

Are unexpected loan losses lower for small enterprises than for large enterprises?

Kai Larsen, senior economist, and Kristin M. Bjerkeland, economist, Financial Institutions Department¹

Unexpected loan losses have been lower for loans to small- and medium-sized enterprises (SMEs) than for those to large enterprises in about ⅔ of the period reviewed in this article. In the remaining period, including two of the years during the banking crisis, unexpected losses were higher for loans to SMEs. The results depend in part on the models and calculation methods used. Consequently, we do not have a basis for concluding that unexpected losses are generally lower for loans to SMEs than for loans to large enterprises. Under the Basel II framework, the capital requirements for loans to SMEs have been reduced (“SME discount”). We do not take a concrete position on this discount. The results of our analysis indicate, however, that an SME discount cannot necessarily be rejected.

1. Introduction

In its assessment of credit risk, a bank normally distinguishes between *expected* and *unexpected* loan losses. Expected loan losses are the losses that banks expect to incur based on their model predictions. These losses can be looked upon as an ordinary cost associated with lending activity, and should therefore be priced into the interest rate on loans. However, it is unrealistic to expect a bank’s model-based predictions to be 100 per cent accurate. There will most likely be some difference between expected losses in a loan portfolio and actual losses. This difference can be referred to as unexpected loan losses.

In this article, we analyse differences between unexpected loan losses for SMEs and large enterprises in Norway. One reason why we look at SMEs and large enterprises is that banks’ exposures to SMEs will receive a lower capital requirement (SME discount) under the new capital adequacy rules. We do not take a concrete position on this discount. Our analysis is a contribution to the discussion on whether it is appropriate to lower the capital requirement for exposures to SMEs.

In section 2, we describe the method, model and data used in our analysis. In the following section we estimate expected loan losses and losses relating to bankruptcy, and on this basis estimate unexpected losses on loans to SMEs on the one hand and large enterprises on the other. In section 4, we analyse the differences between SMEs and large enterprises in greater detail. In the Norwegian version, section 5 provides a description of the SME discount under the new capital adequacy rules. This section was included as background material for those who are not familiar with the discount. This section has been omitted in the English version and we refer our readers to the BIS website (www.bis.org)

2. Method, model and data

2.1 Method

In section 3, we estimate expected losses, losses related to bankruptcy and unexpected losses. *Expected losses* are estimated by multiplying the bankruptcy probability in each individual enterprise by a bank debt of NOK 1 million². Unexpected losses are then totalled for all the enterprises in the group and calculated as a percentage of the group’s total bank debt. *Losses relating to bankruptcy* are calculated by tallying the number of (actual) bankruptcies for the same group of enterprises in the three subsequent years.³ We assume that an individual bankruptcy gives rise to loan losses of NOK 1 million. We have not taken into account that banks may recover portions of the loan amount by realising any collateral. Bankruptcy losses are then totalled for all the enterprises in the group and calculated as a percentage of the group’s total bank debt.⁴ *Unexpected losses* is the difference between the sum of bankruptcy losses and the sum of expected losses. If bankruptcy losses are larger (smaller) than expected losses, the unexpected loss will be positive (negative). Finally, unexpected losses are calculated as a percentage of the total bank debt of the group.

2.2 Model

The bankruptcy probability that is used to estimate expected losses is calculated using Norges Bank’s bankruptcy prediction model Sebra.⁵ The model is a quantitative model that predicts enterprise-specific bankruptcy probabilities. Bankruptcy probabilities are calculated as a function of various key figures in annual corporate accounts and the age, size and industry characteristics of the company.⁶ Initially, we also intended to estimate default probabilities, but owing to data limitations this was not possible. The Sebra model was initially estimat-

¹ We are grateful to Kjell Bjørn Nordal, Per Atle Aronsen and Sindre Wemre in Norges Bank for useful input and comments.

² We assume, in other words, that bank debt is the same for all enterprises. An alternative approach is to multiply the bankruptcy probability by the actual bank debt of each individual enterprise. However, such an approach would weaken an analysis of unexpected losses.

