The Basel II Capital Accord, SME Loans and Implications for Belgium

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Introduction

The Basel Committee is in the process of finalising a new Accord, known as Basel II, as a new regulatory framework for banks. By making capital requirements more risk-sensitive, Basel II aims to further improve the financial soundness of individual banks and so contribute to the soundness and stability of the financial system as a whole. The question addressed in this paper concerns how this preliminary regulatory proposal, currently scheduled for implementation end 2006, is likely to affect the structure of bank lending in Belgium, and in particular its consequences for SME lending.

Using detailed information on loans granted in Belgium as well as individual firm and bank balance sheet information, Section 1 of the paper documents the importance of SME lending in our country, which amounts to roughly 80 p.c. of total lending to firms. The data also indicate that the four large banks based in Belgium focus as much on SME lending as smaller banks, which means that the bulk of SME lending is granted by these four institutions. This fact is important because Basel II plans to offer banks a *menu* of regulatory possibilities with potentially different treatments of different lending categories, and large banks are predicted to adopt the more sophisticated but also more costly-to-implement 'Internal Ratings Based' (IRB) system, rather than the simpler 'Standardised Approach' (SA).

Section 2 presents in detail the Basel II proposals under discussion. Before doing this however, the section discusses the regulatory framework facing banks, putting current regulatory reforms into a more general context. It stresses that regulation can be seen as trying to 'mimic' the discipline exerted by the sophisticated debtholders of non-financial companies (these debtholders are typically banks) in a world where the banks' debtholders do not perform this job, because they are dispersed, non-expert *depositors* (who are, moreover, protected by deposit insurance). This helps to explain the reliance of regulation on capital requirements with a threat of intervention/liquidation of banks that do not comply with these requirements.

Ideally, these regulatory constraints should force banks to internalise the full economic value of equity capital. In reality, however, the regulatory constraint introduces biases of its own, because the relative 'capital weights' of various bank operations do not necessarily coincide with their 'true economic weights', that is, regulatory capital may differ from 'risk-adjusted economic capital'. One can understand both Basel I and Basel II as attempts to minimise these biases. As detailed in Section 2, Basel I was a step in this direction. However, it was excessively favourable to OECD sovereign lending and discriminated against low-risk corporate lending, and Basel II tries to correct these problems.

Basel II intends to make capital requirements more risk-sensitive, and so contributes to a more efficient allocation of capital. For the sake of comparison with Basel I, the Standardised Approach is briefly discussed. It stresses that this approach specifically tries to reduce prior biases against safe firm lending and more risky lending. The specifics of the IRB approach are then discussed in detail. The section presents both the theoretical foundations for the approach, its dual perspective (the 'foundation' and 'advanced' versions, which differ in terms of the internal inputs the bank is able/obliged to supply), and its treatment of asset correlation. Indeed, in contrast with Basel I, the IRB approach of Basel II incorporates to some extent portfolio considerations in computing capital requirements. This leads in particular to a pro-SME effect, following the assumption that small firm risk has a lower correlation with aggregate risk than does large firm risk. Belgian data calculations confirm this assumption and are in line with foreign studies.

Finally, in Section 3, the paper provides an overall estimate of the impact of Basel II on capital requirements for both corporate and SME lending[1]. While caution is clearly called for, we can offer the tentative conclusion that, relative to Basel I, capital requirements under Basel II for firm lending in Belgium should not *automatically* go up. This conclusion is of course reached 'ceteris paribus', i.e. assuming that banks' risk-taking behaviour remains unchanged. A second tentative conclusion is that the IRB approach seems to produce lower capital requirements than the SA approach, and this conclusion obtains for large as well as small Belgian banks and for corporate as well as SME lending. This can only reinforce the presumption that the main Belgian banks will choose the IRB approach in the future. Sensitivity analysis suggests the robustness of these conclusions and is discussed at the end of Section 3. Further discussion is included in the last section, which concludes the paper.

1. Bank lending to SMEs

In order to better understand the potential effects of Basel II on SME lending, this section provides some facts about the structure of this type of lending in Belgium. Basel II is going to offer banks a *menu of approaches* whose relative attractiveness will typically depend on bank size, given the fixed cost of implementing the most advanced approaches. In order to determine how Basel II will affect Belgian banks' capital requirements, it is therefore important to understand which banks lend to which firms in Belgium. Before doing this, it is necessary to define small/large banks and firms.

1.1 Some definitions

1.1.1 Large versus small banks

To distinguish between small and large Belgian banks, the 100 billion euro cut-off for total assets has been chosen. Table 1 clearly shows that this is a natural cut-off point. Furthermore, this cut-off point is often used in the empirical literature (see e.g. Berger et al., 2001), which distinguishes banks with respect to size, to differentiate between the two smallest bank asset classes. Note that the table only covers the banks that granted credit to non-financial firms in the period under consideration.

(1) For a review of the impact of Basel I on capital requirements, see Jackson et al. (1999).

TABLE 1 BANK ASSETS BY SIZE CLASS
(June 2002; in billions of euro)

	Number of banks	Total assets (p.c. of total banking sector)	Mean	Min.	Max.
Large banks[1]	4	658.1 (87 p.c.)	164.5	100.7	271.8
Small banks	39	69.7 (9 p.c.)	1.7	0.1	13.3
Foreign branches	25	28.1 (4 p.c.)	1.0	0.0	4.4

Source : NBB.
(1) Including Belgian subsidiaries since the Accord needs to be applied on a consolidated basis.

The table stresses the overwhelming dominance, in asset terms, of the four large banks that operate in Belgium. We have already mentioned that large banks are likely to follow the IRB approach while small banks are more likely to adopt the SA approach. Foreign branches, on the other hand, will need to adopt the approach of their foreign parent banks. In what follows we will only concentrate on small and large banks.

1.1.2 Non-financial firm exposure

We define non-financial firm exposures as put forward in the Basel II Accord. Basel II identifies 3 types of non-financial firm exposures: exposures to corporates, exposures to corporate SMEs and exposures to retail SMEs. (BIS, 2003b) First, a corporate exposure is defined as a debt obligation of a corporation, partnership or proprietorship. Second, in the corporate portfolio, SME borrowers are defined as those with less than 50 million euro of annual sales on a consolidated basis. Third, loans extended to SME borrowers are eligible for the retail treatment provided the total exposure of the banking group to the individual firm is less than 1 million euro. The definition most often used in the empirical literature on SME lending (see e.g. Berger et al., 2001a) corresponds to the definition of retail SMEs in Basel II.

1.2 The importance of SME lending in Belgian banks' loan portfolios

Empirically, identification of SMEs according to this definition requires us to combine data from the Credit Register (CR), from which we have used information on utilised credit lines to Belgian firms[2], and the Central Balance Sheet Office (CBSO), which provides balance sheet and income statement data for these Belgian firms. We used CR data based on June 2002. As information from the CBSO is not yet available for 2002, financial information for the years 2001 and 2000 is used.[3]

To provide a first indication of the composition of the loan portfolios[4] of large versus small Belgian banks, Table 2 provides descriptive statistics relating to loan exposures

(2) The CR also contains information on credit lines to associations of firms (or associations of firms and individuals). As these lines count for only roughly 11 p.c. of total firm lending, we decided to disregard them.

(3) When combining these two datasets, we noticed that there are exposures in the CR dataset for which no balance sheet information is available in the CBSO. Specifically, total coverage of CR data in the CBSO dataset is on average 90 p.c. in terms of exposure, and 83 p.c. in terms of number of debtors, when lending to associations is not taken into account. When this type of lending is included, the figures are 74 p.c. and 76 p.c. respectively. They also correspond to the coverage of 75 p.c. of exposures calculated in Saurina and Trucharte (2002) for Spain, and they are higher than their total coverage in terms of number of debtors, which was on average only 45 p.c.. Saurina and Trucharte concluded from this that it was mainly for small firms that no financial information was available. In their article there is no reference to the role of associations.

(4) Exposures to public entities and educational institutions have been excluded as most of them are treated differently in Basel II.

