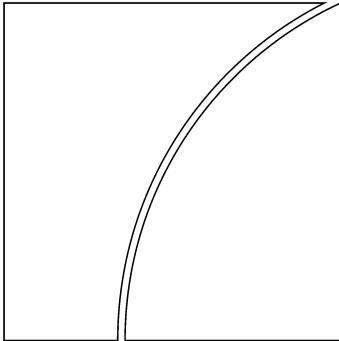


Financial Stability Institute



**FSI Award  
2004 Winning Paper**

A Review of Credit Registers  
and their Use for Basel II

Carlos Trucharte Artigas  
Bank of Spain

September 2004



BANK FOR INTERNATIONAL SETTLEMENTS

The views expressed in this paper are those of their author and not necessarily the views of the Financial Stability Institute or the Bank for International Settlements.

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## Foreword

The Financial Stability Institute is pleased to publish the winning paper for the 2004 FSI Award. This award, announced every two years at the time of the International Conference of Banking Supervisors, was established to encourage thought and research on issues relevant to banking supervisors globally. This year, fifteen papers were received on a broad range of topics from supervisors in thirteen countries.

A jury of highly qualified individuals chose the winning paper. The jury was chaired by Mr Malcolm Knight, General Manager of the Bank for International Settlements. Other jurists were: Mr Urs Birchler, Director, Swiss National Bank and Chairman of the Basel Committee's Research Task Force. Mrs Ruth deKrivoy, former President of the Banco Central de Venezuela; Mr Ryoza Himino, Secretary General of the Basel Committee on Banking Supervision; and Mr Christo Wiese, former Registrar of Banks and Head of Banking Supervision, South African Reserve Bank.

The jury members and the FSI are proud to announce that Mr Carlos Trucharte Artigas of the Bank of Spain has been selected as the winner of the 2004 FSI Award. Mr Trucharte's paper highlights the potential for credit registers to become tools for supervisors in their efforts to address validation and benchmarking issues raised by Basel II. The author stresses that, given the significant presence of credit registers in both developed and emerging economies, credit registers can support supervisory work in many countries in the area of credit risk analysis.

We want to congratulate Mr Trucharte and the other supervisors who submitted their work for consideration. Their obvious commitment to an effective supervisory process is beneficial to us all.

Josef Tošovský  
Chairman  
Financial Stability Institute  
September 2004

# Contents

Foreword .....	iii
Introduction.....	1
Part 1. Review of credit registers .....	4
1.1 Main uses.....	4
1.2 Theoretical and empirical literature.....	5
1.3 Certain characteristics of credit registers.....	7
Part 2. Practical use of a credit register: the Spanish case .....	9
2.1 Main features .....	9
2.2 Use by the supervisor .....	10
Part 3. Credit registers and Basel II: a practical supervisory approach .....	13
3.1 Main challenges .....	13
3.2 Required information structure.....	19
Acknowledgments .....	23
Bibliography.....	24

## Introduction<sup>1</sup>

The Basel Committee on Banking Supervision (BCBS) has been working on the design of a new capital adequacy framework under which bank regulatory capital requirements will be linked more closely to the actual level of risk incurred. The 1988 Capital Accord (Basel I) was a giant step forward in the international consistency of capital standards for banking organisations. However, technological and financial innovation, improvements in credit risk management systems (identification and control, measurement, and broader application of risk reducing techniques), and the practice of regulatory capital arbitrage have made revisions to Basel I necessary.

The simplicity of the 1988 Accord does not allow sufficient discrimination in capital requirements on the basis of the risk exposure to each borrower: for example, a loan to a non-financial corporation with the highest rating requires the same capital allocation as a loan to a firm with a rating one step above default. Within the Organisation for Economic Co-operation and Development (OECD) there are countries with a rating, and thus a likelihood of default on their credit obligations, substantially better than that of other OECD members. Nevertheless, the capital allocation of a loan to any OECD county is, in principle, the same. This has detracted from the information content and the disciplinary effect of the capital ratios maintained by credit institutions and has led the BCBS to undertake the current reform of the 1988 Accord, commonly known as Basel II.

