Recovery Rates of Commercial Lending: Empirical Evidence for German Companies

Abstract

There are very few studies concerning the recovery rate of bank loans. Prediction models of recovery rates are increasing in importance because of the Basel II-framework, the impact on credit risk management, and the calculation of loan rates. In this study, we focus the analyses on the distribution of recovery rates and the impact of the quota of collateral, the creditworthiness of the borrower, the size of the company and the intensity of the client relationship on the recovery rate. According to our hypotheses a higher quota of collateral leads to a higher recovery rate, whereas the creditworthiness of the borrower and the size of the company is negatively related to the recovery rate. Borrowers with an intense client relationship with the bank exhibit a higher recovery rate.

JEL classification: G21, G28

Keywords: Credit risk, Bank loans, Recovery rate

1. Introduction

Whereas the prediction of the probability of default for potential or existing borrowers has been the subject of thorough analysis during the past few decades,[1] the prediction of recovery rates has become increasingly central in academic literature. The recovery rate is defined as the payback quota of the loan. Within the scope of the Basel II framework, the term "Loss Given Default" is used, which denotes the loss quota in the case of the borrower's default.[2] For bonds, it is possible to determine market recovery rates, which can be calculated as the ratio of the actual market price and the nominal value either immediately or after a specific period following the default event. Because of the fact that bank loans are usually non- tradable, mainly "work-out recovery rates" exist, especially for continental Europe.[3] In this context, all future incoming payments within the work-out process, for example due to the realization of collateral, and outgoing payments as a result of legal requirements are discounted at the time of default and divided by the exposure of default (EAD). This value is usually multiplied by 100. This calculation requires a consistent definition of default. In banking, it is a common practice to define various default events. In doing so, the occurence of one of these events places the company in default status.

The increased emphasis placed on the recovery rate is understandable given the importance of it for banking practice. The calculation of loan rates depends on the recovery rate, because this rate is used when estimating the margin income. This margin income covers the expected credit loss as the product of the exposure of default, the probability of default,

[1] See Beaver (1966), Altman (1968), Altman et al. (1977) and Ohlson (1980), who developed models to predict the probability of default based on financial factors.

[2] Thus: recovery rate (RR) = 1 - loss given default (LGD).

[3] There are also implicit market recovery rates. These values are used to price credit derivatives and asset-backed securities based on theoretical models. See Schuermann (2004), p. 6 et seq.

and the recovery rate.[4] Consequently, both the probability of default and the recovery rate have great influence when calculating the margin income. However, the impact of the recovery rate has been far less researched than the default probability. In addition, the recovery rate must be calculated in order to estimate the unexpected credit loss at the portfolio level. The loss given default is an important parameter when using the advanced IRB approach of the Basel II framework to calculate the capital requirements. Banks that use this approach have to estimate the loss given default on the basis of a suitable internal model. As a result, their capital requirements should be lower. The estimate of the loss given default should take the potential influence of deteriorating economic conditions and the potential dependency between the value of the collateral with the probability of default into consideration.[5] Furthermore, the recovery rate is a parameter in credit risk models, which are becoming increasingly important in banking practice. Both in these models and in the calculation of the margin income, the assumption is made that the recovery rate is independent of the probability of the borrower's default. However, various empirical studies on bonds show that there is a negative correlation between recovery rates and default rates of companies. The estimate of the recovery rates of underlying loans is also necessary to evaluate credit derivatives and asset-backed securities. Thus, the hedging premium at the time of the contract of a credit default swap depends on the estimated recovery rate.[6]

The first aim of this empirical study is to gain insight into the level and distribution of recovery rates of borrowers in default at a large German bank. The investigation of the German banking system is especially interesting, because Germany is the world's second

[4] Note that this calculation is only correct under the assumption that the probability of default, the loss given default and the exposure at default are independent of one another.

[5] See the Basel Committee on Banking Supervision (2006), paragraph 468-469.

[6] Jarrow and Turnbull (2000) describe the importance of the density function of risk-neutral recovery rates for the evaluation of credit derivatives.

largest banking system after the United States in terms of total assets at the end of 2001, and Germany provides a typical example for a bank-based financial system.[7] Furthermore, very little research on recovery rates of bank loans has actually been done for continental Europe. Subsequently, factors potentially influencing the recovery rate, both discussed in the literature and self-defined, are examined and compared with empirical findings in the literature for US banks in order to illustrate possible differences caused by factors such as insolvency laws, the financial structure of the companies, and the categorizing of the industry classification of the two countries.

In this study we focus the analysis on the following four hypotheses concerning factors influencing the recovery rate of bank loans. One factor is considered of prime importance for the recovery rate prediction (the quota of collateral; it is defined as the quotient of the sum of the assumed value of the collateral and the exposure at default as shown in Table 2). Two have very rarely been analyzed (the creditworthiness of the borrower and the intensity of the client relationship). The influence of the fourth factor is controversial (size of the company).

H1 Receiving collateral increases the incoming payments, because the collateral can be sold during the work-out process, thus leading to a higher recovery rate.

H2 Some borrowers with poor creditworthiness come to realize that they will soon enter default status under the existing conditions, and thus increase the risks of their projects. If the projects fail, the losses are very high.

H3 It is more difficult for creditors to control the restructuring or liquidation process of large companies due to competing interests of the lenders and the complexity of large firms. The result is less influence of an individual creditor and a prolongation

[7] See Norden and Weber (2005).

of the work-out process.[8] Consequently, we predict that large companies have a lower recovery rate.

H4 The likelihood of receiving collateral is increased if the bank and the borrower enjoy a close relationship. In addition, the bank will have more influence on the business policy and the work-out process of the company. Therefore, the recovery rate increases as the intensity of the bank-borrower relationship increases.[9]

As a result of the analyses, hypotheses 1 to 4 can be confirmed. As the the quota of collateral increases the recovery rate also increases. Small companies and borrowers with good creditworthiness exhibit higher recovery rates. An intense client relationship also leads to a higher recovery rate.

The remainder of this paper is organized as follows. Section 2 reviews the literature regarding recovery rates of loans. The data set is described in Section 3. In Section 4, information about the level and distribution of recovery rates is provided and the proposed hypotheses are tested. Section 5 concludes and suggests areas for further research.

2. Review of Related Literature

Literature investigating recovery rates of loans can be divided into two groups. First, empirical studies analyzing the level of the recovery rate, the factors influencing this rate are summarized, and statistical models of international rating agencies that are used to predict recovery rates of loans are specified. Second, attention is directed to studies that criticize

[8] The prolongation of the work-out process leads to stronger discounting of later payments. This effect reduces the recovery rate. In addition, the financing of large companies is normally based on more creditors, which tends to complicate the work-out process. Brunner and Krahnen (2006) show that the existence of a large banking pool in comparison to a small one prolongs the work-out process.

[9] Machauer and Weber (1998) analyze the impact of the existence of a house bank relationship. They show that banks receive more collateral if they are in a house bank relationship with the company. In return, these companies have higher loan exposures.

assumptions of credit risk models concerning the recovery rate. These studies mainly refer to bonds, but can in all likelyhood pertain to loans. In particular, the assumption that the probability of default and the recovery rate are independent variables is questioned. Possibilities for model dependencies between these factors are presented at the end of the section.

Factors influencing Recovery Rates

In contrast to bonds, there are only a few empirical studies concerning recovery rates of loans, because loans are usually not traded particularly in continental Europe and data confidentiality may be a problem. These studies are mainly based on small samples taken from the US banking system. Usually, only mean values and quantiles are calculated, and sometimes influencing factors are described.[10] Table 1 summarizes these studies.[11]

{insert Table 1}

Compared to bonds, loans exhibit a higher recovery rate. Whereas the recovery rate for bonds averages about 40, it averages 75 for bank loans. The recovery rate for loans may be higher because creditors of loans are in a better situation if the company is liquidated. Furthermore, banks have more influence on the company, owing to covenants and the possibility of renegotiating the contract.[12]

[10] However, Renault and Scaillet (2004) show that the density function of bond recovery rates cannot be described solely on the basis of the mean value and the variance. They identify density functions of recovery rates and discuss methods for the non-parametric estimation of the distribution.

[11] The abbreviation US stands for USA, UK for United Kingdom, LA for Latin America, AU for Australia, MX for Mexico, F for France, G for Germany, P for Portugal and n.s. for not specified. In the column "Data", the source used for the study is identified. Dermine and Neto de Carvalho (2005) do not consider outgoing payments of the work-out process in calculating their recovery rates.

[12] See Amihud et al. (2000), p. 116.

