Lending decisions, procyclicality and the New Basel Capital Accord

Fabrizio Fabi, Sebastiano Laviola and Paolo Marullo Reedtz[1]
Bank of Italy

1. Introduction

At the end of April 2003 the Basel Committee on Banking Supervision released a third consultative paper (CP3) containing a proposal for a new accord on bank capital (Basel II). The proposal contains important changes with respect to an earlier paper, published in January 2001 (CP2). The reform process has been undertaken in response to the increase of financial innovations in banking products and enhancements in the measurement of banking risks, which have highlighted some inadequacies in the simplified framework underlying the 1988 Accord (the "current" Accord). Indeed, the current Accord does not fully reflect changes in risk. As a consequence, it may understate the risks and hence overstate the capital adequacy of banks. It may also create incentives for banks to make high-risk investments.

A more differentiated assessment of banks' risk exposures and the provision of incentives to banks to improve their risk measurement and management capabilities are the key objectives of the new proposal. With regard to the level of overall capital, the Basel Committee has explicitly declared that in the standardised approach minimum capital requirements have to bring about a level of capital that is on average equal to the current requirement (8%), while banks applying the more advanced approaches should receive on average a small capital incentive.

As is well known, the proposal is based on three pillars - minimum capital requirements, supervisory review of banks' capital adequacy and, market discipline - and foresees a plurality of methods to calculate capital requirements, according to the degree of development of banks' risk management systems.

Through the consultation with the banking industry and three impact studies performed by a large number of intermediaries, the Basel Committee has aimed at aligning prudential regulation with the best practices of risk management developed in the marketplace.

Some important changes have been introduced in CP3. The most significant improvements are in the field of defining the capital requirements connected with the corporate and retail portfolios. The rise in capital requirements with the increase in the borrowers' probability of default was deemed to be too sharp in the proposal issued in January 2001. This would have implied a serious impact on the financing of small and medium-sized enterprises (SMEs), which tend to have relatively higher probabilities of default than large corporates. In order to comply with higher capital requirements, banks would have been induced to increase the interest rates charged to high-risk borrowers or to cut the amount of lending.

Moreover, such a conservative calibration of overall capital was likely to lead to a potential increase in the procyclicality of the supply of credit: in times of recession, when the quality of borrowers tended to deteriorate, banks would reduce lending (and therefore risk-weighted assets) in order to comply with the increase in capital requirements.

Capital requirements that change according to the riskiness of bank borrowers are a built-in effect of any risk-sensitive prudential regulation. What is really relevant is that, even under the current Accord, in which essentially all corporate and retail loans are subject to the same capital charge, lending to borrowers with a different financial situation is priced at different interest rates and risk premia are

---

[1] Banking and Financial Supervision departments. The views expressed in this paper are those of the authors and do not necessarily reflect those of the Bank of Italy. We thank M Kwast (US Federal Reserve Board) for helpful comments and suggestions. Please address correspondence to: Banca d'Italia, Servizio Concorrenza, normativa e affari generali, Via Milano 53, 00184 ROMA, tel: +39 06 4792 4458-4601-4455; fax: +39 0647924460; e-mail: Fabi.Fabrizio@insedia.interbusiness.it; Laviola.Sebastiano@insedia.interbusiness.it; Marulloreedtz.Paolo@insedia.interbusiness.it.

usually negatively correlated with the rate of growth of GDP. Such circumstances can also easily be recorded for the period before 1988, when no capital regulation was in force at international level. This implies that the new regulatory proposal could be blamed for altering the lending policies of banks only in the event that the assessment of credit risk implicit in the risk-weight functions substantially differed from banks' perception of risk as reflected in the interest rates they charge to the borrowers.

The aim of this paper is to provide an empirical evaluation of the impact of the CP3 proposals on the lending policies of Italian banks, ie on interest rates on bank loans. We address this issue through two separate steps: first, we compare the interest rates charged to a large set of Italian firms with the cost brought about by the change in the calculation of capital requirements, so as to have an assessment of the impact of the new regulatory scheme on banks' lending policies; and second, we measure the change in interest rates which would be consistent with a sudden deterioration in the cyclical conditions of the corporate sector under the new regulatory scheme, in order to have an indication of the procyclicality effect embodied in the New Accord.

The rest of the paper is organised as follows. In Section 2 we briefly review the main aspects of credit risk measurement under the new capital adequacy framework which are relevant for the empirical exercises conducted later on; in Section 3 we look at the impact of the proposed capital requirements on banks' loan rates to a large sample of non-financial firms. In Section 4 we conduct a "stress testing" exercise, in order to assess the procyclicality of capital requirements on lending conditions in a negative economic scenario. Section 5 draws some conclusions.

2. CP3: credit risk measurement and the IRB approach

As regards Pillar 1 of Basel II, the purpose of creating a more risk-sensitive framework is pursued through a range of options for addressing credit risk, including: (a) a standardised approach, under which risk weights are based on the evaluation of credit quality by external credit assessment institutions (rating agencies and other institutions authorised according to a set of specified criteria); (b) a "foundation" internal ratings-based (IRB) approach, based on both banks' internal assessments of risk components and supervisory parameters; and (c) an "advanced" IRB approach, in which all risk components are estimated internally by banks.

Both IRB approaches to computing risk-weighted assets rely on four quantitative risk factors: (1) the probability of default (PD), which measures the likelihood that the borrower will default over a given time horizon; (2) the loss-given-default (LGD), which measures the proportion of the exposure that will be lost if default occurs; (3) the exposure at default (EAD), which includes the on-balance sheet exposure and an estimate of the off-balance sheet one (as an example, for loan commitments the purpose is to measure the amount of the facility that is likely to be drawn if a default occurs); and (4) the maturity (M) of the exposure, which measures the remaining economic maturity of the asset. For corporate, sovereign and interbank exposures, under the "foundation" IRB approach banks satisfying minimum supervisory requirements will be allowed to input their own assessment of the probability of default associated with the borrower. The value of the other risk factors, such as EAD, LGD and maturity, will be determined by supervisors. Under the advanced IRB approach banks will provide internal estimates of LGD, EAD and M as well as PD.

For each of the relevant portfolios, a risk-weight function translates the risk components into specific capital requirements.[2] In the CP2 document only one risk-weight function was established for bank exposures to the corporate sector. The formula proposed delivered an 8% capital requirement for a benchmark unsecured loan having a 0.7% PD, a 50% LGD and a three-year maturity.

The comments from financial institutions, other market participants and national authorities, as well as the results of an in-depth Quantitative Impact Study on a sample of international banks, and pointed out that minimum capital charges tended to exceed current ones under the revised standardised approach; in turn, the standardised approach requirements were lower than those computed

[2] For further details see BCBS (2001a, 2003a).

according to the foundation IRB approach.[3] This was not consistent with the declared objectives of the Committee.

The steepness of the risk-weight curve in the IRB approach for the corporate portfolio was mentioned among the factors responsible for such a result. Many comments focused on the impact of the proposed regulatory framework on the potential procyclicality effects of the new regulatory scheme and on the financing of SMEs, as well as on the treatment of expected losses.[4]

With reference to the expected loss (EL) treatment, it was argued that it did not recognise the specific provisions made on loans to offset the capital requirements, or the general provisions not included in supplementary capital. 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 rarely been 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.[5] 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.[6] Since the publication of CP2 the issue of procyclicality has therefore stimulated a great debate in the literature; many papers have recently addressed the link between credit risk measurement and procyclicality of the financial system, from both a theoretical and an empirical point of view.[7]

The main cyclical element in credit risk measurement comes from rating 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 probably 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 (for example 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, however, use systems that are in-between, whereby the PD is derived from internal models or from expert judgment 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 is likely to bring about improvements in risk management practices; therefore, deteriorations in credit quality should be detected earlier than before, and banks could take the appropriate measures. Moreover, even though the regulation does not require the rating of 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.

In sum, even with the existing capital standards there is a definite cyclical element in the banking system. To the extent that Basel II encourages banks to be more forward-looking, this could reduce procyclicality because such behaviour would cause banks to react more quickly to changing conditions and expectations.

As far as loans to SMEs are concerned, it was argued that small firms usually have a higher PD but are relatively less sensitive to the evolution of the macroeconomic framework, while large enterprises

---

[3] See BCBS (2001b).

[4] See, among others, ABI (2001), IIF (2001) and ISDA (2001).

[5] See, for example, Jackson et al (1999).

[6] 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 also be a fluctuation in the risk-weighted assets, given the migration of borrowers to higher risk classes.

[7] See, among others, BCBS (2001c), Borio et al (2001), Danielsson et al (2001), ECB (2001), Ervin and Wilde (2001), Estrella (2001), Allen and Saunders (2002), Ayuso et al (2002), Jordan et al (2002), Lowe (2002), Resti (2002), Segoviano and Lowe (2002) and Catarineu-Rabell et al (2003).

tend to behave in the opposite way. In other words, small firms' loans tend to be riskier because of the firms' own specific characteristics; this means the effect of systematic risk on their financial conditions is proportionately lower. In the simplified (with respect to fully fledged state-of-the-art credit risk models) framework for the determination of IRB capital charges, the effect of systematic risk is basically taken into account by the value of the average asset correlation across obligors, which is established by the regulators. Therefore, for a given PD of individual borrowers, a portfolio of loans to SMEs is less risky than a single loan to a large firm, because the asset correlation is lower, all else equal.[8]

On the basis of the comments received and of further empirical evidence, the treatment of exposures to corporates, and to SMEs in particular, has been considerably improved.

In the first place, the steepness of the risk-weight curve has been lowered for all corporate exposures by shifting the threshold for neutrality vis-à-vis the 1988 Accord to a 1.0% PD.[9] The reduction in risk weights is much stronger for higher PD levels. Therefore, this modification has made it possible to significantly reduce the potential degree of procyclicality of the framework and to indirectly take into account, at least partially, the SME issue.

Further, in the IRB approach included in CP3 banks are permitted, separately for any asset class (corporate, retail, interbank, etc), to recognise provisions to offset the EL component of the capital charge.[10] This modification, in addition to providing incentives to banks to make adequate provisions, also makes it possible to reduce the procyclicality of the regulation; specifically, in a downturn the possibility to offset the EL charge with provisions reduces the increase in the requirement connected with the migration of loans towards lower-quality risk buckets.

Finally, the Basel Committee has established that in the IRB approach banks would have to 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 were holding a sufficient capital buffer under Pillar 2 of the New Accord.

With reference to the treatment of SME loans, the smaller size of firms has been recognised as a factor potentially allowing banks to reduce capital requirements on loans to non-financial firms, other things being equal. Specifically, banks will be permitted to distinguish between exposures to large firms and those to SMEs, defined as corporate exposures where the reported sales for the consolidated group of which the firm is a part are lower than €50 million. Loans to SMEs will attract a capital requirement, for a given PD, LGD and maturity, lower than that attracted by larger firms. The capital reduction increases linearly from 0% to 20% with sales going from €50 to €5 million, and remains at 20% for firms with sales figures lower than the latter threshold.

Moreover, loans extended to small businesses can be treated according to the risk-weight formula established for the retail portfolio provided that: (a) each of them represents a small portion of a large pool of loans with similar risk characteristics which are managed by the bank on a pooled basis; (b) the total exposure of the banking group to an individual small business is less than €1 million. In this case, the capital requirements are lower than those for SMEs classified in the corporate portfolio, all else equal.

A third Quantitative Impact Study (QIS3) was performed between October and December 2002 with the cooperation of 365 banks from 43 countries. A total of 188 G10 banks were divided into two groups: Group 1 is representative of the large and internationally active banks; Group 2 includes smaller and, in many cases, more specialised banks.

---

[8] For empirical studies on the asset correlations of portfolios of large and small corporates see Cannata et al (2001), Lopez (2002), Dietsch and Petey (2003) and Dullmann and Scheule (2003).

[9] In the context of the calibration of the capital charges contained in CP3, in the IRB foundation approach the LGD of a senior unsecured loan has been reduced from 50% to 45% of the nominal exposure, and the residual maturity of the asset, originally set at three years, has been lowered to 2.5 years.

[10] Provisions exceeding those already included in supplementary capital (exceeding 1.25% of risk-weighted assets) can continue to be used as one-for-one offsets to capital requirements on performing loans, but only to the extent that the EL portion of the IRB capital requirement also exceeds the maximum amount of provisions eligible for inclusion in Tier 2.