Basel II poses a major challenge for both banks and their supervisors. Why? For the former, because it is the first time they will be allowed to use their own credit and operational risk

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<sup>1</sup> The opinions expressed in this essay are the responsibility of the author and do not necessarily represent those of the Banco de España.

models to determine their minimum regulatory capital requirements. For the latter because, whether they are from industrialised countries or emerging market economies, they will be confronted by a new and hitherto unknown operating and organisational framework, in contrast to the traditional supervision techniques. It will be essential for supervisory authorities to adapt their available resources to that environment and, in short, to develop and use whatever techniques and tools are needed to meet the new challenges and objectives established in the current reform of the 1988 Capital Accord. In particular, they will have to face the challenge posed by the task of validating the internal models developed by banks and, moreover, establish each credit institution's risk profile and assess whether the capital required of it is appropriate for that profile.

The more precise alignment of regulatory capital with the underlying risks in banks' loan portfolios will stimulate them to better allocate the funds attracted and to improve the quality of their management. In the medium term, this will also have implications for the stability of countries' financial systems by reinforcing their soundness, ultimately with the resulting favourable impact on social welfare.<sup>2</sup>

In view of the foregoing, this essay aims to highlight the enormous potential that credit registers (CRs) possess as a key tool in the hands of supervisory authorities, and to demonstrate the as-yet untapped possibilities that will allow bank supervisors to face, with sufficient assurance of success, the new environment and challenges that will accompany the implementation of Basel II.

Moreover, the extensive use of the information contained in CRs, whether public or private, will enable credit institutions to improve the identification and control of their banking risks

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<sup>2</sup> Bank bankruptcies have a high cost in both fiscal terms and forgone potential production (Hoggarth and Saporta (2001)).

and, ultimately, provide conditions conducive to the greater stability of the financial system. At the same time, in certain countries the supervisors, by improving and modernising their inspection practices and thus adapting them to the new credit risk assessment and measurement techniques, can help their supervised institutions enormously in the progressive adoption of the more advanced approaches advocated by Basel II. The possibilities offered by the information included in CRs probably constitute one of the most important available mechanisms to address and eventually resolve certain validation and benchmarking issues that Basel II has recently been posing for banking supervisors.

Part 1 of the essay briefly reviews the main uses of CRs, the current literature on them and their key characteristics. Part 2 then explains the special features of Spain's Central Credit Register and its utilisation by the Spanish supervisor. Finally, Part 3 looks in detail at how to focus the use of CRs to make for more efficient monitoring and, ultimately, implementation of Basel II by the supervisory authority.

## **Part 1. Review of credit registers**

### **1.1 Main uses**

CRs represent one of the essential elements for banking supervision in both developed countries and emerging market economies and, moreover, their contribution is many-faceted. First, they are a tool that enables supervisors to monitor credit risk in the entire system and, additionally, CRs permit each individual bank to accurately assess the quality of its credit assets and exactly evaluate the concentration of its risk exposures (sectorally, geographically, by individual customer, etc).

Second, CRs are a means of helping to impose discipline on borrowers. Specifically, they can limit over-indebtedness and contribute to increasing debt service efforts, because a borrower's reputation, understood as dependent on its capacity to meet its financial obligations, becomes known to all institutions. In addition, they can be used as an instrument to gain a better understanding of the behaviour and different reactions of the economic agents that turn to the credit market in search of financing to carry out their investment projects.

Finally, by providing a better and more exact knowledge of every borrowers' credit quality and by facilitating appropriate analysis of their creditworthiness, CRs foster greater transparency and, in general, more competition between banks, interest rates more in line with the actual risks incurred and, in short, easier access to the credit market on better terms. From the macro-prudential standpoint, this contributes to raising the stability of the financial system as a whole and encourages analysis and research geared to arriving at an accurate assessment of the inherent credit risk of the banking system.

## **1.2 Theoretical and empirical literature**

The uses of CRs, briefly mentioned above, have received differing attention from the theoretical and the empirical literature. The theoretical literature has basically analysed the favourable impact of CRs on adverse selection and moral hazard issues. The empirical literature, which is much less developed, has focused on whether CRs facilitate access to credit, whether they affect interest rates and whether they enable a reduction in credit risk. However, very little attention has been paid so far to the contribution of CRs to improving bank monitoring and supervisory procedures and to their potential for helping to address and assess underlying credit risk in banks' loan portfolios and for validation and benchmarking purposes.

