The treatment of SMEs loans in the New Basel Capital Accord: some evaluations*

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1. Introduction

In April 2003 the Basel Committee on Banking Supervision (BCBS) has released a third consultative paper (CP3, or Basel II) on a proposal for a new Accord on banks' capital; the proposal follows an earlier one, published in January 2001 (CP2). The reform process has been undertaken in response to the increase of financial innovation in banking products and enhancement in the measurement of banking risks, which have pointed out some inadequacies in the simplified framework underlying the 1988 Accord (the 'current Accord', or Basel I).

Among the key objectives of the proposal are a better alignment of capital adequacy assessments with the key elements of banking risks (higher risk sensitivity), the strengthening of financial stability and the provision of incentives to banks to enhance their risk measurement and management capabilities (incentive compatible regulation). As is well known, the proposal is based on three pillars – minimum capital requirements, a supervisory review of banks' capital adequacy, market transparency – and foresees a plurality of methods to calculate capital requirements, according to the degree of development of banks' risk management systems (evolutionary approach). With specific reference

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to credit risk measurement, banks can use their own internal assessments of borrowers' credit quality (internal rating based approach, IRB) for the determination of capital requirements as an alternative to a standardised approach based on the assessments of external rating agencies.

The January 2001 proposal stimulated a debate among academics, practitioners and supervisors. More than 250 comments have been made on this proposal. On the one hand, support has been expressed for the overall reform plan, specifically the goal to obtain a higher risk sensitivity in capital requirements, the articulation of the proposal in three complementary pillars and the desire to provide incentives to improve risk management systems; on the other hand, improvements were requested regarding the too conservative calibration of overall capital, the link between loan provisioning and expected losses, the potential increase in procyclicality that may derive from the application of the proposal, the too severe treatment foreseen for loans to small and medium size enterprises (SMEs).

The continuous interaction of regulators with the industry and the quantitative studies conducted by the Committee in order to assess the likely impact of the new regulation have served as a basis for the various changes contained in CP3.

There have been more than 200 comments to CP3. The responses indicate that there is continued broad support for the structure of the new Accord and agreement on the need to adopt a more risk sensitive framework. However, in light of the comments received, in October 2003 the Committee has proposed a further change to the way in which expected losses and provisions are considered in the framework. The Committee has declared that the outstanding issues should be resolved no later than mid-year 2004; the Accord should be implemented by end 2006 in national jurisdictions.

The aim of this paper is to analyse the treatment of SME loans under the Basel II framework and provide an empirical evaluation of its impact on Italian corporates. Given the complexity of the issues involved and the data limitations, the results have to be taken carefully. However, our simulations indicate that the prudential treatment foreseen in CP3 for loans to SMEs is not penalizing with respect to the current situation. Therefore, we should not expect a reduction of credit or an increase in interest rates on loans to this type of borrowers.

The rest of the paper is organised as follows. In section 2 we briefly review the main factors to consider in the measurement of credit risk under the IRB approach and examine the main components of the risk weight formula contained in CP2; in section 3 we examine the comments made by the industry and the changes to the calibration of capital charges, as reflected in the CP3 document, with particular regard to SME loans; in section 4 we look at the differential impact of the different regulatory proposals (CP2 and CP3) on a hypothetical portfolio of non financial firms; we then try to assess the impact of the latest draft regulation on the universe of loans to non financial firms and to SME in particular. Section 5 draws some conclusions.

2. Credit risk measurement and the IRB approach

The focus of credit risk measurement is to obtain some measure of the dispersion of possible future outcomes. From a risk management and regulatory point of view the likelihood of large losses is more important than the entire distribution of possible future outcomes. This is confirmed by the widespread use among industry participants of value-at-risk based models which, although with different structures and assumptions, all tend to measure the potential credit loss of a portfolio at a predetermined confidence interval and within a set time horizon. The common characteristics (risk components) incorporated implicitly or explicitly in the various models, and which also underlie the IRB approach for the calculation of regulatory capital, are: *a*) a set of criteria for rating loans and mapping these ratings into probabilities of borrowers defaulting (PDs); *b*) estimates regarding the loss rate in the event of default (LGD) and the exposure at default (EAD); *c*) an estimate of the effect of the maturity of the exposure on risk; *d*) assumptions regarding the correlations of PDs across borrowers and between PDs and LGDs.

The regulatory proposal foresees two IRB approaches for the corporate portfolio, according to the ability of the bank to provide accurate estimates of some or all the risk drivers.[1] Under the 'founda-

[1] The treatment of corporates, bank and sovereign portfolios is the same; separate treatments are foreseen for retail and equity portfolios. For retail assets there is

tion' IRB approach, banks satisfying a set of minimum eligibility requirements will be allowed to input their own assessment of the probability of default associated with the borrower. The values of the other risk factors, such as EAD, LGD, and maturity are determined by supervisors.[2] As regards LGD, senior claims on corporate borrowers without specifically recognised collateral will be assigned a value equal to 45% of the nominal exposure (50% in CP2). The value of the LGD associated to specified types of financial or real estate collateral, provided they satisfy a set of eligibility criteria, is also established in the regulation. In the 'advanced' IRB approach EAD, LGD and maturity are instead determined by banks.

To be eligible for the foundation IRB approach, a bank should estimate the probability of default associated with borrowers in each of its internal grades. On the basis of a survey conducted at a number of multinational banking organisations, the proposal establishes that qualifying risk-rating systems should have a minimum of 7 grades for performing borrowers and 1 grade for non-performing ones. A set of operational requirements has to be followed. In the first place, borrowers should be rated at least annually; secondly, the assignment to grades has to reflect the assessment of risk factors for the future horizon based on current information; thirdly, for quantification purposes the PD of each grade has to remain valid over the following year; fourthly, the PD has to represent a conservative average over a long period of time.[3]

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only an advanced approach, therefore banks have to estimate all the risk drivers. Within the corporate asset class, five sub-classes of specialised lending are separately identified, while within the retail asset class three sub-classes are identified; finally, within the corporate and retail asset classes a distinct treatment for purchased receivables may also apply under certain conditions.

[2] In particular, EAD for on-balance-sheet exposures equals the nominal outstanding amount. Off-balance-sheet items have to be estimated using the credit conversion factors provided in the standardised approach, with the exception of undrawn commitments, whose value is set at 75% of the undrawn exposure amount. As far as maturity is concerned, all exposures would be treated as having the same assumed average maturity, set at 2.5 years in CP3 (3 years in CP2); in CP3 there is also the possibility for national supervisors to allow all banks to use their own estimates of maturity in the IRB foundation. For further details see BCBS (2001a, 2002b and 2003a).

[3] For a more detailed and complete analysis of the characteristics of the Basel Accord second consultation document, in particular of the IRB approach, see Carosio (2001) and Laviola (2001).

In the 2001 consultative document, capital requirements for corporate exposures were calculated according to the following formula:[4]

$$K = LGD \cdot 1{,}56 \cdot \Phi\left[\left(1.118 \cdot \Phi^{-1}(PD) + 1.288\right)\right] \cdot \left[1 + 0.047 \frac{1 - PD}{PD^{0.44}}\right]$$

Conceptually, the formula can be divided into four parts: *i*) the loss rate (LGD); *ii*) a scaling factor (1,56) to take into account PD measurement errors and the lower loss absorbing capacity of tier 2 with respect to tier 1; *iii*) the estimate of expected and unexpected losses, based on the information produced by a group of international banks about the capital requirements implicit in their systems of economic capital allocation, as well as on simplified versions of state-of-the-art portfolio models. In this part of the formula there are two important assumptions, that is, the assumption of a confidence interval of 99.5% and of a single correlation across exposures of 20%; *iv*) a correction to take into account the maturity of the exposure, in order to transform the capital charge of a one-year maturity exposure into one with three-year residual maturity.

The formula is designed to cover both expected (EL) and unexpected losses (UL). As regards the correlation between PD and LGD, in the IRB approach the two variables are assumed to behave independently.[5]

In the IRB formula contained in the January 2001 consultative document, risk weighted assets, and thus capital requirements, increased with the probability of default, the loss given default, the asset correlation and, in the advanced IRB approach, the maturity of the exposure.

The formula proposed in January 2001 delivered an 8% capital requirement (the *current minimum requirement*) for a benchmark unsecured corporate loan having a 0.7% PD, a 50% LGD and a three-year maturity.

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[4] See the Annex for the analytic derivation of the formula.

[5] However, recent studies have indicated the existence of a positive correlation between PD and LGD; see for example Altman, Resti and Sironi (2002), Perraudin and Hu (2002) and Frye (2000). Supervisors have indirectly tried to account for the correlation between the two variables by requiring that in the advanced approach banks calculate LGDs from historical data on a default-weighted basis, rather than averaging the yearly LGDs. This provision should yield more conservative estimates of LGDs.

3. Industry comments to CP2, modifications to the risk weight formulae and results obtained

3.1. *Industry comments*

There have been more than 250 comments on the January 2001 proposal, coming from financial institutions, other market participants, national authorities.

The financial community has appreciated the flexibility of the new framework and the goal to obtain a higher risk sensitivity. The possibility of allowing the use of banks' internal methods as a basis for the determination of capital requirements has attracted most attention. However, the industry has underlined that the structure of incentives incorporated in the proposal had to be improved. According to a large number of banking organisations, the overall calibration of capital requirements delivered an excessive amount of capital. This was not consistent with the objectives that the Committee had explicitly declared, that is, *a*) maintaining an overall amount of capital, inclusive of operational risk, equivalent to the 1988 Accord for banks adopting the standardised approach and *b*) providing banks with incentives to move to the more advanced approaches for credit and operational risk.

The Basel Committee has also conducted a number of in-depth Quantitative Impact Studies (QIS) at a wide sample of banks belonging to many countries (G10 and non G10) in order to assess the effects of the new regulatory framework. The results of the second impact study (QIS2) confirmed that capital charges under the standardised approach tended to exceed those obtained under the 1988 Accord. Moreover, capital requirements computed according to the foundation IRB approach turned out to be higher than those produced under the revised standardised approach.[6]

The introduction of too many capital cushions and the calibration of capital on the sum of EL and UL were frequently mentioned as factors responsible for such a result. Furthermore, the shape of the risk weight curve in the IRB approach for the corporate portfolio, whose steepness rapidly increased with higher PD values, was deemed responsible for the potential procyclicality effects of the proposed regulatory framework and for the too harsh treatment of loans to

[6] See BCBS (2001b).