The value assumed for the collateral in comparison with the exposure at default (in the following referred to as the quota of collateral), the seniority, the size of the company, the industry classification and the macroeconomic conditions are considered the most influential factors for the recovery rate. The importance of the quota of collateral is emphasized in all studies that analyze influencing factors. Loans partially or completely covered by collateral exhibit a higher recovery rate due to the realization of the underlying collateral.[13] Furthermore, the recovery rate increases when the bank is in a better position with regard to the claims in the case of the liquidation of the company.[14]

The results concerning the size of the company vary.[15] These differences may be due to the small sample size commonly used and special features of the loan portfolios of the banks. Grossman et al. (1997), Brennan et al. (1998), Bartlett (2000), Grossman et al. (2001), O`Shea et al. (2001), Kabance (2001), Araten et al. (2004) and Dermine and Neto de Carvalho (2005) emphasize the impact of the industry classification, whereas Gupton et al. (2000) and Franks et al. (2004) detect no significant impact of this classification. Altman et al. (2001), Gupton and Stein (2002), Araten et al. (2004), Franks et al. (2004) and Altman et al. (2005) show that the recovery rate increases in macroeconomically good conditions. Acharya et al. (2004) emphasize that the impact depends on the factor that represents the macroeconomic conditions, whereas Dermine and Neto de Carvalho (2005) find no relationship between the macroeconomic condition and the recovery rate. Franks et al. (2004) detect a positive relationship between the intensity of the client relationship and the recovery rate, whereas

[13] See Carty (1998), Gupton et al. (2000), Thorburn (2000), Hamilton et al. (2001), Kabance (2001), Bos et al. (2002), Emery et al. (2003), Araten et al. (2004), Franks et al. (2004) and Dermine and Neto de Carvalho (2005).

[14] See Gupton et al. (2000), Thorburn (2000), and Bos et al. (2002).

[15] Eales and Bosworth (1998), Felsovalyi and Hurt (1998) and Kabance (2001) identify a negative correlation between the size of the company and its recovery rate, whereas Asarnow and Edwards (1995) confirm the general findings of a positive correlation. Carty and Lieberman (1996), Bartlett (2000), Thorburn (2000), and Franks et al. (2004) identify no correlation between the size of the company and its recovery rate.

Dermine and Neto de Carvalho (2005) find no influence of that factor but do find a negative relationship between the size of the loan and the recovery rate. Furthermore, Franks et al. (2004) point out that the recovery rate is higher for companies that can continue their business. Comparing the bankruptcy codes of France, UK and Germany, Davydenko and Franks (2004) detect higher recovery rates in countries with higher levels of creditor protection.

The variety of the empirical results shows that the recovery rate depends to a high degree on the data set and the calculation method.[16] Note that most of these studies employ simple univariate methods, normally the comparison of mean values of two groups, to analyze the impact on the recovery rate.

Treatment of Recovery Rates in Credit Risk Models

Studies critizising the assumptions concerning recovery rates in credit risk models can be divided into two groups: the first deals with assumptions of the distribution of recovery rates. The second group of studies discusses the assumption of independence between the probability of the borrower's default and the recovery rate.[17]

Renault and Scaillet (2004) show the extent to which estimate errors arise if the assumed beta distribution that is commonly used is taken for the value-at-risk calculation.[18] At present, we know of no empirical study that analyzes this correlation for loans. Wilson (1997), Carey (1998), Altman and Brady (2001), Altman and Bana (2002) and Altman and Fanjul (2004) detect a negative correlation for bonds between the recovery rate and default rates of

[16] Araten et al. (2004) describe the sensitivity of the results with respect to variations in the discounting rate.

[17] CreditRisk$^+$ implies a constant recovery rate, whereas CreditMetrics, Credit Portfolio View and the KMV model assume stochastic (for the most part beta-distributed) recovery rates.

[18] For a description of the treatment of recovery rates in credit risk models see also Hu and Perraudin (2002).

companies.[19] Löffler (2003), Altman et al. (2001, 2005) and Chabaane et al. (2004) emphasize the impact of these assumptions on the expected loss of a loan portfolio. Owing to the controversy concerning this correlation, it has been given considerable attention over the past few years.[20] Frye (2000a, 2000b) presents models that use macroeconomic conditions that both cause the default of the borrower and decrease the recovery rate.[21] Thus the dependence of these two parameters on one systematic factor is justified, because, in the case of the borrower's default, the value of the collateral deteriorates and the recovery rates decline.[22]

3. Data Set

The data set contains information about 120 companies that borrowed from one large German bank and defaulted in the years from 1992 to 2003. These companies are located in 10 of the 16 German federal states. There are only a small number of borrowers for the years 2002 and 2003, because only those companies for which the work-out process had been completed were taken into account and the bank anticipated no further payments. The following factors of potential influence specified in Table 2 are incorporated into the analyses of the recovery rate in Sections 4.2 and 4.3.

{insert Table 2}

[19] In contrast: Acharya et al. (2004) detect a positive correlation, whereas Carey and Gordy (2003) find no correlation.

[20] See Altman et al. (2006) for a discussion of the stated and further literature.

[21] Frye (2000a) uses an equation that determines the value of the collateral to define the recovery rate, whereas Frye (2000b) models the recovery rate directly.

[22] Jarrow (2001), Jokivuolle and Peura (2003), Pykhtin (2003), Düllmann and Trapp (2004) and Chabaane et al. (2004) present further models that illustrate the correlation between the probability of default and the recovery rate.

The main loan is defined as the loan with the highest exposure, because only the entire exposure and the main loan are specified in the data set.[23] According to the literature, the parameters for the annual financial statements correspond to the last statement before the default event. Due to the lack of precise specifications regarding the client relationship, the closing of multiple loans, the distance between the domicile of the borrower and the bank, as well as the logarithmized ratio of the exposure at default to the total assets are used as proxies for the intensity of the client relationship. The growth of the gross domestic product (GDP) (both for Germany as a whole and for the federal state of the domicile of the borrowing company), the yearly loss provisions of the volume of credit of German commercial banks that are published by the OECD[24] and the rate of unemployment serve as proxies for the macroeconomic environment.[25] The loan loss provivions in particular appears meaningful, because it describes the specific situation of the German banks. The expression (0,1) indicates a dummy variable. The year of the default events and information on the non-metric variables described in Table 2 are shown in Table 3.

{insert Table 3}

[23] The calculation of recovery rates is based on the borrower level and not on that of the single loan to determine the lien within the terms and conditions of banks.

[24] See Organisation for Economic Co-operation and Development (2001). In the following empirical analysis, the ratio of the loss provisions of the volume of credit and the volume of credit of the default year is calculated and designated loan loss provisions. These figures are available for the years 1992 to 2001.

[25] According to the Basel Committee on Banking Supervision (2006), paragraph 468, banks have to consider macroeconomic downturn conditions when predicting recovery rates. The Basel Committee on Banking Supervision (2005) discusses this requirement and states that banks should use the growth of GDP and the rate of unemployment as factors for the recovery rate prediction.

With the exception of the macroeconomic factors, the metric factors of potential influence are described in Table 4. The size of the companies, as measured by the turnover and the total assets, varies to a great extent.[26, 27]

{insert Table 4}

The correlations between the influencing factors of the regression analyses of the following section are shown in Table 5. This investigation is important for the later multivariate analyses. As expected, there is a strong positive correlation between the logarithmized turnover and total assets of the companies. In addition, the exposure at default increases with an increase in these two factors. Even the negative correlation of both the logarithmized turnover and total assets with the fraction of the total assets seem to be consistent because larger companies typically use loans from multiple lenders and sources. The other two potentially influencing factors for the intensity of the client relationship are negatively correlated. Besides these correlations, the other dependencies that affect the macroeconomic factors are considered in a regression analyses in the next section.[28]

{insert Table 5}

[26] Because only a few very large companies are included in the data set, the median of the total assets amounts to 6.7 mil., the median of the turnover to 10.0 mil., and the median of the exposure at default to 2.4 mil.

[27] The effective yield is the last interest rate before the default event. According to the statement of the bank, the effective yield is frequently adjusted during the life of the loan. Since 1998 the Euribor has been subtracted from the effective yield because the Fibor is no longer available.

[28] Bigus et al. (2004) describe empirical studies that detect interrelations between the quota of collateral, the size of the company, the legal form of the company, the exposure at default, the creditworthiness, the intensity of the client relationship and macroeconomic factors.

4. Empirical Results concerning the Recovery Rate

4.1 Distribution of Recovery Rates

The mean value of the recovery rates of the borrowers amounts to 72.45, a figure very similar to the analyses described in Section 2. The fraction of recovery rates close to 100 is very high, resulting in a median of 91.77, which is considerably higher than the mean. In Figure 1, the borrowers are listed in order of increasing recovery rate. A negative recovery rate indicates that the sum of the discounted outgoing payments is higher than that of the incoming payments. Weighting the recovery rates with their exposure at default yields a mean value of 71.91. This value deviates marginally from the (unweighted) mean recovery rate of 72.45.

{insert Figure 1}

The work-out recovery rate, which amounts to 72.45 on an average, can also be calculated using the advanced IRB approach in the framework of Basel II.[29] Discounting only the incoming payments during the work-out process leads to a mean recovery rate of an average of 74.03. Consequently, the discounted outgoing payments reduce the recovery rate by 1.58 to the value of 72.45 mentioned above. In other words, the bank loses an average of 1.58% of the exposure at default due to outgoing payments during the work-out process. To identify the factors influencing this value, a linear regression analysis is carried out.[30] The sum of discounted outgoing payments divided by the exposure at default of each borrower serves as the dependent variable. The factors stated in Table 2, with the exception of the industry classification, serve as independent variables. As a result, the percentage of outgoing

[29] See the Basel Committee on Banking Supervision (2006), paragraph 460, where both the direct and indirect costs and the discounting of future payments are taken into consideration.

