COMPARING RISK-WEIGHTED ASSETS: THE IMPORTANCE OF SUPERVISORY VALIDATION PROCESSES

José María Arroyo, Ignacio Colomer, Raúl García-Baena and Luis González-Mosquera (*)

(*) José María Arroyo, Ignacio Colomer, Raúl García-Baena and Luis González-Mosquera belong to the Directorate General Banking Supervision of the Banco de España. The authors acknowledge the valuable comments and suggestions made by Jorge Martínez, Rafael Repullo and Fernando Vargas. This article has also benefitted from contributions and discussions in previous related works by Jaime Esteban, M.ª Jesús Lobato and Esther Moral. This article is the exclusive responsibility of the authors and does not necessarily reflect the opinion of the Banco de España.

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This article analyses the problems of using the risk-weighted assets (RWA) density ratio – defined as the ratio of RWA to total assets – to make comparisons across banks, as is frequently done by banks themselves and analysts. An international comparison is made of 16 European banks, based on public information, from which it is concluded that a significant part of the differences in RWA density are a consequence of differences in the type of business involved. In particular, the greater the weight of credit risk in a bank's balance sheet the higher will be its RWA density. We propose alternative RWA density ratios and illustrate them with the results for Spanish banks using confidential data. We show that public information cannot be sufficiently detailed to enable differences across banks arising from their risk profiles to be distinguished from others attributable, for example, to different interpretations of solvency rules by banks or supervisors. Therefore, the supervisory review process and the progress in its inter-jurisdictional harmonisation are especially important. The paper concludes with a review of the process used by the Banco de España for the supervisory validation of Internal Ratings Based (IRB) approaches for credit risk.

1 Introduction

The recent crisis and the discussions on Basel III have focused attention on the need to improve the quality of banks' capital and to increase their capital ratios, relegating some of the objectives of Basel II to the background. However, in our view an appropriate combination of Basel II and III is a necessary condition for avoiding future crises.

It is worth briefly reviewing the transition from Basel I (1988) to Basel III (2010), through Basel II (2004), to understand what the current situation is and to reflect on what it should be. Basel I managed to establish minimum solvency requirements at the international level and a level playing field that did not previously exist. The requirements took the form of a minimum solvency ratio of 8%, the result of dividing eligible capital by the so-called risk-weighted assets (RWA).[1] However, their lack of sensitivity to risk led to regulatory arbitrage[2], which is why Basel II focused on improving the calculation of the risk to which banks are exposed, i.e. the denominator of the solvency ratio (RWA), on the assumption that the system's capital was appropriate. Indeed, Basel II was calibrated so that this level of capital would not vary for the system as a whole. The experience following the implementation of Basel I appeared to support the view that this volume of capital was sufficient to withstand potential crises.

The full emphasis of Basel II was placed on providing incentives to enhance banks' risk management under the premise that capital can never be a substitute for good management and appropriate risk control. The aim was to draw regulatory capital closer to economic capital with more risk-sensitive capital requirements calculation systems, including the use of internal models.[3] Unfortunately, just as Basel II (2007-2008) was entering into force,

1 RWA were the result of multiplying exposures by weighting coefficients. One of the following four weighting factors was applied to each type of exposure: 0%, 20%, 50% or 100%. Thus, for example, public debt issued by sovereign States would be weighted at 0% if they belonged to the OECD, and a weight of 100% would be applied to corporate and retail exposures (except mortgages, which would be weighted at 50%).

2 The difference between regulatory capital and economic capital encouraged banks to take lower-risk exposures off their balance sheets.

3 In the specific case of credit risk, Basel II envisages two alternatives for calculating minimum capital requirements. The first is the standardised approach which, using external ratings and extending the number of weightings, allows for better assessment of borrower creditworthiness than Basel I. The other method, the Internal Ratings Based approach, draws as its name suggests on the use of internal ratings.

the biggest financial crisis of recent history broke. Clearly, this had little to do with Basel II; rather, it was the result of what Basel II was seeking to correct, i.e. the poor assessment and management of the risks to which banks were exposed. The crisis highlighted the fact that there was a lack of high quality capital. All these developments speeded up the preparation of Basel III, this time under the premise that it was necessary to require more capital and of better quality, and that trading book requirements had to be tightened so that the system was better prepared for future crises.

Crises almost always start on the side of the solvency ratio denominator (RWA), i.e. due to inappropriate risk management and measurement. In this crisis a major role was played by the pressure on banks to attain high returns. Such returns were relatively unsustainable over the long run and, in many cases, were achieved with products which, under a halo of "financial innovation", offered a very high return/risk ratio as a result of the inappropriate valuation of their risks and, therefore, of their price. The denominator is the most complex part of the solvency ratio, posing most calculation difficulties (it must reflect the risks to which a bank is exposed), and the most costly to supervise.

In short, Basel II focused on the denominator of the solvency ratio, seeking to have capital requirements that reflect more accurately the risks taken by banks (for more risk, more capital). Basel III changes none of the foregoing, simply adding to it; but, by focusing on the numerator of the ratio, it may give the impression that Basel II has been superseded and that it suffices to have more capital. Yet one of the guiding principles of Basel II, namely that capital cannot replace the sound management and proper control of risks, remains fully valid. A denominator that were not sensitive to risk would again be the precursor of a fresh crisis. Risk-insensitive measures can only lead to greater regulatory arbitrage and competitive distortions. In this respect, internal models continue to play an essential role, bearing in mind - as always - their limitations.

One of the main uncertainties surrounding Basel III is knowing the impact it will have on banks' behaviour. The perception is that this impact will not be insignificant, and much of it will be through the solvency ratio denominator, i.e. via risk management. The greater the pressure to increase the numerator, the greater will be the pressure to reduce the denominator by various means. Ultimately what counts is the ratio itself.

Basel III mainly alters the numerator of the solvency ratio, and requires more capital and of greater quality, but what banks must initially comply with is a now-familiar ratio, of 8%. How can the 8% solvency ratio be achieved under Basel III? There are several alternatives. The most desirable one would be to increase capital in absolute terms, but other possibilities exist: to change the risk profile (for example, moving from private debt to high quality sovereign debt, increasing the levels of collateral on operations, lending less, selling assets...) or to attempt to reduce the estimate of RWA. In this latter case, banks with internal models will now have more incentives to make changes that reduce their requirements, and standardised-approach banks are expected to develop to a greater extent the risk mitigation techniques that they have not so far fully exploited.