TABLE 2 LOANS TO BELGIAN FIRMS AS A PERCENTAGE OF BANK ASSETS ACCORDING TO BANK AND FIRM SIZE

(June 2002; Bank-level data)

Corporate	Mean	Median	Min.	Max.	Stdev.
Large banks	2.15	2.18	1.60	2.64	0.52
Small banks	1.47	0.00	0.00	21.24	4.49
Corporate SME	Mean	Median	Min.	Max.	Stdev.
Large banks	4.89	4.69	3.94	6.22	0.97
Small banks	4.89	0.75	0.00	32.91	8.33
Retail SME	Mean	Median	Min.	Max.	Stdev.
Large banks	3.30	3.28	1.84	4.82	1.34
Small banks	3.27	1.40	0.00	15.82	4.78
Total	Mean	Median	Min.	Max.	Stdev.
Large banks	10.34	10.04	8.42	12.86	2.14
Small banks	9.63	4.17	0.01	48.92	11.75

Source: NBB.

as a percentage of bank assets. Two conclusions emerge from the table. First, we see that, on average, large banks exhibit a portfolio composition similar to that of small banks in terms of proportion of assets devoted to SME lending. A difference exists for corporate lending, as large banks lend more to corporates in terms of assets than do small banks. However, there are large differences between banks, especially between small banks. Second, on average, in terms of bank assets, both large and small banks lend less to large Belgian corporates than to Belgian corporate SMEs or Belgian retail SMEs[5]. This highlights the very important role of SMEs in the Belgian economy.

Table 2 also indicates that small banks devote less of their total assets to firm loans than do large banks, which makes it difficult to draw definite conclusions as to which banks specialise in lending to which firms. Therefore, Table 3 gives an overview of the distribution of loans by firm class as a percentage of total loan exposures. Again, the table stresses the very important role of large and small banks for SME lending in Belgium. Further, it indicates that, although large differences exist between banks, small banks specialise more in loans to retail SMEs while large banks tend to specialise in loans to corporates and corporate SMEs. The latter observation is consistent with a large stream of research which has documented the fact that small banks invest a much higher proportion of their assets in small business loans. (See for example Berger and Udell, 1996, Peek and Rosengren, 1997, Strahan and Weston, 1998 and Berger et al. 1998, 2001a). Small and large banks may have a different lending focus because small banks face an exposure constraint. However, small firms may also be a natural customer base for small banks because of the different organisational structures of small and large banks. As the size and the complexity of the banking organisation increases, organisational diseconomies à la Williamson (1988) may raise the cost of transmitting the "soft" information[6] related to SME lending through layers of management. (Stein, 2002 and Liberti, 2002).[7]

Tables 2 and 3 do not tell us much about the proportion of SME lending that will be represented by banks adopting the IRB approach. An idea is provided by Table 4, which gives information on the aggregate proportions to different firm classes accounted for by large and small banks.[8] We can conclude that although small banks tend to specialise in small loans, an extremely high proportion of total SME loans are provided by large banks since large banks' lending to all firm classes accounts for more than 92 p.c. of total firm lending. If we accept the credible hypothesis that large banks will take the IRB road, we can conclude that IRB banks will account for most SME lending.

(5) We may expect large banks to lend more to corporates when foreign firm lending is also included. Credit Register data, however, does not provide information on utilised credit lines to foreign firms.

(6) Soft information can be defined as information that is initially not available in hard numbers and is difficult to summarise in a numerical score (Petersen, 2002).

(7) However, these organisational costs may be dampened by diversification benefits which can be mainly exploited by large banks (See e.g. Black and Strahan, 2002)

(8) The larger the total exposures to a firm class, the higher the risk weight assigned to these firms.

TABLE 3 COMPOSITION OF BANKS' LOAN PORTFOLIO

(June 2002; Bank-level data; as percentage of loan exposures to Belgian firms)

Corporate	Mean	Median	Min.	Max.	Stdev.
Large banks	21.56	20.37	14.15	31.35	7.34
Small banks	10.22	0.00	0.00	100.00	25.53
Corporate SME	Mean	Median	Min.	Max.	Stdev.
Large banks	47.48	47.56	42.78	52.00	3.82
Small banks	34.71	24.34	0.00	99.06	36.45
Retail SME	Mean	Median	Min.	Max.	Stdev.
Large banks	28.06	28.37	18.00	37.49	9.56
Small banks	55.08	63.26	0.00	100.00	39.93

Source : NBB.

TABLE 4 DISTRIBUTION OF LOANS ACCORDING TO BANK AND FIRM SIZE AS PERCENTAGE OF TOTAL LOAN EXPOSURES TO BELGIAN FIRMS

(June 2002; Aggregate data)

	Corporate	Corporate SME	Retail SME
p.c. of total exposure	20	49	31
of which			
Large banks	93.49	92.50	94.47
Small banks	6.51	7.50	5.53

Source : NBB.

2. The Basel II approach

2.1. The regulatory context up to Basel II [9]

In order to evaluate banking regulation, it is important to start with the question: what is special about these institutions that warrants regulation? A key characteristic of financial institutions concerns the nature of their *claimholders*, i.e. *depositors* in the case of banks. Indeed, typical corporations have liabilities held by debt holders and by equity holders. The latter ones are "in control" in good times and the former ones in bad times. In *non-financial companies*, debtholders – which are often banks – are expected to play a major role in disciplining management in the case of financial distress, in order to avoid "gambling for resurrection", in particular. This requires expertise, and it is often a role played by banks (indeed, only large firms – backed by rating agencies – can get disintermediated debt). By contrast, banks, like several other types of financial institutions, have liabilities held by depositors, i.e. *dispersed non-experts*. In such a case, there is a need for a *debtholder representative*, which is a fundamental role for the regulator. This is especially true since banks can take risks that could contribute to contagion or systemic risk.

How does the regulator act as a bank debtholder representative? First, by imposing constraints, in the form of capital requirements, which serve to ensure bank solvency and to avoid systemic externalities. Second, by threatening a "get-tough-policy" when these requirements are not respected, with the regulator taking control and possibly closing or selling the financial institution. This broadly mimics the role of debt as a contingent control arrangement in non-financial firms, where control over the firm switches to creditors in bad times. Moreover, regulation is aimed at limiting the ability of shareholders to "play with the deposit insurance fund money", something their debtholders/depositors care about insufficiently if they feel at least partially protected by deposit insurance.

The general combination of capital requirements and control shifting to the regulator in the case of violations of the above rules is common to the regulation of banks, securities firms and insurance companies. Specifics, however, differ between types of institutions. Since banks have a special role in bearing *credit risk*, this is the natural focus for banking regulation. In contrast to previous regulation, since 1988, the Basel I accord has tried to measure credit risk and has required banks to hold a capital of at least 8 p.c. of their "risk-weighted assets (RWA)". In this first attempt at forcing banks to internalise the credit risk characteristics of their loans, four risk categories were considered each receiving a different risk weight (RW) [10]: a risk weight of 0 for OECD sovereign risk; a risk weight of 20 for lending to OECD banks; a risk weight of 50 for residential mortgage lending; a risk weight of 100 for all other lending (including all lending to firms). (see BIS, 1988)

Basel I offered an improvement over previous regulation that essentially treated all lending in the same way but still discriminated in favour of sovereign lending as well as within firm lending, against 'safe firms' and in favour of 'risky firms'. As such, Basel I induces a form of regulatory arbitrage: when banks find that economic capital [11] for firm loans is significantly below the 8 p.c. regulatory capital requirement, they have the incentive to minimise the difference between economic and regulatory capital by altering their lending behaviour towards riskier loans. Basel II aims to reduce this form of regulatory arbitrage.

Besides the risk of regulatory arbitrage, another shortcoming of Basel I regulation is the practice of computing total capital requirements by *summing* the requirements associated with individual elements on the asset side of the balance sheet. Although regulators were obviously aware of the potential diversification effects linked to the size or composition of the portfolios held by financial institutions, the difficulty in measuring them had largely prevented regulation from taking diversification into account in Basel I. How to measure and incorporate diversification effects is an issue that Basel II partially tries to address.

(9) For a general treatment of this issue, see Dewatripont and Tirole (1994).

(10) Here we leave aside the question of capital requirements for off-balance-sheet operations, for the sake of simplicity.

(11) Economic capital is defined as the amount of capital needed for a portfolio such that there is only a small probability that losses may exceed capital. For a prescribed level of confidence it is calculated as the confidence quantile of the portfolio loss distribution minus the expected loss. In the literature, economic capital is also often called credit Value at Risk.