³ Analyses undertaken by Norges Bank show that it takes 1-3 years from the time a bankrupt firm submits its last accounts to the time it is recorded in bankruptcy statistics.

⁴ In reality, loan losses that are not related to bankruptcy may also arise, for example in connection with default, compulsory winding-up and the like.

⁵ Sebra is an acronym for System for Edb-basert RegnsaksAnalyse (System for EDP-based Accounts Analysis)

⁶ See Eklund, Larsen and Bernhardsen (2001) and Bernhardsen (2001) for a further description of the model.

ed over the period 1990-1996. In autumn 2003, the model was re-estimated for the period 1990-2000. The model showed relatively little change as a result of the re-estimation and we have used the initial model in this article.

2.3 Data

We define SMEs as enterprises with annual sales of less than NOK 83 million (i.e. about EUR 10 million), while enterprises with annual sales in excess of this amount are defined as large. The analysis covers all limited companies in Norway that have submitted approved accounts and that have bank debt recorded on the balance sheet in the period 1988-2001. We have not included years subsequent to 2001 as it takes up to 3 years to tally bankruptcies. In the period prior to 1999, the annual accounts contained less detailed information about enterprises' debt to banks. As a result, the number of enterprises covered in the years 1988-1998 is smaller than in 1999 and subsequent years.⁷ Moreover, the quality of the bankruptcy data for the period 1988-1990 is poorer. In addition, the registration of bankruptcies in our database was changed as from 1999. Owing to these factors, the periods prior to and following 1999 are not fully comparable. However, we have no reason to assume that this has a bearing on the conclusions in this analysis.

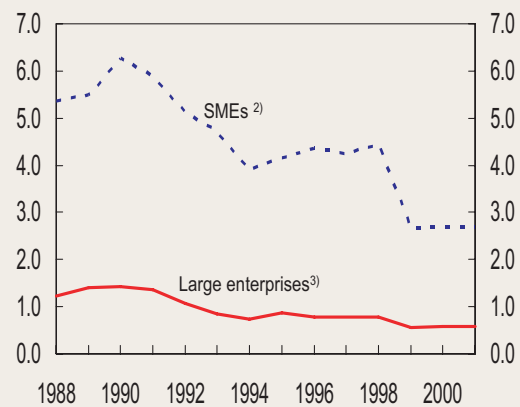
3. Expected, actual and unexpected losses on loans to SMEs and large enterprises

3.1 Expected losses

A bank should in principle assess the expected loss before approving a loan. A bank normally applies a bankruptcy or default model to the loan portfolio to provide an indication of the losses it is likely to incur in the coming period. We have used Norges Bank's Sebra model and database to estimate expected losses on loans to SMEs and large enterprises in the period 1988-2004.⁸

The calculations show that expected losses have on average been substantially higher for loans to SMEs than for loans to large enterprises both in upturns and downturns (see Chart 1). During the banking crisis in the first years of the 1990s, banks could on average expect to lose about 6 per cent on every krone loaned to an SME, whereas the expected loss on the same exposure to a large enterprise was only about 1 per cent. In the years following the banking crisis, the enterprise sector consolidated to a considerable extent. As a result of this, expected losses on loans to both SMEs and large enterprises have been sharply reduced.

Chart 1 Expected losses¹⁾ for SMEs and large enterprises. Percentage of lending



¹⁾ Loss estimate based on predicted bankruptcy probability (Sebra), without realisation of security/collateral (i.e. PD*EAD. Summarised for all enterprises in the group)

²⁾ Enterprises with turnover < NOK 83 million (EUR 10 million)

³⁾ Enterprises with turnover ≥ NOK 83 million

Source: Norges Bank

3.2 Losses relating to bankruptcy (“actual” losses)

Expected losses in a period are calculated at the start of the period and are thus represented by as a forward-looking variable. At the end of the period, the bank can look back and tally actual losses. Actual losses are thus represented by a backward-looking variable. We do not have access to enterprise-specific actual losses, but we do have access to bankruptcy data for Norwegian enterprises for the period 1988-2004. Using this variable, we calculated simulated loan losses relating to bankruptcies. Bankruptcy losses are used here as an indication of banks' actual losses.