Although banks did not succeed in completely simulating the provisions of the new regulation, as regards, for example, the range of collateral instruments allowed or a more clear-cut separation across portfolios because of shortcomings in their information systems, on the whole the results are consistent with the Committee's objectives: (1) minimum capital requirements would be broadly unchanged for Group 1 banks, which are likely to use IRB approaches; (2) for Group 2 banks capital requirements under the IRB approach could be substantially lower than under the current Accord, due to the relatively larger size of retail portfolios.

Within the IRB approach, capital requirements for the financing of the corporate sector are lower than under the current Accord for both Group 1 and Group 2 banks, in connection with the higher quality of the borrowers. As expected, capital requirements both on loans to SMEs treated as corporate and on loans to small businesses included in the retail portfolio also turn out lower than currently. Overall, capital requirements for credit risk show a sharp reduction in comparison with the current Accord especially for Group 2 banks, thanks above all to the better treatment of retail portfolios. However, the overall result is substantially affected by the operational risk requirement.[11]

3. The impact of the new capital requirements on the pricing of bank loans

The results of QIS3 have confirmed the improvements that have been made in the proposed regulation.

However, this is not enough to be able to argue that banks' lending policies will not be distorted by the new regulatory framework. In the current situation, given the dispersion of interest rates by economic sectors and geographical areas (Graph 1), the pricing of individual bank loans is unlikely to be affected by the flat capital requirement.

In general terms, the pricing of bank loans reflects both financial and operating costs, the market power of the bank, and a risk premium computed by the bank according to its internal procedures, in some cases through VaR methodologies. In the context of the IRB approach, internal ratings and default and loss estimates must play an essential role in the credit approval, risk management and internal capital allocation functions of banks using this approach. This implies that a potential change in lending policies could be introduced if the regulatory treatment of credit risk were inconsistent with the internal assessments of banks, as reflected in the pricing of their lending operations.

We define the overall risk component, ORC, (or the "total regulatory cost of risk") of any lending operation, measured as a percentage of the nominal exposure, as: $ORC = EL/EAD + k(REQ\text{-}EL)/EAD$, where EL is the expected loss, REQ is the capital requirement as measured in CP3, k is the rate of return on bank capital and EAD is the nominal exposure. Since the CP3 capital requirement includes both EL and UL (unexpected loss), the formula is equivalent to: $ORC = EL/EAD + k^*UL/EAD$.

In order to measure the capital requirement connected with each lending operation we need estimates of all relevant risk parameters. In the context of the IRB foundation approach, we derived an estimate of the probability of default of each borrower, while we used the supervisory parameters for the loss-given-default (ie, we considered all the exposures as uncollateralised) and maturity. As to EAD, we considered only the on-balance sheet nominal amount.

We refer to the Italian framework, for which a large amount of data on both lending relationships and balance sheets of industrial and commercial firms is available. Quantitative information can be drawn from CERVED's Company Accounts Register and from the Credit Register run by the Bank of Italy. In the Company Accounts Register both the balance sheets and the profit and loss accounts of a large set of Italian firms have been collected since 1993 according to a simplified reclassification scheme including 70 elementary items. The Credit Register records individual credit positions above approximately €75,000; non-performing loans are recorded no matter what their amount. The interest rates charged to individual borrowers by individual banks are also available, with reference to a sample of 68 banks accounting for 80% of total loans.

[11] For further details see BCBS (2003b,c).

3.1 Measuring probabilities of default and capital requirements

The probabilities of default of a large sample of corporate borrowers are estimated on the basis of a scoring model developed for research purposes at the Bank of Italy. A logit model is used in order to distinguish sound from insolvent firms.[12] In particular, balance sheet data at time t and Credit Register information at time $t + 1$ are used to assess the probability for each firm of being recorded as defaulted at time $t + 2$. A firm is regarded as defaulted if it is reported in the Credit Register's bad debt category for the first time in the year $t + 2$ by at least one lending bank.

In the Credit Register bad debts are defined as all exposures to insolvent borrowers, regardless of any collateral received. Debtors are considered insolvent if they are globally unable to cover their financial obligations and are not expected to recover, even if this does not result in a legal bankruptcy procedure.[13]

The estimation procedure was applied to a set of 180,000 firms divided into four sectors of economic activity (manufacturing, trade, construction and services); a separate regression model was estimated for each sector. Through a stepwise procedure, 11 significant explanatory variables were selected out of about 30 ratios proxying for profitability, productivity, liquidity, financial structure, tension in credit relationships, growth, size and geographical location of the enterprises (Table 1).

For each model, two thirds of the firms were used for the estimation; the rest were used to test out of sample. Since in the estimation sample the proportion of sound and insolvent firms mimics that of the universe, the forecast values of the logistic regression can be regarded as the probability of default of the individual firms within one year. The overall correct classification rate - the fraction of firms that are correctly classified by the model as sound or insolvent - is around 74% on average (Table 2). Out of sample, similar percentages are observed for both sound and insolvent firms. The overall performance is also assessed using the power curve (or "Gini curve"), considering the results of the model out of the sample in the year of estimation and the full sample in other periods. This curve measures the discriminatory power of the function; that is, the overall ability of the model to distinguish sound from insolvent firms. A related measure is the accuracy ratio, the ratio of the area between the power curve and the random model to the area between a perfect model and the random model. The model produced an accuracy ratio of 65% for the control sample and of 66-67% for each of the years 2001, 1999 and 1998 (Graph 2). The value of accuracy ratios mentioned in studies regarding other countries normally ranges between 50 and 70%.[14] In the following application we consider 104,300 firms for which, in addition to an estimate of the probability of default, interest rates on credit lines are also available. The sample accounts for nearly 40% of total corporate loans of the banks for which interest rates are known. A set of about 255,000 credit relationships is considered.

The sample includes both large companies and SMEs (Table 3):[15]

- 1,900 firms with sales higher than €50 million account for 2% of those included in the sample and for 41% of lending to the sample;
- 20,000 firms with annual sales between €5 and €50 million represent 19% of the sample and 37% of loans. As mentioned above, in the new regulatory proposal capital requirements on loans to these firms are reduced by up to 20% relative to larger firms;
- 46,000 firms with sales of less than €5 million and an exposure higher than €1 million account for 44% of the total number of enterprises and for almost 19% of lending. Capital requirements on these exposures are reduced by 20%, other things being equal, relative to larger firms;

---

[12] In contrast to the rating systems normally adopted by international banks, which are nearly always determined according to both quantitative and qualitative information, this procedure relies on the first type of information only. Thus, it is only an approximation of the ratings that banks would normally estimate.

[13] This definition of default is narrower than that endorsed by the Basel Committee in the New Basel Capital Accord proposal, which also covers substandard loans and loans 90 days past due.

[14] For further details see Cannata et al (2002).

[15] For simplicity, the amount of bank debt is considered as a single item.

- finally, 36,000 firms accounting for 35% of the sample and 4% of total lending could be included in the retail portfolio provided their exposures are managed as part of a portfolio segment.

The probabilities of default of these firms have been estimated on the basis of company accounts for 2000 and credit relationships for 2001. Therefore their PDs represent an estimate of the default rate in 2002.

Their average value, weighted by the amount of lending, turns out to be 0.93%, lower than the default rate of all bank corporate borrowers recorded in the Credit Register (1.3% in 2002). The gap is mainly due to the overrepresentation of big firms in the sample in relation to smaller firms.

By applying the risk-weight functions contained in CP3, it is possible to obtain a proxy of the new capital requirements.

For the whole sample, the overall minimum capital requirements would be equal to 5.8% of total exposures (Table 4). However, results have to be interpreted with caution, given the data limitations, the narrower default definition adopted, and the bias of the sample towards better credit quality with respect to the average of banks' corporate borrowers.

3.2 Risk assessment and interest rates

As already mentioned, the impact of the New Basel Capital Accord on the pricing of bank loans can be checked by comparing the risk assessment of lending operations that is implicit in the CP3 document and the interest rates currently charged to borrowers. Since we assume that loans are senior unsecured, only the interest rates on short-term loans are considered; collateral should be less relevant in this case.

As a general point, Graph 3 shows an increasing relationship between firms' riskiness and the average interest rate on the loans granted to the firms in the same risk class, even though there is a substantial variation around the mean. A significant relationship is confirmed by a simple regression on cross section data. Similarly, the comparison between the average rate charged by each bank to its own borrowers and the average riskiness of the same borrowers also shows an increasing relationship between the two variables (Graph 4).

This evidence supports the reliability of our assessment of the financial conditions of bank borrowers and strengthens the results regarding the impact of the new capital adequacy framework on banks' lending policies to the sample of non-financial firms considered.

In the simplified formula we have adopted to measure the overall risk component of lending, that is, $EL/EAD + k(REQ - EL)/EAD$, the value of k, the rate of return on bank capital, is proxied by a weighted average of the pre-tax return on equity and of the interest rate on subordinated debt, net of the interest rate on risk-free assets (in which it is assumed that own funds are invested). As a result, for 2001 the rate of return on bank capital turned out to be equal to 10.3%. For the whole sample, the risk component ranges between 0.25 and 2% for the loans to borrowers with a PD not higher than 4%; its average value is 0.97%.

The risk component tends to be relatively low for larger firms, as a consequence of lower PDs; on the other hand, smaller borrowers can benefit from a favourable treatment in the definition of capital requirements. For firms with reported sales higher than €50 million the average risk component is equal to 0.85%, whereas it turns out to be 0.95% for firms with sales up to €5 million. The average risk component peaks at 1.2% both for corporate firms with sales lower than €5 million and for those included in the retail portfolio.

In Graphs 5-9 the change in the overall risk component of lending operations related to borrowers of different quality, as measured according to CP3, can be compared with the corresponding increase in the interest rates on loans. In this framework, we are not interested in explaining the level of the interest rates, which is influenced by several other factors. On the contrary, we are interested in their changes along the whole spectrum of the borrowers' PDs.

For corporate and retail portfolios the two variables, ie overall risk component and short-term interest rates, move together in response to an increase of the borrowers' PDs.

This evidence indicates that the risk-weight functions included in the new capital adequacy framework, for a given risk, are on average consistent with banks' pricing decisions. As a consequence, lending decisions are unlikely to be altered by the introduction of the regulatory scheme.

4. New capital requirements and procyclicality: a stress testing exercise

The potential impact of the new capital requirements on the pricing of bank loans has been assessed with reference to a period in which the overall quality of credit was particularly good in Italy. Indeed, in recent years the favourable trend of corporate profitability has been reflected in improved loan quality. Moreover, Italian banks have tended to direct their lending to less risky counterparties across borrowers of different sizes, economic sectors and geographical areas. Therefore, the result according to which the new capital adequacy framework is not likely to alter the lending decisions of banks needs to be made more robust by considering an unfavourable cyclical situation. For this purpose it is necessary to simulate a sudden deterioration of the financial condition of the corporate sector.

This amounts to dealing with the problem of procyclicality of loan supply in the framework of the New Accord, namely assessing the impact of the new capital requirements on lending decisions in the context of an economic slowdown. In fact, if capital requirements were to react too severely to an increase in the riskiness of lending activity, banks could decide to sharply restrict the supply of loans, thereby contributing to a further deterioration of the macroeconomic environment.

A certain degree of procyclicality in banks' lending decisions is a common experience of all countries: a slowdown in economic activity tends to be considered as an early indicator of increased financial fragility of the corporate sector and to be reflected in higher risk premiums on lending operations.

In order to perform a stress test with reference to the Italian economy, we tried to replicate the financial conditions of corporate borrowers in the recession that occurred in Italy at the beginning of the 1990s (a "worst case" scenario). The slowdown started in the second quarter of 1992; the percentage change of GDP with respect to the corresponding quarter of the previous year turned out to be negative in real terms in the last quarter of 1992 and in the first three quarters of 1993. In 1993 Italy's gross domestic product declined by 0.9% at constant prices, the first contraction since 1975.