Taking as a reference the reason for which CRs are conceived (compilation of the most relevant credit information), Pagano and Jappelli (1993) show at the theoretical level that information exchange among credit institutions helps to limit adverse selection problems, which results in a reduction in doubtful loans. The lower credit risk translates into lower interest rates, although the impact on credit volume is ambiguous, depending on the severity of the adverse selection.

Information exchange among lenders tends to reduce the informational rent they obtain from their relationship with customers. The bank-customer relationship provides banks with valuable information on customer credit quality. This enables them to impose tighter lending conditions (higher interest rates, collateral required, etc). However, information sharing with other banks reduces the possibility of benefiting from that information. Padilla and Pagano (1997) argue that information sharing diminishes the ability to extract income and thus increases the net profitability of the borrower's investment project, which in turn raises its incentives to make an effort to repay, ultimately resulting in a lower amount of doubtful loans.

Apart from the favourable impact in terms of cushioning the effects of adverse selection, information exchange can reduce moral hazard by raising borrowers' incentives to comply with contractual obligations. Padilla and Pagano (2000) show that information exchange on the inability to fulfil payment obligations has a disciplinary effect on borrowers because the default event becomes a signal of poor credit quality entailing a higher financing cost. When banks share information, the amount of doubtful loans decreases because borrowers concerned about their reputation (and financing costs) make a greater effort to repay. If information exchange includes the credit volume granted by each institution, an additional disciplinary effect is achieved that limits the level of borrower indebtedness and also helps to reduce the amount of doubtful loans and enhance banking system stability.

Jappelli and Pagano (2001) empirically analyse the contribution to the credit market by credit registers - both private (*Private Credit Bureaus*, PCBs) and public (*Public Credit Registers*, PCR) - and find a positive impact on the volume of bank lending (as a percentage of GDP) and a decrease in credit risk, regardless of the private or public nature of the information sharing mechanism. Galindo and Miller (2001) also show that the existence of CRs has a positive impact on access to credit. Kallberg and Udell (2003) find that exchange of information by a private mechanism contributes positively when it comes to calculating the probability of business failure.

All in all, theoretical and empirical analyses show that banks' sharing of information on borrowers helps to curtail the effects of adverse selection and moral hazard, reduces credit risk, makes for readier access to the credit market and increases the stability of the banking system. However, as noted above, there are practically no studies analysing the effect that the usage of the information included in CRs has on the supervisory function (monitoring process, validation procedures, benchmarking, etc). Bearing that restriction in mind, this essay is an attempt to make further inroads in this

respect by contributing ideas and future lines of research to fill the gap in this field.

### **1.3 Certain characteristics of credit registers**

The surveys conducted by the World Bank between 1999 and 2001 have substantially increased our knowledge of the mechanisms through which information is exchanged by banks, whether public or private. Miller (2003) provides detailed country-by-country information on the existence or not of CRs and on their information content.

The study cited in the preceding paragraph reveals that public and private CRs have a high presence throughout the world in both developed countries and emerging market economies. Forty-one countries have PCRs and 44 have PCBs.<sup>3</sup> The most common features of PCRs are: compulsory reporting to them by credit institutions; management by the Central Bank; information on defaults and volume of credit exposure; high level of confidentiality and cost-free use by participating institutions. In certain cases PCRs only compile information on large nominal value loans and they usually differ in the frequency with which banks report information to them. In any event, their primary objectives always include setting up a database so that supervisors can analyse the quality of banks' credit portfolios and how it changes over time. However, there is less information on how, and how intensively, supervisors use the information contained in PCRs.

Although it is a moot point, just as arguments are put forward that in emerging market economies it makes sense for banking supervision to be linked to the Central Bank (for reasons of reputation, compliance capability, control of the system's liquidity and monetary independence),<sup>4</sup> arguably it

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<sup>3</sup> Many countries have both types of credit register.

<sup>4</sup> See, for example, Goodhart (2000).

could also be advantageous if these countries' banking supervisors (whether or not in the Central Bank) setup PCR, regardless of any that may be setup on private initiative. Reasons justifying a public register may be the absence of a private one, the paucity of quality of the private register, a scope differing from that desired by the supervisor, a greater capacity to impose minimum standards of compliance and an influence that extends to all the institutions making up the country's banking system. Also, having the ownership and/or management of CRs in the hands of banking supervisors makes it easier to use CRs as a prudential instrument to strengthen the country's financial stability.<sup>5</sup> This does not rule out the possibility that supervisors may be able to, or interested in, using PCBs, particularly in those countries that lack public registers.