SMEs. Finally, the allocation of regulatory capital for the coverage of operational risk was critized as being too large.[7]

With reference to the *EL treatment*, it was argued that it did not recognise the specific provisions made on loans to offset the capital requirements, nor the general provisions not included in supplementary capital.[8] This would not encourage adequate provisioning policies and could create competitive disadvantages for banks subject to more rigorous prudential standards.

As regards the *procyclicality* issue, the influence of capital regulation on the potential propensity of the banking system to increase macroeconomic fluctuations is a theme often addressed in the economic literature, but it has been rarely possible to come to clear-cut conclusions. While it is widely accepted that the banking system is inherently procyclical, it has not been possible to establish a clear link between binding capital requirements and macroeconomic outcomes.[9] However, with the new regulation a potential fluctuation of capital requirements over the business cycle is to a certain extent an inevitable result of the higher risk sensitivity.[10] Since the publication of CP2 the issue of procyclicality has therefore stimulated a great debate in the literature.[11] In our opinion, the new regulatory proposal could be blamed for increasing the traditional procyclicality of banks' lending policies only in the case in which the assessment of credit risk implicit in the new capital requirements would substantially differ from the banks' perception of risk as reflected in the interest rates they currently charge to borrowers.

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[7] For a review of the comments made on the January CP2 see Cannata and Laviola (2001).

[8] It has also been argued that the regulation should recognise the availability of future margin income to offset the EL, at least for the portfolios where the latter is more easily forecasted and incorporated in prices.

[9] See for example Jackson *et al.* (1999).

[10] In the current regulation there can be a lower contribution of earnings to capital as a consequence of the greater losses during a downturn; with the new proposal there would be a fluctuation also in the risk weighted assets, given the migration of borrowers to higher risk classes.

[11] Many papers have recently addressed the link between credit risk measurement and procyclicality of the financial system, both from a theoretical and empirical point of view; see, among others, Allen and Saunders (2003), Ayuso, Pérez and Saurina (2002), BCBS (2001c), Borio, Furfine and Lowe (2001), Catarineu-Rabell, Jackson and Tsomocos (2003), Danielsson *et al.* (2001), ECB (2001), Ervin and Wilde (2001), Estrella (2001), Jordan, Peek and Rosengreen (2002), Lowe (2002), Resti (2002), Segoviano and Lowe (2002).

The main cyclical element in credit risk measurement comes from ratings migration; both internal and external credit ratings improve during phases of economic expansion and deteriorate during contraction, so that measured risk falls in good times and increases in bad times. Therefore, the level of capital required by the new proposal will likely rise in economic downturns and fall in expansionary phases. The changes can be more pronounced to the extent that rating systems rely on market based information (e.g., the method used by the consultant company founded by Kealhofer, Mc Quown and Vasicek, known as KMV) as opposed to relying on the methods employed by credit rating agencies (through-the-cycle ratings). Banks use a variety of rating systems; some are similar to the approach followed by KMV or to that of rating agencies. Many banks use however systems that are in-between, whereby the PD is derived from internal models or from expert judgement systems relying heavily on the experience of credit officers. In the latter case, it is not clear how much the raters take into account the future evolution of the state of the economy.

On the other hand, the use of more accurate rating systems will likely bring about improvements in risk management practices; therefore, deteriorations in credit quality should be detected earlier than in the past, and the bank could take the appropriate measures. Moreover, even though the regulation does not impose to rate borrowers through-the-cycle, it encourages banks to take greater account of uncertainty in economic conditions. In the longer term, banks could choose to run their internal rating processes in a way that incorporates greater provision for unexpected events.

As for *SMEs loans*, most of the commentators argued that the risk weight curve was too steep and too high, which induced too high risk weights for most of the SMEs, due to their relatively higher probabilities of default. There was the fear that too large capital charges for SMEs could induce banks to ration credit to these firms. Concern was expressed also by central banks and supervisory authorities, due to the fundamental role SMEs play in many countries from the point of view of production, exports and employment.

A better graduation of the risk weight curve to reflect the characteristics of this type of borrowers, for example through the introduction of a parameter in the risk weight formula in order to take account of firms' size, or a separate treatment (a separate risk weight

curve with a lower, fixed value of the asset correlation) were requested by some industry participants.[12]

3.2. *Modifications to the risk weight formulae: procyclicality, SME and asset correlation*

In order to deal with the issues highlighted above, in its third consultative document (CP3) the Basel Committee has made various changes to the January proposal. The charge for operational risk has been reduced from 20 to 10-12% on average. As for credit risk, the main modifications concerned adjusted risk-weight functions for corporate and retail portfolios and a revised treatment of provisions. The changes have been made in the context of the simplified theoretical framework outlined in the Annex, that is, the single risk factor model, in order to be consistent with industry credit risk modelling techniques.

With reference to the corporate portfolio, in the first place the capital cushion designed to take account of measurement errors and of the different loss absorbing capacity of capital elements has been abandoned, but the maintenance of the levels of prudence is guaranteed by an increase in the solvency standard (confidence interval) from 99,5 to 99,9%. This modification has the advantage of increasing the requirement only for the UL component (unlike the capital multiplier which applied to both EL and UL) and of contributing to a modest decrease of the degree of potential procyclicality (the capital cushion had instead the effect of amplifying the potential cyclical effects associated with the borrowers migration, given that it multiplied both loss components).[13]

In the second place, the reduction of the potential for procyclicality and the achievement of a more balanced treatment of loans to SMEs have been obtained by making the asset correlation a decreasing function of PDs and an increasing function of firms' size.

The hypothesis included in the CP2 calibration of a fixed, fairly high value of the average asset correlation (20%) was adequate only for portfolios including loans to large firms and of very high quality. Indeed, while there is no limit to the increase of riskiness due to spe-

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[12] See for example IIF (2001), ISDA (2001), ABI (2001).

[13] The increase in the solvency standard raises only UL, which is much higher for highly rated borrowers (low PDs) with respect to riskier counterparties; it therefore contributes to a reduction of the inclination of the risk weight curve.

cific factors of the borrowers, even for low risk borrowers systematic risk cannot be eliminated. Therefore, for the latter ones systematic risk is relatively more important in determining default with respect to riskier borrowers. This implies a negative relationship between probability of default and asset correlation.

Lopez (2002)[14] has found support for a negative relationship between asset correlation and PDs; his results suggest that, when firms deteriorate (high PD), the idiosyncratic elements are proportionately more responsible for the deterioration, relative to the systematic factors. Other studies have not found support for this relationship, after controlling for firm size (Dietsch and Petey 2003, Dullmann and Scheule 2003). The negative relationship between PD and correlations may however be justified by the desire to reduce the potential procyclical effects of the new Accord.

As regards SMEs, it has been argued that small firms usually have a higher probability of default but are relatively less sensitive to the evolution of the macroeconomic framework, while large enterprises tend to behave in the opposite way. To understand why size can be considered as a risk factor, one can think of a firm as an ensemble of activities and assume that as firm size increases so do the different activities undertaken; a large firm should therefore benefit from a diversification effect, with a larger influence of the general economic conditions and a lower weight of the specific riskiness of the individual activities undertaken. As a consequence, small firms' loans tend to be riskier because of firms' own specific characteristics (larger weight of idiosyncratic elements); this implies that the effect of systematic risk on their financial conditions is proportionately lower. Thus, for a given PD of individual borrowers, a portfolio of loans to SME is less risky than one of loans to large firms, because the asset correlation is lower.

Empirical studies on the relationship between firm size and correlation have been made by Lopez (2002),[15] Sironi and Zazzara (2002), Cannata, Grippa and Laviola (2001) on Italian data, Dullmann and

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[14] Evidence of an inverse relationship between asset correlation and probability of default has also been found by a large Spanish bank.

[15] In the bivariate analysis made by Lopez, when one controls for the size variable, the fall in asset correlation with PD is quite small with respect to SMEs; for large firms the asset correlation continues to decline with PD, but it has been argued that this might stem from the specific sample of firms considered (see Ieda 2002). Evidence of a positive effect of firms' size on asset correlation has also been found by several banking institutions, as well as by Cannata, Grippa and Laviola (2001).

Scheule (2003) on German data, Dietsch and Petey (2003) on German and French data, Masschelein (2003) on Belgian data. All the studies find a positive relationship, except in Dietsch and Petey's where the opposite is true.

As regards the actual values of the correlations, the studies show rather different results. As an example, in the Lopez study, where the author has constructed portfolios of American, European and Japanese firms listed on the exchanges and has calculated asset correlations starting from equity returns and using the KMV methodology, the estimates of the correlations are quite high, in certain cases even higher than what has been assumed in Basel II; in the RMA (2003) study on US retail products, asset correlations for small business loans are lower than those determined by Basel II at the low-PD end, higher at the high-PD end; by contrast, all the other studies, made on European data and using historical default rates, have found that correlation estimates are quite low, and in most cases lower than in Basel II.[16] The latter results may be due to a variety of reasons, including the definition of default used,[17] which is less severe than that one contained in Basel II, the fact that the correlations were often calculated from a very large sample of firms, while banks' portfolios contain normally fewer exposures, finally the estimation bias deriving from the short time series of data used.[18]

In summary, there is not a unique theoretical or empirical answer as to what the value of the average asset correlation should be. However, empirical studies regarding the relationship between firm size and correlation show that, although the levels of the correlation are not always in line with the Basel II proposal, they all confirm the ranking of the correlations as those assumed in the new Accord.

In the April 2003 consultative document the formula for risk weighted assets of *large corporates* in the IRB approach is:

$$RWA = K \cdot 12.5 \cdot EAD,$$

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[16] Similar results have been obtained by some Italian, German and Japanese banks.

[17] All the European studies define default as the state of 'legal bankruptcy' of the borrower, except Cannata, Grippa and Laviola (2001), who use the banks' classification of non performing loans (*sofferenze*).

[18] To estimate reliably asset correlations one would need between 20 and 30 years of annual default rates in each rating bucket. Dullmann and Scheule (2003) and Cannata, Grippa and Laviola (2001) correct for the small sample problem using the maximum likelihood estimator of the asset correlation proposed by Gordy and Heitfield (2000) in the context of the one factor model.

where the capital requirement (K) is

$$K = LGD \cdot N\{(1-\rho)^{-0.5} \cdot G(PD) \cdot [R/(1-\rho)]^{0.5} \cdot G(0.999)\} \cdot [1 - 1.5 \cdot b(PD)]^{-1} \cdot [1 + (M - 2.5) \cdot b(PD)]$$

In this formula,[19] the asset correlation is an exponentially weighted average of two extreme values, 24 and 12%, in function of the probability of default;

$$\rho(pd) = 0.12[(1 - e^{-50pd})/(1 - e^{-50})] + 0.24\,[1 - (1 - e^{-50pd} / 1 - e^{-50})];$$

the expression after the square brackets is the maturity adjustment, where the term *b(PD)* is: (b) = $[0.08451 - 0.05898 \cdot \log(PD)]^2$.