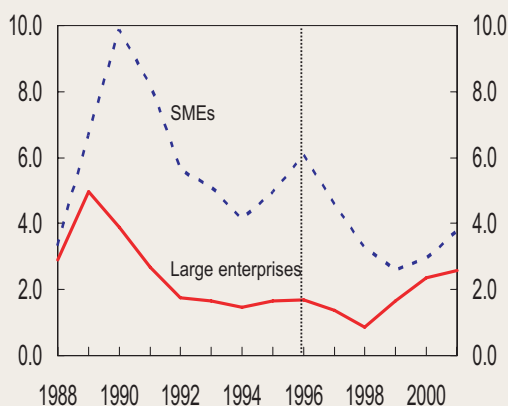
Bankruptcy losses are also higher for loans to SMEs than for loans to large enterprises in the years both before and after the banking crisis (see Chart 2). At most, the loss level is on average 10 per cent for each krone loaned to an SME, or about twice as high as the figure for large enterprises. Bankruptcy losses have also fallen sharply since the banking crisis period for both SMEs and large enterprises. The loan loss levels presented here cannot be directly compared with the banks' actual loan losses in this period, partly because we have assumed the same loan amount for all enterprises.

Our calculations show that both expected losses and bankruptcy losses have on average been higher for loans to SMEs than for loans to large enterprises. However, since losses are a natural component of banking, and banks accept to bear risk on behalf of their borrowers, this is not necessarily a problem. As long as the customer pays for this service in the price of the loan, the

⁷ The number of SMEs included ranges between 18 261 to 26 755 in the period 1988-1998 and between 47 217 and 51 421 in the period 1999-2001. The number of large enterprises ranges between 665 to 1 043 in the period 1988-1998 and between 1 575 and 1 707 in the period 1999-2001.

⁸ In other words, losses up to and including 2004 based on the predictions for the 2001 accounts.

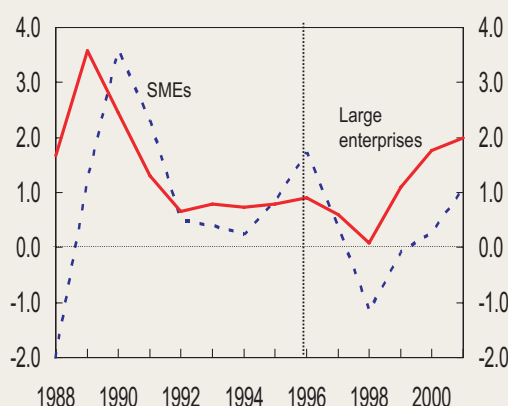
Chart 2 Losses on bankruptcy¹⁾ for SMEs and large enterprises. Percentage of lending



¹⁾ Loan losses in connection with actual bankruptcies. Without realisation of security/collateral. Same loan amount assumed for all enterprises. Because of a change in the underlying statistics, loss levels for 1996-2001 are not directly comparable with previous years

Source: Norges Bank

Chart 3 Unexpected losses¹⁾ for SMEs and large enterprises. Percentage of lending



¹⁾ Losses in connection with bankruptcy less expected losses. Because of a change in the underlying statistics, loss levels for 1996-2001 are not directly comparable with previous years

Source: Norges Bank

bank will be able to cover expected losses. In the light of the above, this implies that SMEs should on average be charged a higher lending rate than large enterprises. Correct pricing by banks will then reflect differences in expected losses.

3.3 Unexpected losses

Even if the banks' risk models have become more sophisticated, it is unlikely that the predictions will be entirely on the mark. When banks record actual losses, there will most likely be a difference between expected losses (Chart 1) and actual losses (Chart 2). We refer to this difference as unexpected losses.