In general, it can be said that the presence of mechanisms for exchanging information on credits granted by banks is widely spread across a large number of countries. This increases the practical possibility of using CRs as a tool to keep abreast of the advances that have recently taken place in the identification, control, measurement and management of credit risk. Consequently, CRs can be seen as a key element for analysing banks' loan portfolios and how their quality changes over time. Hence, CRs can be regarded as an optimal factor that will help supervisors to implement Basel II, in both developed countries and emerging economies, as will be discussed in Part 3.

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<sup>5</sup> See Jappelli and Pagano (2000) for a discussion in welfare terms of whether or not PCRs are advisable. The arguments for the existence of PCRs are that they promote competition and banking sector stability, while the drawbacks are the lesser effort by credit institutions in screening and monitoring borrowers and their lower incentive to maintain a close relationship with customers.

## **Part 2. Practical use of a credit register: the Spanish case**

### **2.1 Main features**

Before describing the potential of CRs in the implementation of Basel II, let us look briefly at the characteristics of the Spanish Credit Register (*Central de Información de Riesgos*, CIR) and its practical utilisation by the Spanish supervisor. It will be shown that the step towards Basel II is a natural and logical extension of its current use, although certain changes have to be made, basically in the information required, to optimise its employment as an instrument for the banking supervisor.

The Spanish CIR records monthly information on all credits granted by credit institutions (banks, savings banks, credit co-operatives and specialised credit institutions) in Spain for a value of over €6,000. The CIR's data structure distinguishes between credits to firms and those to individuals. Among the latter it is possible to identify those engaging in business activities (individual businesspersons). The CIR includes information on the characteristics of each loan, including the following: type of instrument (trade credit, financial credit, lease, etc), currency denomination, maturity, existence or not of guarantees or collateral, type of guarantor (government or credit institution), the coverage of the guarantee, the amount drawn and undrawn of a credit commitment and, finally but very importantly, whether the loan is current or past due (distinguishing between delinquency and default status). The CIR also includes information relating to the characteristics of borrowers: province of residence and, for firms and businesspersons, the industry in which they operate.

All credit institutions supply monthly information to the CIR on any changes in the status of their outstanding credits (for example, whether the borrower has changed to delinquent or default status) and information on the new loans granted during the period. In exchange, they receive information on

defaulted obligors in the system and can obtain data at any time on the total bank debt of any of their customers. Therefore, before granting a loan to a potential customer, any bank can consult the CIR to see whether that customer fulfils its credit obligations to other banks. The CIR also enables the bank to know the amount of that customer's total debt to other credit institutions. The CIR does not include information on borrowers' financial characteristics. New entrants in the credit market can consult the CIR under the same conditions as can insider banks. Moreover, the information provided by the CIR is supplied to institutions at no cost.

## **2.2 Use by the supervisor**

The CIR is used both to support on-site inspections and to carry out off-site monitoring of credit and concentration risk. Since the CIR contains practically the entire population of loans granted by each credit institution, it can be put to various uses. First, it enables a series of indicators to be constructed both for individual banks and for peer groups (concentration expressed as a percentage of total risk exposure, concentration expressed as a percentage of own funds, percentages of exposure per economic sector, volume of non-performing loans, collateral required, etc), both at an individual level and at a system level. These indicators permit descriptive analyses of the situation of each bank's loan portfolio, which helps in optimising inspection work and contributes to an appropriate allocation of the supervisory resources.

Additionally, samples can be taken and significant borrowers selected for examination during on-site inspection. It should be noted that sampling can be random or can be restricted by means of certain parameters to permit analysis of a particular type of operation or borrower (for example, loans to real estate firms, to firms of a certain size, to firms in a certain region, secured or unsecured loans, etc) when a comparison is being made with other institutions or when changes over time are being analysed. Also, the CIR is used to monitor the risk concentration of each credit institution through selection and

subsequent systematic analysis of all credits exceeding a certain nominal amount.<sup>6</sup>

In addition to the foregoing, the CIR itself and certain associated applications exploiting its potential provide a series of services that range from error detection and maintenance and validation of input information (reports not sent or that are incorrect, checks in common fields for a particular borrower across different institutions, checks of the economic sector, etc), to the preparation of a dataset in which to note down details of the inspections conducted (reclassification of borrowers, adjustment of provisions, borrower ratings, etc).