With the new function the threshold for neutrality *vis-à-vis* the 1988 Accord shifts from a 0.7% PD to a 1.0% PD. Relative to the January CP2, this modification has two effects: *a*) it reduces the capital requirement, especially for below-investment-grade borrowers, allowing indirectly to take partially account of the SMEs issue; *b*) it flattens the curve over a significant range of PD values, reducing the potential for procyclicality.[20] The ratio between the risk weights of a S&P 'C'-rated loan (very risky, but not yet in default) and of a 'AAA–' rated loan was 45 with the CP2 calibration; it has been reduced to 23 in CP3.[21]

The new Accord will also contain a revised *treatment of provisions* which, in addition to promoting prudent provisioning policies, should contribute to reduce the potential for procyclicality. The treatment foreseen in CP2 has been modified twice, the first one in the

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[19] For calibration purposes, in this formula a benchmark senior unsecured corporate loan has LGD=45% and M=2.5. *N(x)* denotes the cumulative distribution function for a standard normal random variable and *G(z)* the inverse of the normal cumulative distribution function.

[20] With reference to a portfolio of loans to firms recorded in the Italian 'Centrale dei Bilanci', it has been shown that, applying the January 2001 risk weights, the maximum variation of requirements over the period 1990-99 would have been 30%; the application of the new set of risk weights would reduce the variation by a third (see Carosio 2002).

[21] In addition to the adoption of a flatter risk-weight curve for corporate credits and to a modification in its guidance for rating processes to encourage banks to take more account of uncertainty over the full economic cycle, the Basel Committee, in order to address more thouroughly concerns over the cyclicality of the IRB approaches, supplemented these measures through a credit risk stress-testing requirement. Banks should conduct reasonably conservative stress tests of their own design, with the aim of estimating the extent to which their IRB requirements could increase during a stress scenario. The results of these stress tests would be used by supervisors in order to ensure that banks hold a sufficient capital buffer under pillar 2 of the new Accord.

CP3 document, the second in October 2003. In CP3, given the cross-country differences in the fiscal and accounting regulations on provisioning, it was still assumed that the capital requirement had to cover the sum of EL and UL in the corporate portfolio; however, the provisions made on loans would be recognised dollar-for-dollar. Specific provisions made on loans classified as non performing according to the proposed definition of default would offset the EL on these loans;[22] general provisions exceeding those already included in supplementary capital (exceeding 1,25% of risk weighted assets) would instead offset the EL portion of capital requirements on performing loans.[23,24]

However, in light of the analysis of the more than 200 comments received on CP3, in October 2003 the Basel Committee has proposed a further modification, e.g. to base the IRB capital requirement solely on the UL portion.[25] At the same time, a separate treatment of EL has been established, with the objective of ensuring strong incentives for banks to provision adequately. Specifically, the positive difference (*shortfall)* between EL on the whole portfolio and the sum of general and specific provisions would be deducted from capital, while the negative difference (excess) would be included in capital with a cap set with reference to risk weighted assets.[26] This treatment of provisioning *shortfall* or *excess* with respect to EL would substitute the

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[22] For defaulted loans it is assumed that PD=1; therefore, the UL=0 and the capital requirement=EL. In the standardised approach it is foreseen that the capital charge on past due loans (12%) may be reduced in function of the level of specific provisions made by the bank.

[23] To the extent that a substantial share of the fluctuation of requirements reflects changes in the EL (in the higher risk buckets the EL component represents an increasing share of the total requirement), the offset of the charge with provisions allows to reduce the overall effects associated to the migration of loans towards lower quality buckets. Indeed, while the deterioration of a loan would always determine a marginal increase in the EL and in the capital requirement, it will be possible to use the provisions already made to partially offset the EL overall requirement. In contrast, with the CP2 method a bank would have faced a marginal increase in the requirement due to the new EL, but could not have used the provisions accumulated before the migration of the loan to the higher risk class. The variation of the requirement (before and after the migration) would have therefore been bigger, increasing the potential for procyclicality.

[24] The reduction in risk weights and the modified treatment of provisions with respect to CP2, as well as other revisions, have been the subject of another quantitative impact study (QIS2.5) in November 2001, which showed a marked reduction in the capital charges, most of all for the corporate portfolio, consistently with the goals of the Committee. See BCBS (2001d and 2002a).

[25] See BCBS (2003d).

[26] See BCBS (2004).

current inclusion of general provisions in tier 2. Under this treatment, given that the capital requirement would mainly be based on UL, there should be a further reduction of the potential procyclicality of the requirements. All interested parties had to produce their comments within the end of 2003.

As regards *SMEs loans in the corporate portfolio*, in CP3 the small size of firms has explicitly been recognised as a factor implying a reduction of capital requirements on loans to non financial firms, everything else being equal. Specifically, loans to firms with annual sales lower than € 50 mln. will attract a capital requirement, for a given PD, LGD and maturity, lower than that relative to larger firms. The capital reduction increases linearly from 0 to 20% with sales going from € 50 to 5 mln., and remains at 20% for firms with sales figures lower than the latter threshold.[27]

The formula for the capital requirements of SMEs loans is the same as that for large corporates, except that the correlation equation is modified in the following way:

$$\rho(pd) = \{0.12[(1 - e^{-50pd})/(1 - e^{-50})] + 0.24\,[1 - (1 - e^{-50pd} / 1 - e^{-50})]\} - 0.04^{*}\,[1 - (S - 5)/45]$$

where *S* is the total annual sales of the firm in mln. euros.

The combined effect of the flattening of the risk-weight curve and of the firm-size adjustment is very relevant with respect to the CP2 calibration. If we assume that a small firm (with sales below 5 mln. euros) is typically characterised by a probability of default around 2%, in CP2 the capital requirement of an unsecured loan to this firm would have been 15.4% of the nominal exposure; under the CP3 calibration, the capital charge would be 10.1% if it were treated as a large corporate loan, and 8% considering the firm-size adjustment.

In addition to this modification, the Basel Committee has clarified the treatment of loans to small firms that can be included in the retail portfolio. In this case they are subject to a lower capital charge with respect to SMEs loans in the corporate portfolio, all else equal, given the greater diversification which characterises retail assets. Exposures lower than € 1 mln. to *small firms can be treated according to the*

[27] In addition, the range of collateral able to mitigate the riskiness of the exposures (reduction in the LGD value in the foundation IRB) has been widened for all firms; since SMEs loans are normally more collateralised with respect to loans to large firms, this modification should provide a larger capital relief to SMEs.

risk weight formula established for the retail portfolio, provided that from a risk management point of view they are treated in a way broadly similar to that of the other retail products.

In this case the capital requirement is:[28]

$$K = LGD \cdot N\{(1-\rho)^{-0.5} \cdot G(PD) + [R/(1-\rho)]^{0.5} \cdot G(0.999)\}$$

The asset correlation also varies with PD, but with different parameters:

$$\rho(pd) = 0.02\,[(1-e^{-35pd})/(1-e^{-35})] + 0.17\,[1-(1-e^{-35pd}/1-e^{-35})]$$

Using the same example as above (same PD and LGD), a SME exposure below € 1 mln. in the retail portfolio would be charged a capital requirement of 5.5%.

Finally, in the standardised approach loans below € 1 mln. to a SME are also included in the retail portfolio, provided this is highly granular,[29] and risk weighted at 75% of the nominal amount (equivalent to a capital charge of 6%), which compares with a 100% risk weight for all the other corporates (equivalent to an 8% capital requirement).

The effect of the modifications for the SME loans in the IRB approach is highlighted in charts 1 (SME corporate) and 2 (SME retail); Table 1 contains instead a comparison between Basel I and Basel II capital charges for loans to firms in the standardised approach.

3.3. *Results of the third Quantitative Impact Study*

The complete set of proposed rules has been the subject of the third quantitative study conducted by the Committee (QIS3). The results are much more robust than the other quantitative studies, given the wider number of banks participating from all over the world (365 banks from 43 countries; they were respectively 38 and 13 in QIS2.5, 138 and 25 in QIS2), the fact that the rules encompassed all the assets of the banks, including securitisations, equities, specialised lending, etc., and the higher qualitative standards employed in the survey.

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[28] In the retail portfolio there is not a maturity adjustment.

[29] One way of achieving a high granularity is for national supervisors to establish that each individual exposure is lower than 0.2% of the regulatory retail portfolio; however, differently from CP3, in the EU consultation document issued in July 2003 this additional condition is not foreseen.

CHART 1

IRB APPROACH: CAPITAL REQUIREMENTS
(corporate loans – in percentage)

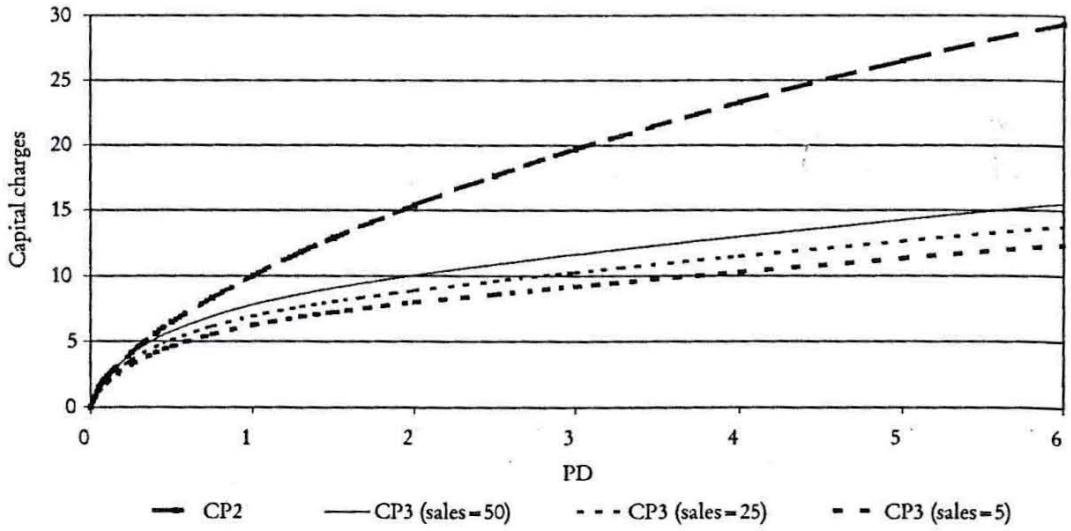
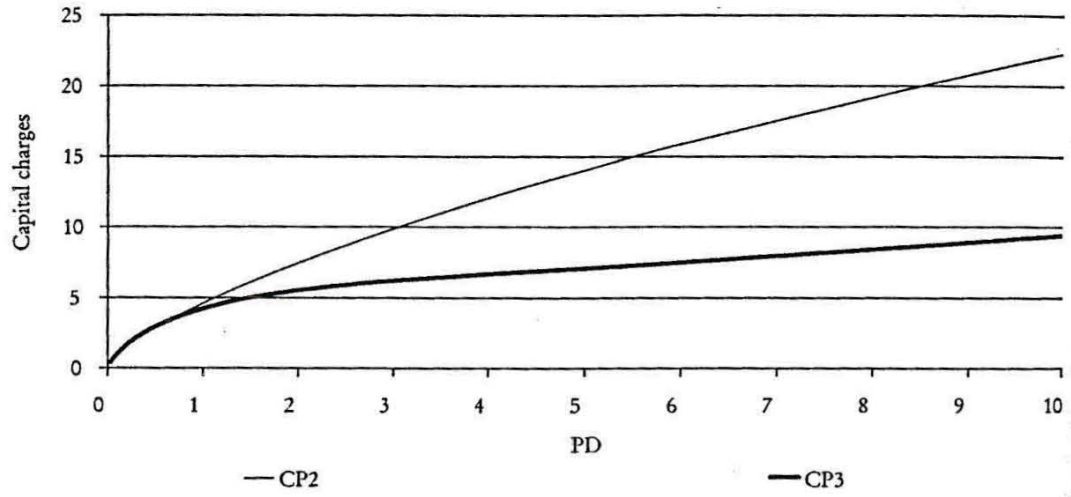