The economic recovery took place in 1994, as a consequence of an acceleration of export growth driven by the fall in the exchange rate and wage moderation in the framework of increased world trade. However, in banks' balance sheets the volume of bad debts and substandard loans continued to increase substantially for some years: bad debts peaked at 10% as a ratio to total loans in 1997, although in the following years this ratio rapidly decreased, down to 4.5% at the end of 2002, partly as a result of loan securitisation.

A small number of financial ratios is sufficient to describe the severity of the financial situation of the industrial and commercial firms in the 1992-93 recession and the improvements recorded in the most recent period (Graph 10): (1) gross operating profit as a ratio to value added recorded its minimum value in the 1990-92 period: 37.7% as opposed to 40.6% in the second half of the 1980s and 44.4% in 2001; (2) net financial costs increased from a yearly average of 22.2% of gross operating profit in the 1985-89 period to a peak value of 29.7% in 1992; they were equal to 3.4% in 2001; (3) the return on assets was negative in 1992 and 1993, as opposed to 2.1% in the second half of the 1980s; it was equal to 1.1% in 2001; (4) leverage peaked at 60% in 1992 and 1993, from 56.5% in the second half of the 1980s; it was equal to 50.7% in 2001.

In order to set up a distressed scenario, we compute: (a) the PDs of individual firms consistent with the financial situation of the Italian corporate sector at that time; (b) the corresponding capital requirements according to CP3; and (c) the overall risk component of each credit relationship.

The increase of the overall risk component with respect to the present situation provides a proxy of the increase we should expect to observe in the interest rate (net of the risk-free rate) charged to each borrower.

4.1 Measuring PDs in a distressed scenario

Data on firms' balance sheets starts in 1993; we therefore use both financial ratios and credit relationships as of 1993 in order to simulate a sudden deterioration in the probabilities of default of the corporate borrowers included in our sample for 2002.

The assumptions underlying this calculation are: (1) the logit regression estimated for recent years is also suited to estimating probabilities of default for the past. In fact, we did not check whether there could be a better algorithm to proxy the financial health of Italian firms in those years. However, we compared the ex post effective default rate in 1994, relative to the 1993 sample of firms, with the ex ante estimates and the results were satisfactory for all risk classes; (2) the shocks affecting the macroeconomic scenario are completely incorporated in the micro-variables used in the exercise, the impact on which is different depending on the economic sector, geographical area and size of the firms considered.

Finally, we assume that the downturn materialises suddenly and abruptly, starting from the relatively good situation for banks' portfolios recorded in 2001, whereas usually a slowdown in economic activity unfolds gradually over time. Moreover, as a result of capital requirements directly linked to the probability of default on loans, banks should usually behave more proactively, continuously adjusting bank capital and loan loss reserves to changes in the quality of their portfolios.

In order to compute the PDs in the distressed scenario we use all the information contained in the original set of 188,000 non-financial firms. However, the final results in terms of lending policies refer to the sample of 104,000 corporate borrowers for which information on loan rates is also available.

About 64,000 firms out of the 188,000, accounting for 56% of the loans extended by banks to the firms in the 2002 sample, were recorded both in CERVED's Company Accounts Register and in the Credit Register in 1993. For these firms we simply used the 1993 data to calculate the PDs.

For the 124,000 firms which are not included in the 1993 sample, we have modified the 2000 balance sheet values and the 2001 credit relationship indicators so as to reproduce on average the values recorded in 1993 by economic sector, geographical area and size, thereby maintaining relative differences among firms.

The simulated deterioration in the financial conditions of the corporate sector can be better assessed on the basis of the transition matrices referring both to the number of the firms and to the overall amounts of their financing. The ratio of borrowers included in the first two classes (PDs not higher than 0.45%) shrinks from 27.2% to 16.5% as a number (Table 5) and from 31.3 to 19.9 as a percentage of total bank loans (Table 6). On the other hand, the number of firms for which the PD exceeds 1% increases from 29.4% to 43%, whereas their overall lending increases from 20.3% to 33.3% of the total.

The average PD, which was 1.27% in 2002, would increase to 1.79%, as opposed to 1.51% recorded in 1994 for all the firms included in CERVED's Company Accounts Register. The weighted average PD would increase from 0.97% to 1.4%, as compared with an actual default rate of 1.87% in 1994 in CERVED's database.

Such a sudden deterioration of the macroeconomic framework would involve a 16% increase in the overall minimum capital requirements. At the end of 2002 the overall capital buffer of the Italian banking system was equal to 40% of the minimum amount of capital required.

4.2 Capital requirements and interest rates in a distressed scenario

The results of the stress test provide a first indication regarding the reduction of potential procyclicality effects of the New Accord relative to the proposal issued in January 2001. Indeed, the application of the risk-weight function contained in CP2 would have implied a 24% increase in the overall minimum capital requirement for this set of loans.

However, we are more interested in assessing whether the risk measurement implicit in the new regulatory scheme would force banks to charge their customers exceptionally high loan rates when confronted with an adverse macroeconomic scenario. If this were true, we should conclude that the New Accord would anyway involve an increase in the procyclicality of banks' lending decisions. In the opposite case, the change in the capital regulation would turn out to be at least neutral in relation to the current situation.

Similarly to the exercise we performed on the more recent data, we can compare the overall risk component of lending operations as computed on the basis of the distressed PDs with the interest rates which were actually recorded at the time of the recession. For each credit line, the increase of the overall risk component provides a proxy of the increase we should expect to observe in the interest rates on credit lines.

Unfortunately, the comparison can be performed only to a limited extent, due to data limitations. Ten years ago only 20,000 firms out of the 104,000 that are included in our sample were financed by banks participating in the survey on interest rates. For this reason, we complement the comparison based on individual data with the observation of the differential between the average short-term lending rate and the rate of return on treasury bills.

Graph 11 shows that the risk premium on lending operations increased sharply during the 1992-93 recession. The increase in the second half of the 1990s was not connected with concerns regarding firms' financial situation, since banks' interest rates were decreasing and corporate profitability strongly improving. On the contrary, it was linked to the convergence of domestic monetary conditions towards the situation prevailing in the other leading European countries, consistent with the reduction of actual and expected inflation in Italy. Finally, some increase in the risk premium on bank loans was observable at the end of 2000, when a deterioration of the macroeconomic environment also took place.

By applying the risk-weight functions included in CP3 to the PDs referring to the 1993 situation, it is possible to compute the overall risk component of lending operations that is consistent with a distressed scenario. For the whole sample of 104,000 firms, the average risk component comes out a quarter of a percentage point higher than in 2002: 1.22% compared with 0.97%. Its increase ranges between 18 basis points for firms with reported sales higher than €50 million and 35 basis points for firms with sales between €50 and €5 million and for those included in the retail portfolio.

As a consequence, the lending rates (net of the risk-free rate) should increase on average by a quarter of a percentage point, starting from the value of 2.9 percentage points recorded at the end of 2002. The new level, although quite high, would not reach peak values relative to those recorded in the previous recession. As a matter of fact, it would be between the two values observed in 1992 and 1993, which were 2.6% and 3.6% respectively.

A more detailed analysis can be performed with respect to the 20,000 companies for which the interest rates on credit relationships in 1993-94 are available and for a subset of 7,000 firms with sales between €5 and €50 million.

Graphs 12 and 13 differ slightly from the corresponding Graphs 9 and 6. The low number of firms included in the first risk bucket made it difficult to use this class as a benchmark; we therefore considered the levels of the average interest rates corresponding to the firms included in each bucket.

The results achieved for the more recent period are basically confirmed: even in a distressed macroeconomic environment, the interest rates charged to borrowers in 1994 move together with the overall risk component of lending operations as credit quality deteriorates. This seems to imply that, as a consequence of the new regulatory scheme, banks are not induced to behave in a more procyclical way than in the past. Thus, the New Basel Capital Accord is unlikely to alter banks' decisions regarding the financing of the economy even under a distressed scenario.

Indeed, the new regulation will stimulate the banking industry to introduce more forward-looking elements in the assignment of ratings, in order to make judgments less correlated with the business cycle. Moreover, the role of provisions in offsetting expected losses, as well as the need for banks to continuously adjust their capital endowments to changing risk, could actually reduce the procyclicality of loan supply.

5. Conclusions

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.

Among the issues that emerged after the publication of the January 2001 consultative document was the need to prevent any difficulty in the financing of small and medium-sized firms and to balance the goal of a higher risk sensitivity of capital requirements with the potential amplification of business cycle fluctuations. As confirmed by the results of the Quantitative Impact Study recently conducted by the Basel Committee (QIS3), the changes made to the original proposal and contained in the third consultative document reduce the capital charges for almost any risk level and deal better with the peculiarities of credit risk in the case of SMEs.

As a result of the new treatment of credit risk, the exposures to a substantial share of borrowers will attract a capital charge for credit risk lower than 8%. However, this is not sufficient to argue that banks' lending decisions will not be distorted by the application of the new framework. What is relevant is whether the assessment of credit risk implicit in the new regulatory scheme (CP3) substantially differs from the banks' own evaluation, as embodied in their lending rates.

With reference to a large sample of Italian firms, for which the probabilities of default have been computed on the basis of their balance sheets and credit relationships, we compared the change in the overall risk component of lending operations, defined according to the foundation IRB approach, with the interest rates charged by banks on individual credit lines at a recent date. Since we find that the two variables move together in response to an increase of the borrowers' PDs, we tend to conclude that the CP3 approach to measuring credit risk is consistent with banks' risk assessment.

This result is supported by the finding that the same relationship also holds in a distressed scenario which replicates the financial condition of the Italian corporate sector in the 1993-94 recession. This provides an indication that the procyclicality of loan supply is not strengthened by capital requirements more strictly related to the riskiness of lending operations.

On the basis of this empirical evidence, we do not expect loan pricing to be distorted as a consequence of the new capital adequacy framework.

Table 1

Estimating the probability of default of non-financial firms

Significant explanatory variables[1]

	Economic sector			
	Manufacturing	**Trade**	**Construction**	**Services**
"Geographical" (dummy) variables				
Central Italy	**	*	**	–
Southern Italy	***	***	–	–
"Credit Register" variables				
Drawn/granted amount (y avg)	***	***	–	***
Overshoot (avg no)	***	***	***	***
Δ (Drawn/granted amount)	***	*	–	–
"Balance sheet register" variables				
Value added/total assets	–	**	–	–
Current assets/current liabilities	***	–	–	–
Cash flow/total assets	***	–	–	***
Coverage ratio	**	**	**	–
Leverage ratio	***	***	***	***
Long-term debt/total debt	–	–	–	***

[1] Significance levels (Wald chi-squared statistic): *** 0.1%, ** 1%, * 5%.