2.2 General philosophy of Basel II

The above section suggests that regulation is clearly helpful in limiting risk-taking by banks, by forcing them to 'play with their own money': if they are forced to stay above the 8 p.c. capital threshold at all times, the externality from deposit insurance is eliminated. And one can hope that, in general, imperfections in reporting systems and regulatory lags are not so severe that an 8 p.c. rule would be insufficient to 'catch violators' before their capital becomes negative.

While the Basel II Accord has not been finalised[12], current plans give a good idea of its philosophy. The accord is relatively complex and multi-faceted, and we do not aim to summarise it in all its dimensions here. The proposal is based on three pillars:

1. A system of minimum capital requirements.

2. Supervisory review in which supervisory authorities assess banks risk control systems and capital adequacy policies.

3. The use of market discipline as a lever for strengthening disclosure.

As most elements for the treatment of SME exposure are included in the first pillar, we will focus on principles developed in this pillar. The New Accord maintains the level of the minimum capital requirement at 8 p.c. of RWA but adds the RWA for operational risk to the RWA for credit risk and market risk[13]. In what follows, we will concentrate on the calculation of minimum capital requirements for credit risk. More specifically, we will focus on changes in risk weights relative to Basel I, the incorporation of asset correlation effects, and their implications for the specific treatment of SME lending.

A key feature of the first pillar of Basel II is that it presents two options for the measurement of credit risk: the SA and the IRB approach.[14] Within the IRB approach the Accord gives two methods for calculating risk capital charges: the 'Foundation IRB Approach' and the 'Advanced IRB Approach'. Banks are encouraged to move along the spectrum of available approaches as they develop more sophisticated risk measurement systems and practices. The SA is closer to Basel I, and is expected to be adopted by smaller institutions. The IRB approach relies to some extent on internal risk calculations by banks, implying a fixed set-up cost that, in the first instance, may only be worthwhile for bigger institutions on average (since the gain of a more 'tailor-made' system will typically grow with asset size). So, although most SME lending in Belgium is likely to be granted in the future by banks adopting the IRB approach, it is useful to spend some time first on the standardised approach, to understand better what Basel II implies relative to Basel I.

2.3 The Standardised Approach

This approach differs from Basel I essentially in making the capital requirement depend on external ratings (by nationally certified rating agencies, e.g. Moody's, Standard and Poor's or Fitch). Specifically, the risk weights are as detailed in Table 5. Risk-weighted assets are then calculated by multiplying these risk weights by credit exposures.

(12) The Committee released a final consultation paper on the 29th April 2003 and is planning to agree on the new Accord by the end of this year. (BIS, 2003b)

(13) RWA for market risk need to be calculated as put forward by the Committee in 1996. The amendment allowed banks, for the first time, to use their own internal models. (BIS, 1996)

(14) Note that supervisory authorities may require systemically important banks to adopt the IRB approach.

TABLE 5 RISK WEIGHTS BY RATING BUCKET

Rating	AAA to AA–	A+ to A–	BBB+ to BBB–	BB+ to BB–	B+ to B–	Below B– and defaulted	Unrated
Sovereigns	0	20	50	100	100	150	100
Banks 1	20	50	100	100	100	150	100
Banks 2							
< 3 months	20	20	20	50	50	150	20
> 3 months	20	50	50	100	100	150	50
Corporates	20	50	100	100	150	150	100

Source: Basel (2001a).

Moreover, residential mortgages would carry a 35 p.c. weight, while other 'retail exposures' would carry a 75 p.c. weight.

The key adjustments to Basel I are thus:

1. Refined treatment of sovereign lending relative to the Basel I system of 0 p.c. for OECD States and 100 p.c. for non-OECD States. There will thus be, in particular, 'tougher' treatment of some OECD sovereign lending.

2. Refined treatment of interbank lending, where two options are possible: either according to the sovereign rating where the bank is incorporated ("option 1") or according to the bank's own rating ("option 2", with preferential treatment for maturities of less than 3 months). On average, OECD interbank lending receives a higher capital requirement.

3. A drop in the residential mortgage requirement from 50 p.c. to 35 p.c..

4. Refined treatment of lending to firms, with two key effects: (i) more favourable treatment of firms that have a good rating but harsher treatment of firms with bad ratings; (ii) unchanged treatment of firms that are unrated, except for 'retail lending', where the capital requirement is down from 100 p.c. to 75 p.c..

Banks are also allowed to take account of several credit risk mitigating techniques, such as collateral, guarantees, credit derivatives and netting arrangements. Where banks take eligible collateral, which has been expanded to include most types of financial instruments, they are allowed to reduce their credit exposure to take account of the risk mitigating effects of the collateral. Banks may opt for different approaches. For guarantees and credit derivatives a substitution approach will be applied. The portion of the exposure that is protected will be assigned the risk weight of the protection provider. To the extent that there are netting arrangements, banks will be allowed to calculate capital requirements on the basis of net credit exposures.

Let us make two comments on the standardised approach at this point: First, note that the regulation would seem to suggest that, at least for firms wishing to access capital markets, being unrated is on average a bad thing; that is, good firms presumably find it profitable to get rated. This has been analysed in the economics literature on 'disclosure of hard information' (see Grossman and Hart (1980), Grossman (1981), Milgrom (1981), and Okuno-Fujiwara et al. (1990). This literature shows how such information naturally gets disclosed in equilibrium. This is called the 'unraveling argument': since it pays to disclose whenever one's private information is favourable, the 'market' will 'assume the worst' when disclosure does not take place.

However, this unraveling argument will not apply fully if, for example, it is very costly for a firm to access capital markets (it will only need a rating if it accesses these markets) or if there is a fixed cost entailed in disclosing information. In this case, non-disclosure only means that the gain from accessing capital markets or disclosing information is less than the cost. While very favourable information will be disclosed, the undisclosed information is not necessarily the most damaging. The higher the cost of disclosure, the less unfavourably one should look at non-disclosure.

If we apply this view to Basel II, since only firms that plan to access capital markets get rated and since getting rated involves a fixed cost, which is a more significant hurdle for SMEs, this is a justification for the lower capital requirement of retail lending relative to other firm lending: retail lending involves unrated firms, but their lack of rating is due much more to the cost of accessing capital markets than the possibly unfavourable financial situation of the firm.

A second justification for the more favourable regulatory treatment of retail lending seems to come from the desire to have a 'level playing field' between the standardised approach and the IRB approach, and has to do with the fact that retail default has a lower correlation to aggregate movements than corporate default (see below). Indeed, while the standardised approach keeps the idea of summing individual capital requirements, thereby leaving aside any explicit portfolio considerations, one can see the 'retail correction' as a means of taking on board this diversification effect in a simple (and admittedly crude) way.

2.4 The IRB approach

The second approach that the Basel Committee envisages for the determination of regulatory capital is based on internal ratings systems. Banks are allowed to use their own internal ratings, subject to supervisory approval, to assign a wide range of risk weights to corporate, bank, sovereign and retail exposures. The weights planned under the IRB approach exhibit much higher risk-sensitivity than those under the standardised approach.

2.4.1 Risk weights

The general risk weight curve for corporate, sovereign, banks and retail portfolios[15] transforms risk components (PD – Probability of Default, LGD – Loss Given Default and ρ – correlation) into capital requirements. The main part of this risk weight function is based on a structural-approach portfolio model in which the correlation is the free parameter. See Box 1 for a discussion of the theoretical foundation of the following risk weight curve:

$$k = \Phi\left(\frac{\Phi^{-1}(PD) + \sqrt{\rho}\Phi^{-1}(C)}{\sqrt{1-\rho}}\right) * LGD$$

where:

k = capital requirement

Φ = standard normal function

Φ^{-1} = inverse standard normal function

ρ = asset correlation (see formulae below)

C = confidence interval – set by Committee at 99.9 p.c.

We can think of the risk weight formula as being the marginal contribution of a debtor to bank risk, i.e. the additional capital a bank needs to hold to protect itself against the risk of a single extra exposure (see Box). For the corporate, sovereign and interbank curve, the capital requirements are adjusted for maturity (M). For retail exposure, the capital requirement curve contains no explicit maturity adjustment. Risk-weighted assets can then be obtained by multiplying the derived capital charge by 12.5[16] (to obtain the RW) and by the exposure at default (EAD). Note that capital requirements, and thus the risk-weighted assets, increase with the probability of default, the loss given default, the asset correlation and, when it applies, the maturity of the exposure.