In this setting, there has been a proliferation of the comparisons that banks themselves and other market participants make in terms of what they call "density of RWA", that is, the ratio of RWA to total assets. This simple measure, which – applied using public information – shows a range of variation that fluctuates from 15% to almost 60% for European international IRB banks, is used to support widely different conclusions. Banks in the lower range usually attribute this result to differences in risk profile, while those in

the upper segment (Spanish banks among them) attribute the difference mainly to inter-jurisdictional divergences in the calculation of RWA.

As is usually the case, neither of the two extremes is right. But it does re-open an old debate on the extent to which the RWA of different banks are comparable. In this case, the focus falls particularly on the calculations of banks with approved models for their regulatory use. The variability seen in these calculations offers support to proposals such as a return to Basel I or even to simpler measures, such as leverage ratios, forgetting, as previously discussed, that Basel II arose to avoid the lack of comparability "in terms of risk" of RWA under Basel I. There is also a tendency to forget that the dispersion of the density of RWA, if it were ever really informative, is also very high at standardised-approach banks, fluctuating in a way depending on the type of activity from values close to 0% in some cases to 150% in others, which are the two extremes of weights under the standardised approach. The question that needs answering is whether matters are better or worse in terms of the comparability of capital requirements with Basel II. This article addresses this issue for the particular case of credit risk.

While not the aim of this paper, it is worth remarking that the measurement of the soundness of a bank is often confused with the measurement of its capital ratio. However, although this ratio has a role to play in the measurement of the soundness of banks, other relevant factors are occasionally overlooked, such as risk management and internal control capabilities, recurrence and diversification of results, accessibility to capital markets, the sustainability of funding structures, operating markets, etc. In short, all the factors that make up a bank's risk profile.

The article comprises six sections. The following section discusses some of the problems posed by the density ratio of RWA frequently used by analysts and banks to make comparisons across banks, and some alternatives in the field of credit risk are proposed. Two comparisons between banks then follow, the first at the international level, using public information, and the second at the national level, based on confidential data. The fifth section sets out the process followed by the Banco de España in the supervisory validation of IRB credit risk approaches. Finally, the main conclusions of the paper are drawn.

2 Problems with the RWA density ratio and alternatives

There has been growing concern for some time among banks and supervisors about cross-bank and cross-country consistency in the calculation of risk-weighted assets (RWA) in the context of solvency regulations. There is interest in this matter because, as is known, RWA are used in the denominator of the various capital ratios[4] set in different solvency regulations, thus acting as a yardstick for deciding whether banks' eligible own funds are sufficient.[5] Accordingly, if there are unwarranted differences in the calculation of

4 Capital ratios with RWA as their denominator are occasionally called risk-based ratios so as to distinguish them from leverage ratios, whose denominator basically consists of the book value of total assets, with certain adjustments and additions.

5 It should be pointed out here that, as the current status of the solvency regulations stands, the concept of "risk-weighted assets" is perhaps being overemphasised, and may occasionally lead to some confusion. True, under Basel I and the Basel II standardised approach to credit risk, a weighting of "assets" – actually, exposures, including certain off-balance sheet items – is made as a prior step to calculating capital requirements, defined as 8% of weighted assets (the minimum value required for the total capital ratio). However, in many cases (the IRB approach for credit risk, market risk, operational risk...) such prior weighting is not carried out; rather, the capital requirements are calculated following different procedures, and the RWA are derived – a posteriori – by multiplying them by a factor, 12.5, directly related to the total capital ratio required (12.5 is the inverse of 8% or 0.08). Given that, moreover, several capital ratios have at present been explicitly defined in respect of solvency regulations, with different minimum percentages depending on the capital aggregate considered, it is natural to enquire about the suitability of the RWA concept, which in the best of cases is an intermediate variable, and at worst a purely conventional calculation.

RWA, distortions will arise in the measurement of banks' solvency, which will be to the detriment of a level playing field for banks and their competitiveness.

In order to analyse the consistency of RWA in the context of solvency regulations, certain agents – chiefly international banks and analysts – have been using the *Risk-Weighted Assets*/*Total Assets* (RWA/TA) or density ratio. This ratio compares total regulatory weighted assets with banks' total balance sheet, and it may be interpreted as a measure of the average relative risk – according to regulatory criteria – of a bank's overall operations. The disclosure of notable differences in the value of this ratio from bank to bank and from country to country has led some to conclude – to denounce, it might be said – that the calculation of RWA is not carried out consistently, and that there must be significant and unwarranted differences in banks' calculation methodologies and in supervisors' criteria.

This section examines whether this conclusion is warranted. Also, adopting a broader perspective, the section reflects on what would be the appropriate use that could be given to this type of ratio, in which a measure of risk and a measure of exposure are related, and a ratio that might be useful is proposed.

Focusing on the RWA/TA ratio, it should be said there are good reasons why this measure should differ from bank to bank, without having to resort to undesirable differences in the methodologies or criteria applied (which cannot be ruled out either). Among such reasons are the following:

- Regarding the numerator *(Risk-Weighted Assets):*

  - It should not be forgotten that regulatory RWA are derived from the application of a solvency framework that seeks to be risk-sensitive: the greater the risk taken by banks, the greater RWA should be in relation to their "assets".[6]

    Thus, the risk profile of banks should have a significant effect on the value of this ratio. This profile can be reflected in various aspects: banks' balance-sheet structure (the relative weight of their different portfolios), the quality of the assets included in each portfolio, the geographical areas in which they operate, the types of business in which they engage (commercial banking, investment banking, *bancassurance…).* Those banks focusing on what are considered as low-risk activities, or whose investments are of higher quality, should show lower ratios.

  - Another aspect to bear in mind is that RWA are the outcome of a weighting of assets based only on their risk of unexpected loss, and they do not take into account the risk of expected loss. The breakdown of total risk into these two components may differ substantially across banks depending on the type of business pursued, so that the numerator of the ratio offers a partial view of the risk taken or of the regulatory requirements made.

6 The term is in inverted commas to highlight the fact that in many cases it refers not only to on-balance sheet assets, but also to off-balance sheet items. A more appropriate term would be 'exposures', also commonly used, which covers both on and off-balance sheet items.