CHART 2

IRB APPROACH: CAPITAL REQUIREMENTS
(SME retail; LGD=45%; in percentage)



The results are substantially consistent with the goals of the Committee, that is, to obtain on average minimum capital requirements similar to actual ones and to give some capital incentive to banks for the adoption of the advanced approaches over time.

Overall, for G10 banks the capital charges increase by 3% in the standardised and IRB foundation approaches with respect to the cur-

rent rules. The charge decreases by 2% in the IRB advanced approach (Table 2). In presenting these results the Committee has underlined that they tend to overestimate capital requirements, given the incompleteness of the available information at banks. The improvements in banks' risk measurement and information systems that will take place within the date of implementation of the new Accord will produce lower charges than those estimated in survey.

TABLE 1

STANDARDISED APPROACH:
UNSECURED LOANS TO NON FINANCIAL FIRMS
(in percentage)

	Risk buckets	AAA AA–	A+/A–	BBB+ BB–	Below BB– and past due	Unrated
Basel 1	Capital charge	8	8	8	8	8
Basel 2 Loans > 1 mln. €	Capital charge	1,6	4	8	12 4-8-12**	8***
Basel 2 Loans < 1 mln. €*	Capital charge	6	6	6	4-8-12**	6

* Small business loans included in the retail portfolio; the capital charge does not depend on the external rating.
** For past due loans the capital charge depends on the amount of provisions.
*** In the simplified standardised approach the capital charge is always 8%.

TABLE 2

RESULTS OF THE THIRD IMPACT STUDY
(in percentage)

Banks	Standard	IRB Foundation	IRB Advanced
Group 1	+10.5	+2.6	–1.6
Group 2	+3.4	–19.4	n.a.

TABLE 3

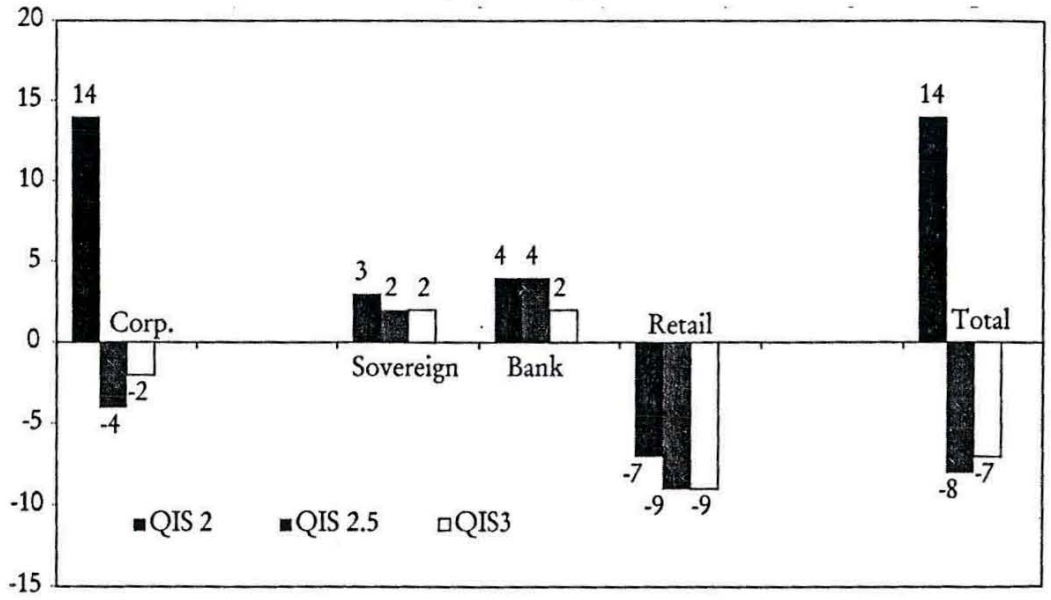
IMPACT STUDIES, VARIATIONS WITH RESPECT TO THE CURRENT METHOD
(in percentage)

Requirements	QIS 2	QIS 2.5	QIS 3
Credit risk	+14	–8	–7
Total	+24	+2	+3

As regards credit risk in the IRB approach, to appreciate the magnitude of the changes obtained one can compare QIS3 results with those of QIS2 and QIS2.5 (Table 3). The results are only broadly comparable, given that the sample of banks is different, that QIS3 qualitative standards are much higher, that the latter survey includes the capital charges of all the other portfolios not considered in previous exercises, that there have been different allocations of assets across portfolios as a consequence of the modifications made to the rules. However, for the large international banks belonging to the G10 countries the IRB credit risk charge decreases in QIS3 by 7% with respect to the current Accord, similarly to QIS2.5 (–8%), while it increased by 14% in QIS2. An examination of the different portfolios shows that the main contribution to the overall change derives from the corporate and retail portfolios (Table 4).

TABLE 4

QUANTITATIVE IMPACT STUDIES (QIS2, QIS2.5, QIS3) IRB APPROACH
(in percentage)



A closer look at QIS3 results disaggregated by portfolios shows that capital charges for SME loans are on average lower than current ones. The survey indicates that the requirements decrease, between 1 and 3% with respect to current rules, for both Group 1 and Group 2 banks (large international or mid-sized domestic banks) in any regulatory approach considered (Table 5). The biggest improvement will of

course be obtained for loans to SMEs of high credit standing in the corporate portfolio and for those SME loans included in the retail portfolio.

4. The impact on the Italian corporate sector

4.1. *Estimation of probability of default*

In this paragraph we provide an empirical evaluation of the impact of the IRB foundation approach based on a sample of domestic enterprises under a set of simplifying assumptions. Given that the majority of Italian corporates are not rated by rating agencies, we estimated borrowers' probability of default with a logistic procedure. With respect to the rating systems normally adopted by international banks, which are nearly always determined according to both quantitative and qualitative information, this procedure relies only on the first type of information. Thus, it is only an approximation of the ratings that banks would normally estimate.

TABLE 5

QIS3 RESULTS
(in percentage)

Approach	Banks	Corp.	SME Corp.	States	Banks	Retail	SME Retail	Total
Standard	Group 2	-1	0	0	0	-10	-2	3
IRB Foundation	Group 1	-2	-1	2	2	-9	-1	3
IRB Foundation	Group 2	-4	-1	0	-1	-17	-3	-19
IRB Advanced	Group 1	-4	-1	1	0	-9	-2	-2

The data sources are the information collected in the Company Accounts Register (Cerved) and in the Credit Register; the former is managed by a private enterprise, while the latter is managed by the Bank of Italy.

The Company Accounts Register provides the most comprehensive data on Italian companies. It is available since 1993. In each of the recent years half a million firms balance-sheets have been collected in the database according to a simplified reclassification scheme including 70 elementary items and approximately 30 financial ratios. The Credit

Register records individual credit positions above a certain threshold (about € 75,000); non performing loans are recorded no matter their amount. All Italian banks have to report their individual positions towards domestic borrowers. It contains information regarding approximately 1.7 million of borrowers. Its services are available to banks since mid 1960s.

Depending on the year observed, the firms recorded in both registers, which passed some quantitative filters (total assets, capital and value added always positive, etc.), vary between 150,000 and 190,000. The 180,000 firms available for year 1998 have been split according to four sectors of economic activity (manufacturing, trade, construction and services) and a separate regression model has been estimated for each sector. Two thirds of the firms have been included in the estimation sample, and one third has been used for testing out of the sample.

The definition of default used is the classification of a loan as non performing for the first time in a certain year by the lending bank. It is important to remark that this definition is narrower than that proposed in the new Accord for the corporate portfolio, which covers also substandard loans and loans past due 90 days.[30] However, the Credit Register does not contain individual information on substandard loans, neither on past dues. Therefore, relative to the proposed Basel definition, the PDs obtained below may slightly overestimate the credit quality distribution of borrowers.

Balance-sheet data for 1998 and Credit Register information for 1999 have been used to assess the probability of each firm being recorded as defaulted in year 2000. To use the procedure for forecasting purposes, a difference of at least one year between accounting and credit data is necessary to take account of the delay with which the accounting information becomes available.

The defaults are the 'new' non performing loans over year 2000, which were performing in the previous years. The number of defaults is 2,300, or 1.3% of the 180,000 firms considered. Even though the dataset is very large, it does not completely represent the default rate of the universe of loans to non financial firms granted by Italian banks, both in terms of frequency and of loan weighted average of

[30] Italian banks generally use as 'default event' in their rating systems the classification of a loan as non performing and substandard. In the Basel proposal, for a transition period of 5 years from the implementation of the Accord (2006), Italian banks can consider in default loans past due 180 days, instead of 90 days.

defaulting firms. The bias is however lower in recent years with respect to mid 1990s (for year 2000 the default rate of all loans to non financial firms recorded in the Credit Register was 1.8%, while it was 1.3% for the Cerved sample).

