate									
Treated as retail									
Equity; of which:									
Non material									
Excluded (grandfathered, legislative programmes (0% RW in Standardised))									
Market based approach									
PD/LGD approach									
Eligible purchased receivables									
Securitised assets (including liquidity facilities and early amortisation)									
Pending assignment to a Basel II asset class or subclass									

ANNEX 4 IRB MODEL DOSSIER

DOSSIER TO MONITOR AND DOCUMENT IRB METHODS FOR CALCULATING THE MINIMUM CAPITAL REQUIREMENTS FOR CREDIT RISK

The IRB Model Dossier is not a manual, but rather is intended to gather relevant information on the internal credit risk model to enable review and reasonable monitoring by a third party. Therefore, it may contain links to other files, documents, manuals, etc. which is not necessary to include in the Dossier.

The minimum structure of the Model Dossier will be as follows:

0. **Institution, author(s) and person responsible for content.**

1. **Definition/description of the portfolio.**
   - 1.1. **Identification:** Identify the portfolio to which the model is applied.
   - 1.2. **Description.** Describe the portfolio to which the model is applied (types of products, regulatory segments, internal segments). Specify the number of transactions and the total exposure (amount) corresponding to unrated transactions, explaining why they are unrated and evidencing their non-materiality.
   - 1.3. **Historical data** (quarterly frequency). Percentage obtained by taking the exposures represented by the portfolio to which the model is applied as a proportion of the total segment[1] in the unit[2] .
2. **Scoring or rating system.**
   - 2.1. **Version**. Identifier of the version
   - 2.2. **Type of model and main features**. Describe the method used to distinguish between transactions according to their risk. For example, credit scoring systems based on expert assessment, replicas of external ratings based on neuronal networks, etc.
   - 2.3. **Methodology and dynamics of the model.** Rank-ordering or classification system, and detailed description of its methodology. Analysis of behaviour during changes in the business cycle: is it point in time (PIT) or through the cycle (TTC)? Supporting evidence.
   - 2.4. **Discriminatory measures**. Tests used to calculate the discriminatory power of the ratings or scores used by the institution. Historical results.
   - 2.5. **Rating system manual.** The manual explaining how the rating or scoring system functions must be included as an annex[3].
   - 2.6. **Warning systems.** Document the warning systems set up and how they are integrated with the rating system.
   - 2.7. **Period of application and operation of the rating system.**

[1] Segment to which the portfolio corresponds according to the new capital Framework.
[2] The term unit refers, in most cases, to the whole institution. If the institution considers the scope of comparison to be smaller (i.e. the unit is not the whole institution), then this unit will have to be suitably defined, for example, business in Spain.
[3] In general, annexes can be presented as links to other files.

2.7.1. **Period of application**. Time that the current rating/scoring system has been in operation.

2.7.2. **Modifications of the rating or scoring**. This section contains the past history of the method used to distinguish between transactions. Changes in the weights of ratings or scores. Dates of the main events should be kept.

2.7.3. **Other significant events.**

2.7.4. **Summary table of the historical activity of the rating/scoring system.** This section will include an annual summary of:

2.7.4.1. Scoring systems. Number of applications and transactions finally approved

2.7.4.2. Rating systems. Obligors rated.

3. **Risk parameters and exposures.**

3.1. **Risk parameters**

3.1.1. **Probability of default (PD).**

3.1.1.1. **Definition.** Definition of default used to estimate PDs.

3.1.1.2. **Exceptions.** The exceptions to the definition of default should be duly documented (technical defaults).

3.1.1.3. **Type.** Describe what kind of probability of default is being estimated.

3.1.1.4. **Calculation.** Method used to estimate the parameter**,** detailing the treatment of credit risk mitigation techniques (CRMT)[4].

3.1.1.5. **Estimates**. Presentation of the latest PD estimates as well as a historical table of estimated PDs.

3.1.1.6. **PD Databases**. Detailed description of the calibration databases used in estimating PDs.

3.1.1.7. **Backtesting**. Analysis of the differences between the PDs used in the model and the realised default frequencies.

3.1.2. **Severity (loss given default, LGD).**

3.1.2.1. **Definition**. Definitions of default and loss used in the estimation of LGDs.

3.1.2.2. **Type**. Description of the kind of LGD being estimated according to the definition of loss used.

3.1.2.3. **Calculation**. Analysis method used to estimate the parameter, clearly stating which procedure is used to put the LGD estimates on an equal footing with the PD estimates whenever the definitions of default used in calibrating these two parameters do not coincide. CRMT treatment must also be specified[5].

3.1.2.4. **Estimates**. Presentation of the latest estimates of LGDs as well as a historical table of estimated LGDs.

3.1.2.5. **LGD Databases**. Detailed description of the calibration databases used to estimate LGDs.

3.1.2.6. **Backtesting**. Analysis of the differences between the LGDs used in the model and the realised severities.

[4] In those cases where the PD value is modified by Credit Risk Mitigation Techniques (CRMT).
[5] In those cases where the LGD value is modified by CRMT.

3.1.3. **Credit conversion factors (CCFs).**

3.1.3.1. **Definition**. Definition of default used in the estimation of CCFs.

3.1.3.2. **EAD Databases**. Detailed description of the calibration databases used to estimate CCFs.

