Banks' pricing of risk associated with corporate lending

Eivind Bernhardsen, doctoral student, University of Oslo and Norges Bank, and Kai Larsen, senior economist in the Financial Analysis and Structure Department, Norges Bank[1)]

If a bank on average prices its loans too low in relation to the risk associated with the loans, the bank's financial strength will deteriorate over time. Banks' pricing of risk is therefore important to the stability of the financial system. The pricing of loans also has an impact on the allocation of capital in the economy. In this article, we attempt to analyse the degree of risk pricing of loans to Norwegian limited companies. We look at the relationship between an estimated corporate borrowing rate and a bankruptcy risk measure, both calculated on the basis of the annual accounts of a large selection of enterprises for the period 1989-2001. The results indicate that the degree of risk pricing has increased during the period. The interest rate offered to high-risk enterprises is on average somewhat lower than we would expect if the rate does not have a retroactive effect on the risk of bankruptcy. We argue that this may be attributed partly to the effects of asymmetric information in the credit market.

1 Contents

This article opens with a general discussion of the credit market. We look at strategic pricing, the information aspect and the relationship between lender and borrower. The next three sections introduce our model, methods and data. The following two sections contain an analysis and discussion of our findings, including a brief analysis of the degree of risk pricing in various industries and regions. The article concludes with a summary. The annexes present a more detailed description of some of the results.

2 The credit market

A number of factors, such as portfolio effects, the competitive situation, the scope of asymmetric information and risk aversion, have an impact on the pricing of corporate loans. The information aspect in particular has been the subject of extensive economic literature. The following discussion is not exhaustive, but provides a brief presentation of some of the factors that we believe may have special relevance to the analysis.

Portfolio effects

In a market with free competition and symmetric information, a risk-neutral bank will set the lending rate at a level that covers expected losses associated with a loan. If the bank is not risk-neutral, it will differentiate between risk that may be eliminated in a large portfolio and non-diversifiable risk. Other things being equal, the bank will want to set the interest rate at a level that will include a risk premium that reflects the individual loan's contribution to the portfolio's overall risk.

It may be argued, however, that portfolio effects have a limited influence on banks' pricing of individual loans. Loan agreements are often fixed for a specified period, and may only be renegotiated in the course of this period if there is a violation of important borrowing terms. These terms may relate to the company's debt servicing capacity, its financial strength or the estimated value of loan collateral. It is unnatural to assume, however, that the loan agreement terms are linked to the bank's general transactions. Therefore, when the composition of the bank's portfolio changes, the bank will have limited possibilities of repricing the risk. Making a sound estimate of each loan's contribution to the portfolio's overall risk will also present a challenge. For example, very few companies in Norway are listed on the stock exchange. Correlations in credit risk must therefore be calculated largely on the basis of, for example, industry and location using historical data on losses. Therefore, it is reasonable to assume that banks deal with diversification primarily by limiting their exposures in some industries when entering into new loan agreements.

Strategic pricing

Interest rates may be used strategically by the bank to acquire new and retain existing customers. The bank may have a good profit margin on "secondary" products which may be sold in combination with the loan. Products such as payment services, insurance and financial advice may therefore cross-subsidise interest rates. In a market segment where competition is weak, the bank may want to underprice risk for a period if they see an opportunity to increase market power at a later time. A bank which can offer customers a wide range of services will normally have a greater opportunity to pursue such a strategy than a specialised lender.

One may assume that with effective competition, such strategic pricing is less common. Competition, however, does not necessarily have a clear-cut effect on interest rate setting. A bank with experience understands that the

1) With thanks to Tore Anders Husebø, Steinar Strøm and Bent Vale for valuable comments and suggestions.

profitability of its lending operations is higher during periods of expansion than during periods of contraction, and that risk calculations made when the economy is doing well are not necessarily correct in the event of an economic turnaround. Therefore, a good, long-term strategy for the bank may be to factor in extra risk in periods when profitability is high. It may be tempting, however, to deviate from this strategy in the short term, especially when competing with less well-established loan providers which may operate with risk premia that are too low in an effort to win market shares during a period when the market is especially profitable.[2)]

The information aspect

In the loan capital market, there will be several dimensions of private information. Borrowers will know more than banks about their prospects for the future and about the risks associated with ongoing projects. Banks, on the other hand, will acquire information about borrowers which is not known by competing lenders. The first may be the source of moral hazard and adverse selection, while the latter may give banks an information profit on existing customers.

Owners of a company with limited liability will have the entire upside potential of a risky investment, while they can only lose their equity if the investment proves to be unsound. When a company has private information about the risk associated with the projects in which it chooses to invest, it is natural to assume that it selects the project that maximises the return on equity. This project will not necessarily be the one that generates the highest expected net present value of total assets. If the upside potential is sufficiently large or the equity ratio is sufficiently small, the company may well choose a project that gives a negative expected net present value. The risk that a company may use its information advantage to defy the bank's intentions with the loan agreement is referred to as moral hazard in economic literature. The possibility of moral hazard is one of the reasons that banks require collateral and that loan agreements often contain detailed debt covenants. If the debt covenants are not complied with, the bank may demand renegotiation of the agreement before it expires.[3)] In some cases, the bank may cancel the agreement.