The information held in the CIR also permits off-site monitoring. The obligation of all credit institutions to report defaulted obligors works as a disciplinary element that helps to maintain the quality of the information received and is a basic input for accurately assessing the risk incurred by each bank. The veracity and accuracy of the information provided by reporting institutions is a key characteristic which, as mentioned above, should be preserved in the best possible manner. In this connection, obligatory reporting generates its own indirect cross-check mechanisms. For example, if a bank systematically overvalues the creditworthiness of its borrowers, this will be detected when it is compared with the information reported by other credit institutions that are also creditors of that bank's borrowers. Since this behaviour can be penalised by the supervisor, the incentives to report truthfully are very high.

A deterioration of the credit quality of a bank's loan portfolio in relative terms with respect to the rest of the system can be used as an indicator of possible problems in that bank and, therefore, of the need to analyse it in depth (typically through an on-site examination). The supervisor can also monitor the

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<sup>6</sup> Concentration has shown itself to be a factor that magnifies bank crises.

dynamics of the credit portfolio. For example, an analysis of each bank's credit policy can show if it is directing its credits towards more problematic borrowers or losing market share in loans to borrowers that are more solvent and less likely to default. That is to say, the supervisor can monitor and assess the contribution of a credit institution's new credits to its overall risk, which can act as an early warning of a possible increase in the financial fragility of that bank.

Recently, in step with Basel II developments, and given the higher and more accurate credit risk quantification capability, the CIR is increasingly becoming a key information source for the supervisory authority. Whenever credit institutions adhere to the Internal Ratings-Based (IRB) approach proposed by Basel II, supervisors from both developed and emerging economies will have to deal with the practical implications that derive from that decision. In essence, they will have to validate the internal models (and their associated risk parameters) to be presented by credit institutions and evaluate the estimated minimum capital requirements resulting from them. In this respect, the information contained in CRs can be seen as a crucial factor for modelling (calculating and validating) the probability of default (PD) of the different borrowers, as a favourable framework for monitoring loss-given-default (LGD) and as a reliable yardstick with which to certify banks' estimates of exposure at default (EAD), as will be explained in the next section.

## **Part 3. Credit registers and Basel II: a practical supervisory approach**

### **3.1 Main challenges**

Basel II will enable credit institutions to use their own credit risk models (specifically, their estimates of probability of default or PD, loss given default or LGD and exposure at default or EAD) to determine their minimum regulatory capital, provided they have been previously validated by the relevant supervisor. Additionally, Pillar 2 obliges supervisors to require a level of capital in proportion to the actual level of risk incurred by each bank. Clearly, the work of supervisors will be affected, and largely determined, by these two tasks.

Therefore, the validation of banks' internal credit risk models (and of their associated risk parameters) is a central element for supervisors in the current reform of the Capital Accord. Although this statement is true, it should be noted that validation is a task that, initially, has to be carried out by banks themselves. Proper management based on an internal model requires an in-depth verification of that model. To conduct their business efficiently, banks must have sound and accurate models on which to base their decisions. Nevertheless, supervisors should generally have a thorough knowledge of the activities conducted by their supervised institutions and particularly of the tools with which they carry them out. Hence verification ultimately has to form part of the review process in a careful and efficient inspection.

As regards PD, the validation of the internal models from which this parameter is obtained can be divided into two parts. First, supervisors have to check that the borrower rating systems internally developed by credit institutions are functioning properly. Specifically, they have to assess the performance of these systems, ie their predictive ability in terms of the correct classification of obligors (risk classification). Second, they have to check the accuracy of

calculations and the appropriate assignment of the estimated PD to each borrower, ie they have to verify the calibration of the PD (risk quantification).