[30] The detailed results are not presented in this paper, but can be requested by the authors.

payments decreases if the exposure at default increases.[31] No other factor is statistically significant at the 10% level. Indeed, a high quota of collateral leads to an increase of the sum of discounted outgoing payments that are generated because of the realization of collateral in relation to the exposure at default, but this influence is statistically insignificant.

The distribution identified here supports the findings of Carty and Lieberman (1986) and the critique of Renault and Scaillet (2004) of the beta distribution commonly assumed in calculating credit risk models. In their data set, Carty and Lieberman (1996) detect a unimodal distribution, where half of the loans have a recovery rate greater than 70. In contrast, Carty (1998) finds a bimodal distribution with peaks at the intervals from 0 to 10 and 90 to 100 percent. Similarly to Carty (1998), Asarnow and Edwards (1995) find a bimodal distribution of the recovery rates.

4.2 Univariate analyses testing factors of potential influence

To investigate the hypotheses according to the univariate method, only those borrowers for whom information about the recovery rate and the factor tested was available were included. Therefore, the sample size is limited in contrast to the analysis in 4.1 to the extent shown in Table 4.[32] The figures below demonstrate and show other aspects of the influence of the factors on the recovery rate.

To test hypothesis 1 concerning the influence of the quota of collateral, the recovery rates are contrasted with the corresponding quotas of collateral for the 70 borrowers. The borrowers are listed in order of increasing recovery rate.

{insert Figure 2}

[31] As is to be expected, the sum of the discounted outgoing payments (without dividing the sum by the exposure at default) rises if the exposure at default increases.

[32] Because of the use of subsamples, the recovery rate shown in Figures 3, 5 and 6 varies from that of the entire sample with a recovery rate of 72.45.

Hypothesis 1, which predicted a positive relationship between the quota of collateral and the recovery rate, could be substantiated. The Bravias and Pearson correlation coefficent is statistically significant at the 5% level using the two-tailed t-test with a value of 0.25. Figure 3 illustrates the deviations of the quotas of collateral and the recovery rates. Negative (positive) deviations indicate that the quota of collateral is higher (lower) than the borrower's recovery rate.

{insert Figure 3}

In 53 of the cases, the bank achieved a higher recovery rate than the quota of collateral. In seven cases the deviation is greater than 95. A value of 100 (the largest value in the data set is 99.97) would mean that the recovery rate of an uncollateralized exposure is 100. The deviation of 17 borrowers is negative, the lowest value being -99.24. A value of -100 indicates a fully collateralized exposure where the recovery rate is 0. On an average, the recovery rate of the bank is nearly twice the quota of collateral. With regard to the medians, the recovery rate is more than three times higher than the quota of collateral. As shown in Grunert (2007), on an average banks receive the value assumed for the collateral. On the basis of the above findings, the quota of collateral has a very important influence on the recovery rate, but is clearly not the only factor, as is often assumed in banking practice.

Figures 4, 5 and 6 show the relationship between the risk premium (as indicator for the creditworthiness of the borrower), the logarithm of total assets (size of the company) and the multiple loan contracts (intensity of the client relationship).

{insert Figures 4 and 5}

As stated in hypothesis 2, borrowers with poor creditworthiness exhibit a low recovery rate. This result is apparent from the correlation coefficient of -0.21, which is statistically significant at the 5% level. The negative relationship of the firm size and the recovery rate – as proposed in hypothesis 3 – could be confirmed as well. The correlation coefficient amounts to -0.28, which is also significant at the 5% level.

{insert Figure 6}

Finally, hypothesis 4 can be confirmed using univariate analysis methods. An intense bank borrower relationship – measured as multiple loan contracts in the history of their client relationship – leads to a higher recovery rate. If only one loan has been granted, the recovery rate amounts to 59.0 on an average in comparison with 76.3 for more than one loan. Using the Wilcoxon-Ranksum test, the assumption of equal medians can be rejected at the 1% level. As shown in Figure 6, borrowers with recovery rates lower than 50 often closed only one loan with the bank.

Hypotheses 1, 2, 3 and 4 can be confirmed using univariate analysis methods. The quota of collateral, the creditworthiness of the borrower, the size of the company, and the intensity of the client relationship influence the recovery rate as assumed. The next section discusses whether these findings can be verified on testing the combined influence of multiple factors. Note that banks receive a decidedly larger part of the exposure at default than the quota of collateral.

4.3 Factors influencing the Recovery Rate with the Use of Regression Analyses

The aim of the following regression analyses is to investigate the combined influence of multiple independent variables on the the recovery rate.

As shown in Tables 3 and 4, not all borrowers have specifications for all of the factors. For this reason, only those variables that were available to the greatest extent are taken into consideration in the first regression analysis. The industry classification is not used in the regression analyses, because preliminary investigations show no influence of this feature. Furthermore, the inclusion of this variable considerably lowers the quality of the regression analyses on the basis of the adjusted R^2. The result of the regression analysis with the largest sample size is shown in Column (1) of Table 6. The appropriate independent variable is added to regression (1) to analyze the influence of the other factors on the basis of a preferably large

sample size. Thus the values in the columns of Table 6 are the results of different regression analyses.

{insert Table 6}

The results of the regression analyses confirm the findings from the univariate analyses. The importance of the quota of collateral owing to collateral realization can be detected in this analysis, a point that has been verified in the literature. Furthermore, companies can signal their good creditworthiness by providing collateral.[33] This assumption is contradictory to the models of Manove and Padilla (1999, 2001), which assume a negative correlation between the quota of collateral and the creditworthiness of the borrower. This is due to a less thorough analysis of the creditworthiness with regard to loans provided with collateral.[34] As shown, companies possessing a good creditworthiness exhibit a high recovery rate.

We find a negative relationship between the creditworthiness of the borrower (measured as the risk premium) and the recovery rate. In other words, borrowers with high probabilities of default exhibit higher losses in relation to the exposure when entering the default status. The reason for that may be that borrowers increase the risk of their projects to avoid the default status. If the projects fail, the losses are very high. Because of this dependency, the formula commonly used to calculate the margin income results in an expected loss that can be too low. This correlation leads to an underestimate of the credit risk of credit risk models.

Because of the more complicated restructuring or liquidation process of large companies, the recovery rate decreases if the size of the company increases. The difficult work-out process seems to dominate the assumption that large companies have a better

[33] See Bester (1985), Chan and Kanatas (1985) and Besanko and Thakor (1987).

[34] This assumption is supported both by empirical analyses that detect a minor quality of the ratings of loans provided with collateral (see Orgler, 1970, Hester, 1979, Scott and Smith, 1986) and by those that verify a higher risk premium of collateralized loans (see Berger and Udell, 1990, 1992, Booth, 1992, Booth and Chua, 1996, Angbazo et al., 1998). See Jiménez and Saurina (2004), p. 2194 per seq.

creditworthiness. In connection with hypothesis 1 (creditworthiness of the borrower), this leads to a higher recovery rate. As mentioned, the influence of the size is controversal in the literature.

There has not been much discussion in the literature on the influence of the intensity of the client relationship. In our study, if there is a strong relationship, banks will have a higher recovery rate if the variables "multiple loan contracts" and the fraction of total assets are used as proxies for the intensity. This can be explained by a better position in realization of the collateral, a greater influence on the business policy of the company, and the success of the work-out process.[35] These findings are in line with Franks et al. (2004), whereas Dermine and Neto de Carvalho (2005) detect no relationship between the intensity of the client relationship and the recovery rate. However, the distance between the domicile of the company and the lending bank is not important for the recovery rate. This may be due to the fact that distances are all quite short in our sample and publicly available information can be obtained electronically. The advantages caused by an intense client relationship may be a further reason for the higher recovery rate of bank loans in comparison with bonds.

Besides these factors, we find a significant influence of the continuation variable. Companies that can continue their business have a higher recovery rate.[36] The reason for this might be that the bank can receive payments that greatly exceed the payments of the realization of collateral from the company.

The liability of the private means of business partnerships does not significantly increase the recovery rate. The reason may be that corporations exhibit a shorter work-out process

[35] However, Jiménez and Saurina (2004) determine that for Spanish companies banks are more frequently willing to take higher credit risk if the client relationship is strong. With respect to the positive correlation between the creditworthiness and the recovery rate, this finding should lead to a lower recovery rate.

[36] See also Franks et al. (2004).

because of the nonexistent liability of the participators. A short work-out process leads to minor discounting of future payments.

The exposure at default is not significant. This is contrary to the assumption that a higher exposure at default leads to a more thorough inquiry into the company's creditworthiness. Assuming the risk standardization hypothesis[37] and the negative correlation between the probability of default and the recovery rate shown above, the recovery rate increases with a higher exposure at default. Furthermore, banks intensify their effort in the work-out process if high losses are apparent.

As mentioned above, the Basel Committee on Banking Supervision (2006) requires banks to consider macroeconomic downturn conditions when predicting recovery rates. The Basel Committee on Banking Supervision (2005) discusses this requirement and states that banks should use the growth of GDP and the rate of unemployment as factors for the recovery rate prediction. In our analysis, which includes the proposed factors, macroeconomic conditions do not influence the recovery rate. These findings contradict the concept that collateral decreases less in value in good macroeconomic conditions. Also, the time to conclude a work-out process decreases when the courts have less work to do. Furthermore, under good economic conditions, the probability that the company can run its business according to the work-out process increases.[38, 39] Because the work-out process often takes some months, we also test these macroeconomic factors in two further regressions: one (regression 1) and two

[37] The risk standardization hypothesis states that banks do not grant a loan if the probability of default exceeds a specific level. A more thorough inquiry into the creditworthiness leads to a higher probability that companies with a high chance of default can be detected.