If the bank believes that a borrower has increased its risk, it will require compensation in the form of a higher interest rate when the loan is renegotiated. However, a higher interest rate may increase the risk the borrower wants to take because the net present value of equity after an interest rate increase may be too low if the company restricts itself to projects with moderate risk. If a bank tries to factor in every risk by charging a sufficiently high interest rate when it establishes new credit relationships, the bank will face the problem of adverse selection.[4)]

Relations between lenders and borrowers

Under asymmetric information, there may be considerable differences in the pricing of new and existing loan agreements. Banks will typically want to monitor the companies in their loan portfolio. It is reasonable to believe that monitoring costs diminish as the bank becomes familiar with the company so that the bank can gradually offer a lower interest rate than a competitor. The bank's information advantage with regard to the existing credit relationship may also be a disadvantage for the company. If the bank chooses to cancel the loan agreement, alternative credit suppliers may interpret this as a signal that the bank has negative information about the company. The risk of this type of stigma increases the company's opportunity cost. The bank, on the other hand, will be able to charge a higher interest rate than would otherwise have been possible.[5)] It may be argued that some costs will accrue again if the bank chooses to replace the company with a new loan customer. Because the company's prospects are uncertain, these costs may prompt the bank in some cases to retain a debtor even though the bank believes that for the moment the debtor represents a high risk in relation to the interest rate the bank can charge. By cancelling the loan agreement or petitioning for company bankruptcy, the bank relinquishes the possibility of future income if the company's prospects improve and the risk involved declines. This possibility may be considered an option for the bank and the price of this may be seen as part of the opportunity cost of cancelling the credit relationship.[6)]

There is little doubt that the information aspect has a strong influence on the credit market.

The significance of asymmetric information for the functionality of the credit market as a whole will, however, depend on the institutional framework, relevant laws and regulations, expertise in the sector and available instruments, as well as special cultural factors and historical experience.

3 A simple model for pricing loans

We will now look at a simple two-period model for pricing loans. Let ρ be the loan's rate of return. With probability $(1-p)$, the company will not go bankrupt and the bank will be repaid $(1+r)$ for every krone borrowed at the end of the period. With probability p, the company will go bankrupt and the bank will only receive a portion α of the agreed amount. In both cases, administrative costs γ accrue for each krone borrowed. The relationship is

[2)] Øverli (2002) provides a general discussion of banks' adjustments to business cycles as well as possible implications for financial stability. *Financial Stability* 1/2001, p. 29, provides information about the effects of competition on the spread between bank lending rates and three-month money market rates for the same period.

[3)] See, for example, Berlin and Mester (1992).

[4)] See Stiglitz and Weiss (1981).

[5)] See, for example, Sharp (1990).

[6)] See, for example, Dixit and Pindyck (1993).

summarised in equation (1). Further, we assume that the bank will require a premium for the credit risk involved when it provides the loan to the company instead of investing in a risk-free alternative with return $1+r_f$. Motivated by the price equation from the capital asset pricing model[7], we describe this risk premium as the product of the loan's beta value β and a parameter π, which is meant to represent the bank's degree of risk aversion[8] (see equation (2)).

$$(1) \quad E(1+\rho) = p\alpha(1+r) + (1-p)(1+r) - \gamma$$

$$(2) \quad E(\rho) - r_f = \beta\pi$$

In equation (1) and (2) we can eliminate $E(\rho)$ and solve the equation to find the interest rate. Repayment of the loan is uncertain, whereas costs and the risk premium accrue with certainty. The interest rate is therefore set to cover the sum of the risk premium, opportunity cost and administrative costs, adjusted for the probability of bankruptcy and the loss given default rate as shown in equation (3).

$$(3) \quad (1+r) = \frac{\beta\pi + (1+r_f) + \gamma}{(1-p(1-\alpha))}$$

This two-period model does not take into account the significance of the loan's maturity for interest rate setting. Strictly speaking, we can therefore only use this model sequentially if we decide that during each period, the company can immediately repay the entire debt and that the bank knows this. The uncertainty may then be connected with whether the company will go bankrupt each subsequent period.

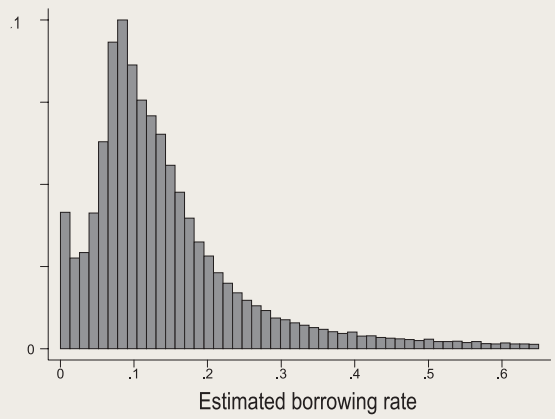
The model does not take into account any effects of asymmetric information. As discussed in section 2, asymmetric information may set a limit on how high the bank wants to set interest rates.[9] For high-risk companies, interest rates determined by equation (3) will probably be higher than actual interest rates for companies of this kind. The magnitude of this effect will depend, however, on whether the bank cancels the loan agreement when the risk of bankruptcy becomes too high. As discussed in section 2, the bank may be reticent to do this if it has non-reversible costs in connection with the establishment of new credit relationships.

4 Data

We do not have access to enterprises' actual borrowing rates. Therefore, we have calculated an estimated borrowing rate using information from the enterprises' annual accounts. In the calculation, we have used the enterprise's interest expenses as a percentage of average long-term debt and bank overdrafts through the year. Since we use an unweighted average of debt at the beginning and end of the year, the calculated average debt will be lower (higher) than the actual average if the enterprise has repaid a large portion of the debt (raised considerable new debt) towards year-end. Interest expenses in the profit and loss account show, however, actual interest expenses in the course of the year. In such a case, the borrowing rate will therefore be higher (lower) than the actual borrowing rate.

Chart 1 shows the distribution of the estimated borrowing rate after excluding the top and bottom 5 per cent. The distribution peaks at around 8 per cent, shows relatively few observations above 30 per cent and a slight jump at zero. As a result of problems connected with the use of unweighted average debt, we have found it appropriate to reduce the data set somewhat more. We have chosen to exclude observations of borrowing rates below 2.5 per cent and above 25 per cent. The sample then consists of 118 464 enterprises and a total of 532 066 observations over the period 1989-2001.

Chart 1 Distribution of estimated borrowing rate. Share



We use predictions from Norges Bank's credit risk model[10] as estimates for the probability of bankruptcy for each company. We have used the yield on Norwegian government bonds with a maturity of 10 years as the risk-free interest rate.