Table 2

Estimating the probability of default of non-financial firms

Performance of the logistic regression model

Economic sector	**Sample composition**			**"Correct classification" rate (%)**			
	No of sound firms	**No of insolvent firms**	**% insolvent**	**In-sample**		**Out-of-sample**	
				Sound	**Insolvent**	**Sound**	**Insolvent**
Manufacturing	46,683	585	1.2	74.7	74.9	74.6	71.7
Trade	28,949	387	1.3	75.1	74.9	75.7	73.7
Construction	17,282	323	1.8	72.7	72.4	72.1	70.7
Services	22,915	242	1.0	75.0	74.8	75.2	81.8
Total or average	115,829	1,537	1.3	74.6	74.4	74.6	73.6

Table 3

The sample: number of firms and bank debt by risk bucket

Risk buckets (PDs)	Total sales									
	>€50 million (share)		€5-50 million (share)		<€5 million (share)		"Retail" (share)		Total (share)	
	No	Debt	No	Debt	No	Debt	No	Debt	No	Debt
0.00-0.15%	11.4	5.2	7.5	3.5	5.3	2.5	3.8	2.2	5.3	4.0
0.15-0.45%	33.4	35.9	27.0	23.9	21.8	17.7	18.5	14.4	21.9	27.3
0.45-0.70%	26.2	30.3	25.4	25.6	21.9	18.8	18.7	15.8	21.5	25.9
0.70-1.00%	18.3	19.5	22.8	25.5	23.0	23.5	20.3	20.8	21.9	22.5
1.00-2.00%	8.0	6.7	12.8	16.1	18.1	23.5	21.0	24.4	17.9	13.9
2.00-4.00%	1.8	2.0	2.8	3.5	5.4	7.3	8.8	11.1	6.0	3.9
>4.00%	0.8	0.4	1.8	2.0	4.5	6.9	8.9	11.3	5.5	2.6
Number of firms	1,915		20,078		45,935		36,381		104,309	
Bank loans	79,605		71,802		36,354		7,333		195,093	
Average PD	0.62		0.89		1.49		1.91		0.93	

Table 4

Expected losses, capital requirements and risk components

Whole sample

Risk buckets	Bank loans		Expected losses (%)	Capital requirements (%)	Risk components (%)
	Amount	%			
0.00-0.15%	7,729	4.0	0.04	2.09	0.25
0.15-0.45%	53,201	27.3	0.14	4.06	0.54
0.45-0.70%	50,502	25.9	0.26	5.63	0.82
0.70-1.00%	43,898	22.5	0.38	6.41	1.00
1.00-2.00%	27,201	13.9	0.58	7.21	1.26
2.00-4.00%	7,529	3.9	1.24	9.27	2.07
>4.00%	5,033	2.6	3.83	16.38	6.40
Total	195,093	100.0	0.42	5.81	0.97

Table 5

Stress test: transition matrix for the whole sample

Number of firms

Risk buckets (2002)	Amount	Share	Risk buckets (simulated 1994)								Number of firms in simulated 1994
			0.00-0.15%	0.15-0.45%	0.45-0.70%	0.70-1.00%	1.00-2.00%	2.00-4.00%	>4.00%	Total	Shares
0.00-0.15%	5,534	5.3	44.2	35.6	9.2	5.2	3.8	1.4	0.8	100.0	2.3
0.15-0.45%	22,821	21.9	–	56.2	25.3	8.9	5.9	2.3	1.4	100.0	14.2
0.45-0.70%	22,450	21.5	–	–	55.3	28.8	10.1	3.4	2.4	100.0	17.9
0.70-1.00%	22,852	21.9	–	–	–	64.5	27.5	4.4	3.6	100.0	22.6
1.00-2.00%	18,701	17.9	–	–	–	–	76.9	17.7	5.4	100.0	23.4
2.00-4.00%	6,258	6.0	–	–	–	–	–	73.9	26.1	100.0	9.9
>4.00%	5,693	5.5	–	–	–	–	–	–	100.0	100.0	9.7
Total	104,309	100.0	2.3	14.2	17.9	22.6	23.5	9.9	9.7	100.0	100.0

Table 6

Stress test: transition matrix for the whole sample

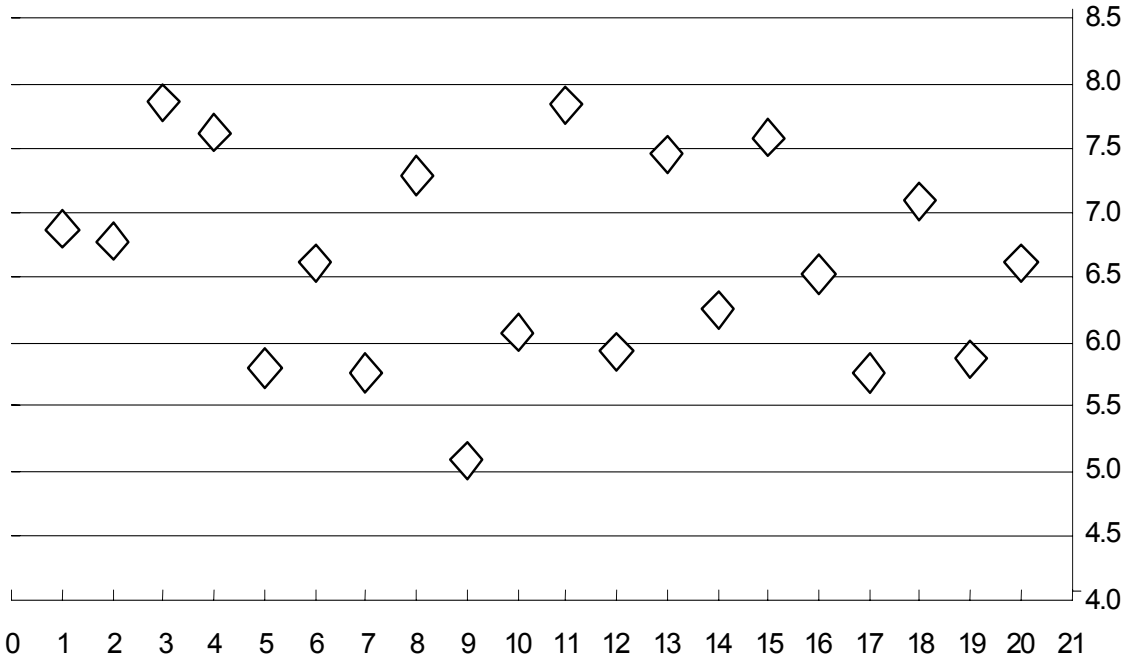
Bank debt

Risk buckets (2002)	Amount	Share	Risk buckets (simulated 1994)								Bank debt in simulated 1994
			0.00-0.15%	0.15-0.45%	0.45-0.70%	0.70-1.00%	1.00-2.00%	2.00-4.00%	>4.00%	Total	Shares
0.00-0.15%	7,729	4.0	35.0	44.5	13.3	2.6	2.8	1.6	0.3	100.0	1.4
0.15-0.45%	53,201	27.3	–	61.5	25.4	6.3	4.6	1.3	1.0	100.0	18.5
0.45-0.70%	50,502	25.9	–	–	53.8	33.6	9.4	2.0	1.3	100.0	21.4
0.70-1.00%	43,898	22.5	–	–	–	65.7	25.5	5.0	3.8	100.0	25.3
1.00-2.00%	27,201	13.9	–	–	–	-	83.1	11.4	5.5	100.0	21.1
2.00-4.00%	7,529	3.9	–	–	–	–	–	80.5	19.5	100.0	6.8
>4.00%	5,033	2.6	–	–	–	–	–	–	100.0	100.0	5.5
Total	195,093	100.0	1.4	18.5	21.4	25.3	21.1	6.8	5.5	100.0	100.0