[38] Companies that can proceed to run their business possess a higher recovery rate. See also Franks et al. (2004).

[39] Furthermore, Shleifer and Vishny (1992) develop a model assuming that the work-out-process of companies in financial distress is more expensive if the financial situation of the competitors is bad.

(regression 2) years after the borrower's default year. None of the macroeconomic factors are significant at the 10% level.[40]

In summary, no systematic national differences are found when we compare our findings with those of other authors. Factors beyond those discussed in the literature seem to influence the recovery rate. These factors have to be taken into account when developing a model for recovery rate prediction.

Robustness check

To describe the impact of correlations of the independent variables on the regression results as shown in Table 5, we repeat all five regression analyses, eliminating one or more independent variables. We then investigate whether former significant factors lose significance and whether formerly non-significant factors are now significant at the 10% level.

To correct for the correlations between the macroeconomic factors, we repeat the five regressions four times, each time using only one of the macroeconomic factors. If we look at regressions (1) and (2), the variable multiple loan contracts loses significance when we use the rate of unemployment and the regional growth of GDP as independent variables. Furthermore, the risk premium loses significance when we use the loan loss provisions of German banks as an independent variable. The risk premium is not significant if we use the growth of GDP in regression (5). No further variable becomes significant in these regression analyses.

To analyze the impact of the correlations between turnover, total assets and exposure at default, we repeat regressions 2 and 3, eliminating the exposure at default. No change of significance is found.

[40] The detailed results are not presented in this paper, but can be requested by the authors.

To correct for the correlation of the distance with the multiple loan contracts variable and the exposure at default, we initially eliminate the distance in all five regression analyses. The risk premium loses significance in regressions (2) and (5), and no other variable becomes significant. Next, the variable multiple loan contracts is eliminated. Only the distance is now significant negative in regression (1). Finally, we eliminate the exposure at default. The distance is now significant negative with regard to regression (1). The risk premium is not significant in regression (2).

To describe the impact of the correlation of risk premium with the growth of GDP and the rate of unemployment, we eliminate the risk premium in all regression analyses.[41] No change in significance is found.

As regards the correlation of the continuation and the loan loss provivions of German banks, the continuation is eliminated in the five regressions.[42] Again, the regression results do not change.

The correlations of the fraction of total assets with the turnover and total assets are not important for the regression analyses because the variables are independent variables in different regressions. The correlation of the total assets with the regional growth of GDP and that of the fraction of total assets with the loan loss provisions are tested above because every variable is eliminated at least once if the correlated variable still serves as an independent variable.

In summary, the correlations of the independent variables influence the results only marginally. Correcting for the correlations, the risk premium and multiple loan contracts variable become insignificant in some cases. If we eliminate variables correlated with the distance, the distance becomes significant negative, as assumed in Hypothesis 3.

[41] These macroecomomic variables are dropped in the analyses at the beginning of the robustness check section.

[42] The loan loss provisions of German banks is dropped in the analyses at the beginning of the robustness check section.

Factors leading to a very high or very low recovery rate

So far, multiple factors that influence the recovery rate with respect to the whole range of values were analyzed. Therefore, there is no evidence as to whether these factors influence the fact that banks receive the exposure at default almost completely or only minimally. To investigate this question, the dummy variable RR^{+} (0,1) is introduced in the first step. This variable is one if the recovery rate of the borrower is higher than 99. This is the case for 32 of the 120 borrowers. The result of the logistic regression analyses with RR^{+} (0,1) as dependent variable is shown in Table 7.

{insert Table 7}

In contrast to the previous analyses, the exposure at default is now of great importance. The probability that a bank will have a recovery rate greater than 99 increases with increasing exposure at default. This suggests that banks conduct a more intensive examination of the creditworthiness of the borrowers if the exposure is high. This assumption in connection with the detected positive correlation between the creditworthiness and the recovery rate leads to an increase in the recovery rate. Taking the recovery rate into consideration, these findings show that the disadvantages of default events of companies with high exposures at default decrease. Furthermore, the continuation and the size of the company (measured as the logarithm of total assets) are statistically significant, whereas this is not the case for the intensity of the client relationship. Therefore, the intensity of the client relationship is especially important in those cases where the recovery rate is lower than or equal to 99.

Using macroeconomic factors one year after the default year, the corresponding loan loss provisions of German banks becomes significant positive at least at the 10% level in four of the five regression analyses. One reason could be that banks intensify their efforts to get a very high recovery rate in times of high provivions on their loan portfolio. No macroeconomic factor is statistically significant two years after the default year.

Because of the correlated independent variables described in the previous section, we implement the same robustness check. The significant coefficients found remain significant, at least at the 10% level. No other factor becomes significant.

To identify which factors influence the fact that banks receive a very low recovery rate, the dummy variable RR^- (0,1) is introduced, taking the value 1 if the recovery rate is less than 50. This is the case for 26 companies. As shown in Table 8, the results of these logistic regression analyses show the influence of the intensity of the client relationship and the quota of collateral in contrast to the regression analyses with RR^+ (0,1) as dependent variable. The probability of obtaining a very low recovery rate decreases if the client relationship is intense. This result is in line with the findings in Figure 6 Even the possibility to sell collateral increases this probability. Similar to the regression analyses with RR^+ (0,1) as dependent variable, the continuation and the logarithm of total assets are important. In contrast to the previous investigation, the logarithm of the exposure at default is statistically not significant.

{insert Table 8}

Using macroeconomic factors one year after the default year, the loan loss provisions of German banks again become significant negative in three of the five regression analyses. If this quota is low, the probability of obtaining very low recovery rates is high. Two years after the default year, a high regional growth of GDP reduces the probability of obtaining a very low recovery rate in three of the five cases.

Again, correcting for correlated independent variables, the significant coefficients found remain significant at least at the 10% level, and no other factor becomes significant.

5. Conclusions

The probability of default of a borrower is intensely discussed in academic literature, but there are only a few studies concerning the recovery rate. In addition to the impact of the decision to grant a loan and the determination of the effective yield, the recovery rate gains

importance because of the Basel II framework. Banks need to have a suitable model to predict the recovery rate if they use the advanced IRB approach to calculate their capital requirements concerning credit risk. Banks that apply this approach should fulfill lower capital requirements. To develop this model, most banks need to collect data about borrowers who defaulted in the past in order to consider special features of the bank's specific loan portfolio. To restrict the extent of data collection, they must be aware of the influencing factors of past analyses. One problem is that these studies mainly concern the US banking sector, but there could be national differences regarding insolvency laws or specific features of the companies.

No essential difference between the mean value of the recovery rates, amounting to 72.45, and the results of studies in literature can be found. The average recovery rate would amount to 74.03 if only incoming payments would be taken into consideration. In other words, outgoing payments during the work-out process reduce the recovery rate by 1.58. The distribution of recovery rates found with values near to 100 contradicts the assumption of beta distribution made in credit risk models.

The proposed hypotheses are confirmed. The statement that a high quota of collateral leads to a higher recovery rate appears to be plausible because of the realization of collateral. The influence of the creditworthiness of the borrower and the recovery rate has not yet been extensively analyzed. We find a negative relationship between these two factors. For this reason, the formula commonly used to calculate the margin income results in an expected loss that can be too low. Furthermore, this correlation leads to an underestimate of the credit risk of credit risk models. Consistent with Asarnow and Edwards (1995), Eales and Bosworth (1998), Felsovalyi and Hurt (1998), and Kabance (2001), but in contrast to Carty and Lieberman (1996), Bartlett (2000), Thorburn (2000), and Franks et al. (2004), the recovery rate decreases if the size of the company increases because the work-out process is more complicated. To estimate the recovery rate, the intensity of the client relationship has to be consistent with Franks et al. (2004), and contrary to Dermine and Neto de Carvalho (2005).

An intense relationship improves the access to collateral and increases the influence on the business policy and work-out process of the company.

In addition to these factors, the fact that companies can continue to run their business after the work-out process increases the recovery rate (see also Franks et al., 2004), whereas macroeconomic conditions do not significantly influence the recovery rate, not even using the postulated macroeconomic factors in the Basel Committee on Banking Supervision (2005).

The exposure at default is important when analyzing the factors that cause a very high recovery rate. If the exposure is high, the probability that the bank can achieve a high recovery rate increases. This may be due to the thesis that the bank intensifies inquiries regarding the creditworthiness and monitoring of the borrower. Similar to the results for the whole range of recovery rates, the fact that companies can continue business increases the probability of attaining a very high recovery rate. The probability of obtaining very low recovery rates decreases if the risk premium is low, the client relationship is intense, the quota of collateral is high, and companies can continue to run their business.

Future analyses based on preferably larger samples are required to gain further insight into the prediction of recovery rates similar to that of the probability of default. In this context, the question is raised as to how far special bank features complicate the transfer of a model that was not developed based on internal data, as with models from rating agencies.

References:

Acharya, V.V., Bharath, S.T., Srinivasan, A., 2004. Understanding the Recovery Rates on Defaulted Securities, Working Paper, April 2004.