Parameters of this risk weight function, and especially the parameters of the correlation formula (see below), were adjusted to fit the goal of keeping the average economy-wide requirement unchanged at the current 8 p.c. This calibration of the IRB capital requirements has occurred within a simplified portfolio model to cover both unexpected and expected credit losses (see Box). This seems at first sight counter-intuitive, as capital is intended to provide a cushion against unexpected losses, while provisioning and (at origination of the loan) loan prices need to provide a cushion for expected loss. However, there are several reasons for the Committee's decision. First, this is to prevent loan loss provisions that are considered eligible for capital (up to a maximum of 1.25 p.c. of risk-weighted assets) from also being used to cover for expected loss ('double gearing'). Furthermore, this prevents problems that may arise from differences in provisioning practices between countries. And finally, it prevents difficulties that supervisors may experience when validating estimates of future margin income. However, as there are conceptual arguments for taking provisioning and prices into account in the calculation of capital, the Basel Committee decided to include the following two elements. First, under certain conditions, banks may reduce risk-weighted assets by the difference between 12.5 times the provisions and the expected loss portion of the risk-weighted assets (which is calculated as 12.5*PD*LGD*EAD) in a given class. And second, for qualifying revolving retail credit such as credit cards, which exhibit a high ratio of future margin income to expected losses, the expected loss portion of the risk-weighted assets can be reduced by 12.5 times future margin income (see BIS, 2001b).

As already mentioned above, there are two variants within the IRB approach: the IRB foundation and the IRB advanced approach. Under both approaches, the capital charge required to cover credit risks depends on the same components: PD, LGD, EAD, correlations and maturity M. However, they differ mainly in terms of the inputs that need to be estimated by the bank and those specified by the Committee (see Table 6 and see the following section for the treatment of correlations). Under the foundation approach, banks must assign each borrower to an internal rating bucket and allocate an average PD to each of the rating buckets. Other components such as LGD, EAD and M are set by the Committee. At national discretion, maturity values can be provided by banks based on own estimates. Under the advanced IRB approach, banks must provide their own estimates of PD, LGD, EAD and M. For retail exposures, there is no distinction between the foundation and advanced approaches, and banks must provide their own estimates of PD, LGD and EAD for these exposures. In general, the advanced approach is expected to be adopted by more sophisticated institutions and is intended as the starting point for accepting the use of banks' own credit risk portfolio models in determining regulatory capital.

(15) Capital requirements for other portfolios, such as specialised lending (i.e. project finance, object finance, commodities finance, income-producing real estate and high-volatility commercial real estate), purchased receivables, and equity portfolios are subject to another specific treatment.

(16) The inverse of the current minimum 8 p.c. risk-based capital requirement.

TABLE 6 INPUT FACTORS SPECIFIED BY BANKS AND/OR THE BASEL COMMITTEE IN THE IRB APPROACH

	Sovereign, corporate and interbank		Retail
	Foundation	*Advanced*	
PD	Bank	Bank	Bank
LGD	Committee	Bank	Bank
EAD	Committee	Bank	Bank
M	Committee or Bank	Bank	N.A.

An important element of the IRB framework is also the treatment of credit risk mitigants such as collateral, guarantees, credit derivatives and netting arrangements. Compared to the SA approach, a wider range of collateral is accepted. In addition to the eligible financial collateral, other collateral types such as receivables, and residential and commercial real estate can be taken into account in the value of LGD. As physical collateral is often used in lending to SMEs, this favours SME lending. Under the foundation approach, the risk-mitigating effects of guarantees and credit derivatives are recognised as follows: for the covered portion of the EAD, a risk weight function may be used which is specific to the type of protector and the PD specific to the protector's rating may be used. Under the advanced approach banks may choose whether the guarantee is reflected through the probability of default or through the LGD estimates. On-balance-sheet netting of loans and deposits is recognised under certain conditions on EAD.

Box 1

Theoretical foundation of the IRB risk weight curve

The model used by the Basel Committee to calibrate the risk weight functions of the IRB approach is derived from a structural-approach portfolio model.(1) The roots of these models can be found in the seminal papers by Merton (1977) and Black and Scholes (1974). Structural-approach models typically postulate some explicit microeconomic model of the process that determines the default of the individual debtor(2). In these models, a borrower's financial position is driven by underlying latent variables, which are determined by common risk factors and idiosyncratic risk factors. In this box we discuss the theoretical foundations of the risk weight function and its underlying assumptions. (see also Gordy, 2000, 2003)

The model that underlies the Basel proposal is a one-factor model, which implies that there is only one systematic risk factor common to all debtors. The state of borrower i is driven by the latent variable Y_i , which is defined as a linear function of a single systematic factor X and an idiosyncratic risk component ε_i

$$Y_i = wX + \sqrt{1 - w^2}\varepsilon_i, \qquad i = 1 \ldots n \qquad (1)$$

where w can be thought of as the weight with which the latent variable of an individual obligor is driven by the systematic risk factor X. The variables X and ε_i follow a standard normal distribution with mean 0 and variance 1, and X and are independent for every obligor i. The weights of the two components are chosen so that Y_i is also standard normally distributed. The common factor affects all companies equally and represents the state of the economy, i.e. the systematic risk. The idiosyncratic risk component affects one specific borrower and represents the diversifiable risk.

The model is a default-only model, assuming the firm to be in a state of either default or of non-default. As default occurs when Y_i is below a critical threshold value γ at a certain horizon, and rearranging formula (1), we obtain

$$\varepsilon_i < \left(\frac{\gamma - wX}{\sqrt{1 - w^2}} \right) \qquad (2)$$

(1) In general, there are two main correlation estimation procedures: the structural approach and the reduced-form approach. Reduced form models assume a particular relationship between the default rate and some background factors, which represent systematic factors. To the extent that two obligors are sensitive to the same set of background factors, their default probabilities will move together.

(2) The best-known industry models of portfolio risk using a structural - based approach are the RiskMetrics Group's CreditMetrics and KMV's Portfolio Manager.

From this we can derive the probability of default conditional on the realisation of the systematic risk factor $X = x$.

$$p(x) = \Phi\left(\frac{\gamma - wx}{\sqrt{1 - w^2}}\right) \qquad (3)$$

where Φ is a standard normal distribution function. Once we have conditioned on the common factor, the individual obligor defaults are driven only by own idiosyncratic terms and are independent for other defaults. This independence justifies the Basel decision to apply risk bucketing rules.

As the latent variable is a standard normal variable, this threshold value γ is equal to $\Phi^{-1}(PD)$ where PD is the unconditional probability of default, i.e. the average value of the conditional default probability across all possible realisations of the systematic risk factors.

A random expected loss given default rate *(LGD)* is introduced that is independent and has mean λ. The conditional portfolio loss is then equal to

$$p(x) = \lambda^* \Phi\left(\frac{\Phi^{-1}(PD) - wx}{\sqrt{1 - w^2}}\right)$$

If the number of loans in a portfolio goes to infinity, i.e. the portfolio is asymptotically fine-grained, the variance of the portfolio is completely determined by the variance of the market, as the specific risk contributes no volatility to a well-diversified portfolio. Therefore, it is possible to map the percentile $(1-\mathrm{C})$ of the X-distribution to the C portfolio percentile to account for portfolio variance. Banks typically hold reserves and capital sufficient to cover this percentile of the distribution of portfolio loss over the horizon.

$$p(x) = \lambda^* \Phi\left(\frac{\Phi^{-1}(PD) - w\Phi^{-1}(C)}{\sqrt{1 - w^2}}\right) \qquad (4)$$

We can replace the weighting parameter w by $\sqrt{\rho}$, which stands for the average value of the asset correlation. Since we have assumed that idiosyncratic factors are independent, correlations between latent variables are due to the existence of the systematic risk factors. The degree of correlation between defaults is determined by the sensitivity of the latent variables to the systematic factor, that is by w of the latent variables of two obligors, as shown by

$$\rho = corr\,(Y_i, Y_j) = w^2$$

Using this result, the conditional portfolio loss function looks as follows:

$$p(x) = \lambda^* \Phi\left(\frac{\Phi^{-1}(PD) + \sqrt{\rho}\Phi^{-1}(C)}{\sqrt{1 - \rho}}\right) \qquad (5)$$

This function appears to be an important input factor of the IRB risk weight function and can be interpreted as a benchmark in terms of marginal value at risk for the capital required for an individual loan. To arrive at the risk weights the function is multiplied by an adjustment that allows for the maturity of the exposure and by 12.5 p.c. The IRB capital requirements are calibrated within this simplified portfolio model (assuming a one-factor model and portfolio-invariant capital requirements) and cover thus both expected (defined as $\lambda^* PD$) and unexpected credit losses.