– As to the denominator *(Total Assets),* the use of the total balance sheet poses various problems in respect of comparison with RWA:

  – Not all RWA arise from weighting balance sheet assets in the proper sense of the term: evident examples are RWA relating to contingent exposures and commitments (guarantees extended, undrawn amounts in credit accounts), short positions in financial instruments, financial derivatives, etc. On the contrary, there are balance sheet assets to which the regulations do not apply the weighting and capital requirements scheme, opting instead, conventionally, for deducting them from eligible own funds; that is the case, for example, of intangible assets, such as goodwill, certain holdings in other companies, some securitisations, etc. Operations such as the foregoing mean that some components of the numerator have no reflection in the denominator, and vice-versa: the RWA/TA ratio is inconsistent by definition.

  – Another source of inconsistency arises from the fact that the ratio mixes risks whose requirements are calculated on the basis of "assets" (or rather, as noted, exposures), such as credit risk, with others that use methodologies whose relationship to balance sheet assets is less direct, as occurs with market and operational risk, and where a "weighted assets/assets" ratio is not really adequate. This matter is particularly serious when banks whose type of business is very different (e.g. commercial banks versus investment banks) are compared.

  – Furthermore, differences in the accounting criteria applied to certain operations may mean the value of total assets is very different under different regulations[7], prompting likewise notable differences in the ratio. This especially affects trading book operations.

In this context, it would be unwarranted to state that the differences in the RWA/TA ratio are principally due to possible inconsistencies in the methodologies for calculating RWA or in supervisors' criteria, even though it cannot be ruled out that such inconsistencies may exist.

The flaws exposed in this ratio have raised doubts over its usefulness as an analytical tool: in particular, its intrinsic inconsistency and the fact that, by attempting to cover all the bank's activity, its value is influenced by a multitude of different factors whose effect is difficult to assess (balance sheet structure, investment policies, type of business, operations and also the calculation methodologies for RWA). Indeed, it is likely that their use will readily lead to mistaken conclusions. If the aim is to detect methodological or criteria-related inconsistencies in the calculation of RWA across banks, this ratio does not appear to be overly useful.

It is worth asking whether a ratio (or a set of ratios) could be designed to measure the relative risk taken by banks, that does not have the shortcomings of the one discussed above (or that has them in a less serious form), so that more appropriate comparisons can be made. To do this, a measure of the risk taken should be set against a measure of the

7 Ledo, M. (2011) mentions two real, and telling, examples of to what extent total assets may differ under US-GAAP and IFRS.

exposure that has given rise to this risk. It seems reasonable to require that any ratio of this type should meet the following conditions:

- *Consistency:* there should be no risks in the numerator whose exposure is not reflected in the denominator.

- *Completeness:* all exposures that are relevant in the context of analysis should be included in the denominator, and all significant risks associated with such exposures should appear in the numerator.

In the area of solvency regulations, the construction of ratios of this type would involve using capital requirements (or their equivalent RWA) in the numerator, and it seems reasonable to also include expected losses in the case of credit risk, since they are actually part of the regulatory estimate of risk and, moreover, their amount is by no means insignificant. As a result, a measure of the relative risk assumed by banks in accordance with regulatory criteria would be obtained, as would, therefore, a measure of the relative effort that regulations require of banks in terms of own funds required relative to exposures held. Unfortunately, it seems difficult to find an "overall" ratio, similar to that criticised above, which consistently measures the risks incurred by banks, due above all to the fact that, as said, the requirements are calculated in very different ways for the different risks envisaged (credit, market and operational risk, mainly), and the concept of exposure is not clearly defined in certain cases (market and operational risk).

Consequently, a ratio of this type will be all the more significant and useful the more restricted and uniform the area to which it is applied. Focusing on credit risk, it does seem possible to design useful ratios that meet the conditions mentioned above, although certain particularities of the two fundamental approaches for calculating requirements should be borne in mind; in short:

- *Standardised approach:* capital requirements are calculated from the exposure at default (EAD[8]) *net of provisions,* similarly to under Basel I. This implicitly assumes that capital requirements cover estimated unexpected losses arising from exposures, and that provisions cover expected losses.

- *Internal Ratings Based (IRB) approach:* capital requirements are calculated from *gross* EAD (provisions not deducted). Expected losses (EL) are calculated explicitly and the difference between provisions and EL is included, subject to an upper limit, in regulatory capital (i.e. EL are treated as a deduction from regulatory capital).

Given these differences, if it is wished to treat these two approaches together or to compare their respective regulatory capital requirements, it seems reasonable to define the ratio as follows:

- *Numerator:* capital requirements *plus* expected losses, so as to reflect all regulatory 'capital' requirements (all the estimated risk of loss). For exposures

8 This is the fundamental measure of exposure used in credit risk regulatory capital calculations, to which risk weights and expected loss estimates are applied to calculate RWA and expected loss amounts (the latter only in the case of the IRB approach).

treated under the standardised approach, given that expected losses are not calculated explicitly, it is necessary to make certain assumptions in this respect. Since the loss estimates used are derived from the legal regulations, it would seem adequate to use the assumption implicit in the regulations for that approach (expected losses are covered by provisions) and take the best estimate of expected losses under the standardised approach to be the provisions booked.[9]

– *Denominator:* with a view to encompassing both on-balance-sheet assets and off-balance-sheet contingent exposures and commitments, it would seem most appropriate to use the same concept of exposure as that used to calculate capital requirements and EL, namely EAD, since this includes off-balance-sheet exposures through the application of conversion factors which transform them into equivalent on-balance-sheet amounts. It is also of interest that the exposures treated under the standardised approach should be made as consistent as possible with those used under the IRB approach, by taking their gross value, i.e. not net of provisions.

This would give the following theoretical ratio:

$$\frac{\text{Capital requirements + Expected credit losses}}{\text{Gross exposure}}$$

Or, more specifically:

$$\frac{(\text{Capital req. + EL})_{IRB} + (\text{Capital req. + Provisions})_{STA}}{\text{Gross EAD}}$$

where gross EAD = $(EAD)_{IRB} + (EAD + Provisions)_{STA}$.

In terms of risk-weighted assets, the ratio would be:

$$\frac{12.5 \times [(\text{Capital req. + EL})_{IRB} + (\text{Capital req. + Provisions})_{STA}]}{\text{Gross EAD}}$$

Hence, in the area of credit risk, a consistently defined ratio is obtained that includes all the regulatory capital requirements for the exposures in question (i.e. a regulatory estimate of the risks taken) and whose value represents the sum of the average risk-weight and the average expected loss (multiplied by 12.5), which are applied to the total EAD considered. This ratio can be used for banks applying the standardised approach, the IRB approach or both.