A stepwise procedure has been used to select up to 11 explanatory variables, depending on the economic sector, out of about 30 ratios proxying for profitability, productivity, financial structure, state of credit relationships, size and geographical location of the enterprises. The performance of the model is satisfactory: the overall correct rate of classification is around 74% on average, both in and out of sample. A better idea of the performance is obtained through the so-called 'Gini curve' which measures the ability of the model to identify the firms that will deteriorate in the chosen horizon (over the following year in our case). The accuracy ratio generated by the curve is between 65 and 67% in each of the years 1998-2001; similar values, ranging between 50 and 70%, have been observed in other studies regarding Italy[31] and other countries.[32]

In order to judge whether the discrimination is effective, we have grouped firms in nine risk classes approximately corresponding to those of the rating agencies and compared the *ex ante* default frequency and the *ex post* realisations for various years (backtesting). Chart 3 shows that the *ex post* frequency of default is consistent with the *ex ante* estimations for all the risk classes for the years 1998-2001. For more details on the model estimated and its performance, see Cannata, Fabi and Laviola (2002).

4.2. *Capital treatment of SME loans*

4.2.1. Impact of the different proposals on a hypothetical portfolio

Turning now to the application of the methodology, we used the same procedure to compute probabilities of default for approximately 157,000 corporate borrowers on the basis of year 2000 company

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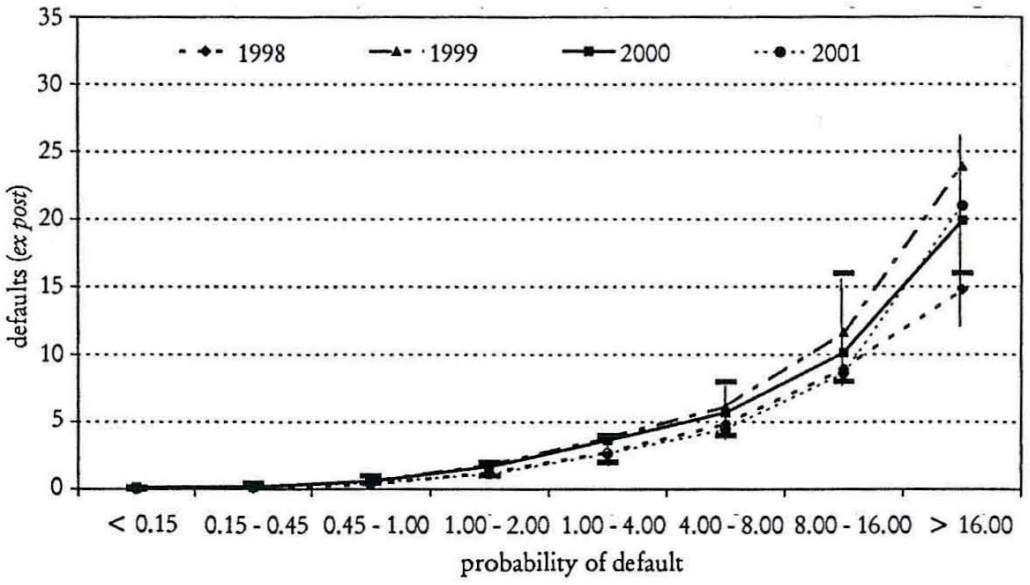
[31] See for example Borgioli (1999).

[32] See for example Moody's Investors Service (2000), Blockwitz, Liebig and Nyberg (2000) and Trucharte and Marcelo (2002). The comparison can only represent a plausibility check, because the performances of different models on different data sets, with diverse default definition, are not strictly comparable.

accounts and year 2001 credit relationship data. The PDs represent therefore an estimate of the default rate for year 2002.

CHART 3

EDF BUCKETS



The total amount of loans to these borrowers is over € 260 billion, corresponding to about 50% of total performing loans to the corporate sector.[33] The set of firms includes a large share of SMEs: about 82% of the firms, with sales less than € 5 mln., accounts for 24% of total loans; 1.6% of the firms, with sales larger than € 50 mln., represents over 40% of the loans.

As regards the quality distribution of loans to these firms as of end-2001, about 33% of the total is classified in investment grade classes (probability of default lower than 0.45%); 47% is included in risk classes with PD between 0.45 and 1%. In the last three risk classes corresponding to single B and below is included 3% of the loans in the sample.

With respect to the regulatory proposal a set of simplifying assumptions has been used: we assumed that all loans are uncollateralised (LGD=45%), and that the EAD is equal to the drawn exposure. In order to assess whether the new set of risk weights addresses the SMEs problem, we analysed the difference in the requirements deriving from the application of the January 2001 CP2 and the April 2003

[33] The firms that did not report information on sales have been excluded.

CP3 calibrations for this hypothetical portfolio classified by firms size and risk classes.

About 58% of loans is included in risk classes below 0.7% PD (the neutrality threshold between the CP2 curve and the current Accord), while 80% is assigned in classes lower than 1% PD (neutrality threshold between the new curve obtained when the asset correlation decreases with PD and the current Accord). The shares of loans above and below the two thresholds are however very different depending on the size of the firms. The difference between the share of loans to small firms (sales lower than € 5 mln.) and that regarding loans to large firms (sales higher than € 50 mln.) is about 30 percentage points for both thresholds. The observation of the quality distribution of firms according to their size confirms that small firms tend to be classified in relatively higher risk classes (Chart 4); in each of the four risk classes with PD below 1% the largest firms account for a share of loans between 35 and 55%, while the smallest firms cover a share between 15 and 25%. In higher risk classes the bulk of loans is granted to SMEs.

CHART 4

NEW BASEL CAPITAL ACCORD - IRB APPROACH LOANS BY RISK CLASSES AND FIRMS' SALES (2001)

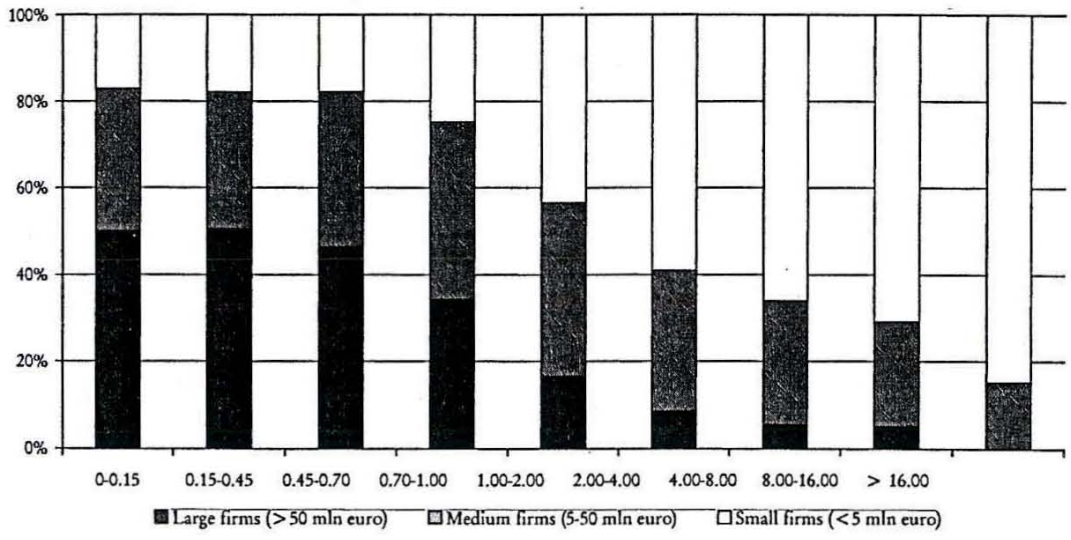


Table 6 shows that the changes in risk weights, between the CP3 and CP2 proposals, decrease the requirements for all subportfolios, but the effect is much higher for SMEs. In the first place, the flattening of the risk weight curve for all corporates results in a reduction of 21%

TABLE 6

NEW CAPITAL ACCORD EFFECTS ON LOANS TO NON FINANCIAL FIRMS
(changes in capital requirements between CP2 and CP3; data as of December 2001, € mln. and %)

Sales (€ mln.)	No. of firms	Bank debt	Share (%)	PD weighted average (%)	Cap. req. change (%) – variable asset corr.	Cap. req. change (%) – firm size adj.	Overall cap. req. change (%)
> 50	2,521	108,430	41.1	0.6	–15.0	0.0	–15.0
25-50	2,839	27,170	10.3	0.7	–18.0	–6.3	–23.1
5-25	23,571	64,689	24.5	1.0	–21.9	–16.7	–34.9
< = 5	128,037	63,436	24.1	1.6	–28.5	–19.9	–42.8
Total	156,968	263,726	100.0	0.9	–21.3	–10.7	–29.7
Total 2 (excluding > 50)	*154,447*	*155,296*	58.9	*1.2*	–24.6	–16.6	–37.1

of the charge in capital requirements; however, the change is –15% for larger firms, while it raises to –25% for SMEs (–29% for firms with sales lower than € 5 mln.). When we consider the firm-size adjustment, there is a further reduction of 17% (with respect to the flattened risk weight curve) in the capital charge for firms with sales below € 50 mln. The total reduction in requirements between the CP2 and the CP3 proposals is 30% on average, and 37% for SMEs (a reduction of 43% for the smallest firms).

Therefore, there has been a large improvement for loans to SMEs, given that with the January 2001 risk weights they would have been associated with a requirement substantially higher with respect to the current situation.

4.2.2. *Impact on the universe of Italian corporates*

The extension of the results of the previous exercise to the entire population of Italian corporates is biased under two regards: *a*) the default rate recorded in year 2001 is the lowest one out of the last 10 years; *b*) the credit quality of the firms included in the sample is better than average.

To deal with these problems we extended the analysis to the rest of domestic loans granted to the corporate sector by Italian banks and used, as a proxy for the default rate, the average rate of classification of firms as bad loans, as reported in the Credit Register, for the period 1997-2002. In this way, we have included in the average years where the default rate of Italian firms was relatively high (above 2%). This calibration should also account, at least partially, for the different definition of default with respect to Basel II.

As regards the loans to firms which are not in our sample, given that we have neither an estimate of the probability of default nor a distribution of firms by size, we had to make some assumptions.

– We assumed that, out of € 241 bln. loans without a PD and recorded in the Credit Register, there is not any loan granted to large corporates. These borrowers have therefore to be allocated either in the SME corporate or in the SME retail portfolios.