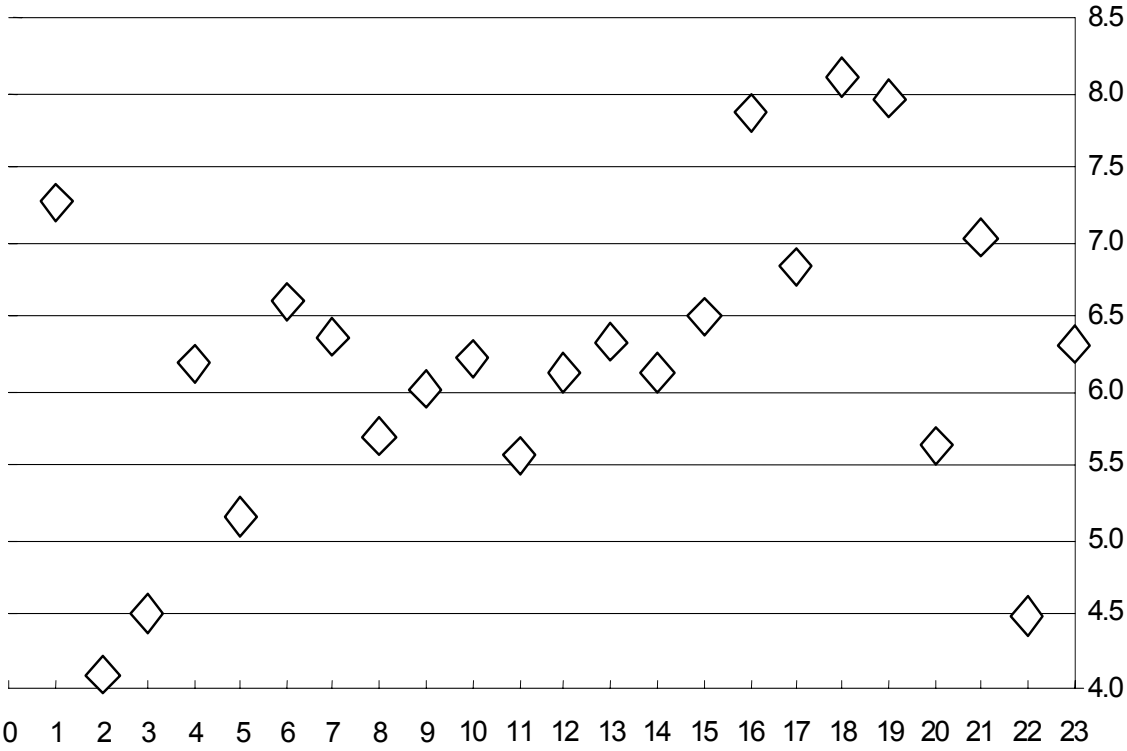
Graph 1

Interest rates on bank loans

(a) by region



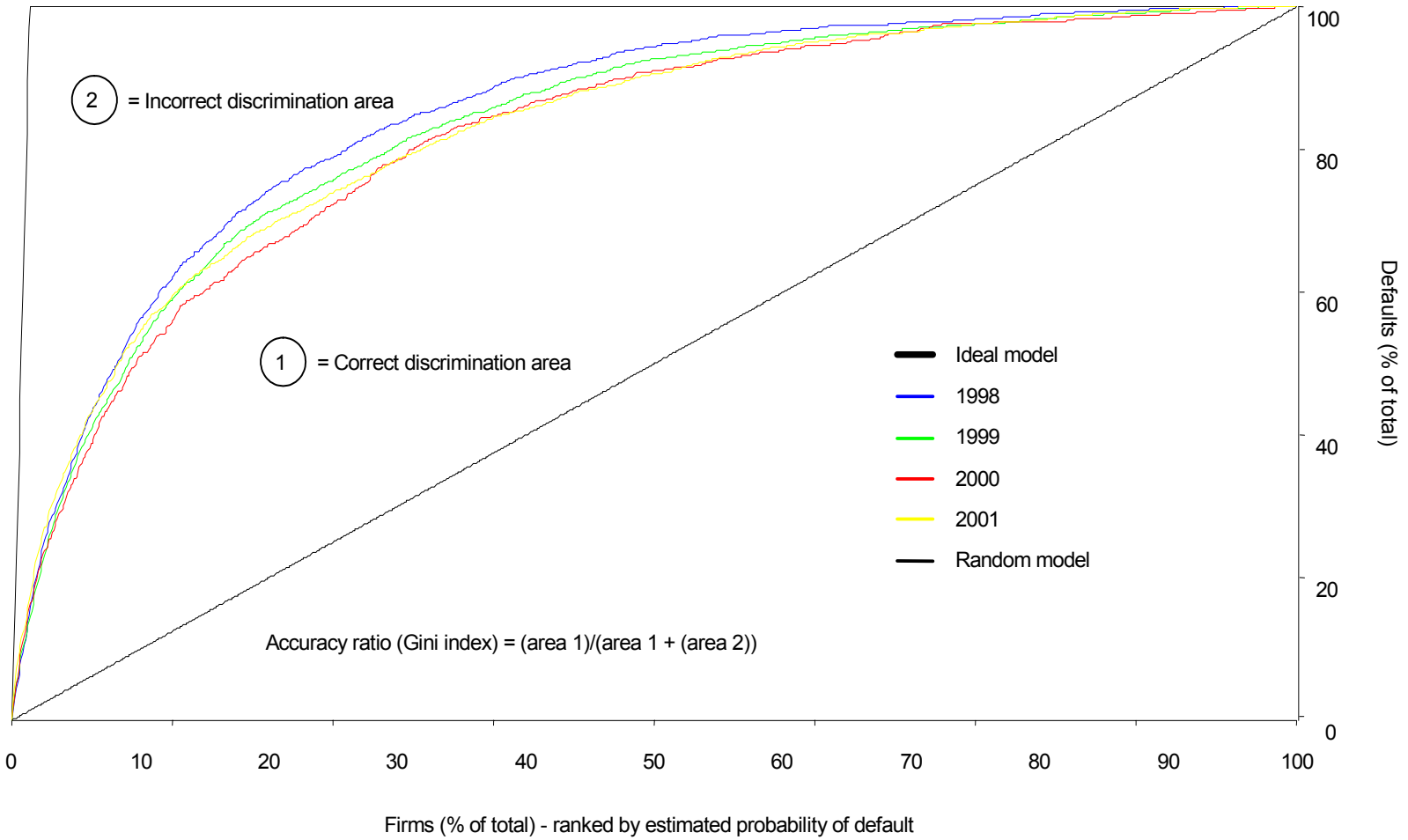
(b) by economic sector



Graph 2

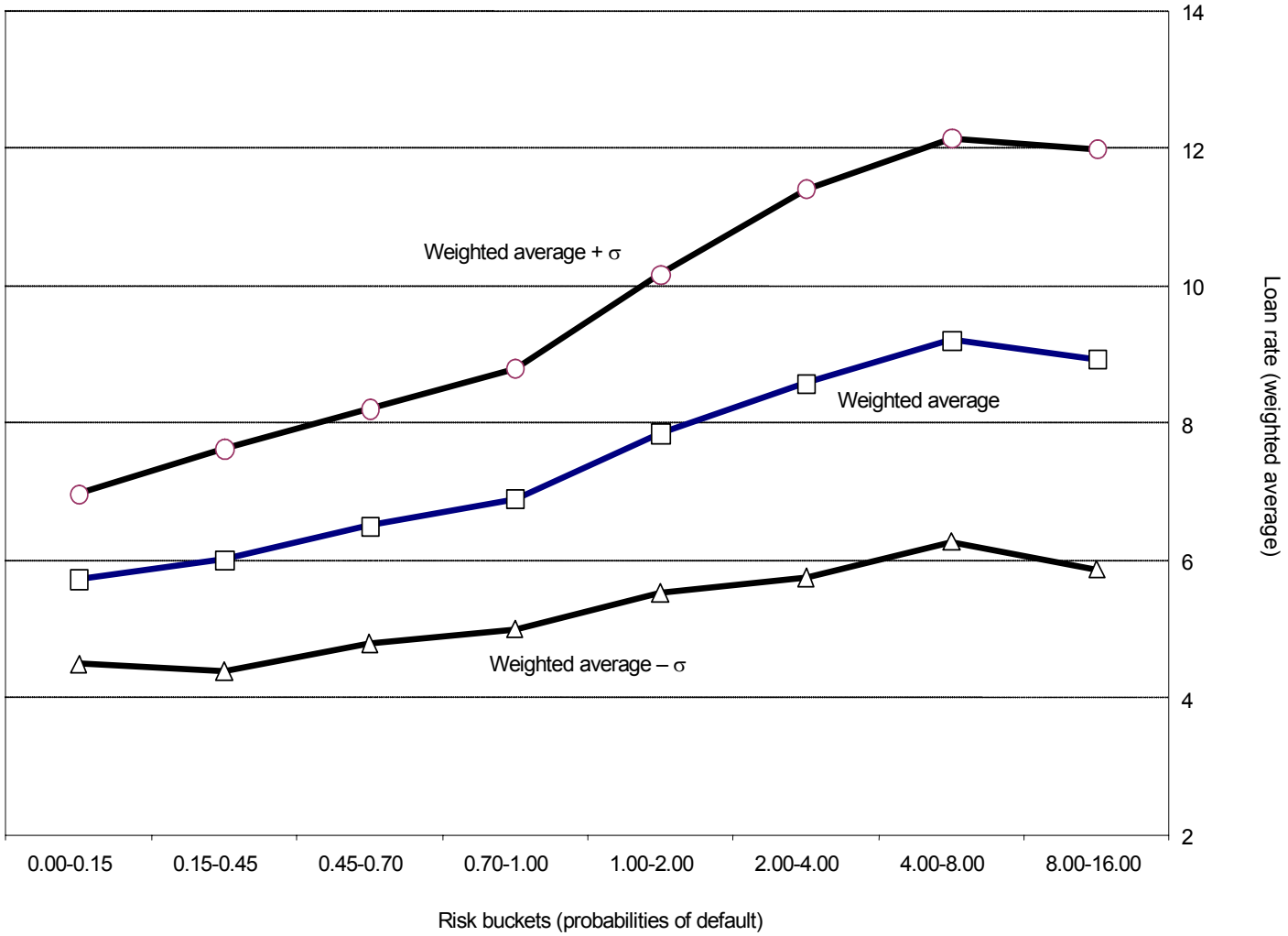
Estimating the probability of default of non-financial firms

Model accuracy



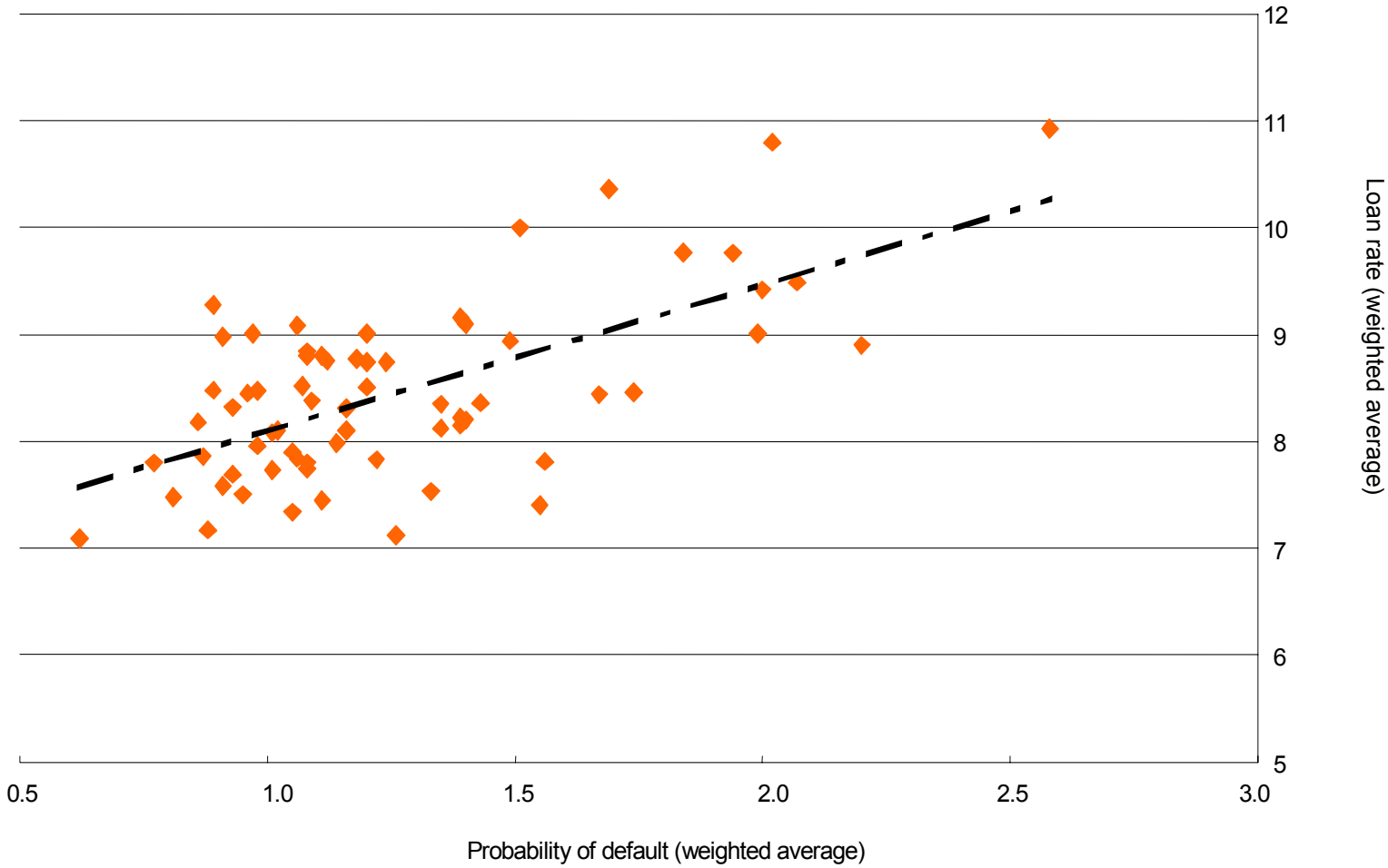
Graph 3

Probabilities of default and loan rates



Graph 4

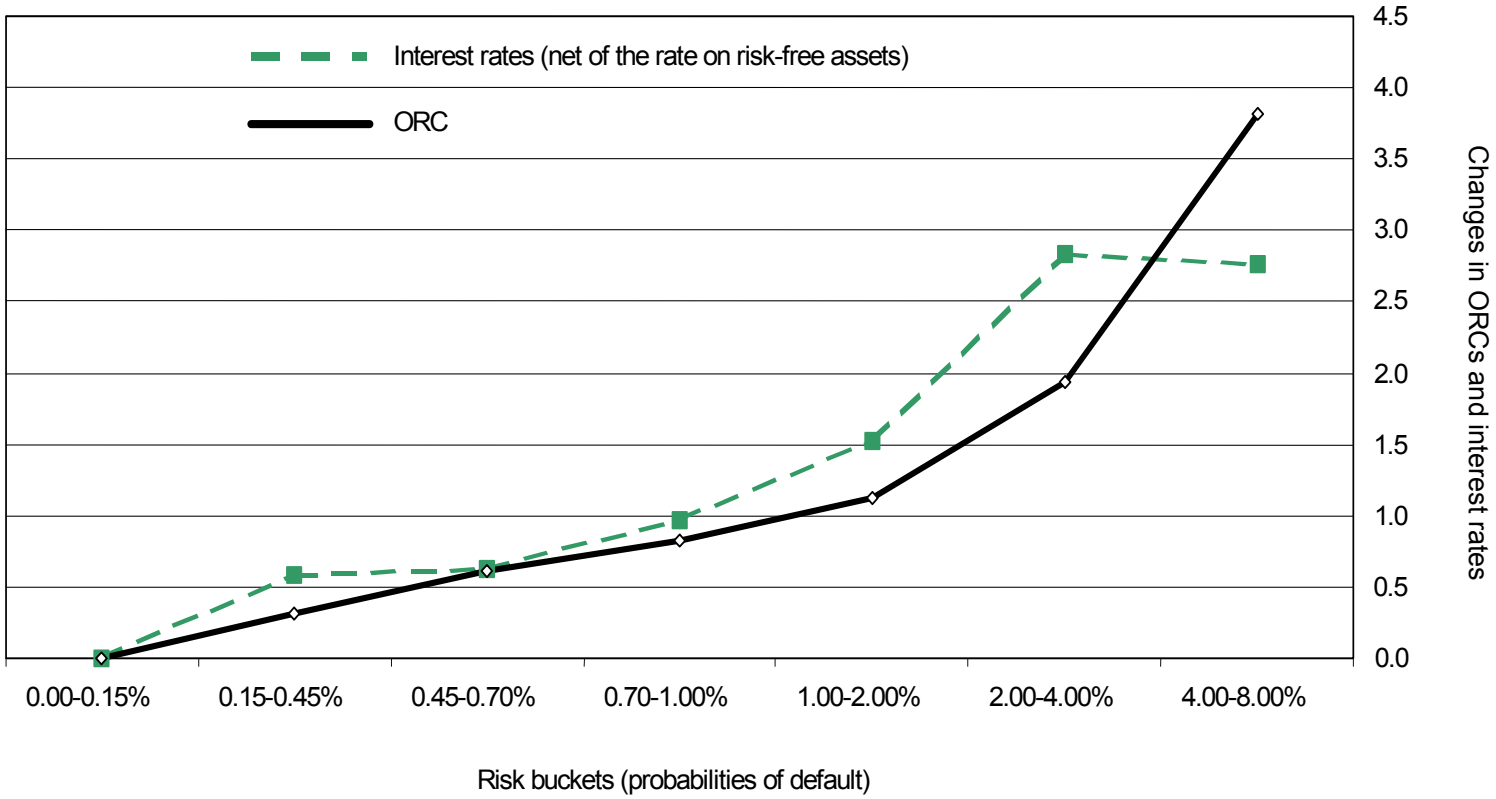
Distribution of banks by loan rate and firm riskiness