However, this ratio is not without its shortcomings and problems. Most notable among these are, firstly, that if the ratio is applied at a high level of aggregation (total credit risk, total IRB approach, total standardised approach, etc.), the result will be the average of a heterogeneous set of diverse approaches, portfolios or exposures. Secondly, that from the standpoint of measuring banks' regulatory capital requirements, the ratio is still somewhat

9 A legitimate criticism here is that often it is not very obvious that there is a close relationship between the risk of expected losses and provisions booked by banks.

incomplete because, as it provides a measure of the regulatory requirements per unit of EAD, it does not show the effect of the credit conversion factors (CCF) that are used to estimate the EAD of off-balance-sheet items: the larger CCF are, the larger the EAD and the larger the volume of RWA and expected losses, although the ratio is practically unaffected.

3 International comparison and shortcomings of public information

As noted in the introduction, the information published by banks has been the subject of numerous studies which have reached contrasting conclusions. Some perceive disproportionate differences in banks' RWA calculations, while others consider that, although not perfect, they are fulfilling their role. Yet others assert that the highest dispersion is found in investment banking, as against those that say it is where there is most homogeneity. The only point on which they are unanimous is the limitations shown by Pillar 3 information and it is generally considered that greater homogeneity would be desirable.[10]

Even the simplest aggregate comparisons become complicated when they have to be made using banks' public information. Furthermore, as the level of aggregation decreases the assumptions needed to compare the information multiply, which perhaps explains why such different conclusions have been reached. Here, therefore, only a simple comparison is made of 16 European international banks[11], based on public information as at December 2010, to illustrate the limitations of the density of RWA – noted in the previous section – as a measure for comparing the consistency of RWA. It is therefore not possible to establish a relationship between the density of RWA and capital ratios to conclude, for example, that a higher RWA density justifies, without further qualification, a lower capital ratio.

Chart 1 plots RWA density against the ratio of exposure at default (EAD) for credit risk to total assets[12]. Banks are ordered by RWA density, number 1 representing the bank with the highest density and number 16 that with the lowest density. The two ratios are highly correlated. Banks with a high weight of lending activity on their balance sheet have a higher density of RWA, i.e. this higher density is largely a result of their type of business. Quite another matter is whether or not the relative distance between banks and the contribution of other risk exposures to RWA are accurate, which is an issue beyond the scope of this study. What does seem clear is that a higher weight of credit risk on the balance sheet produces a higher density of RWA.[13]

10 See Barclays Capital (2011) as an example of the studies that conclude that Basel II RWA calculations leave considerable scope for subjectivity and interpretation. In contrast, see Bernsteinresearch (2011) as an example of those that show that RWA calculations, although not perfect, offer a reasonable estimate of risks. For a comprehensive overview of the concerns surrounding the variations in calculation of RWA see Le Leslé, V., and Avramova, S. (2012).

11 The banks used in the comparison are European, are all internationally active and have a high percentage of their banking book in internal models (IRB). The banks are: Barclays, BBVA, BNP, Commerzbank, Crédit Agricole, Credit Suisse, Deutsche Bank, HSBC, ING, Lloyds, Nordea, RBS, Santander, Société Générale, UBS and Unicredito.

12 Total EAD for credit risk is not, in most cases, explicitly reported in public information, so that estimations have to be made. As Pillar 3 reports do include total RWA for credit risk, and also detailed information at the portfolio level (RWA and EAD in particular), we are able to derive total EAD for credit risk. In those cases where the sum of the RWA of all portfolios is lower than total credit risk RWA, we have assumed a 100% risk weight for the residual value to estimate the EAD. The impact of this assumption is not significant and it does not change the conclusions reached. In all cases considered in the sample, the residual value is lower than 9% of the RWA for credit risk.

13 This situation may change partially under Basel 2.5, since the new capital charges it introduces will substantially increase the capital requirements for the trading book.

RWA DENSITY AND THE RATIO OF CREDIT RISK EAD TO TOTAL ASSETS FOR A SAMPLE OF EUROPEAN BANKS

CHART 1

SOURCES: Financial and Pillar 3 reports by individual banks.
NOTE: The chart plots RWA density against the ratio of exposure at default (EAD) for credit risk to total assets for a sample of 16 European international IRB banks. The banks are: Barclays, BBVA, BNP, Commerzbank, Crédit Agricole, Credit Suisse, Deutsche Bank, HSBC, ING, Lloyds, Nordea, RBS, Santander, Société Générale, UBS and Unicredito. The ratios have been calculated using public information as at December 2010. Banks are ordered by RWA density, number 1 representing the bank with the highest density.

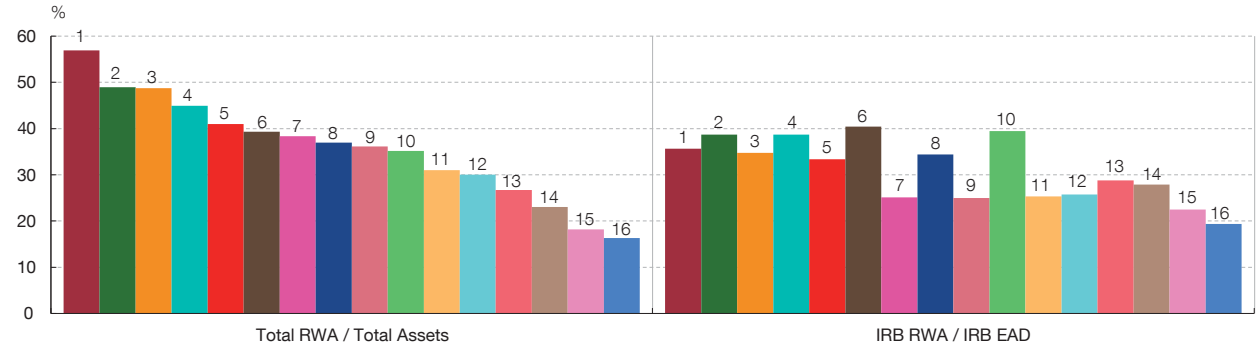
Chart 2 compares the dispersion and order of RWA densities with those of a similar but more consistent measure: the ratio of RWA to EAD in IRB portfolios[14]. In this case, when the comparison is limited to the IRB portfolios and is based on the EAD, the dispersion decreases substantially from a standard deviation of 11% to 7%. Moreover, the order varies and those banks with a greater density of RWA do not have the highest capital requirements for credit risk. For example, the bank with the highest RWA density, 59% higher than the average, ranks fifth in the second ratio, being 15% above the average.