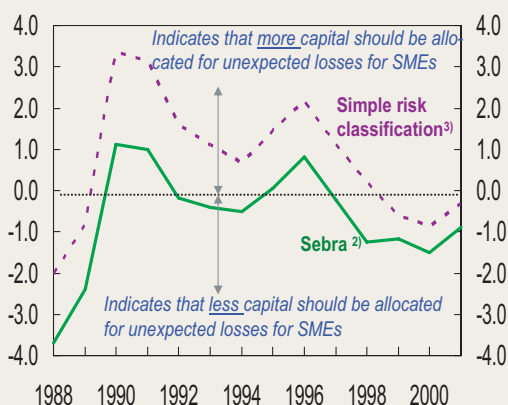
Chart 3 shows the portion of loans to SMEs and large enterprises that resulted in unexpected losses in our calculations. As shown in the chart, the picture is not as unambiguous here as in the previous charts. In some years, unexpected losses are smaller for loans to SMEs than for loans to large enterprises, and in other years the opposite applies (for example in 1990 and 1991, i.e. during two of the banking crisis years).

Taking a closer look, Chart 4 compares the two curves in Chart 3. The chart shows the difference between average unexpected losses on loans to SMEs and average unexpected losses on exposures to large enterprises for each year in the period 1988 to 2001. The green curve in the chart shows the difference when using the Sebra model. For purposes of comparison, we have also included the results of similar simulations when using a very simple risk classification model, as represented by the purple (broken) curve. In this model, the enterprises are divided into four risk groups based on the key figures earnings/bank debt and equity capital/total capital.

The model is probably too simple to be a realistic alternative for banks and has only been included to illustrate that different models may produce different results.

Since the curves show the *difference* between unexpected losses for SMEs and unexpected losses for large enterprises, all the points below zero indicate that unexpected losses on loans to SMEs are smaller than on loans to large enterprises, and the inverse. This implies that when the curves are below zero, it can be argued that banks should set aside a relatively smaller portion of their capital for exposures to SMEs than for exposures to large enterprises to provide for unexpected events. In the opposite case, when the curve is above

Chart 4 Difference in unexpected losses¹⁾ between SMEs and large enterprises



¹⁾ Unexpected losses for SMEs less unexpected losses for large enterprises

²⁾ Based on Norges Bank's bankruptcy prediction model Sebra

³⁾ Based on simple risk classification

Source: Norges Bank

zero, banks should have a higher level of buffer capital for SME borrowers than for large enterprises to cover unexpected losses.

Two important observations can be made on the basis of the charts: *First*, we see that the results vary during the period under review. It may thus be difficult to draw any conclusions that are robust over time. *Second*, we see that the two models may yield different results. When using the Sebra model, we find that banks on average should set aside less capital to provide for exposures to SMEs than for those to large enterprises in 10 of a total of 14 years, i.e. in 71 per cent of the years analysed. In the simple risk classification model, the result was 36 per cent, i.e. almost the inverse. However, the Sebra model is on the whole more accurate than the simple model for both groups. It is not unrealistic to assume that the banks' models are more accurate than the Sebra model, partly because banks have a better data basis for making model-based calculations, particularly for large enterprises.⁹ This could narrow the differences in unexpected losses between SMEs and large enterprises.

4. Differences within the groups SMEs and large enterprises?

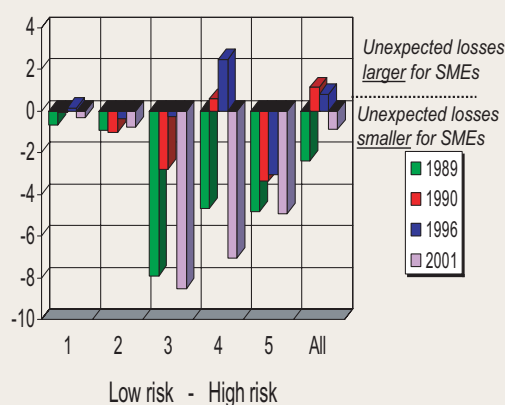
The results we have presented so far have been based on averages for the two groups SMEs and large enterprises. Naturally, all SMEs are not alike and the behaviour and risk profile of all large enterprises are not the same. In this section, we take a closer look at the possible implications of differences within groups for unexpected losses on loans to SMEs and large enterprises.

4.1 Differences between risk categories?

First, we have looked at the distribution of the results in Chart 4 when we divide enterprises into different risk categories. In Chart 5, the differences in unexpected losses are shown for different risk categories using the Sebra model.¹⁰ We have selected four years between 1988 and 2001 to elucidate this point. As in Chart 4, a negative value means that unexpected losses are lower for SMEs than for large enterprises, and the inverse.