[7] See, for example, Copeland and Weston (1988) for an introduction to the capital asset pricing model. For a discussion of the capital asset pricing model in relation to banking, see Pyle (1971) and Hart, et al. (1974).

[8] The parameter β is interpreted as the individual loan's correlation with the bank's total portfolio of loans. If the bank is risk-averse, then π is positive, whereas the value of π is zero if the bank is risk-neutral.

[9] In isolation, higher interest rates will increase the probability of bankruptcy, even when we disregard the effects of asymmetric information, by weakening the company's financial strength. Therefore, in the empirical analysis, we cannot interpret the deviation from the interest rate set in equation (3) as effects of asymmetric information alone.

[10] This model uses an estimated relationship between bankruptcy and company characteristics such as equity ratio, liquidity, earnings, number of years since establishment, etc. See Bernhardsen (2001) or Eklund, Larsen and Bernhardsen (2001) for a more comprehensive description of the model.

5 An empirical specification of the model

Many questions will arise when we apply this model to the data. How reliable are the estimates we use for borrowing rates and bankruptcy probability, and what relationship do we find between them? Is there an interest rate inertia, and what is the possible reason for this? If the estimates for borrowing rates and bankruptcy probability are adequate and the actual rate is set according to the model, what does this imply for the loss given default rate banks must have applied, and what do our findings show about how this has varied over the period?

To answer these questions, we have chosen to estimate the following relation using the non-linear least-squares method[11]:

$$(4) \quad (1+r_{it}) = q_1(1+r_{it-1}) + q_2 \frac{\delta_t + (1+r_{f_t})}{(1-p_{it}(1-\alpha_t))} + e_{it}$$

In equation (4), *i* refers to company and *t* denotes year. The parameter q_1 indicates the share of enterprises for which the borrowing rate is maintained at the same level as in the previous period, for example as a result of a fixed-rate agreement. The parameter q_2 indicates the share of rate agreements set in accordance with equation (3). A priori, we would expect that $q_2 = 1\text{-}q_1$, but we impose no restrictions on q_1 and q_2 when estimating the model beyond assuming that they remain constant throughout the period. The parameters δ_t are the sum of administrative costs γ and the risk premium $\beta\pi$. We have assumed that this parameter will vary over time, although not from one company to another at the same point in time. This corresponds to a situation where banks do not wish or are not able to factor in individual portfolio effects in the interest rate, as discussed in the introduction. The parameter β can then be interpreted as a variable indicating how the profitability of corporate loans is correlated with other risks in the bank's total portfolio, for example loans to the household sector, interbank loans, domestic and foreign share capital etc. The loss given default rate ($1\text{-}\alpha_t$) is also only assumed to vary over time.

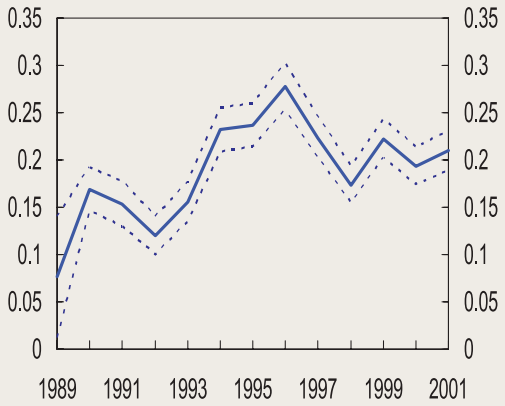
We have now allowed for the possibility that the rate an enterprise pays may be constant between two periods, and that the difference we observe is only a coincidental result of the method used to calculate the rate. It may be argued that this will not be relevant given the motivation for the two-period model in section 3. One solution may be to assume that the bank, even though it is able to verify at no cost that the enterprise is solvent in the current period, is not able to calculate at no cost the probability that the enterprise will go bankrupt in the next period, and may therefore choose to keep the interest rate constant.[12]

6 Estimation results[13]

We estimate the parameters q_1 and q_2 at 0.568 and 0.429 respectively. The fact that both parameters are between 0 and 1, and that their sum is 1, firmly supports the interpretation that they are shares. The estimated sum of administrative costs and risk premium varies over the period from a minimum value of 0.01 to a maximum of 0.065. We find it reasonable that this parameter may vary between 1 and 6.5 per cent. Chart 2 shows the estimates for the loss given default rate ($1\text{-}\alpha_t$) over the period.

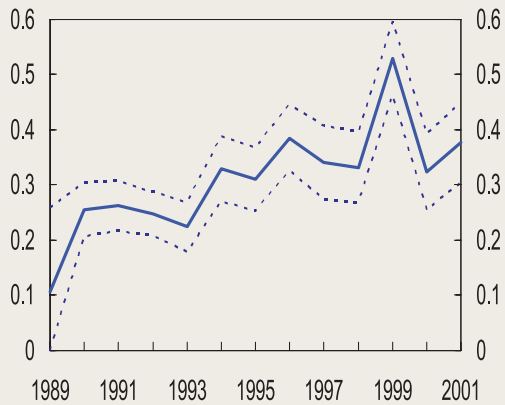
The loss given default rate is lower than expected and follows a surprising path through the period[14].Just before and during the banking crisis the estimate varies around 10-15 per cent, while 20-25 per cent is more representative for the last half of the 1990s. In our view, an

Chart 2 Estimated loss given default rate for the entire sample [1]. Share



[1] Dashed lines show 95 per cent confidence interval

Chart 3 Estimated loss given default rate for a reduced sample. Share



[11] For an introduction to the non-linear least-squares method (NLS), see for example Greene (1997).

[12] An estimate of the probability that a company will be declared bankrupt in year t+1 may be calculated at no cost from the annual accounts for year t. However, the accounts for year t are not generally available until year t+1 and cannot be used to determine the interest rate the company must pay in the course of year t. The assumption is nonetheless stylistic and is applied in order to simplify the problem. We do not have any information on loan maturities.

[13] See Annex A for regression results.