Obviously, significant differences still remain, but the information banks publish gives no insight into whether they are due to differences in the risk profile of the portfolios or to other factors. Also, it should be noted that the banks' data are at the consolidated level, often the result of mixing portfolios of subsidiaries from different countries, so they do not allow the idiosyncratic behaviour of a given portfolio to be linked to the bank's home country. Thus, for example, if the comparison is restricted to a more homogeneous group

14 The IRB portfolios included are: central government and central banks, institutions, corporate and retail.

RWA DENSITY AND THE RATIO OF RWA TO EAD IN IRB PORTFOLIOS FOR A SAMPLE OF EUROPEAN BANKS

CHART 2



SOURCE: Financial and Pillar 3 reports by individual banks.
NOTE: The chart shows RWA density, on the left, and the ratio of RWA to exposure at default (EAD) in IRB portfolios (central government and central banks, institutions, corporate and retail) on the right, for a sample of 16 European international IRB banks. The banks are: Barclays, BBVA, BNP, Commerzbank, Crédit Agricole, Credit Suisse, Deutsche Bank, HSBC, ING, Lloyds, Nordea, RBS, Santander, Société Générale, UBS and Unicredito. The ratios have been calculated using public information as at December 2010. Banks are ordered by RWA density, number 1 representing the bank with the highest density.

of banks, such as the six Spanish banks with approved IRB approaches which do not have significant international activity (not represented in the above charts), the dispersion in terms of RWA density would be less than that in the international comparison, fluctuating from 57% to 72%[15], as a natural consequence of more comparable businesses and a homogeneous supervisory validation process.

There are three possible sources of differences in banks' RWA:

– Different risk profile of their portfolios. This difference would be justified.

– Different progress in implementing advanced approaches, and differences in banking regulation due to areas of national discretion. The latter are not few in number and may have a substantial impact, although they are envisaged in banking regulation.[16] In this connection, efforts are being made at the international level to reduce the areas of national discretion. The differences arising from disparate progress in implementing advanced approaches are generally a more or less logical consequence of the incentives offered to encourage banks to improve their risk management.

– Finally, those due to differing interpretations by banks or supervisors or to less supervisory "pressure" in validation processes. This source of differences is not justified, although it is not difficult to find examples of divergences, not only in validation processes, reflecting the supervisory models in place in each country, but also in the interpretation of banking regulations, from the most complex issues such as the definition of long-run probability of default (PD), the concept of downturn for calculating the loss given default (LGD) and the credit conversion factors (CCF), the treatment of exposures in default or the justification of the number of rating grades to be used,[17] to simpler matters such as the application of certain floors or whether some conservative adjustments should be reflected in risk parameters (Pillar 1) or in Pillar 2.

The difficulty is to determine what part of the differences comes from each source. The main conclusion is that the information included in Pillar 3 reports does not allow us to say whether the differences are due to different risk profiles or to other factors, since not enough details on the regulatory parameters are provided. For example, given two portfolios that are identical in terms of counterparties (the same PD), collateral (the same LGD), size (the same S) and applying the same credit conversion factors (CCF), if one of them has a maturity (M) longer than the other, the minimum capital requirements for the portfolio with the longer maturity may be twice as high. There are many matters not included in sufficient detail in the public information which could be important in calculating capital requirements.

The problem is that, although unquestionably Pillar 3 information can be improved, it is unlikely that it will contain sufficient detail to enable banks to be compared satisfactorily. For this reason, the supervisory review process takes on special importance, particularly

15 Values obtained from public information as at December 2010.

16 The very definition of "default" is an area of national discretion in retail portfolios, as the minimum period of time established to classify a past due exposure as defaulted ranges from 90 to 180 days.

17 The mere grouping of transactions in homogeneous categories may give rise to significant changes in minimum capital requirements, although, in fact, it does not modify the risk associated with the portfolio.

considering that many decisions considered to be "details" may have a major impact on calculations and they cannot be assessed without a thorough review. It is therefore essential to make progress in harmonising supervisory validation processes. This harmonisation is undoubtedly one of the main challenges of the new European Banking Authority, in which it will have to take an active role. Section 5 describes the main characteristics of the supervisory validation process in Spain.

4 Comparison of Spanish IRB and standardised banks

Table 1 shows various RWA density ratios for the Spanish banks applying the standardised approach and for those authorised to use the IRB approach to calculate their capital requirements for credit risk, on an aggregate basis for each group. The calculation of these ratios took into account the considerations set out in Section 2 and used the information in the confidential accounting and solvency returns as at June 2011:

The ratios shown are of two types:

- *Risk-Weighted Assets*/*Total Assets* (RWA/TA) ratio: as noted above, this is the ratio most widely used in the market to analyse the consistency of risk-weighted assets in the context of solvency regulations.

- Other ratios: these are also designed to measure the relationship between the risk taken and their respective exposures, all likewise measured by regulatory methods, but with the focus on credit risk. The first focuses on assets weighted by the risk of unexpected losses (i.e. the customary RWA), while the next two also include assets weighted by the risk of expected losses, this being done most completely and consistently in the last of these ratios.

As discussed in detail in Section 2, the RWA/TA ratio does not seem suitable for comparing banks, and less so for attempting to detect inconsistencies in the calculation of RWA, basically because it is not defined consistently and because its value is influenced by a mix of heterogeneous factors whose effects are difficult to separate from each other, since it is a ratio which encompasses all risks (credit, market, operational, etc.) and activities of the bank.

Therefore, to make comparisons in terms of the relative risk taken, it seems advisable to restrict the analysis to a domain as homogeneous as possible, at least that of one type of risk in particular. For this purpose, the last three ratios shown in Table 1 focus on a bank's total credit risk.[18] The RWA/EAD ratio reflects the average risk weight applied to the credit

18 Actually, this is still an excessive level of aggregation for an adequate analysis, and the results may be influenced by the relative weight of the various credit risk portfolios on banks' balance sheets, because the capital requirements (and asset weights) vary greatly from one bank to another.