Chart 5 shows that the Sebra model results in unexpected losses that are lower for SMEs than for large enterprises within almost all the risk categories for all periods. The exceptions are risk category 1 in 1996 and risk category 4 in 1990 and 1996, where unexpected losses are somewhat higher for SME exposures. The differences are small in the two best risk categories. This is not surprising as they consist of enterprises with a solid financial position irrespective of the size of the enterprise. Very few of these enterprises go bankrupt and they

Chart 5 Difference in unexpected losses between SMEs and large enterprises. Sebra model



Source: Norges Bank

are relatively easy to predict. As a result, the difference in unexpected losses between the two groups is small. Losses are more difficult to predict for enterprises that have neither a solid nor a weak financial position, i.e. enterprises in the middle risk categories. A wider difference can thus be expected between unexpected losses on loans to SMEs and to large enterprises in these categories.

The Sebra model used in this analysis is estimated for almost all limited companies in Norway. This means that the estimation sample is dominated by SMEs. Therefore, it is not surprising that the model is generally more accurate for SMEs than for large enterprises. It is not unrealistic to assume that the banks' prediction models will show a somewhat similar result. In practice, the banks will probably have fewer observations for large enterprises than for SMEs for estimating their models. If this is the case, the banks' models may also be less accurate for large enterprises than for SMEs. However, we cannot draw any conclusions as to whether this favours or disfavors loans to SMEs in relation to large enterprises. The reason for this is that we do not know which way the difference will affect large enterprises. On the other hand, a smaller data quantity for large enterprises may be compensated for by a more complete and detailed data set.¹¹

4.2 Idiosyncratic risk

It has been argued that the level of idiosyncratic risk is higher for SMEs than for large enterprises.¹² Idiosyncratic risk is defined as the risk linked to internal or individual factors in a firm, while general risk reflects the risk associated with general economic developments. High idiosyncratic risk reduces the impact of general economic developments on company risk levels.

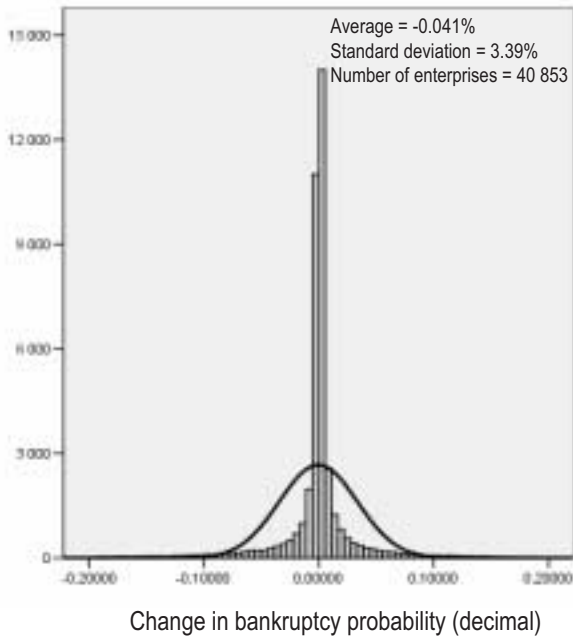
⁹ For example access to default data (and not only bankruptcy data) and access to detailed payment information about borrowers.

¹⁰ We have used 5 risk categories, where category 1 denotes low risk and category 5 denotes high risk.

¹¹ We have also calculated unexpected losses for large enterprises using a version of the Sebra model that is adapted to large enterprises. The changes in unexpected losses were marginal and do not change any of the conclusions in our analysis. The "large enterprise version" is essentially based on the same input variables as the ordinary Sebra model. A model for large enterprises could contain more detailed information to improve accuracy and thus reduce unexpected losses for large enterprises, for example, market information, credit ratings, more detailed accounts information and the like.