3.1.3.3. **Calculation**. Analysis method used to estimate the parameter,

3.1.3.4. **Significant parameters**. Current value of the parameters used to estimate the CCFs and their changes over time. Those cases in which parameters change sharply should be analysed. Historical table containing estimates of CCFs.

3.1.3.5. **Backtesting**. Analysis of the differences between CCFs estimated by the model and those ones actually realised.

3.2. **Classified exposures.**

3.2.1. **Description**. Description of the classification or assignment process by which the exposures subject to regulatory capital are arranged in homogeneous classes so as to apply CCFs and obtain EADs.

3.2.2. **Credit Risk Mitigation Techniques, CRMT.** Description of the procedures established to calculate the exposures before and after application of CRMT[6], providing both figures.

3.2.3. **Distribution.** Analysis of the current portfolio composition by internal risk grade, concentration and type of instruments.

3.2.4. **Changes**. Descriptive analysis of the changes in the composition of the portfolio by internal risk grade, concentration and type of instruments.

3.2.5. **Historical table** of exposures by risk grade and type of instrument, with a quarterly periodicity.

4. **Model outputs.**

4.1. **Expected losses (EL).** Calculation and changes.

4.2. **Regulatory capital.** Calculation of the regulatory capital requirements for the analysed portfolio and their changes over time.

4.3. **Economic capital.** Calculation of the capital assigned internally to the analysed portfolio, and its historical behaviour.

5. **Internal validation.**

5.1. **Homogeneity analysis. Evidence supporting** the homogeneity of the set of transactions constituting the portfolio, giving reasons for the application of the same model.

5.2. **Transition matrix.** Analysis of the rating transition matrix. (Not applicable in the case of credit scoring systems.).

5.3. **Transition study**. Values of the rating transition matrix in recent years (not applicable in the case of credit scoring systems).

5.4. **Stability analysis**. Description of the different studies carried out to test the stability of the results obtained (confidence intervals, bootstrapping, etc..)

[6] In those cases where CRMTs alter the value of the exposure.

5.5. **Comparisons with other similar portfolios and benchmarking.** Comparisons of the results given by the model with those from other similar external or internal portfolios, for both outputs and risk parameters.

5.6. **Stress-test** (type, description of data and results).

6. **Technological environment, information systems and maintenance.**

6.1. **Periods of time covered by the calibration databases of each risk parameter: PDs, LGDs and CCFs.**

6.2. **Identification and description of the external sources used by the model.**

6.3. **Consistency, integrity and reliability.** Results of the studies carried out in databases on the consistency, integrity and reliability of the information stored in them.

6.4. **Processes.** Analysis of the processes used to obtain calibration databases and regulatory capital figures from the institution's applications and databases.

6.5. **Stored information.** Description of the applications and databases used to store information on rating systems, estimated parameters and any other relevant aspect, indicating the persons responsible.

7. **Qualitative matters.**

7.1. **Policies.** Summary of institution's credit policies (credit approval and renewal policy and pricing policy) and the delegation of powers. It is necessary Description of those situations in which the institution is trying to penetrate a new market.

7.2. **Senior Management.** Involvement of senior management in implementation of the model. Organisational structure identifying the responsibilities and functions of the different areas involved in credit risk management and control, as well as the committees set up.

7.3. **Human resources.** Details of the human resources in the different areas relating to credit risk control and measurement, as well as their qualifications.

7.4. **Credit extension.** Description of the process of granting facilities and of the implications of the rating or score. Compliance with internal rules.

7.5. **Exceptions.** Treatment of exceptions, as well as a summary of those facilities granted without following the established procedures.

7.6. **Uses of the model.** Identification and description of the processes for which the model outputs are used, for example credit approval, pricing, setting limits, capital, etc.. Identification of and reasons for all the differences between the risk parameters used in management and those used to calculate regulatory figures

7.7. **Reporting.** Enumeration and short description of the reports produced using data from the model, for example those remitted to senior management, control reports, etc.

7.8. **Securitisation.** Securitisation policy. Identification of securitisations and their main features.

7.9. **Manuals**. List of all internal manuals relating to the information of this Dossier[7].

[7] Specifying their location or providing links to them.

8. **Internal controls.**

8.1. **Descriptions of the internal controls** used to ensure consistency in the credit approval process, the reliability of the data used to analyse the transaction, etc.. Indicate the persons responsible and their functions.

8.2. **Controls of risk parameters and explanatory factors**[8]**,** showing the dates of recalibrations and the analyses of the discriminatory power of such factors.

9. **Independent reviews**.

9.1. **In particular, analysis carried out by an independent department (**internal or external) so as to ensure the reliability of database information, the way facilities are approved, the computer processes used to obtain calibration databases, etc..

9.2. **Inventory of independent reviews** (Banco de España, Internal audit, External audit, consultants), aims of the reviews and the conclusions drawn.

10. **Weaknesses and future developments.**

10.1. **Knowledge of weaknesses**. Description of any known weakness of the model and the anticipated timetable for remedying or improving them.

10.2. **Future changes**. Details of expected changes or future plans relating to the models and systems used to measure and control the risks arising from this portfolio.

11. **Acronyms, terminology and definitions.** Description of the terminology and definitions used by the institution.

[8] Explanatory factors are those variables used in the rating system in order to assess the creditworthiness of the obligor /transaction.