– The share of SME loans allocated to the retail portfolio was estimated out of the amount of all credits below € 1 mln. granted to

any individual firm. It has been set to around 30% of the overall loan amount to non financial firms. As regards the average size of SME borrowers in the corporate portfolio, it has been assumed that the rest of SME loans have been granted to firms with exposure-weighted average turnover of € 10 mln. [34]

– Finally, the 30% of SME loans included in the retail portfolio comprises the loans to firms below the € 75,000 threshold of the Credit Register (€ 37 bln.).

As regards the PDs for the firms in the sample, all estimates were raised by a certain percentage, according to the different sub-portfolios. The system's exposure-weighted average default rate for non financial firms was 1.25% in 2001, 1.8% on average in the last six years. Therefore, in our sample the weighted average PD has been increased from 0.93% of 2001 to 1.3%.

With reference to the PDs assigned to the loans granted to 'unrated' firms, the exposure-weighted average PD has been set to 2.2%, in order to keep the system's average of 1.8%. Since the distribution of loans by risk buckets was unknown, we calculated the capital charges corresponding to a single PD value for each portfolio we have created; given the convexity of the relationship between PDs and capital charges, the results tend to overestimate the capital impact for any PD level.

The results (Table 7) show that the capital requirement would be on average about 6.2% for the firms to which an estimate of PD is associated; the rest of loans would get a capital charge of 7.3%. Overall, the regulatory burden for credit risk would be around 7%. For the loans to the SMEs included in the corporate portfolio the requirement would be slightly below 8%, while for those classified as retail it would be two percentage points lower. For all loans to SMEs the capital charge would be around 7%. Taking into account also the requirement for operational

[34] For the Italian banks that participated in the third impact study the exposure-weighted average turnover of borrowing firms was about 15 mln.; given that here we are considering the population of Italian firms with bank debts, their average size should be smaller. By the same token, the share of loans included in the retail portfolio (30%) should be higher than that one (22%) reported on average by the largest Italian banks participating in the impact study; we have of course assumed that the classification of small firms as retail by the largest Italian banks satisfies the provisions of the proposed regulation.

risk, equal on average to 10-12% of the current minimum requirement, the overall charge would be close to 8%.

Of course, the results have to be considered carefully, given all the hypotheses we made, in particular the distribution of loans in the various portfolios and the assumption of single values of PDs and firms' sales. However, reasonable variations of the hypotheses made have not altered substantially the outcomes. Moreover, we have to consider that a share of loans to non financial firms will be treated according to the rules of the revised standardised approach (for the banks that will choose this approach), and not according to those of the IRB approach. As we mentioned above, in the former case all retail loans to small businesses will be associated with a reduced capital requirement of 6%, while all other corporate loans will attract an 8% capital charge.

TABLE 7

ESTIMATE OF THE IMPACT OF BASEL II ON SME LOANS

Non financial firms	Bank debt (€ mln.)		Weighted avg. PD (%)	Capital requirements
A) With sales and estimated PD	263,726		1.3	6.2
B) With 'assumed' PD and sales of which:	278,489		2.2	7.3
b1) Firms not recorded in Credit Register	37,620		2.5	5.9
b2) Other firms	240,869		2.2	7.5
Total: A + B	542,215		1.8	6.8
Of which:		Share (%)		
- SME corporate	*271,120*	*0.5*	*1.8*	*7.8*
- SME retail	*162,665*	*0.3*	*2.4*	*5.7*
- SME total	*433,785*	*0.8*	*2.0*	*7.0*

Comparable results in terms of overall impact, subject to similar assumptions and caveats, have been obtained by Saurina and Trucharte (2003) in a study regarding Spanish SMEs and by Masschelein (2003) for Belgian ones. It has to be noted that these studies have used a 'less stringent' definition of default, that is, firms' bankruptcy, while here we have used banks' classification as non performing loan.

4.3. *Basel II and loan rates*

In this section we want to check the impact of the new Accord on the pricing of loans. The purpose is not to investigate the determinants of loan rates, rather to verify whether there is a relationship between the average risk differential across loans, as implied by the new regulatory framework, and the interest rate differentials on the same loans.

Since we assumed that loans are senior unsecured, we have considered the interest rates on short term loans reported by a sample of 68 banks for year 2001; collateral should be less relevant in this case. The firms included in the sample are about 140,000, corresponding to about 350,000 credit relationships. Short term bank debt is about € 160 bln., or 60% of short term loans granted by the sample of banks to Italian non financial companies.

In the first place, chart 5 shows a direct relationship between firms' riskiness and the average loan rates made by the 68 banks to the firms in the same risk class, even though there is a substantial variation around the mean. We also remark that there are differences among rates depending on the size of firms, whereby, for the same risk class, rates made to smaller firms are higher than those to large firms. This may indicate that, if one had to analyse the determinants of loan rates, it would be necessary to consider, in addition to borrowers' riskiness, other variables representing the characteristics of the firms, of the banks and of the credit relationships. As an example, an important variable which strongly influences loan rates concerns unit administrative costs associated to the screening, monitoring and management of the credit relationship; these costs are normally higher for small firms.

The relationship between firms' riskiness and loan rates is substantially confirmed also at the level of each individual bank. Finally, the comparison between the average rate made by each bank to its own borrowers and the average riskiness of the same borrowers also shows a direct relationship between the two variables. For smaller firms (exposure lower than € 1 mln.) the correlation is 64% (Chart 6).

In the second place, we make a comparison between the actual interest-rate differentials by risk classes and the risk premium that should be applied in order to cover the cost of capital implied by the new regulation. For this purpose, we assumed that the total cost of risk (in percentage terms) for any loan is given by the EL on the loan and the UL multiplied by a return rate. This rate of return is applied

to banks' capital, whose composition is assumed to be made for 2/3 of core capital and for 1/3 of subordinated debt. Therefore, we have:

$$\text{total cost of risk} = EL + K \cdot UL,$$

CHART 5

LOAN RATES AND FIRMS' RISKINESS

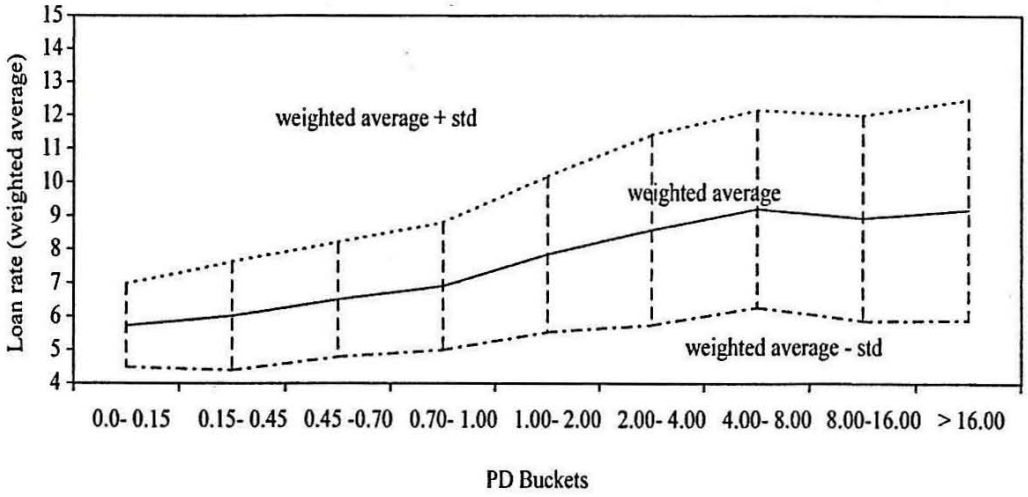
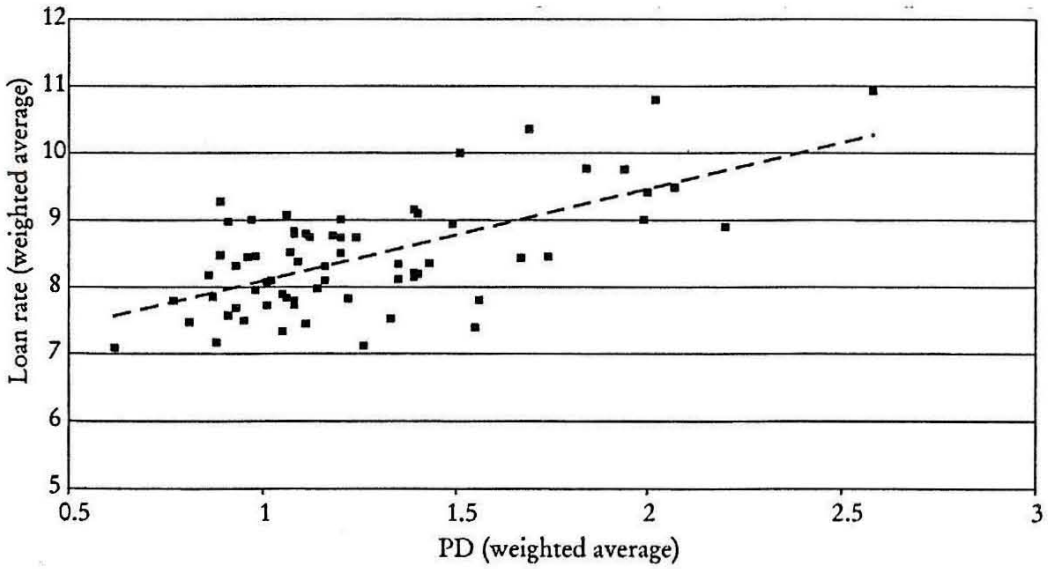


CHART 6

BANKS: LOAN RATES AND FIRMS' RISKINESS
(year 2001)



where K=(2/3 bank shareholders' gross return + 1/3 subordinated debtholders' return) – risk free rate (6 month BOT rate). EL and UL are derived from the regulatory formulae. Shareholders' gross return has been determined as the double of the net return of equity (to take into account taxation); subordinated debtholders' return has been determined as the rate of return on senior unsecured bonds plus a spread, to take into account their higher riskiness.

The computation shows that, for a given firm size (turnover below € 5 mln. and between 5 and 50 mln.), actual and theroretical spreads, the latter being calculated according to the CP3 formula for SMEs in the IRB approach, are much closer one to the other with respect to what happens when the cost of capital is calculated according to the CP2 formula, whereby for certain risk classes the implied risk premium should be higher than the actual spread (Charts 7-8). The calculation has been repeated for year 2002, and the results are broadly confirmed.