These two aspects have so far evolved very differently. Apart from backtesting, which is central for validating classification systems, there are now fairly advanced methodologies available to determine the discriminatory power of a given rating system.<sup>7</sup> (There is relatively extensive, up-to-date literature on accuracy measurements to assess the predictive capacity of borrower rating systems.<sup>8</sup>)

By contrast, the validation of the PD calibration is not so well developed. Here two basic problems make this a difficult task. First, the paucity of data, particularly on defaulted obligors; and second, the correlation between defaults. The statistical tests (eg binomial tests) applied to determine the correctness of the PD estimates need a large volume of data to be acceptable. However, default correlation invalidates the assumption of independence underlying the binomial distribution, clearly biasing the results obtained. It can thus be said that the performance of a rating system may be readily verifiable, but reviewing the calibration of the probabilities obtained from that system is a much tougher problem.

The limited statistical development of this subject makes it necessary to seek alternative solutions to substantiate a supervisor's judgment on the soundness of banks' estimates in the most objective manner. A possible solution could be the

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<sup>7</sup> The most common statistical measures for determining the discriminatory power of models are the well-known accuracy ratios obtained from CAP (Cumulative Accuracy Profile) and ROC (Receiver Operating Characteristic) curves. Also common is the use of contingency tables (particular cases of accuracy ratios), entropy measurements or others such as the Brier score or similar statistics.

<sup>8</sup> See, among many others, Sobehart et al (2000), Sobehart and Keenan (2001) and Engelmman et al (2003).

definition and use of benchmarks, such as, for example, the development by supervisors of borrower rating systems (similar to those used by individual banks) estimated for the entire population of all credit institutions. A system of this type could overcome one of the problems mentioned above, namely the paucity of data. The probabilities of default obtained from it could constitute the yardstick with which to compare, and consequently validate, those assigned by individual credit institutions to each borrower. Additionally, the analysis of defaults over long periods of time and of the correlation structure arising between them could constitute the basis for calculating acceptable sampling estimates of this parameter.

It should also be remarked that the information on a borrower's overall behaviour (fulfilment of its credit obligations) in the entire credit system is very valuable. This is so because it gives a much more exact assessment of a borrower's true creditworthiness, since partial analysis at individual bank level is unable to capture possible differences in a borrower's ability to meet its payment obligations in dealings with several banks. This is the added value that distinguishes a correct evaluation of both a borrower's credit quality and a bank's risk profile from an incomplete awareness of the facts.

Based on the above, CRs managed by supervisors (or to which supervisors have access) and containing a certain minimum quantity of information could be used as the basis on which to develop an overall rating system and thus act as a supplementary tool in verifying the calibration of the PD, for which there are not currently many alternatives.

Regarding the second risk parameter, namely LGD, both estimation and validation are much less developed than in the case of the PD. The Basel Committee's third Consultative Document establishes the basis for the calculation of this parameter. Specifically it considers that LGD estimates must be based on historical recovery rates although it leaves open the option of making use of external data. As a result, the most common methods currently in place for estimating LGDs resort

to either market data (market prices of defaulted loans or bonds) or credit institutions' own data (discounted cash flows, revenues and expenses, once a default has taken place,<sup>9</sup> or can be indirectly inferred from the total amount of losses and PD estimates).

As to the validation of the LGD, little progress has been made to date. Apart from the stability and robustness of analyses that should accompany any estimate, an assessment based on qualitative elements could be an appropriate starting point, at least in the early stages of Basel II implementation, as a possible alternative for LGD validation. Also, and here the CRs come into play, there is another possible solution based on the practical application of the information contained in them. In this case, validation would be carried out via an empirical estimate of the LGD itself. This would be based on quantitative variables (specific characteristics of credit operations) in order to identify which of them (via a regression model) turn out to be statistically significant determinants of the LGD. Under this approach, supervisors could obtain individual values of LGD based purely on credit data, with which the banks' estimates could ultimately be compared. An additional verification alternative stems from the possibility of CRs permitting supervisors to keep track over time of the losses incurred in every single credit. This would enable supervisors to establish a target population of loans (nominal value of credits) and evaluate the economic loss resulting from them. From those realised losses and PD estimates, LGDs can be automatically inferred and possibly used as an additional validation tool.

The situation regarding the third risk parameter, EAD, is very similar to that of LGD, although, if anything, even less developed. Very little is known of possible methods to

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<sup>9</sup> Calculating LGD properly requires knowledge of the amount finally recovered, the time taken to recover it, all the costs incurred in the process (from legal costs to the opportunity cost of money), all possible intermediate recoveries and the discount rate to be applied.

estimate EAD and even less of how to validate it. However, in contrast to LGD, it seems that modelling it is, in principle, simpler and requires less information.