ANNEX 5 MR FILE AND ANNEXES

BANCO DE **ESPAÑA**
Directorate General Banking Supervision

AUTHORISATION APPLICATION FILE FOR INTERNAL MODELS TO BE USED TO CALCULATE MINIMUM CAPITAL REQUIREMENTS FOR POSITION RISK ON TRADING BOOK, COMMODITY, FOREIGN EXCHANGE AND/OR GOLD POSITIONS

Pursuant to Section 2 of Rule thirty-eight of Banco de España Circular 5/1993 of 26 March 1993, amended by Circular 3/2003 of 24 June 2003, consolidable groups of financial institutions wishing to use internal models to calculate minimum capital requirements for position risk on trading book, commodity, foreign exchange and/or gold positions must submit an application for authorisation to the Banco de España inspection service (see model letter in Annex 1) accompanied by a report which, as specified in this file, describes the model developed by the "Institution" and the risk management control system established and accredits compliance with the quantitative and qualitative requirements set out in Rule thirty-nine.

The application must clearly define and justify the scope of application of the model or models the approval of which is requested, both in relation to the risks and in relation to the institutions of the consolidable group covered by them.

The application must expressly state that the internal calculation model whose conformity the Banco de España inspection service is requested to verify forms part of an integrated market risk measurement, management and control system which is applied effectively and consistently in the daily management of this risk.

In providing the information required, regard must be had to the following:

1. An application file must be completed for the full scope to which the application refers. However, if, within the requested scope, various internal market risk models coexist with distinct features (either in different institutions of the group or for different risk categories in a single institution), the relevant sections must be duplicated in order to complete the information required for each of the models.

2. Any information additional to that indicated herein that the institution may consider important for the purpose of evaluating compliance with minimum requirements should be provided.

CONTENTS:

1. **Scope of application**

   1.1. **Potential scope:**
   Identify all the units or centres which are able to assume position risk on trading book, commodity, foreign exchange and gold positions, specifying the systems used to measure these risks in each of them.

   1.2. **Identification of scope for which authorisation is requested.** State the following:

      1.2.1. **Group institutions included.** Describe the group institutions as a whole and indicate the risk covered by the internal model as a percentage of the total risk of the same type in the consolidable group.

      1.2.2. **Types of risks:** Indicate the risk categories covered by the model (price risk on trading book, foreign exchange, gold and/or commodity positions).

      1.2.3. **Types of financial instruments included in the trading book**. Indicate the criteria for inclusion of products in the trading book and the criteria for separation from the banking book.

      1.2.4. **Details of market risk management units included in the scope of the application**. Specify the levels reached by the measurements (business units, trading desks, products, risk factors, etc.) and describe the policy on authorised products/markets in the main business units.

   1.3. **Justification of the excluded portion:** If the potential scope does not coincide with that of the application for authorisation, the reasons for excluding a portion must be explained.

2. **Description of exposures**

   2.1. **Exposure by product.** Detail the exposures (value of positions) by product type and the VaR by product type.

   2.2. **Current distribution of risk by business unit:** Current level of risk at business unit level, and treasury desks, together with any available disaggregation (risk factors and/or products).

3. **Estimate of regulatory capital**
   Give an estimate of regulatory capital calculated using the internal model, as specified in Rule forty, and the regulatory capital calculation performed so far using the standardised measurement method.

4. **Policies and organisation**

   4.1. **Market risk management policies and organisational structure:** Organisation chart and committees, with definition of responsibilities and functions. Describe the involvement of senior management in the risk control process, specifying the documents evidencing approval given by it, and detail the reports sent to it for assessment.

4.2. **Details of the functioning of the units involved in market risk management:** functions performed, composition (with details of the number of technically skilled people assigned to them) and details of reporting hierarchies and relationships with other risk control areas and with business units.

4.3. **New product authorisation procedures and list of authorised products**. Describe the units involved, the approval procedure and the post-approval procedures for monitoring new products (market inputs, monitoring of valuation models, sensitivity measurements).

4.4. **Manuals**: List of internal manuals relating to market risk information on policies, methodology, complementary analyses (backtesting and stress testing), information and control systems, and procedures, with a summary of the content of each of them detailing when they were last updated, the persons responsible for preparing them and, where applicable, the bodies to which they were submitted for approval.

5. **Measurement system**

Describe in the greatest possible detail the methodology or methodologies used to calculate VaR, the price series used, including reasons justifying the historical observation period chosen, and the valuation models used.

Indicate expressly whether the model covers the specific risk on debt and equity positions and describe, where applicable, the measurement methodology.

Explain why the structure of the internal models is suitable for the institution's activity and identify the assumptions and limitations of the measurement systems used.

The description of the measurement system should include at least the following:

5.1. **Model inputs:**

5.1.1. **Parameters**.

5.1.1.1. **Holding period**:

5.1.1.1.1. Describe the methodology for estimating market risk with the regulatory time horizon, indicating whether it is a 1 day calculation scaled up to that holding period or a direct calculation.

5.1.1.1.2. Indicate whether the use of longer holding periods than the regulatory one is envisaged for illiquid instruments/markets and, if not, state what limitation this places on market risk measurement, according to the importance of the operations in illiquid positions.

5.1.1.2. **Historical observation period for risk factors.**

Describe the procedures used to select the historical observation period for risk factors, indicate how often that period is revised and state why it is suitable.

5.1.2. **Details of market variables captured,** indicating their source and describing the **secondary calculations** performed using these market inputs and the related methodology.