[14] The relationship between bankruptcy probability and the interest rate is significant in all years apart from 1989, see the confidence intervals in Charts 2 and 3. We have also used figures for 1988 in the calculation for 1989 and therefore have few observations.

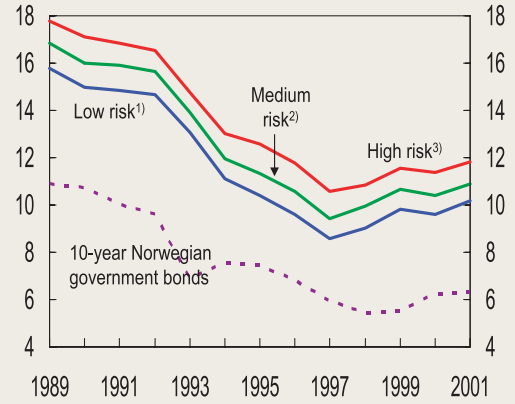
average loss given default rate of about 50 per cent might be expected around the time of the banking crisis, possibly decreasing to about 30 towards the end of the period. One reason for this contradiction may be that the degree of differentiation when setting interest rates has increased in the period, and that the degree of differentiation was low in the first half of the 1990s[15]. The model being estimated assumes full risk pricing throughout the period, so that the implied rate of loss given default will be low if the pricing is incomplete.

In an attempt to examine to what extent this result is robust to "measurement errors" in the estimated borrowing rate or the estimate for bankruptcy risk, we have estimated the same model for enterprises that are all represented by at least 10 consecutive observations.[16] We thereby exclude all observations from enterprises that were previously excluded for one or more years because the estimated borrowing rate was outside the specified interval of 2.5 to 25 per cent[17]. For this sample, we estimate the parameters q_1 and q_2 at 0.605 and 0.392 respectively. The parameters δ_t are also virtually unaffected by the reduction in the data set. Chart 3 shows that the estimates for the loss given default rate are now generally higher. With the exception of 1989, it is now fairly stable at about 25 per cent in the period around the banking crisis, while it varies around 40 per cent in the last half of the period. We see no reason to assume that banks have estimated a higher loss given default rate for the enterprises in this sample and ascribe the difference in level to varying degrees of uncertainty in the estimated borrowing rate and bankruptcy probability. The loss given default rate is now more in line with what we expect, but because the level continues to rise, we see no reason to change our interpretation that the degree of risk pricing has increased in the period.

7 Are banks' pricing risk adequately?

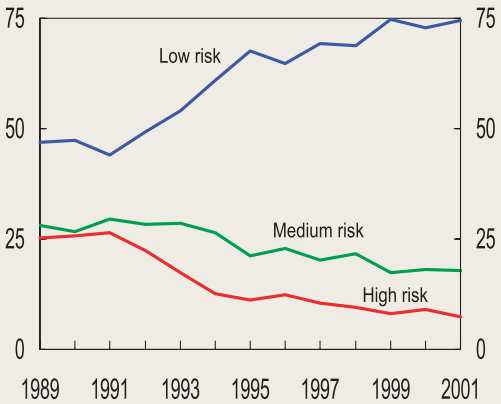
In the two previous sections, we analysed how banks actually set corporate borrowing rates. We found a significant relationship between bankruptcy risk and borrowing rates and attempted to analyse the degree of risk pricing in light of this. In this section, we attempt to analyse whether banks' pricing of risk has been adequate both with regard to the degree of differentiation and the level of the interest rate. In Chart 4, the enterprises in the sample are divided into three risk groups based on the level of bankruptcy probability. The boundaries between "low", "medium" and "high" risk have been determined on a discretionary basis. Chart 5 shows the percentage of debt that can be assigned to the various risk classes.

Chart 4 Average estimated borrowing rate in different risk groups. Per cent per year



1) Probability of bankruptcy below 0.5%
2) Probability of bankruptcy 0.5 – 2.0%
3) Probability of bankruptcy above 2.0%

Chart 5 Share of debt in different risk groups. Per cent



The data confirm that banks differentiate between the degree of risk in their pricing of loans[18]. However, we want to investigate the quantitative relationship. A difference in the borrowing rate of less than two percentage points between high- and low-risk enterprises may seem small. Furthermore, it may be questioned whether a total margin for the overall lending portfolio of about 4 to 5 percentage points above the risk-free interest rate is sufficient to cover expected loan losses, administrative costs and risk premium[19].

Again, our basis is the model set out in equation (3). However, instead of using the estimated model, estimates for the various parameters have been inserted. We define a "benchmark rate" as:

15) One reason for the higher degree of risk pricing may be that competition has intensified in the period, see *Financial Stability* 1/2001, p. 29.

16) The data set now contains 134 712 observations for approximately 10 000 enterprises.

17) If "measurement errors" in the estimated borrowing rate are correlated over time, we would expect less 'noise' in this data set. Bankruptcy probability and the borrowing rate are both calculated using the same annual accounts, and we would therefore also expect less 'noise' in bankruptcy probabilities.

18) We have also examined a division into 8 and 12 risk groups and found that there is a relationship between the estimated borrowing rate and the risk group for all the years in the period 1989-2001.

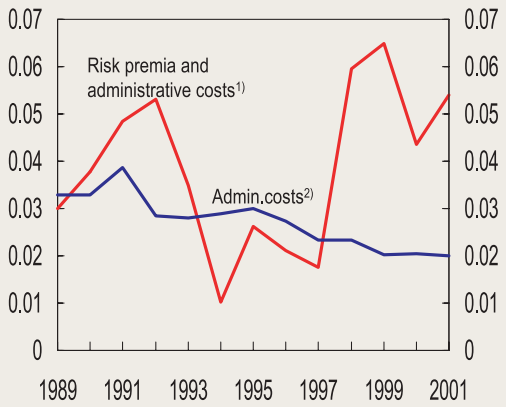
19) The margin must also cover costs related to capital adequacy.

$$(5) \quad r_{it} = \frac{\beta\pi + (1 + rf_t) + \gamma_t}{(1 - p_{it}(1 - \alpha_t))} - 1$$

To find an estimate for the cost component γ , we have used figures from banking statistics. We have assumed that the share of banks' administrative costs related to corporate lending is the same as the interest income share of banks' overall income from corporate lending each year. This amount is divided by the total amount of corporate loans in order to arrive at a premium in per cent. The estimate falls somewhat in the period, from about 3.2 per cent in 1989 to 2.1 per cent in 2001 (Chart 6).