Regarding EAD validation, CRs compile the main characteristics of loan commitments and can thus provide information on drawn and undrawn exposures, particularly in the period of time prior to a default event. An analysis of how borrowers make use of their credit commitments (particularly the undrawn part) over time would be a good first approximation for validating EAD. Moreover, as noted above for LGD, an assessment based on qualitative elements could also be a reasonable validation solution.

Having identified validation as a key element in Basel II, another central matter is the determination of each bank's risk profile to establish whether the regulatory minimum capital requirements set are in line with its actual level of risk.

The development of a borrower rating system by supervisory authorities at the credit system level would enable them to compare the portfolios of different banks in the same peer group, obtain a measure of their average credit quality and determine their highest or lowest risk profile. Similarly, the risk associated with a given loan portfolio can be analysed over time and that analysis can be used as a basis for determining whether its behaviour (credit quality) is moving towards or away from that of similar institutions. Naturally, an overall rating system allows each institution to be compared with the system average.

Another important item from the standpoint of supervision work, which can be obtained from a rating estimated for the total credit system, is the transition matrix and its associated probabilities. It is of interest to know not only the probabilities of default of each risk category (rating grade), but also how borrowers migrate from one category to another. Again, the transition matrix for the entire credit system can by itself provide useful information: significant differences between time periods (recessions and expansions), sectoral differences (different probabilities of default and migrations between

distinct economic sectors), geographical differences, etc. Also, comparison of a bank's transition matrix with the average matrix for the entire system, or with the matrix of similar credit institutions, provides an additional degree of freedom when it comes to establishing that bank's risk profile. An example is the case of two similar institutions (belonging to the same peer group) for which similar minimum capital requirements could be required (they have a similar distribution of borrowers in their internally estimated systems). However, their transition matrices might be significantly different. This would be evidence that their risk profile is different even though their regulatory capital requirements are nearly identical.

Another basic point in the current reform of the Capital Accord is the treatment of credit risk mitigation. The fact that Basel II allows a broad recognition of risk mitigation techniques means that the supervisory authorities need to have a detailed and precise knowledge of them to measure exactly the risk actually incurred by banks. The increasing requirement for guarantees of one kind or another when credit operations are involved means that CRs need to contain the most precise information possible so that the minimum regulatory capital, among other parameters, can be determined accurately. The value of guarantees (full or partial collateral), the rating of the guarantor and the type of the mitigating factor are basic characteristics that have to be fully identified and known so that they can be thoroughly treated within the Basel II environment.

The potential of CRs and how they can contribute notably to this new and crucial task of implementing Basel II has thus been established. Given the significance of the presence of CRs in both developed and emerging economies, supervisors have a unique opportunity, at a relatively low cost, to adapt, adjust and, finally, take full advantage of these instruments so that they may contribute to Basel II in a rigorous and orderly manner.

### **3.2 Required information structure**

To enable the potential described in the previous section to be harnessed, CRs have to contain a certain minimum amount of information. This section aims to describe, in general terms, what type of information should be included and what its natural end-use will be when applied efficiently as an effective tool for the implementation of Basel II.

First, to calculate each bank's minimum capital requirements under Basel II, supervisors need to have ready access to an essential minimum information set. Leaving aside the approach (Standardised or IRB) adopted by the bank (which could involve numerous combinations), the values of PD, LGD, EAD, maturity, risk mitigation factors and provisions are the basic elements underpinning the extensive use that may be made of CRs.

After determining the regulatory minimum capital requirements, the supervisory authorities have to ensure that the items used for this purpose have been properly obtained and employed. That is to say, the validation process described above has to be carried out. As regards PD validation, the development of an overall borrower rating system unquestionably requires default information. Information must be available on whether or not borrowers are current on payments. The big advantage of a mechanism at the credit system level is that it provides information on all the defaults at any given credit institution, which, while not many, may be sufficient to overcome the problems of paucity of data that individual banks face as they develop their internal models. Also, as mentioned above, the behaviour of borrowers in the system is fundamental for properly assessing their credit quality.