2.4.2 Asset correlations

The risk of individual loans can be assessed by different drivers of credit risk such as PD, LGD and EAD. To assess the risk of a credit portfolio, however, it is not sufficient to simply aggregate the individual risks; it is also necessary to take into account the correlations of the risks between the assets in the portfolio. These correlations determine by how much the loss on a portfolio is reduced by diversification across debtors, industries and regions. Although there has been much progress in recent years in the estimation of correlations across exposures in a portfolio, there is not at present a single, well-accepted "best-practice" for calculating them. Estimating correlations is indeed considered to be one of the central challenges for quantifying portfolio credit risk.

The Basel Committee (BIS, 1999) recognises that an approach based on a full credit risk portfolio model that takes into account the effect of correlations may bring regulatory capital into closer alignment with the perceived riskiness of the assets and portfolio concentrations. For a number of reasons, however, Basel II does not allow for a full portfolio-based approach in the assessment of credit risk. First, a lack of data on individual bank portfolios hinders the reliable estimation of the correlations between different exposures. This lack of data is due partly to the infrequent character of default events and the relatively longer-term time horizon used in the calculation of credit risks. Furthermore, the lack of data prevents appropriate back-testing of the models. This is in sharp contrast with market risk models, which typically can make use of daily data.

Second, correlation estimates are subject to several methodological issues. Different assumptions, e.g. on the distribution function, made in different credit risk models to calculate correlations may affect the loss distributions. There appears to be no theoretical answer as to what the value of the average asset correlation should be. In the end, it is an empirical question whether the correlations calculated by the different models are acceptable in size and whether they are stable over time.

Given the data and the methodological limitations involved in calculating correlations, the Basel Committee decided not to allow banks to calculate the correlations themselves, but rather to incorporate correlations in a more indirect manner. Following empirical research, the Committee incorporated variables reflecting some of the characteristics displayed by correlations into the regulatory formula; in particular, a decreasing relationship between asset correlation and the probability of default is incorporated, and a positive relationship between firm size and correlation is introduced. Thus, although the risk weight curve is based on a structural portfolio model, asset correlations are introduced in a more indirect way, dependent on PD and firm size.

The correlation formulae that are put forward by the Basel Committee vary for different asset portfolios and are set as follows:

1. sovereign, corporate and interbank exposures:

$$\rho A = 12\% * \left(\frac{1 - e^{-50*PD}}{1 - e^{-50}} \right) + 24\% * \left(1 - \frac{1 - e^{-50*PD}}{1 - e^{-50}} \right) \quad (1)$$

Correlations are a decreasing function of the probability of default, and they vary between 12 p.c. for low quality exposures and 24 p.c. for high quality exposures. For corporate SMEs, there is a firm-size adjustment to the corporate risk weight formula:

$$\rho A = (1) - 4\% * \left(1 - \frac{(S-5)}{45} \right)$$

where S is expressed as annual sales in millions of euros with values of S falling in the range of less than or equal to 50 million euros or greater than or equal to 5 million euros. Firms with annual sales of less than 5 million euros will be treated as if their sales were equal to 5 million euros for the purposes of the firm-size adjustment. The formula shows that the smaller the firm size, the lower the asset correlation and hence the lower the ultimate capital requirement. On average, this size-adjustment may reduce the capital requirements by 20 p.c. for the smallest firms.

2. retail exposures:

For exposures secured by residential mortgages, asset correlation is fixed at the level of 15 p.c.. This rather high correlation takes into account the fact that mortgage loans are in general long-term loans (recall that there is no maturity adjustment for retail exposures) which may be greatly affected by the business cycle. Banks will be allowed to apply the following formula for correlations for their SME exposures so long as the total exposure of the banking group to the SME is less than 1 million euro and provided that those exposures are managed in a way similar to retail exposures. This implies that they should be treated consistently over time and in the same manner as other retail exposures and that they must not be managed individually but as a part of a portfolio segment. (BIS, 2003b, § 200)

$$\rho_A = 2\%* \left(\frac{1 - e^{-35*PD}}{1 - e^{-35}} \right) + 17\%* \left(1 - \frac{1 - e^{-35*PD}}{1 - e^{-35}} \right)$$

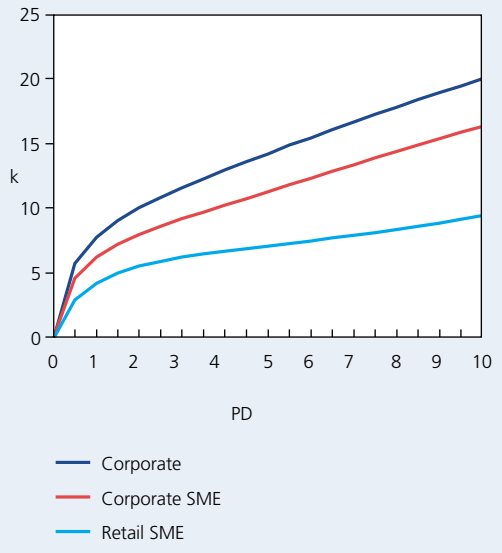
Correlations thus vary between 2 p.c. for low quality retail lending and 17 p.c. for high quality retail lending.

The asset correlation curve for qualifying revolving retail credit is very similar to the one for loans to retail SMEs; correlations vary between 2 p.c. and 11 p.c. while the value 35 needs to be replaced by 50.

To show the impact of these different correlation formulas on the risk weight curve for non-financial firms, Chart 1 reports the risk weight curves for loans to corporates, corporate SMEs and retail SMEs under the assumption of a 45 p.c. LGD (which is the value put forward by the Committee for senior unsecured claims under the foundation approach), a maturity of 2.5 years, (which is the value for banks using the foundation approach) and annual sales of 5 million euros (for the purposes of the firm-size adjustment for SME borrowers). The risk weight curve for exposures to retail SMEs is both lower and less steep than the risk weight curves for exposures to corporate SMEs and corporates.

CHART 1 THE RELATIONSHIP BETWEEN CAPITAL REQUIREMENTS (k) AND PROBABILITIES OF DEFAULTS (PD) NON-FINANCIAL FIRMS

(In percentages)(1)



Source : BIS (2002).
(1) LGD = 45 p.c. and Maturity = 2.5 year, S=5

2.4.3 Rationale of PD and size dependence of correlations

The box has shown that the risk weight formula is based on a one-factor model in which the correlation factor measures the exposures against systematic risk. Basel incorporates a lower correlation factor for smaller firms, which implies that these firms are less vulnerable to systematic risk than larger firms. Although small firms have on average a higher default rate than large firms, the weak sensitivity to systematic risk of small firms favours a reduction in the SME risk weight. Two arguments can be found in the literature that explain this positive size dependence of correlation.

First, large firms may be more sensitive to systematic risk because they are better diversified than SMEs (see e.g. Lopez et al. (2002)). Larger firms generally have many divisions in many markets, and thus superficially resemble diversified portfolios of smaller firms. According to the theory of portfolio diversification, we may expect those diversified portfolios to resemble more closely the general economy and less idiosyncratic elements. Although SMEs have on average a higher default rate, it is due mostly to idiosyncratic risk, which can be diversified away in a large portfolio. The positive effects of diversification may explain the decreasing relationship between asset correlation and firm size as reflected in the Basel correlation formulae. However, Roll (1988) has found that portfolios of smaller firms, which were constructed to match large firms in asset size, were more exposed to systematic risk, in terms of R^2, than the size-matched large firms.

Second, Düllmann and Scheule (2003) argue that firm size may serve as proxy of the business sector dependency of the correlations, since sectors which are more correlated to the state of the economy are dominated by large firms while sectors which are less prone to systematic risk are dominated by small firms. They found support for this hypothesis with German data. Sectors such as manufacturing, construction and automotive have a higher percentage of large firms, while sectors such as transport & communication services, health and financial services and other public services have a higher percentage of small firms.