Chart 6 also shows the model estimates for the sum of administrative costs and risk premium δ_t, (section 6). The spread between the curves provides an estimate for the risk premium $\beta\pi$, that, perhaps surprisingly, varies considerably in the period. On the basis of the chart, it may be tempting to conclude that banks have regarded corporate lending as particularly correlated with other risks in the period around the banking crisis and after 1998. There is a spread of 1.1 per cent on average in the period. We find an alternative estimate for the risk premium from banking statistics by using the average of banks' overall profits related to corporate loans divided by gross corporate loans for the period 1993-2001. We also find this to be about 1 per cent. In our calculation of the benchmark rate, we therefore use a constant risk premium of 1 per cent. We also use a constant loss given default rate of 40 per cent, the yield on 10-year Norwegian government bonds as the risk-free interest rate, and the estimates we have for bankruptcy probabilities. Chart 7 shows the average estimated borrowing rate and the benchmark rate for 12 risk groups. We see that the benchmark rate

Chart 6 Risk premium and administrative costs. Share of each krone borrowed



1) Estimates from the model
2) Calculated on the basis of banking statistics

Chart 7 Average estimated borrowing rate and benchmark rate in different risk groups. 2001. Per cent per year

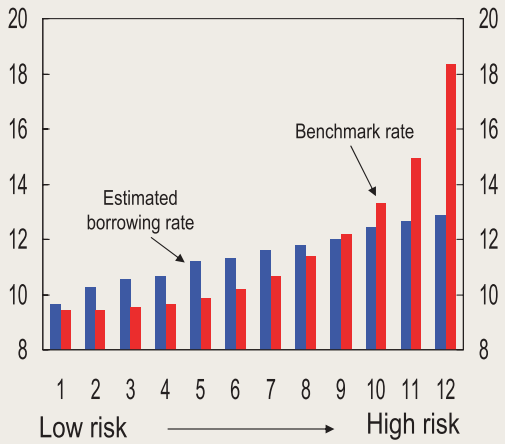


Chart 8 Average estimated borrowing rate and benchmark rate. Per cent per year

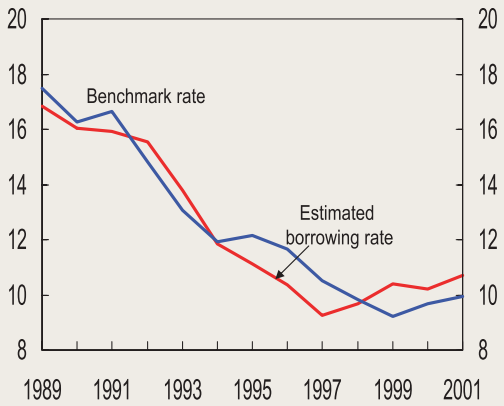
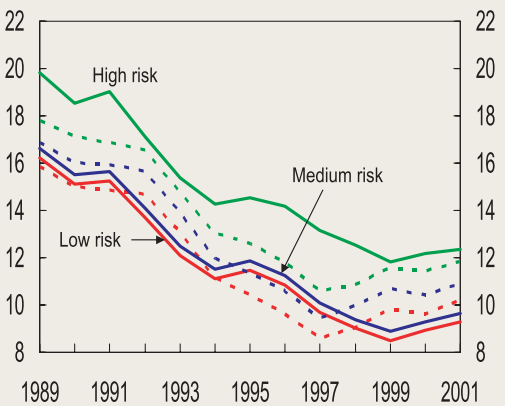


Chart 9 Average estimated borrowing rate (dashed lines) and benchmark rate (solid lines). Per cent per year



is higher than the estimated rate for the enterprises with the highest risk exposure. This is perhaps not surprising considering that, in our calculation of the benchmark rate, we have not taken into account that banks may wish to set an upper limit for the interest rate. The benchmark rate can only be interpreted as a correct price for risk in a situation unaffected by asymmetrical information or other factors that cause the rate to have a retroactive effect on bankruptcy probability.

According to the analysis, the benchmark rate was on average about the same as the estimated borrowing rate up to 1994 (Chart 8). The estimated borrowing rate was then somewhat lower than the benchmark rate up to 1997. During this period, the credit market expanded rapidly and competition intensified, while risk in the enterprise sector was generally perceived as low and falling. This may have contributed to a lesser degree of risk pricing. Between 1999 and 2001, however, the estimated borrowing rate was higher than the benchmark rate. One reason for this may have been fears of higher loan losses as a result of increasing unrest in financial markets in 1998 and 1999, in addition to the negative developments in the latter half of 2001[20]. Moreover, greater focus in general on risk pricing and the introduction of more advanced risk management systems may have contributed to an increase in risk pricing. Our impression is that the large banks in particular have systematically worked on this for several years, partly to enable them to use internal credit risk models for determining capital adequacy, as is possible under the proposal for the new capital adequacy rules (Basel II).

The benchmark rate for high-risk enterprises was markedly higher than the estimated borrowing rate in much of the period up to 1999 (Chart 9). Since 1999, the benchmark rate for high-risk enterprises has stood at about the same level as the estimated borrowing rate, while the borrowing rate for enterprises with low and medium risk has been higher than the benchmark rate.

Brief comments on various industries and regions

We find that there is a clear relationship between the estimated borrowing rate and risk group in all the industries we have analysed except the fishing industry (Annex B). In the fishing industry, there was little correlation between these two indicators. In 1999, for example, the estimated borrowing rate for low-risk enterprises was higher than the rate for high-risk enterprises in this industry. The degree of risk pricing, measured by the difference in the estimated borrowing rate between the highest and lowest risk group, is greatest in the construction and hotel/restaurant industries. There are, however, small differences between the various industries we have analysed. The property industry has by far the lowest estimated borrowing rate, averaging 10 per cent in the period, while the rate was highest in retail trade, averaging 13.5 per cent.