Graph 5

Changes in ORCs and interest rates by risk bucket

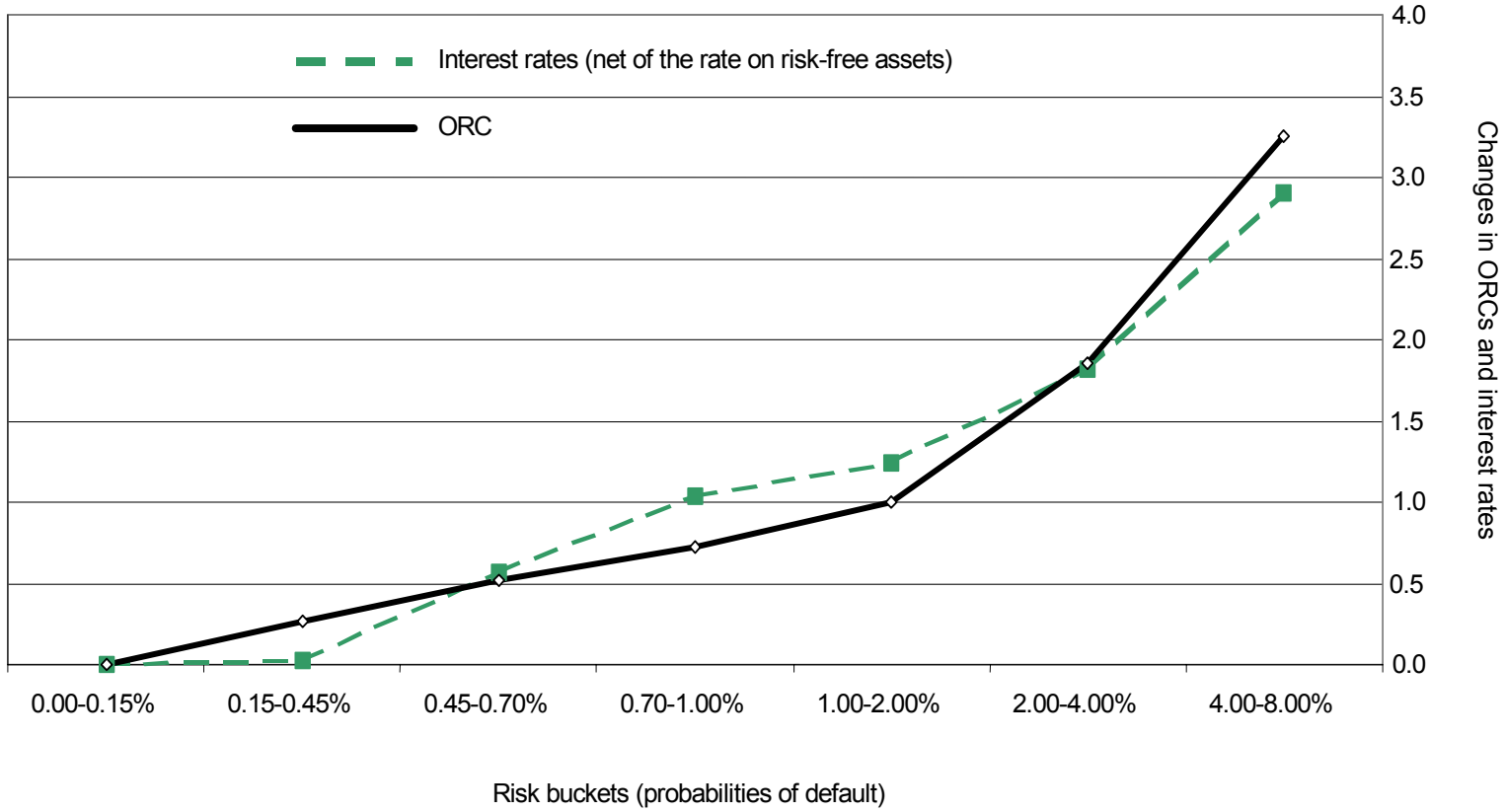
Total sales >€50 million



Graph 6

Changes in ORCs and interest rates by risk bucket

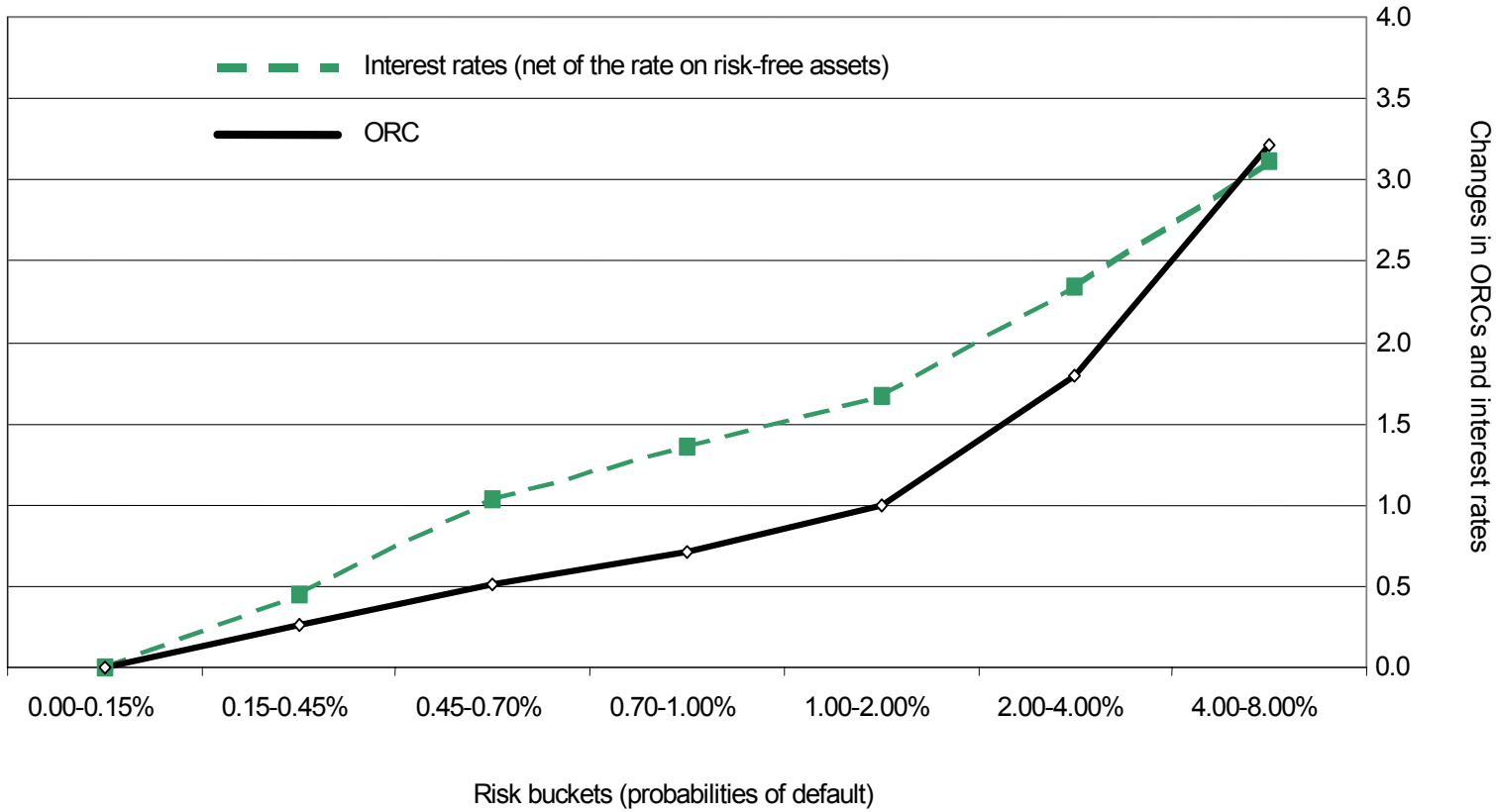
Total sales €5-50 million



Graph 7

Changes in ORCs and interest rates by risk bucket

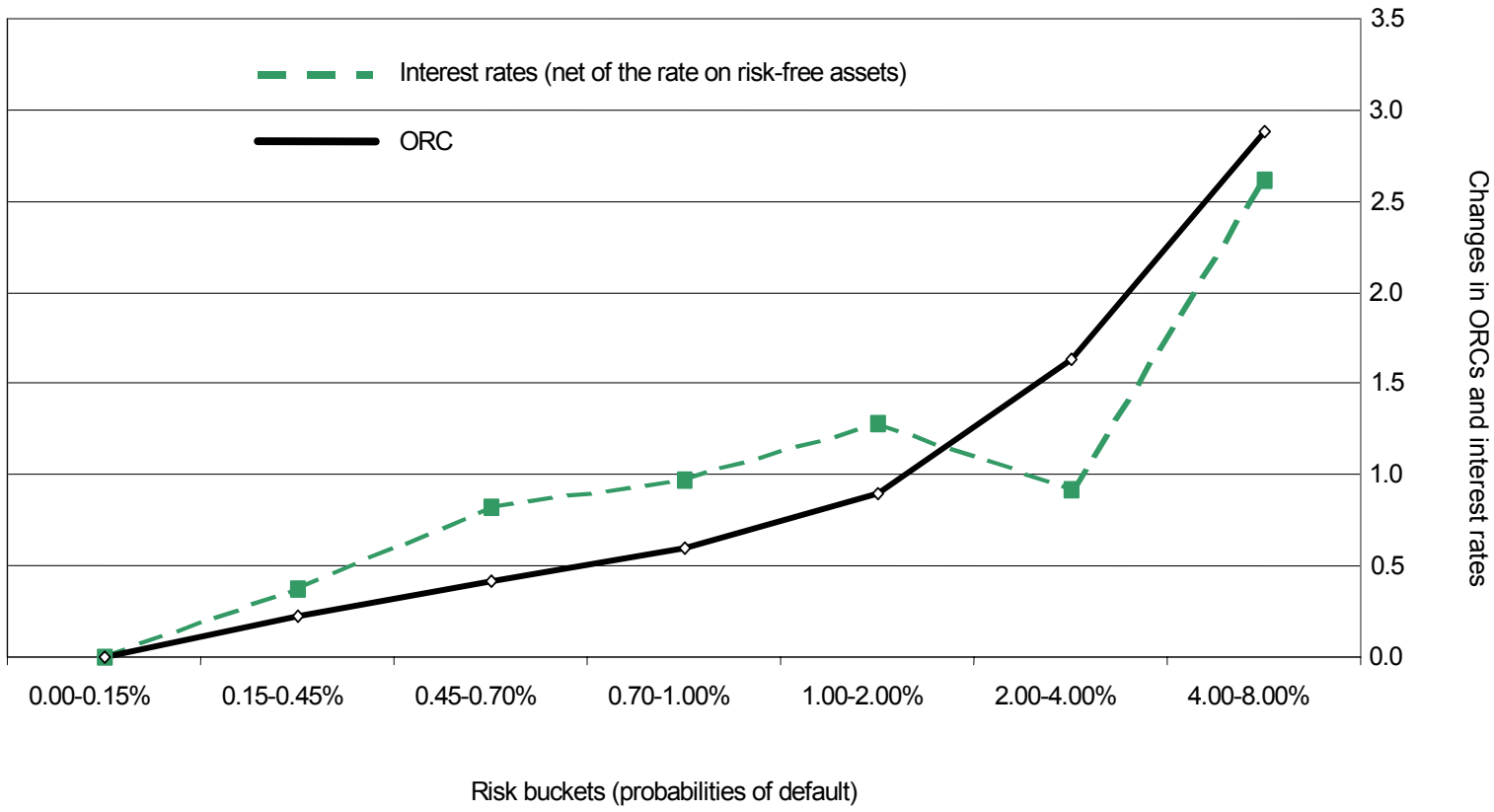
Total sales <€5 million