RWA DENSITY RATIOS FOR SPANISH BANKS

TABLE 1

%

	Total RWA / Total Assets	Credit Risk: RWA / EAD	Credit Risk: (RWA + 12.5*EL) / EAD	Credit Risk: [RWA + 12.5* (EL + STA Prov.)] / Gross EAD
Standardised banks	60.3	57.1	57.1	98.4
IRB banks	53.7	49.1	63.1	77.3

SOURCE: Banco de España.
NOTE: The table shows various RWA density ratios for the Spanish banks applying the standardised approach and for those authorised to use the IRB approach, on an aggregate basis for each group and using confidential data as at June 2011.

risk, considering only the risk of unexpected losses. However, it seems reasonable to take into account not only this risk, but also the risk of expected losses, as in the last two ratios. The first of them incorporates the expected losses from the exposures treated under the IRB approach, but this is still incomplete and inconsistent, since only unexpected losses are included for exposures under the standardised approach (the rule does not require an explicit calculation of expected losses). The last ratio remedies this defect by using the assumption implicit in the standardised approach (expected losses are covered by provisions) and equating the expected losses under this approach to the provisions set aside. This ratio seems to be the most suitable one, within its limitations, for comparing banks which apply different approaches to calculate their regulatory capital requirements for credit risk.

Examination of the results obtained shows that most of the calculated ratios are, on average, higher in standardised banks than in IRB banks. The exception is the ratio which includes the IRB expected losses but not an approximation of EL for standardised banks. As noted above, this ratio is not totally suitable for comparing or aggregating banks or portfolios subject to different approaches because of the asymmetrical way in which it treats the standardised and IRB approaches. In the last of the ratios shown, it can be seen that, when a reasonable estimate of the EL for exposures under the standardised approach is included, the estimation of the "density of RWA" increases considerably for Spanish standardised banks, and clearly exceeds that for IRB banks.[19] This is consistent with the incentives established in Basel II.

Portfolio-level comparisons of the capital requirements of Spanish IRB banks are conducted periodically for their business in Spain in order to detect possible inconsistencies in the calculation of RWA. In this comparison, the dispersion of which is much lower than that in the international comparison, the differences can be attributed mostly to the different risk profiles due to the relative weight of the various portfolios and the quality of their component assets.[20]

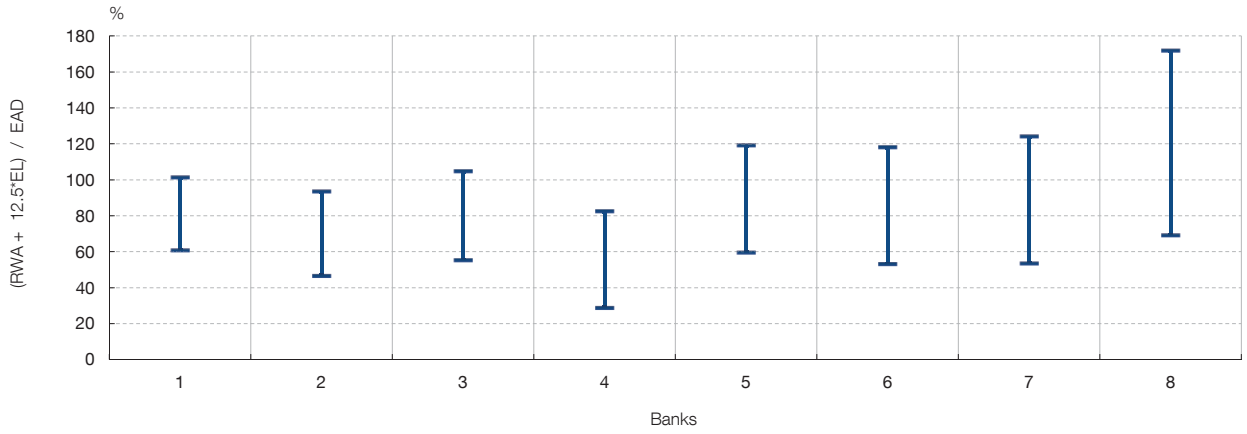
To illustrate to what point the portfolio structure alone can affect density ratios, in this case specifically the third ratio in Table 1 above, restricted to IRB portfolio data, the following simulation was carried out for each bank: the bank's capital charges for each portfolio were maintained, but the portfolio structure (with different weights in terms of EAD) of the other IRB banks was applied, thus changing the total value of the ratio[21]. The minimum and maximum capital charges for each bank resulting from this simulation were taken. The results are shown in Chart 3, where in many cases the maximum value reaches twice the minimum, illustrating to what extent the risk profile – only in relation to portfolio structure – can affect these ratios. And this is only one of the possible sources of differences mentioned in Section 2, which evidences the limitations of the RWA density comparisons between groups of heterogeneous banks seen in numerous studies.

19 The ratio also increases for IRB banks because a portion of the credit risk of these banks is treated under the standardised approach.

20 Other explanatory variables of possible differences may arise in other studies. These variables, which are mentioned in Section 2, are either isolated or without effect in the Spanish comparison. They refer to the type of bank (basically commercial), geographical area (only exposures in Spain), scope of analysis (only credit risk by the IRB approach) and accounting regulations and validation process (the same for all the banks analysed).

21 For instance, for bank 1 we substitute its portfolio mix for the portfolio mix of bank 2, but retaining the average requirements for each portfolio of bank 1 and we calculate a simulated ratio for bank 1. Repeating this simulation with the portfolio mix of the rest of the banks, we obtain a set of simulated ratios for bank 1, in addition to its true ratio.

IMPACT OF PORTFOLIO STRUCTURE ON IRB CREDIT RISK REQUIREMENTS CHART 3



SOURCE: Banco de España.
NOTE: The chart illustrates the effect of portfolio structure on density ratios, in particular on the ratio that considers RWA and also expected losses in the numerator and uses exposure at default in the denominator. Confidential June 2011 data of the IRB portfolios of eight Spanish IRB banks are used. The vertical bars represent the range of possible values of the ratio when the portfolio structures of all banks are applied to the risk weights and expected losses of every bank.

5 Supervisory validation of IRB approaches in Spain [22]

Irrespective of its complexity, the best regulation is useless if it is not applied correctly. Hence the importance of adequate supervision. In Basel II, the incorporation of greater sensitivity to risk and the possibility of applying a range of approaches depending on the level of development of risk management has certain implications. First, the supervisory task is more complex and its implementation and monitoring require greater consumption of supervisory resources. Second, this greater complexity may make comparisons between banks difficult. However, the solution should not be to return to arrangements that were less sensitive to risk, but rather to strive for more uniform implementation. The alternative of a less complex system does not guarantee greater comparability in terms of risks taken; it may be recalled that under Basel I exposures with very different levels of risk had the same capital requirements.