According to the analysis, there are relatively small regional differences in the degree of risk pricing. There is a relationship between the estimated borrowing rate and risk group in all regions and in all years (Annex C). The difference in the estimated borrowing rate between high- and low-risk groups in the period is greatest in Northern Norway and smallest in Oslo/Akershus. One reason why the difference is smallest in Oslo/Akershus may be that there is stiffer competition between banks for loan customers in this region. The average estimated borrowing rate is about the same in all regions.

8 Summary and conclusion

In this article, we have assessed the relationship between the estimated borrowing rate and a bankruptcy risk measure using a simply motivated regression model. The regression analysis shows a significant relationship between bankruptcy risk and the estimated borrowing rate, where we interpret the regression coefficient as an estimate of the loss given default rate banks must have used if the rate was set in accordance with the model. While we, a priori, would assume that the loss given default rate has fallen in the period, we find that the implied loss given default rate increases. We interpret this contradiction to mean that the degree of risk pricing has increased in the course of the period. We have also calculated a benchmark rate on the basis of estimated risk and relevant cost components in an attempt to give some indication of whether risk differentiation has been adequate. We find that there are, on average, small differences between the benchmark rate and the estimated borrowing rate but that the former was marginally higher in the period 1995-1997 and marginally lower in 1999-2001. The figures may indicate that loans to high-risk enterprises were priced too low in the period up to 1998. From 1999 onwards, however, the benchmark rate has been about the same as the estimated borrowing rate for high-risk enterprises. We find small differences in the degree of risk pricing between the various industries and regions.

References

Berlin, Mitchell and Loretta J. Mester (1992): "Debt covenants and renegotiation", *Journal of Financial Intermediation* 2:95-133.

Bernhardsen, Eivind (2001): "A model of bankruptcy prediction", Working Paper 2001/10, Norges Bank.

Copeland, Thomas E. and J. Fred Weston (1988): *Financial Theory and Corporate Policy, third edition*, Addison-Wesley. New York.

Dixit, Avinash K. and Robert S. Pindyck (1993): *Investment under uncertainty*, Princeton University Press. New Jersey.

[20] In order to comment on changes in the degree of risk pricing by banks, it would also have been of interest to analyse changes in the number of rejected loan applications. We do not have any information about this.

Eklund, Trond, Kai Larsen and Eivind Bernhardsen (2001): "Model for analysing credit risk in the enterprise sector", *Economic Bulletin* 3/01, Norges Bank.

Financial Stability 1/01 (p. 29): "Lending margins – a measure of competition intensity?", Norges Bank.

Greene, William H. (1997): *Econometric Analysis*, Prentice Hall. New Jersey.

Hart, Oliver D. and Dwight M. Jaffee (1974): "On the application of portfolio theory to depository financial intermediaries", *Review of Economic Studies* 41 (vol. 1): 129-47.

Pyle, David H. (1971): "On the theory of financial intermediation", *Journal of Finance* 26 (vol. 3):737-47.

Sharpe, Steven A. (1990): "Asymmetric information, bank lending and implicit contracts: A stylized model of customer relationships", *Journal of Finance* 45(4): 1096-87.

Stiglitz, Joseph E. and Andrew Weiss (1981): "Credit rationing in markets with imperfect information", *American Economic Review* 71(3):393-410.

Øverli, Frode (2002): "Forsterker bankene konjunkturbølgene? (Do banks amplify cyclical fluctuations?)", *Penger og Kreditt* 3/02 (vol.30), Norges Bank.

Annex A

Regression results:

Number of obs = 381906
F(27,381879) = 1389617
Prob > F = 0.0000
Root MSE = .0354994
Res. dev. = -1466011
(nls)

R	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
q1	.5675235	.0012959	437.90	0.000	.5649835	.5700634
q2	.4293936	.0014279	300.72	0.000	.426595	.4321922
d89	.03	.	.	.	.	.
d90	.0377677	.0017475	21.61	0.000	.0343427	.0411928
d91	.0483756	.0017427	27.76	0.000	.04496	.0517911
d92	.0530519	.0017138	30.96	0.000	.0496929	.0564109
d93	.0348689	.0016611	20.99	0.000	.0316132	.0381245
d94	.0101504	.0016104	6.30	0.000	.0069941	.0133067
d95	.026263	.0016244	16.17	0.000	.0230791	.0294469
d96	.021012	.0016142	13.02	0.000	.0178483	.0241757
d97	.0174669	.0015882	11.00	0.000	.0143541	.0205797
d98	.0596362	.0016311	36.56	0.000	.0564393	.0628331
d99	.064943	.0016321	39.79	0.000	.061744	.0681419
d00	.0434577	.0016038	27.10	0.000	.0403142	.0466011
d01	.0540313	.0016258	33.23	0.000	.0508447	.0572179
(1-a)89	.0762203	.0327269	2.33	0.020	.0120766	.140364
(1-a)90	.1692386	.0117114	14.45	0.000	.1462846	.1921926
(1-a)91	.1538507	.0120374	12.78	0.000	.1302577	.1774437
(1-a)92	.1198669	.0101518	11.81	0.000	.0999698	.1397641
(1-a)93	.1556884	.0108725	14.32	0.000	.1343785	.1769982
(1-a)94	.2320214	.0118519	19.58	0.000	.2087921	.2552508
(1-a)95	.2370839	.011433	20.74	0.000	.2146756	.2594922
(1-a)96	.2772347	.0126754	21.87	0.000	.2523912	.3020782
(1-a)97	.2235629	.0110626	20.21	0.000	.2018806	.2452452
(1-a)98	.1737577	.0097461	17.83	0.000	.1546556	.1928598
(1-a)99	.2226676	.0103407	21.53	0.000	.2024001	.242935
(1-a)00	.1935901	.0099488	19.46	0.000	.1740907	.2130895
(1-a)01	.210104	.0109636	19.16	0.000	.1886157	.2315923