Graph 8

Changes in ORCs and interest rates by risk bucket

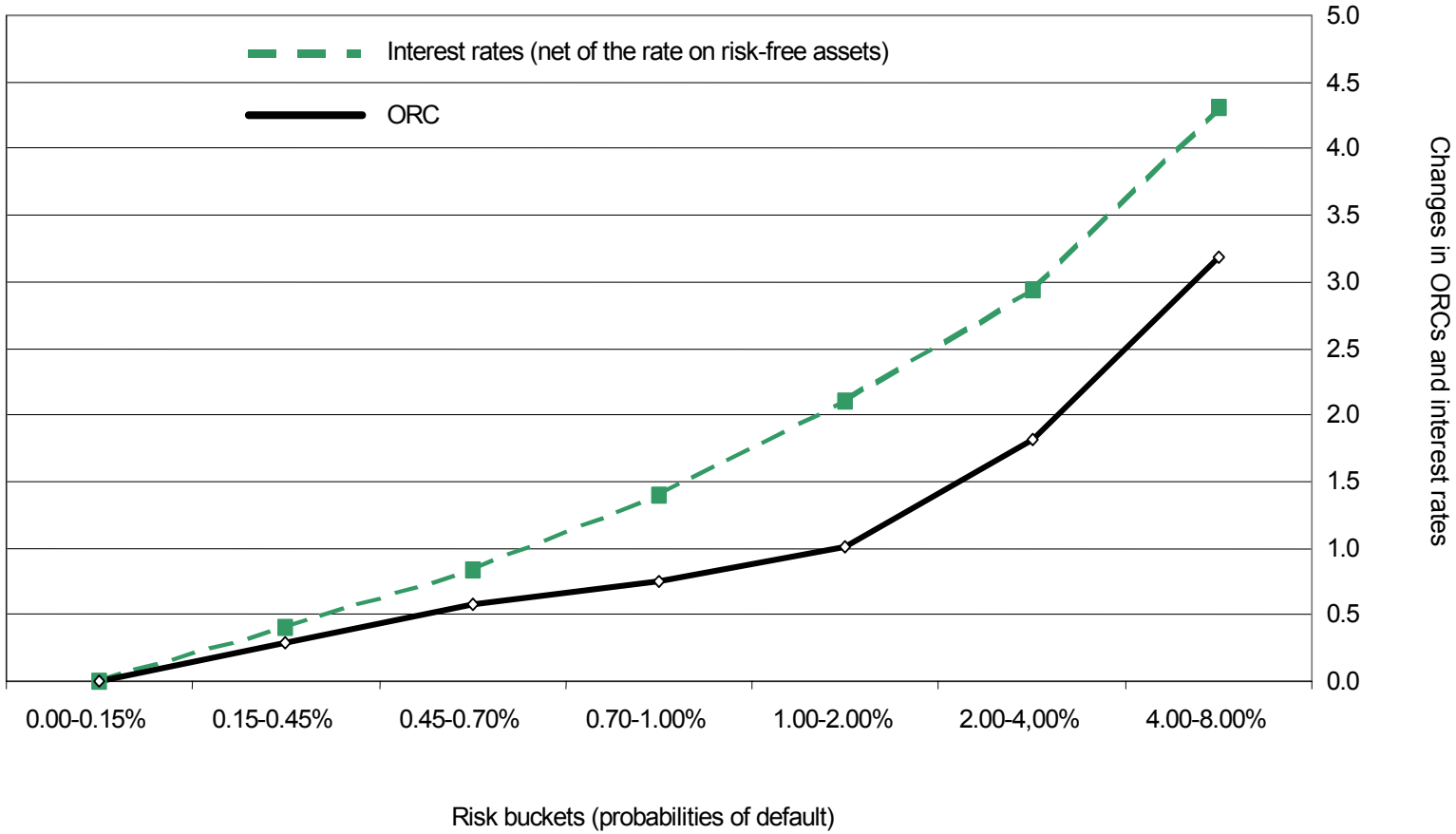
Retail portfolio



Graph 9

Changes in ORCs and interest rates by risk bucket

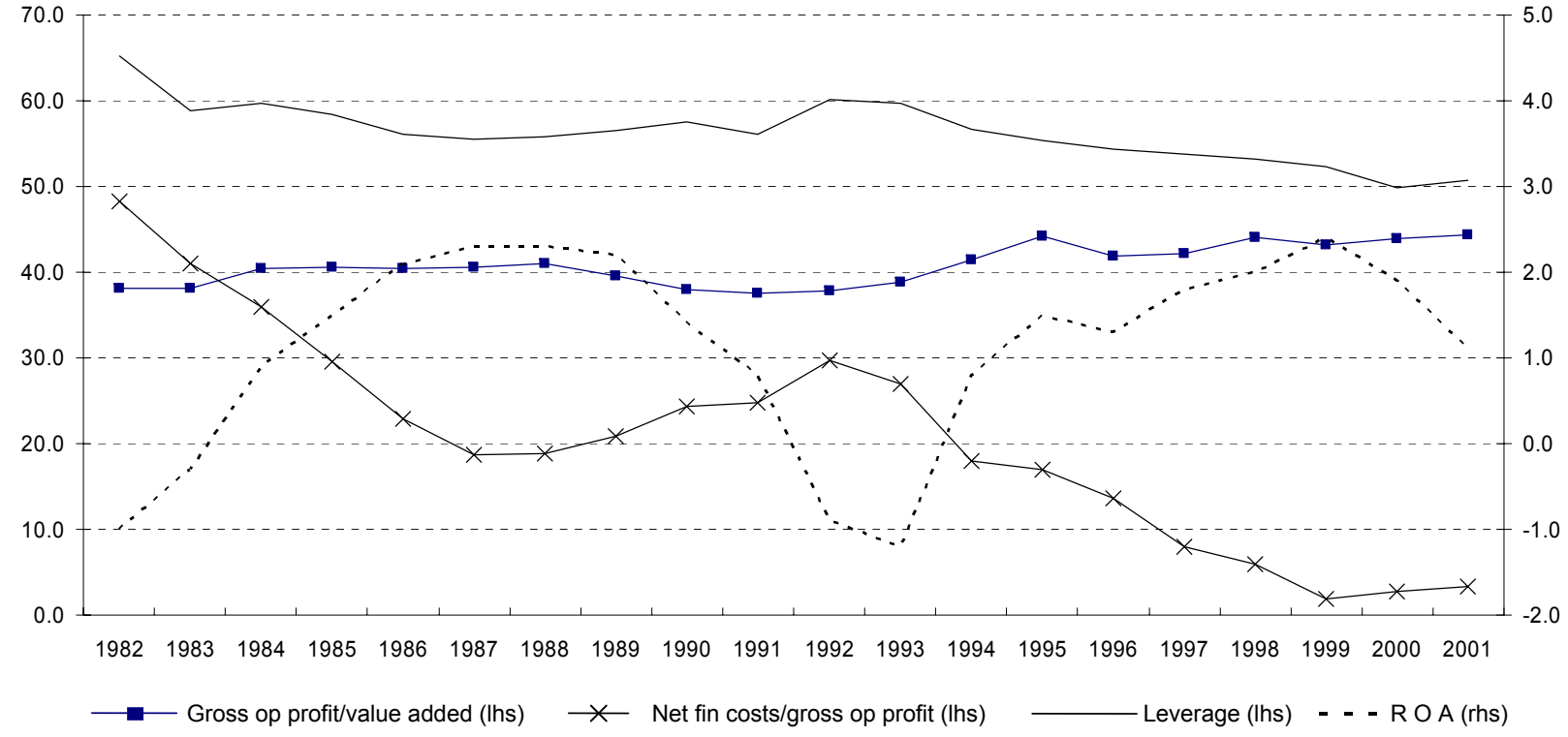
Whole sample



Graph 10

Industrial and commercial firms

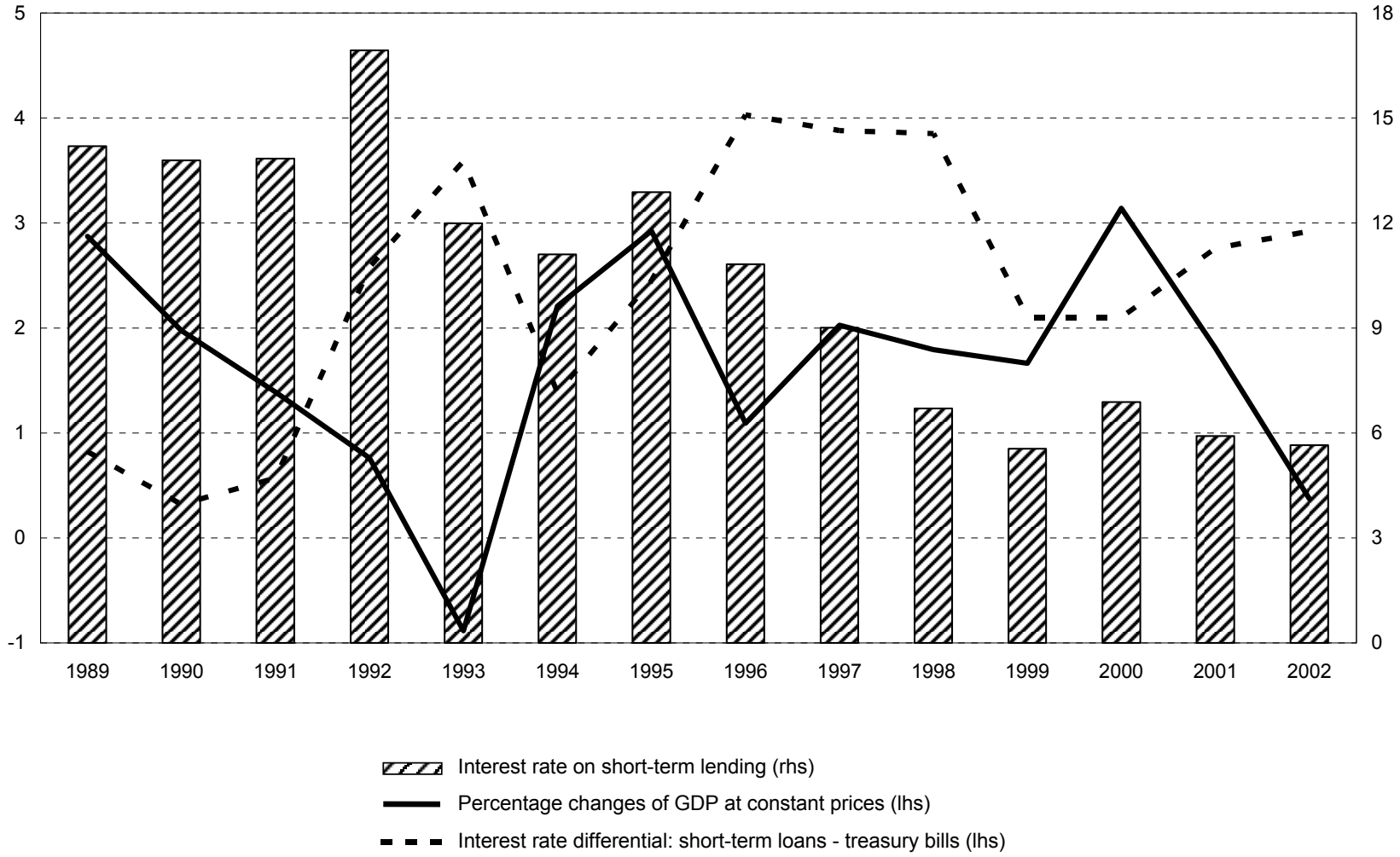
Accounting ratios



Source: Credit Register.