Empirical studies have also found support for the relationship between firm size and correlation. Lopez et al. (2002) constructed portfolios of American, Japanese and European firms and calculated asset correlations using the KMV methodology using equity returns as input data. Another stream of research (see Sironi and Zazzara (2001) on Italian data, Düllmann and Scheule (2003) on German data and Dietsch and Petey (2003) on French and German data) calculated correlations using historical default rates. Also, initial estimates of correlations with Belgian data conform to the hypothesis of positive size-dependency of

correlations (see infra). Although all studies found an increasing relationship between firm size and correlation, there is less uniformity in the literature related to the actual size of the correlations. The asset correlations for firms estimated in Lopez et al. are more in line with the ones proposed in Basel II[17] while in the other studies correlations are consistently lower. The underlying methodology and data may be the cause of these variations in results across studies. Two potential explanations exist for the low correlations in the second stream of research. First, the studies use a legal bankruptcy definition of default, which is more restrictive than the definition put forward in Basel[18]. Second, correlations may have been underestimated as they were calculated from the total population. In general, a portfolio of banks contains fewer exposures. Some limited studies (Düllman and Scheule, 2003 and Dietsch and Petey, 2003) that tried to address part of these problems found larger correlation estimates. However, they stayed well below the ones put forward by Basel II. In sum, studies analysing the relationship between firm size and correlations have shown that, although the level of the correlations and/or the relative correlations are not always in line with the Basel II proposal, they all confirm the same ranking of correlations as the ones assumed in Basel II.

The negative relationship between PD and correlations appears to be somewhat counter-intuitive since empirically asset correlations increase during systemic crises, when PDs also tend to increase, which would suggest that correlation and PD are positively related. Furthermore, empirical research has not found support for the negative relationship between PD and correlations (see e.g. Carey (1998); Erlenmaier and Gersbach (2001), De Servigny and Renault (2002) and Dietsch and Petey (2002)) even after controlling for firm size (see e.g. Dietsch and Petey (2003) and Dülmann and Scheule (2003).

The assumed negative relationship between PD and correlations in the risk weight formulas may, however, be understood by the desire to reduce the procyclical effects of the Basel Accord. Excessively large capital charges for certain firms could induce a credit rationing process, especially in periods of economic downturn, which may amplify the business cycle. If the correlations are made negatively dependent on PD, the risk weight curve becomes flatter, thereby dampening procyclical effects.

(17) Here we refer to the asset correlations included in the retail risk weight curve.

(18) Basel II considers a default to occur when one of two events has taken place: the bank considers that the debtor is unlikely to pay its credit obligation to the banking group; or the debtor has failed to honour for more than 90 days any credit obligation to the banking group. (see BIS, 2003b, §414)

(19) The cut off point has been calculated as the average of the mid-point of the 90th and 80th percentile of the retail SMEs and the mid-point of the 20th and 10th percentile of the corporate SMEs.

(20) The multiple reasons for not filing a balance sheet are for example: new established firms that did not have the time to file a balance sheet (±32 p.c.), firms that went bankrupt and never filed a balance sheet (±20 p.c.), firms that disappeared for several other reasons, such as voluntary discontinuation (± 24 p.c.) and firms that do not have to file a balance sheet (±15 p.c.)

3. The implication for Belgian banks of the Basel II treatment of SME loans

The object of this section is to evaluate the implications of the Basel II accord on capital regulation for Belgian banks, given the special treatment of SMEs. We make use of the empirical distributions of loans in Belgian banks' portfolios and calculate average PDs for differing firm types to estimate the capital requirements for Belgian banks. Here we focus on the SA and the foundation IRB approach.

3.1 Probabilities of Default

To get an idea of the PD of Belgian firms, we can make use of a database linked to the balance sheet register, which provides information on the Belgian firms entering bankruptcy procedures and the timing of these bankruptcies. These data allow one to estimate PD by the average default rate of a given class of firms. As mentioned above (see footnote 20), this definition is more restrictive than the definition put forward by Basel. To obtain estimates of the default rates for corporate firms and corporate SMEs, we have linked data on entry into bankruptcy with data from the balance sheet register. To obtain estimates of the default rate for retail SMEs we need information on exposure size. As this information is not available in either data set, we have analysed the characteristics of the firms classified as retail SMEs in 2002 using the Credit Register dataset. We used information on asset values to identify corporate SMEs and retail SMEs which enables us to calculate a proxy for the PD for the retail SMEs category. Following examination of the percentiles of the asset values of corporate SMEs and retail SMEs, we classified firms with an asset value of roughly 2 000 000[19] euro as retail SMEs.

Table 7 presents the size distribution of the total firm population and of the firms that entered into default. We see that retail SMEs form the highest proportion of (defaulting) firms. Corporates represent only a minor proportion of total (defaulting) firms. The distribution of defaulting firms does not include firms that did not file a balance sheet. These firms represent a rather large percentage of the total number of defaulted firms, on average about 34 p.c. Although we may assume that a significant proportion of these firms belong to the retail SME class[20], in what follows we have decided to disregard them. Making assumptions on the size of these firms will inevitably lead to a bias. Furthermore, although adding them to the retail SME class increases the PD of this class, it does not have

TABLE 7 THE SIZE DISTRIBUTION AND DEFAULT RATES OF BELGIAN FIRMS

(Average 1990-2001; in percentages)

	Corporate	Corporate SME	Retail SME
Total firms	0.5	8.3	91.2
Total firms entering bankruptcy	0.2	4.4	95.4
Default rate	0.30	0.89	1.69

Source : NBB.

an impact on the general conclusions (see Section 3.3 on sensitivity analysis). In any case, most defaulting firms for which financial information is available are classified as retail SMEs.

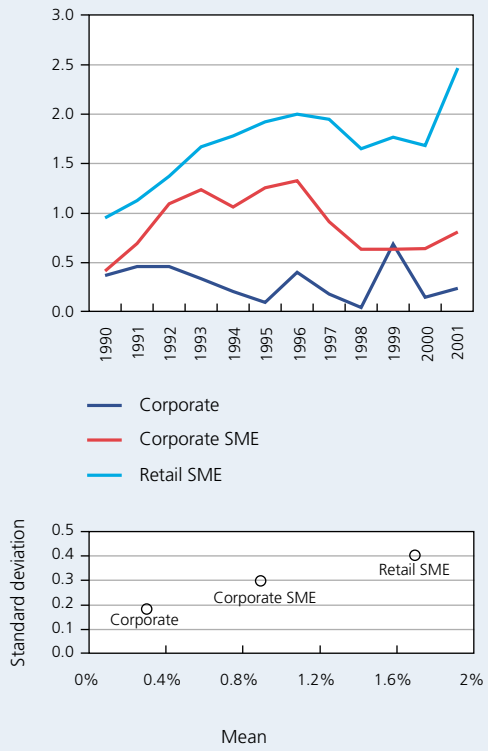
The following Chart 2 shows the 1-year default rates of corporates, corporate SMEs and retail SMEs. The data clearly show that bank loans to corporates are the least risky while the retail SMEs present the highest risks. The chart thus confirms that the default rate tends to decrease on average with the size of the firms. On average, corporates have a default rate of 0.30 p.c., corporate SMEs a default rate of 0.89 p.c. and retail SMEs a default rate of 1.69 p.c. Furthermore, the default rates are volatile over time and over the business cycle as the figures for the standard deviations in Chart 2 below show. Note that the volatility of the PD decreases with size. As these default rates fluctuate, we performed bootstrap simulations to test the stability of the average historical default rates. Results are presented in the annex. The analysis suggests that the observed average default rate provides us with a good proxy of the true average default rate. In what follows, we will therefore use the time-average of the one-year default rates over the period 1990-2001 to derive a credit rating to calculate capital requirements according to the SA and to plug into IRB the risk weight curve to calculate the capital requirements according to IRB foundation approach.

3.2 Capital requirements

To calculate capital requirements for banks under the standardised approach, we need information on the credit ratings. Assigning a credit rating to the average PDs or assuming that corporates and corporate SMEs are unrated does not make much difference in the standardised approach, as a 0.30 p.c. one-year PD for corporates and a 0.89 p.c. one-year PD for corporate SMEs correspond to a BBB-rating and a BB-rating respectively (S&P, 2002),

CHART 2 PROBABILITIES OF DEFAULT OF BELGIAN FIRMS (21)

(In percentages)



Source : NBB.

which are assigned a 100 p.c. risk weight, which is equal to the risk weight for unrated firms. Retail SMEs obtain a risk weight of 75 p.c. Information on the distribution of credit exposures per asset class reported in Table 3 is then combined with these risk weights to obtain total capital requirements for firm lending for each bank under the standardised approach.