5.1.3. **Position inputs**.

Description of position inputs entered in market risk calculation systems. If cash flow decompositions and/or mappings are carried out, indicate the methodology, specifying the particular features of each product type. In the case of optional instruments, if it is necessary for measuring market risk, indicate the method of

calculating sensitivity to the various risk factors (underlying, implied volatility and others).

5.2. **Methodology**.

5.2.1. **Type of methodology or methodologies used** and detailed description thereof, specifying the following:

5.2.1.1. **Risk factor categories and the factors within each category, detailing the method of aggregation within and between risk factors.**
Provide a table setting out the risk factors used in each risk category (interest rates –detailing the credit categories used-, exchange rates, equity factors, implied volatilities of options, etc.) and specify the vertices used in each category.

5.2.1.2. **Method of aggregating business unit risk measurements.** Where applicable, describe also the manner of incorporating the measurement of risk on positions held in Local Units whose currency differs from that of the parent company**.**

5.2.1.3. **Valuation models used.** Select the complex products that are most significant in terms of exposures generated, and attach their valuation models.

5.2.1.4. **Risk factor simulation models**. Where applicable, explain the models used to simulate the behaviour of risk factors when Monte Carlo simulation techniques are used to estimate market risk.

5.2.1.5. **Treatment of specific risk.** Indicate whether the internal model covers the specific risk on non-government debt and equity positions, specifying whether it covers event/default risk. Describe, where applicable, the measurement methodology.

5.2.2. **Identification of known limitations of the methodology.**

6. **Stress testing programme**

6.1. **Description of structure of stress testing programme**. The description should refer to both the scenarios considered and to their periodicity and their influence on policy-making and risk taking limits. Explain the minimum periodicity set for reviewing the stress testing structure, and indicate when the current scenarios were last reviewed. Specify who is responsible for defining their content. Specify also the periodic and/or isolated stress testing reports sent to senior management.

6.2. **Results of stress testing in the past year**.

7. **Backtesting programme**

7.1. **Types of backtesting**. Detail the types of backtesting conducted ("clean" and/or "dirty") and specify the level of disaggregation reached (by business unit/treasury desk and disaggregations by product and/or risk factor).

7.2. **Description of the methodology used in constructing results.**
State who is responsible for calculating results, detail the price series used and describe the particular features of calculation of the results used in backtesting. Specifically, detail the following:

7.2.1. **"Clean" results.**
Describe the procedure used to obtain these results, i.e. whether it is by re-evaluating the previous day's positions at the new prices or by stripping out from the day's actual outcomes the portion relating to intraday operations and other result components not linked to price movements (market fees and commissions, customer margins, etc.).
If "clean" results are calculated from a hypothetical portfolio instead of from an actual portfolio, describe the composition of the portfolio, indicating the parameters that turn out to be a representation of the actual portfolio. Indicate also the frequency established for reviewing its composition.

7.2.2. **Actual results.** Describe, where applicable, possible adjustments made to actual results so that they can be used in cross-checks.

7.3. **Backtesting analysis procedures.**
Describe the type of analyses conducted, detailing whether, in addition to recording the number of overshootings, complementary analyses are carried out (examination of size of exceptions, symmetry studies of profit and loss exceptions, tests of normality of results, analyses of the ratio of variability of results to variability of VaR, etc.). State also the type of analysis conducted to identify the causes of exceptions.
In addition, describe to what extent backtesting results are taken into account to improve VaR measurement methodology. Give specific examples.

7.4. **Backtesting results for the previous year**.

7.4.1. **"Clean" backtesting results for the previous year (minimum of 250 observations).** Provide the number of overshootings at all available disaggregation levels, with an explanation of each.

7.4.2. **"Dirty" backtesting results for the previous year (250 observations).** If complementary cross-checks against actual results are being conducted, provide the number of overshootings at all available disaggregation levels.

8. Technological environment and information integrity controls

8.1. **Description of technological environment of the applications involved in the model.**
Prepare an explanatory diagram of all the systems involved in the market risk measurement and control process (market variable input systems, systems for entering position inputs and systems for calculating VaR and results. Explain in detail the calculations carried out in each system. The description should also specify estimates made on spreadsheets (valuations of out-of-systems transactions, measurement of sensitivities, partial calculation of VaR, etc.) that can be used as inputs to other processes. Describe also the information flows between systems, specifying whether transmission is automatic or manual.

8.2. **Description of controls.** Detail the internal procedures established to ensure the consistency and reliability of positions and of market sources, indicating who is responsible for these controls and what their periodicity is. Explain explicitly the following:

8.2.1. **Reconciliation of front-office positions with accounting.**

8.2.2. **Procedures for identifying the scope** of portfolios included in the model, both for calculating market risk and for calculating results.

8.2.3. **Reconciliation of positions between the front-office systems and the market risk calculation systems.** Describe the type of reconciliation and its level (total of business units/by treasury desk/by product).

8.2.4. **Procedures for daily analysis of risk exposures** enabling errors to be detected in position data capture. Indicate the lowest level reached by this analysis.

8.2.5. **Procedures (automatic and manual controls) for validating market sources and for calculating volatilities and correlations.** In the case of institutions with Local Units in different geographical locations that capture price data, state the procedures for validating the market variables captured, indicating whether the reliability and independence of the data sources is to be validated by Local Units or by a Central Risk Unit.