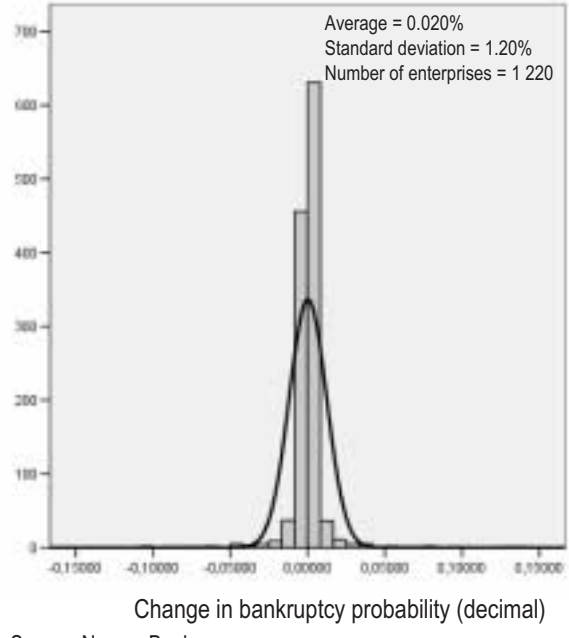
¹² This is one of the arguments behind the introduction of the SME discount under the Basel II framework (for further information see BIS website)

Chart 6a Change in bankruptcy probabilities from 2000 to 2001. SMEs. Deviation from average change for all enterprises. Frequency distribution



Source: Norges Bank

Chart 6b Change in bankruptcy probabilities from 2000 to 2001. Large enterprises. Deviation from average change for all enterprises. Frequency distribution



Source: Norges Bank

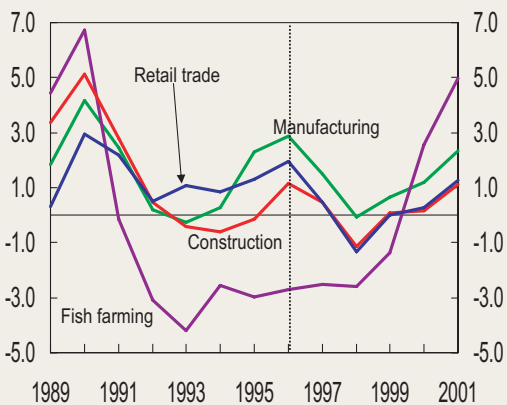
Distribution of unexpected losses across industries

Diversification gains can be achieved by spreading lending across different industries. In a further analysis, we have looked at the breakdown of unexpected losses on a selection of industries over time (see Charts A1 and A2). Note that the charts only include SMEs.

The charts show that developments in unexpected losses have been largely the same for most industries. Unexpected losses increased for all industries before

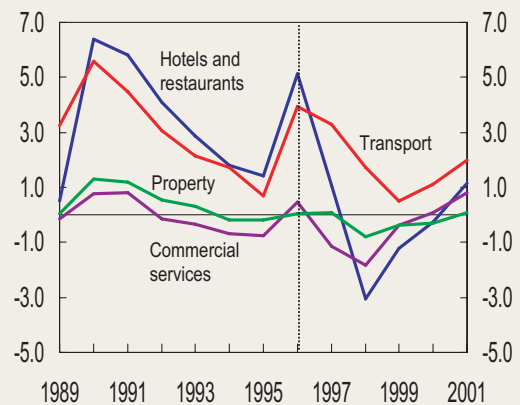
and after the banking crisis. After the banking crisis, losses dropped markedly for all the industries. Unexpected losses for all the industries with the exception of *fish farming* fell from 1996 to the end of the 1990s. Losses subsequently increased up to 2001. *Fish farming* shows the widest variations in unexpected losses over time, while *real estate* and *commercial services* show the smallest variations.