As Section 2.4 has shown, we need more information on different input factors in order to calculate capital requirements for individual Belgian banks under the foundation IRB approach. As an estimate of the PD for the different asset classes, we used the average PDs calculated in the previous section : 0.30 p.c. PD for corporates; 0.89 p.c. PD for corporate SMEs; and 1.69 p.c. PD for retail SMEs. To compute the capital requirements for the corporate SMEs, it was also necessary to calculate a firm-size adjustment for each bank on the basis of the characteristics of their debtors (22). When available, we used annual sales

(21) The calculations exclude the firms for which balance sheets are unavailable.

(22) It is no surprise that this size-adjustment S is larger for the loan portfolios of larger banks than for smaller banks. On average, e.g., the value of the variable S for large banks was 14 million euros while this was 4 million euros for small banks.

reported in the firms' balance sheet. When there was no information on total sales[23], we used instead total assets, as suggested by the Basel Committee (see BIS, 2003b, § 243). Furthermore, we assumed a 45 p.c. LGD (which is the value put forward by the Committee for senior unsecured claims under the foundation approach). Maturity is assumed to be 2.5 years (which is the value for banks using the foundation approach). This information is then plugged into the formulas presented in Section 2.4 to compute capital requirements for credit risk for each bank. And finally, we have used information on the distribution of credit exposures per asset class reported in Table 3 to calculate total capital requirements for each bank.

Tables 8 and 9 present descriptive statistics on the capital requirements for credit and operational risk corresponding to each firm asset class and by bank size. These tables give an idea of the contribution of each firm class to total capital requirements. Table 8 assumes that all banks apply the standardised approach, and Table 9 assumes that all banks apply the IRB foundation approach. For the operational risk component of capital, we have assumed that the capital requirement is 10 p.c. of the total capital requirements, which is the target set by the Basel Committee.

The following conclusions emerge from the analysis. First, total capital requirements derived from the SA and IRB approach are mostly lower than the 8 p.c. put forward in Basel I, although the capital requirements for SA large banks exceed 8 p.c. when operational risk is taken into account. For SA banks this observation reflects the fact that both large and small banks greatly benefit from the risk weight reduction for retail SMEs in the standardised approach relative to Basel I.[24] On the other hand, the benefit to large SA banks of the reduction in risk weight for retail SMEs is counterbalanced by the additional operational risk requirements. The differences between small and large banks thus depend very much on the composition of the loan portfolios, as the main reason

(23) In Belgium, firms that file an abbreviated balance sheet do not need to report turnover.

(24) As a point of comparison, the mean contribution of retail SMEs to total capital requirements under Basel I would have been 2.48 p.c. for large banks and 4.41 p.c. for small banks. The contribution of corporates to total capital requirements under Basel I would have been on average 1.72 p.c. for large banks and 0.83 p.c. for small banks and for corporate SMEs it would have been on average 3.80 p.c. for large banks and 2.78 p.c. for corporate SMEs.

TABLE 8 CAPITAL REQUIREMENTS (CREDIT PLUS OPERATIONAL RISK) PER ASSET CLASS ASSUMING ALL BANKS APPLY THE STANDARDISED APPROACH

(June, 2002; Bank-level data; in percentages of risk-weighted assets)

Corporate	Mean	Median	Min.	Max.	Stdev.
Large banks	1.92	1.81	1.26	2.79	0.65
Small banks	0.91	0.00	0.00	8.89	2.27
Corporate SME	Mean	Median	Min.	Max.	Stdev.
Large banks	4.22	4.23	3.80	4.61	0.34
Small banks	3.09	2.16	0.00	8.81	3.24
Retail SME	Mean	Median	Min.	Max.	Stdev.
Large banks	2.07	2.15	1.46	2.50	0.46
Small banks	3.67	4.22	0.00	6.67	2.66
Total	Mean	Median	Min.	Max.	Stdev.
Large banks	8.20	8.17	8.06	8.40	0.15
Small banks	7.66	7.48	6.67	8.89	0.89
Credit risk only (excluding operational risk)	Mean	Median	Min.	Max.	Stdev.
Large banks	7.38	7.35	7.25	7.56	0.14
Small banks	6.90	6.73	6.00	8.00	0.80

Source : NBB.

why small banks receive a lower total capital requirement than large banks is because small banks invest a higher proportion of their assets in retail SMEs.[25]

The figures in Table 9 reflect the fact that all banks adopting the IRB approach greatly benefit from using the IRB risk weight functions.[26] On average, each asset class contributes less to the total capital requirement than it would have under Basel I. The IRB approach is also favourable with respect to the Basel II SA approach in terms of capital, and this holds for both large and small banks and for each firm class. This is consistent with the aim of Basel to give banks incentives to move to more advanced approaches.[27] Finally, Table 9 reveals that the capital requirements vary significantly between banks, especially between small banks. This highlights the need for analysis of the PD- sensitivity of capital requirements (see the next section).

Not much empirical research has yet been published on the impact of Basel II on banks' capital regulation. The Basel Committee has initiated a number of quantitative impact studies to calculate the impact on capital requirements of all the elements of the proposed approaches, and several banks participated in these studies. A general summary of the results is published for each study after completion of the exercise (see BIS, 2003a for an overview of the results of the last exercise) and the results have been used by the Basel Committee to calibrate the parameters of the risk weight function.

Saurina and Trucharte (2002) have analysed the aggregate impact for Spanish banks of the Basel treatment on SMEs, however, they do not examine possible differences between individual banks. Furthermore, they do not take into account requirements for operational risk. They find that for Spanish banks the difference between the SA and the IRB approach in terms of capital appears to be rather small. This result is primarily because of higher PDs obtained for Spanish firms.

(25) In the standardised approach, if we were to treat each firm class as a separate portfolio, we would obtain total capital requirements for corporates and corporate SMEs of 8.89 p.c. and for retail SMEs of 6.67 p.c.

(26) In the IRB approach, if we were to treat each firm class as a separate portfolio, we would obtain the following capital requirements: corporates, 4.97 p.c.; corporate SMEs , 6.93 p.c. for large banks and 6.61 p.c. for small banks; and retail SMEs, 5.81 p.c.

(27) To smooth the transition period, the Basel Committee has decided to introduce in the first two years after implementation a minimum floor capital requirement. The implementation year 2006 and the following year, IRB capital requirements for credit risk together with operational risk cannot fall below 90 p.c. of current minimum requirements. In the third year of implementation, the minimum will be 80 p.c. of this level.

TABLE 9 CAPITAL REQUIREMENTS (CREDIT PLUS OPERATIONAL RISK) PER ASSET CLASS ASSUMING ALL BANKS APPLY THE IRB FOUNDATION APPROACH

(June, 2002; Bank-level data; in percentages of risk-weighted assets)

Corporate	Mean	Median	Min.	Max.	Stdev.
Large banks	1.07	1.01	0.70	1.55	0.36
Small banks	0.51	0.00	0.00	4.96	1.27
Corporate SME	Mean	Median	Min.	Max.	Stdev.
Large banks	3.80	3.85	3.32	4.27	0.39
Small banks	2.61	1.74	0.00	7.62	2.81
Retail SME	Mean	Median	Min.	Max.	Stdev.
Large banks	1.63	1.65	1.05	2.18	0.56
Small banks	3.20	3.68	0.00	5.81	2.32
Total	Mean	Median	Min.	Max.	Stdev.
Large banks	6.52	6.54	6.22	6.78	0.24
Small banks	6.39	6.21	4.96	7.74	0.78
Credit risk only (excluding operational risk)	Mean	Median	Min.	Max.	Stdev.
Large banks	5.87	5.89	5.60	6.10	0.22
Small banks	5.75	5.59	4.46	6.97	0.70

Source : NBB.