8.2.6. **Automatic procedures in systems for calculating risk on position input and market variables capture.**

9. **Limits structure**

9.1. **Description of the types of limits and their hierarchical structure, detailing the procedures for approval, change, control and reporting of excesses.**

9.2. **Limits structure during the previous year.** Attach the latest limits structure imposed on the model scope, with the greatest level of detail defined.

9.3. **Procedures for establishing the level of limits**. Detail the methodology used to ensure that the limits at hierarchically lower levels are consistent with the market risk limits at higher levels in a business unit. Attach as an annex the consistency study on the latest limits structure.

9.4. **Exceptions to limits in the previous year.**

10. **Information systems**

10.1. **Periodic and non-periodic reports** with their supporting documentation, particularly those sent to senior management. Indicate the periodicity of each, their recipients and to what extent they are prepared manually.

10.2. **Contingency plans for market crises**. Specification, where applicable, of contingency plans for market crises that affect activities within the model's scope, describing their content. Indicate any provisions made in this respect in manuals and detail the contingency plans that would be set in motion.

11. **Databases**

11.1. Daily time series of aggregated and disaggregated VaR with the greatest level of detail available for at least the past year.

11.2. Daily time series of results used in backtesting, with the greatest level of detail reached by these tests for at least the past year. If "clean" backtesting is not conducted on the actual portfolio, but rather on a hypothetical one, give the daily VaR time series of this portfolio at all available levels of disaggregation.

11.3. Daily time series for the last two years of interest rates, exchange rates and equity prices that are most significant for measuring market risk on the positions within the scope of the model.

12. **Operational manual and input tables of the market risk calculation application or applications**
    Provide the operational manual of the VaR calculation application and the input tables (of positions and market inputs) in the market risk calculation applications, with a list and description of fields, as well as the tables of partial calculations needed to estimate the overall market risk within the scope of the model. The institution should state that it is able to provide the Banco de España's inspection service with the data needed to verify the integrity of the information and enable the VaR calculations to be replicated as at a specific date.

13. **Future developments**

    13.1. **Schedule designed to ensure that the potential scope of application excluded from the requested authorisation meets the requirements** for using models in capital calculations.

    13.2. **Details of anticipated changes or future plans** relating to the models and systems used to measure and control the risks to which this authorisation application refers.

14. **Internal audit**
    Updated internal audit report with the scope specified in Rule 39.1.h) of Circular 5/1993, and the content of the internal audit tests conducted in reviewing the risk control systems, particularly the measurement systems and the systems for verifying the accuracy and rigour of data on positions.

15. **Other independent assessments**
    List of other independent reviews (external auditors, consultants) conducted, specifying the objectives of the reviews and the conclusions drawn.

Annex 1

Letter requesting authorisation to calculate minimum capital requirements for position risk on trading book, commodity, foreign exchange and/or gold positions

(place), *(day) (month) 200X*

Banco de España
Dirección General de Supervisión
Alcalá, 48
28014 Madrid

Dear Sirs,

[*Name of parent/group*] requests authorisation to use the internal model of the institution to calculate minimum capital requirements for [position risk on trading book, commodity, foreign exchange and/or gold positions] of [*Name of parent/group*]. Consequently, [*Name of parent/group*] manifests its readiness to participate in the necessary validation processes.

For this purpose we are sending you the initial information required in the application file, including the necessary internal audit reports.

We expressly state that the internal calculation model the authorisation of which is requested herein forms part of an integrated market risk measurement, management and control system which is applied effectively and consistently in the day-to-day management of this risk.

We also inform you that the Board of Directors of [*Name of parent/group*] approved the content of this letter of application on (day) (month) 200X.

We are at your disposal to complete any matters you may consider appropriate and to assist in any pertinent checks.

Yours faithfullly,

[*SIGNATURE OF MANAGING DIRECTOR OR SIMILAR*]

ANNEX 6 MR MODEL DOSSIER

BANCO DE **ESPAÑA**
Directorate General Banking Supervision

MODEL DOSSIER FOR MARKET RISK MODELS

Structure of the Dossier used to monitor and document internal models for calculating minimum capital requirements for market risk

The Market Risk (MR) Model Dossier is not a manual, but rather is intended to gather relevant information on the internal market risk model to enable review and reasonable monitoring by a third party. Therefore, it may contain links to other files, documents, manuals, etc. which it is not necessary to include in the Dossier.

0. **Institution, author(s), persons responsible for content and date updated.**

1. **Description of the scope of application of the model**.

   1.1. **Identification**: Identify the scope of the model. State the following:

      1.1.1. **Group institutions included.** Describe the Group institutions and indicate the risk covered in the internal model as a percentage of the total risk of the same type in the consolidable Group.

      1.1.2. **Types of risks:** Indicate the risk categories covered by the model: trading book risk, foreign exchange positions outside the trading book, positions in gold and positions in commodities.

      1.1.3. **Types of financial instruments included in the trading portfolio**. Indicate the criteria for inclusion of products in the trading book and the criteria for separation from the banking book.

   1.2. **Description**. List and describe the business units included in the scope of the model. Include (if a policy has been defined in this respect) the policy on authorised products/markets in each business unit.

2. **Risk exposures and levels:**

   2.1. **Exposure by product.** List the exposures (value of positions) by product type and the VaR by product type.

   2.2. **Current distribution of risk:** Current level of risk at business unit level, and treasury desks, together with the disaggregation available (risk factors and/or products).