At the same time the advantages entailed by the introduction of Basel II should not be forgotten. The quantity and quality of the information available to analyse banks' exposures are much higher than before its introduction. As a result, analyses can be performed that, despite their limitations, are deeper and more revealing than would have been the case if Basel I were still in place and banks had developed internal models with little comparability and not subject to supervisory validation.

Under Basel II, banks may use their models to calculate capital requirements only if they comply with a number of minimum requirements and they have first been validated and authorised by the supervisory authority. Here, as in the case of other types of supervisory tasks, differences between jurisdictions remain. Although the scope of supervisory validation work tends to be the same for many supervisors and generally covers the revision of methodologies, documentation, data quality, the technological environment and quantitative and qualitative aspects, its focus and intensity differs. This section presents some of the main characteristics of the validation process in Spain.[23]

Supervisory validation of models in Spain commenced following the publication of Basel II in June 2004, and the first phase culminated in 2008 with the approval of the use of the

22 Although many of the comments in this section are applicable to the supervisory validation of models to measure different kinds of risks, the section refers to credit risk models in particular.

23 See Banco de España (2006) for details of the Basel II implementation process in Spain and of the validation of advanced approaches.

IRB approach by eight Spanish banking groups. Since then the IRB approach has been rolled out across portfolios, including those of their subsidiaries abroad in coordination with host supervisors. So-called mixed validation teams were created to carry out this validation, consisting of staff responsible for the regular inspections of each bank and staff specialised in risk measurement models. The approach applied is characterised by its global view of all the essential elements of an advanced risk management system, by its intensity, both in terms of the number of staff involved and its duration, and by being performed mainly on-site, at the banks' headquarters.

At the end of the validation process it should be possible to answer three key questions in the affirmative:

- The first is whether the bank's models contribute to daily risk management. To answer this question, among other aspects assessed are their internal uses, besides their regulatory ones, and the participation of senior management in the whole process.[24]

- The second is whether the models produce outputs that are adequate for their regulatory use. Here, not only the methodologies but also the quality of the information are reviewed.

- And finally, whether the bank has a structure of internal controls that guarantees the correct functioning of its models in the future, with special attention being given to the role played by internal validation units[25] and internal audit.

Although the questions are simple, they cannot be answered without a profound knowledge of the models and the data fed into them, and also of the bank's risk management and its technological environment. Two validation tests stand out here which consume a large amount of resources, but which have proven to be enormously useful for answering those three questions and have shown the importance of descending to a very detailed level to be able to understand banks' capital estimates and the great impact that apparently "minor" factors may have. These two tests are data checking and replication exercises.

Data checking

One of the key elements, and the largest source of incidents detected by far, is the quality of the databases. Given that scoring models (or rating systems) and risk parameters, whether internal or regulatory, are obtained by applying estimation procedures to data, the quality and reliability of such data need to be assessed. This is a necessary but not sufficient condition for obtaining models and estimates that are also adequate and reliable.

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24 It is worth highlighting that the main aim of developing internal models should be to improve risk management. For this reason, a basic requirement for the regulatory use of models is that they must be integrated in day-to-day risk management and be part of the bank's culture. This requirement is commonly known as the "IRB use test". However, integration does not mean that models outputs for management and regulatory purposes must be the same. As has been stated by the Basel Committee on Banking Supervision (2006), "measures used for internal processes may reasonably differ from IRB components in some instances… Where such differences exist, banks should demonstrate good reasons for use of parameters that do not match IRB components. The supervisory objectives of the use test could be met if banks demonstrate that the degree of consistency between the IRB components and the internal estimates is sufficiently high as to contribute to continuous quality pressure on the IRB components. In this context, consistency might be demonstrated by establishing clear linkages between the internal inputs and the IRB components, showing that any differences reflect legitimate risk management needs."

25 See Banco de España (2007) for the criteria that banks' internal validation units are expected to meet.

This data checking is generally carried out in two ways:

- Consistency and coherence with other databases of the bank. Thus, inter alia, the data are checked against the original systems and databases (loans, cards, etc.) and the accounting information. Also, the information controls and filters existing in the different sample creation processes are analysed, whether they are for building the model or for calibrating the risk parameters, as well as the information treatment protocols.[26] Special emphasis is placed on the replicability of the data.

- Review of physical files: not only enables the assessment of the reliability of the information (model variables, collateral data, recovery cash flows, etc.), but also the evaluation of the monitoring of the internal management procedures established, the relevance of models when granting credit facilities and the effectiveness of controls.

Replication exercises

Replication exercises generally consist in verifying the reality of the various outputs presented by the bank in its estimates, starting from internal databases and carrying out the operations and treatments reflected in the documentation. There are three different areas in which this type of task is performed:

- Construction of scoring models or rating systems.

- Calibration of risk parameters (PD, LGD, etc.).

- Regulatory outputs (capital requirements and expected loss amounts).

In Spain replications have focused on the latter two areas. As regards scoring models and rating systems we rely on the control procedures that their use should entail because, as they ought to be used to approve credit facilities, set prices and for other management practices, the bank itself is the main party interested in their proper functioning and in adapting them to changes, so as to ensure that they retain sufficient discriminatory power.[27] Moreover, if there is any problem in the ranking of exposures it will be detected in the replication of the risk parameter calibration.

Replications in the area of parameter calibration help to answer the question of whether the calculated outputs are appropriate, and seek:

- To detect gaps in the documentation.

- To provide a sufficient understanding of the estimation processes and hypotheses assumed, as well as to assess their importance and reasonableness.

- To check compliance with the minimum requirements established in the regulations.

Replications have also highlighted the importance of the details in the estimation processes, many of which are not incorporated into the documentation, so that it would

26 For example, the treatment of outliers and of zero or absent values.
27 In any case, partial replications are sometimes performed, in relation to the discriminatory power measures.

not be possible to be aware of their existence and assess them without carrying out these exercises. In our experience, taken together, they normally have an important impact on the final estimates.

As regards the calculation of the regulatory outputs (capital and expected losses), the aim of the replication tasks is to check that the bank's calculations are correct. The revision of the capital requirements that banks must regularly report to their supervisors has become a complex task, and certainly much more so than in the case of banks that apply the standardised approach. Replicating the capital calculations has the following objectives:

- To check that the bank is using for its capital calculations the approved set of regulatory parameters, and that the segmentation of the exposures and the capital curves applied are correct given the characteristics of each operation.