Altman, E.I., 1968. Financial Ratios, Discriminant Analysis and the Prediction of Corporate Bankruptcy, Journal of Finance 23, 589-609.

Altman, E.I., 2006. Default Recovery rates and LGD in Credit Risk Models and Practice: An Updated Review of the Literature and Empirical Evidence, NYU Stern Scholl of Business, Salomon Center Working Paper, New York, November 2006.

Altman, E.I., Bana, G., 2002. Defaults & Returns on High Yield Bonds: Analysis through September 30, 2002, NYU Stern School of Business, Salomon Center Working Paper, New York, October 2002.

Altman, E.I., Haldemann, R.G., Narayan, P., 1977. Zeta^{TM} Analysis – A New Model to Identify Bankruptcy Risk of Corporations, Journal of Banking and Finance 1, 29-54.

Altman, E.I., Brady, B., 2001. Explaining Aggregate Recovery Rates on Corporate Bond Defaults, NYU Stern School of Business, Salomon Center Working Paper, New York, November 2001.

Altman, E.I., Brady, B., Resti, A., Sironi, A., 2001. Analyzing and Explaining Default Recovery Rates, ISDA Research Report, December 2001.

Altman, E.I., Brady, B., Resti, A., Sironi, A., 2005. The Link between Default and Recovery Rates: Theory, Empirical Evidence, and Implications, Journal of Business 78, 2203-2228.

Altman, E.I., Fanjul, G., 2004. Defaults and Returns in High Yield Bond Market: Analysis through 2003, NY Stern School of Business, Salomon Center Working Paper, January 2004.

Amihud, Y., Garbade, K., Kahan, M., 2000. An Institutional Innovation to Reduce Agency Costs of Public Corporate Bonds, Journal of Applied Corporate Finance, 114-121.

Angbazo, L.A., Mei, J., Saunders, A., 1998. Credit Spreads in the Market of Highly Leveraged Transaction Loans, Journal of Banking and Finance 22, 1249-1282.

Araten, M., Jacobs, M. Jr., Varshney, P., 2004. Measuring LGD on Commercial Loans: An 18-Year Internal Study, The RMA Journal 4, 96-103.

Asarnow, E.; Edwards, D. (1995): Measuring Loss on Defaulted Bank Loans. A 24-Year-Study; Journal of Commercial Lending, Edition 77, 7, 11-23.

Bartlett, F., 2000. Secured Loan Recovery Study: The UK Experience, Europe Loan Products, Fitch IBCA, February 2000.

Basel Committee on Banking Supervision, 2006. International Convergence of Capital Measurement and Capital Standards, June 2006.

Basel Committee on Banking Supervision, 2005. Guidance on Paragraph 468 of the Framework Document, July 2005.

Beaver, W.H., 1966. Financial Ratios as Predictors of Failure, Journal of Accounting Research 4, 71-111.

Berger, A.N., Udell, G.F., 1990. Collateral, Loan Quality, and Bank Risk, Journal of Monetary Economics 25, 21-42.

Berger, A.N., Udell, G.F., 1992. Some Evidence on the Empirical Significance of Credit Rationing, Journal of Political Economy 100, 1047-1077.

Besanko, D., Thakor, A. V., 1987. Competitive Equilibrium in the Credit Market under Asymmetric Information, Journal of Economic Theory 42, 167-182.

Bester, H., 1985. Screening vs. Rationing in Credit Markets with Imperfect Information, American Economic Review 75, 850-855.

Bigus, J., Langer, Th.., Schiereck, D., 2004. Wie werden Kreditsicherheiten in der Praxis eingesetzt? – Ein Überblick über empirische Befunde, Zeitschrift für Bankrecht und Bankwirtschaft 6, 465-480.

Booth, J.R., 1992. Contract Costs, Bank Loans, and the Cross-Monitoring Hypothesis, Journal of Financial Economics 31, 25-41.

Booth, J.R., Chua, L., 1996. Loan Collateral Decisions and Corporate Borrowing Costs, Working Paper, Arizona State University, Tempe, AZ.

Bos, R.J., Kelhoffer, K., Keisman, D., 2002. Recovery Research: Ultimative Recovery in an Era of Record Defaults, Standard & Poor's, July 2002.

Brennan, W., McGirt, D., Roche, J. , Verde, M., 1998. Bank Loan Ratings, in: Bank Loans: Secondary Market and Portfolio Management, Frank J. Fabozzi Associates, New Hope, P.A., 57-69.

Brunner, A., Krahnen, J.P., 2006. Multiple Lenders and Corporate Distress: Evidence on Debt Restructuring, CFS Center for Financial Studies, Frankfurt, June 2006.

Carey, M., 1998. Credit Risk in Private Debt Portfolios, Journal of Finance 53 (4), 1363 – 1387.

Carey, M., Gordy, M., 2003. Systematic Risk in Recoveries on Defaulted Debt, Working Paper, Federal Reserve Bank, Washington.

Carty, L.V., Lieberman, D., 1996. Defaulted Bank Loan Recoveries, Moody's Investors Service, November 1996.

Carty, L.V., 1998. Bankrupt Bank Loan Recoveries, Moody's Investors Service, June 1998.

Chabaane, A., Laurent, J.P., Salomon, J., 2004. Double Impact: Credit Risk Assessment and Collateral Value, Working Paper, February 2004.

Chan, Y.-S., Kanatas, G., 1985. Asymmetric Valuations and the Role of Collateral in Loan Agreements, Journal of Money, Credit and Banking 17, 84-95.

Davydenko, S.A., Franks, J.R., 2004. Do Bankruptcy Codes matter? A Study of Defaults in France, Germany and the UK, Working Paper, December 2004.

Dermine, J., Neto de Carvalho, C., 2005. Bank Loan Losses-Given-Default, A Case Study, Working Paper, March 2005.

Düllmann, K., Trapp, M., 2004. Systematic Risk in Recovery Rates – An Empirical Analysis in U.S. Corporate Credit Exposures, Working Paper, June 2004.

Eales, R., Bosworth, E., 1998. Severity of Loss in the Event of Default in small Business and larger Consumer Loans, The Journal of Lending & Credit Risk Management, 58-65.

Emery, K., 2003. Moody`s Loan Default Database as of November 2003, Moody`s Investors Service, December 2003.

Felsovalyi, A., Hurt, L., 1998. Measuring Loss on Latin American Defaulted Bank Loans: A 27-Year Study of 27 Countries, Journal of Lending & Credit Risk Management.

Franks, J., de Servigny, A., Davydenko, S., 2004. A Comparative Analysis of the Recovery Process and Recovery Rates for Private Companies in the U.K., France, and Germany, Standard and Poor`s Risk Solutions, June 2004.

Frye, J., 2000a. Collateral Damage, Risk 4, 91-94.

Frye, J., 2000b. Collateral Damage Detected, Federal Reserve Bank of Chicago, Working Paper, Emerging Issues Series October, 1-14.

Grossman, R.J., Brennan, W.T., Vento, J., 1997. Syndicated Bank Loan Recovery Study, Fitch Research, October 1997.

Grossman, R.J., O´Shea, S., Bonelli, S., 2001. Bank Loan and Bond Recovery Study: 1997-2000, Fitch Loan Products Special Report.

Grunert, J., 2007. Die Werthaltigkeit von Kreditsicherheiten bei Ausfall des Kreditnehmers, Working Paper, University of Tuebingen.

Gupton, G.M., Gates, D., Carty, L.V., 2000. Bank Loan Loss Given Default, Moody's Investors Service, November 2000.

Gupton, G.M., Stein, R.M.., 2002. Loss Calk^{TM}: Moody's Model for Predicting Loss Given Default (LGD), Moody's Investors Service, February 2002.

Hamilton, D.T., Carty, L.V., 1999. Debt Recoveries for Corporate Bankruptcies, Moody's Investors Service, June 1999.

Hamilton, D.T., Gupton, G., Berthault, A., 2001. Default & Recovery Rates of Corporate Bond Issuers: 2000, Moody's Investors Service, February 2001.

Hamilton, D.T., Cantor, R., Ou, S., 2002. Default & Recovery Rates of Corporate Bond Issuers: A Statistical Review of Moody's Ratings Performance 1970-2001, Moody's Investors Service, February 2002.

Hamilton, D.T., Varma, P., Ou, S., Cantor, R., 2004. Default & Recovery Rates of Corporate Bond Issuers: A Statistical Review of Moody's Ratings Performance 1920-2003, Moody's Investors Service, January 2004.

Hester, D.D., 1979. Customer Relationships and Terms of Loans, Journal of Money, Credit, and Banking 11, 349-357.

Hu, Y., Perraudin, W., 2002. The Dependence of Recoveries and Defaults, Bank of England and Birkbeck College, February 2002.

Hurt, L., Felsovalyi, A., 1998. Measuring Loss on Latin American Defaulted Bank Loans: A 27-Year Study of 27 Countries, Citibank, July 1997.

Jarrow, R.A., Turnbull, S.M., 2000. The Intersection of Market and Credit Risk, Journal of Banking and Finance 24, 271-299.

Jarrow, J.A., 2001. Default Parameter Estimation using Market Prices, Financial Analysts Journal 57 (5), 75-92.