   2.3. **Historical data:** At business unit level, give quarterly historical VaR data by risk factor and/or product.

3. **Policies and organisation.**

   3.1. **Market risk management policies:** Summarise the market risk management guidelines.

   3.2. **Senior management:** Detail the involvement of senior management in the application of the model. Detail the various committees, giving their composition and responsibilities.

3.3. **Organisational structure:** Organisation chart of the different units involved in market risk management, indicating the functions performed and the number of technically skilled people assigned to them.

3.4. **Procedures for authorising new products**. Describe the units involved, the approval procedure and the post-approval procedures for monitoring market inputs, valuations and sensitivity measurements. List of authorised products.

3.5. **Procedures for changing and improving methodology**: Identify the unit entrusted with monitoring and improving the internal model and describe the procedures for significant changes of the model.

3.6. **Manuals**: List the internal manuals relating to market risk information and summarise the content of each of them.

4. **Measurement system.**

4.1. **Model inputs:**

4.1.1. **Parameters**.

4.1.1.1. **Holding period**:

4.1.1.1.1. Describe the methodology for estimating market risk with the regulatory holding period, indicating whether it is a 1 day calculation scaled up to that holding period or a direct calculation. If market risk for the regulatory holding period is a direct estimate, compare the estimated risk with that which would result from rescaling the estimated 1 day market risk to the holding period.

4.1.1.1.2. Indicate whether it is envisaged considering longer time horizons than the regulatory one for illiquid instruments/markets.

4.1.1.2. **Historical observation period for risk factors.** Describe the procedures used to select the historical observation period for risk factors and specify the frequency with which that historical period is revised. Indicate, where applicable, the application of decay factors.

4.1.1.3. **Confidence interval**

4.1.2. **Market inputs**

4.1.2.1. **Details of market variables captured, indicating their source**. In the case of consolidable groups with local market risk units that capture prices in different geographical locations, detail the market variables captured.

4.1.2.2. **Details of secondary calculations using market inputs and calculation methodology**: valuation of unpriced instruments (illiquid corporate bonds), zero coupon curves, credit spread curves and volatility smile curves.

4.1.2.3. **Manuals relating to market inputs.** Include as annex.

4.1.3. **Position inputs**.

4.1.3.1. **Description of position inputs entered in market risk calculation systems**. If cash flow decompositions and/or mappings are carried out, indicate the methodology, specifying the particulars of each product type. In the case of optional instruments, indicate the method of calculating sensitivities to the various risk factors (underlying, implied volatility and others), stating whether they are calculated using closed formulas

(analytical calculation) or by numerical means. Also, for options in which the models are based on parametric methodology, indicate the types of options with discontinuity problems in their sensitivity measurements.

4.1.3.2. **Position input tables in the market risk calculation system**. List and describe the fields.

4.2. **Methodology**.

4.2.1. **Level of disaggregation of risk measurements** (by business unit/treasury desk, by risk factor and by product).

4.2.2. **Criteria for aggregating business unit risk measurements.** Where applicable, describe the manner of integrating the measurement of risk on positions held in local units whose currency differs from that of the parent company.

4.2.3. **Type of methodology or methodologies used**. Indicate the type of methodology used (variance-covariance, historical simulation or Monte Carlo simulation).

4.2.4. **Description of methodology.** Detailed description of the methodology indicating expressly the following:

4.2.4.1. **Risk factor categories and factors within each category.** In the case of options, indicate the type of input used as a volatility risk factor (market volatilities/historical volatilities), detailing in the first case the vertices considered in the volatility curve for each type of option.

4.2.4.2. **Criteria for aggregation within and between risk factors.**

4.2.4.3. **Valuation models used.** Select the complex products that are most significant in terms of exposures generated, and attach their valuation models as an annex.

4.2.4.4. **Risk factor simulation models**. Where applicable, explain the models used to simulate the behaviour of risk factors when Monte Carlo simulation techniques are used to estimate market risk.

4.2.4.5. **Treatment of specific risk.** Indicate whether the internal model covers the specific risk of non-government debt securities and of equity securities, stating whether it covers event/default risk. Where applicable, detail the measurement methodology and indicate whether the specific risk component of the positions subject to this risk is kept separate from the measurement of the related general market risk.

4.2.5. **Methodology application period and functioning of the model:**

4.2.5.1. **Period of application.** Time that the current methodology has been in service.

4.2.5.2. **Changes in methodology since the model was approved**. Indicate the reasons why and the dates when these changes took place.

4.2.6. **Manuals relating to methodology.** Attach as annex.

5. **Stress testing programme.**

5.1. **Types of stress testing used**.

5.1.1. **Methodologies used.** Indicate whether the method employed is scenario analysis (historical or hypothetical), sensitivity analysis on model parameters or

systematic analysis based on abrupt movements in risk factors. Whichever of these cases it may be, specify whether **customised analysis of the portfolio** or **independent analysis of portfolio composition** is chosen.

5.1.2. **Risk factors affected.**

5.1.2.1. Indicate expressly whether stress analyses are conducted of the credit spreads on positions in private debt securities and credit derivatives and whether stress analyses are conducted on inputs affecting the valuation of options apart from the underlying (volatility curves, correlation input in options on asset baskets, etc.).