- To analyse the changes in capital requirements and expected loss amounts, trying to identify the causes of such changes: portfolio changes (migrations, new transactions...), parameter recalibrations or other relevant changes.

Finally, once the models have been approved it is necessary to design a structure for monitoring them so as to be able to check that the answers to the three basic questions of the validation process remain in the affirmative. Models are dynamic and must be adapted to changing reality and improved, as more and better information becomes available, which means they must be carefully maintained. This monitoring task has proven to be more costly in terms of supervisory resources than initially expected.

In Spain, model monitoring is based on the following elements:

1 Periodic information that banks must send or keep updated and available to the supervisor: the monitoring dossier, model-based internal validation reports and internal audit reports on use tests, databases and the technological environment. In addition, obviously, the sending of official solvency returns.

2 Continuous review of parameter recalibrations, including the related internal validation reports.

3 Cross-sectional analysis, both at the bank and portfolio level.

4 Prior notification of those changes that are considered relevant, in relation to models, essential parameters and the risk management system.

The importance that we already attributed, at the time of the first approvals, to internal control procedures and to the need for tight control over models and parameter estimates has been clearly confirmed by our experience over the last four years of severe crisis. This situation, and the policy changes and management decisions made by banks, have substantially modified the calibration samples used to estimate parameters, so increasing the importance of their detailed review. In addition, regulatory changes, especially those seeking to increase the quality of eligible capital, have, as discussed, increased the pressure on the denominator, and therefore on the parameter estimation processes. However, the monitoring scheme described has enabled supervisors to see the true nature of so-called "model optimisation", a very trendy topic along with RWA comparability. While

naive comparisons with similar banks seemed to be enough to endorse certain changes in models, it should be clearly stated that any change must be justified in terms of actual portfolio risk.

We believe that the Banco de España's supervisory validation process is appropriate, given the possibilities that use of the IRB approach allows for offering disparate results for portfolios that are similar from the point of view of their risk profile. Although it is difficult to know the extent to which the possible heterogeneity in this sense is affecting the comparability of RWA and the level playing field at the international level, we consider that it is necessary to homogenise further supervisory validation processes and the interpretation by the supervisory community of certain key aspects of estimation procedures. Steps are already being taken in this direction, such as the work at the European level to develop binding technical standards and the intention to reduce substantially the areas of national discretion. In addition, Basel and European working groups have been set up to analyse the consistency of RWA.

At the same time, it should be noted that when the scope of the models encompasses subsidiaries of Spanish banks in third countries, or subsidiaries in Spain of international banks, validation processes are performed in close collaboration with the relevant supervisors. This collaboration takes the form of joint reviews of models, with a division of labour that seeks to exploit the synergies arising from the specific knowledge of each supervisor and to avoid a duplication of work that may impose excessive costs on banks. The channels of communication and cooperation established with other supervisory authorities during approval processes serve, without a doubt, to increase the homogeneity of Basel II implementation, since both supervisors must feel comfortable with the model results at the end of the validation.

6 Summary and conclusions

In order to analyse the consistency of risk-weighted assets in the context of solvency regulations, comparisons in terms of the so-called RWA density – the ratio between a bank's total regulatory weighted assets and its total balance sheet – have proliferated. The revelation of notable differences in the value of this ratio across banks and countries has led some studies on the subject to conclude, one could say denounce, that RWA are not calculated consistently, and that there are significant, and unwarranted, differences in the calculation methodologies used by the banks and in the criteria of supervisors.

This article analyses the problems of this ratio, including its intrinsic inconsistency and the fact that very different business structures are considered. An international comparison is made of 16 European banks, which concludes that a significant part of the greater RWA density of banks is a consequence of the type of business. In particular, the greater the weight of credit risk in the balance sheet the greater the RWA density. In addition, the dispersion is reduced if we limit the scope of the comparison to the ratio of RWA to EAD in IRB portfolios.

Also, alternative RWA density ratios are proposed and the best way to relate a measure of risk to a measure of exposure is discussed. It is concluded that to be able to make a more appropriate comparison one must restrict the sphere to which it is applied. The article focuses on credit risk and shows that it is not sufficient to compare RWA, but that in the case of IRB banks, at least, expected losses must be included and, if the aim is to make a comparison with standardised banks, the different treatment of provisions should be considered. A comparison is presented for the Spanish case, showing that IRB banks have

a lower RWA density than standardised banks, which is consistent with the Basel II incentives. An example of the very important impact that the portfolio structure can have on RWA density ratios is also offered.

The possible sources of RWA differences are analysed, specifically differences in risk profiles, in the amount of progress made in applying advanced approaches and those permitted by the rules themselves, as well as differences of interpretation by banks and the heterogeneity of the supervisory validation processes. The conclusion drawn is that, unfortunately, it is not possible to determine from public information how much of the differences arises from each source, and that, although Pillar 3 could be improved, in particular in terms of comparability, it is doubtful whether it could ever offer sufficient detail to permit adequate cross-bank comparisons. As in other areas, there are certain aspects that can only be assessed by supervisors, not only because the information needs to be so detailed, but also because confidential information may need to be assessed.

Accordingly, the supervisory review process acquires particular importance, especially considering the quantitative importance that issues regarded as details may have, and therefore it is essential that the harmonisation of supervisory validation processes be increased. The main characteristics of the validation and monitoring carried out by the supervisor in Spain of banks with authorised internal models are presented. An adequate level of knowledge of the models of such banks is considered to have been achieved so that most of their differences can be explained in terms of different risk profiles.

Finally, two important aspects should be stressed. First, the Basel II rules are more complex than those of Basel I and consequently more supervisory resources are needed to monitor them. Second, this greater complexity can make comparison of the capital requirements across banks difficult, and their specific implementation in different countries may involve different criteria or different degrees of strictness in certain aspects. However, the solution must be to achieve greater uniformity in their implementation. The alternative of a less complex system would not guarantee greater comparability in terms of risks taken; it should be recalled that under Basel I exposures with very different levels of risk had the same capital requirements. Risk insensitive measures only lead to greater regulatory arbitrage and distortion of competition. In this respect, models continue to play an essential role, although, as always, their limitations should not be forgotten.

The advantages entailed by the introduction of Basel II should not be overlooked. Both the quantity and quality of the information available to analyse banks' risks have improved greatly since its introduction, with the resulting synergies, both for banks, in their risk management, and for supervisors, in their various monitoring tasks. Consequently, analyses can be performed which, despite their limitations, are more profound and revealing than those that would be possible if Basel I were still in force.

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