Graph 11

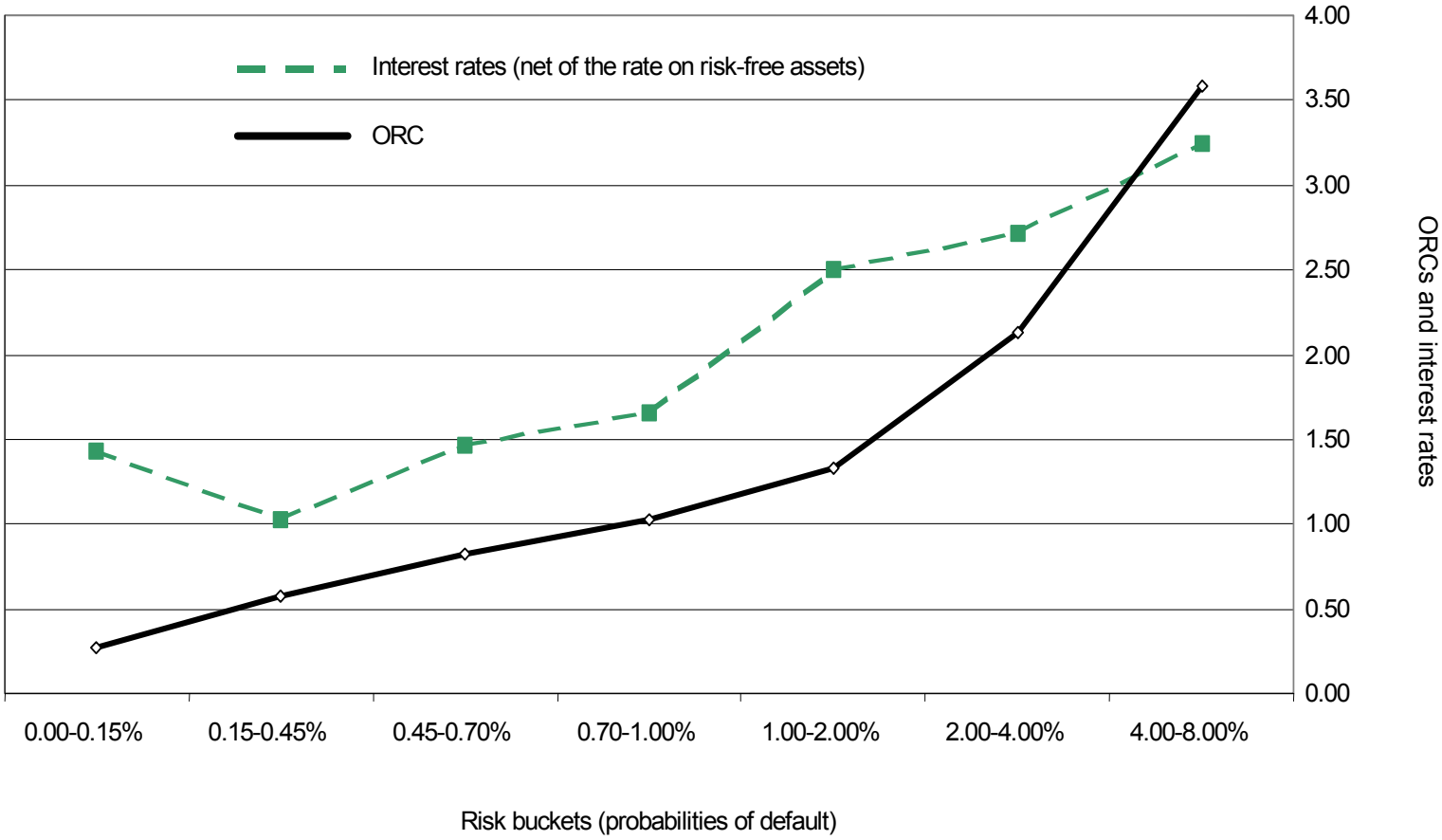
Gross domestic product and interest rates on bank loans



Graph 12

ORCs and interest rates by risk bucket in a distressed scenario

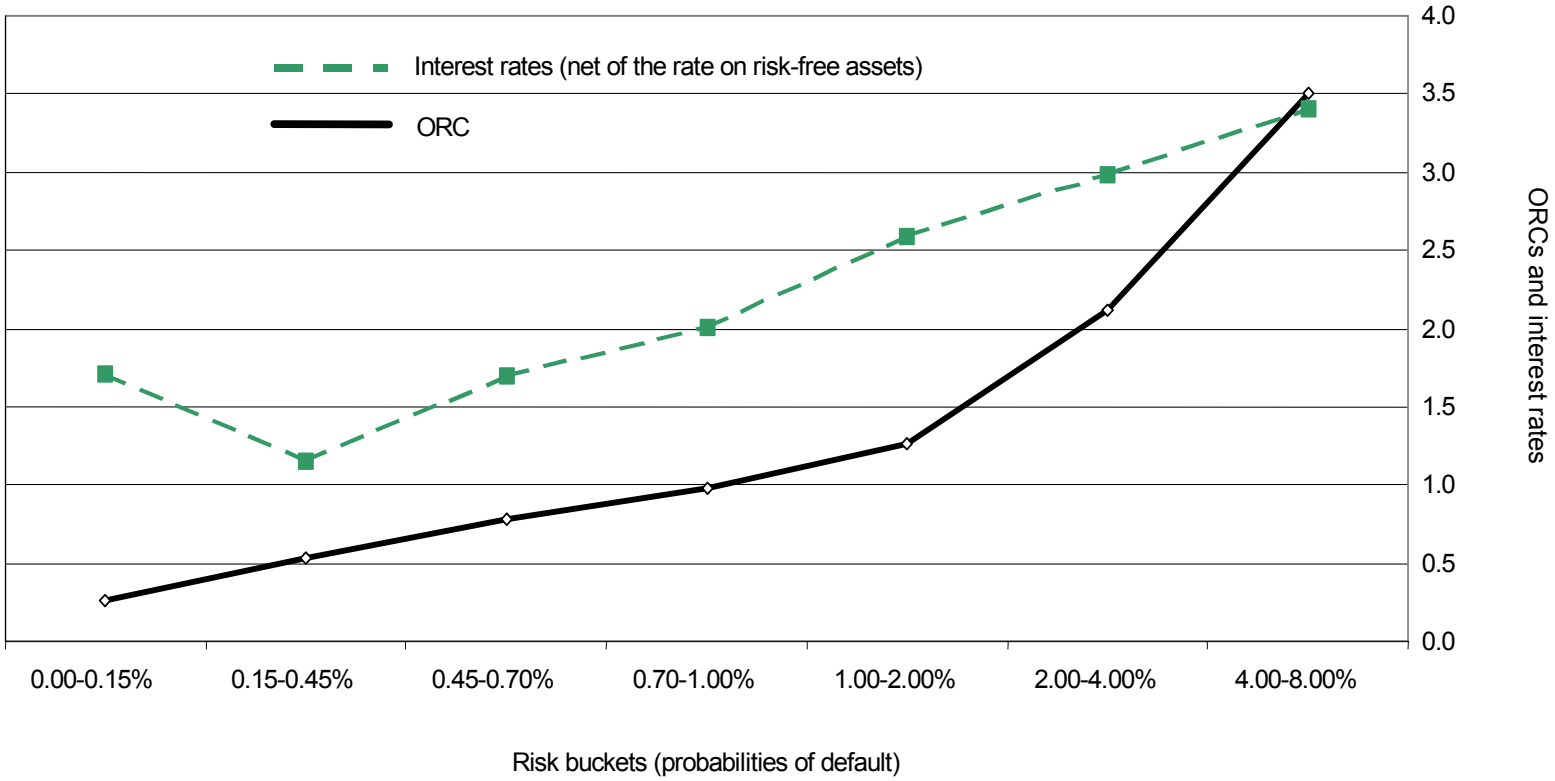
Whole sample



Graph 13

ORCs and interest rates by risk bucket in a distressed scenario

Total sales €5-50 million



6. References

Allen, L and T Saunders (2002): "A survey of cyclical effects in credit risk measurement models", presentation at the conference on "Changes in risk through time: measurement and policy options", BIS, Basel, 6 March.

Altman, E, A Resti and A Sironi (2002): "The link between default and recovery rates: effects on the procyclicality of regulatory capital ratios", paper presented at the conference on "Changes in risk through time: measurement and policy options", BIS, Basel, 6 March.

Associazione Bancaria Italiana (2001): *Italian banks' position*, paper on capital adequacy revision, May.

Ayuso, J, D Pérez and J Saurina (2002): "Are capital buffers pro-cyclical?", paper presented at the conference "Basel II: an economic assessment", BIS, May.

Basel Committee on Banking Supervision (2001a): *The New Basel Capital Accord*, consultative document, January.

——— (2001b): *Results of the Second Quantitative Impact Study*, November.

——— (2001c): *Review of procyclicality*, mimeo.

——— (2001d): *Potential modifications to the Committee's proposals*, November.

——— (2002a): *Results of Quantitative Impact Study 2.5*, June.

——— (2002b): Press statement, 10 July.

——— (2002c): *QIS3 technical rules*, October.

——— (2003a): *The New Basel Capital Accord*, consultative document, April.

——— (2003b): *Quantitative Impact Study 3 - overview of global results*, May.

——— (2003c): *Supplementary information on QIS3*, May.

Borio, C, C Furfine and P Lowe (2001): "Procyclicality of the financial system and financial stability: issues and policy options", *BIS Papers*, no 1.

Cannata, F, F Fabi and S Laviola (2002): "Rating interni e gestione del rischio di credito: la misurazione della probabilità di insolvenza", *Bancaria*, no 4.

Cannata, F, P Grippa and S Laviola (2001): *Calibration of benchmark risk weights in the internal ratings based approach*, Bank of Italy, mimeo, October.

Cannata, F and S Laviola (2001): "Il nuovo Accordo sul Capitale delle banche: i commenti dell'industria bancaria", *Rivista Bancaria - Minerva Bancaria*, no 4.

Carosio, G (2001): "Il Nuovo Accordo sul Capitale: aspetti generali", *Bancaria*, no 4.

——— (2002): *Il nuovo Accordo sul Capitale: aggiornamento sui lavori del Comitato di Basilea*, Associazione per lo Sviluppo degli Studi di Banca e Borsa, Sadiba (Perugia), 15 marzo.

Catarineu-Rabell, E, P Jackson and D Tsomocos (2003): "Procyclicality and the new Basel Accord - banks' choice of loan rating system", *Bank of England Working Paper Series*, no 181, March.

Danielsson, J, P Embrechts, C Goodhart, C Keating, F Muennich, O Renault and H Song Shin (2001): "An academic response to Basel II", *Special Paper Series*, no 130, Financial Markets Group, London School of Economics.

Dietsch, M and J Petey (2003): *Should SME exposures be treated as retail or corporate exposures? A comparative analysis of default probabilities and asset correlations in French and German SMEs*, mimeo.

Dullmann, K and H Scheule (2003): "Asset correlation of German corporate obligors: its estimation, its drivers and implications for regulatory capital", paper presented at the Basel Committee's Research Task Force Workshop on "Banking and Financial Stability", Bank of Italy, Rome, March.

Ervin, W and T Wilde (2001): "Procyclicality in the new Basel Accord", Credit risk special report, *Risk Magazine*, October.

Estrella, A (2001): *The cyclical behaviour of optimal bank capital*, Federal Reserve Bank of New York, mimeo.

European Central Bank (2001): "The new capital adequacy regime, the ECB perspective", *ECB Monthly Bulletin*, May.

Institute of International Finance (2001): *Report of the Working Group on Capital Adequacy*, May.

International Swaps and Derivatives Association (2001): *ISDA's response to the Basel Committee on Banking Supervision's consultation on the New Capital Accord*, May.

Jackson, P, C Furfine, H Groeneveld, D Hancock, D Jones, W Perraudin, L Radecki and M Yoneyama (1999): "Capital requirements and bank behaviour: the impact of the Basel Accord", *Basel Committee on Banking Supervision Working Papers*, no 1.

Jordan, J, J Peek and E Rosengren (2002): "Credit risk modeling and the cyclicality of capital", paper presented at the conference on "Changes in risk through time: measurement and policy options", BIS, Basel, 6 March.

Laviola, S (2001): "Il Nuovo Accordo sul Capitale: il metodo dei rating interni", *Bancaria*, no 4.

Lopez, J (2002): "The relationship between average asset correlation, firm probability of default and asset size", paper presented at the conference "Basel II: an economic assessment", BIS, May.

Lowe, P (2002): "Credit risk measurement and procyclicality", paper presented for the conference "Banking Supervision at the Crossroads", held at the Netherlands Bank, Amsterdam, 24-25 April.

Masschelein, N (2003): *The Basel II Capital Accord, SME loans and implications for Belgium*, mimeo.

Perraudin, W and Y T Hu (2002): *The dependence of recovery rates and defaults*, Birkbeck College, UK, mimeo.

Resti, A (2002): *The New Basel Capital Accord: structure, possible changes, micro and macroeconomic effects*, mimeo.

Saurina, J and C Trucharte (2003): *The impact of Basel II on lending to small and medium-sized firms. A regulatory policy assessment based on the Spanish Credit Register*, Bank of Spain, mimeo.

Segoviano, M and P Lowe (2002): "Internal ratings, the business cycle and capital requirements: some evidence from an emerging market economy", *BIS Working Papers*, no 117, September.