5.1.2.2. Describe the incorporation of the market liquidity risk factor in the stress scenarios, indicating how importance this risk is for the institution's positions.

5.1.3. **Description of overall stress scenarios applied.** Indicate the analyses that take into consideration all the risk factors and that affect the positions of all geographical areas. Describe them.

5.1.4. **Description of local (or specific) stress scenarios**. Give details of stress analyses that specifically affect a certain risk factor and/or positions in a certain geographical area.

5.1.5. **Scenario that has received most attention in the past year.**

5.2. **Frequency of measurement**. Indicate how frequently systematic analyses are conducted, and any isolated analyses. Give details of those conducted in the past year.

5.3. **Frequency of review of stress scenarios**. Specify whether there is a minimum periodicity for reviewing stress scenarios and indicate the last time the current scenarios were reviewed. Specify also the unit responsible for defining the stress scenarios.

5.4. **Results of stress testing**.

5.5. **Reporting to senior management of stress test results and consideration thereof in the setting of policies and limits.**

5.5.1. **Details of periodic and/or non-periodic reports** sent to senior management, describing the attention it gives to these results.

5.5.2. **How stress test results are taken into account in the institution's market risk management** and economic capital allocation.

6. **Backtesting programme.**

6.1. **Types of backtesting**. State whether, in addition to "clean" backtesting (that conducted on the same positions with which risk is estimated), "dirty" backtesting is also carried out.

6.2. **Methodology used in constructing results.**

6.2.1. **"Clean" results.**

6.2.1.1. Specify the procedure used to obtain these results, i.e. whether it is by reevaluating the previous day's positions at the new prices or by stripping out from the day's actual outcomes the portion relating to intraday operations and other result components not linked to price movements (market fees and commissions, customer margins, etc.). Describe the unit

responsible for their calculation and the system with which they are measured.

6.2.1.2. If "clean" results are calculated on a hypothetical portfolio instead of on an actual portfolio, describe the composition of the portfolio, indicating parameters that prove to be a representation of the actual portfolio. Indicate also the frequency established for reviewing its composition.

6.2.2. **Actual results.** Describe, where applicable, possible adjustments made to actual results so that they can be used in cross-checks. Describe the unit responsible for their calculation and the system with which they are measured.

6.3. **Level of disaggregation.** State the level of disaggregation of the tests (by business unit/treasury desk and disaggregations by product and/or risk factor).

6.4. **Backtesting analysis procedures.** Describe the type of analyses conducted, detailing whether, in addition to recording the number of overshootings, complementary analyses are carried out (examination of size of exceptions, symmetry studies of profit and loss exceptions, tests of normality of results, analyses of ratios of variability of results to variability of VaR, etc.). State also the type of analysis conducted to identify the causes of exceptions.

6.5. **Backtesting results for the previous year**.

6.5.1. **"Clean" backtesting results for the previous year (250 observations).** Provide the number of overshootings at all available disaggregation levels, with an explanation of each.

6.5.2. **"Dirty" backtesting results for the previous year (250 observations).** If complementary cross-checks against actual results are being conducted, provide the number of overshootings at all available disaggregation levels, with an explanation of each.

6.6. **Historical data (from the date of initial use of the model) of the plus-factor** applied quarterly to calculate the regulatory capital derived from the backtesting results.

6.7. **Procedures for taking backtesting results into account in the VaR measurement methodology.** Description, from the model authorisation date, of changes in methodology made using backtesting analyses.

7. **Uses of VaR within the institution.** Description of the processes for which the model outputs are used, for example, control of risk exposures, internal allocation of economic capital, risk-adjusted financial performance, pricing of transactions, etc. Specifically, the following should be stated:

7.1. **Structure of limits.**

7.1.1. **Types of limits.** Classification into limits designed to cap future losses (limits based on VaR, on stress results or on risk factor sensitivity measures) or limits calculated on losses borne, and the relationship between them.

7.1.2. **Hierarchical structure and approval, change and control procedures.**

7.1.3. **Procedures for establishing the level of limits**. Detail the methodology used to ensure that the limits at hierarchically lower levels are consistent with the market risk limits at higher levels in a business unit. Attach as an annex the consistency study on the latest structure of limits.

7.1.4. **Limits structure during the previous year.** Attach as an annex the latest limits structure defined in the model scope.

7.1.5. **Exceptions to limits in the previous year.**

7.1.5.1. Exceptions to the limits in place at the higher hierarchical level.

7.1.5.2. Exceptions to the limits in place at the lower hierarchical level.

7.2. **Information system.** Enumeration and brief description of the reports generated using model data, giving details of their periodicity and recipients.

7.3. **Action plans for market crisis situations**. Specification, where applicable, of action plans for market crisis situations that affect activities within the model's scope, describing the events that trigger them and the planned actions.

8. **Technological environment and information integrity controls.**

8.1. **Description diagram of information systems and of information flows between them.**
Prepare a diagram setting out all the systems involved in the market risk measurement and control process (market variable input systems, systems for entering position inputs and systems for calculating VaR and results. Explain in detail the calculations in each system (in line with points 4.1.2 4.13 and 4.2). The scheme should also specify estimates, which are made on spreadsheets (valuations of out-of-systems transactions, measurement of sensitivities, partial calculation of VaR) that can be used as inputs to other processes. Describe also the information flows between systems, specifying whether the transmissions are automatic or manual.