CHART 7

REGULATORY COSTS AND FIRMS' LOAN RATES
FIRMS WITH SALES BETWEEN € 5 AND 50 MLN.
(2001, 4th quarter)

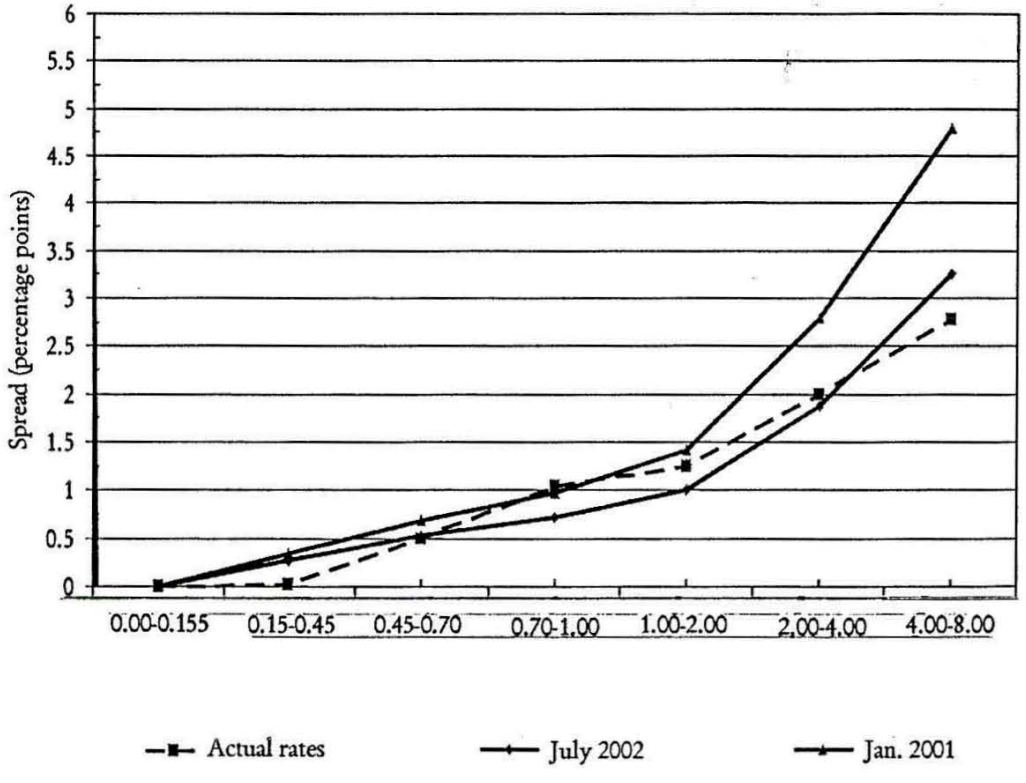
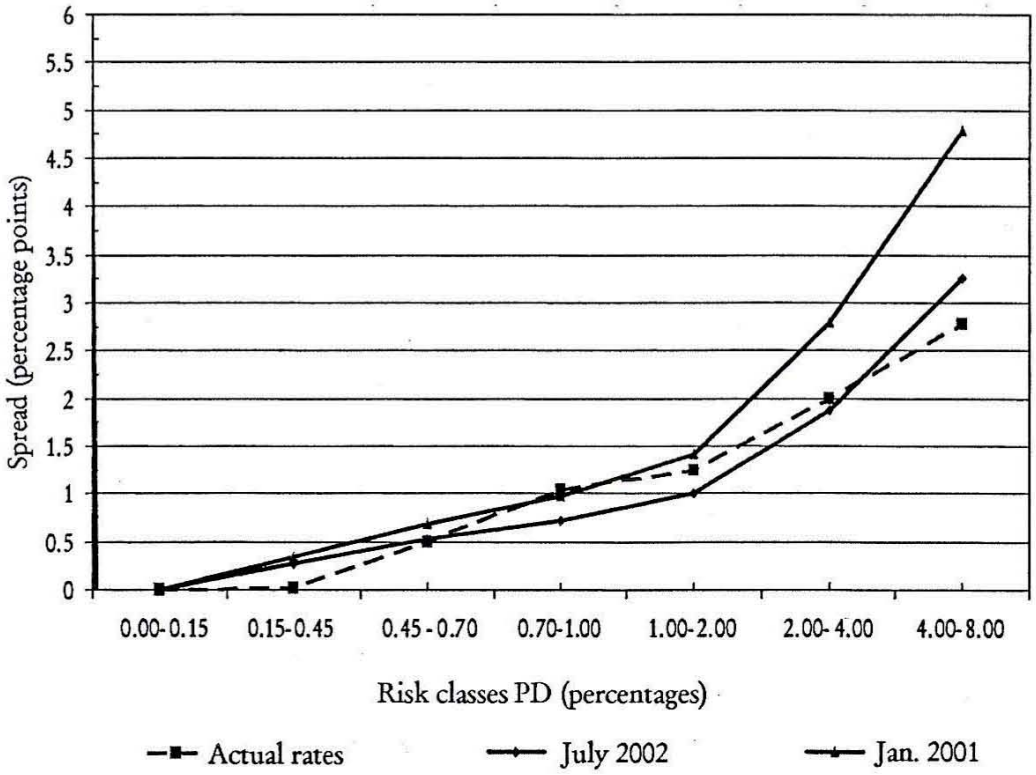


CHART 8

REGULATORY COSTS AND FIRMS' LOAN RATES
FIRMS WITH SALES < 5 MLN. €
(2001, 4th quarter)



These results indicate that: *a*) interest rates on corporate loans already take into account the relative riskiness of borrowers; *b*) the new regulation does not imply a capital burden, for a given borrowers' risk, which should be covered by a modification of the interest rates applied by banks. Lending decisions are therefore unlikely to be altered, on average, by the introduction of the new regulatory framework; *c*) the latest Basel II proposal is much more consistent with the evaluation of relative riskiness made by banks than the CP2 proposal.

5. Summary

The new Basel Capital Accord can promote a vast improvement in the risk measurement and management practices of banks. The flexibility of the approach allows regulation to adapt to institutions of different

size and sophistication. The complexity of the issues involved has required a longer time than expected for completion.

The need to avoid unduly penalisation of loans to SMEs and to balance the goal of a higher risk sensitivity of capital requirements with the potential amplification of business cycle fluctuations were among the issues that emerged since the publication of the January 2001 Consultative document (CP2).

The impact studies made by banks in 2001 showed that the calibration of the level of overall capital was too severe. The harsh treatment of *SMEs loans* was a particular concern for a substantial part of the financial community. In April 2003 the Basel Committee issued a third consultative document which contains relevant changes with respect to the earlier proposal. The new risk weight curve for corporate credits reduces the capital charge for any risk level, but the effect is much larger for higher PD buckets, where the majority of SME loans is likely to cluster; in addition, an explicit downward adjustment for firm size has been introduced. Finally, those SMEs loans that will be included in the retail portfolio will benefit from an even larger capital reduction, in all approaches to credit risk measurement (standardised and IRB). The results of a third impact study conducted by the authorities, to which a wide number of banks throughout the world has participated, confirmed that the capital charges for SMEs loans will on average be lower than under the current rules.

As regards Italy, the effects estimated on a large sample of corporates are quite relevant. With the new risk weight curve the reduction of the requirement on a hypothetical portfolio used for the calculations is estimated to be over 35% for SMEs with respect to the CP2 calibration.

The extension of the analysis to all loans granted to non financial firms by Italian banks shows that the overall impact is consistent with the goals of the Basel Committee, that is, to keep an overall charge of 8% on average and not to penalise loans to SMEs. Furthermore, the analysis of the relationship between loan rates and the riskiness of loans shows that, on average, Italian banks already price loans according to their relative riskiness, and that there is a remarkable consistency beween interest rate differentials and the 'regulatory cost' of the different loans according to their riskiness, as measured through the new regulatory framework.

The results have of course to be considered carefully, given the hypotheses made and the data limitations, among which the different definition of default, the assumption that all loans are uncollateralised and that the EAD coincides with the on-balance part, the assignment of an arbitrary PD to a substantial part of the loans granted to non financial firms, the allocation of loans in different portfolios.

Notwithstanding these shortfalls, we believe our results indicate that the changes made by the BCBS in the third consultative paper address the problems that had been highlighted by the financial community and by national regulators. In other words, the analysis carried out, consistently with those made by researchers in other European countries, does not indicate any rationing effects or distortions in the allocation of credit to SMEs as a consequence of the application of the new Accord.

As regards the *procyclicality debate*, with respect to the original formulation the modifications made in the last consultative document reduce the potential fluctuations in capital requirements with changes in cyclical conditions. Beyond the modifications included directly in the risk weight curve, the new regulation will stimulate the banking industry to introduce more forward-looking elements in the assignment of ratings, in order to make judgements less correlated with the business cycle. The introduction of ratings in risk management practices should make possible to detect earlier deteriorations in credit quality and start corrective action.

Since a certain degree of fluctuation of the capital requirements is to a certain extent inevitable, supervisors and the market will require banks to conduct macroeconomic stress tests, in order to make sure that they hold an adequate level of capital over time. As a consequence, it is possible that in the future the capital buffers over the required minimum will show a more anti-cyclical pattern, that is, increase or remain stable during economic upturns and decrease in downturns, in order to avoid that the minimum capital requirements become binding in recessions and contribute to amplify the business cycle.

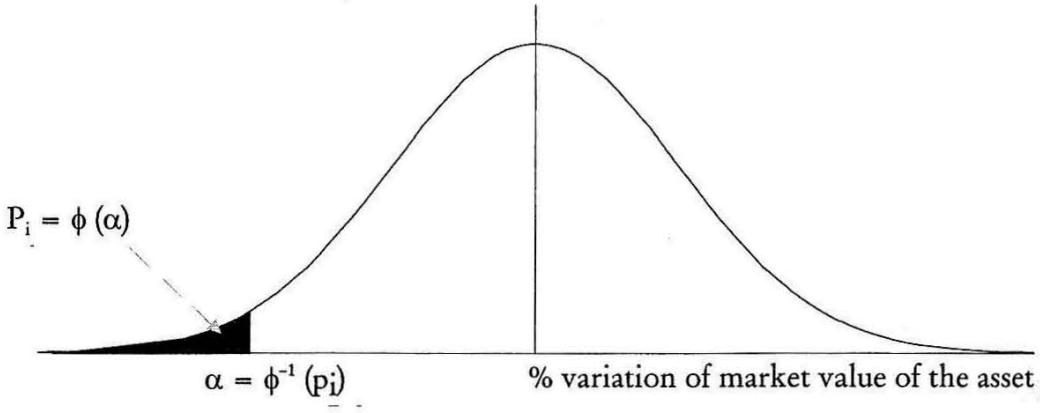
APPENDIX

THE IRB RISK WEIGHT FORMULA[1]

The risk weight formula in the internal rating based approach is based on a simplified version of the CreditMetrics model, which relies on the so-called 'Merton approach'. This approach assumes that the market value of the firm asset has a log-normal distribution and that the firm defaults when the asset value goes below a specified threshold.