(SE's, P values, CI's, and correlations are asymptotic approximations)

Number of obs = 134712
F(27,134685) = 6735779
Prob > F = 0.0000
Root MSE = .0301997
Res. dev. = -560694.5
(nls)

R |	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
q1	.6048628	.0021057	287.25	0.000	.6007356	.6089899
q2	.3924014	.002334	168.13	0.000	.3878269	.396976
d89	.03	.	.	.	.	.
d90	.0344721	.0030941	11.14	0.000	.0284078	.0405365
d91	.0471869	.0030849	15.30	0.000	.0411406	.0532332
d92	.0524137	.0030488	17.19	0.000	.0464381	.0583892
d93	.0282857	.0029413	9.62	0.000	.0225207	.0340507
d94	-.0026869	.0028484	-0.94	0.346	-.0082698	.0028959
d95	.0183903	.0028861	6.37	0.000	.0127336	.0240471
d96	.0128889	.0028626	4.50	0.000	.0072783	.0184994
d97	.0074406	.0028312	2.63	0.009	.0018915	.0129897
d98	.0568858	.0029395	19.35	0.000	.0511244	.0626472
d99	.0622513	.002948	21.12	0.000	.0564733	.0680294
d00	.0395939	.0029036	13.64	0.000	.0339029	.0452849
d01	.0544442	.0029624	18.38	0.000	.0486379	.0602505
(1-a)89	.1058379	.0785803	1.35	0.178	-.0481781	.2598539
(1-a)90	.2557277	.0249103	10.27	0.000	.206904	.3045514
(1-a)91	.2626347	.0236628	11.10	0.000	.216256	.3090135
(1-a)92	.2479645	.0202783	12.23	0.000	.2082193	.2877096
(1-a)93	.2242997	.0229499	9.77	0.000	.1793183	.2692811
(1-a)94	.3294118	.0301303	10.93	0.000	.270357	.3884667
(1-a)95	.3107942	.0291615	10.66	0.000	.2536382	.3679501
(1-a)96	.3857019	.030508	12.64	0.000	.3259067	.4454971
(1-a)97	.340759	.0342636	9.95	0.000	.2736029	.4079151
(1-a)98	.3320303	.0326596	10.17	0.000	.2680182	.3960425
(1-a)99	.5293786	.0342624	15.45	0.000	.4622249	.5965322
(1-a)00	.3239914	.035376	9.16	0.000	.2546552	.3933277
(1-a)01	.3770482	.0365072	10.33	0.000	.3054947	.4486017

(SE's, P values, CI's, and correlations are asymptotic approximations)

The goodness of fit R^2 is calculated at 44.7 and 48.2 per cent respectively for the two models.

Annex B

AVERAGE ESTIMATED BORROWING RATE IN DIFFERENT RISK GROUPS. SELECTED INDUSTRIES. PER CENT

FISHING AND FISH FARMING	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	Average 1989-2001
Low risk	15.5	15.6	15.0	15.2	14.7	11.9	11.0	9.7	8.5	9.5	10.4	9.7	9.9	12.0
Medium risk	15.9	14.8	15.2	15.7	13.9	12.0	10.9	10.3	8.0	9.5	9.9	9.7	10.4	12.0
High risk	16.9	16.3	16.3	15.8	14.5	12.7	12.2	11.2	9.3	9.8	10.2	10.2	10.2	12.7
Average overall	16.5	15.9	16.0	15.7	14.4	12.3	11.5	10.5	8.6	9.6	10.2	9.9	10.2	12.4
-Standard deviation	3.7	3.8	4.1	3.9	4.0	3.9	4.0	3.8	3.7	3.7	3.5	3.2	3.1	3.7
Bankruptcy probability (%)	*7.60*	*6.69*	*7.86*	*6.31*	*5.16*	*3.30*	*3.62*	*3.57*	*3.18*	*2.80*	*2.76*	*3.15*	*3.19*	*4.55*

MANUFACTURING AND MINING	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	1989-2001
Low risk	16.1	15.6	15.4	15.3	13.8	11.8	11.2	10.3	9.2	9.7	10.6	10.3	10.8	12.3
Medium risk	16.8	16.1	16.1	15.9	14.5	12.3	11.7	10.9	9.6	10.4	11.1	10.9	11.4	12.9
High risk	17.5	16.8	16.8	16.6	15.0	12.9	12.6	11.8	10.6	11.1	11.7	11.4	12.1	13.6
Average overall	16.9	16.2	16.2	15.9	14.4	12.3	11.7	10.9	9.7	10.3	11.0	10.8	11.3	12.9
-Standard deviation	4.2	4.0	4.1	4.2	4.1	3.8	4.0	3.9	3.9	4.0	3.7	3.7	3.7	4.0
Bankruptcy probability (%)	*3.74*	*3.53*	*4.00*	*3.44*	*3.04*	*2.74*	*2.59*	*2.86*	*2.72*	*2.68*	*2.45*	*2.63*	*2.28*	*2.98*

CONSTRUCTION	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	1989-2001
Low risk	16.5	16.2	16.0	15.5	14.2	12.2	11.4	10.8	9.6	10.1	10.9	10.5	11.3	12.7
Medium risk	17.7	16.8	16.8	16.5	14.7	12.7	12.2	11.5	10.4	10.8	11.5	11.3	11.8	13.4
High risk	18.4	17.9	17.7	17.1	15.5	13.5	13.5	12.3	11.5	11.9	12.3	12.2	12.8	14.4
Average overall	17.7	17.1	17.1	16.5	14.9	12.8	12.2	11.4	10.3	10.7	11.3	11.1	11.8	13.4
-Standard deviation	4.2	4.3	4.4	4.4	4.3	4.2	4.4	4.2	4.2	4.1	3.9	3.8	3.8	4.2
Bankruptcy probability (%)	*4.61*	*4.76*	*5.48*	*4.13*	*3.87*	*3.07*	*2.50*	*2.52*	*2.26*	*2.34*	*2.19*	*2.33*	*2.20*	*3.25*