Chart A1 Unexpected losses to selected industries.¹⁾ SMEs. Percentage of lending to the industry



¹⁾ Losses in connection with bankruptcy less expected losses. Because of changes in the underlying statistics, loss levels for 1996-2001 are not directly comparable with previous years

Chart A2 Unexpected losses to selected industries. SMEs. Percentage of lending to the industry



Source: Norges Bank

It also means that a group of enterprises with high idiosyncratic risk is not correlated with general economic developments to the same extent as a group of enterprises with low idiosyncratic risk. If general economic developments are unfavourable during a period, most enterprises in the latter group will face higher risk while there will be more variation among the enterprises in the former group. An interesting question is whether the bankruptcy probabilities for SMEs are less correlated with general economic developments than the bankruptcy probabilities for large enterprises. One way of analysing this is to estimate the change in the individual bankruptcy probabilities from one year to the next for the two groups of enterprises, and then compare these with the average change for all enterprises. We have done this for all the years in the period 1988-2003, and then calculated the standard deviation for each group in each year. The results show that SMEs have systematically shown wider variations around the average from one year to the next. Examples for two years are shown in Charts 6a and 6b, while the same picture also applies to the other years. This indicates that idiosyncratic risk is higher for SMEs and that they are less correlated with general developments than large enterprises.

4.3 Risk diversification

In theory, it is conceivable that a bank can reduce its portfolio risk by spreading its exposures across many borrowers and by choosing borrowers in industries with different developments. The analysis in the box above indicates that the potential for diversification gains across different industries with regard to unexpected losses is relatively limited in Norway.

However, it is realistic to assume that a bank's loan portfolio will include far more SMEs than large enterprises. In the analysis above, the number of SMEs is from 20 to 30 times as high as the number of large enterprises. Does this mean we can assume that the degree of risk diversification is higher for the SME portfolio? Is it the case, for example, that unexpected losses in our analysis are somewhat lower over time for SMEs because the number of enterprises in this group is higher? We take a closer look at these questions below.

Charts 7a-7d show unexpected losses on loans to SMEs and large enterprises for 1990 and 2001, respectively, given a varying number of enterprises in the loan portfolio. For each portfolio size for the two groups, we have used a random selection of 50 enterprises. We have then calculated the average expected loss and a 95 per cent confidence interval around the average.

We see that the confidence interval falls relatively sharply up to 100-200 enterprises for both groups. It would appear, in other words, that there are relatively small diversification gains to be achieved by increasing the number of enterprises in the loan portfolio beyond

about 100-200 enterprises. The results also indicate that the differences in sample size between SMEs and larger enterprises do not affect the results in the previous section. This is because the number of enterprises in both groups is markedly higher than 200.¹³

5. Summary and conclusions

In this article, we have analysed expected losses, losses relating to bankruptcy and unexpected losses on loans to SMEs and large enterprises in the period 1988-2004. Expected losses and bankruptcy losses have been substantially higher for loans to SMEs than for loans to large enterprises during the period. As regards unexpected losses, the picture is more mixed. In over 2/3 of the period, unexpected losses were lower for loans to SMEs than for loans to large enterprises. In the remaining period, including two years during the banking crisis, unexpected losses on loans to SMEs were higher.

One reason why unexpected losses on loans to SMEs were somewhat lower over time is that the model used (i.e. the Sebra model) is generally somewhat more accurate for SMEs than for large enterprises. This applies in particular to enterprises for which it is especially difficult to predict losses, for example enterprises that have neither a solid nor a weak financial position. The differences between unexpected losses for SMEs and large enterprises have thus been widest for enterprises with medium risk. For the best risk categories, the differences are marginal. This may not be surprising as few of these enterprises go bankrupt. These enterprises are relatively easy to predict, and the difference in unexpected losses between the two groups is thus small.

The results depend on the models used and the method for calculating unexpected losses. For example, a simple risk-classification model shows the opposite result to the Sebra model. Nor is it unlikely that the banks' own models are more accurate than the Sebra model, particularly if they have models adapted to large enterprises. This could yield results that are different from those obtained in this analysis. Consequently, we do not have a basis for concluding that unexpected losses are generally lower for loans to SMEs than for loans to large enterprises.

We do not take a concrete position on the SME discount in the Basel II framework.¹⁴ However, the results of our descriptive analysis indicate that a discount cannot necessarily be rejected.