Jiménez, G., Saurina, J., 2004. Collateral, Type of Lender and Relationship Banking as Determinants of Credit Risk, Journal of Banking and Finance 28, 2191-2212.

Jokivuolle, E., Peura, S., 2003. A Model for Estimating Recovery Rates and Collateral Haircuts for Bank Loans, in: European Financial Management.

Kabance, G., 2001. Mexican Bankruptcy and Recovery Rate Study, Fitch IBCA, December 2001.

Keisman, D., 2003. 2084 Defaulted Loans and Bond Issues that Defaulted between 1987-2003, Standard & Poor`s LossStats™ Database, Working Paper.

Löffler, G., 2003. The Effects of Estimation Error on Measures of Credit Portfolio Risk, Journal of Banking and Finance 27, 1427-1453.

Machauer, A., Weber, M., 1998. Bank Behavior Based on Internal Credit Ratings of Borrowers, Journal of Banking & Finance 22, 1355-1383.

Manove, M., Padilla, A.J., 1999. Banking (Conservatively) with Optimists, RAND Journal of Economics 30, 324-350.

Manove, M., Padilla, A.J., 2001. Collateral Versus Project Screening: A Model of Lazy Banks, RAND Journal of Economics 32, 726-744.

Norden, L., Weber, M., 2005. Funding Modes of German Banks: Structural Changes and Their Implications, CEPR Discussion Paper 5027, CEPR, London.

Ohlson, J.A., 1980. Financial Ratios and the Probalistic Prediction of Bankruptcy, Journal of Accounting Research 18, 109-131.

Organisation for Economic Co-Operation and Development, 2001. Bank Profitability: Financial Statements of Banks.

Orgler, Y.E., 1970. A Credit Scoring Model for Commercial Loans, Journal of Money, Credit, and Banking 2, 435-445.

O'Shea, S., Bonelli, S., Grossman, R., 2001. Bank Loan and Bond Recovery Study: 1997-2000, Fitch IBCA, March 2001.

Pyktin, M., 2003. Unexpected Recovery Risk, Risk 16 (8), 74-78.

Renault, O., Scaillet, O., 2004. On the Way to Recovery: A Nonparametric Bias-Free Estimation of Recovery Rates Densities, Journal of Banking and Finance 28, 2915-2931.

Schuermann, T., 2004. What do we Know about Loss Given Default?, Credit Risk-Models and Management, edited by David Shimko, 2, Risk Books.

Scott, J.A., Smith, T.C., 1986. The Effect of the Bankruptcy Reform Act of 1978 on Small Business Loan Pricing, Journal if Financial Economics 16, 119-140.

Shleifer, A., Vishny, R. W., 1992. Liquidation Values and Debt Capacity: A Market Equilibrium Approach, Journal of Finance 4, 1343-1366.

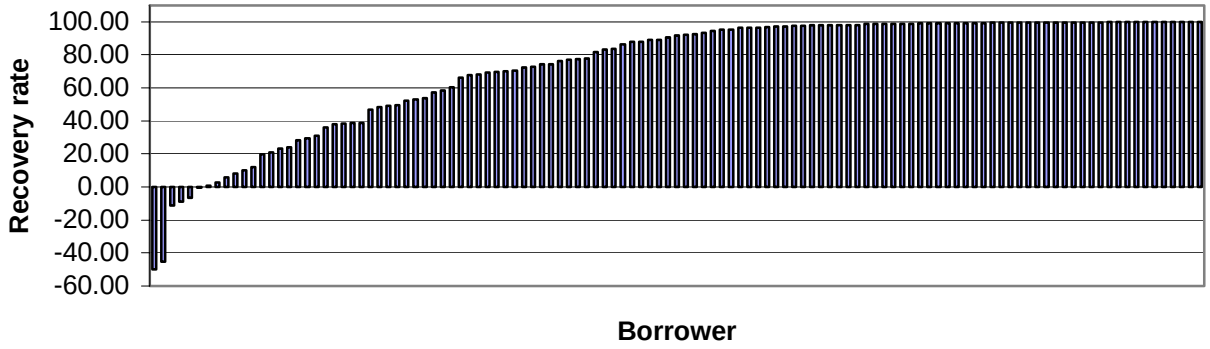
Thorburn, 2000. Bankruptcy Auctions: Costs, Debt Recovery and Firm Survival, Journal of Financial Economics 58, 337-368.

van de Castle, K., Keisman, D., 1999. Recovering your Money: Insights into Losses from Default, Standard & Poor's Credit Week, 29-34.

van de Castle, K., Keisman, D., Yang, R., 2000. Suddenly Structure Mattered: Insights into Recoveries from Defaulted, Standard & Poor's Credit Week, 61-68.

Wilson, T.C., 1997. Portfolio Credit Risk, Risk 9, S. 56-62.

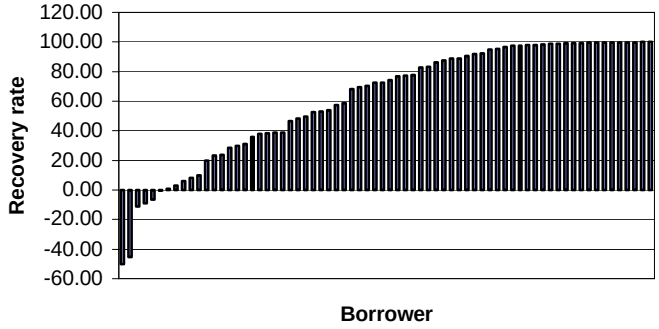
Figure 1: Distribution of the recovery rates



work-out-recovery rate		
mean	median	std.dev.
72.45	91.77	35.64

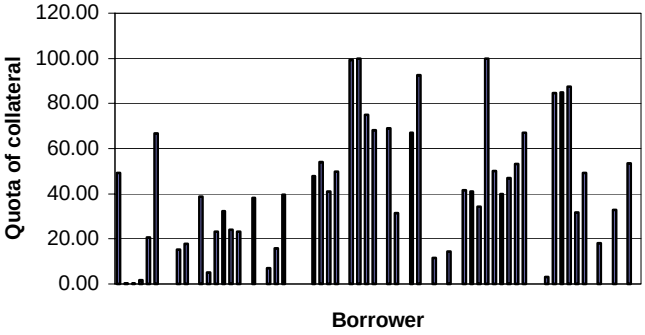
EAD-weighted recovery rate	71.91

Figure 2: Comparison of the recovery rate and corresponding quota of collateral



N = 70

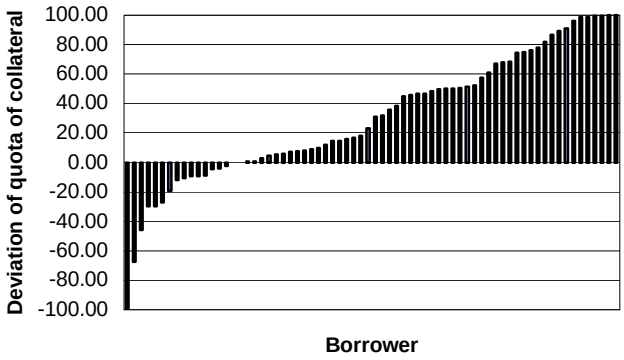
recovery rate		
mean	median	Std.dev.
61.36	73.50	39.51



N = 70

quota of collateral		
mean	median	Std.dev.
30.87	23.63	30.77

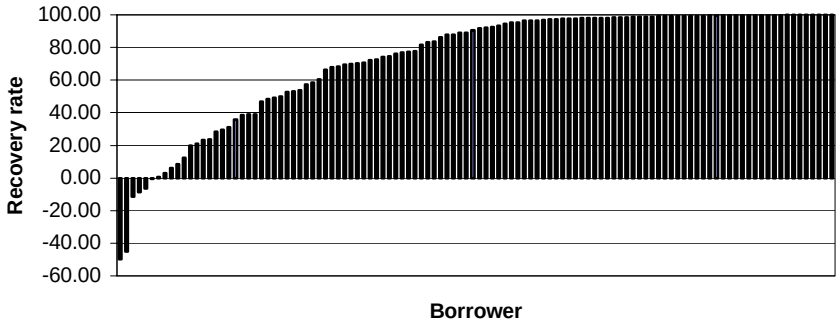
Figure 3: Deviation of the quota of collateral and recovery rate



N = 70

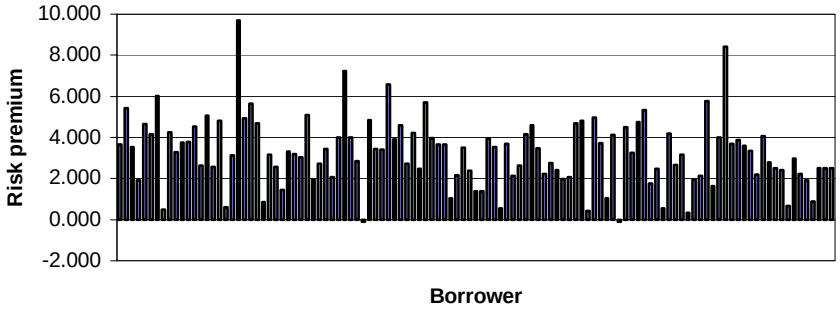
deviation		
mean	median	std.dev.
30.49	26.98	43.52