In addition to default information, the development of an appropriate rating system would require information on certain loan characteristics that could be used, either directly or through some transformation (data refinement), to construct variables that are significant for determining each borrower's credit quality or, in other words, its probability of default.

Among other items, desirable information would be: existence of guarantees, how long the borrowers have been in the system, default history of each borrower (number of times that they have defaulted previously, or proportion of defaults in terms of how long they have been in the system), history of an obligor's rating migrations (upgrades or downgrades), number and type of banks with which obligors deal, information on whether borrowers' debt is past due without reaching default status (delinquency status), industry to which obligors belong, type of credit instrument and maturity date.

The above variables, which we shall call "credit variables", and others that are financial (leverage ratios, debt burden, efficiency, productivity and profitability) in the case of firms, and that relate to employment status and indebtedness profile in the case of individuals, along with the stage of the business cycle of the economy, could form the core group of variables needed to estimate a consistent rating system for supervisory purposes.

In the case of LGD, certain readily identified characteristics would be needed to estimate its determinants empirically via a regression model. There are few studies in which such an analysis has been conducted and that can thus serve as a reference. However, common sense and supervisory experience indicate that the potentially more suitable variables for explaining LGD and about which information would thus be required are: type of collateral; percentage of collateral coverage (*loan to value ratio*), which is particularly important in mortgages where the guarantee plays a primary role; credit operation interest rate; age of the operation (time elapsed since loan origination); industry; loan size and loan maturity date. Moreover, information based on the analysis of losses incurred by banks or even on their level of provisions, along with other qualitative variables furnished by the departments entrusted with recovery management, could also be used for LGD validation, a task on which little research has been done so far. Note that for the validation of the LGD the required information structure basically depends on characteristics of the credit operations themselves whereas for PD validation the

required data mostly refer to intrinsic characteristics of borrowers.

Regarding EAD, the indispensable information is the volume of the credit commitment, distinguishing between drawn and undrawn exposures. Once this is known, the use made by borrowers of the committed line of the facility can be estimated (approximation using historical data). Consideration could also be given to modelling EAD by empirically estimating its ultimate determinants (similar to the case of LGD). Basically, the number of banks with which a borrower deals, past default history, size of the loan, industry and guarantees appear to be the items which, in principle, best seem to explain EAD. In this respect it should be noted that, since there are no known references to empirical work on EAD determination and validation, it remains to be seen what precision will be yielded by adjusting an empirical model based on loan characteristics to explain this risk parameter.

Last but not least, the full implementation of Basel II necessarily involves allowing for risk mitigation techniques to the extent that they are accepted. The broad recognition of these techniques (reflecting their risk reducing effects) means that there are many ways in which they can be applied. The different mitigation techniques (which, put simply, are guarantees and credit derivatives, financial collateral and other types of collateral) and their differing treatment (simple approach, comprehensive approach or through direct adjustment of the LGD) result in a wide range of possible combinations of them being recognised. Ultimately, this means that a more complex information structure is needed to cover all possible cases. In any event, although complex, this task is feasible and necessary for properly assessing the minimum capital requirement of banks. Just how it is included in the information content of CRs will depend largely on their internal organisation.

The information to be considered should include, firstly, the type of mitigating instrument. In this respect, the more detailed its definition, the easier it will be to establish the approach to

be taken in recognising it and the more exactly its risk-reducing effect will be determined. Additionally, information that distinguishes between full and partial collateralisation is fundamental. However, full recognition of collateral necessarily entails knowing the percentage of coverage of the credit operation in question. The rating of the guarantor and of the collateral, if any, is another key point. It is absolutely necessary to have information on the guarantor rating because the substitution effect is based on this knowledge. With regard to financial collateral, its eligibility as a risk-mitigating instrument depends, in certain cases, on what its rating is. Two other factors to be taken into account in calculating either banks' own estimates or supervisory haircuts are currency denomination and maturity, so information on them should somehow also be included.

As a general conclusion, it can be said that the ample recognition of risk-reducing techniques, the need to validate the internal risk parameter estimates made by banks to calculate their minimum capital requirements and the substantiation as to whether these are in line with each bank's risk profiles, make it necessary to review the required minimum information that should be included in the data structure of CRs. This review will enable fuller development of their potential, which will convert them into a basic support tool for the supervisory authorities in the process of adapting to the new requirements of Basel II.

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