8.2. **Description of controls.** Detail the internal procedures (include manual as annex) established to ensure the consistency and reliability of positions and of market sources, indicating who is responsible for these controls and how regular they are. Explain explicitly the following:

8.2.1. **Reconciliation of front-office positions with accounting.**

8.2.2. **Procedures for identifying the scope** of portfolios included in the model, both for calculating market risk and for calculating results.

8.2.3. **Reconciliation of positions between the front-office systems and the market risk calculation systems.** Description of the type of reconciliation and of its level (total by business unit/treasury desk/product).

8.2.4. **Daily analysis of risk exposures** enabling errors to be detected in the data on positions. Indicate the lowest level that this analysis goes down to.

8.2.5. **Procedures (automatic and manual controls) for validating market sources and for calculating volatilities and correlations.** In the case of institutions with Local Units in different geographical locations, state the procedures for validating captured market variables, indicating whether the validation is to be done by the Local Units or by the Central Risk Unit.

8.2.6. **Automatic procedures in systems for calculating risk on captured position inputs and market variables.** (Controls of file receipt, of file size, of levels of change in market variables and volatilities/correlations, control of uncaptured market inputs, etc.).

9. **Independent assessments.** Inventory of independent reviews (internal audit, external audit, consultants), aims of the reviews and the conclusions drawn.

10. **Weaknesses and future developments.**

    10.1. **Knowledge of weaknesses**. Description of any known weaknesses of the model and the anticipated timetable for remedying or improving them.

    10.2. **Future changes.** Details of expected changes or future plans relating to the models and systems used to measure and control the risks arising from this portfolio.

ANNEX 7 SCOPE OF INTERNAL AUDIT REPORT ON AMA MODELS

Specific Internal Audit report on advanced models (*AMA*) for calculation of the minimum capital requirements for operational risk

Internal Audit has to develop a plan for ongoing review of the group's operational risk management framework and of the operations of the unit specialised in operational risk management and measurement.

This plan should cover all significant activities exposing the group to substantial operational risk. Also, it should be updated regularly to take account of:

- The development of internal procedures for the identification, measurement, monitoring, control and mitigation of operational risk
- The implementation of new products, procedures and systems exposing the group to significant operational risk

Internal Audit should issue a **specific report for the internal operational risk model** in which it explicitly pronounces on at least the matters listed below and documents all its conclusions. It should also include a list of the audit tests performed to support each of the opinions issued.

If an opinion cannot be issued on any of the matters mentioned above because they are not at a sufficiently advanced stage, the implementation timetable and, subsequently, the degree of compliance with it will be indicated.

A. Integration of the measurement system in the management process

Internal Audit should verify that the internal operational risk measurement system is integrated in the day-to-day management procedures for this risk. In particular, the various uses of the AMA model additional to its regulatory use should be specified.

Also, the adaptation and evolution of the AMA model as the group acquires more experience in operational risk management techniques should be verified.

B. Operational risk management procedures and tools

Internal Audit will have to verify compliance with internal rules on this risk. In particular, it should check that:

1. The internal documentation is complete.
2. The management information reporting procedures are followed.
3. Operational risk assessment and quantification meet the required standards.
4. Monitoring actions are effective and timely.
5. The procedures for reviewing and updating the operational risk management framework are followed.
6. The risk indicators/loss data/compliance reports and risk estimates are in line with the results of the qualitative self-assessment.

C. Operational risk measurement system

Internal Audit should take into account the specific purpose for which the operational risk management system is used, including all quantitative and qualitative elements, as follows:

1. All the elements that are to form the operational risk measurement system in an AMA model should be verified to ensure that they are understandable, appropriate and accurate and that they comply with the group's internal rules and the standards applicable to this risk class:
    a. Internal data. It should be verified that the information captured:
        i. is full and complete
        ii. is consistent throughout the whole organisation
        iii. is suitable for calculating regulatory capital
        iv. results from application of the internal policies on:
            iv.a. identification of the events that will form part of the regulatory capital calculation database.
            iv.b. treatment of the possible gains arising from the events
            iv.c. treatment of multiple losses (incurred in different time periods or affecting different units)
            iv.d. setting of minimum thresholds for capture of losses in the different operational risk categories defined by the group.
    b. External data.
    c. Scenario analysis.
    d. Business environment and internal control factors.
2. If any of the above four elements, which should form the operational risk measurement system, contain qualitative data, Internal Audit will have to check that these data are appropriate for accurately defining the risk factors.
3. It should be checked that the relationship between model inputs and outputs follows the procedure established by the group and that this procedure is transparent and consistent.

D. Technological environment and computer applications

The activity of Internal Audit should also include matters such as the suitability of technological infrastructures and data capture and maintenance, in order to check that the model is used effectively. In particular the following should be checked:

1. The degree of internal integration (between model components) and external integration (with other information systems in the institution), identifying manual procedures, technological weaknesses and possible deficiencies in other external systems that may affect the model.
2. Regarding computer applications:
    a. Availability of data and replicability of databases used in the model over time.
    b. Degree of automation of periodic processes for the proposed regulatory use.
    c. Suitable programming of the calculation methodologies used in the model.
    d. *Replicability* of model outputs.

3. Regarding the model as an information system:
    a. *Maintenance* processes.
    b. Systems plan.
    c. Database management.
    d. Contingency plans.
    e. Adequacy of *resources (*human, software and hardware*)*.

4. Existing technical documentation.