RETAIL TRADE	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	1989-2001
Low risk	16.7	15.7	15.7	15.7	13.9	12.2	11.7	10.9	9.9	10.2	10.8	10.6	11.4	12.7
Medium risk	17.5	16.9	16.9	16.7	14.7	13.0	12.4	11.6	10.6	11.1	11.7	11.4	11.9	13.6
High risk	18.3	17.8	17.5	17.2	15.3	13.6	13.1	12.4	11.3	11.5	12.3	12.1	12.5	14.2
Average overall	17.7	17.0	16.9	16.6	14.7	12.9	12.4	11.6	10.6	10.8	11.5	11.3	11.9	13.5
-Standard deviation	4.3	4.3	4.4	4.4	4.4	4.2	4.4	4.4	4.3	4.2	4.1	4.0	4.0	4.3
Bankruptcy probability (%)	*4.76*	*4.29*	*4.95*	*4.16*	*3.59*	*2.99*	*2.71*	*3.10*	*3.20*	*3.27*	*2.82*	*3.03*	*2.67*	*3.50*

HOTELS AND RESTAURANTS	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	1989-2001
Low risk	14.2	14.0	14.3	14.3	12.4	10.7	9.8	8.8	7.9	8.6	9.5	9.1	9.7	11.0
Medium risk	15.0	14.9	14.8	15.0	13.3	11.2	10.4	9.4	8.8	9.1	10.1	9.5	10.3	11.7

Annex C

AVERAGE ESTIMATED BORROWING RATE IN DIFFERENT RISK GROUPS. REGIONS. PER CENT

NORTHERN NORWAY 1)	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	Average 1989-2001
Low risk	15.4	15.0	15.0	14.7	13.1	11.0	10.3	9.4	8.5	9.0	9.8	9.5	10.0	11.6
Medium risk	16.6	15.9	15.8	15.8	14.0	12.1	11.4	10.7	9.5	10.2	10.7	10.5	11.0	12.6
High risk	17.8	17.3	17.2	16.9	15.1	13.4	12.8	11.9	10.7	11.1	12.0	11.6	11.9	13.8
Average overall	16.7	16.1	16.1	15.8	14.0	11.9	11.2	10.5	9.3	9.8	10.6	10.3	10.7	12.5
-Standard deviation	4.1	4.1	4.3	4.3	4.2	4.1	4.1	4.0	4.0	3.9	3.8	3.7	3.7	4.0
Bankruptcy probability (%)	*4.09*	*3.76*	*4.01*	*3.25*	*2.99*	*2.51*	*2.39*	*2.68*	*2.50*	*2.39*	*2.18*	*2.39*	*2.12*	*2.87*

1) Nord-Trøndelag, Nordland, Troms and Finnmark

WESTERN NORWAY 2)	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	1989-2001
Low risk	15.8	14.9	14.8	14.7	13.1	11.1	10.2	9.4	8.4	8.9	9.7	9.4	10.0	11.6
Medium risk	16.7	16.0	15.9	15.7	14.0	11.8	11.3	10.4	9.3	9.9	10.7	10.3	10.8	12.5
High risk	17.7	17.1	16.9	16.7	14.9	13.1	12.5	11.8	10.5	11.0	11.6	11.5	12.0	13.6
Average overall	16.8	16.0	15.9	15.7	13.9	11.8	11.0	10.2	9.1	9.7	10.4	10.1	10.7	12.4
-Standard deviation	4.1	4.1	4.2	4.3	4.2	4.0	4.1	4.1	4.0	3.9	3.8	3.7	3.7	4.0
Bankruptcy probability (%)	*4.03*	*3.55*	*4.00*	*3.27*	*2.82*	*2.48*	*2.14*	*2.47*	*2.41*	*2.42*	*2.10*	*2.24*	*2.05*	*2.77*

2) Sør-Trøndelag, Møre og Romsdal, Sogn og Fjordane, Hordaland and Rogaland

SOUTHERN NORWAY 3)	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	1989-2001
Low risk	16.2	15.2	15.2	14.8	13.2	11.2	10.6	9.8	8.7	9.1	9.9	9.8	10.4	11.8
Medium risk	17.0	16.0	15.8	15.5	13.8	11.8	11.3	10.7	9.6	9.9	10.7	10.5	11.1	12.6
High risk	17.8	17.0	16.8	16.5	14.7	12.8	12.6	11.8	10.4	10.7	11.7	11.4	12.0	13.6
Average overall	17.0	16.1	16.0	15.6	13.8	11.8	11.2	10.5	9.3	9.7	10.5	10.3	10.9	12.5
-Standard deviation	4.2	4.2	4.2	4.3	4.3	4.1	4.2	4.2	4.1	3.9	3.8	3.8	3.8	4.1
Bankruptcy probability (%)	*3.71*	*3.39*	*4.18*	*3.48*	*2.95*	*2.43*	*2.19*	*2.35*	*2.23*	*2.37*	*2.08*	*2.20*	*1.98*	*2.74*

3) Vest-Agder, Aust-Agder, Vestfold and Østfold

EASTERN NORWAY 4)	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	1989-2001
Low risk	15.6	15.0	14.8	14.6	13.0	11.1	10.4	9.6	8.4	9.0	9.9	9.4	10.2	11.6
Medium risk	16.6	15.9	15.8	15.7	13.8	12.0	11.3	10.4	9.2	9.8	10.6	10.3	10.9	12.5
High risk	17.3	16.7	16.7	16.4	14.7	12.8	12.4	11.6	10.6	11.0	11.7	11.5	11.8	13.5
Average overall	16.5	15.9	15.8	15.5	13.7	11.8	11.1	10.2	9.1	9.7	10.5	10.2	10.7	12.4