Figure 4: Comparison of the recovery rate and corresponding risk premium



N = 115

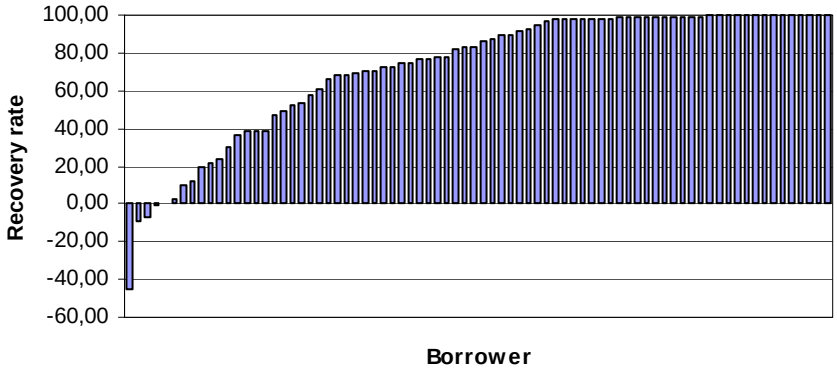
recovery rate		
mean	med.	std.dv.
72.58	91.25	35.52



N = 115

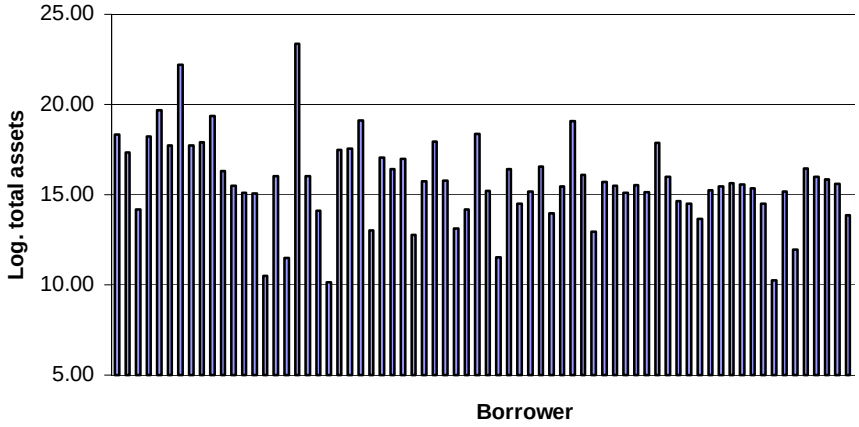
risk premium		
mean	med.	std.dv.
3.24	3.29	1.67

Figure 5: Comparison of the recovery rate and corresponding logarithm of total assets



N = 69

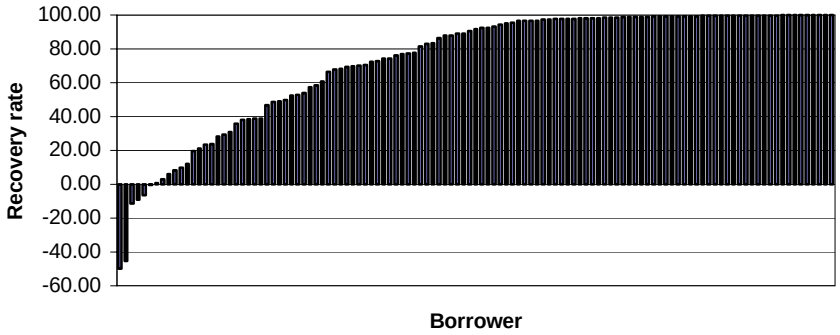
recovery rate		
mean	med.	std.dv.
71.72	85.00	34.51



N = 69

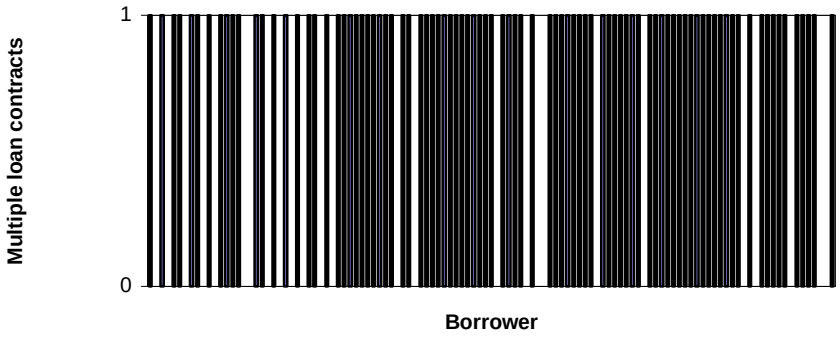
log. total assets		
mean	med.	std.dv.
15.83	15.68	2.40

Figure 6: Comparison of the recovery rate and corresponding multiple loan contracts variable



N = 117

recovery rate		
mean	med.	std.dv
72.40	91.52	35.61



N = 117

multiple loans	
one loan	26
more than one	91

Table 1: Empirical studies concerning the recovery rate of loans

Authors	Country	Data	Years	RR	Number

Asarnow and Edwards (1995)	US	bank	70-93	65.2	831
Asarnow and Edwards (1995)	US	bank	70-93	87.3	89
Carty and Lieberman (1996)	US	capital market	89-96	71.0	58
Carty and Lieberman (1996)	US	capital market	90-96	79.0	229
Grossman et al. (1997)	US	capital market	91-97	82.0	60
Grossman et al. (1997)	UK	capital market	91-97	68.1	14
Felsovalyi and Hurt (1998)	LA	bank	70-96	68.0	1149
Eales and Bosworth (1998)	AU	bank	92-95	69.0	5782
Carty (1998)	US	capital market	86-97	87.0	200
Carty (1998)	US	capital market	86-98	70.0	98
Hamilton and Carty (1999)	US	capital market	82-97	84.3	195
van de Castle and Keisman (1999)	US	capital market	87-97	84.5	258
Bartlett (2000)	UK	capital market	96-00	76.5	55
Gupton et al. (2000)	US	capital market	89-00	69.5	181
van de Castle et al. (2000)	US	capital market	87-96	83.5	264
Kabance (2001)	MX	capital market	95-01	40.0	70
O'Shea et al. (2001)	US	capital market	97-00	73.0	35
Hamilton et al. (2002)	US	capital market	82-01	71.3	n.s.
Bos et al. (2002)	US	capital market	88-01	83.5	528
Hamilton et al. (2004)	US	capital market	03	86.0	21
Keisman (2003)	US	capital market	88-03	78.8	750
Araten et al. (2004)	US	bank	82-99	60.2	3761
Franks et al. (2004)	UK	bank	84-03	75.0	1418
Franks et al. (2004)	F	bank	84-03	52.9	586
Franks et al. (2004)	G	bank	84-03	61.4	276
Dermine and Neto de Cavalho (2005)	P	bank	95-00	71.0	374

Table 2: Factors of potential influence

Part A: Variables referring to the hypotheses

Potential Influencing Factor	Variable	Definition
Value of collateral	Quota of collateral	Quotient of the sum of the assumed value of the collateral and the exposure at default
Creditworthiness of the borrower	Risk premium	Effective yield of the main loan less the 3-month Fibor or Euribor
Size of the company	ln (turnover)	Logarithmized turnover
	ln (total assets)	Logarithmized total assets
Intensity of the client relationship	Multiple loan contracts (0,1)	= 1 if more than 1 contract was concluded
	ln (distance)	Logarithmized distance in kilometers
	ln (fraction of total assets)	Logarithmized quotient of the exposure at default and the total assets

Part B: Control variables

Potential Influencing Factor	Variable	Definition
Industry classification	Manufacturing industry (0,1)	= 1 if the company belongs to the manufacturing industry
	Building industry (0,1)	= 1 if the company belongs to the building industry
	Supply of services (0,1)	= 1 if the company belongs to the supply of services sector
	Real estate (0,1)	= 1 if the company belongs to the real estate sector
	Car industry (0,1)	= 1 if the company belongs to the car industry
Form of company	Corporation (0,1)	= 1 if the borrower is a corporation
Continuation of the company	Continuation (0,1)	= 1 if the company can be continued
Exposure at default	ln (EAD)	logarithmized exposure at default
Economic conditions	Growth of GDP	Growth of the GDP in the default year in
	Regional growth of GDP	Growth of the GDP in the default year in
	Unemployment rate	Rate of unemployment in the default year
	Loan loss provisions	Loss provivions on the loan portfolio of all German commercial banks in the default year divided by the quantity of the loan portfolio

Table 3: Description of the data set. The numbers in parantheses indicate the number of borrowers in the category.