TABLE 10 IMPACT ON CAPITAL REQUIREMENTS OF AN INCREASE IN PD BY ONE STANDARD DEVIATION
(June 2002; Bank-level data; in percentages of risk-weighted assets)

Probability of default

Corporate	Corporate SME	Retail SME
0.48	1.19	2.09

Credit risk plus operational risk

	Mean	Median	Min.	Max.	Stdev.
Large banks	7.50	7.51	7.34	7.64	0.16
Small banks	7.11	6.85	6.24	8.74	0.92

Source : NBB.

Our analysis suggests that the system seems to 'push' banks towards the IRB approach. Indeed, there are several additional factors which may reinforce the incentives suggested by the figures. First, credit risk mitigating techniques can lower capital requirements (especially given that IRB banks lending to SMEs will benefit from the wider recognition of collateral[28]). Second, banks are not expected to move to the IRB approach simply because of capital relief. Other incentives, such as potential market pressure and willingness to improve risk management systems, may be important. Thirdly, through the supervisory review process in the context of the second pillar of the New Accord, supervisory authorities may require banks (in particular systemically important banks) to adopt the IRB approach. Finally, we need to be very cautious when drawing conclusions about such incentive effects, however, as we need to bear in mind that the evidence reported here is subject to the "Lucas critique", namely that structural changes are likely to occur after the implementation of risk-based capital requirements which may affect the distribution of firm lending. Here the results were obtained for a given structure of bank lending.

3.3 Sensitivity analysis

In this section, we perform an analysis to see how sensitive the results on capital requirements are to the PD. Analysing the impact of varying PD on capital requirements is important, given that it allows us to account for potential PD variations between banks' portfolios. Furthermore, data limitations induced us to make some assumptions (e.g. we used a more restrictive definition of default) which may have biased the figures in the exercise. This suggests the importance of establishing and elaborating datasets, possibly as an industry-level

(28) If we for example decrease the LGD in Table 10 to 40 p.c., then capital requirements covering credit and operational risk for large banks have a mean of 5.80 p.c. and for small banks 5.68 p.c.

TABLE 11 IMPACT ON CAPITAL REQUIREMENTS OF AN INCREASE IN PD BY TWO STANDARD DEVIATIONS
(June 2003; Bank-level data; in percentages of risk-weighted assets)

Probability of default

Corporate	Corporate SME	Retail SME
0.66	1.49	2.49

Credit risk plus operational risk

	Mean	Median	Min.	Max.	Stdev.
Large banks	8.29	8.35	8.02	8.42	0.18
Small banks	7.68	7.31	6.57	9.54	1.07

Source : NBB.

initiative, which are compatible with the new Basel concepts of PD, LGD and EAD.

For this analysis we make use of the information on PD standard deviations presented in Chart 2. Table 8 shows the impact of an increase in PDs by one standard deviation on the figures presented in Table 9. This increases the PD for corporates from 0.30 p.c. to 0.48 p.c., for corporate SMEs from 0.89 p.c. to 1.19 p.c. and for retail SMEs from 1.69 p.c. to 2.09 p.c. As expected, we notice an increase in capital requirements. However, the general conclusions from the previous section remain the same.

In a next step, we investigate by how many standard deviations we need to increase the PD to bring capital requirements under the IRB approach in line with those under the SA. Table 9 shows that this implies increasing the PD by two standard deviations. As this covers variations between Belgian banks, we can safely conclude that the above-mentioned results are robust.

Conclusion

In this paper we have given an overview of the Basel II proposal with a special focus on the treatment of loans to SMEs, as these constitute an important part in Belgian banks' portfolio. Moreover, we have analysed the rationale of this treatment and the implications of the proposal on capital requirements for SME lending. This has been performed by combining information on credits granted in Belgium and individual firm balance sheet data. As the paper has highlighted the complexity of assessing the impact of the Basel II proposals on capital requirements for SME lending, its conclusion should therefore be treated with caution.

The lower risk weights that Basel II has put forward for loans to retail SMEs and to corporate SMEs for a given probability of default has been justified by the special characteristics associated with SMEs. Although small firms have on average a higher default probability, Basel has argued that this higher risk is mainly caused by idiosyncratic risk which can be diversified away in a large portfolio. The extent to which non-borrower-specific risk is responsible for default probability can be analysed by looking at correlations. Research on foreign and Belgian data has confirmed the positive firm size dependence of asset correlation, as is assumed in Basel II.

From the analysis of the impact of the treatment of SME loans in Basel II, one can safely argue that firm lending will not be made more expensive in terms of capital requirements when moving from Basel I to Basel II. This is especially true of the IRB approach, which does seem to imply lower capital requirements than the SA approach for Belgian banks, whether for large or small banks or for corporates and SMEs. This can only reinforce the presumption that most SME lending in Belgium will be granted by banks operating under the IRB approach. Furthermore, it also suggests that Basel II does not seem to induce any credit rationing for SMEs.

In this empirical exercise, data limitations required us to make some assumptions (e.g. we used a more restrictive definition of PD), which may have slightly biased the figures in the exercise. This points to the importance of establishing and elaborating datasets, possibly as an industry-level initiative, which are compatible with the new Basel concepts of PD, LGD and EAD. However, the robustness exercises in Section 3 suggest that the uncertainty that surrounds the parameters of the model does not invalidate the results. Specifically, if one were to bring the capital requirement on aggregate firm lending to its Basel I level, individual average probabilities of default would have to reach levels that are in excess of observed entry rates into bankruptcy. Note that our results have nevertheless been obtained for a given structure of bank lending.

Finally, although far from an integrated portfolio management approach, Basel II is an important step towards the convergence of regulatory capital and economic capital. As banks develop more sophisticated risk measurement methods, they are encouraged to move along the spectrum of available approaches in Basel II. The most advanced approach is expected to be pursued by the most sophisticated institutions and is expected to pave the way for the eventual acceptance of the use of banks' own credit risk portfolio models in determining regulatory capital. Basel II is a significant step in the right direction which is likely to be followed by revisions which might lead to a full convergence between regulatory and economic capital.

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Annex

Robustness on probability of default

As default rates may fluctuate over time and with the business cycle (see e.g. Nickell et al, 2000), we tested whether the calculated default rates are stable by carrying out simulations on the historical default rate. Specifically, we performed a bootstrap analysis, which is a method for estimating the distribution of an estimator by resampling the data. The bootstrap procedure involves choosing random samples with replacement from a data set. It is based on the idea that the sample is a good representation of the underlying population. The bootstrap analysis is a type of non-parametric Monte Carlo analysis as it combines Monte Carlo methods with the analysis of real data. The main advantage of this method is that it preserves the distribution that may exist in the underlying data. See Greene (2000), Horowitz (1997) and Jeong and Maddala (1993) for a detailed description of the methodology.

We resampled the data sets 10 000 times[29] under the assumption that the number of elements in each bootstrap sample equals the number of observations in the original data set. Table 10 reports some basic statistics on the histogram of the simulated PDs. They suggest that the resulting distributions resemble the normal distribution. Kurtosis is a measure of the tallness or flatness of the distribution. In each class, the measure is close to 3, which is the kurtosis value of the normal distribution. However, in case of the corporate class and the corporate SME class, the value is slightly below 3 (platykurtic distribution). In case of the retail SME the kurtosis value is slightly above 3, (leptokurtic distribution). Skewness is a measure of asymmetry of the data around the sample mean. Again in all cases skewness is close to that of the normal distribution, that is, zero. Only the skewness of the retail SMEs is slightly negative, which indicates that data points are spread out more to the left of the mean.

Table 10 reports the simulated histogram, postulating a 95 p.c. confidence level.. Both the lower and the upper confidence level are very close to the simulated mean. This analysis suggests that the observed historic average default rate provides us with a good proxy of the true average default rate.

TABLE 12 DESCRIPTIVE STATISTICS ON DISTRIBUTION OF SIMULATED PDS

	Corporate	Corporate SME	Retail SME
Mean	0.30 p.c.	0.89 p.c.	1.69 p.c.
Standard deviation	0.0504 p.c.	0.0823 p.c.	0.1100 p.c.
Kurtosis	2.8815	2.8684	3.0853
Skewness	0.1024	0.0426	–0.0448
Lower confidence level	0.21 p.c.	0.75 p.c.	1.47 p.c.
Upper confidence level	0.40 p.c.	1.06 p.c.	1.91 p.c.

Source : NBB.

(29) The bootstrap analysis has also been performed by resampling the dataset 50 000 and 100 000 times and no significant differences in the results were noticed.