If we assume that the firm's liability structure is extremely simple, this threshold coincides with the nominal value of the debt: if, at debt maturity, the market value of the assets is not enough to reimbourse the debt, the shareholders have to leave the firm to creditors, who can extract the liquidation value. It is therefore clear the analogy with financial options, whereby firm's shares are considered as a call option on the value of the firm with a strike price equal to the nominal value of the debt.

In the CreditMetrics[2] model the threshold which triggers default is given, for each rating class, by the percentile of the standard normal distribution corresponding to a probability of default equal to the average default rate of the rating class. If we indicate with p_i the average default rate, we have:



As an example, for the Standard & Poor's rating class BB, with a default rate of 1,06%, the threshold is:

$$\phi^{-1}(1.06\%) = 2.30 \qquad (2)$$

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[1] This description of the risk weight formula is contained in a tutorial note written by Grippa and Laviola (2001).

[2] See Gupton, Finger and Bhatia (1997).

The simplified version of CreditMetrics[3] assumes that the standardised logarithmic variations of the firm's assets (Z_i) are explained by a single systematic risk factor (X) and by an idiosyncratic component (ε_i):

$$\begin{aligned} Z_i &\equiv \frac{ln(A_i) - E[ln(A_i)]}{\sigma[ln(A_i)]} \sim N[0,1] \\ Z_i &= w_i \cdot X + \sqrt{1 - w_i^2} \cdot \varepsilon_i \end{aligned} \tag{3}$$

The parameter w_i represents the so-called 'factor loading', that is, the sensitivity of firm's assets value to the systematic factor.

Without loss of generality it is assumed that the systematic factor and the idiosyncratic component are distributed as standard normal variables, and that they are uncorrelated; the idiosyncratic components of asset values of two different firms are also supposed uncorrelated:

$$\begin{aligned} &X \sim N[0,1] \\ &\varepsilon_i \sim N[0,1] \\ &E[X\varepsilon_i] = 0 \\ &E[\varepsilon_i \varepsilon_j] = 0 \\ &E[Z_i] = w_i \cdot E[X] + \sqrt{1 - w_i^2} \cdot E[\varepsilon_i] = 0 \\ &V[Z_i] = w_i^2 \cdot V[X] + (1 - w_i^2) \cdot V[\varepsilon_i] = w_i^2 \cdot 1 + (1 - w_i^2) \cdot 1 = 1 \end{aligned} \tag{4}$$

Assuming that each firm has the same degree of sensitivity to general economic conditions, that is, the same factor loading, we obtain that the asset correlation of two firms is equal to the square of the factor loading w:

$$\begin{aligned} \rho_{i,j} &\equiv E[Z_i Z_j] \\ &= w^2 E[X^2] + w \cdot \sqrt{1 - w^2} E[X\varepsilon_i] + w \cdot \sqrt{1 - w^2} E[X\varepsilon_j] + (1 - w^2) E[\varepsilon_i \varepsilon_j] \\ &= w^2 \end{aligned} \tag{5}$$

In this simplified version of CreditMetrics a default, conditional to a determined value of the systematic factor, happens when:

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[3] In this version there are only two possibile states for the borrower, in default or not in default; in the multinomial version of the model there are more than two possibile states, corresponding to the various rating classes of the rating agencies.

$$Z_i = w \cdot \overline{X} + \sqrt{1-w^2} \cdot \varepsilon_i < \alpha = \Phi^{-1}(p_i)$$
$$\varepsilon_i < \frac{\alpha - w \cdot \overline{X}}{\sqrt{1-w^2}} = \frac{\Phi^{-1}(p_i) - w \cdot \overline{X}}{\sqrt{1-w^2}} \quad (6)$$

Given X, the conditional (connected to a given economic scenario) probability of default of firm 'i' is:

$$p(default_i \mid X = \overline{X}) = p\left(\varepsilon_i < \frac{\Phi^{-1}(p_i) - w \cdot \overline{X}}{\sqrt{1-w^2}}\right) = \Phi\left[\frac{\Phi^{-1}(p_i) - w \cdot \overline{X}}{\sqrt{1-w^2}}\right] \quad (7)$$

The model described provides the general theoretical framework behind the IRB regulatory formula for the derivation of the risk weights. The calculation of the capital at risk of a given portfolio is not possible if we do not use a portfolio model in which the following elements, among others, are specified: *a*) the relative importance of each exposure; *b*) the correlations between the defaults of each pair of borrowers in the portfolio, or those between homogeneous groups of borrowers.

However, given that the Basel Committee wanted to determine the risk weights in the new Accord with a unique formula for all banks, it has been necessary to adopt the following restrictions: *a*) the portfolio is infinitely granular, that is, is made by a high number of exposures, none of which represents a relevant share of the portfolio, which allows regulators not to consider concentration risk under Pillar 1; *b*) the systematic component of default risk can be explained by just one systematic factor, as in the model outlined above, which implies that, apart for the single systematic component, borrowers' defaults are uncorrelated.

The first hypothesis allows to apply the law of large numbers to the calculation of the capital at risk: given a certain state of the economy, the default rate converges to its expected value when the number of borrowers in the portfolio goes to infinity. In other words, in a portfolio 'infinitely granular', for each value of the systematic factor the number of defaults that will occur is known with certainty, therefore, given the LGD rate, it is possible to calculate exactly the amount of loss that will be generated by the portfolio.[4]

[4] Given that in the real word credit portfolios are never infinitely granular, in the CP2 formula there was a correction for the effective granularity of the portfolio. Following industry criticism on the complexity of the formula and on its modest

In a single risk factor model it is assumed that there is a common business cycle on all obligors, while all the other elements of credit risk are considered to be idiosyncratic. An advantage of the single factor model is that the capital requirement assigned to a new borrower depends only on his characteristics and not on those of all the other borrowers in the portfolio. In the January 2001 proposal it was assumed that all borrowers shared the same sensitivity to the single systematic risk factor. An asset correlation of 20% for all borrowers was assumed. Within this framework, the capital requirement for a portfolio equals the sum of the capital requirements for the individual credits. This last property allows credits to be 'bucketed' on the basis of certain characteristics, such as firms' probability of default.[5]

In this simplified framework the residual element of uncertainty is represented by the variability of the systematic factor, but it can be shown that the probability distribution of the latter determines completely the loss probability distribution; in other words, it is possible to calculate a given percentile of the loss distribution starting from the corresponding percentile of the distribution of the systematic factor.[6]

If we apply to equation 7 the LGD rate of the position, we obtain, conditionally to the realization of the systematic factor, the corresponding expected loss:

$$LGD \cdot \Phi\left[\frac{\Phi^{-1}(p_i) - w \cdot \overline{X}}{\sqrt{1-w^2}}\right] \tag{8}$$

In the January CP2 the Committee determined the value of the systematic factor on the basis of the desired confidence level, set to 99.5%,[7] so that X was equal to the value that, in a standard normal distribution, leaves at its left 0.5% of probability:

$$\overline{X} = \Phi^{-1}(0.5\%) = -2.58 \tag{9}$$

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advantages for corporate portfolios of large and diversified international banks, in CP3 the correction has been eliminated from Pillar 1, but the assessment of concentration risk by national supervisors is explicitly mentioned in Pillar 2.

[5] For an extensive discussion of the single factor model and explanations of the IRB regulatory formula see Gordy (2000, 2001 and 2002), Finger (1999 and 2001) and Wilde (2001).

[6] This result is strictly dependent from the assumption of a single systematic factor (see Gordy 2001).

[7] According to banks' practice, the confidence level in credit risk models should be established in such a way as to correspond to the level of credit standing chosen or desired by the bank: for example, a level of 99.5% implies a probability of negative net worth lower than 0.5%, corresponding to the insolvency rates of firms with S&P rating between AA and A.

From the assumption of a constant and equal to 0.20 asset correlation across firms, it derives that the 'factor loading' w was :

$$w = \sqrt{0.20} = 0.45 \tag{10}$$

With this calibration we obtain the 'basic' CP2 IRB risk weight formula:

$$\begin{aligned} CaR &= LGD \cdot \Phi\left[\frac{\Phi^{-1}(p_i) - 0.45 \cdot (-2.58)}{\sqrt{1-0.45^2}}\right] \\ &= LGD \cdot \Phi\left[\frac{\Phi^{-1}(p_i) + 1.161}{0.89}\right] \\ &= LGD \cdot \Phi\left[1.118 \cdot \Phi^{-1}(p_i) + 1.288\right] \end{aligned} \tag{11}$$

The formula reported in the January CP2 and supporting documents is:

$$\frac{LGD}{50} \cdot \left[976.5 \cdot \Phi\left(1.118 \cdot \Phi^{-1}(PD) + 1.288\right)\right] \cdot \left[1 + 0.047 \frac{1-PD}{PD^{0.44}}\right] \tag{12}$$

The differences with respect to equation 11 are, apart from the division of the LGD (treated as an integer in equation 12) by 50, value considered as a benchmark for the calibration, the consideration of a fixed multiplication factor of 976.5 and of a correction to take account of the maturity of the exposures. As regards the scaling factor,[8] it incorporates a capital cushion of 56% which takes into account measurement errors in the risk parameters (PD and LGD) and the lower capacity of supplementary capital to absorb losses.[9] The adjustment to the risk weights for the maturity of the exposure in the foundation IRB was calibrated for a fixed residual maturity of three years (in CP3 reduced to 2.5 years).

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[8] The number is the product of 12.5 (to transform the capital charges in risk weights) times 50 (to correct for the division of the LGD by 50) times 1.56, that is, $12.5 \cdot 50 \cdot 156\% \cong 976.5$.

[9] Analyses made by regulators suggested that errors in PD estimates of, say, 50% would produce errors in capital amounts of approximately 40% on average across different PD levels. The capital amounts proposed in CP2 were consistent with an adjustment for PD measurement error in the range of 20%. The correction for the lower loss-absorbing capacity of Tier 2 elements assumed that these elements provided 25% of the loss-absorbing capacity of Tier 1 elements and that in the aggregate they represented 30% of total capital. Therefore, the adjustment ratio is: 1/[(proportion of Tier 1) + (proportion of Tier 2) · (loss capacity of Tier 2)]= $1/[0.7 + (0.3) \cdot (0.25)] \cong 1.30$. The capital cushion is therefore: $1.20 \cdot 1.30 \cong 1.56$.

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