Period of defaults (120)

1992:	4	1995:	7	1998:	9	2001:	17
1993:	4	1996:	15	1999:	25	2002:	3
1994:	9	1997:	10	2000:	16	2003:	1

Industry classification (119)

Manufacturing industry:	31	Real estate:	30
Building industry:	21	Car industry:	10
Supply of services:	9	Others:	18

Legal form of the company (120)

Corporations:	58
Business partnerships:	62

Continuation of the company (120)

Continuation:	48
No continuation:	72

Number of loans (117)

One loan:	26
More than one loan:	91

Table 4: Specifications of the influencing factors of the empirical analysis

Influencing Factor	Mean	Std.dev.	Min.	Max.	Number

Quota of collateral in %	30.87	30.77	0	100	70
Risk premium in %	3.24	1.67	-0.11	9.69	115
Turnover in mil. Euro	347.27	2350	0.00	20451	76
Total assets in mil. Euro	27.30	1.66	0.025	14153	79
Distance	149.69	187.00	1.74	653.54	119
Fraction of total assets	20.687	28.58	0.034	96.583	78
Exposure at default in mil. Euro	5.59	10.70	0.052	93.2	117

Table 5: Description of the correlations between the factors of potential influence. To save space, the column headings were given numbers instead of titles. The numbers refer to the variables on the left; i.e., column heading 1 is risk premium, 2 is corporation, etc. If the

Bravias-Person correlation coefficient is statistically significant at the 5% level above or below zero, the corresponding field is shown in shaded grey.

	1	2	3	4	5	6	7	8	9	10	11	12	13
1 Quota of collateral													
2 Risk Premium	0.12												
3 ln (turnover)	-0.17	-0.04											
4 ln (total assets)	-0.14	0.01	0.76										
5 Multiple loan contracts	-0.07	-0.12	-0.05	-0.02									
6 Distance	-0.18	-0.04	-0.09	0.20	-0.21								
7 ln (fraction total assets)	0.01	-0.09	-0.63	-0.85	0.00	-0.07							
8 ln (EAD)	-0.07	-0.08	0.43	0.54	-0.00	0.27	0.01						
9 Corporation	-0.06	0.07	0.07	-0.03	-0.01	0.14	0.11	0.18					
10 Continuation	0.13	-0.10	0.01	-0.01	0.02	-0.00	-0.08	-0.14	-0.04				
11 Growth of GDP	0.14	-0.21	0.08	0.01	-0.08	0.13	-0.06	0.02	0.13	0.05			
12 Regional growth of GDP	0.14	-0.12	-0.16	-0.24	-0.11	-0.14	0.15	-0.14	-0.06	0.04	0.46		
13 Unemployment rate	-0.09	0.22	-0.13	0.04	0.06	0.08	-0.05	0.06	0.03	0.12	0.03	-0.37	
14 Loan loss provivions	-0.02	-0.03	-0.17	-0.20	-0.05	-0.03	0.30	-0.02	-0.06	-0.30	-0.23	-0.27	-0.51

Table 6: Results of the linear regression analyses of factors influencing the recovery rate. ***, **, * indicate that the coefficient is significantly different from 0 on the 1%, 5% and 10%

levels using the two-tailed t-test. The standard deviations of the coefficients are shown in brackets.

	(1)	(2)	(3)	(4)	(5)
Constant	70.01 ***	-18.04 *	263.7 **	258.2 ***	229.1 **
	(72.23)	(112.5)	(100.8)	(90.77)	(89.37)
Risk premium	-3.82 *	-6.04 *	-2.88 *	-1.63	-1.72 *
	(1.99)	(3.25)	(2.85)	(2.61)	(2.45)
Multiple loan contracts	14.65 *	21.49	22.31 **	27.25 ***	25.75 ***
	(7.60)	(12.50)	(10.75)	(9.49)	(8.49)
ln (distance)	-3.35	-2.41	-0.11	1.61	1.69
	(2.32)	(3.73)	(3.19)	(2.73)	(2.75)
ln (EAD)	-2.47	-0.48	-0.53	2.15	-4.18
	(2.54)	(4.50)	(3.53)	(3.40)	(2.84)
Corportaion	0.50	6.13	-5.38	-7.19	-4.58
	(6.50)	(10.61)	(8.61)	(7.51)	(6.51)
Continuation	23.01 ***	19.87 **	21.70 **	20.73 ***	20.75 ***
	(6.84)	(8.14)	(8.58)	(7.82)	(7.78)
Growth of GDP	4.00	0.37	2.13	1.19	1.21
	(4.85)	(7.79)	(6.36)	(5.64)	(5.44)
Regional growth of GDP	-4.26	-2.44	-7.09	-7.82	-6.78
	(3.95)	(6.28)	(6.00)	(4.97)	(4.77)
Rate of unemployment	4.24	9.39	-7.19	-6.68	6.88
	(4.23)	(6.83)	(6.14)	(5.14)	(5.55)
Loan loss provisions	5.85	-12.30	-66.87	-76.94	-66.94
	(40.51)	(53.74)	(57.51)	(52.29)	(48.82)
Quota of collateral		0.32 *			
		(0.18)			
ln (turnover)			-3.57		
			(1.80)		
ln (total assets)				-6.33 ***	
				(1.89)	
ln (fraction total assets)					6.63 **
					(89.37)
Sample size	104	58	65	68	68
Adjusted R^2	0.1974	0.1015	0.2358	0.3325	0.3308

Table 7: Results of the logistic regression analyses with RR^+ (0,1) as dependent variable. ***, **, * indicates that the coefficient is significantly different from 0 on the 1%, 5% and 10%

level using the two tailed t-test. The standard deviations of the coefficients are shown in brackets.

	(1)	(2)	(3)	(4)	(5)
Constant	-5.61 (6.08)	-2.68 (8.63)	2.48 (8.93)	2.89 (8.61)	1.08 (8.42)
Risk premium	-0.05 (0.17)	-0.12 (0.26)	-0.22 (0.24)	-0.08 (0.24)	-0.08 (0.26)
Multiple loan contracts	0.40 (0.66)	0.34 (1.03)	-0.30 (0.89)	0.55 (0.96)	0.57 (0.94)
ln (distance)	-0.04 (0.20)	0.02 (0.29)	-0.19 (0.27)	0.03 (0.27)	0.03 (0.52)
ln (EAD)	0.65 *** (0.22)	-0.52 (0.34)	0.51 * (0.28)	0.75 ** (0.31)	0.35 (0.25)
Corporation	-0.34 (0.53)	-0.01 (0.81)	-0.19 (0.74)	-0.65 (0.71)	-0.65 (0.74)
Continuation	1.46 *** (0.56)	1.68 ** (0.63)	1.87 ** (0.77)	1.95 ** (0.77)	1.99 ** (0.77)
Growth of GDP	0.08 (0.39)	0.11 (0.57)	-0.03 (0.27)	-0.04 (0.52)	-0.04 (0.54)
Regional growth of GDP	-0.24 (0.30)	-0.18 (0.43)	-0.48 (0.46)	-0.58 (0.44	-0.58 (0.44)
Rate of unemployment	-0.38 (0.33)	-0.35 (0.48)	0.65 (0.50)	-0.76 (0.48)	-0.76 (0.48)
Loan loss provivions	-1.17 (3.59)	-4.24 (4.36)	2.16 (4.96)	0.87 (5.09)	0.85 (5.11)
Quota of collateral		0.01 (0.01)			
ln (turnover)			2.48 (8.93)		
ln (total assets)				-0.39 ** (0.19)	
ln (fraction total assets)					0.39 (0.19)
Sample size	104	58	65	68	68
Pseudo R^2	0.1630	0.1049	0.1672	0.2196	0.2206

Table 8: Results of the logistic regression analyses with RR^- (0,1) as dependent variable. ***, **, * indicates that the coefficient is significantly different from 0 on the 1%, 5% and 10%

level using the two tailed t-test. The standard deviations of the coefficients are presented in brackets.

	(1)	(2)	(3)	(4)	(5)
Constant	2.34 (6.75)	6.38 (7.69)	-24.02 (15.15)	-28.05 * (16.46)	-25.03 (15.86)
Risk premium	0.22 (0.20)	0.57 * (0.31)	0.10 (0.37)	-0.20 (0.45)	-0.22 (0.50)
Multiple loan contracts	-1.29 * (0.67)	-1.51 * (0.81)	-2.95 ** (1.38)	-4.84 ** (1.90)	-4.58 ** (1.83)
ln (distance)	0.32 (0.23)	0.07 (0.26)	-0.28 (0.46)	-0.84 (0.55)	-0.78 (0.53)
ln (EAD)	-0.18 (0.27)	0.09 (0.31)	-0.15 (0.47)	-0.58 (0.55)	0.13 (0.47)
Corporation	-0.04 (0.64)	-0.58 (0.76)	0.23 (1.17)	1.19 (1.32)	1.09 (1.34)
Continuation	-3.19 *** (1.14)	-4.11 ** (1.89)	-3.40 ** (1.61)	-4.44 ** (2.02)	-4.38 ** (1.98)
Growth of GDP	-0.30 (0.48)	0.19 (0.54)	0.74 (0.80)	0.80 (0.91)	0.78 (0.89)
Regional growth of GDP	0.21 (0.37)	-0.14 (0.43)	1.68 (1.09)	2.20 (1.18)	2.15 (1.08)
Rate of unemployment	-0.22 (0.42)	-0.77 (0.49)	1.26 (0.95)	1.71 (1.10)	1.65 (1.03)
Loan loss provisions	1.18 (3.09)	4.72 (3.58)	2.58 (5.45)	5.48 (6.22)	5.14 (5.89)
Quota of collateral		-0.04 *** (0.02)			
ln (turnover)			0.34 (0.23)		
ln (total assets)				0.66 ** (0.29)	
ln (fraction total assets)					-0.66 ** (0.29)
Sample size	104	58	65	68	68
Pseudo R^2	0.3100	0.2798	0.4238	0.5262	0.5168