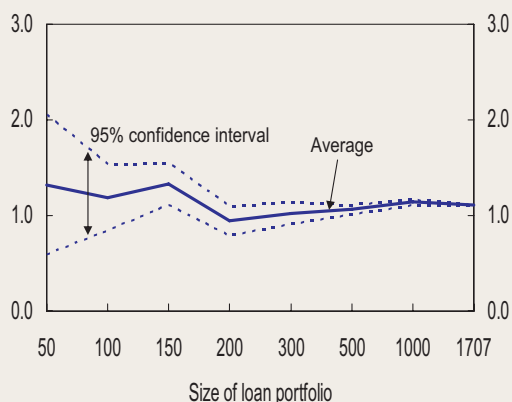
The analyses we have carried out show that bankruptcy probabilities for SMEs have varied more than the probabilities for large enterprises from one year to the next throughout the period 1988-2003. This indicates that idiosyncratic risk is higher for SMEs. A high level of idiosyncratic risk implies a weak correlation with general economic developments.

Developments in unexpected losses were fairly similar for most industries we analysed in the period 1988-

¹³ The lowest number of enterprises in the samples used is 665 for large enterprises in 1993.

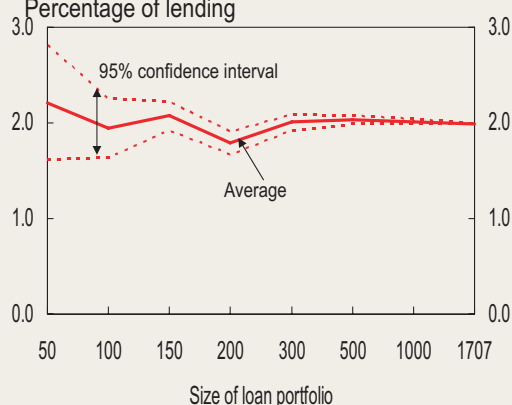
¹⁴ In a box in *Financial Stability 2/04* (pages 30-31) the question was raised as to whether banks would set aside sufficient capital for credit risk if the SME discount were introduced.

Chart 7a Unexpected losses¹⁾ for different portfolio sizes. SMEs. 2001. Percentage of lending



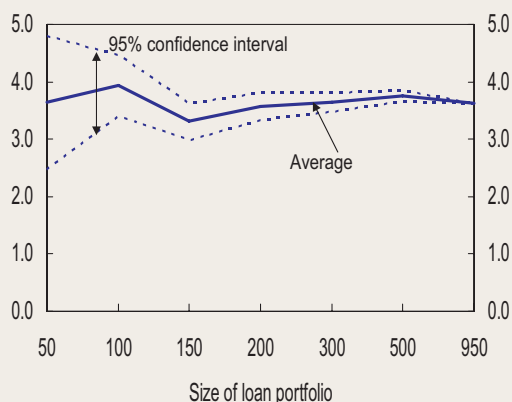
¹⁾ Losses in connection with bankruptcy less expected losses. Based on 50 samples (random withdrawal without return) for each portfolio size

Chart 7b Unexpected losses for different portfolio sizes. Large enterprises. 2001. Percentage of lending



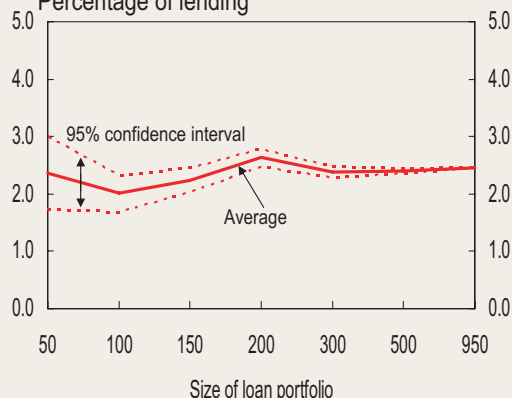
Source: Norges Bank

Chart 7c Unexpected losses for different portfolio sizes. SMEs. 1990. Percentage of lending



Source: Norges Bank

Chart 7d Unexpected losses for different portfolio sizes. Large enterprises. 1990. Percentage of lending



Source: Norges Bank

2003. This indicates that the possibilities for diversification across industries are relatively limited in Norway. The analysis also indicates that the potential for diversification gains is limited when the number of enterprises in the loans portfolio is increased to more than about 100-200 enterprises. This applies to both SMEs and large enterprises.

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